No. 10/764,076, Serial No. 11/868,827, and reexamination of U.S. Pat. No. 6,064,970 (Serial No. 90/011,252).

U.S. Patent No. 6,064,970 is the subject of litigation in *Progressive Casualty Insurance Company v. Safeco Insurance Company of Illinois, et al.*, Case No. 1:10-cv-01370-PAG, in the U.S. District Court for the Northern District of Ohio. On November 12, 2010, the court stayed the litigation pending the outcome of this reexamination. Therefore, the litigation is currently closed, but will be reopened upon immediate notification of either party after the conclusion of the reexamination process.

By submitting this Statement, Applicants are attempting to fully comply with the duty of candor and good faith mandated by 37 CFR §1.56. As such, this Statement is not intended to constitute an admission that any of the enclosed references, or other information referred to therein, constitutes "prior art" or is otherwise "material to patentability," as that phrase is defined in 37 CFR §1.56(a).

The Applicants have calculated no fee to be due in connection with the filing of this Information Disclosure Statement. However, the Director is authorized to charge any fee deficiency associated with the filing of this Information Disclosure Statement to a deposit account, as authorized in the Transmittal accompanying this Information Disclosure Statement.

Respectfully submitted,

March 9, 2011
Date

/James A. Collins/
James A. Collins
(Reg. No. 43,557)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 12/132,487 | 06/03/2008 | Raymond Scott Ling | 12654/42 |

**CONFIRMATION NO. 7812**

757
BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610

**POA ACCEPTANCE LETTER**

*OC000000044180479*

Date Mailed: 10/27/2010

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/03/2008.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/tnnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Inventors: Raymond Ling, Richard Hutchinson, Wilgert Steigerwald III, William Say, Patrick O'Malley, Dane Shrallow, and William Everett

Title of Appln.: VEHICLE MONITORING SYSTEM

# POWER OF ATTORNEY BY ASSIGNEE AND CORRESPONDENCE ADDRESS INDICATION

The specification of the above-identified patent application:

☐ is attached hereto.

☒ was filed on *June 3, 2008* as U.S. application No. 12/132,487.

**As required by 37 CFR 3.73(b)(1), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.**

Progressive Casualty Insurance Company, an Ohio Corporation, ("ASSIGNEE") certifies that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of either:

☐ An assignment from the inventor(s) of the patent application identified above,

- ☐ a copy of which was recorded in the Patent and Trademark Office at Reel , frame , or
- ☐ a copy thereof which is attached hereto and another copy thereof which is being recorded concurrently herewith pursuant to 37 CFR 3.11; OR

☒ A chain of title from the inventor(s) of the patent application identified above, to the current assignee as shown below:

1. From Raymond Ling, Richard Hutchinson, Wilgert Steigerwald III, William Say, Patrick O'Malley, Dane Shrallow, and William Everett to Progressive Casualty Insurance Company.
   The document was recorded in the Patent and Trademark Office at Reel 021360, Frame 0881, or a copy thereof is attached.
2. From to .
   The document was recorded in the Patent and Trademark Office at Reel , Frame , or a copy of which is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

ASSIGNEE hereby revokes all previously granted powers of attorney in the above identified patent application and appoints the Practitioners named below as my/our attorney(s) or agent(s), with full power of substitution and revocation, to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent(s), to transact all business in the United States Patent and Trademark Office connected therewith, and to act on ASSIGNEE'S behalf before the competent International Authorities in connection with any and all international applications filed by ASSIGNEE:

James A. Collins - Reg. No. 43,557
Gustavo Siller, Jr. - Reg. No. 32,305
Joseph S. Hanasz - Reg. No. 54,720

Please recognize or change the correspondence address for this application to the address associated with the above-mentioned Customer Number. Please direct all telephonic and facsimile communications to:

James A. Collins - Reg. No. 43,557
Tel.: (312) 321-4200; Fax: (312) 321-4299

The undersigned hereby authorizes the Practitioners associated with the above Customer Number to accept and follow instructions from James A. Collins as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the Practitioners and the undersigned. In the event of a change in the persons from whom instructions may be taken, the Practitioners will be so notified by the undersigned.

The undersigned (whose title is supplied below) is empowered to act on behalf of ASSIGNEE.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature Dane A. Shrallow Date: Oct. 8, 2010

Name: Dane A. Shrallow

Title: Associate General Counsel

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 8657308 |
| **Application Number:** | 12132487 |
| **International Application Number:** | |
| **Confirmation Number:** | 7812 |
| **Title of Invention:** | VEHICLE MONITORING SYSTEM |
| **First Named Inventor/Applicant Name:** | Raymond Scott Ling |
| **Customer Number:** | 00757 |
| **Filer:** | James A. Collins/Maggie Pieczonka |
| **Filer Authorized By:** | James A. Collins |
| **Attorney Docket Number:** | 12654/42 |
| **Receipt Date:** | 19-OCT-2010 |
| **Filing Date:** | 03-JUN-2008 |
| **Time Stamp:** | 17:23:44 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Miscellaneous Incoming Letter | transforpoa42.PDF | 41587<br>a331d88fb973ef0e0360c1badbcb0ab5ee05a919 | no | 1 |

**Warnings:**

**Information:**

| | | | | | |
|---|---|---|---|---|---|
| 2 | Power of Attorney | poa42.PDF | 76891<br>2f8190a78bab74d089f923f615c9fd5bad6f3b34 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 118478 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

CERTIFICATE OF EFS FILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office, Commissioner for Patents, via the EFS pursuant to 37 CFR §1.8 on the below date:

Date: October 19, 2010 Name: James A. Collins, Reg. No. 43,557 Signature: /James A. Collins/

BRINKS HOFER GILSON &LIONE

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re Appln. of: | Raymond S. Ling et al. | | |
| Appln. No.: | 12/132,487 | Examiner: | Robert R. Niquette |
| Filed: | June 3, 2008 | Art Unit: | 3695 |
| For: | VEHICLE MONITORING SYSTEM | Conf. No.: | 7812 |
| Attorney Docket No.: | 12654-42 | | |

# TRANSMITTAL

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

**Attached is/are:**

☒ Transmittal and Power of Attorney.

**Fee calculation:**

☒ No additional fee is required.

☐ Small Entity.

☐ An extension fee in an amount of $_____ for a ____-__ month extension of time under 37 CFR § 1.136(a).

☐ A petition or processing fee in an amount of $_____ under 37 CFR § 1.17(___)__ .

☐ An additional filing fee has been calculated as shown below:

| | Claims Remaining After Amendment | | Highest No. Previously Paid For | Present Extra | Small Entity Rate | Small Entity Add'l Fee | OR | Not a Small Entity Rate | Not a Small Entity Add'l Fee |
|---|---|---|---|---|---|---|---|---|---|
| Total | | Minus | | | x $26= | | | x $52= | |
| Indep. | | Minus | | | x 110= | | | x $220= | |
| First Presentation of Multiple Dep. Claim | | | | | +$195= | | | + $390= | |
| | | | | | Total | $ | | Total | $ |

**Fee payment:**

☐ Please charge Deposit Account No. 23-1925 in the amount of $_____ for _____.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

Respectfully submitted,

October 19, 2010
Date

/James A. Collins/
James A. Collins (Reg. No. 43,557)

| FORM PTO-1449 | | SERIAL NO. 12/132,487 | CASE NO. 12654-42 |
|---|---|---|---|
| **LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT** | | FILING DATE June 3, 2008 | GROUP ART UNIT 3695 |
| (use several sheets if necessary) | APPLICANT(S): Raymond S. Ling et al. | | CONFIRMATION NO. 7812 |

**REFERENCE DESIGNATION** **U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | | DOCUMENT NUMBER Number-Kind Code (if known) | DATE | NAME | CLASS/ SUBCLASS | FILING DATE |
|---|---|---|---|---|---|---|
| | D1 | US 6,064,299 | 05/16/2000 | Lesesky et al. | | |
| | D2 | US 6,411,203 B1 | 06/25/2002 | Lesesky et al. | | |
| | D3 | US 6,505,106 B1 | 01/07/2003 | Lawrence et al. | | |
| | D4 | US 6,529,723 B1 | 03/04/2003 | Bentley | | |
| | D5 | US 6,879,962 B1 | 04/12/2005 | Smith et al. | | |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIAL | | DOCUMENT NUMBER Number-Kind Code (if known) | DATE | COUNTRY | CLASS/ SUBCLASS | TRANSLATION YES OR NO |
|---|---|---|---|---|---|---|
| | | | | | | |
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| EXAMINER INITIAL | | **OTHER ART – NON PATENT LITERATURE DOCUMENTS** (Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | |
| | | |
| | | |

| EXAMINER | DATE CONSIDERED |
|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 12132487 |
| **Filing Date:** | 03-Jun-2008 |
| **Title of Invention:** | VEHICLE MONITORING SYSTEM |
| **First Named Inventor/Applicant Name:** | Raymond Scott Ling |
| **Filer:** | James A. Collins/Tina Sieczkowski |
| **Attorney Docket Number:** | 12654/42 |

Filed as Large Entity

## Utility under 35 USC 111(a) Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 8260771 |
| **Application Number:** | 12132487 |
| **International Application Number:** | |
| **Confirmation Number:** | 7812 |
| **Title of Invention:** | VEHICLE MONITORING SYSTEM |
| **First Named Inventor/Applicant Name:** | Raymond Scott Ling |
| **Customer Number:** | 00757 |
| **Filer:** | James A. Collins/Jesus Rodriguez |
| **Filer Authorized By:** | James A. Collins |
| **Attorney Docket Number:** | 12654/42 |
| **Receipt Date:** | 20-AUG-2010 |
| **Filing Date:** | 03-JUN-2008 |
| **Time Stamp:** | 16:35:42 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Deposit Account |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 2959 |
| Deposit Account | 231925 |
| Authorized User | |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Miscellaneous Incoming Letter | transfor3rdids.PDF | 41624<br>1fd68d168f0b76fd17550c65819096bef7dcce33 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Transmittal Letter | 3rdids.PDF | 71893<br>9a626418420a425af9674f0663f1b1ddb15a89d2 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Information Disclosure Statement (IDS) Filed (SB/08) | 3rdids1449.PDF | 40705<br>5797ffffe48f575a8f1ae819d5dc2520f82df1a9 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| This is not an USPTO supplied IDS fillable form | | | | | |
| 4 | Fee Worksheet (PTO-875) | fee-info.pdf | 30328<br>cb169b771324cd952e1b4f9b6d4e917680ec4d29 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 184550 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**<u>New Applications Under 35 U.S.C. 111</u>**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

CERTIFICATE OF EFS FILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office, Commissioner for Patents, via the EFS pursuant to 37 CFR §1.8 on the below date:

Date: August 20, 2010 Name: James A. Collins, Reg. No. 43,557 Signature: /James A. Collins/

BRINKS HOFER GILSON &LIONE

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: Raymond S. Ling et al.

Appln. No.: 12/132,487

Filed: June 3, 2008

For: VEHICLE MONITORING SYSTEM

Attorney Docket No.: 12654/42

Examiner: Robert R. Niquette

Art Unit: 3695

Conf. No.: 7812

# TRANSMITTAL

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

**Attached is/are**:

☒ Transmittal; Third Supplemental Information Disclosure Statement; and Form PTO-1449.

**Fee calculation**:

☐ No additional fee is required.

☐ Small Entity.

☐ An extension fee in an amount of $_____ for a _____-month extension of time under 37 CFR § 1.136(a).

☒ A petition or processing fee in an amount of $180.00 under 37 CFR § 1.17(p).

☐ An additional filing fee has been calculated as shown below:

| | Claims Remaining After Amendment | | Highest No. Previously Paid For | Present Extra | Small Entity Rate | Small Entity Add'l Fee | OR | Not a Small Entity Rate | Not a Small Entity Add'l Fee |
|---|---|---|---|---|---|---|---|---|---|
| Total | | Minus | | | x $26= | | | x $52= | |
| Indep. | | Minus | | | x 110= | | | x $220= | |
| First Presentation of Multiple Dep. Claim | | | | | +$195= | | | + $390= | |
| | | | | | Total | $ | | Total | $ |

**Fee payment:**

☒ Please charge Deposit Account No. 23-1925 in the amount of $180.00 for Information Disclosure Statement.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

Respectfully submitted,

August 20, 2010
Date

/James A. Collins/
James A. Collins (Reg. No. 43,557)

CERTIFICATE OF EFS FILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office, Commissioner for Patents, via the EFS pursuant to 37 CFR §1.8 on the below date:

Date: August 20, 2010 Name: James A. Collins, Reg. No. 43,557 Signature: /James A. Collins/

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: Raymond S. Ling et al.
Appln. No.: 12/132,487
Filed: June 3, 2008
For: VEHICLE MONITORING SYSTEM
Attorney Docket No: 12654/42

Examiner: Robert R. Niquette
Art Unit: 3695
Confirmation No. 7812

## THIRD SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

In accordance with the duty of disclosure under 37 CFR §1.56 and §§1.97-1.98, and more particularly in accordance with 37 C.F.R. §1.97(c), Applicants hereby cite the following reference(s):

| U.S. PATENT DOCUMENTS | | |
|---|---|---|
| DOCUMENT NO. | DATE | NAME |
| US 6,064,299 | 05/16/2000 | Lesesky et al. |
| US 6,411,203 B1 | 06/25/2002 | Lesesky et al. |
| US 6,505,106 B1 | 01/07/2003 | Lawrence et al. |
| US 6,529,723 B1 | 03/04/2003 | Bentley |
| US 6,879,962 B1 | 04/12/2005 | Smith et al. |

Applicants are enclosing Form PTO-1449 (one sheet) along with a copy of each listed reference for which a copy is required under 37 C.F.R. §1.98(a)(2). As each of the listed references is in English, no further commentary is believed to be necessary, 37 C.F.R §1.98(a)(3). Applicants respectfully request the Examiner's consideration of the above reference(s) and entry thereof into the record of this application.

Additionally, Applicants respectfully request that the Examiner review the claims and prosecute history, including any Office Actions issued by the USPTO for co-pending related serial numbers 10/764,076, filed January 23, 2004, and 11/868,827, filed October 8, 2007.

By submitting this Statement, Applicants are attempting to fully comply with the duty of candor and good faith mandated by 37 C.F.R. §1.56. As such, this Statement is not intended to constitute an admission that any of the enclosed references, or other information referred to therein, constitutes "prior art" or is otherwise "material to patentability," as that phrase is defined in 37 C.F.R. §1.56(a).

The Applicants have calculated a processing fee in the amount of $180.00 to be due under 37 CFR §1.17(p) in connection with the filing of this Information Disclosure Statement. Applicants have enclosed a check covering this fee, or authorized charging the fee to a deposit account or credit card, as indicated in the Transmittal accompanying this Information Disclosure Statement.

Respectfully submitted,

August 20, 2010
Date

/James A. Collins/
James A. Collins
Registration No. 43,557

| FORM PTO-1449 | | SERIAL NO.: 12/132,487 | CASE NO.: 12654/42 |
|---|---|---|---|
| **LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT** | | FILING DATE: June 3, 2008 | GROUP ART UNIT: 3695 |
| (use several sheets if necessary) | APPLICANTS: Ling et al. | | CONFIRMATION NO.: 7812 |

**REFERENCE DESIGNATION** **U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | | DOCUMENT NUMBER Number-Kind Code (if known) | DATE | NAME | CLASS/ SUBCLASS | FILING DATE |
|---|---|---|---|---|---|---|
| | C1 | 6,225,898 B1 | 05/01/2001 | Kamiya et al. | | |

| EXAMINER | DATE CONSIDERED |
|---|---|
| | |

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 7935982 |
| **Application Number:** | 12132487 |
| **International Application Number:** | |
| **Confirmation Number:** | 7812 |
| **Title of Invention:** | VEHICLE MONITORING SYSTEM |
| **First Named Inventor/Applicant Name:** | Raymond Scott Ling |
| **Customer Number:** | 00757 |
| **Filer:** | David Paul Lindner/Nkosi Harvey |
| **Filer Authorized By:** | David Paul Lindner |
| **Attorney Docket Number:** | |
| **Receipt Date:** | 01-JUL-2010 |
| **Filing Date:** | 03-JUN-2008 |
| **Time Stamp:** | 15:24:13 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 12654_42_1.pdf | 148387<br>dfbf5ba92b857fccc303d8d43eee99fa2274 0324 | yes | 4 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Miscellaneous Incoming Letter | 1 | 1 |
| | Transmittal Letter | 2 | 3 |
| | Information Disclosure Statement (IDS) Filed (SB/08) | 4 | 4 |

**Warnings:**

**Information:**

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|---|---|
| **Total Files Size (in bytes):** | 148387 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

CERTIFICATE OF EFS FILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office, Commissioner for Patents, via the EFS pursuant to 37 CFR §1.8 on: Date: July 1, 2010 Name: David P. Lindner – Reg. No. 53,222

Signature:

BRINKS HOFER GILSON &LIONE

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: Ling et al.

Appln. No.: 12/132,487

Filed: June 3, 2008

For: VEHICLE MONITORING SYSTEM

Attorney Docket No.: 12654/42

Examiner: Robert R. Niquette

Group Art Unit: 3695

Confirmation No.: 7812

## TRANSMITTAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

**Attached is/are:**

☒ Transmittal (p.1); Second Supplemental Information Disclosure Statement and Form PTO 1449 (pp. 2-4).

**Fee calculation:**

☒ No additional fee is required.

☐ Small Entity.

☐ An extension fee in an amount of $_____ for a _____-month extension of time under 37 CFR § 1.136(a).

☐ A petition or processing fee in an amount of $____ under 37 CFR § 1.17(p).

☐ An additional filing fee has been calculated as shown below:

| | Claims Remaining After Amendment | | Highest No. Previously Paid For | Present Extra | | Small Entity Rate | Small Entity Add'l Fee | OR | Not a Small Entity Rate | Not a Small Entity Add'l Fee |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | | Minus | | | | x $26= | | | x $52= | |
| Indep. | | Minus | | | | x 110= | | | x $220= | |
| First Presentation of Multiple Dep. Claim | | | | | | +$195= | | | + $390= | |
| | | | | | | Total | $ | | Total | $ |

**Fee payment:**

☐ Please charge Deposit Account No. 23-1925 in the amount of $____ for ______________________.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

Respectfully submitted,

July 1, 2010
Date

David P. Lindner (Reg. No. 53,222)

**CERTIFICATE OF TRANSMISSION UNDER 37 C.F.R. §1.8**

I hereby certify that this correspondence, including recited attachments, is being electronically transmitted to the United States Patent and Trademark Office on: Date: July 1, 2010 Name: David P. Lindner – Reg. No. 53,222

Signature: David P. Lindner

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re Appln. of: | Ling et al. | | |
| Appln. No.: | 12/132,487 | Examiner: | Robert R. Niquette |
| Filed: | June 3, 2008 | Group Art Unit No.: | 3695 |
| For: | VEHICLE MONITORING SYSTEM | Confirmation No.: | 7812 |
| Attorney Docket No.: | 12654/42 | | |

## SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

In accordance with the duty of disclosure under 37 CFR §1.56 and §§1.97-1.98, and more particularly in accordance with 37 CFR §1.97(b), Applicants hereby cite the following references:

| U.S. PATENT DOCUMENTS | | |
|---|---|---|
| **DOCUMENT NO.** | **DATE** | **NAME** |
| 6,225,898 B1 | 05/01/2001 | Kamiya et al. |

Applicants are enclosing Form PTO-1449 (one sheet), along with a copy of each listed reference for which a copy is required under 37 CFR §1.98(a)(2). Pursuant to the undersigned attorney's obligation and duties under 37 CFR §§ 1.56 and 1.98(a)(3) and (c), either English language abstracts, partial translations, or full translations are included for patent documents which are not in English for the express purpose of providing a concise explanation of the references to the Patent and Trademark Office with the opportunity to evaluate the same. Applicants respectfully request the

Examiner's consideration of the above references and entry thereof into the record of this application.

Additionally, Applicants respectfully request that the examiner review the claims and prosecution history, including any Office Actions issued by the USPTO for co-pending related serial numbers 10/764,076, filed January 23, 2004, and 11/868,827, filed October 8, 2007.

By submitting this Statement, Applicants are attempting to fully comply with the duty of candor and good faith mandated by 37 CFR §1.56. As such, this Statement is not intended to constitute an admission that any of the enclosed references, or other information referred to therein, constitutes "prior art" or is otherwise "material to patentability," as that phrase is defined in 37 CFR §1.56(a).

The Applicants have calculated no fee to be due in connection with the filing of this Information Disclosure Statement. However, the Director is authorized to charge any fee deficiency associated with the filing of this Information Disclosure Statement to a deposit account, as authorized in the Transmittal accompanying this Information Disclosure Statement.

Respectfully submitted,

July 1, 2010
Date

David P. Lindner
(Reg. No. 53,222)

| FORM PTO-1449 | | SERIAL NO.: 12/132,487 | CASE NO.: 12654/42 |
|---|---|---|---|
| **LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT** | | FILING DATE: June 3, 2008 | GROUP ART UNIT: 3693 |
| (use several sheets if necessary) | APPLICANTS: Ling et al. | | CONFIRMATION NO.: 7812 |

**REFERENCE DESIGNATION U.S. PATENT DOCUMENTS**

| EXAMINER INITIAL | | DOCUMENT NUMBER Number-Kind Code (if known) | DATE | NAME | CLASS/ SUBCLASS | FILING DATE |
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| EXAMINER | DATE CONSIDERED |
|---|---|
| | |

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

| FORM PTO-1449 | SERIAL NO.: 12/132,487 | CASE NO.: 12564/42 |
|---|---|---|
| **LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT** | FILING DATE: June 3, 2008 | GROUP ART UNIT: 3693 |
| (use several sheets if necessary) APPLICANTS: Ling et al. | | CONFIRMATION NO.: 7812 |

**REFERENCE DESIGNATION** **U.S. PATENT DOCUMENTS**

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| EXAMINER | DATE CONSIDERED |
|---|---|
| | |

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

| FORM PTO-1449 | | SERIAL NO.: 12/132,487 | CASE NO.: 12564/42 |
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| **LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT** | | FILING DATE: June 3, 2008 | GROUP ART UNIT: 3693 |
| (use several sheets if necessary) | APPLICANTS: Ling et al. | | CONFIRMATION NO.: 7812 |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIAL | | DOCUMENT NUMBER Number-Kind Code (if known) | DATE | COUNTRY | CLASS/ SUBCLASS | TRANSLATION YES OR NO |
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| EXAMINER INITIAL | | **OTHER ART – NON PATENT LITERATURE DOCUMENTS** (Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published. |
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| | B87 | Gordon, Jacques. " – this Year and Beyond: OBD III is Just Speculation, but OBD II Keeps Evolving in Response to Real-World Experience." Aftermarket Business v112, n3, p52. March 2002: ISSN: ISSN: 0892-1121, pp. 5. |
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| EXAMINER | DATE CONSIDERED |
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| (use several sheets if necessary) | APPLICANTS: Ling et al. | | CONFIRMATION NO.: 7812 |

| **EXAMINER INITIAL** | | **OTHER ART – NON PATENT LITERATURE DOCUMENTS** (Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published. |
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| EXAMINER | DATE CONSIDERED |
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| | |

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 7693818 |
| **Application Number:** | 12132487 |
| **International Application Number:** | |
| **Confirmation Number:** | 7812 |
| **Title of Invention:** | VEHICLE MONITORING SYSTEM |
| **First Named Inventor/Applicant Name:** | Raymond Scott Ling |
| **Customer Number:** | 00757 |
| **Filer:** | David Paul Lindner |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | |
| **Receipt Date:** | 26-MAY-2010 |
| **Filing Date:** | 03-JUN-2008 |
| **Time Stamp:** | 18:58:30 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Foreign Reference | EP1207499A2.pdf | 914356<br>12f7e7dc1ae5b2d2b1013edbba6828b038 88dc68 | no | 12 |

**Warnings:**

**Information:**

| | | | | | |
|---|---|---|---|---|---|
| 2 | Foreign Reference | EP1164551A2.pdf | 253674<br>4fc9d47c5b83c10e288ccbf3f80fd0403bcb0081 | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Foreign Reference | WO0186576A1.pdf | 955146<br>5df1cc772581c580a73c3e042d1bda3407a7563d | no | 19 |
| **Warnings:** | | | | | |
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| 4 | Foreign Reference | WO0155690A1.pdf | 592480<br>d3664eedc149606f29d656873f82a9c61a95104c | no | 14 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Foreign Reference | WO0079727A2.pdf | 2541448<br>1db7109701db293e0c9fc7504f0c31f3894bdb2b | no | 79 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Foreign Reference | JP_2000_335450_A_1.PDF | 2423316<br>3d6d13216799db80f17fbe82901bd11580d57246 | no | 33 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 7 | Foreign Reference | NL_C_1016618_1.PDF | 1685686<br>ba8af969eabac13527a5af22fbefd435116c6c5d | no | 39 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 8 | Foreign Reference | WO9713208A1.pdf | 2180707<br>e741fa03bf5dde680024bdf14f7c1eae9ed0c601 | no | 46 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 9 | Foreign Reference | EP0629978A1.pdf | 627640<br>6e53eb31d7ea37a90f8c86b46a593abfc55914e4 | no | 11 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 10 | Foreign Reference | WO9321583A1.pdf | 848887<br>bd2d1cda65acb9f32584de129d5d87d798b7cbb9 | no | 20 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 11 | Foreign Reference | JP_05104985_A_1.PDF | 1459102<br>fcca0798991f60aee5dfef45f4747aae319fa3c3 | no | 31 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 12 | NPL Documents | Gordon_Jacques_1.PDF | 370237<br>71b013edd282af4d7523ce12526e6ae91e5355be | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 13 | NPL Documents | Sensors_1.PDF | 1153432<br>6347b449c1810b48663aaa595e86d5a19cc11a43 | no | 14 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 14 | NPL Documents | Paul_Berk_1.PDF | 273335<br>bcb9ad9f70f374809b2b4f97501179c2e025db58 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 15 | NPL Documents | Davis_DriveRight_Solutions_for_Vehicle_Safety_and_Management_1.PDF | 12228661<br>7079648455eaf9c7c954c814a19e3d6d9ae14420 | no | 16 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 16 | NPL Documents | Safemotions_1.PDF | 100620<br>70a273f03e8bb627c1579098118556a046e6f684 | no | 2 |
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**Multipart Description/PDF files in .zip description**

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| Transmittal Letter | 2 | 6 |
| Information Disclosure Statement (IDS) Filed (SB/08) | 7 | 10 |

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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 207 499 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**22.05.2002 Bulletin 2002/21**

(51) Int Cl.[7]: **G07C 5/00**

(21) Application number: **01204375.8**

(22) Date of filing: **15.11.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR**
Designated Extension States:
**AL LT LV MK RO SI**

(30) Priority: **16.11.2000 NL 1016618**

(71) Applicant: **Kuitenbrouwer, Tibor Benediktus Stanislas Sebastiaan**
**2623 CR Delft (NL)**

(72) Inventor: **Kuitenbrouwer, Tibor Benediktus Stanislas Sebastiaan**
**2623 CR Delft (NL)**

(54) **System enabling transfer of mileage and other vehicle data as registered, processed and stored by the system, to telecommunications and data networks outside the vehicle**

(57) System to be used in wheeled vehicles, for registration, processing and storage of data with respect to trips of the vehicle, comprising means for data transfer between the system according to the present invention and suitable electronic devices in said vehicle or in the proximity of said vehicle, characterised by the fact that the system according to the present invention comprises means to control at least one other electronic device in such manner that through said electronic device, trip data as registered, processed and stored by the system according to the present invention, is transferred to one or more telecommunications and/or datanetworks outside the vehicle.

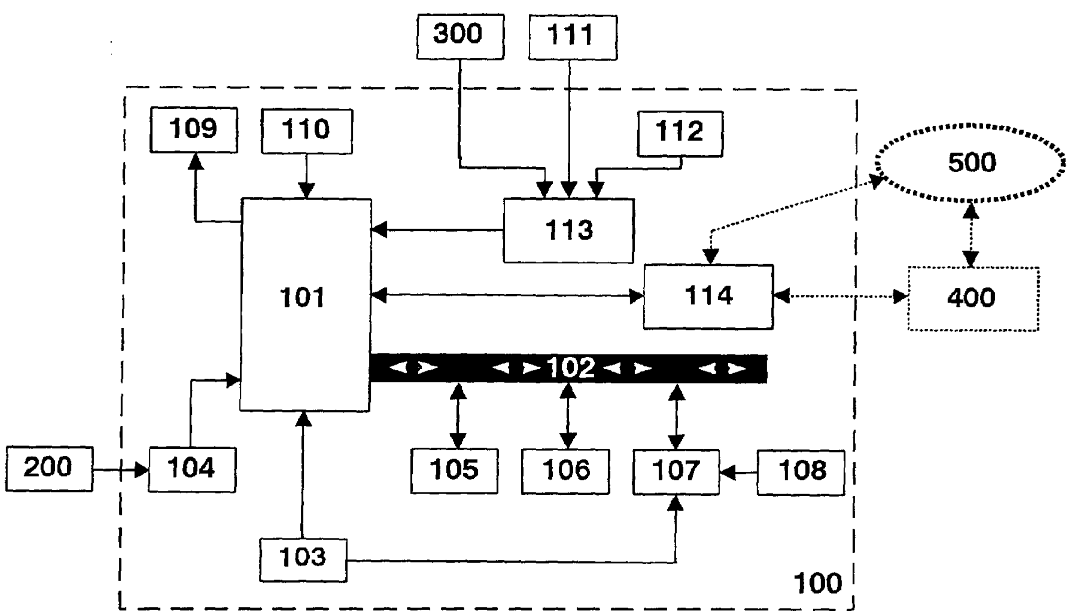



Fig. 1

EP 1 207 499 A2

**Description**

FIELD OF THE INVENTION

**[0001]** The present invention generally relates to a system to be used in wheeled vehicles, enabling registration, processing and transfer to at least one telecommunications or datanetwork outside the vehicle, of data with respect to a trip of the vehicle, like for instance a trip number, date and time at the start of a trip, date and time at the end of a trip, the odometer reading at the start and at the end of a trip, and an identification of the purpose of the trip, for instance private, business or commuting.

BACKGROUND OF THE INVENTION

**[0002]** Traditionally in motorcars and other (motor)vehicles there's a device present to register the distance traveled by the vehicle. Even today the principle of many of these "odometers" is based on a mechanical conversion of wheel or axle rotation into a measure of the distance traveled, which measure is displayed through a mechanical or electronic counter in the vehicle's dashboard. In addition to registration of the total distance traveled by the vehicle since it was manufactured, many odometers offer a possibility to register the distance traveled by the vehicle during a specific trip, through the use of a so-called "daycounter", which can be reset to zero prior to every trip. In the above mentioned conversion of wheel or axle rotations into mileage information, the conversion error may be as large as five percent.

**[0003]** Presently registration of the distance traveled by a vehicle is predominantly achieved through the use of electro-mechanical sensors, with the aim to facilitate processing of the resulting data in electronic form by the measurement and control electronics that take an increasingly important position in modern road vehicles. The wheel or axle rotations are in this case represented by electrical pulses, where the number of pulses in a specific period of time is related to the distance traveled by the vehicle during that period of time. In this respect it is to be noted that the relation between the number of pulses per period and the distance traveled by the vehicle during that same period is dependent on vehicle parameters like the wheel diameter.

**[0004]** An accurate registration of the distance traveled by a vehicle is important in many respects. Some of the more traditional situations where this registration plays a role include for instance determining the market value of a vehicle that is to be purchased or sold, determining when vehicle maintenance is required, determining the rent when one has rented a vehicle, calculating the height of the allowance to be paid by an employer to an employee when the latter uses his/her private vehicle for business purposes, calculating the fare for a taxi trip, or registering the fuel consumption of a vehicle per unit distance.

**[0005]** Nowadays the economic importance of (car) mobility is very high. In addition to this many corporate motor pools consist completely of leased vehicles, leading to a situation in which leasing companies are the legal owners of the vehicles and are in most cases also responsible for vehicle maintenance. However, current information with respect to the leased vehicles is not continuously at the disposal of said leasing companies, like for instance the odometer reading, that may be important to determine for instance whether maintance is required, or to determine whether the lease contract should be revised because the distance traveled with a specific vehicle significantly exceeds the contract provisions. Cars in the higher priced segments are in some cases equipped with extensive sensor and control systems, for instance offering the possibility to send a telecomunications message to the maintenance service with respect to (potential) defects in the vehicle's technical systems. Such equipment is however quite expensive, what makes application economically infeasible for average corporate motor pools. In addition to this comes the fact that such equipment is in most cases specifically tailored to a particular brand or even a particular type of car. This makes flexible application of said equipment in vehicles of different brand and/or type virtually impossible.

**[0006]** The patent document US 5 673 018 describes a relatively simple passive transponder device that is to be affixed to a vehicle wheel. By means of a sensor the wheel rotations are registered and converted into a measure of the distance traveled by the vehicle. This mileage data is stored in an electronic memory in the device. When the transponder comes into the range of the electro-magnetic field of a special transmitter/receiver which is located for instance at the entrance of a garage or a fuel station, the transponder emits a signal, for instance consisting of an electronic representation of said mileage data, which is then received by said receiver. The main disadvantage of this device is the fact that the mileage data can only be transferred to systems outside the vehicle at specific locations. In addition to this, the affixing of electronics to moving parts of the vehicle's exterior, in this case a wheel, considerably increases the risk of damage to the device which may result in defects.

**[0007]** Furthermore, devices are known in the art, that enable the transfer of vehicle data by means of infrared light to receivers outside the vehicle. Also in this case, data can only be transferred at specific locations, and there is a need for a clear line of sight between the transmitter inside the vehicle and the receiver outside.

**[0008]** Registration of the distance traveled with a vehicle furthermore plays an important role when a distinction has to be made between distance travelled for private purposes and distance travelled for business purposes. For most companies with a motor pool that mainly consists of leased vehicles this will be the case. In some countries people who drive a "company car" that is leased by their employer will be subjected to the payment of extra income taxes when the distance travelled with the company car for private purposes exceeds a specific treshold value. To avoid extra taxation the registered user of the leased vehicle is required to keep a consistent and accurate mileage record. It is also required that there exits an unambiguous relationship between mileage registered as being for business purposes and a specific business activity. To be able to prove such relationship an accurate activity record has to be kept. Manually keeping such mileage and activity records, for instance by reading the vehicle's odometer at the start and end of every trip, calculating the distance travelled during said trip and writing it down together with the corresponding business activity, may easily lead to errors, omissions and unnecessary costs.

**[0009]** In the past, numerous systems have been developped to remedy the problems mentioned above by automating said mileage registration as well as said activity registration. In the patent document US 5 541 858 a device is disclosed consisting of a portable unit comprising at least a micro-processor, RAM-memory, a display and a keyboard, that can be placed in a docking-station in the vehicle. The device makes use of the electronic odometer signal that is standard available in most recent model road vehicles. In addition to this, the device offers the possibility to a user to register activities by assigning a numerical code to each of the activities. The record of an activity, for instance a visit to a specific client, may then be logically connected to a vehicle trip record by entering the corresponding numerical code, after which the data is stored in the portable unit. On the portable unit there's an electrical connector present, through which the registered data can be transferred at a later stage to for instance a personal computer for further processing.

**[0010]** The patent document US 6 064 929 discloses a device wherein the above mentioned portable unit is a portable personal computer (notebook computer, laptop computer), equipped with software for keeping an extensive activity record. The odometer signal that is available in the vehicle is lead to the computer by means of a cable and is combined in said computer with a time and activity record.

**[0011]** A significant drawback of the latter two devices known in the art, is that said portable unit as well as said personal computer are in fact assigned to a specific user and not to a specific vehicle. It is the personal responsibility of this user to transport the device from the vehicle to, for instance, an office location where the stored information can be read out of the device and entered into, for instance, the company's accounting system. The electronic odometer signal however, is dependent on vehicle specific parameters like for instance the wheel diameter. Consequently, when the above mentioned systems are used in another vehicle than the vehicle used for the previous registration, the distance measurement needs to be calibrated before the first trip in this new vehicle. In most cases such calibration requires reading the odometer and entering the resulting data into the device at least twice, which may lead to errors and omissions. Another drawback of the registration of odometer readings with the help of a portable personal unit, like a portable computer, is the fact that if a vehicle is used by a second person between two trips of a first person, and this second person does not use the same portable unit, the mileage record will not be consistent anymore. The most recent odometer reading stored in the portable unit of the first person will in this case differ from the current odometer reading in the vehicle. Preceding a next registration with said first portable computer, a user will then have to enter again the current odometer reading into the device, with the aforementioned drawbacks as a potential consequence.

**[0012]** The system according to the present invention means to remedy the drawbacks of devices known in the art in this field. To this effect a system for use in wheeled vehicles will be proposed, enabling registration, processing and storing data with respect to trips of said vehicle. The system comprises means for the transfer of data between said system and suitable other electronic devices in the vehicle and/or in the proximity of the vehicle. Said other electronic devices may include for instance mobile cellular telephones en portable computers (like laptop computers, notebook computers, palmtop computers, personal digital assistants) which can nowadays be regarded as more or less belonging to the standard equipment of professional users of wheeled vehicles, and will, as such, be present in said vehicles at least during normal business hours.

**[0013]** The system according to the present invention is characterised by the fact that it comprises means to control said electronic devices in the vehicle or in the proximity of the vehicle in such a fashion that through said electronic devices, data with respect to trips of said vehicle, as registered, processed and stored by the system according to the present invention, can be transferred to at least one telecommunications and/or datanetwork outside the vehicle.

**[0014]** In this way a user has a high degree of freedom in selecting a telecommunications and/or datanetwork through which the data transfer will take place, for instance a GSM (Global System for Mobile communication)-network, satelite networks, networks similar to the Dutch Traxys-network or the future UMTS (Universal Mobile Telecommunications System)-network, as well as a high degree of freedom in selecting a format according to which the communication will take place, for instance in the form of S.M.S. (Short Message Service)-messages, email-messages or facsimile-messages. A significant advantage of the use of such networks is the fact that a vehicle does not have to be at a specific location to be able to transfer the trip data stored in the system according to the invention. Electronic devices like mobile cellular telephones and portable computers are commonly available and relatively low-priced. For said transfer of data between the system according to the present invention and said electronic devices in or in the proximity of the vehicle, the system according to the present invention may employ a range of communications standards like IrDA (Infrared Data Association) for communication by way of infrared light and Bluetooth for short-distance radio communications. These communications standards are widely supported by manufacturers of, for instance, mobile cellular telephones and portable computers.

**[0015]** Systems like said portable computers offer flexible possibilities for further on-site processing of trip data, for the addition of extra information and for example for making hard-copies of data by means of a printer in the vehicle itself.

**[0016]** The system according to the present invention may itself comprise means for direct transfer of data as registered, processed and stored by said system according to the present invention to at least one telecommunications and/or datanetwork outside the vehicle. For this purpose the system according to the present invention may for instance comprise built-in transmission/reception means for the GSM-network. This embodiment of the system according to the present invention is particularly advantageous in case only very limited interaction between the system according to the present invention and a user of the vehicle is necessary or required. This may for instance be the case when the functionality of the system according to the present invention is limited to the periodic transfer of trip data to for instance the manager of the corporate motor pool or to a maintanance service. Access to said means for transfer of data between the system according to the present invention and said electronic devices in or in the proximity of the vehicle may then for instance be restricted to an authorised maintenance employee for entering or correction of vehicle specific data in the system according to the present invention. To perform said entering or correction of said vehicle specific data for instance a remote control device using infrared light could be used.

**[0017]** Trip data as registered, processed and stored by the system according to the present invention at least comprise a trip number, date and time at the start of a trip, date and time at the end of a trip, the odometer reading at the start and at the end of a trip, and an identification of the purpose of the trip. The purpose of the trip may be for instance private, business or commuting.

**[0018]** Through an electronic device in the vehicle or in the proximity of the vehicle, which is suitable and comprises means for the transfer of data between the system according to the present invention and said electronic device, extra information may be added. Said extra information may for instance comprise information pertaining to the business activity related to the specific vehicle trip, for instance a visit to a specific client. Such extra information can be added by means of for instance a portable computer (like a laptop computer, notebook computer, palmtop computer, personal digital assistant etc.). In this way a consistent combination of mileage registration and activity registration can be achieved, which may lead to reduced taxation. Furthermore said extra information may comprise the vehicle location at the start and at the end of the trip, which information could be provided by for instance a G.P.S. (Global Positioning System)-system in the vehicle. Said vehicle location could also be determined by detecting automatically, for instance by means of a mobile cellular telephone, in which cell of a cellular network for mobile communications the vehicle is located and by using the known geographical location of said cell as an approximation for the location of said vehicle. In addition to this extra information could be added in the form of an electronic representation of speech. For this purpose one could make use of a vehicle's built-in microphone/speaker system for a mobile telephone or a microphone/headphone set, which are commonly used nowadays. In this way the system according to the present invention offers flexible and relatively simple usage for a wide range of applications.

**[0019]** To provide for a base functionality, the system according to the present invention comprises at least the following parts:

- a central control and processing unit, for instance a microprocessor, equipped with a suitable software program to provide for the right functionality.
- an electronic memory for storage of vehicle specific data like for instance a vehicle identification code and data necessary for calibration of the vehicle's electronic odometer signal.
- an electronic memory for storage of trip data as registered and processed by the system according to the present invention.
- electronic means to provide the accurate date and time to the system according to the present invention.
- means to detect whether the vehicle's ignition switch is being operated.
- means to register the vehicle's electronic odometer signal.
- means to connect a cable for datacommunication with electronic devices outside the system according to the invention.
- output means, suitable for issuing an optical and/or acoustical warning to a user of the system according to the invention.

**[0020]** All of the abovementioned parts may be realised by means of commonly available and relatively low-priced components.

**[0021]** Said electronic odometer signal may be easily obtained from a standardised connector which is present in most recent model road vehicles to connect for instance a car radio. By using said electronic odometer signal instead of signals provided by complex electronic control and processing systems that may be present in the vehicle, only relatively simple vehicle parameters like for instance the wheel diameter have to be taken into account. This has the advantage that the system according to the present invention can be built-in and calibrated in a relatively simple manner.

**[0022]** By using said standardised connector, one can furthermore detect in a simple way whether the vehicle's ignition switch is being operated, by detecting significant changes in the electric voltage on the supply lead in said connector.

**[0023]** Said output means, suitable for issuing an optical and/or acoustical warning to a user of the system according to the invention, preferably issues a warning to a user, when the available memory capacity for storing trip data has decreased below a specific treshold value. The latter situation may occur when, due to for instance a defect in an electronic device in the vehicle or in the vehicle's proximity, data transfer to a telecommunications or datanetwork outside the vehicle can not take place for a certain period of time. It is evident that said memory capacity treshold value needs to be chosen so as to provide a user of the system according to the present invention under normal usage conditions with sufficient time to seek technical assistance and support before trip data is lost.

**[0024]** It is advantageous to realise the system according to the present invention in such a way that the system periodically derives data from the aforementioned electronic odometer signal, with respect to the distance travelled by the vehicle per unit time, and stores this data in an electronic memory in the system according to the present invention. In the case that said data with respect to the distance travelled by the vehicle per unit time is stored in the system according to the present invention, and the storage capacity of said electronic memory is sufficiently large, so that at every point in time distance data with respect to a fixed period of time preceding said point in time is present in said electronic memory, the system according to the present invention can function as an accident recorder, more or less similar to a flight data recorder, sometimes referred to as "black box", in airplanes. For at any point in time the system according to the present invention contains a record of the distance travelled by the vehicle per unit time, registered over a certain period of time preceding said point in time. If said unit time is chosen in the order of one second, the registered distance traveled per unit time is a reasonably accurate measure of the vehicle speed. For instance when the vehicle has been involved in an accident, such data may provide valuable information with respect to the cause and course of the accident, like details concerning the vehicle's acceleration and deceleration.

**[0025]** The aforementioned electronic memory for storage of vehicle specific data in the system according to the present invention, may for instance contain data necessary for calibration of the vehicle's electronic odometer signal. The contents of this memory is of primary importance for a correct functioning of the system according to the present invention, and it may therefore be advantageous to secure said memory by means of data encryption, so that said vehicle specific data can only be entered, read out and altered by an authorised person.

**[0026]** It is furthermore advantageous when the system according to the present invention comprises input means enabling a user to indicate if a trip is to be registered as business, private or commuting. A simple embodiment of said input means could be a three-position switch.

**[0027]** The system according to the invention may comprise means to detect whether the filling opening of the vehicle's fuel tank is open or closed. The open or closed status of said filling opening may serve as an indication of the instances when the vehicle is fueled. Such registration of fueling sessions could provide a basis for keeping a fuel administration. Such fuel administration is often kept in addition to the aforementioned mileage and activity records. In many cases leasing companies offer so-called fuel arrangements with leased vehicles. according to such arrangements a chipcard may be issued to the user of a leased vehicle which can be used to pay for fuel at for instance a fueling station. Said registration of the open or closed status of the filling opening of the vehicle's fuel tank may then be used to establish an administrative relation between a fueling session of a specific vehicle and fuel payments with the use of said chipcard.

**[0028]** The system according to the present invention preferably comprises means for the transfer of data by way of infrared light, between the system according to the present invention and electronic devices in the vehicle and/or in the proximity of the vehicle. To achieve this, a transmitter/receiver for infrared light can be placed at a suitable location in the vehicle's interior. Many electronic devices like mobile cellular telephones and portable computers (like laptop computers, notebook computers, palmtop computers, personal digital assistants), which can nowadays be regarded as more or less standard equipment of professional users of wheeled vehicles, are already equipped with means for datacommunication by way of infrared light. A further advantage of this could be that the aforementioned vehicle specific data, stored in the system according to the present invention, could simply be entered or corrected with a remote control using infrared light by for instance a maintenance employee. In most cases it would not even be necessary for said maintance employee to enter the vehicle's interior.

**[0029]** The aforementioned means of the system according to the present invention for datacommunication by way of infrared light could advantageously be organised to adhere to the so-called "IrDA" (Infrared Data Association) communications standard. Electronic devices in the vehicle or in the proximity of the vehicle that are to be used in combination with the system according to the present invention, like mobile cellular telephones or portable computers, already comprise in many cases means for datatransfer and/or remote control by way of infrared light.

**[0030]** A rapidly increasing number of systems in the field of information technology and telecommunications adheres to the de-facto standard "Bluetooth" for short-distance radio communications. Therefore it is advantageous if the system according to the present invention comprises means enabling data transfer between said system and electronic devices in or in the proximity of the vehicle, according to this de-facto standard, which is supported by a significant part of the information technology and communications industry.

**[0031]** The data registered by means of the system according to the present invention will often serve to accurately establish for instance the extent of the private use of a company vehicle, the distance traveled with a rented vehicle etc. The financial consequences of this will often be beneficial for the owner, renting or leasing company, but chargeable to the user of the vehicle concerned. Such system will consequently have to be able to resist unwanted tampering or sabotage. With the exception of the aforementioned means for communication by way of infrared light, which should placed at an accesible location in the passenger compartment of the vehicle, it could be advantageous if the remaining parts of the system according to the present invention are placed in the vehicle in a way and at a location that such remaining parts are mechanically fixed to the vehicle and protected against unauthorised access and/or tampering from the passenger compartment, as well as from outside the vehicle.

**[0032]** S.M.S. (Short Message Service)-messages are data-messages with a relatively simple structure that can be exchanged efficiently and at low cost through for instance GSM (Global System for Mobile communication)-networks. Trip data and additional information as registered, processed and stored by the system according to the present invention may therefore be effectively transferred to GSM or other suitable networks outside the vehicle in the form of S.M.S.-messages.

**[0033]** Furthermore, trip data and additional information as registered, processed and stored by the system according to the present invention may be transferred to suitable telecommunications and/or datanetworks outside the vehicle in the form of electronic mail or facsimile messages.

**[0034]** The system according to the present invention will be explained in more detail below, according to the attached drawings and a description of a preferred embodiment. It should be noted however that the described embodiment has been selected exclusively to illustrate application of the system according to the present invention and should not be regarded as limiting such application whatsoever.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0035]** Figure 1 is a schematic diagram of a preferred embodiment of the system according to the present invention.

**[0036]** Figure 2 is a graphical representation of a datastructure for trip data, which can advantageously be used with the system according to the present invention.

**[0037]** Figure 3 is a graphical representation of a preferred datastructure of a S.M.S. (Short Message Service)-message.

**[0038]** Figure 4 is a graphical representation of a preferred datastructure for the header of a S.M.S.-message.

## DESCRIPTION OF PREFERRED EMBODIMENTS

**[0039]** Figure 1 shows a schematic diagram of a preferred embodiment 100 of the system according to the present invention, comprising a central processing unit 101, preferably a microcontroller with RAM-memory (not shown) for storage of the program instructions for the microcontroller and intermediate data storage. The microcontroller is connected to a databus 102 enabling exchange of data with other parts of the system. A wide range of standardised systems may be used for such databus. Said databus 102 connects the microcontroller 101 to a first electronic memory 105 for storage of vehicle specific data, being for instance odometer calibration data and/or vehicle identification data, connects microcontroller 101 to a second electronic memory 106 for storage of trip data and additional information, and connects microcontroller 101 to a so-called "Real-time-clock" (RTC) 107, being an electronic means which provides the current date and time. The electronic memory 106 is organised in such a fashion that when it is full, the oldest trip record stored in said memory will be lost, every time a new trip record enters into the memory. RTC 107 can be adjusted by microcontroller 101 and is equipped with an emergency power supply 108, being for instance a (rechargeable) battery, which secures provision of the current date and time when there is a interruption in the power supply to the system according to the invention. Said electronic memories 105 and 106 are shown separately in figure 1, but could in practice be integrated in one electronic component, together with the microcontroller's RAM-memory. Maintaining a physical separation between said memories could however be preferred, when one would for instance additionally protect the electronic memory 105 for vehicle specific data, against unwanted tampering from the outside because this electronic memory contains data that may disturb the correct functioning of the system according to the invention when the integrity of said data is compromised. Normally, such vehicle specific data will be entered by an authorised party, for instance the manager of the motor pool, when the vehicle is put into operation for the first time. For extra security said data could be stored in encrypted form in electronic memory 105. Said electronic memories may advantageously be realised in the form of EEPROM's (Electrical Erasable Programmable Read Only Memory). In that case the contents of said electronic memories is not lost when an interruption occurs in the power supply to the system according to the present invention. Microcontroller 101, as well as RTC 107 are being supplied with the necessary clock pulses by an oscillator 103. Said oscillator 103 is preferably a quartz chrystal oscillator. The system according to the present invention preferably receives the necessary electrical power from the vehicle's electrical supply system 200. The system according to the present invention may obtain the necessary electrical power through the ISO (International Standardization Organisation)-standardised connector, which is present in most recent model road vehicles to facilitate installation of a car radio. The system according to the invention furthermore comprises an electrical supply part 104, which converts the electrical supply from the vehicle's electrical system into a form suitable for the electronic components of the system according to the present invention. The electrical supply part 104 may additionally comprise means to conserve electrical energy when the system according to the present invention is used infrequently. To issue an optical and/or acoustical warning to a user of the system according to the present invention, the system may comprise an output means 109. Said output means 109 may consist of, for instance, a display, one ore more light emitting diodes (LED's), a buzzer, etc., or combinations of these elements. Through said output means, information can be presented to a user, with respect to, for instance, the operational status of the system according to the present invention, or a warning when the storage capacity of the electronic memory 106 for storage of trip data is occupied to a certain extent. The system according to the present invention furthermore comprises an input means 110, which preferrably has a simple form, like a three-position switch enabling a user to communicate to the system whether a vehicle trip should be registered as business, private or commuting, but said input means 110 could also be a keyboard. In most recent model road vehicles an electronic pulse signal 300 is generated, that gives a measure for the distance travelled by the vehicle. Such pulse signal may be obtained in most cases through the aforementioned ISO-standardised connector, which is present in most recent model road vehicles to facilitate installation of a car radio. The system according to the present invention furthermore comprises a means 111, enabling detection of operation of the vehicle's ignition switch, and means 112 enabling detection of the open or closed status of the filling opening of the vehicle's fuel tank. Said detection of operation of the vehicles ignition key may be realised by detecting significant changes in the electric voltage on the supply lead of the aforementioned ISO-standardised connector. Means 113 converts the signals delivered by means 111 and 112 into a form that is suitable for further processing of the signals by microcontroller 101. Numerical reference 114 refers to the communications part of the system according to the present invention. This communications part comprises means for transfer of data between the system according to the present invention and electronic devices 400 in the vehicle or in the proximity of the vehicle. An electronic device 400 may be for instance a mobile cellular telephone and/or a portable computer (like a laptop computer, a notebook computer, a palmtop computer or a personal digital assistant). Said means for data transfer may consist of a simple electric cable, but may also consist, for instance, of a transmitter/receiver for infrared light or short-distance radio communications. The system according to the present invention may, through the communications part 114, control said electronic devices 400 in such a fashion that these devices transfer data that is supplied by the system according to the present invention, to telecommunications and/or datanetworks outside the vehicle. In this way trip data and additional information, for instance in the form of S.M.S. (Short Message Service)-message or email messages, can be transferred to for instance a leasing company or a maintenance service by means of a mobile telephone. The data transfer between the communications part 114 of the system according to the present invention and said mobile cellular telephone may be accomplished by way of a cable, or by way of infrared light, for instance adhering to the IrDA (Infrared Data Association) communications standard. In case the system according to the present invention should operate completely autonomous because user interaction, for instance to install a mobile telephone or switch-on a portable computer, is unwanted, the communications part 114 may itself comprise means like for instance a transmission/reception means, to enable direct transfer of data to for instance a network for mobile telecommunications. Through said electronic devices 400 extra information may be added to the trip data stored in electronic memory 106. Such extra information may, for instance comprise information with respect to the business activity to which the trip is to be allocated, information supplied by a GPS (Global Positioning System)-system with respect to the location of the vehicle at the start and the end of a trip, or a voice message recorded by means of the microphone system of a mobile telephone. In addition to this an electronic device 400 may be an infrared remote control enabling entering, readout and correction of the vehicle specific data in electronic memory 105 by an authorised person. As such, the system according to the present invention offers a user a large degree of freedom and flexibility in determining the preferred extent of user interaction and in selecting suitable communications media. By making use of standardised data transfer methods the functionality of the system may easily be extended with for instance the use of GPS-systems, which are nowadays present in an increasing number of vehicles. Furthermore all parts of the system according to the present invention can be realised with commonly available standard components, and the system utilizes technical means that are quite common in most vehicles nowadays.

**[0040]** Trip data and additional information are preferably stored in the electronic memory 106, according to the datastructure shown in figure 2. In principle the system according to the present invention is continuously operational, however supply part 104 may comprise means to switch off the system partially or completely in case of infrequent use. Detection of specific events, hereinafter referred to as "registration events", however causes the system according to the present invention to return automatically to an operational status enabling registration of such registration event. In it's simplest form a registration event consists of the operation of the vehicle's ignition switch, irrespective of whether the engine is started or stopped, or consists of the opening or closing of the filling opening of the vehicle's fuel tank. Both registration events cause the generation of a trip registration which is stored in electronic memory 106 according to the data structure in figure 2. Every basic trip registration consists of a 20-byte datablock (8 bits per byte). The first two bytes RN of said datablock contain a trip number. Trip numbers are assigned in consecutive order on the occurrence of a registration event, like for instance operation of the ignition switch or the opening of the vehicle's fuel tank. The microcontroller 101 receives the current date and time of the start of the registration event from the real-time-clock 107 and adds these to the trip registration in the form of four bytes DT1. In the three bytes KM1 the odometer reading at the start of the trip is stored. When the system is put into operation for the first time, the current odometer reading is entered into the electronic memory 105 by an authorised person. Based on the calibration data that has been entered into the same memory 105, the pulse signal 300 that is generated during movement of the vehicle, is converted into a measure of the distance travelled by the vehicle and added to said odometer reading. The three bytes KM2 contain the odometer reading at the end of a trip and the four bytes DT2 contain date and time of the end of the trip. Due to the fact that opening of the vehicle's fuel tank is regarded as a registration event and is registered as the start of a new trip, and due to the fact that a vehicle generally does not move during fueling, it may be obvious that the odometer readings at the start and at the end of a fueling session will be equal. The byte RT contains a reference stating the purpose of the trip. For this trip purpose one could distinguish between "business", "private", "commuting" and "fueling". As mentioned earlier, extra information can be added to a trip registration by means of electronic devices in or in the proximity of the vehicle, like mobile cellular telephones, portable computers, GPS-systems etc. The bytes XTR in figure 2 may be used for this purpose. In case the trip registration and additional information can not be stored in 20 bytes, extra 20-byte datablocks may be added to a trip registration, and the first (left side) byte XTR in figure 2 can be used as a counter to indicate the total number of 20-byte datablocks for the current trip registration. Without addition of for instance speech as extra information, it is not to be expected that an average trip registration will contain more than two 20-byte blocks. In case the storage capacity of electronic memory 106 for storage of trip data would be as small as 8 Kilobytes (=8192 bytes), more than 400 trip registrations could be stored in said memory. As described earlier, an optical and/or acoustical warning could be issued to a user of the system according to the present invention through means 109, in case the available storage capacity of the electronic memory 106 is equal to a specified minimum treshold value. In practice however such a situation will only occur if transfer of trip data to a telecommunications or datanetwork outside the vehicle is not possible for an extended period of time because of a defect in for example the communications part 114 of the system according to the present invention, a defect in an electronic device 400 (for instance a mobile telephone), or a defect in the external telecommunications or datanetwork. It is evident that said minimum treshold value for the storage capacity of electronic memory 106 needs to be chosen so as to provide a user of the system according to the present invention with sufficient time after an optical and/or acoustical warning has been issued, to seek technical assistance before the electronic memory 106 is full and trip data is lost.

**[0041]** The communications part 114 of the system according to the present invention could for instance control a mobile telephone in such a way that by means of said mobile telephone, trip data from the electronic memory 106 are periodically transferred in the form of a S.M.S. (Short Message Service)-message to for instance a GSM (Global System for Mobile communication)-network. Figure 3 shows a preferred data structure of an S.M.S.-message for transfer of trip data and extra information by the system according to the present invention. The message contains a 20-byte header and six 20-byte datablocks. This leads to a total message length of 140 bytes. Data-blocks could in this case represent trip registrations produced by the system according to the present invention. Figure 4 shows a preferred data format for the header of a S.M.S.-message when used in combination with the system according to the present invention. The two bytes BN contain the message number and the byte VNS contains the version number of the software used. The two bytes CHK contain a so-called ChecKsum, which serves to verify the correct transfer of the message after reception. the six bytes ID contain an identification of the transmitting vehicle. This identification may for instance be the official vehicle registration, coded in ASCII (American Standard Code for Information Interchange). The nine bytes XTR are available for transmission of extra information. In addition to the use of S.M.S.-messages, trip data could be easily transmitted in the form of email or facsimile messages.

**[0042]** It should be clear to the reader that the invention is in no way limited to the embodiment described above, and that, within the scope of the invention, many different and advantageous embodiments and additions can be envisaged.

## Claims

1. System to be used in wheeled vehicles, for registration, processing and storage of data with respect to trips of the vehicle, comprising means for data transfer between the system according to the present invention and suitable electronic devices in said vehicle or in the proximity of said vehicle,
**characterised by** the fact that the system according to the present invention comprises means to control at least one other electronic device in such manner that through said electronic device, trip data as registered, processed and stored by the system according to the present invention, is transferred to one or more telecommunications and/or datanetworks outside the vehicle.

2. System according to claim 1, **characterised by** the fact that the system itself comprises means for transfer of said trip data to one or more telecommunications and/or datanetworks outside the vehicle

3. System according to one of the preceding claims, **characterised by** the fact that trip data as registered, processed and stored by the system according to the present invention, comprises at least a trip number, date and time at the start of a trip, date and time at the end of a trip, the odometer reading at the start and at the end of a trip, and an identification of the purpose of the trip.

4. System according to one of the preceding claims, **characterised by** the fact that extra information can be added to trip data stored in the system according to the present invention, through an electronic device in the vehicle or in the proximity of the vehicle, which is suitable and comprises means for transfer of data between the system according to the present invention and said electronic device.

5. System according to claim 4, **characterised by** the fact that said extra information consists of an electronic representation of the vehicle's location at the start and at the end of a trip.

6. System according to claim 5, **characterised by** the fact that said electronic representation of the vehicle's location is determined by automatic detection of the cell of a cellular network for mobile communications in which the vehicle is located at a certain moment, and by using the known geographical location of this cell as an approximation for the location of said vehicle.

7. System according to claim 4, **characterised by** the fact that said extra information consists of an electronic representation of speech.

8. System according to one of the preceding claims, **characterised by** the fact that said system comprises at least the following parts:

   - a central control and processing unit, for instance a microprocessor, equipped with a suitable software program to provide for the right system functionality.
   - an electronic memory for storage of vehicle specific data like for instance a vehicle identification code and data necessary for calibration of the vehicle's electronic odometer signal.
   - an electronic memory for storage of trip data as registered and processed by the system according to the present invention.
   - electronic means to keep track of the current date and time.
   - means to detect whether the vehicle's ignition switch is being operated.
   - means to register the vehicle's electronic odometer signal.
   - means to connect a cable to establish datacommunication with electronic devices outside the system according to the present invention.
   - output means, suitable for issuing an optical and/or acoustical warning to a user of the system according to the present invention.

9. System according to claim 8, **characterised by** the fact that said detection whether the vehicle's ignition switch is operated, is realised by detecting significant changes in the electric potential on the supply lead of the standardised connector, which is provided in most recent model road vehicles to facilitate installation of for instance a car radio.

10. System according to claim 8, **characterised by** the fact that said electronic odometer signal is obtained by the system according to the present invention, through the standardised connector, which is provided in most recent model road vehicles to facilitate installation of for instance a car radio.

11. System according to claim 8, **characterised by** the fact that said output means for issuing an optical and/or acoustical warning to the user of the system according to the present invention, issues said warning when the available memory capacity for storing trip data has decreased below a specified

treshold value.

**12.** System according to claim 8, **characterised by** the fact that the system periodically derives data with respect to the distance travelled by the vehicle per unit time, from said electronic odometer signal, and stores said data in an electronic memory in the system according to the present invention.

**13.** System according to claim 12, **characterised by** the fact that said data with respect to the distance travelled by the vehicle per unit time are stored in said electronic memory in such manner, and that said electronic memory has such capacity, that a databuffer is created, which contains at all time a certain amount of the most recently registered data, equal to the storage capacity of said electronic memory.

**14.** System according to claim 8, **characterised by** the fact that at least the contents of said electronic memory for storage of vehicle specific data is secured by means of encryption in such manner that said data can only be entered, read-out and altered by an authorised person.

**15.** System according to one of the preceding claims, **characterised by** the fact that the system comprises an input means, which provides a possibility to a user of the system according to the present invention, to indicate whether the system should register the vehicle trip as business, private or commuting.

**16.** System according to one of the preceding claims, **characterised by** the fact that the system comprises means to detect whether the filling opening of the vehicle's fuel tank is in an open or closed state.

**17.** System according to one of the preceding claims, **characterised by** the fact that the system comprises means for data transfer by way of infrared light between the system according to the present invention and electronic devices in the vehicle or in the proximity of the vehicle.

**18.** System according to claim 17, **characterised by** the fact that said means for data transfer by way of infrared light, operate in conformity with the so-called "IrDA" (Infrared Data Association) communications standard.

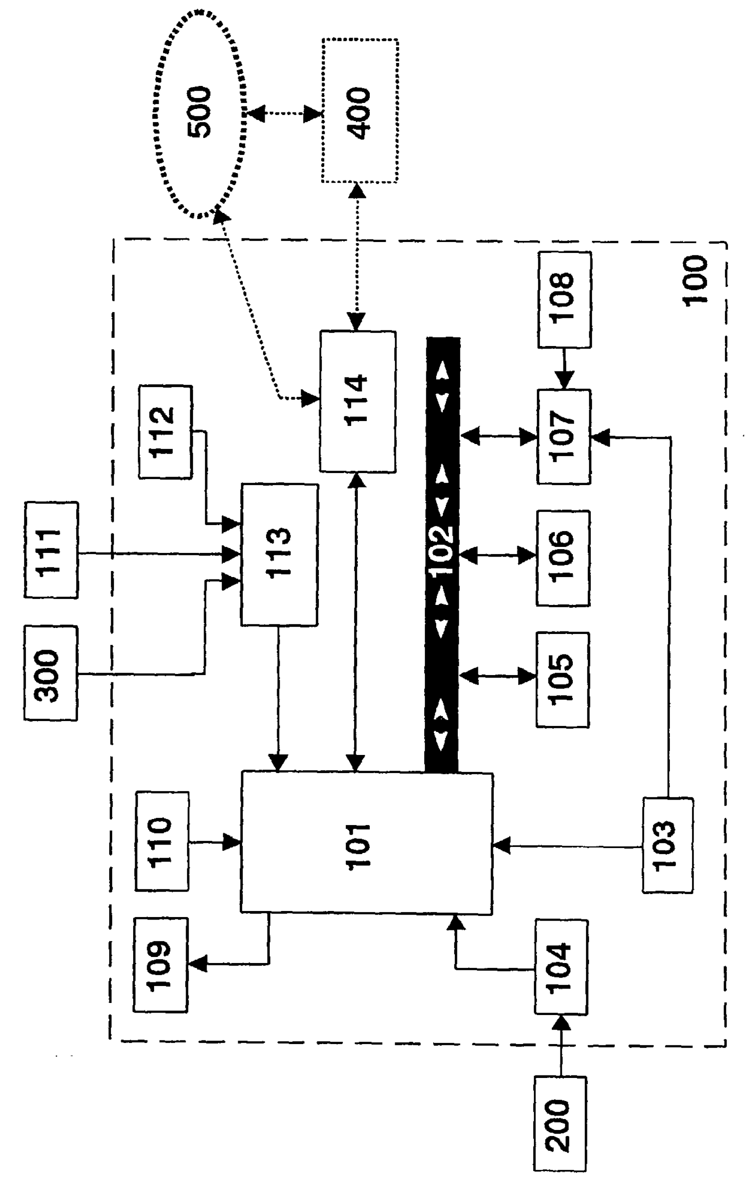
**19.** System according to one of the preceding claims, **characterised by** the fact that the system comprises such means that data transfer between the system according to the present invention and electronic devices in the vehicle or in the proximity of the vehicle, is accomplished in conformity with the so-called "Bluetooth" de-facto standard for short-distance radio communications.

**20.** System according to one of the preceding claims, **characterised by** the fact that parts of the system are placed in the vehicle in such manner and at such location(s) that said parts are mechanically attached to the vehicle and protected against unauthorised access and/or tampering, from within the vehicle's passenger compartment, as well as from outside the vehicle.

**21.** System according to one of the preceding claims, **characterised by** the fact that trip data and extra information as registered, processed and stored by the system according to the present invention, is transferred to telecommunications and/or datanetworks outside the vehicle, in the form of S.M.S. (Short Message Service)-messages.

**22.** System according to one of the preceding claims, **characterised by** the fact that trip data and extra information as registered, processed and stored by the system according to the present invention, is transferred to telecommunications and/or datanetworks outside the vehicle, in the form of email messages.

**23.** System according to one of the preceding claims, **characterised by** the fact that trip data and extra information as registered, processed and stored by the system according to the present invention, is transferred to telecommunications and/or datanetworks outside the vehicle, in the form of facsimile messages.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200

Fig. 1

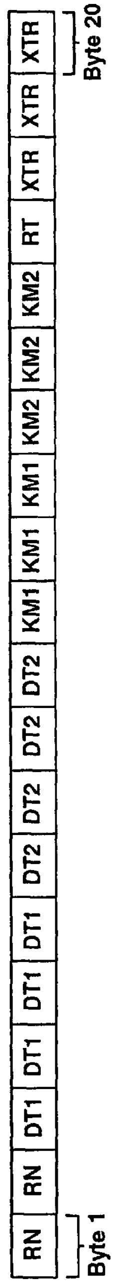



Fig. 2

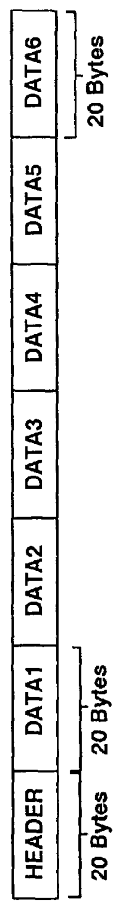



Fig. 3

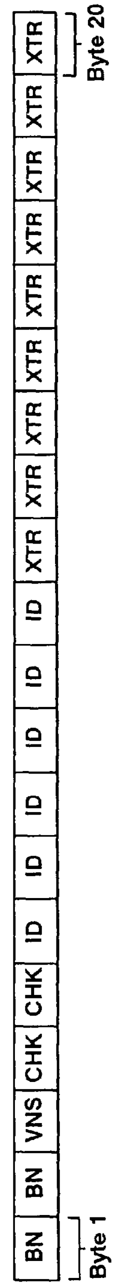



Fig. 4

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 164 551 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**19.12.2001 Bulletin 2001/51**

(51) Int Cl.[7]: **G07C 5/00**

(21) Application number: **01304905.1**

(22) Date of filing: **05.06.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR**
Designated Extension States:
**AL LT LV MK RO SI**

(30) Priority: **12.06.2000 US 591970**

(71) Applicant: **Meritor Heavy Vehicle Technology LLC**
**Troy, Michigan 48084 (US)**

(72) Inventor: **Ramsey, Reno**
**Sterling Heights, Michigan 48313 (US)**

(74) Representative: **Barnfather, Karl Jon, Dr. et al**
**Withers & Rogers, Goldings House, 2 Hays Lane**
**London SE1 2HW (GB)**

(54) **Personal data computer for vehicle monitoring**

(57) A personal computer, generally of the type commonly available under the trade name Palm Pilot™is utilized on a heavy vehicle to obtain information. The information may be analyzed by software provided on the computer. The computer is removed from a docking module on the vehicle and plugged into a docking module at a headquarters base. Data can then be downloaded to the headquarters. At the same time, the headquarters can upload information into the computer which may be then downloaded into the vehicle when the computer is returned to the vehicle. The information taken from the vehicle to the computer may include trip information such as mileage, state line crossing, etc. The information uploaded into the computer may include trip information which can then provide instructions to a navigation system on the vehicle. Moreover, the system may also provide diagnostic analyses while on the vehicle.

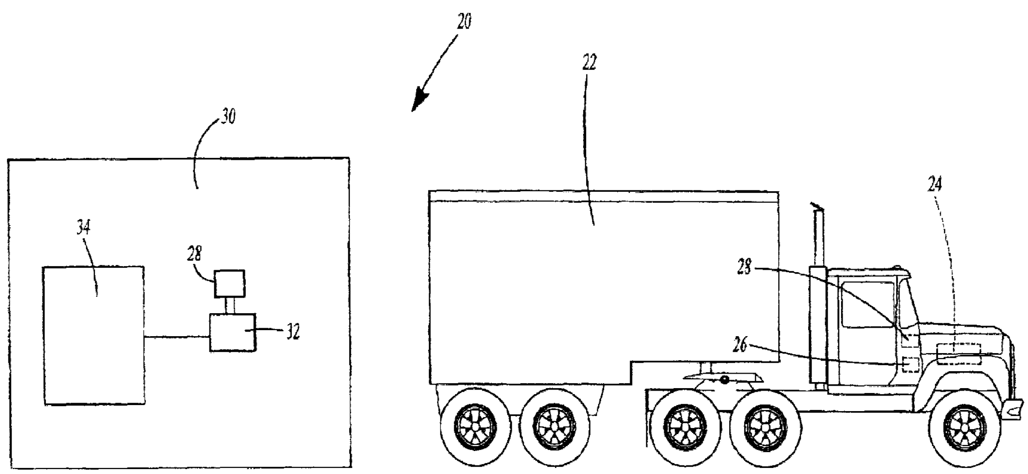



Fig-1

EP 1 164 551 A2

Printed by Jouve, 75001 PARIS (FR)

## Description

### BACKGROUND OF THE INVENTION

**[0001]** This invention relates to the use of a personal computer which is selectively plugged into a vehicle, and into a base facility to selectively gather, analyze and transmit data. Heavy vehicles such as trucks, typically require a good deal of data storage and gathering. In particular, on a typical heavy truck trip, the driver must gather a good deal of information with regard to the route traveled. As an example, taxes must be assessed based on the number of state lines crossed, etc. Thus, it is typically necessary for a truck driver to prepare detailed manual logs during or after a trip.

**[0002]** It would also be desirable to have a system which monitors and analyzes variables during the operation of the vehicle. As an example, it would be desirable to be able to monitor the number of hours driven by an operator, such that an operator is not allowed to drive for too many hours. Moreover, it would be desirable to have a system that can monitor variables such as anomalies in the operation of the vehicle, and analyze such anomalies.

**[0003]** On-board computers are known for vehicles. However, these on-board computers are typically dedicated into the control system for the vehicle. Moreover, the system is relatively expensive in that hardware and software must be individually tailored for the particular vehicle. Many heavy vehicles are manufactured in relatively low runs, and thus, it may not be cost effective to prepare individual computers.

**[0004]** More recently, the assignee of the present invention has proposed a system wherein a so-called "Smart Card" stores information during operation of a vehicle, and may then be taken from the vehicle. This card is able to store information with regard to the vehicle, and with regard to the operator operating the vehicle. While this Smart Card does provide many functional benefits, it is not able to perform any computations on the gathered data.

**[0005]** It would be desirable to develop a system which can not only gather, but also analyze and respond to the gathered data.

### SUMMARY OF THE INVENTION

**[0006]** In the enclosed embodiment of this invention, a removable personal data assistant (PDA) or computer, is docked in a docking station on the vehicle. The PDA gathers operational information from the vehicle. When the driver leaves the vehicle the PDA can be taken with the operator and brought to a headquarters facility. In this way, it is relatively simple to download operational information from the vehicle to the headquarters. Further, the headquarters can upload information into the PDA which can then be transmitted to the vehicle when the driver returns to the vehicle.

**[0007]** Among the types of information which may be gathered and stored by the PDA includes operational information such as driver identification, trip information, operational history for the driver, etc. Moreover, the information which has typically been stored in manual logs by the operator can be simply stored on the computer. As an example, the number of state lines crossed, etc., may be stored.

**[0008]** Moreover, the computer is able to analyze and/or store information from the vehicle during operation of the vehicle to look for anomalies. As an example, a number of particular conditions may be sensed by the computer which would be indicative of a particular problem. The computer may then send a diagnostic signal which will enable the problem to be further identified.

**[0009]** In a most preferred embodiment, an off-the-shelf computer may be utilized. In this way, no expensive hardware or software need be developed. One such PDA is typically known and available under the trade name Palm Pilot™. Such a PDA is easily tailored to include additional software such that the headquarters can program the PDA to include particular software for any particular function the headquarters would like be performed at the vehicle. Again, the use of this system simplifies and facilitates the gathering of data from the vehicle.

**[0010]** These and other features of the present invention can be best understood from the following specification and drawings, the following which is a brief description.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0011]**

Figure 1 schematically shows a headquarters and vehicle.

Figure 2 is a schematic view of the PDA mounted in a vehicle.

Figure 3 is a flow chart showing the invention.

### DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

**[0012]** Figure 1 is a schematic view of a system 20 incorporating a heavy vehicle 22 with an onboard computer or controller 24. Computer 24 communicates through a bus line with a docking module 26. A removable computer 28 is plugged into the docking module 26.

**[0013]** A remote headquarters 30 also includes a docking module or base 32 to receive the removable computer 28. The docking module 32 communicates with a headquarters computer 34.

**[0014]** As shown in Figure 2, the computer 24 receives operational information from a number of onboard devices 40, 42, 44. Thus, operational information is transferred through the data bus, into the module 26, and then to the removable computer 28. Among the information received by the computer 28 is distance traveled, location, navigation system information, etc. The removable computer 28 calculates information applicable for taxes such as fuel taxes, and taxes based on crossing a state line. The software provided on the removable computer 28 is appropriate for receiving the information and calculating the required taxes.

**[0015]** Moreover, the removable computer 28 may be provided with the ability to analyze anomalies in the information transferred over the data bus. As an example, if a particular anomaly is indicative of a problem with one of the components 40, 42, or 44 the computer 28 may send a signal which will assist in diagnosing which components is experiencing a failure. That diagnosis is then stored at the computer 28, or a signal can be sent. When the removable computer 28 is next loaded into the docking module 32 at headquarters, the computer may then download the operational information with regard to the failing component. A worker in this art would understand the signals, etc. that would provide such diagnostic functions.

**[0016]** Updated software, or additional information with regard to the driver, the trip, etc., may be uploaded from the headquarters computer 34 into the removable computer 28. In this way, chip information, or updated information with regard to what the company would like to be monitored can be uploaded into the computer 24 on an ongoing basis. A navigation system which may be one of the components 40, 42 or 44 may be associated with the onboard computer 24, and provide detailed trip information to removable computer 28. Further, trip information could be uploaded from the headquarters into the vehicle, and would then communication with the navigation system. Again, the provision of a removable computer 28 which is relatively inexpensive thus provides valuable benefits.

**[0017]** Further, while plugged into either module 32 or 26, the computer is being recharged.

**[0018]** Figure 3 is a flow chart for an invention utilizing the removable computer 28 into a vehicle. First, the computer 28 is plugged into a vehicle. It begins to receive information and/or transmit information. Information received may be analyzed for purposes of calculating required taxes. Further, information may be outputted to the vehicle as in the diagnostic information as mentioned above.

**[0019]** Finally, the removable computer may be unplugged from the vehicle and plugged into a terminal at headquarters. At that time data may be downloaded, while other information may be uploaded.

**[0020]** While preferred embodiments of this invention have been disclosed, a worker in this art would recognize that many modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

**Claims**

1. A method of gathering and analyzing data from operation of a vehicle (22) comprising the steps of:

    (i) providing a first docking module (26) on a vehicle, and a second docking module (32) at a remote location (70);
    (ii) plugging a removable computer (28) into said first docking module on the vehicle and operating said vehicle;
    (iii) storing information from operation of the vehicle on said removable computer, and analysing said information; and
    (iv) removing said removable computer from said first docking module on said vehicle and plugging said removable computer into said docking module at said remote location.

2. A method as recited in Claim 1, wherein among the analyses made is calculating taxes required for operation of said vehicle.

3. A method as recited in Claim 2 wherein the removable computer processes data supplied by one or more onboard devices (40, 42, 44) on said vehicle so as to calculate said taxes.

4. A method as recited in any preceding Claim wherein information is uploaded into said removable computer when docked into said second docking module at said remote location, and said information is downloaded into said vehicle when said removable computer is docked into said first docking module.

5. A method as recited in Claim 4, wherein trip information and/or driver information is uploaded into said removable computer and then downloaded into said vehicle.

6. A method as recited in any preceding Claim, wherein said removable computer analyses operational information and identified anomalies, and then sends control signals to a vehicle controller while docked on said vehicle.

7. A method as recited in Claim 6, wherein the removable computer sends a signal to assist in diagnosing said anomaly, and/or interrogates the vehicle control to assist in diagnosis and/or analysis.

8. A method as recited in Claim 6 or Claim 7, wherein said operational information is at least one of location data, navigational data, data related to passing a State Line, and/or distance data.

9. A method as recited in any preceding Claim, wherein trip information is downloaded from said vehicle

into said computer during step (ii).

**10.** A method as recited in any preceding Claim, wherein the removable computer may be programmed so as to store and analyse differing data for differing drivers of said vehicle.

**11.** A system (20) for monitoring operation of a vehicle (22) comprising:

A vehicle (22) including a docking module and a computer;
A headquarters (30) having a docking module (32); and
A removable computer (28) which may be plugged into said docking module at said headquarters and said docking module on said vehicle, said computer obtaining data from said vehicle during operation of said vehicle, and downloading said data to said headquarters when removed from said vehicle.

**12.** A system as set forth in Claim 10, wherein said headquarters also uploads information into said computer to be downloaded into said vehicle.

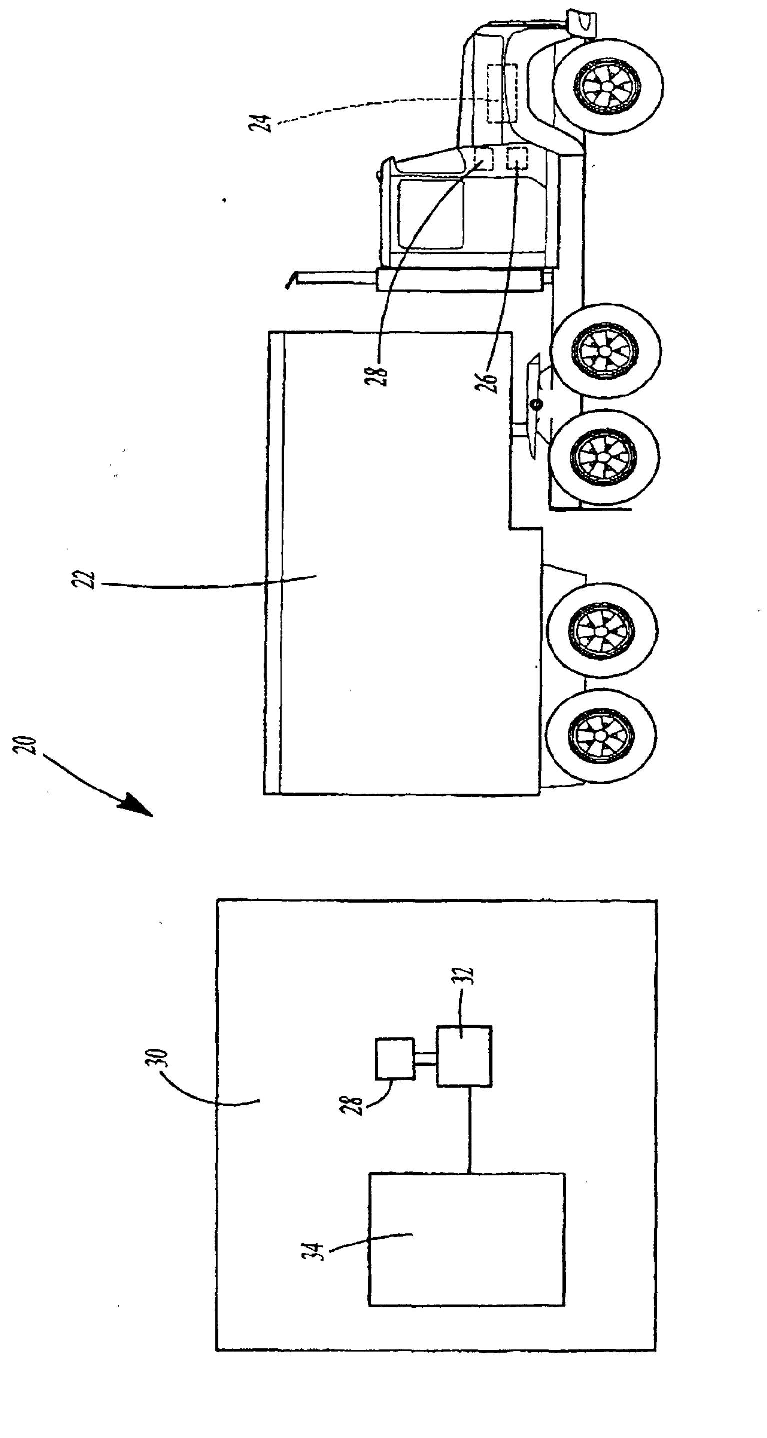
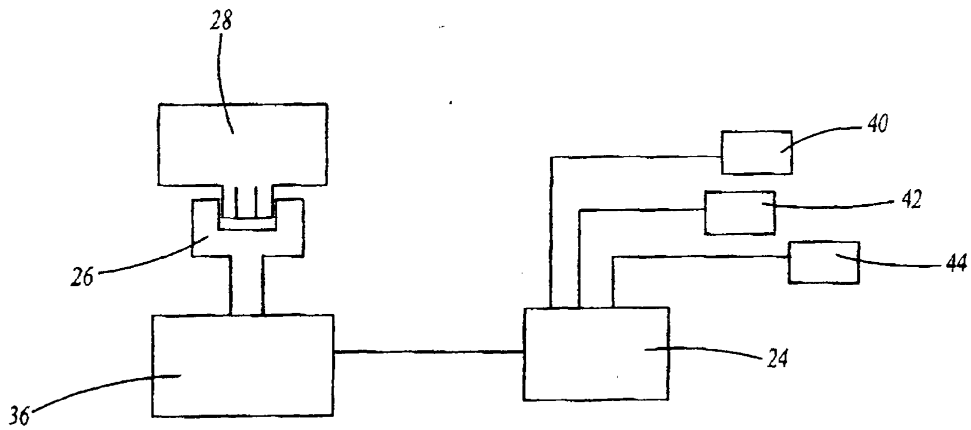



Fig-1


28
26
36
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42
44
24

Fig-2

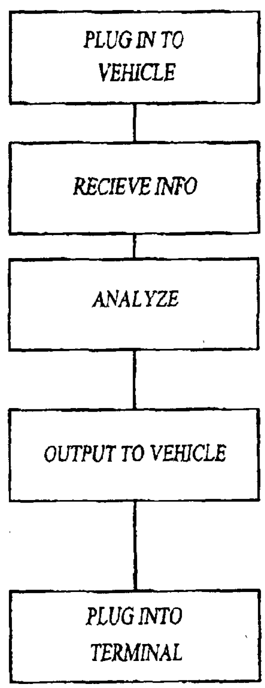

PLUG IN TO VEHICLE
RECIEVE INFO
ANALYZE
OUTPUT TO VEHICLE
PLUG INTO TERMINAL

Fig-3

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2001 (15.11.2001)

PCT

(10) International Publication Number
WO 01/86576 A1

(51) International Patent Classification[7]: G06F 19/00, G06G 7/70

(21) International Application Number: PCT/US01/14747

(22) International Filing Date: 8 May 2001 (08.05.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/202,419 8 May 2000 (08.05.2000) US

(71) Applicant (*for US only*): **SYSTECH INTERNATIONAL, L.L.C.** [US/US]; 6075 Jackson Road, Ann Arbor, MI 48103 (US).

(72) Inventor; and
(75) Inventor/Applicant (*for US only*): **TRIPHATHI, Pradeep, R.** [US/US]; 5500 Lohr Lake Drive, Ann Arbor, MI 48108 (US).

(74) Agents: **VAN DYKE, GARDNER, LINN & BURKHART L.L.P.** et al.; 2851 Charlevoix Drive, S.E., Suite 207, P.O. Box 888695, Grand Rapids, MI 49588-8695 (US).

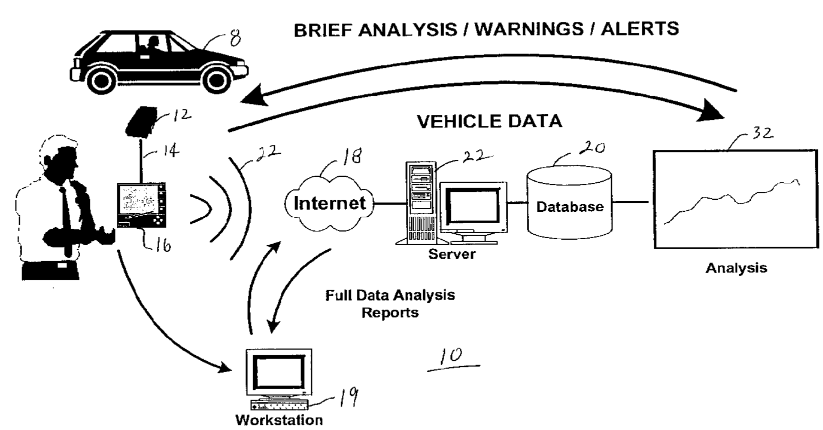
(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published:**
— *with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**(54) Title:** MONITORING OF VEHICLE HEALTH BASED ON HISTORICAL INFORMATION




**(57) Abstract:** A method and apparatus for detecting abnormal behaviour in a vehicle (8) with an engine having engine control module includes providing a database (20), and a vehicle analyser (12) having a communication device (16) and an interface (14) that links the communication device (16) to a vehicle (8). Engine parameters that are retrieved through the interface (14) during driving experience are uploaded to the database (20) using the communication device (16). The database (20) analyses the engine parameters from multiple driving experiences to establish historical data and determine normal operation of particular retrieved engine parameters based on the historical data. A vehicle (8) can be diagnosed by comparing its retrieved engine parameters with the database (20).

WO 01/86576 A1

# MONITORING OF VEHICLE HEALTH BASED ON HISTORICAL INFORMATION

## CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority from U.S. provisional patent application Ser. No. 60/202,419 filed on May 8, 2000, the disclosure of which is hereby incorporated herein by reference in its entirety.

## BACKGROUND OF THE INVENTION

In the United States, automotive mechanics are not always viewed as being fully trusted and reliable. Practicality indicates that automotive mechanics typically are not fraudulent, but rather overwhelmed with the complexity of the modern computer-controlled vehicle. With hundreds of parameters dictating a vehicle's performance, it may be difficult to pinpoint the source of the problem regardless of the mechanic's skill level. There has also been decay in the number of households that perform basic maintenance to their own vehicles. The primary reason again relates to the increase in complexity of the modern vehicle.

The problem with the current approach for diagnosis and maintenance is that it is performed in a static manner. Typical diagnosis of a vehicle's performance is based on a single snap shop image of the vehicle's characteristics. Presently, adequate use of vehicle and driving mode specific historical information is not used to assist in this process.

Present diagnostic tools that interface to the vehicle computer will show various sensor data and information. However, aside from actual fault codes from the vehicle, these tools do not contain tolerances for each and every vehicle type and driving conditions for the vast available parameters. As a result, the mechanic must determine from hundreds of available parameters the potential cause of the problem. This requires extensive expertise and references to technical manuals on sensor input and output status for that vehicle type. Ultimately, vehicle maintenance and diagnosis can be complicated and costly, considering the current tools that are available.

Onboard Diagnostics, or OBD, was developed primarily for monitoring the vehicle's emissions control systems by the Engine Control Module (ECM), which will typically display a general warning to the operator when a fault is detected. It also provides a means by which a mechanic or vehicle inspector can access specific fault codes related to engine hardware that can affect emissions and engine performance. The OBD system is accessible via a standardized communications cable and a microprocessor-based device, often referred to as a scan tool, that implements a standardized communications protocol. Data from onboard sensors can be accessed at a rate of up to 50 Hz.

Prior art includes U.S. Pat. Nos. 5,539,638 to Keeler et al. and 5,625,750 to Puskorius et al. that claim the use of artificial intelligence computer systems that can be trained to predict failure of the catalytic converter and to predict certain emissions levels. Both standard OBD sensors and additional sensors are used to generate inputs into these learning algorithms. Prior systems do not attempt to establish parameters during different driving and vehicle conditions. Instead, generic broad parameters are established covering multiple vehicles and driving conditions. Prior systems also use several parameters in conjunction to predict a certain condition, such as high hydrocarbon emissions.

## SUMMARY OF THE INVENTION

The federal government has mandated that all vehicles sold in the United States shall have a standardized interface to the vehicle's computer. The present invention provides a vehicle analyzer that can be embodied as a microprocessor-based hardware/software package designed to communicate with OBD (onboard diagnostics) computer systems contained in 1996 and later vehicles sold in the United States. The present invention provides a product that is useful for both the consumer and the professional.

A method of detecting abnormal engine behavior in a vehicle, according to an aspect of the invention, includes providing a database, a communication device and an interface to an engine control module and retrieving engine parameters through the interface during a driving experience and uploading the engine parameters to the database using the communication device. The method further includes analyzing the uploaded engine parameters from multiple driving experiences at the database to establish historical data and determining normal operation of particular retrieved engine parameters based on the historical data. The method further includes comparing engine parameters of a vehicle to be diagnosed with the normal operation of particular retrieved engine parameters to determine whether the vehicle to be diagnosed operates outside of the normal operation.

A method of detecting abnormal engine behavior in a vehicle, according to another aspect of the invention, includes providing a database and multiple vehicle analyzers, each of the vehicle analyzers including a communication device and an interface with an engine control module. The method further includes retrieving engine parameters for multiple vehicles that are generally the same type as each other using the multiple vehicle analyzers and uploading the retrieved engine parameters to the database. The method further includes analyzing the uploaded engine parameters from the multiple vehicles to establish historical data and determining normal operation of particular retrieved engine parameters based on the historical data. The method further includes preparing engine parameters of a vehicle generally of the same type with the normal operation of particular retrieved engine parameters to determine whether the vehicle operates outside the normal operation.

In either of the above-identified methods, the analyzing may include retrieving engine parameters over multiple driving experiences, storing the data over multiple driving experiences into the database and establishing statistical control limits for the particular engine parameters. This may further include establishing statistical control limits for particular engine parameters during various driving conditions which may include idle, steady cruise at various speeds, and various rates of acceleration and deceleration. The particular engine parameters may include critical engine parameters. The historical data may be based on engine parameters retrieved previously from the vehicle to be diagnosed.

In either of the above-identified methods, the uploading may include communicating over either an Internet or an Intranet. The communication may be via wireless communication. The uploading may include communicating over a global network and may further include providing a wireless communication device that is adapted to connect with the database over the global network. The communication device may include browser software and the interface may include an onboard diagnostic interface.

A system for detecting abnormal vehicle engine behavior, according to an aspect of the invention, includes a vehicle analyzer having a communication device and an interface that links the wireless communication device to a vehicle. The system further includes a database system that is separate from the vehicle analyzer. The wireless communication device collects data from the vehicle through the interface scan tool while the vehicle is driven. The database system is programmed to receive data broadcast by the wireless communication device from the scan tool. The database includes normal operation of particular engine parameters based on historical data. The database system compares the collected data to the normal operation of particular engine parameters to determine normal conditions of the vehicle.

A system for detecting abnormal vehicle engine behavior, according to another aspect of the invention, includes a database and a plurality of vehicle analyzers, each including a communication device and an interface that links the communication device to a vehicle. The communication device is adapted to upload to the database engine parameters retrieved by the interface. The database is adapted to analyze the retrieved engine parameters uploaded from a plurality of vehicle analyzers to establish historical data among vehicles that are generally of the same type and to determine normal operation of particular retrieved engine parameters based on historical data. The database is further adapted to compare engine parameters of a vehicle generally of the same type with the normal operation of particular retrieved engine parameters to determine whether that vehicle operates outside of the normal operation.

Either of the above-identified systems may further include determining the normal operation of particular engine parameters from data retrieved from multiple previous driving experiences. The communication device may include a wireless communication device, such as a cellular telephone or a personal digital assistant. The wireless communication device may include a radio frequency transmitter. The vehicle analyzer may include a data port for uploading data to a computer for subsequent uploading to the database at a later time. The communication device may be adapted to operate on a global network, such as an Internet or an Intranet, and may further include browser software. The database system may establish statistical control limits for particular engine parameters during various driving conditions which may include idle, steady cruise at various speeds, and various rates of acceleration and deceleration. The particular engine parameters may include critical engine parameters.

The present invention utilizes a technique to characterize normal limits for individual engine parameters and provides a means by which to detect when said parameters begin to operate outside normal levels for certain operating conditions. While the ECM contains limits on some engine parameters, these are typically gross limits that apply to all operating conditions, and vehicle age or mileage combined. The present invention provides a much narrower tolerance of what is considered normal operation of engine parameters to facilitate diagnosis of actual and imminent engine failure. This invention, therefore, provides a means of early detection of failure of specific components.

A vehicle analyzer, according to more detailed aspects of the invention, obtains information from the vehicle's computer to track critical engine parameters and reports any problems or potential problems to the user. The vehicle analyzers pass information from a large number of vehicles to a database that uses statistical modeling to "learn" typical performance of these critical engine parameters under various driving conditions, including idle, steady cruise, accelerations, and decelerations. Once a sufficient statistical database is established, the vehicle analyzer in conjunction with the database can diagnose a vehicle under driving conditions. The operating condition, including any abnormal behavior that could indicate or eventually lead to a failure of one or more engine components, can be determined with the use of either historical or reference information. The vehicle analyzer will also translate any specific fault codes stored in the onboard computer system to useable information for the user in order to diagnose and repair the vehicle.

The vehicle analyzer and database, according to an aspect of the invention, is a system that implements a method of tracking and monitoring a vehicle's health based on historical statistical information, rather than only instantaneously accessing the vast diagnostic information available on vehicles. As a result, vehicle maintenance and diagnosis can be simplified such that the consumer has a tool that permits him or her to know when something has failed or is about to fail by comparing an individual vehicle's diagnostic information with the comparable data of the same vehicle fleet. It also assists the mechanic in repairing the vehicle back to the fault-free condition. The historical parameters also serve as a reference for the effectiveness of the repair on a broad range of parameters. The vehicle analyzer is able to gather significant data and establish tighter acceptable operating parameters based on the vehicle's history that allows early detection of problems.

In addition, the vehicle analyzer can be used to assess the health of a vehicle before it is purchased. In this case, the vehicle analyzer system is used in conjunction with the database that contains data on other vehicles of the same type. This can provide a more objective analysis by the consumer prior to the purchase of a modern vehicle.

The primary advantages of this system include its low cost and early detection of problems resulting from tight tolerances. It also provides simplification of diagnosis. The invention may be used for repair verification and objective purchase analysis.

These and other objects, advantages and features of this invention will become apparent upon review of the following specification in conjunction with the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a system for detecting abnormal engine behavior, according to the invention; and

Fig. 2 is a flowchart of a method of detecting abnormal engine behavior, according to the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now specifically to the drawings, and the illustrative embodiments depicted therein, a system 10 for detecting abnormal engine behavior of a vehicle 8 based on historical information is provided including a vehicle analyzer, such as an OBD scan tool hardware device 12 having a connector, or data port, 14 to link to a wireless Internet ready communication device, such as a cellular telephone 16, a personal digital assistant (PDA), or the like. Wireless Internet ready phone 16 includes an Internet browser to connect, via a wireless data link 22, to a global network, such as the Internet or an Intranet 18. A master database 20 and application software are run on a computer 22 connected with Internet or Intranet 18.

In operation, system 10 is linked to vehicle 8 to collect data. Vehicle analyzer 12 interfaces with the Engine Control Module (ECM) on a vehicle via standardized communications protocol, connector and hardware that is adapted to link to the data port of wireless Internet ready phones 16. Application software allows for communication between the wireless Internet ready phone 16 and the vehicle onboard computer.

A method 34 of detecting abnormal engine behavior of vehicle 8 begins at 26 by initiating data link 22 when performing a diagnosis or to generate or maintain the personal vehicle data on a predetermined frequency. The operator will be instructed to perform regular data acquisitions at a certain time interval, so parameters can be monitored with statistical tools. While the user drives the vehicle in a normal fashion (28), the vehicle analyzer will collect, process, and transmit data (30) on critical engine components to the master database. The engine parameters that will be tracked may include, but are not limited to, exhaust gas oxygen (both upstream and downstream of the catalytic converter), mass airflow, engine coolant temperature, engine rpm, and operating controls, such as degree of spark advance and degree of exhaust gas recirculation. This data will be sampled during various driving conditions and processed in such a way as to establish a database for certain operating conditions. These conditions include idle, cruise at various speeds, and various rates of acceleration and deceleration.

System 10 analyzes the data at 32. The vehicle analyzer will use Statistical Process Control (SPC) tools and trend-modeling analysis to analyze data-based vehicle history. When the master database of information at this condition is sufficiently large, upper and lower control limits are established based on statistical analysis of the master database. This establishes normal operation of particular retrieved engine parameters. This may include the mean and standard deviation of the database.

The application software at the master database compares the retrieved engine parameter (34) and determines if there are any trends in this data or if data is outside statistical limits. This would suggest a change in the operation of the engine, which may be an early detection of some component failure. If a problem is detected (36), the master database notifies (40) the operator and suggests how to further diagnose the problem, such as by sending a message, voice or data, to the wireless Internet ready phone. This message can also be sent by E-mail, facsimile, or mail. The same process can be performed on other critical engine parameters and other operating conditions. If no problem is detected (38), the retrieved data can be used to further update the database of engine parameters.

System 10 may also analyze vehicle data based on data from vehicles of the same type and condition as the vehicle being analyzed. The vehicle analyzer may further have the ability to connect to a global network, such as the Internet or Intranet, to exchange data and information for the purpose of vehicle maintenance, diagnosis or purchase. In particular, the vehicle analyzer has the capability to connect to the Internet or an Intranet to upload vehicle data to the Internet/Intranet server system. Upon connection to the server system, the vehicle analyzer transmits all local vehicle data and information. At this time, the vehicle analyzer can request data on vehicles of the same type. Each connection increases the master database information. Data port 14 may also be connected with a computer 19 for uploading data retrieved by vehicle analyzer 12 at a later time. Computer 19 may also receive notifications (36) from database 20.

The master database may use variance analysis algorithms to perform analyses based on data from other vehicles of the same type. Data on the same vehicle type acquired from the database system may be used to compare to the consumer collected vehicle data. This will allow for a consumer to compare the sensor outputs from a properly operating vehicle to a vehicle being purchased. It also may be used to determine the source of the problem when performing vehicle diagnosis. Detailed comparisons and analyses are performed at the master database. The results can be sent and made available to the consumer in many different ways, such as wireless messaging, facsimile, E-Mail, web site, etc.

Example

An example of the invention used to evaluate the vehicle's oxygen ($0_2$) sensor follows. Data collected on that vehicle, whether continuous or discrete, is modeled in the same manner as the $O_2$ sensor described below to achieve the most effective early detection and diagnosis. Data is gathered from the vehicle using vehicle analyzer 12 based on an Internet ready wireless device, such as an Internet ready cellular phone 16. Data is sent to the main database 20. The application software at the main database analyzes $O_2$ data. Driving conditions, such as the vehicle is warm/cold or accelerating/decelerating/cruising/ idling, are determined for sets of data collected by looking at vehicle speed, engine coolant temperature, engine rpm, calculated vehicle load and much more. Data within a driving event may have different conditions from start to end, since a cold car will warm up over time. Vehicle condition can be affected by factors such as age, faulty condition, etc. For a given vehicle and given driving conditions, the vehicle analyzer evaluates $O_2$ parameters such as:

i. Time between transitions

ii. Min sensor voltage

iii. Lean to rich switch time

iv. Rich to lean switch time

v. Lean to rich threshold

vi. Rich to lean threshold

vii. High sensor voltage and low sensor voltage

Acceptable and actual decay rate of a sensor are modeled to achieve the tightest tolerances established utilizing SPC modeling tools. Since data of the same type, based on same vehicle and driving condition, is available in the master database, the resultant data-set will have a normal distribution allowing hypotheses testing for significant difference by utilizing analysis of variance design and analysis.

Changes and modifications in the specifically described embodiments can be carried out without departing from the principles of the invention which is intended to be limited only by the scope of the appended claims, as interpreted according to the principles of patent law including the doctrine of equivalents.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of detecting abnormal behavior in a vehicle having an engine with an engine control module, said method comprising:

providing a database, a communication device, and an interface to an engine control module;

retrieving engine parameters through said interface during a driving experience and uploading the retrieved engine parameter to said database using said communication device;

analyzing the uploaded engine parameters from multiple driving experiences at said database to establish historical data and determining normal operation of particular retrieved engine parameters based on the historical data; and

comparing engine parameters of a vehicle to be diagnosed with said normal operation of particular retrieved engine parameters to determine whether the vehicle to be diagnosed operates outside of the normal operation.

2. The method of detecting abnormal engine behavior of claim 1 wherein said analyzing includes retrieving engine parameters over multiple driving experiences, storing the data over multiple driving experiences into a database, and establishing statistical control limits for the particular engine parameters.

3. The method of detecting abnormal behavior of claim 2 including establishing statistical control limits for particular engine parameters during various driving conditions.

4. The method of detecting abnormal behavior of claim 3 wherein the various driving conditions include idle, steady cruise at various speeds, and various rates of acceleration and deceleration.

5. The method of detecting abnormal behavior in claim 1 wherein said particular engine parameters comprise critical engine parameters.

6. The method of detecting abnormal behavior in claim 1 wherein said historical data is based on engine parameters retrieved prior to said comparing from the vehicle to be diagnosed.

7. The method of detecting abnormal behavior in claim 1 wherein said uploading includes communicating over one of an Internet and an Intranet.

8. The method of detecting abnormal behavior in claim 1 wherein said uploading includes communicating via wireless communication.

9. The method of detecting abnormal behavior in claim 8 wherein said uploading includes communicating over a global network.

10. The method of detecting abnormal behavior in claim 9 wherein said uploading includes providing a wireless communication device that is adapted to connect with said database over said global network.

11. The method of detecting abnormal behavior in claim 10 wherein said communication device includes browser software.

12. The method of detecting abnormal behavior in claim 1 wherein said interface includes an onboard diagnostic interface.

13. A method of detecting abnormal behavior in a vehicle having an engine with an engine control module, said method comprising:

providing a database and multiple vehicle analyzers, each of said vehicle analyzers including a communication device and an interface with an engine control module;

retrieving engine parameters from multiple vehicles that are generally the same type as each other using said multiple vehicle analyzers and uploading the retrieved engine parameters to said database;

analyzing the uploaded engine parameters from the multiple vehicles to establish historical data and determining normal operation of particular retrieved engine parameters based on the historical data; and

comparing engine parameters of a vehicle generally of said same type with said normal operation of particular retrieved engine parameters to determine whether that vehicle operates outside of the normal operation.

14. The method of detecting abnormal behavior of claim 13 including retrieving engine parameters from multiple driving experiences from said multiple vehicles.

15. The method of detecting abnormal behavior of claim 14 wherein said vehicle analyzer includes an interface to an engine control module and a wireless communication module.

16. The method of detecting abnormal behavior of claim 15 wherein said uploading includes communicating over a global network.

17. The method of detecting abnormal behavior in claim 16 wherein said uploading includes providing a wireless communication device that is adapted to connect with said database over said global network.

18. The method of detecting abnormal behavior in claim 17 wherein said communication device includes browser software.

19. The method of detecting abnormal behavior in claim 13 wherein said analyzing includes retrieving engine parameters over multiple driving experiences, storing the data over multiple driving experiences into a database, and establishing statistical control limits for the particular engine parameters.

20. The method of detecting abnormal behavior of claim 19 including establishing statistical control limits for particular engine parameters during various driving conditions.

21. The method of detecting abnormal behavior of claim 20 wherein the various driving conditions include idle, steady cruise at various speeds, and various rates of acceleration and deceleration.

22. The method of detecting abnormal behavior in claim 13 wherein said particular engine parameters comprise critical engine parameters.

23. A system for detecting abnormal vehicle engine behavior of a vehicle having an engine with an engine control module, comprising:

a vehicle analyzer comprising a communication device and an interface scan tool that links said communication device to a vehicle engine control module;

a database system separate from said vehicle analyzer, said database system being programmed to receive data uploaded by said communication device, said database determines normal operation of particular engine parameters based on historical data;

wherein said vehicle analyzer retrieves data from the vehicle while the vehicle is driven to retrieve engine parameters and uploads the retrieved engine parameters to said database;

said database system compares the collected data to said normal operation of particular engine parameters to determine abnormal conditions of the vehicle.

24. The system for detecting abnormal vehicle engine behavior of claim 23 wherein said database determines normal operation of particular engine parameters from data retrieved from the vehicle being diagnosed over multiple previous driving experiences.

25. The system for detecting abnormal vehicle engine behavior of claim 23 wherein said communication device comprises a wireless communication device.

26. The system for detecting abnormal vehicle engine behavior of claim 25 wherein said wireless communication device comprises one of a cellular telephone and a personal digital assistant.

27. The system for detecting abnormal vehicle engine behavior of claim 25 wherein said wireless communication device comprises a radio frequency transmitter.

28. The system for detecting abnormal vehicle engine behavior of claim 23 wherein said vehicle analyzer includes a data port for uploading data to a computer for subsequent uploading to said database.

29. The system for detecting abnormal vehicle engine behavior of claim 23 wherein said communication device is adapted to operate on a global network.

30. The system for detecting abnormal vehicle engine behavior of claim 29 wherein said communication device includes browser software.

31. The system for detecting abnormal vehicle engine behavior of claim 23 wherein said database system establishes statistical control limits for particular engine parameters during various driving conditions.

32. The system for detecting abnormal behavior of claim 31 wherein the various driving conditions include idle, steady cruise at various speeds, and various rates of acceleration and deceleration.

33. The system for detecting abnormal behavior in claim 23 wherein said particular engine parameters comprise critical engine parameters.

34. A system for detecting abnormal vehicle engine behavior of a vehicle having an engine with an engine control module, comprising:

a database and a plurality of vehicle analyzers, each including a communication device and an interface that links that communication device to a vehicle, wherein said communication device is adapted to upload to said database engine parameters retrieved by said interface; and

said database is adapted to analyze the retrieved engine parameters uploaded from said plurality of vehicle analyzers to establish historical data among vehicles that are generally of the same type and to determine normal operation of particular retrieved engine parameters based on historical data;

wherein said database is further adapted to compare engine parameters of a vehicle generally of said same type with said normal operation of particular retrieved engine parameters to determine whether that vehicle operates outside of the normal operation.

35. The system for detecting abnormal vehicle engine behavior of claim 34 wherein said communication device comprises a wireless communication device.

36. The system for detecting abnormal vehicle engine behavior of claim 35 wherein said wireless communication device comprises one of a cellular telephone and a personal digital assistant.

37. The system for detecting abnormal vehicle engine behavior of claim 35 wherein said wireless communication device comprises a radio frequency transmitter.

38. The system for detecting abnormal vehicle engine behavior of claim 34 wherein said vehicle analyzer includes a data port for uploading data to a computer for subsequent uploading to said database.

39. The system for detecting abnormal vehicle engine behavior of claim 34 wherein said communication device is adapted to operate on a global network.

40. The system for detecting abnormal vehicle engine behavior of claim 39 wherein said communication device includes browser software.

41. The system for detecting abnormal vehicle engine behavior of claim 34 wherein said database system establishes statistical control limits for particular engine parameters during various driving conditions.

42. The system for detecting abnormal behavior of claim 41 wherein the various driving conditions include idle, steady cruise at various speeds, and various rates of acceleration and deceleration.

43. The system for detecting abnormal behavior in claim 34 wherein said particular engine parameters comprise critical engine parameters.

1/2

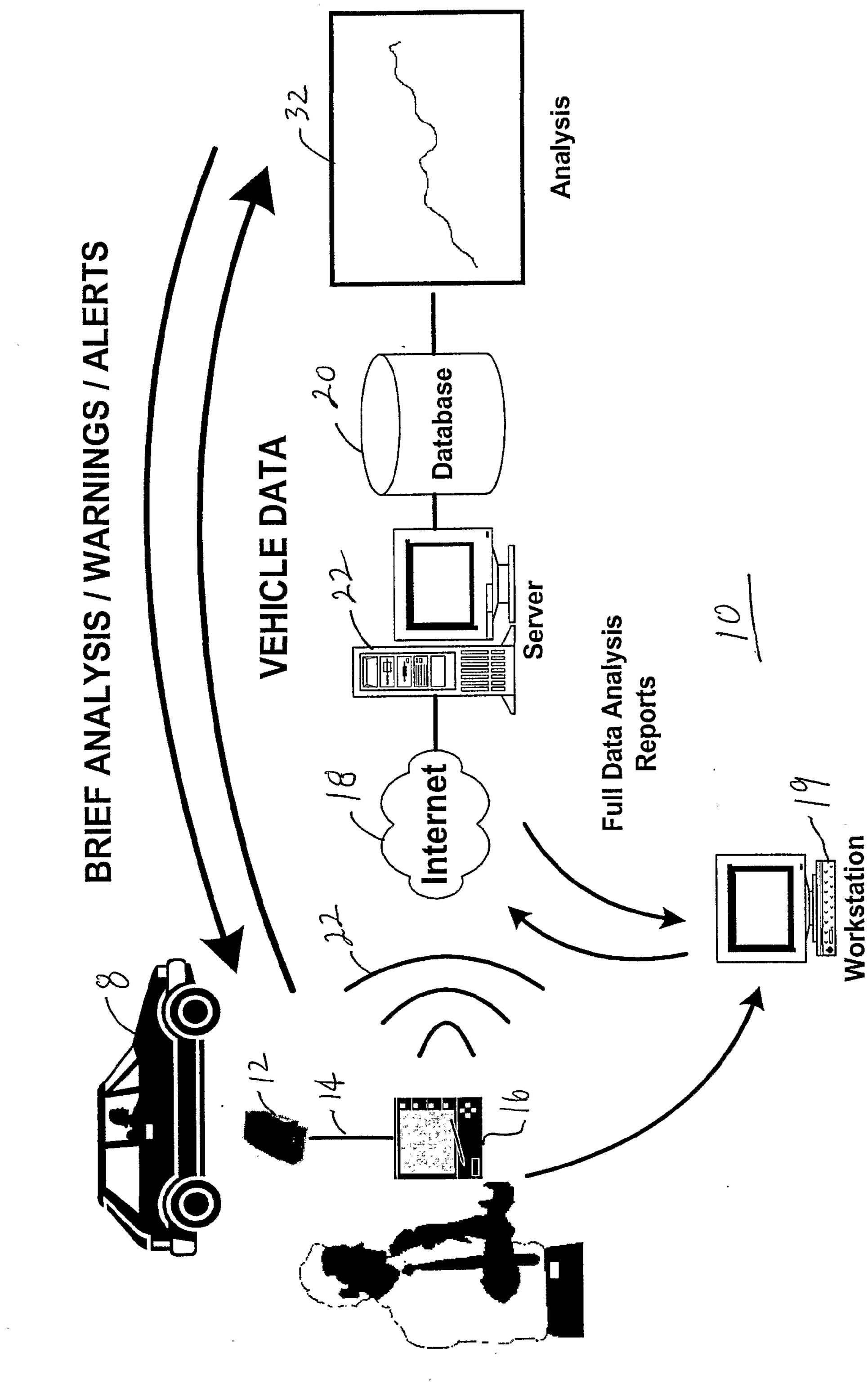

BRIEF ANALYSIS / WARNINGS / ALERTS
VEHICLE DATA
8
12
14
16
22
18
Internet
22
Server
20
Database
32
Analysis
Full Data Analysis Reports
19
Workstation
10

Fig 1

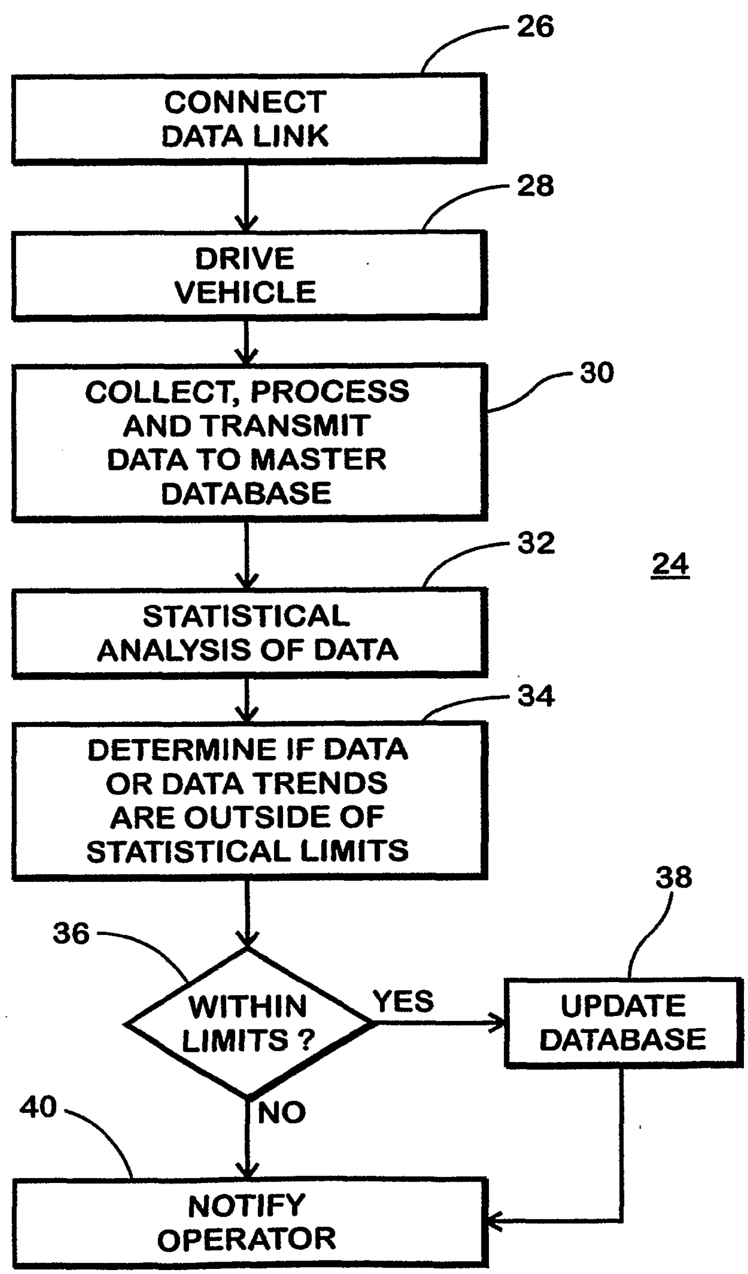

26
CONNECT DATA LINK
28
DRIVE VEHICLE
30
COLLECT, PROCESS AND TRANSMIT DATA TO MASTER DATABASE
32
24
STATISTICAL ANALYSIS OF DATA
34
DETERMINE IF DATA OR DATA TRENDS ARE OUTSIDE OF STATISTICAL LIMITS
38
36
WITHIN LIMITS ?
YES
UPDATE DATABASE
NO
40
NOTIFY OPERATOR

Fig. 2

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/14747

**A. CLASSIFICATION OF SUBJECT MATTER**
IPC(7) : G06F 19/00; G06G 7/70
US CL : 701/114, 29, 33
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 701/114, 29, 33, 101, 102, 115; 340/439, 825.69; 455/456

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 4,602,127 A (NEELY et al.) 22 July 1986 (22.07.1986), abstract, Figures 1, 2. | 22-43 |
| Y | US 5,884,202 A (ARJOMAND) 16 March 1999 (16.03.1999), Figures 1, 6, 8-11. | 22-43 |
| A | US 5,916,287 A (ARJOMAND et al.) 29 June 1999 (29.06.1999), entire document. | 1-43 |
| X, P | US 6,055,468 A (KAMAN et al.) 25 April 2000 (25.04.2000), Figures 1, 2, entire document. | 22-43 |
| A, P | US 6,094,609 A (ARJOMAND) 25 July 2000 (25.07.2000), entire document. | 1-43 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 13 July 2001 (13.07.2001) | 22 AUG 2001 |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. (703)305-3230 | Authorized officer<br>HIEU T. VO Diane Smith for<br>Telephone No. 703-308-1951 |

Form PCT/ISA/210 (second sheet) (July 1998)

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/14747

**Continuation of B. FIELDS SEARCHED Item 3:** EAST (ver 1.02.0008)search terms: vehicle analyzer, communication links, wireless, database, abnormal conditions.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 August 2001 (02.08.2001)

PCT

(10) International Publication Number
**WO 01/55690 A1**

(51) International Patent Classification[7]: G01M 15/00

(21) International Application Number: PCT/US01/02546

(22) International Filing Date: 25 January 2001 (25.01.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/492,264 27 January 2000 (27.01.2000) US

(71) Applicant: **INFOMOVE, INC.** [US/US]; 10635 NE 38th Place, Suite A, Kirkland, WA 98033 (US).

(72) Inventor: **LANG, Brook, W.**; 40 lake Bellevue, Ste 100, Bellevue, WA 98005 (US).

(74) Agent: **CRAINE, Dean, A.**; 400-112th Avenue NE, Suite 140, Bellevue, WA 98004-5542 (US).

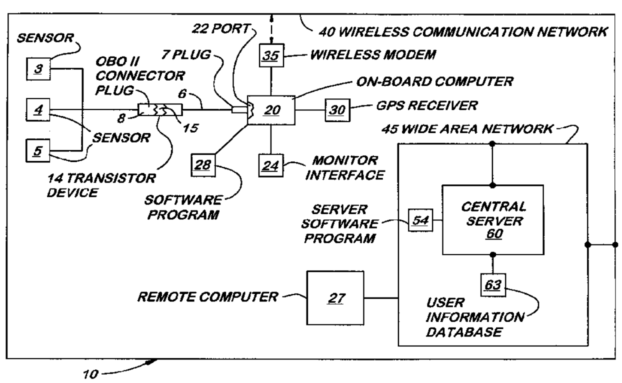
(81) Designated States *(national)*: AT, AU, BR, CA, CN, DE, DK, ES, FI, GB, JP, KP, MX, NO, NZ, PT, SE.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

**Published:**
— *with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**(54) Title:** SYSTEM FOR TRANSMITTING AND DISPLAYING MULTIPLE, MOTOR VEHICLE INFORMATION




**(57) Abstract:** A system (10) for transmitting, collecting and displaying diagnostic and operational information from one or more motor vehicles to a central server (60) connected to a wide area network (45). The system (10) is designed to be used with an existing on-board diagnostic system found in most motor vehicles manufactured today. The system (10) includes a translator device (14) capable of translating the codes from an on-board diagnostic connector (8) into computer readable file such as ASCII files. The translator device (14) may be connected to an on-board computer (20) that includes a wireless modem (35) capable of connecting to a wireless communication network (40) and eventually to a wide area network (45). A central server (60) is connected to the wide area network (45) which receives and stores information from the on-board computer (20). Authorized users may connect to central server (60) via the wide area network (60) and request information therefrom regarding selected motor vehicles. All of the information may be presented in a single interface.

WO 01/55690 A1

# TITLE: SYSTEM FOR TRANSMITTING AND DISPLAYING MULTIPLE, MOTOR VEHICLE INFORMATION

## TECHNICAL FIELD

This invention relates to methods of presenting multiple, mobile wireless communications network service information, and more particularly, to systems for transmitting and displaying multiple motor vehicle information.

## BACKGROUND ART

On-board computers coupled to a wireless communications network service are now available that enable manufacturers of motor vehicles to obtain useful information regarding the motor vehicle. Typically, these on-board computers are electrically connected to sensors located in various systems in the motor vehicle that instantaneously report the status or condition of the system. Manufacturers of motor vehicles can connect to the on-board computer via the mobile, wireless communication network to obtain information from the motor vehicle anywhere within the region covered by the wireless communication network.

Recently, it has been reported that on-board computers can now be used by motor vehicle operators to download and upload information from a central server connected to a wide area network such as the World Wide Web via the mobile, wireless communications network. Using the on-board computer, an operator can now obtain e-mail messages or other important information from any other servers connected to the wide area network.

Many motor vehicle drivers own motor vehicles manufactured by different manufactures. Unfortunately, no standard computer program has been developed which can interact with all on-board computers used in every motor vehicle. This creates a large burden for the operator of multiple motor vehicles to understand and learn to operate every computer and program.

On-board diagnostic systems are used today in most cars and light trucks. To meet federal EPA emission standards implemented in the 1970's, motor vehicle manufacturers started using electronic devices to control engine functions such as fuel feed, ignition, and to diagnose engine problems.

Initially, motor vehicle manufacturers had their own systems which were not compatible. In 1988, the Society of Automotive Engineers (SAE) set standards which included a standard connector plug and a set of diagnostic test signals that dealer's used when adjusting or repairing the motor vehicle. Although motor vehicle manufacturers may used a uniform set of test signals, the meaning of these test signals is proprietary. The standard connector plug and set of test signals, today, is known collectively as OBD-II which applies to all cars and light trucks built after January 1, 1996. It is anticipated that new on-board diagnostic connectors (i.e. OBD-III) will be developed in the future.

Translator devices, also known as diagnostic scanners, are available that connect to the OBD-II connector plug and translate the diagnostic test signals into ASCII files capable of being used by a personal computer. One translator device, known as AUTOTAP, is available from B&B Electronics Manufacturing Company, of Ottawa, IL. Using this device, independent mechanics are able to connect to the OBD-II connector plug and obtain factory diagnostic service code information. What is needed is a system for operators of motor vehicles to easily obtaining motor vehicle diagnostic and operating information and store this information in a location for later retrieval.

What is also needed is such a system that enables operators to obtain information remotely for a plurality of motor vehicles and then present this information in a concise manner on a single interface.

## DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide a system for collecting and transmitting diagnostic and operation motor vehicle information to a central computer for real time or later retrieval.

It is another object of the present invention to provide such a system that collects and transmits motor vehicle information from a plurality of motor vehicles in remote locations and collects the information on a central server.

It is a further object of the present invention to provide such a system that enables the information to be presented in a single interface.

These objects and other objects are met by a system designed to be used with motor vehicles that use sensors and an on-board diagnostic system , such as OBD-II, that enables users to review real time and historical diagnostic and performance information data for one motor vehicle or a plurality of motor vehicles. The system includes the use of a translating means that connects to the motor vehicle's on-board diagnostic system. In one embodiment, the translating means is a separate translator device designed specifically to connect to a commonly used OBD-II connector plug. The translator device includes a translator program capable of translating the proprietary diagnostic test signals into diagnostic service codes presented in a standard computer language, such as ASCII files, to be used by an electronic device, hereinafter called an on-board computer.

The on-board computer is connected to a wireless communication means that continuously or intermittently transmits the ASCII files to a central network server connected to a wide area network, such as the INTERNET. The central network server collects the ASCII text files in a user database file. Authorized users, such as the owner of the motor vehicle or representatives of the motor vehicle manufacturer may connect to the central network server and receive real time data or historical information from the user's database file.

An important aspect of the system is that information from multiple motor vehicles may be collected and transmitted to the central server for retrieval by authorized users. A second important aspect is that the system may be used with all motor vehicles that use EPA-mandated diagnostic codes, translating manufacturer's proprietary diagnostic service codes, and provides real time performance data. A third important aspect is that operators can obtain this information anywhere they have access to the wide area network and have it presented in a single interface.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic of the system showing the relationship between the different motor vehicle manufacturers, the central server, the wide area network, a plurality of different motor vehicles owned by one operator with a motor vehicle computer coupled to various motor vehicle systems, a translator device, an add-on computer with an display interface, and a remote computer with a display interface.

Fig. 2 is a front plan view of a monitor presenting information collected for a plurality of motor vehicles

## BEST MODE FOR CARRYING OUT THE INVENTION

Disclosed herein is a system 10 of transmitting and displaying real time and historical multiple motor vehicle information over a central server 60 connected to a wide area network 45. Authorized users may then connect to the central server 60 to connect the real time or historical information on selected motor vehicles. The system 10 is especially beneficial to operators of multiple motor vehicles, each having factory-installed sensors or computer module which enables the operators to conveniently connect to the wide area network 45 and receive the stored uploaded information for each motor vehicle. The information for all of the motor vehicles controlled by the operation may be conveniently present on one monitor interface as shown in Fig. 2.

The system 10 uses a translator device 14, also known as diagnostic scanners, capable of connected to an existing OBD-II connector plug 8 and translate the diagnostic test signals into ASCII files capable of being used by a personal computer. One translator device 14, known as AUTOTAP, is available from B&B Electronics Manufacturing Company, of Ottawa, IL. Each motor vehicle that uses the system 10 must have a translator device 14 that connects to the OBD-II plug connector 8. The translator device 14 includes an output cable 6 and plug 7 that connects to a RS 232 (COM) port 22 on the on-board computer 20. The translator device 14 includes a microprocessor and custom circuitry (not shown) that translate the signals from the motor vehicle's sensors 3-5 or computer module 7 to ASCII text file capable to being used by the on-board computer 20.

The on-board computer 20 may be a hand-held device, a lap-top computer, or a PDA. Each on-board computer 20 is coupled to a wireless communication means, such as a wireless modem 35, which transmits the diagnostic and performance information and other useful information over a wireless communication network 40 to the central server 60 connected to a wide area network 45. The central server 60 collects the uploaded information from an on-board computer 20 located in one motor vehicle or in a plurality of motor vehicles located in the region.

The on-board computer 20 may also be coupled to an optional physical location detection means capable of instantaneously determining the physical location, heading, and elevation of the on-board computer 20, and hence, the motor vehicle. In the preferred embodiment, the physical location detecting means is a global positioning system (GPS) receiver 30. The GPS receiver 30 is able to immediately establish the monitoring electronic device's global position, (i.e. latitude, longitude, elevation), heading, and velocity.

The GPS is a location system based on a constellation of twenty-four satellites orbiting the Earth at altitudes of approximately 11,000 miles. The GPS satellites provide accurate positioning information twenty-four hours per day, anywhere in the world. The GPS uses a receiver that stores orbit information for all GPS satellites. During use, the receiver determines the time and the positions of the overhead satellites and then calculates the amount of time it takes a GPS radio signal to travel from the satellites to the receiver. By measuring the amount of time it takes for a radio signal to travel from the satellites, the exact location of the GPS receiver can be determined. GPS receivers 30 are available from Corvallis Microtechnology, Inc., in Corvallis, Oregon. It should be understood however, that other means for automatically determining the user's physical location could be used.

In the preferred embodiment, the system 10 uses GPS receivers 30 that are 3-D coordinate receivers that require a minimum of four visible satellites. It should be understood, however, that the system 10 could be used with 2-D coordinate receivers, which require a minimum of three satellites. The 3-D coordinate receivers are preferred, since they will continue to provide 2-D coordinate information when their views are obstructed by trees, mountains, buildings, etc.

A critical component of the system is the client-side software program 28 loaded on each on-board computer 20. The software program 28 collects the information from the translator device 14 and the GPS receiver 30 and transmits it via the wireless modem 35 to the wireless communication network 40. The client-side software program 28 must be able to communicate with the server software program 54 located in the central computer 60. When the user initially logs into the system 10, the client-side software program 28 also transmits the user identification information such as the user's name and password.

Another important function of the client-side software program 28 is also used to display a standard interface is then created which displays the translated information to the operator. The interface can then be used to review all of the data stored in the central server 60 thereby providing a complete review of all of the sensors 3-5 used in the motor vehicles under the operator's control. The client-side software program 28 can also be loaded into remote computers to enable the operator to obtain information regarding the motor vehicles. .

As discussed above, the central server 60 is connected to the wide area network 45 and is able to communicate with a plurality of on-board computers 20 also connected to the wide area network 45. It should be understood that the central server 60 may be one server or a group of servers all connected to the wide area network 45. Loaded into the memory of the central computer 60 or in the memory of each server is the server-side software program 56 capable of uploading and processing data from the client side software program 28 used with each on-board computer 20 and remote computer 27 as shown in Fig. 2. During use, the central server 60 creates a user information database 63 containing all of the user ID information collected motor vehicle information.

In order to download information from the central server 60, the user must submit a request using the client-side software program 28. In order to use the system 10, the user's or on-board computer's network address must be known to the central server 60 so that information may be downloaded thereto. If the central server 60 is also the authorized user's network service provider to the wide area network 45 and a previously established account has been set up on the central server 60, the numerical or temporary address would be known to the central computer 60 when the user signs onto the central server 60. If the user does not have a previously established account on the central server 60, then the client side software program 28 must be used to collect and transfer the account information to the central server 60 each time the user logs onto the central computer 60.

During use, the user's personal information is entered into the client side software program 28. When initial contact is made with the central server 60, the personal information is automatically downloaded to the central server 60. The client side software program 28 may be a proprietary software program, or may be included as an add-on to an existing INTERNET browser software program. After the account information has been confirmed or set up on the central server 60, the users may begin to download and/or upload information from the central server 60.

In compliance with the statute, the invention, described herein, has been described in language more or less specific as to structural features. It should be understood, however, the invention is not limited to the specific features shown, since the means and construction shown comprised only the preferred embodiments for putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the amended claims, appropriately interpreted in accordance with the doctrine of equivalents.

## INDUSTRIAL APPLICABILITY

This invention has application in the wireless communications industry. More specifically, this invention has application in the communications industry that deal with systems for transmitting and displaying multiple motor vehicle information.

## CLAIMS

We claim:

1. A system (10) for transmitting and displaying diagnostic and performance information for motor vehicles having an on-board diagnostic system, said diagnostic system (10) including a plurality of sensors (3 – 5) capable of transmitting codes indicating the status of component on said motor vehicle, said system (10) comprising:

b. a translating means capable of translating said codes from said sensors (3 – 5) to a computer readable file;

c. a wireless communication means coupled to said translating means capable of communicating with a wireless communication network (40) located around a region;

d. a wireless communication network (40) located around a region;

e. a computer wide area network (45); and,

f. a central computer (60) connected to said wide area network (45), said central computer (60) capable of receiving said translating information from said on-board computers (20) in a region and connected to said wide area network (45) by said wireless communication means (40).

2. The system (10) as recited in Claim 1, further including an on-board computer (20) connected between said translating means and said wireless communication means (40).

3. The system (10) as recited in Claim 1, wherein said translating means is a translator device (14) capable of connecting to said on-board diagnostic system (10) in said motor vehicle.

4. The system (10) as recited in Claim 3, wherein said translating means translates said codes into ASCII files.

5. The system (10) as recited in Claim 2, further including a physical location detecting means (30) coupled to each said on-board computer (20), said physical

location detecting means (30) capable of determining the physical location of said on-board computer (20);

6. The system (10), as recited in Claim 6, wherein said physical location detecting means (30) is a GPS receiver used in a GPS network.

7. The system (10), as recited in Claim 6, wherein said wireless communication means is a wireless modem (35) capable of communicating with said wireless communication network (40).

8. The system (10), as recited in Claim 2, further including a client-side software program (28) loaded into each said on-board computer (20) and a server side software program (56) loaded into said central server to enable said on-board computer to communicate with said central server (60).

9. A system (10) for transmitting and displaying diagnostic and performance information for motor vehicles having an on-board diagnostic system, said on-board diagnostic system including a plurality of sensors capable of transmitting codes indicating the status of components on said motor vehicle, said system (10) comprising:

a. a translating device located in each motor vehicle capable of being coupled to said sensors and capable of translating said codes from said sensors to a computer readable file;

b. an on-board computer (20) connected to said translating device;

c. a wireless communication means coupled to said translating means capable of communicating with a wireless communication network (40) located around a region;

d. a wireless communication network (40) located around a region;

e. a computer wide area network (45); and,

f. a central computer (60) connected to said wide area network (45), said central computer (60) capable of receiving said translating information from said on-board computers (20) in a region and connected to said wide area network (45) by said wireless communication means.

10. The system (10) as recited in Claim 9, wherein said translating means translates said codes into ASCII files.

11. The system (10) as recited in Claim 9, further including a physical location detecting means (30) coupled to each said on-board computer (20), said physical location detecting means (30) capable of determining the physical location of said on-board computer (20);

12. The system (10), as recited in Claim 11, wherein said physical location detecting means (30) is a GPS receiver used in a GPS network.

13. The system (10), as recited in Claim 9, wherein said wireless communication means is a wireless modem (35) capable of communicating with said wireless communication network (40).

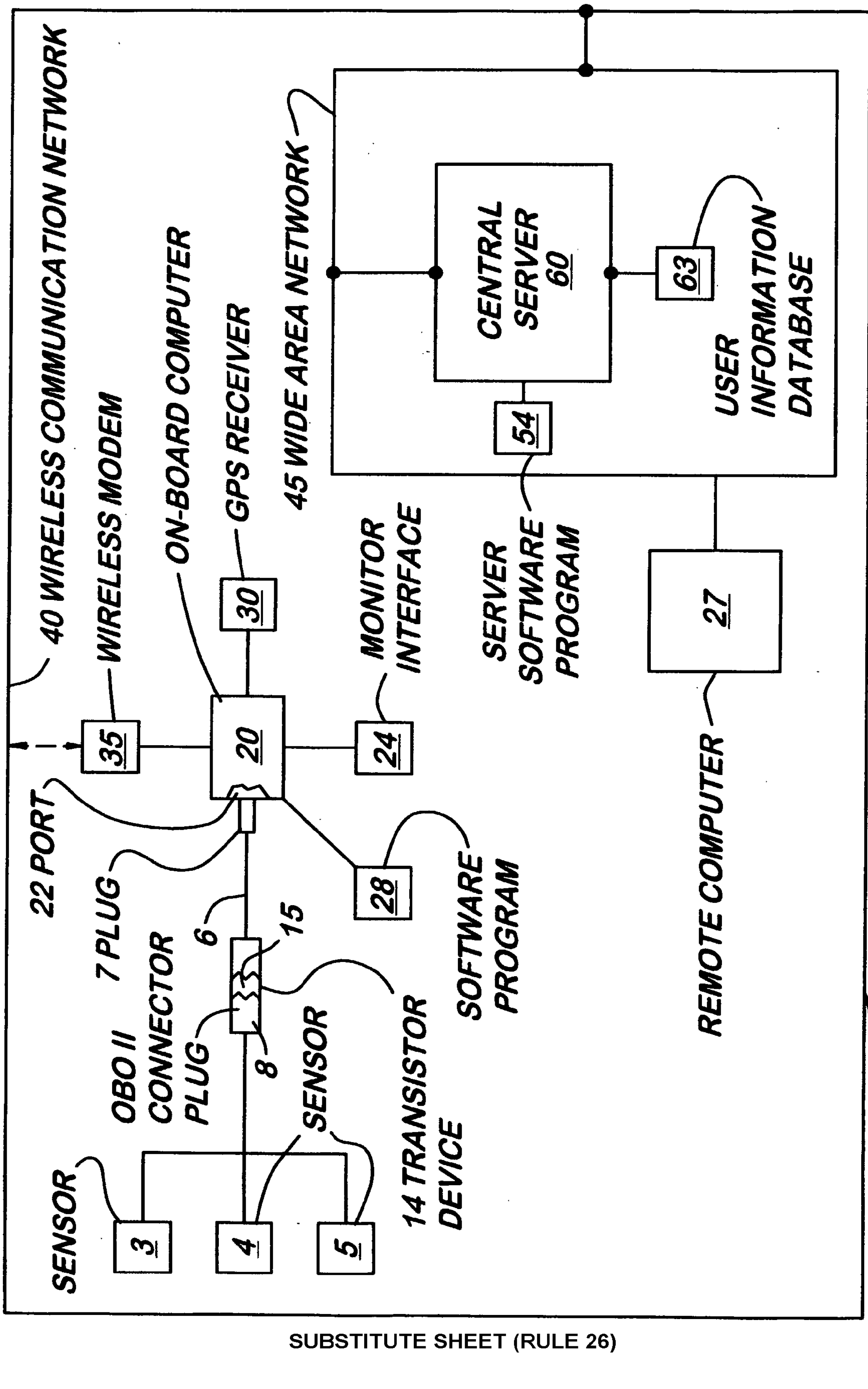

40 WIRELESS COMMUNICATION NETWORK
WIRELESS MODEM
35
ON-BOARD COMPUTER
20
GPS RECEIVER
30
45 WIDE AREA NETWORK
MONITOR INTERFACE
24
CENTRAL SERVER
60
63
USER INFORMATION DATABASE
54
SERVER SOFTWARE PROGRAM
27
REMOTE COMPUTER
22 PORT
7 PLUG
6
15
OBO II CONNECTOR PLUG
8
SENSOR
SENSOR
3
4
5
14 TRANSISTOR DEVICE
28
SOFTWARE PROGRAM
10

FIG. 1

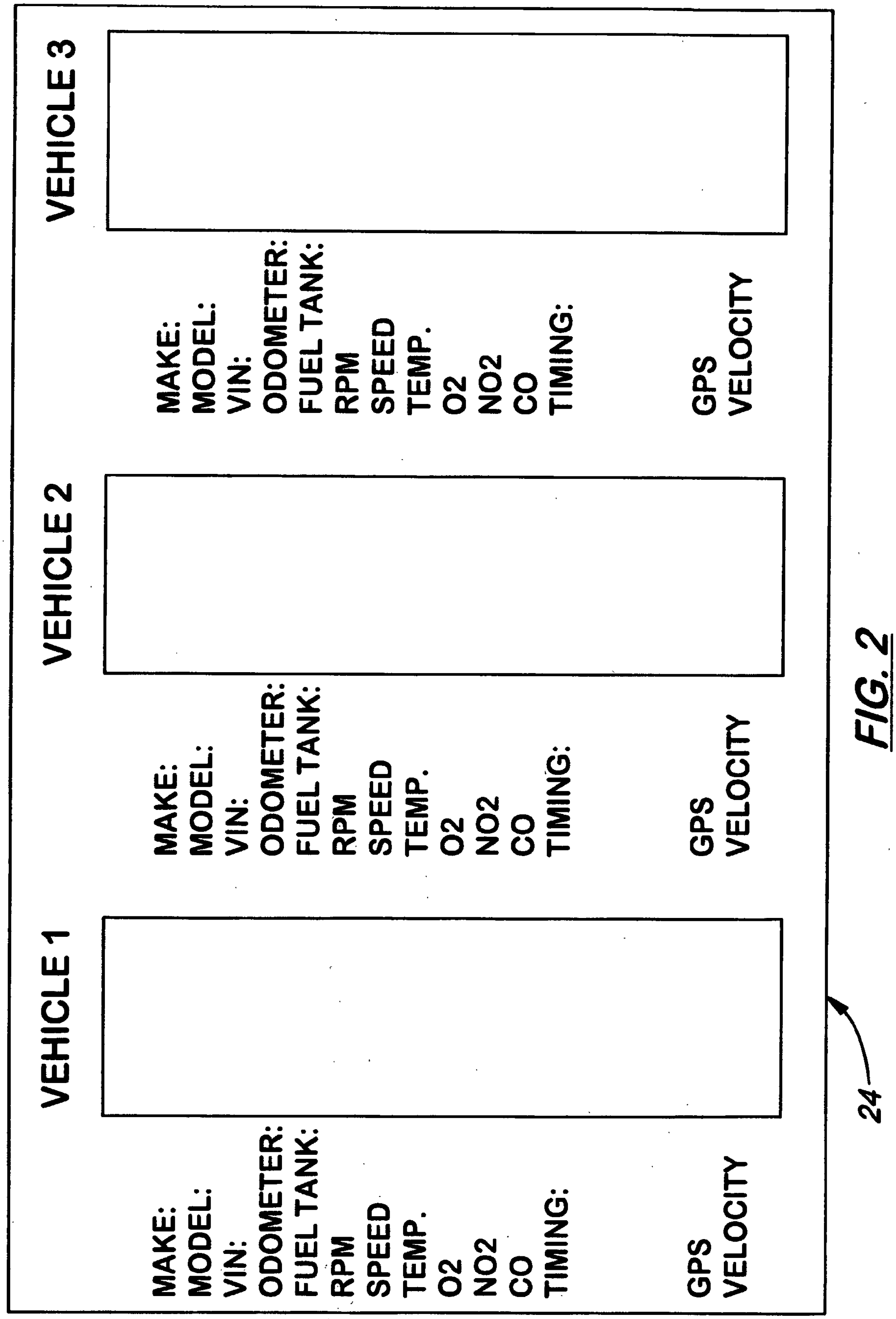

VEHICLE 1
MAKE:
MODEL:
VIN:
ODOMETER:
FUEL TANK:
RPM
SPEED
TEMP.
O2
NO2
CO
TIMING:
GPS
VELOCITY
VEHICLE 2
MAKE:
MODEL:
VIN:
ODOMETER:
FUEL TANK:
RPM
SPEED
TEMP.
O2
NO2
CO
TIMING:
GPS
VELOCITY
VEHICLE 3
MAKE:
MODEL:
VIN:
ODOMETER:
FUEL TANK:
RPM
SPEED
TEMP.
O2
NO2
CO
TIMING:
GPS
VELOCITY
24

FIG. 2

| **INTERNATIONAL SEARCH REPORT** | International application No. PCT/US01/02546 |
|---|---|

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : G01M 15/00
US CL : 701/33
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 701/33, 36, 200, 213, 24, 35, 1; 340/438,425.5,459,286.02,286.01

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>---<br>Y | US 5,884,202 A (Arjomand) 16 March 1999 (16.03.1999), see entire document. | 1-2<br>-----<br>9 |
| Y, P | US 6,141,611 A (Mackey et al.) 31 Octuber 2000 (31.10.2000), see complete document | 6,7,13 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

| | |
|---|---|
| * Special categories of cited documents: | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| "A" document defining the general state of the art which is not considered to be of particular relevance | "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
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| "P" document published prior to the international filing date but later than the priority date claimed | "&" document member of the same patent family |

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 3/15/01 | **11.04.01** |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. (703)305-3230 | Authorized officer<br>William A. Cuchlinski Diane Smith<br>Telephone No. (703) 308-1113 |

Form PCT/ISA/210 (second sheet) (July 1998)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 December 2000 (28.12.2000)

PCT

(10) International Publication Number
**WO 00/79727 A2**

(51) International Patent Classification[7]: H04L 12/00

(21) International Application Number: PCT/CA00/00712

(22) International Filing Date: 19 June 2000 (19.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

| | | |
|---|---|---|
| 60/139,573 | 17 June 1999 (17.06.1999) | US |
| 60/148,270 | 11 August 1999 (11.08.1999) | US |
| 60/187,022 | 6 March 2000 (06.03.2000) | US |
| 09/556,289 | 24 April 2000 (24.04.2000) | US |

(71) **Applicant** *(for all designated States except US)*: **PAX-GRID TELEMETRIC SYSTEMS INC.** [CA/CA]; 29 Southvale Drive, Toronto, Ontario M4G 1G1 (CA).

(72) **Inventors; and**
(75) **Inventors/Applicants** *(for US only)*: **NATHANSON, Martin** [CA/CA]; 29 Southvale Drive, Toronto, Ontario M4G 1G1 (CA). **NADER, Frederick** [US/US]; 28382 Harwich, Farmington Hills, MI 48334 (US).

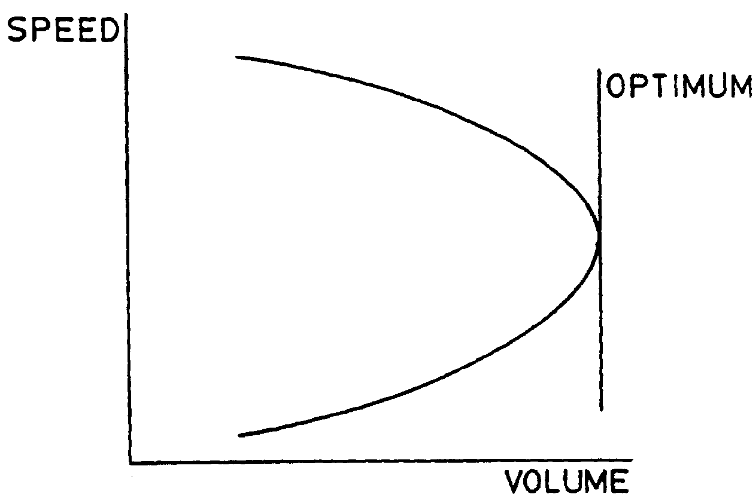
(74) **Agents: BROWN, Peter** et al.; McCarthy Tetrault, P.O. Box 48, TD Bank Tower, TD Centre, Toronto, Ontario M5K 1E6 (CA).

(81) **Designated States** *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) **Designated States** *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

*[Continued on next page]*

(54) **Title:** VEHICULAR TELEMETRY




(57) **Abstract:** The present invention provides a system for reporting on-board diagnostic data from mobile vehicles to regulatory agencies whose mandate it is to ensure compliance with environmental emissions and safety standards. The system comprises three (3) principal components: (i) an enhanced Hybrid Network Radio, enabled for both IEEE 802 wireless LAN connectivity and Mobile IP; (ii) an IEEE 802 Access Point, configured as an IPv6 Router and enabled for Mobile IP to support the functionality of foreign mobility agent; and (iii) a "cluster intelligence" module, incorporated in the same mobile device as the Hybrid Network Radio, using the Automotive Telemetry Protocol (ATP) to enable vehicles to exchange telemetry data with each other over an ad-hoc IEEE 802.11 network.

WO 00/79727 A2

**Published:**
— *Without international search report and to be republished upon receipt of that report.*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# 'VEHICULAR TELEMETRY'

## REFERENCE TO CO-PENDING APPLICATIONS

The subject matter of both provisional application serial number 60/056.388 filed August 26. 1997 and utility patent application serial number 09/140.759 filed August 26. 1998 (both entitled SYSTEM AND METHOD FOR PROVIDING MOBILE AUTOMOTIVE TELEMETRY) is incorporated herein by reference. The subject matter of PCT Application serial number PCT/CA98/00986 filed October 23. 1998 entitled TELECOMMUNICATIONS SYSTEM and designating the United States is also incorporated herein by reference. The subject matter of provisional application serial number 60/139.573 filed June 17, 1999 and entitled VEHICULAR TELEMETRY is also incorporated herein by reference. The subject matter of U.S. provisional application serial number 60/148.270. filed on August 11. 1999 and entitled VEHICULAR COMPUTING DEVICE is also incorporated herein by reference. The subject matter of U.S. provisional application serial number 60/187.022 March 6. 2000 is also incorporated herein by reference.

## BACKGROUND OF THE INVENTION

### FIELD OF THE INVENTION

The present invention relates to data communications systems and more particularly to the field of vehicular telemetry using RF packet networks in conjunction with Internet or similar protocols.

### DESCRIPTION OF THE RELATED ART

Hereinafter numerical reference is made to materials listed in Appendix A at the end of the disclosure.

Conventionally, vehicles have been known to exchange data with a diagnostic computer system (such as in a repair garage) over a hardwired or infrared data link, or a regulatory computer system (such as an electronic toll highway) by a data link using a low power transponder.

More sophisticated vehicular telemetry for commercial fleets has been made possible in the last several years through satellite RF packet networks. In these vehicular telemetry systems, vehicle sensor data can be transported over wireless data links to a computer that is programmed to monitor and record automotive phenomena and to support database systems for vehicular maintenance, without the need for the vehicle to be in a particular service bay for example. However, these systems are relatively expensive to operate.

A considerable amount of research is being dedicated to developing feasible Intelligent Vehicle Highway Systems (IVHS) which are computer-assisted methods to manage highway infrastructures, synchronize traffic lights, measure traffic flow, to alert drivers to ongoing traffic conditions through electronic billboards and other innovations aimed at improving the quality and efficiency of road transportation systems for vehicles.

The California Air Resources Board (CARB) has been a leader in establishing standards for monitoring vehicle emissions. A recent CARB initiative, known as OBD-III, is the third generation of on-board diagnostic requirement, calling for an emissions regulatory agency to retrieve, remotely, diagnostic data from vehicles, thereby avoiding the need for a visit to a clean air inspection station. In one pilot program, a low-power transponder was used on each vehicle, capable of transferring data between the vehicle and a roadside receiver. Of course, in order for the OBD-III proposal to proceed, each vehicle must have a system capable of collecting and dispatching the requested data through the transponder. CARB is actively reviewing currently available technologies and is surveying the telecommunications industry to see what future equipment is planned. The operating platforms tested thus far by CARB have been relatively cumbersome and have limited capability to be used for other data exchange needs in the future. There is interest in finding a platform that will be economical to operate in order to minimize the financial burden placed on the consumer to implement the proposal.

Morever, it would be desirable for the chosen platform to be capable of doing more than just sending diagnostic information to a clean air agency. Both the telecom and auto industries are looking at ways to utilize the tremendous business opportunities of reaching urban commuters in their vehicles while they devote several hours each day to their commute.

Vehicular traffic has become a major problem for urban planners. With land values skyrocketing and land-use issues becoming more of a concern, planners are looking for ways of getting more vehicles through existing commuter arteries as an alternative to expanding them. It is also known that the actual volume of traffic handled by a thoroughfare plummets when traffic becomes congested. Therefore, it would be desirable to have vehicles which are capable of exchanging data with themselves as a way to control such things as safe driving distances to avoid collisions and exchanging data with traffic monitoring systems to control such things as driving speeds.

It is therefore an object of the present invention to provide a improved platform for vehicular telemetry.

It is a further object of the present invention to provide an improved vehicular telemetry system which is relatively inexpensive, yet capable of exchanging a range of useful data through a data communications system between a vehicle and a fixed location.

It is still a further object of the present invention to provide a vehicle communications system in which the vehicles therein are each capable of communicating both through a data communications system and with themselves.

## SUMMARY OF THE INVENTION

Briefly stated, the invention involves, in one of its aspects, a method of exchanging data between a mobile node and an access point on a communication network, comprising the steps of:

a) providing at least two data links between the mobile node and the access point;

b) measuring impedance on each data link; and

c) transmitting said data across the data link having the lowest impedance.

Preferably, the data links are wireless and a first of the data links is established on a spread spectrum radio frequency (RF) band. The data links may also comprise a satellite RF packet network or a terrestrial RF packet network. It is contemplated that other data links may become available in future as wireless data communications evolve.

In another of its aspects, the present invention provides a communications system, comprising

a mobile communications network having a mobile node,

a fixed communications network having an access point, a pair of alternative data links, each of which joins the mobile node with the access point. and

a switching unit for switching between the alternative data links to exchange data between the mobile node and the access point.

In one embodiment, the mobile communications network includes a plurality of vehicle- mounted mobile nodes wherein at some are Internet addressable, for example under IPv6 protocol. Each mobile node and selected ones of the access points operate under the IEEE 802.11 standard. In this case, the data link joins each mobile node with at least one access point on a spread spectrum band. At least some of the access points are located adjacent a roadway.

Preferably, the system includes a measuring module for measuring impedance on each of the data links. In this case, the switching unit is operable to select the data link having the least impedance.

In still another of its aspects, the present invention provides a communications network for exchanging data between a plurality of vehicles, comprising a computing unit onboard a corresponding vehicle. each computing unit being operable in a first phase to broadcast enquiry messages in a region surrounding the vehicle, a second phase to receive reply messages from other vehicles in the region, and a third phase to exchange status messages with selected ones of the other vehicles.

In one embodiment. each computing unit includes an IEEE 802.11 node and exchanges data using an SNMP-derived protocol. Desirably, each node is Internet addressable. such as by the IPv6 standard for example.

In still another of its aspects, the present invention provides a vehicle comprising an onboard computing unit which is operable in a first phase to broadcast enquiry messages in a region surrounding the vehicle, a second phase to receive reply messages from computing units of other vehicles in the region, and a third phase to exchange status messages with computing units of selected other vehicles.

Preferably, the vehicle is operable in a fourth phase to exchange data with a remote site in the form of a non-mobile gateway, which routes communications between a wireless mobile data link and a non-mobile network.

In one embodiment, the computing unit includes an IEEE 802.11 node and can exchange data with other computing units using an SNMP-derived protocol.

In still another of its aspects, the present invention provides a hybrid communications system, comprising a wired network portion and a wireless network portion, each having a network connection node, at least two data link means between the network connection nodes, and a switch means for enabling either of the data links for data exchange between the connection nodes.

Preferably, the system further comprises measurement means for measuring impedance on the data links, the switch means being responsive to the measurement means for enabling the data link having a lower impedance.

In yet another of its aspects, the present invention provides a vehicle communications system having a controller, a data pathway joining the controller with a plurality of vehicle components and means for establishing a data link with other vehicles within a given region surrounding the vehicle in order to exchange data therewith.

In still another of its aspects. the present invention provides an operational event-reporting system for use by a plurality of neighboring vehicles to support IVHS comprising a plurality of communication units. each onboard a corresponding vehicle to collect operational data from selected components thereof and to exchange data with the communication units of one or more of the neighboring vehicles.

Preferably, the system is capable of exchanging data related to the operation of the neighboring vehicles. for example. GPS position and heading, vehicle speed. braking or the like. Data of this kind can be useful for vehicle telemetry systems to provide. for example. collision avoidance.

In yet another aspect of the present invention. there is provided a method of exchanging data between a vehicle and at least one remote site, comprising the step of providing the vehicle with a transmitter and receiver capable of transmitting and receiving messages under an SNMP protocol. Preferably, the data exchange site includes a neighboring vehicle or an access point for a wired network. for example.

In one embodiment, the method further comprises the steps of:

- exchanging discovery signals with neighboring vehicles; and

- exchanging status data with selected ones of the neighbouring vehicles.

In yet another of its aspects. there is provided a system for transferring data between a vehicle and another data exchange site. comprising a pair of data link means. wherein at least one of the data link means has a varying signal impedance level and switch means for switching between the data link means so that the data is transferred on the data link means having the least impedance.

In yet another of its aspects, the present invention provides an extension of the hybrid RF packet network comprising:

(i) an interface to an IEEE 802.11 data link integrated in the Hybrid Network Radio;

(ii) an IEEE 802.11 Access Point acting as an IPv6 router and a foreign mobility agent for mobile nodes implementing Mobile IP;

(iii) an interface to a non-wireless subnetwork from which the Hybrid Network Gateway can route mobile-terminated traffic through an IEEE 802.11 Access Point; and

(iv) a cluster intelligence module, based on the establishment of ad-hoc networks between a vehicle and its IEEE 802.11 neighbors.

Preferably, mobile nodes that are ATP-enabled can exchange Internet traffic with regulatory agencies over license-free wireless data links (IEEE 802.11) whenever connections are established with Mobile IP-enabled Access Points. The cluster intelligence module is operable using ATP from vehicular node to acquire information about the automotive behavior of any of its discovered neighbors.

In another of its aspects, the present invention provides a method of exchanging data between a mobile node and an access point on a communications network, comprising:

a) a step for providing at least two wireless data links between the mobile node and the access point;

b) a step for measuring impedance on each data link; and

c) a step for transmitting said data across the data link having the lowest impedance.

In still another aspect of the present invention, there is provided a method of exchanging data between a motor vehicle and a remote station, comprising:

a) a step for providing at least two data links between vehicle and said station;

b) a step for measuring impedance on each data link; and

c) a step for transmitting said data across the data link having the lowest impedance.

In still another aspect of the present invention, there is provided an inter-vehicle communications network, comprising at least two motor vehicles, each having an on-board control system, the system including monitoring portion and a spread spectrum radio portion and which is operable to exchange useful vehicle operational data with the control system of the other vehicle.

Preferably, each monitoring portion is capable of registering a vehicular event and each control system may, if desired, be operable with other vehicular override systems to override a vehicle function according to a vehicular event. Desirably, each control system includes a memory portion for storing vehicle operational data of the other vehicle.

In one embodiment, the network includes at least one, preferably more than one, remote station is located along a road way on which the vehicles are traveling. The remote station includes a spread spectrum radio portion to be capable of exchanging data with either of the vehicles and is also preferably an internet or intranet or other network access point.

Conveniently, the vehicles are operable to exchange data using an SNMP-derived protocol and each vehicle is capable of monitoring vehicular events in its own region.

In still another aspect of the present invention, there is provided a motor vehicle comprising an onboard general purpose computer and a spread spectrum radio, the computer operable to monitor a number of predetermined operating characteristics of the vehicle, the spread spectrum radio operable to establish a data link with a radio in at least one other neighbouring vehicle, wherein the computer is capable of identifying at least one vehicular event from data received on the data link.

In still another aspect of the present invention, there is provided a computer program product for operating a programmable computer system on board a motor vehicle, wherein the system includes a spread spectrum radio, comprising a computer readable medium including the computer executable steps of:

- instructing the radio to issue a signal to a region surrounding the motor vehicle;

- monitoring the radio for reply signals from other vehicles in the region; and when a reply signal is received from another vehicle,

- establishing a data link with the other vehicle; and

- exchanging operational data with the other vehicle over the data link.

In yet another of its aspects, there is provided a mobile automotive telemetry system for installation on-board a vehicle, comprising:

(i) diagnostic means for monitoring operational functions of the vehicle and generating operational information;

(ii) memory for storing the generated operational information; and

(iii) a server, in communication with the diagnostic means and the memory, the server comprising:

(a) means to receive a request from a remote client for the generated operational information;

(b) means to retrieve the generated operational information from the memory means; and

(c) means to transmit the generated operational information to the remote client.

Preferably, the means to receive and the means to transmit are wireless communication means.

In one embodiment, the system further comprises an Internet access means and a means to transmit generated operational information to a remote client, in absence of a request from the client, when the generated operational information satisfies predetermined criteria. Preferably, the Internet access means is compliant with IP V6 internet protocol and allows the server to act as a mobility agent. Preferably, the system further comprises means to interface to a global positioning system (GPS) receiver.

As described hereinbelow, the Applicant's pending application, serial number 09/140,759 filed August 26, 1998 entitled SYSTEM AND METHOD FOR PROVIDING MOBILE AUTOMOTIVE TELEMETRY discloses a system and method for automotive maintenance telemetry. The system functions on a client-server architecture enabling a remote client to request information from an on-board diagnostic (OBD) module in a vehicle, such as that commonly referred to as the Electronic Control Module (ECM). The OBD module performs the role of 'server' by being programmed to interface with the ECM, and with any other sources of diagnostic information and then communicates the data to a requesting client, such as OEM suppliers, dealers or regulatory agencies.

The location of the requesting client can dictate how the data is delivered. For example, in the Applicant's co-pending PCT Application PCT/CA98/00986 filed October 23, 1998 entitled TELECOMMUNICATIONS SYSTEM, the OBD module may select a path of least impedance to deliver the data to the client. For example, where the client is land-based, such as, for example an emissions regulatory body, the OBD module may deliver the data either through a conventional RF packet network (such as over a cellular phone connection) or through an RF packet network using a Hybrid network as described in the above mentioned PCT application. However, the requesting client may in fact be another vehicle traveling along the same roadway as the server vehicle and may request data for such things as vehicle speed, braking, position and the like. The OBD module may convey the data over a wireless data link such as over the band known as the "spread spectrum band" as is described in the applicant's co-pending provisional application serial number 60/139,573 filed June 17, 1999, entitled VEHICULAR TELEMETRY and as specified in the IEEE 802.11 standard.

IEEE 802 Standards Family

The IEEE 802 family of standards specifies the methods for implementation of local area networks (LAN's) using both wired and wireless media. The IEEE 802.11 standard specifies the medium access control (MAC) layer and three separate methods for implementation of the physical layer (PHY) as a wireless medium. IEEE 802.11 is intended to ensure inter-operability between multi-vendor equipment operating in wireless networks. As such, it is the basis for the interface specified herein enabling vehicular computing equipment to establish license-free data links with fixed stations.

The IEEE 802.11 standard specifies three different physical layers. use of Infrared light, Direct Sequence Spread Spectrum and Frequency Hopping Spread Spectrum. The band utilized for the Spread Spectrum technique is ISM (Industrial, Scientific and Medical) RF band, which is free of regulatory licenses in most of the world. Communications in the Spread Spectrum involve a coordinated change in frequencies, either by a "Direct Sequence" or a "Frequency Hopping" format.

The IEEE 802.2 standard, called Logical Link Control (LLC), specifies a method for addressing and control of the data link, independent of the underlying medium, and is applicable to all types of LAN's defined within the IEEE 802 family. Both 802.11 and 802.2 are incorporated herein by reference.

The IEEE 802.11 does not specify the handoff mechanism for a mobile node to roam from one Access Point to another. When both the IEEE 802.11 client and Access Points incorporate IPv6 implementations, including ND (Neighbour Discovery) and RD (Router Discovery), roaming clients are able to bind to (or to establish a data link with) the Access Points, where the latter take on the role of Foreign Mobility agents as defined in [3]. The Access Point acts as a mobility agent for the roaming client. The Mobile IP specification therefore provides a solution to the lack of an IEEE 802.11 mechanism for coordination of roaming (handoff) between Access Points.

Automotive Telemetry Protocol

In one embodiment, data is exchanged between vehicles using a protocol herein called "Automotive Telemetry Protocol" (or ATP) and is based on Simple Network Management Protocol (or SNMP). The latter is commonly used in data communication networks to monitor and control switching equipment. SNMP is specified in [2], the contents of which are incorporated herein by reference. ATP is intended to function according to the same client-server model as SNMP, wherein the client issues the requests for information and the server issues the responses. Although the ATP makes use of the same formats of the requests and responses as SNMP, ATP implements a novel set of "object identifiers" which are required to encompass the OBD data requested, in contrast to the telecommunications equipment data exchanged in SNMP. For example, the object identifiers may, in this case, correspond to nodes on the Controller Automation Network (CAN) bus in the vehicle, such as the ABS system, emission control system and the like.

SNMP and its derivative defined herein, ATP, are efficient request-response mechanisms which require less bandwidth than Web-based data exchanges between client and server. The payload (i.e. the useful telemetry data) can be encapsulated within the maximum allowable frame sizes of the underlying data links. These protocols therefore do not require the overhead associated with fragmentation at the source, and properly sequenced reassembly of large messages at the destination.

IPv6 and Mobile IP: Dynamic topology of the new Internet

The well known "Mobile IP" specification defines a protocol that enables IPv6 datagrams to be transparently routed to mobile nodes in the Internet. This specification is provided in ***Internet Engineering Task Force, Perkins, C. (ed.), " IPv6***

***Mobility Support", March 1995*** [3], the contents of which are incorporated herein by reference.

By definition, a mobile node is one that can connect to the Internet through any one of a variety of different access points, called *mobility agents*. Each mobile node is registered with one and only one mobility agent, called a home agent. When a mobile node attaches itself to the Internet through an access point other than its home agent, the access point is called a foreign agent. The Mobile IP protocol incorporates a mechanism for mobile nodes, when they are attached to a foreign agent, to register a "care-of-address" with the home agent. Thus, datagrams routed to the mobile node through the home agent can be re-routed to reach the mobile node at its current network location.

When a mobile vehicle is already equipped with radio-modem technology that provides a unique address on a wireless network, it is possible to assign a unique Internet address that can be reached through an IP router between the wired Internet and the wireless network. This is described in the Applicant's co-pending PCT Application PCT/CA98/00986 filed October 23, 1998 entitled TELECOMMUNICATIONS SYSTEM. This represents a static Internet topology because, although the vehicle is mobile, the IP router through which it is reached never varies. The topology of the wireless network itself is dynamic and supports the roaming required for a vehicle to establish contact with the network through different base stations and regional switches. However, at the IP level, this dynamic topology is not visible.

In contrast, the Mobile IP extension to the IPv6 specification allows for a dynamic network topology. It lends itself to the task of enabling communication from the Internet to a mobile vehicle through different foreign mobility agents. In the context of vehicular mobility, the role of mobility agent can potentially be adopted by any Internet node that has the ability to dynamically create a data link with a vehicle. To date, the most efficient means available by which such data links can be quickly established are defined by the IEEE 802.11 specification for wireless LAN's (Local Area Networks).

A data link can be established between a mobile IEEE 802.11 node, implemented in the vehicle, and any fixed IEEE 802.11 node, called an *Access Point*, provided that both nodes incorporate full implementation of the IPv6 protocols, specifically the Neighbor Discovery protocol, (hereinafter referred to as ND) and the Router Discovery protocol (RD). ND and RD are specified in ***Narten, T., Nordmark, E., and W. Simpson, "Neighbor Discovery for IP Version 6 (IPv6)", RFC 1970, August 1996.***[5], the contents of which are incorporated herein by reference. For every interface to a datalink implemented in an IPv6 node, in this instance a wireless IEEE 802 datalink, ND is required to ensure that neighbors, defined as other nodes which are "on-link" (i.e., capable of communications on the same datalink) can be dynamically identified as they appear. This is accomplished through the use of periodic broadcasts on the wireless medium, called Neighbor Solicitations, to which any recipient of the broadcast is required to respond, in such a way as to enable the broadcaster to identify the responder with a unique IPv6 address. An implementation of ND typically maintains a table of neighbors that dynamically changes as each new cycle of neighbor solicitation either reveals a new respondent or loses, through lack of response, a (previously) existing neighbor. RD is a specialization of ND, ensuring that on-link nodes capable of routing IP datagrams to other sub-networks, can be discovered.

Thus, the vehicle communications system, according to one embodiment of the present invention, is capable of handling the Mobile IP protocols over an IEEE 802.11 data link and, as a consequence, is capable of delivering vehicular diagnostic data under the requirements of OBD-III and of exchanging a wide range of data, including e-commerce transactions and the like, as well as data needed for such things as Intelligent Vehicle Highway Systems.

According to one aspect of the present invention, each vehicle has one of a number of Hybrid Network Radios (as described in Applicant's PCT patent application PCT/CA98/00986) which can effectively communicate with one another using the Mobile IP protocol over one or more wireless LAN's. In this particular case, then, Internet-addressable vehicles may roam between wireless LAN's and still be in the network.

Ad Hoc Network

By making the vehicular computers Mobile IP-enabled as described in utility patent application 09/140,759 filed August 26, 1998 (entitled SYSTEM AND METHOD FOR PROVIDING MOBILE AUTOMOTIVE TELEMETRY) as described hereinbelow, each vehicular system may be connected to the Internet through the IEEE 802.11 data link. When two or more vehicular computer systems are equipped with IEEE 802.11 interfaces and where each operates on the same frequency changing format, that is by using either Direct Sequence Spread Spectrum or Spread Spectrum Frequency Hopping, they can then communicate amongst themselves and thereby create an "ad hoc" network between them. The so-equipped vehicular systems can now support IP Neighbor Discovery, which enables all vehicles within range to recognize each other as "on-link" IPv6 nodes, provided that the adjacent vehicular systems are also compliant with IPv6. This means that useful information may be exchanged between adjacent vehicles by the use of spread spectrum frequencies. Therefore, the same UDP/IP mechanism, used to permit telemetry traffic to be encapsulated in IPv6 datagrams from any vehicle to a fixed-location host, can be used to permit telemetry traffic to be exchanged between vehicles.

This ad hoc network also enables mobile vehicles within range of each other to establish a "cluster intelligence", which is defined, within the context of the present invention, as an infrastructure for interactive vehicular control based on the same request/response telemetry architecture described in utility patent application serial number 09/140.759 filed August 26, 1998 (entitled SYSTEM AND METHOD FOR PROVIDING MOBILE AUTOMOTIVE TELEMETRY).

In one embodiment, the system comprises the following components:

(1) Hybrid Network Radio, as specified in [4], supplemented by:
  (a) Wireless LAN interface compliant with:
    (i) IEEE 802.2
    (ii) IEEE 802.11 interface

  (b) IPv6 modules including:
    (i) IPv6
    (ii) IVMPv6
    (iii) IP Neighbor Discovery and Router Discovery
    (iv) Mobile IP

(2) IEEE 802 Access Point as an IPv6 Router

(3) *Cluster Intelligence* Module

The cluster intelligence module is intended to provide a means by which Intelligent Vehicle Highway Systems (IVHS) can be implemented without the need for electronic wiring of the highway infrastructure. Cluster intelligence is based on the establishment of an *ad hoc network* connecting vehicular Hybrid Network Radios. Whereas the primary goal of the Hybrid Network Radios is to enable least-cost IPv6 communications of telemetry data required by environmental regulations, an ad hoc network among and between Hybrid Network Radios provides a platform on which vehicles can transmit real-time operational information to each other.

As a result, in those instances where the aim of IVHS is to control the spacing and speed of vehicles on highways, and therefore the volume of vehicular traffic flow, cluster intelligence offers a low-cost alternative to the conventional ideas proposed for highway infrastructure upgrades.

Figure 1 shows the classic relationship defined in traffic engineering between speed and volume on a road link. There is an optimum point along this curve where the volume is maximized. The speed at this point is defined as the "free flow" speed. Below this speed, traffic flow is conjested. Above this speed, the spacing between vehicles required for safety results in profligate use of the roadway. At any point along the curve, the volume-speed relationship represents the most efficient inter-vehicle spacing, given the braking distance required for safety, which can be achieved.

In one embodiment, the peer-to-peer telemetry architecture of [1] and as described below, supports the ability of vehicles to adapt their speeds in accordance with the optimal volume-speed relationship. The ATP protocol used between vehicles enables each one to determine, among other things:

(a) The distance(s) between it and the vehicle(s) immediately ahead of it (using GPS position and heading reports).

(b) The speed(s) of the vehicles immediately ahead of it.

(c) Application of brakes.

This information provides the enabling technology for all vehicles to engage in a cooperative effort to maximize traffic flow on electronically enhanced highways.

The term "Impedance" used herein is intended to be a measure of the "costs" of sending a datagram across a data link. This cost can include the monetary charges associated with the transmission of data across a wireless data link and are typically imposed by the operator of the wireless data network, as well as other factors such as . for example, the size of packet and the time of day, which of course will change over time. As is described in the PCT Application serial number PCT/CA98/00986 filed October 23, 1998 entitled TELECOMMUNICATIONS SYSTEM, the Impedance governs the functionality of the RF path switch. As impedance changes, the output of the RF path switch (i.e. the routing decision) can change. The sections entitled Error Reporting and Airlink Status Reporting describe the mechanisms whereby changes in impedance are reported to the RF path switch module.

## BRIEF DESCRIPTION OF THE DRAWINGS

Several preferred embodiments of the present invention will be provided, by way of example only, with reference to the appended drawings, wherein:

Figure 1 is plot of traffic volume versus speed on a road link;

Figure 2 is a schematic view of a vehicle communications system;

Figure 2a is a schematic view of one aspect of the vehicle communications system of figure 2;

Figure 3 is another schematic view of the vehicle communications system of figure 2;

Figure 4 is a schematic view of one segment of the vehicle communications stem of figure 2;

Figure 5 is a schematic view of another segment of the vehicle communications system of figure 2;

Figure 6 is a schematic view of still another segment of the vehicle communications system of figure 2;

Figure 7 is schematic representation of a system in accordance with one embodiment of the present invention;

Figures 8 a) and 8b) are schematic representations of a system according to still another embodiment; and

Figures 9, 10, 11, 12, 13, 14 and 15 are schematic views of portions of still another embodiment.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 2 illustrates a communications network for exchanging data between a plurality of vehicles, including vehicles 10 and 12 on a highway shown at H. Each vehicle has a computing unit 10a and 12a, the latter of which is shown schematically in figure 2a. Each computing unit has a processor10c which is connected via a serial port to a GPS receiver 10d, an IEEE 802.11 spread spectrum unit 10e, a cell packet data unit 10f capable of broadcasting and receiving data over a cell packet data network and a memory unit 10g. If desired, the components of the computing unit may be integrated on the same board using application specific integrated circuits (ASIC's), as described hereinbelow and in U.S. provisional application serial number 60/148,270, filed on August 11, 1999 and entitled VEHICULAR COMPUTING DEVICE.

Referring to figure 2, each computing unit 10a, 12a broadcasts ND and RD messages in a region surrounding the vehicle as shown by the circles 10b, 12b. In the example shown in figure 1 three other similarly equipped vehicles labeled 14a to 14c are all within the region 10b and therefore are capable of receiving the broadcast enquiry messages from the vehicle 10. The vehicles 14a to 14c issue reply messages which are received by the vehicle 10. Similarly, vehicles 14b to 14f are within the region 12b of the vehicle 12 which in turn receives reply messages from them. These messages may include such things as vehicle speed and GPS information as well as status indicators such as acceleration or braking. In this manner the computing units 10a, 12a are able to determine the position and movements of neighboring vehicles.

Thus, the number of vehicles in the corresponding region for each vehicle will change over time with the traffic pattern. In this case, the computing unit for each vehicle can retain status data for each target vehicle while the vehicle is in the region and then erase the data for those vehicles that have left the region. The memory unit 10g can have allocations for storing data for each vehicle while the processor can manipulate the data to determine if any action needs to be taken. The processor also receives data from the ECM 10h which can include such things as emissions, braking, acceleration, speed and the like, that is, any function of the vehicle which is being electronically sensed, monitored or measured. Optionally, the processor may also pass off, to other vehicle systems, braking or other override commands for controlling the vehicle if necessary.

Located along the highway are a number of access points which are routers to a fixed communications network, in this case spread spectrum base stations. One of the access points is shown at 16. The access point 16 issues router advertisement messages with a region shown by the circle 16a. Therefore, vehicle 12, in the instant of time represented by the figure 1, receives the advertisements. In this example, the vehicle computing units 10a and 12a as well as the access point 16 are IPv6 addressable. Therefore, the vehicle 12 and the access point 16 may then exchange data which may include Internet email and the like. The access point 16 may also convey status request data from a clean air regulatory body to the vehicle 12 which may then return the status data to the regulatory body through the access point 16 if the vehicle is still in its region.

Base station 18 provides a wireless data link to a proprietary RF packet network, for example that known as the MOBITEX network, or the like. This is a different data link from the spread spectrum data link operating at the access points 16. The computing units exchange data with the station 18 via the cell packet data unit 10f.

The GPS information from the neighboring vehicles may, for example, include Differential GPS (D-GPS). In the latter cases, the vehicle may more accurately measure the position of neighboring vehicles, relative to a reference GPS position which may be broadcast, for example, from the access point 16.

Global System

Figure 3 shows the overall system architecture. As will be described, Figure 3 illustrates how the IEEE 802 data link is incorporated into the hybrid mobile packet network and shows the path of Mobile IP communications between a mobile node shown at 10 and its home mobility agent, i.e., the Hybrid Network Gateway 230. Mobile node 10 is an embedded vehicular computing device functioning both as an OBD server [1] and as a Hybrid Network Radio [2]. The Hybrid Network Radio functionality is implemented through the interface 40 to the hybrid mobile packet network 250.

Fixed node 16 is a wireless communications base station implemented in accordance with the definition of a "foreign (mobility) agent" contained in [3]. Mobile node 10 and fixed node 16 share the same IEEE 802 wireless data link 15, which, from the perspective of the mobile node 10 and as will be described further below, is integrated as a "zero-cost" data link in the interface 40 to the hybrid mobile packet network 250.

Fixed node 16 may be, for instance, an embedded computing device permanently installed near a roadway and connected to a data communications network 210 via a stationary (non-mobile) backbone 220.

When a mobile node 10 comes sufficiently within range of a fixed node 16 to establish an IEEE 802 data link, Internet traffic, in the form of IP datagrams, may flow from the vehicle to any address in the Internet. This is called "mobile-originated" traffic. "Mobile-terminated" traffic can only reach the vehicle once the Mobile IP "care-of address" registration has been completed. This procedure, specified in [3], allows the mobile node to notify its "home (mobility) agent" that it can be reached through the foreign (mobility) agent embodied in the fixed node 16. As a foreign (mobility) agent, fixed node 16 is, by definition, an IPv6 router.

The home mobility agent for mobile node 10 resides in the Hybrid Network Gateway 230. A Hybrid Network Gateway (HNG) is the stationary equivalent of a Hybrid Network Radio and is defined in [2]. HNG 230 has an abstract interface 240 to the hybrid mobile packet network 250, through which it can route Internet traffic to a mobile node. In order to ensure least-cost routing to a mobile node that has registered fixed node 16 as its care-of-address, interface 240 must also incorporate the data link associated with stationary backbone 220. This extends the hybrid mobile packet network to include a stationary data link.

In other words, the system has the capacity to carry out least-cost transfer data between the Hybrid Network Gateway 230 and the mobile node 10 in one of three routes:

i) via the data link 15, the fixed node 16, the data link 220 and the stationary non-mobile data link 210; or alternatively

ii) through the hybrid mobile packet network 250. which itself can provide least cost switching between :

a) a satellite Packet Network; or

b) an RF Packet Network.

Ipv6 Communication Protocol Stack

The IPv6-based communications software infrastructure for a telemetry system in accordance with this example is shown in Figure 4. Figure 4 is a representation of the Hybrid Network Radio incorporating interfaces to an arbitrary number of RF packet networks, including an interface to a wireless IEEE 802 data link. integrated into a single abstract data link as specified in [4]. Figure 4 also shows the relationship between the Hybrid Network Radio and an IEEE 802.11 Access Point incorporating an IPv6 router implementation. In this scenario, mobile-originated Internet traffic (datagrams emanating from the Hybrid Network Radio) can be routed through the access point or alternatively through the hybrid mobile packet network 250 depending on 'cost'. Mobile node 10 is an IPv6 (Internet) node consisting of a protocol stack 20 in accordance with definition of a Hybrid Network Radio provided in [4]. Fixed node 16 is an IPv6 (Internet) router consisting of the router-specific equivalent of protocol stack, labeled 21. The components of protocol stack 20 are:

(i) a combined RF packet network 30 that unifies all the wireless data links available to mobile node 10 into a single abstract data link capable of least-cost switching;

(ii) an IPv6 module 60, in accordance with [6], the contents of which are incorporated herein by reference;

(iii) an ICMPv6 module 70. in accordance with [7], the contents of which are incorporated herein by reference, that provides the assembly and parsing mechanisms for the specific datagrams required by ND;

(iv) a Neighbor Discovery (ND) module 80, in accordance with [5], that enables mobile node 10 to dynamically discover other "on-link" mobile nodes, i.e., other vehicles capable of communicating on the same IEEE 802.11 medium; and

(v) a Router Discovery (RD) module 90, in accordance with [5], which enables mobile node 10 to discover dynamically IPv6 router 16.

Both the ND and the RD protocols require the broadcasting of, respectively, neighbor and router advertisement datagrams, defined in ICMPv6. These datagrams are sent to the interface 40 to the combined RF packet network 30. Broadcast datagrams can only be transmitted on data links that are broadcast-enabled. Typically, wide area RF packet networks do not support broadcasting initiated by subscribers, although they often allow multicasting to selected groups of mobile subscribers. Since IEEE 802.11 depends on broadcast frames to establish the data link, it should identify itself to interface 40 as broadcast-enabled, whereas all other RF packet networks incorporated in the combined packet network 30 should report that they are not broadcast-enabled. The intelligent switching mechanism of this interface, which ensures that datagrams are transmitted over the least-cost data link, will therefore switch all mobile-originated broadcast datagrams over the IEEE 802.11 data link.

In case of overlapping of the coverage areas of two or more Access Points, a mobile node may receive router advertisements from more than one fixed station, in response to its broadcast of router solicitations, providing it with alternative on-link routes to use for outbound datagrams. Both neighbor and router discovery should rely primarily on unsolicited neighbor and router advertisements.

Registration of the "care-of-address" provides a means for requests from the OBD telemetry client to reach a mobile node via the foreign mobility agent, which, by definition, is an IEEE 802 access point. The maximum acceptable impedance values associated with these requests can be set such that the mobile-terminated ATP traffic that would otherwise incur costs traveling over RF packet networks, can be deferred until the "care-of-address" is registered with the home address.

Cluster Intelligence

The cluster object as an ATP client is a specialization of the generic SNMP client using the UDP/IP protocol. The ATP allows for message passing to the cluster object.

The establishment of an IEEE 802.11 ad-hoc network as a "mobile cluster" in accordance with the present example is shown in Figure 5. Mobile node 10 incorporates the User Datagram Protocol (UDP) module 100 and the ATP module 110. An equivalent mobile node 11, with equivalent UDP and ATP modules 101 and 111, respectively, can interact with mobile node 10 such that the automotive behavior of 11 is known to 10. This is accomplished through the mechanism of an ATP request issued by 10 to 11 and an ATP response from 11 to 10.

The interaction between any two mobile nodes is managed by a "cluster", which is an active object that registers with the ATP for reports from neighboring vehicles. Cluster 120 has container 130 of neighbors, or more precisely, "images" of neighbors. These neighbors are placed in the container when detected by the ND mechanism operating over the IEEE 802.11 data link, as shown in Figure 4. By propagating the discovery mechanism in ND module 90 upwards through the UDP/IP stack. Node 11 becomes a member of Node 10's cluster when the ATP signals the cluster that a new neighbor has appeared. (The whole process can be repeated for mobile node 12, which becomes a second neighbor of node 10).

Registration of neighbors discovered through the ND requires an implementation of IPv6 that can be asynchronously notified of ND, which requires a "callback" method of IPv6 to be invoked when the neighbor's response to a solicitation request is being processed. The conventional processing of such a response is simply to update the cache of on-link neighbors known for that interface. However, the requirements of cluster intelligence are that dynamic neighbor identification propagate upward from the subnetwork layer to an application port of the UDP/IP protocol stack.

In this example, cluster communications over wireless data links is intended to take place only over the license-free spread spectrum band. The cluster object itself has "no knowledge" of the fact that there are alternative radio paths between vehicles. However, when the cluster asks each new neighbor to transmit GPS position reports and automotive events in which it is interested, both the requests as well as the responses will travel only over zero-cost links - which are precisely the same links over which the ND operates. In others words, by virtue of the least-cost mechanism described in [4], a license-free wireless data link will always be the data link over which the ND datagrams are transmitted. ND can and should be configured such that its maximum acceptable impedance level can only be supported by the license-free links. ND will therefore only discover neighbors that are on the license free links and cluster traffic that follows from this will travel only over these links.

Provided that an implementation of cluster 130 is compliant with the requirements for the interface to the module ATP 110, already specified in [1], the internal behavior of the cluster may vary depending on the design objectives and implementation style for a specific vehicular device. The precise design of the methods (behavior) or the specification of other methods intended to process (and act on) information reports from neighboring vehicles is not within the scope of the present invention.

*Process Architecture*

Figure 6 illustrates the process architecture of the device comprising the mobile node. ATP client process 300 is part of the cluster intelligence module. Figure 6 illustrates the architecture of the processes, running on top of the UDP/IP stack, that provide all of the functionality of the system. These processes are:

(i) an OBD process, with the behavior of an ATP server;

(ii) a Cluster Intelligence process with the behavior of an ATP client;

(iii) a Mobile IP process, with the behavior specified in [3]; and

(iv) a diagnostic data acquisition process.

ATP is registered with UDP module 330 through the *application port* 305. Similarly Mobile IP process 310, which is responsible for registration of care-of-addresses (i.e., addresses of foreign mobility agents) with home mobility agents, is registered with UDP module 330 through the application port 315. The ATP server process 320, registered with UDP module 330 through port 325, provides access to the Diagnostic Information date Base (DIB) 340. This data base, similar to the Management Information data Base (MIB) used by SNMP (from which ATP is derived), contains all of the on-board diagnostic information obtained from the data acquisition processes 350 (Analog and digital signal processing), 360 (CAN-bus data processing) and 370 (GPS receiver data processing).

Whereas the present invention does not limit the scope or characteristics of possible cluster implementations, the behavior recommended for effective use of the ATP to implement cluster intelligence within each vehicle is described by the pseudo-code below. The cluster is defined as an object that owns an ATP client process with a set of methods corresponding to the handling of each of the possible messages that could be received through the ATP.

In one example, the cluster's ATP client process would be:

```
ClusterProcess()
{
   while( TRUE ) {
      pointer_event_object = Wait_Queue_Event_Signalled_By_ATP();
      pointer_event_object->Handler();    // behavior of event object
      destroy_event( pointer_event_object-)
   }
}
```

The cluster process blocks on an event queue, registered with the ATP, to which the ATP can append events relevant to the cluster process as they occur. These events are removed from the queue and processed on a first-in first-out basis. All events are treated as objects derived from a common base class within a virtual "handler" method, the internal behavior of which varies for each type of event. The handler method of the event is invoked by the cluster process when the event is removed from the queue.

The primary type of event which the ATP should signal to the cluster is a GPS position report from a neighbor. This implies, of course, that all nodes on the ad-hoc IEEE 802.11 network should broadcast GPS position reports. Other on-link nodes receiving these broadcasts should propagate the reports upward through the protocol stack to the ATP, which should signal an *Event_GpsReport* to the cluster.

*Event_GpsReport_Handler()* is the method invoked when the *GpsReport* signaled by the ATP is removed by the cluster process from its queue. The inputs to this method are:

(i) *ID_Remote_Vehicle* - which should be the unique IP address of the vehicle;

(ii) *GpsPosition* – which is a latitude-longitude coordinate pair, determined by the GPS receiver of the remote node and contained in the payload of the UDP segment received from the remote; and

(iii) *GpsHeading* – which is a heading determined by the GPS receiver of the remote node and contained in the payload of the UDP segment received from the remote.

```
Event_GpsReport_Handler ( ID_Remote_Vehicle, GpsPosition, GpsHeading )
{
    Remote_Vehicle  = GetRemote( ID_Remote_Vehicle);
    Proximity       = CompareGps(Remote_Vehicle, GpsPosition,
GpsHeading );
    If(Proximity ) {
      AtpRequest( Remote Vehicle, speed, frequency, duration, amplitude );
      AtpRequest( Remote_Vehicle, foot brake, 0, 0, 0 );
    }
}
```

*Event_GpsReport_Handler* carries out the following functions:

(i) Invokes the private function *GetRemote* using the input *ID_Remote_Vehicle*. (The term *private* signifies that the function is usable only by the cluster module and is not accessible to "external" software modules). This searches the cluster's container of remote vehicles for the object matching *ID_Remote_Vehicle*;

(ii) Uses the private function *CompareGps* to determine whether this vehicle is within a specified distance threshold. This function takes as inputs:

(a) pointer to the Remote Vehicle object; and

(b) the new GPS position and heading.

The GPS position and heading of the remote vehicle are compared to the position and heading of the "local" vehicle. The "local" position and heading are maintained in the DIB (diagnostic information base). Since the ATP is a peer-to-peer protocol, cluster intelligence request/response exchanges can be symmetrical. The DIB can therefore be used by the ATP client to obtain GPS information for comparison with reports from remote nodes, as well as by the local OBD server to respond to cluster intelligence requests from remote nodes.

The output of *CompareGps* is a boolean variable (*Proximity*) indicating whether ATP requests to this remote are warranted because the vehicle is within a specified distance threshold to require preventive measures if there is a sudden change in speed. Since the implementation of cluster intelligence is not within the scope of the present invention, the internal algorithm of CompareGps is not defined here. However, it should be noted that any implementation of CompareGps must account for margins of error in the accuracy of the GPS receiver where the remote position report originates. Furthermore, it may not be possible to distinguish between several remote vehicles moving in parallel in different lanes ahead of the "local" vehicle so that the identity of the vehicle directly in front may remain indeterminate. The cluster intelligence decision algorithm may have to assume that all of these vehicles are equally important to monitor.

If Proximity is TRUE, then ATP requests can be issued to the remote node's OBD server, the responses to which enable the cluster to provide decision support to other intelligent modules within the complete automotive system. A minimum set of requests could consist of speed reports, at values of frequency and duration established by the owner of the cluster, (i.e., one of the aforementioned automotive modules), and of notifications for the application of the foot brake.

Another embodiment of the present invention is shown in figure 7 A mobile automotive telemetry system is shown generally at 110 in Figure 1. System 410 comprises a diagnostic means 415 for monitoring the operational functions of the vehicle in which system 410 is installed and generating operational information. The generated operational information may be stored in a memory 420 until required. Both diagnostic means 415 and memory 420 are in communication with a server 425 which ultimately controls the operation of system 410.

Server 425 can communicate with a remote client 430 via a data link 435. To this end, server 425 comprises a means (440) to receive a request for information from remote client 430; a means (445a, 445b) to retrieve the generated operational information from memory 420; and a means (450) to transmit the retrieved generated operational information to remote client 430. Server 425 is a processor which is programmed to respond to requests for information from remote clients and to respond to control commands.

Diagnostic means 415 may be a conventional, computer-based OBD module which monitors various operational functions of the vehicle in which system 410 is located. Diagnostic means 415 may, for example, monitor exhaust emissions, fuel use, ignition timing, engine temperature, speed and/or distance travelled. Diagnostic means 415 receives inputs from the various vehicle sites via a plurality of communication lines 460 and, after interpreting the inputs and generating formatted operational information, passes the operational information to memory 420 via communication line 465. Diagnostic modules suitable for use in the present invention are known in the art and are referred to as Electronic Control Modules (ECM) or Electronic Control Units (ECU). The specifications for the diagnostic modules may be found in Society of Automotive Engineers, "On-Board Diagnostics for Light and Medium Duty Vehicle, Standards Manual" 1997 Edition, the contents of which are incorporated herein by reference.

Memory 420 may be any conventional computer memory, the size and operation of which will be dependent on the nature of the operational features of the vehicle a user wishes to monitor. The choice of suitable memory is believed to be within the purview of a person of skill in the art. In one embodiment of the present invention, system 410 comprises a memory 420 which includes 32k of non-volatile RAM and a configurable amount of additional RAM, allocated at run-time from the host processor system. Memory 420 receives the operational information, generated by diagnostic means 415, via communication line 465 and stores the operational information. Memory means 420 is in communication with server 420 and is capable of receiving instructions from server 425 and sending information to server 425 via communication lines 470a and 470b, respectively. As will be apparent to a person of skill in the art, communication lines 470a and 470b may be replaced by a single communication line if the appropriate communication protocol is used.

Server 425 acts as a gateway between remote client 430 and diagnostic means 415 and eliminates the requirement that remote client 430 has knowledge of the specialist OBD protocols of diagnostic means 415. Server 425 in effect acts as a "universal translator", allowing a remote client to interact with any diagnostic means of any vehicle. One way of achieving this end is through the implementation of a request/response protocol which acts as a proxy for the corresponding OBD protocols. Under this type of protocol, an abstract request from the remote client which is received by the server is mapped to the corresponding request under the specialist OBD protocols and is then transmitted on the diagnostic means or memory, as appropriate. In the other direction, the responses returned by the diagnostic means or memory to the server are then mapped to an abstract response which is sent back to the client.

Such request/response protocols are known in the art and include, for example, IAS protocol for infrared links and UDP/IP protocol for wide area network communications.

Data link 435 may be any conventional communication link, including, for example, telephony (wired and mobile wireless), specialized mobile radio (SMR), infrared and satellite (both low earth orbit (LEO) and geosynchronous). Server 425 may be provided with the hardware and operational protocols necessary for communicating with remote client 430 by a variety of means, thereby not restricting communication to a remote client having one particular type of data link. Providing server 425 with a plurality of communication protocols aids in making the system of the present invention universally acceptable.

In one embodiment, server 425 is provided with infrared data link capabilities. An infrared data link between the server and the remote client provides a local wireless method of acquiring data from an OBD module. It therefore removes the need for the client's equipment to incorporate a system-compatible connector (i.e, an OBD-connector as specified by the SAE) and to be physically joined by a cable in order to communicate with the system.

When, for example, the client is test equipment in a garage, the use of an infrared data link renders possible the development of service bays where information can be transferred almost instantaneously from the vehicle to the service technician's computer without requiring the customer to get out of the vehicle. The infrared connection may be achieved by attaching a serial infrared connector to a serial port on the server and by ensuring that there is an unobstructed path for IR transmission between the LED's of the infrared connector and that of the service technician's computer.

As will be apparent, the reliability of an infrared data link is improved with the implementation of a robust protocol which detects transmission errors and avoids collisions by operating in a half-duplex fashion. Such protocols are known and have, for example, been implemented by computer and software manufacturers for incorporation in consumer electronic products such as micro-computers, modems and cellular phones (i.e. the IrDA stack). Suitable protocols are described in Infrared Data Association, "Serial Infrared Link Access Protocol (IrLAP)", Version 1.1, June 1996 and Infrared Data Association, "Link Management Protocol", Version 1.1, January 1996, the contents of both of which are incorporated herein by reference.

Through compliance with these infrared protocols, the server achieves a goal of rendering client test equipment independent of the OBD protocols. Accordingly, any micro-computing equipment which is infrared-aware, such as a desk-top, notebook or palm-top (Personal Digital Assistant or PDA) can effectively become a remote client.

In an alternative embodiment, the infrared data link may be replaced or enhanced by incorporating mobile wireless data links, coupled with the UDP/IP infrastructure for peer-to-peer client/server exchanges over a wide area network. This adaptation of the system extends the range of the services offered by the server beyond its capabilities with only the infrared connector and data link. The principles described in the previous sections remain the same, with the exception that access to OBD information no longer requires that the vehicle be moved within infrared detection range (typically 2-5 metres) of the test equipment. The vehicle can be in any location which is reachable on the Internet, via a mobile data link.

The system of the present invention may further comprise a means to transmit generated operational information to a remote client, in the absence of a request from the client, when the generated operational information satisfies predetermined criteria. Such transmissions of the generated operational information implies that server 25 effectively becomes a client with respect to a remote site which is capable of logging the transmission. This functionality can be achieved by utilizing the peer-to-peer communication architecture described above and is useful in, for example, alarm/emergency situations.

If, for example, while monitoring the exhaust emissions of a vehicle on the road, the level of carbon monoxide in the exhaust gases exceeds a predetermined level, the diagnostic means can communicate this information directly to server 125 via communication line 175. Server 125 can then transmit an alarm report to a remote site advising of the problem. This report can be transmitted in real-time, allowing the problem to be dealt with immediately, rather than having to wait until the vehicle undergoes routine servicing and diagnosis, days or even months after the problem has first come to light.

It is envisioned that the threshold values for alarms, as well as the frequency and duration of the alarm message, can be configured either directly at the server during installation or servicing, or by using remote commands from the client.

The system described herein may also incorporate Internet access technology for the drivers or passengers. The existing method of Internet access for individual personal computers (PC) is well-known. The PC establishes a serial link with a computer which has a permanent Internet (IP) address. The latter computer, for the purposes of this description, can be called a gateway. The serial link is physically either a direct cable connection or via a telephone circuit, using modems at both ends of the link. The PC does not have a permanent IP address. It is assigned a temporary IP address by the gateway for the duration of the connection. Therefore, if the link is maintained via a telephone circuit, then the connection automatically terminates when the circuit is dropped and the temporarily assigned IP address ceases to be valid.

One of the conventional methods of Internet access from a vehicle follows the technique described above, using an analog cellular phone and a cellular modem. By connecting the PC to the cellular modem, the driver/passenger can obtain a temporary IP address in the same fashion as with wired telephony.

Another method of Internet access from a vehicle is a technology called Cellular Digital Packet Data (CDPD), which is a form of packet-switching overlaid on the existing analog cellular infrastructure in the United States. CDPD operates with a portion of the bandwidth of the analog cellular system and provides a multiple access data link technology within each cellular base station's territory of coverage. However, contrary to the method already described, the network architecture of CDPD also allows each access device (CDPD modem) to have its own permanent IP address. Therefore, no dial-up connection is required to establish the presence of the PC on the Internet. It suffices for the PC to be connected to the CDPD modem (which is typically in the form of a credit-card style PCMCIA card) for any Internet traffic from another location to reach the PC.

IP V6 is a new version of the Internet Protocol. One of the design objectives of IP V6 is to enable portable computing devices (notebooks, palm-tops, etc.) to have permanent IP addresses which can be reached regardless of where the portable device is physically connected to the Internet. Therefore, the device could be connected, at different times, to both an office LAN (Local Area Network) as well as a residential LAN, without requiring manual intervention by a network administrator in either LAN to ensure delivery of Internet traffic. This is achieved by ensuring that both LAN's have at least one node (computer) which acts as a "Mobility Agent". The Mobility Agent incorporates software which implements IP V6 and related protocols. The purpose of the mobility-related functions in this software is to ensure that roaming computing devices are automatically "discovered" when they establish a link to the Mobility Agent and that the rest of the Internet is informed of the new path which must be used to route traffic to the roaming device. Only those routers in the Internet which have been upgraded to support IP V6 will participate in this function.

A Mobility Agent can reside in a mobile environment as well as a fixed LAN. This scenario is a distinct departure from the existing models of Internet access already described. A mobile Mobility Agent, installed in a vehicle in the form of a mobile computer, can effectively "host" any IP V6-enable portable computing device, provided that it has a wireless data link to a network which is capable of routing packets on the Internet, such as CDPD. The implication is that if a vehicle is equipped with a Mobility Agent using, for instance, CDPD, then any portable device which a driver or passenger wishes to use in the vehicle to obtain access to the Internet does not also need the CDPD modem. It only requires the IP V6 software.

In order to equip any vehicle with IP V6 support, a hardware platform is required to host all of the required protocols and to provide the data links for portable devices trying to connect to the Mobility Agent. In order to support the SAE diagnostic test modes in the remote fashion described herein, the server contains all of the components which will also allow it to function as a mobile Mobility Agent.

It is envisioned that the Infrared port (and IrDA protocols), which is primarily useful for OBD diagnostic test modes while the vehicle is stationary and being examined, can "double" as an in-vehicle wireless point of entry to the internet for portable devices operated by the driver/passengers.

Another embodiment is shown in figures 8a, 8b which provides an integrated circuit board for a vehicular computing device which supports the following:

a) Acquisition of diagnostic data via an automotive data bus interface (or directly through analog and digital inputs) and storage of the data.

b) Data communications using spread spectrum radio in accordance with the IEEE 802.11 specification for wireless local area networks.

c) Reception of signals from Global Positioning System satellites and determination of position, heading and speed based on these signals.

d) The IEEE 802.11 protocol stack is implemented in an additional task executed by the host CPU. Depending on the choice of processing resources, the GPS position determination may be carried out by an additional task executed by the host CPU.

In both Figures 8a) and 8b), the CPU board 510 comprises the Universal OBD Server host system into which both the spread spectrum modem and GPS receiver functions are integrated in the form of chipsets.

In Figure 8a), spread spectrum transceiver circuitry 512 comprises the RF processing functions required for implementation of a spread spectrum radio modem. These are embodied in a series of semiconductor devices constituting a chipset for integration of spread spectrum radio in a host CPU board. As these devices constitute externally defined components that are integrated in the present invention, only those components that interface with the host system are numbered.

Host CPU 520 communicates with spread spectrum transceiver circuitry 512 through two (2) serial interfaces. Serial interface 514 handles inbound data received from the sequence generator 516 while serial interface 518 handles outbound data sent to the decimator 519.

The embedded software required to drive the spread spectrum transceiver is an implementation of the IEEE 802.11 specification, executed by the host CPU. The functional interface between the host CPU and the spread spectrum sub-system corresponds to the interface between the two bottom layers of the IEEE 802.11 physical layer architecture. The lower layer is called the Physical Medium Dependent (PMD) sub-layer, which is embodied in the spread spectrum transceiver circuitry. The upper layer is called the Physical Layer Convergence Procedure (PLCP) sub-layer, which constitutes the lowest level of the protocol stack implemented in software to be executed by the host system.

Similarly, in Figure 8 b), GPS reception circuitry 542 comprises the RF processing functions required for implementation of a GPS receiver. These are embodied in a series of semiconductor devices constituting a chipset for implementation of a GPS receiver. As these devices constitute externally defined components that are integrated in the present invention, only those components that interface with the host system are numbered.

Yet another embodiment is shown in figures 9 to 15. The term "*Automotive Telemetry*" refers to the conveyance of operational data from a mobile vehicle to a regulatory or maintenance authority as well as to other, neighboring mobile vehicles. The data transmitted are acquired directly from analog and digital sensors, the in-vehicle data bus, ECU and from a GPS receiver. The data are conveyed via a wireless packet-oriented data links provided by terrestrial RF packet networks, spread spectrum and satellite.

An Automotive Telemetry System according to the present invention may be configured to enable interested parties (regulatory agencies, OEM's, dealers) to obtain critical automotive performance information in a wireless manner. It is believed that a system according to the present invention may also be configured to enable:

– reliable. substantially error-free data communications between the on-board CPU and persistent data storage;

- high-level services in the form of API's (Application Programmer Interfaces) for real-time alarm monitoring, trending and back-office decision-support systems. IT developers responsible for maintenance. performance monitoring and automotive engineering systems can invoke high-level services that make the CAN-bus. or any sensors and actuators. appear as though they are directly connected to the fixed-location host system.

- flexible communications architecture enabling many-to-many, simultaneous, multiple virtual connections between on-board CPU's and fixed-location host systems. This means that both the on-board CPU and the ground-based workstation can maintain client-server relationships with several peers at the same time.

on-board filtering intelligence and remote configuration capability. The on-board CPU should have the ability to restrict real-time transmission of diagnostic data according to threshold levels that can be dynamically changed from a fixed-location host. In addition. the host should also be able to remotely configure the frequency and duration of telemetry reports as well as logging to nonvolatile ram (NOVRAM);

- minimal use of wireless bandwidth. There is an inherent economic cost associated with the deployment of infrastructures supporting wireless data links. regardless of the method used to recover this cost. Therefore both the application and the communication software should, where possible, minimize the use of these links through such methods as exception-driven reporting and data compression.

An exemplified system according to the present invention has three components:

– Universal On-Board Diagnostic (UOBD) Server (in-vehicle telemetry computer)

- Communications Protocol Stack

- Application Programmer Interface (API)

A hardware instantiation of the in-vehicle UOBD Server has been built based on an embedded 80386 CPU and a hard real-time multitasking kernel. The current model incorporates the following features:

- 512KB flash memory (192 KB for data logging)
- 512 SRAM
- 8 A/D channels for analog sensor inputs
- 8 digital channels for discrete inputs (each channel configurable as an output)
- CAN-interface
- RS-485 serial ports for interface to J-1708 bus (heavy trucks and buses)
- 2 RS-232 ports for PPP and/or IrDA (InfraRed) connections with external computing devices.
- GPS receiver with NMEA-compliant data link to the CPU
- RF packet radio network interface (Mobitex or ARDIS)

- Spread spectrum data link (2.4 GHz ISM band, frequency hopping CMSA/CA protocol)

Real-Time Executive

The operating kernel adopted for the UOBD is RTEMS (Real-time executive for multi-processor systems). However, the entire body of software embedded in the UOBD (with the exception of the real-time kernel itself and bootstrapping code) is capable of running in alternative operating environments. This is achieved through the definition of an abstract operating system in terms of an object-oriented abstract base class, with specific instantiations for whatever operating environments are required.

In particular, a Windows NT instantiation of the operating environment has been developed for emulation and testing of the embedded system.

Communications Sub-System

The communications sub-system is a protocol stack which supports any combination of terrestrial RF packet network, satcom packet networks and short-range spread spectrum data links. As shown in Figure 9, the software architecture treats each wireless data link as part of a sub-network according to the Internet paradigm.

The Internet standards are implemented within the protocol stack so that, if required, the UOBD Server can become addressable on the Internet. Internet accessibility to the UOBD Server is an option which facilitates remote diagnostics by a variety of authorized clients. The protocol capabilities of the device include both PPP and IrDA (InfraRed) which provide connectivity to other devices in the vehicle such as palm-tops or notebook computers.

The architecture of the communications sub-system is designed to provide an infrastructure for "seamless" peer-to-peer communications between the vehicle and a fixed-location host system or another vehicle.

The following sections describe the various layers of the protocol stack in more detail.

Session Layer: Automotive Telemetry Protocol

The Automotive Telemetry Protocol (ATP) provides a simple and effective bi-directional request-response mechanism. From the vehicle, ATP allows the diagnostic monitor embedded in the UOBD Server to report fault conditions to a host system application. In the reverse direction, diagnostic inquiries and parameter configurations can be issued from the host. The ATP message syntax is similar to that of SNMP and contains streamed versions of Object Identifiers (OID's) as a means of specifying the performance or operational parameter to which the message pertains.

Figure 10 illustrates this mechanism with the request initiated from a fixed location host. However, the implementation of the ATP supports both client and server functionality in either the host or the UOBD Server. As such, the UOBD Server may provide simultaneous OBD services to more than one (authorized) OBD "client".

Sub-net and DataLink Layers: Hybrid RF

Short-range spread spectrum data links provide a powerful complement to RF packet networks for vehicle-to-vehicle telemetry and a potentially low-cost mechanism for OBD-III compliance monitoring. The UOBD incorporates both technologies with the intelligence to switch between them on a "least-cost" basis. In order to preserve the IP addressing mechanism allowing for a unique IP address at the interface between the UOBD Server's IP module and the drivers for its wireless data links, the present system has implemented the concept of

- an *Hybrid Network*, which is an abstraction that combines multiple physical data links. This is illustrated in Figure 11.

Any node on a *Hybrid Network* is either an in-vehicle UOBD Server or a Hybrid Network Gateway (HNG). This is a ground-based IP gateway to the *Hybrid Network* and is functionally symmetrical to the UOBD Server. It has an IP module bound to a network interface for the *Hybrid Network*. This network interface has a unique IP address.

The current HNG resides on a dedicated Windows NT workstation and effectively provides an IP-level gateway between the Hybrid Network and the rest of the Internet or corporate Intranet.

The complete protocol stack for a hybrid network node is illustrated in Figure 9. At the lowest level of this stack are data link drivers for RF packet networks. A combination of such data links is subsumed by a single abstract Hybrid Network interface, which is responsible for switching outbound transmissions over the least-cost data link in a manner that is transparent to the IP. The "cost" of using any given wireless data link is expressed as a measure of "impedance", which is established in terms of the monetary cost of transmission and of the availability of service.

Figure 12 illustrates the mechanism implemented for switching of mobile-originated frames over the least-cost wireless data link. Note that this describes the protocol behavior only at the data link layer of the stack. The behavior of the stack at other layers is described hereinbelow.

In part (a) of Figure 12, the UOBD CPU sends a frame over the serial link to the primary RF radio modem (spread spectrum), which in turn successfully sends it over the airlink to a base radio modem (spread spectrum access point). From there, the payload is sent to the Hybrid Network Gateway from where it can be routed over a network backbone (possibly the Internet) to a host system.

Part (b) of Figure 12 shows the instance where a mobile-originated frame fails to traverse the airlink. In this instance, a failure notification is received, either from the radio modem, or from a timer expiry within the CPU. The failure notification is propagated back up the protocol stack to the process which was responsible for the message contained in the frame (e.g. the ATP client or server process), which can then choose to reschedule the transmission. The failure notification also causes the impedance level for the destination address to be raised to a maximum level. The retry is therefore carried out over the alternate RF data link. The impedance will be lowered whenever a notification is received that the mobile has returned within "RF range" of the base.

Network Layer: In-Vehicle Routing and IP Header Compression

The IP implementation is intended to enable the UOBD Server to act as a gateway from the wireless Hybrid Network to a subnet of computing devices used within the vehicle. The data link used for any of the devices is PPP (point-to-point protocol) over an RS-232 serial connection. This is designed to support a palm-top or notebook computer using PPP with a direct serial link to obtain a temporary IP address.

In many cases, the Automotive Telemetry System does not encompass more than one host site (client). The mobile UOBD Servers do not therefore need to distinguish between remote addresses. Furthermore, the Hybrid Network Gateway has address tables for resolving all IP addresses to unique physical addresses, associated with each of the RF data links, for each UOBD. Therefore, mobile-terminated datagrams do not require an explicit destination address in transmission. Similarly, mobile-originated datagrams do not require an explicit source address in transmission. In these cases, the IP headers can be compressed from 20 to 3 bytes, without loss of information. The overhead of 3 bytes is necessary to provide a sequence number for the datagram, an identifier for the transport protocol to be used and the in-vehicle subnet address of the destination. Regardless of the protocol, this amount of overhead would be required in any event.

The IP implementation supports varying levels of compression simultaneously. Telemetry traffic from a "well-known" client is subject to full compression as described above, whereas "external" Internet traffic must preserve more header information.

Transport Layer: UDP and ICMP

There are two basic types of transport protocol: "stream-oriented" and "datagram". The corresponding specifications commonly used in conjunction with the Internet are called, respectively, TCP (Transport Control Protocol) and UDP (User Datagram Protocol)

When the quantities of data transmitted are very small, relative to the maximum size of individual packets allowed over the wireless data links, the transport mechanism used is UDP. Typically, this is applied in a « request/response » mechanism one of the following three (3) scenarios :

-Host « requests » data for a specific parameter – UOBD Server « responds »

- UOBD Server reports alarm value for a specific parameter – Host confirms alarm received

- Host « commands » UOBD Server to set new configuration value – UOBD Server confirms setting.

The transport-level protocols included in the stack are UDP (User Datagram Protocol) and ICMP (Internet Control and Message Protocol). UDP supports the Automotive Telemetry Protocol in a manner identical to its use in other request/response protocols such an SNMP.

In contrast to UDP, TCP/IP provides what is commonly referred to as a « reliable, stream-oriented, virtual circuit ». Variable quantities of data can be pushed into the circuit at one end, and will be delivered at the other end in the same sequence that they were submitted. If errors occur, or individual packets traversing the actual physical networks are lost, the TCP/IP protocol stack is responsible for re-transmission. However, this is not manifest to the application software using the circuit. At each end of the circuit (called a « socket ») , all that is understood is two steady « streams » of octets (bytes) : one for reception and one for transmission.

The successful operation of TCP/IP requires significant « overhead », i.e. octets which are not part of the deliverable « payload » but are used for addressing, routing and retransmission control. Therefore, in a network environment where transmission of each packet is relatively expensive, such as RF TCP/IP should be used frugally.

ICMP is used as an error reporting mechanism, specifically for the case where the destination for an IP datagram cannot be reached. This mechanism is used in conjunction with a switching mechanism for directing over the least-cost wireless data link.

The use of ICMP is illustrated in Figure 13. The fixed location host sends an ATP message using UDP to the mobile. (It is irrelevant whether the ATP message is a request or a response. UDP is indifferent). The message is transported in an Internet datagram which must transit the Hybrid Network Gateway. The HNG attempts to route the datagram to the UOBD using the primary RF data link. This attempt fails because the UOBD is not currently reachable via the primary RF data link.

The HNG is not responsible for attempting a retry. Instead, it generates, on reception of the failure notification from the RF data link, an ICMP "destination unreachable" message which is sent to the source address of the original IP datagram. The ATP process (either client or server, depending on whether the ATP message was a request or a response) handing this message can reschedule a retransmission at a later time. In the meantime, the HNG will have changed the impedance level of the primary RF data link for the destination address in question. When the datagram transmission is retried, the HNG will route it through the lower impedance data link, i.e. the alternate RF data link. The impedance of the primary RF data link will return to its lower level when a registration packet is received from the mobile indicating that it is reachable, i.e. it is within "RF range".

Figure 9 also shows the TCP and IGMP protocols at the transport level. These protocols are not incorporated in the current version of the UOBD Server but they may have future roles in, respectively, "batch" data acquisition and multicast messaging to fleet groups

API

The API, as described in the system objectives, provides a platform on which application programmers can develop database systems and user interfaces. The API resides above the Automotive Telemetry Protocol at the "Presentation" layer of the stack. ATP is derived from SNMP, and therefore the API resembles an interface to SNMP. It consists of three types of objects which must be allocated and which methods must be invoked to execute the interface. The following provides brief definitions for these objects and a conceptual outline of their use. The precise class definitions, function prototypes, initialization sequences and so on, are provided in a separate programmer's manual.

Diagnostic information Base (DIB)

These objects are similar to the notion of MIB (Management Information Base) used in SNMP. Each one corresponds to a specific data source from the vehicle: e.g. engine temperature, oil pressure, fuel level, etc. They have a unique OID (object identifier) and a cache variable for storing for the most recent value received from a remote vehicle. A DIB must be allocated for each data source which the application intends to monitor from any given vehicle. Only one DIB is required for a given data source, regardless of the number of vehicles being monitored. In other words, DIB's are not needed for each vehicle but only for each unique type of data.

All the DIB's are held in a container belonging to the ATP (see below). When a DIB is allocated, the user must add it to the ATP container by invoking a method of the ATP.

ATP (Automotive Telemetry Protocol)

The ATP is the object that encapsulates the UDP portion of the communications protocol stack. A method of the ATP is used to allocate a "listener", which is an ATP Server object that handles requests from unknown remote clients. If a UDP message had been received from a mobile client for which no ATPClient object (see below) has been allocated, the ATPServer allocates a new ATPClient and registers it with the DIB's

ATPClient

An ATPClient should be allocated for each remote vehicle being monitored. The ATPClient needs to be "registered" with each DIB in the container belonging to the ATP.

Sending requests to a mobile is accomplished in two (2) steps. First, the user needs to invoke the appropriate ATPClient methods which will specify the OID, the message type (i.e. what type of command is being issued to the remote) and any data values which should be appended to the message (e.g. new thresholds for alarms). In the second step, the transmit method of the ATPClient is invoked.

Reception of messages from a mobile, whether requests or responses, is handled within the ATP. The user can provide a "hook" for each ATPClient to process the payload data of both requests and responses. This is registered with the ATPClient in the form of a function pointer. For processing of requests, the user-supplied function should indicate to the caller whether the data was correctly processed. For example, if the request received is to log an alarm to persistent storage and there is an error, a Boolean return code should indicate FALSE. As a result, the response message to the mobile will indicate failure and appropriate action can be taken at the mobile end (i.e. rescheduling the transmission).

Design and Development Practices

Object Design

All software implementation is based on the object-oriented design principles of inheritance and encapsulation. This means that every module (class definition) of the software is derived from an abstract base class (with the exception of the abstract base classes themselves). This section describes the class hierarchies at the Operating System level and the data link layer of the protocol stack.

Operating Kernel

The operating system level is defined as an abstract set of services. to which user interfaces are standardized in order to facilitate rapid porting of the code to different operating environments. This is illustrated in Figure 11.

Figure 14 also shows various instantiations of the multi-tasking kernel. including a "device emulation" version in Windows NT.

Data Link Layer

All the data links in the embedded system. whether airlinks to RF packet networks or internal bus data links (CAN. J-1708) share common logic which is implemented in a generic data link object. The entire behavior which is unique to any particular data link protocol is encapsulated in class derivations of an abstract base class called a link identity.

This architecture. illustrated in Figure 14, is intended not only to minimize the code space required in the embedded system, but also to facilitate rapid integration of new RF data link protocols, particularly as they become available in the form of newly deployed infrastructures.

While this invention has been described with reference to illustrative embodiments. this description is not intended to be construed in a limiting sense. Various modifications of the illustrative embodiments as well as other embodiments will be apparent to a person of skill in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications or embodiments.

# APPENDIX A

[1] Nathanson, M., "System and Method for Providing Mobile Automotive Telemetry", August 1997. (1st Transcontech Patent Filing)

[2] Case, J., Fedor, M., Schoffstall, M., and J. Davin, " A Simple Network Management Protocol (SNMP)", RFC 1157, May 1990.

[3] Internet Engineering Task Force, Perkins, C. (ed.), " IPv6 Mobility Support", March 1995.

[4] Nathanson, M., "System and Method for Hybrid Mobile Data Communications", November 1997. (2nd Transcontech Patent Filing).

[5] Narten, T., Nordmark, E., and W. Simpson, " Neighbor Discovery for IP Version 6 (IPv6)", RFC 1970, August 1996.

[6] Deering, S. and Hinden, R., "Internet Protocol, Version 6 (IPv6) Specification", RFC 1883, December 1995.

[7] Conta, A. and Deering, S., "Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification", RFC 1885, December 1995.

What is claimed is:

1. A method of exchanging data between a mobile node and an access point on a communication network, comprising the steps of:

a) providing at least two data links between the mobile node and the access point;

b) measuring impedance on each data link; and

c) transmitting said data across the data link having the lowest impedance.

2. A method as defined in claim 1, wherein a first of said data links is established on a spread spectrum band.

3. A method as defined in claim 1, wherein said mobile node and said access point are IEEE 802.11 compliant.

4. A method as defined in claim 1, wherein one of said data links is a satellite RF packet network.

5. A method as defined in claim 1, wherein one of said data links is a terrestrial RF packet network.

6. A communications system, comprising

a mobile node,

a fixed communications network having an access point, a pair of alternative data links, each of which joins said mobile node with said access point, and

a switching unit for switching between said alternative data links to exchange data between said mobile node and said access point.

7. A system as defined in claim 6, wherein said mobile node is Internet addressable.

8. A system as defined in claim 6, further comprising a measuring module for measuring impedance on each of said data links, said switching unit being operable to select the data link having the least impedance.

9. A system as defined in claim 6, wherein both said mobile node and said access point are IEEE 802.11 compliant.

10. A system as defined in claim 6, wherein said mobile node is one of a plurality of mobile nodes on a communications network.

11. A system as defined in claim 10, wherein each of said mobile nodes is on a vehicle.

12. A system as defined in claim 6, wherein said fixed communications network includes a plurality of access points, wherein said data links join each mobile node with at least one access point.

13. A system as defined in claim 12, wherein some of said access points are located adjacent a roadway.

14. A system as defined in claim 10 wherein at least some of said mobile nodes are Internet addressable.

15. A system as defined in claim 10, wherein at least some of said mobile nodes are IPv6 addressable.

16. A communications network for exchanging data between a plurality of vehicles, comprising a computing unit onboard a corresponding vehicle, each computing unit operable in a first phase to broadcast enquiry messages in a region surrounding said vehicle, a second phase to receive reply messages from other vehicles in said region, a third phase to exchange status messages with selected ones of said other vehicles.

17. A network as defined in claim 16, wherein each computing unit includes an IEEE 802.11 node.

18. A network as defined in claim 16, wherein each computing unit exchanges data using an SNMP-derived protocol.

19. A network as defined in claim 16, wherein each node is Internet addressable.

20. A vehicle comprising an onboard computing unit which is operable in a first phase to broadcast neighbour solicitation messages in a region surrounding said vehicle, a second phase to receive neighbour response messages from computing units of other vehicles in said region, and a third phase to exchange status messages with computing units of selected other vehicles.

21. A vehicle as defined in claim 20, which is operable in a fourth phase to exchange data with a remote site.

22. A vehicle as defined in claim 21. wherein the remote site is reached through non-mobile network gateway.

23. A vehicle as defined in claim 20 wherein said computing unit includes an IEEE 802.11 node.

24. A vehicle as defined in claim 20. wherein said computing unit is capable of exchanging data using an SNMP protocol.

25. A hybrid communications system. comprising a wired network portion and a wireless network portion. each having a network connection node. at least two data link means between the network connection nodes. and a switch means for enabling either of the data links for data exchange between said connection nodes.

26. A system as defined in claim 25, further comprising measurement means for measuring impedance on said data links. said switch means being responsive to said measurement means for enabling the data link having a lower impedance.

27. A vehicle communications system having a controller, a data pathway joining said controller with a plurality of vehicle components and means for establishing a data link with other vehicles within a given region surrounding said vehicle in order to exchange data therewith.

28. A system as defined in claim 27. wherein said data link is operable in A spread spectrum band.

29. An operational event-reporting system for use by a plurality of neighboring vehicles to support IVHS comprising a plurality of communication units. each onboard a

corresponding vehicle to collect operational data from selected components thereof and to exchange data with the communication units of one or more of the neighboring vehicles.

30. A system as defined in claim 29. wherein the communication units broadcast messages on a spread spectrum band.

31. A method of exchanging data between a vehicle and at least one remote site, comprising the step of providing the vehicle with a transmitter and receiver capable of transmitting and receiving messages under an SNMP protocol.

32. A method as defined in claim 31. wherein the at least one data exchange site includes a neighboring vehicle.

33. A method as defined in claim 32. further comprising the steps of:

- exchanging discovery signals with neighboring vehicles; and

- exchanging status data with selected ones of the neighbouring vehicles.

34. A system for transferring data between a vehicle and a data exchange site, comprising a pair of data link means. wherein at least one of said data link means has a varying signal impedance level and switch means for switching between said data link means so that said data is transferred on the data link means having the least impedance.

35. A system as defined in claim 34. wherein a first of said data link means is operable in a spread spectrum band.

36. An extension of the hybrid RF packet network comprising:

(i) an interface to an IEEE 802.11 data link integrated in the Hybrid Network Radio;

(ii) an IEEE 802.11 Access Point acting as an IPv6 router and a foreign mobility agent for mobile nodes implementing Mobile IP;

(iii) an interface to a non-wireless subnetwork from which the Hybrid Network Gateway can route mobile-terminated traffic through an IEEE 802.11 Access Point; and

(iv) a cluster intelligence module, based on the establishment of ad-hoc networks between a vehicle and its IEEE 802.11 neighbors.

37. The system according to claim 36, wherein mobile nodes that are ATP-enabled can exchange Internet traffic with regulatory agencies over license-free wireless data links (IEEE 802.11) whenever connections are established with Mobile IP-enabled Access Points.

38. The system according to claim 37, wherein the cluster intelligence module is operable using ATP from vehicular node to acquire information about the automotive behavior of any of its discovered neighbors.

39. A method of exchanging data between a mobile node and an access point on a communications network, comprising:

a) a step for providing at least two wireless data links between the mobile node and the access point;

b) a step for measuring impedance on each data link; and

c) a step for transmitting said data across the data link having the lowest impedance.

40. A method as defined in claim 39, wherein a first of said data links is established on a spread spectrum band.

41. A method as defined in claim 39, wherein the mobile node and the access point are IEEE 802.11 compliant.

42. A method as defined in claim 39, wherein one of said data links is a satellite RF packet network.

43. A method as defined in claim 39, wherein one of said data links is a terrestrial RF packet network.

44. A method of exchanging data between a motor vehicle and a remote station, comprising:

a) a step for providing at least two data links between the vehicle and the station;

b) a step for measuring impedance on each data link; and

c) a step for transmitting said data across the data link having the lowest impedance.

45. An inter-vehicle communications network, comprising at least two motor vehicles, each having an on-board control system, the system including monitoring portion

and a spread spectrum radio portion and which is operable to exchange useful vehicle operational data with the control system of the other vehicle.

46. A network as defined in claim 45 wherein each monitoring portion is capable of registering a vehicular event.

47. A network as defined in claim 45, wherein each control system is operable with other vehicular override systems to override a vehicle function according to a vehicular event.

48. A network as defined in claim 45. wherein each control system includes a memory portion for storing vehicle operational data of the other vehicle.

49. A network as defined in claim 45. further comprising at least one remote station which includes a spread spectrum radio portion to be capable of exchanging data with either of said vehicles.

50. A network as defined in claim 49, wherein the remote station is an internet access point.

51. A network as defined in claim 50. wherein the vehicles are operable to exchange data using an SNMP-derived protocol.

52. A network as defined in claim 49. wherein the remote station is located along a road way on which the vehicles are traveling.

53. A network as defined in claim 52. wherein a plurality of remote stations are located along said roadway.

54. A network as defined in claim 45, wherein each vehicle is capable of monitoring vehicular events in its own region.

55. A motor vehicle comprising an onboard general purpose computer and a spread spectrum radio, the computer operable to monitor a number of predetermined operating characteristics of the vehicle, the spread spectrum radio operable to establish a data link with a radio in at least one other neighbouring vehicle, wherein the computer is capable of identifying at least one vehicular event from data received on the data link.

56. A computer program product for operating a programmable computer system on board a motor vehicle, wherein the system includes a spread spectrum radio, comprising a computer readable medium including the computer executable steps of:

- instructing the radio to issue a signal to a region surrounding the motor vehicle;

- monitoring the radio for reply signals from other vehicles in the region; and when a reply signal is received from another vehicle,

- establishing a data link with the other vehicle; and

- exchanging operational data with the other vehicle over the data link.

57. A mobile automotive telemetry system for installation on-board a vehicle, comprising:

(i) diagnostic means for monitoring operational functions of the vehicle and generating operational information;

(ii) memory for storing the generated operational information; and

(iii) a server, in communication with the diagnostic means and the memory, the server comprising:

(a) means to receive a request from a remote client for the generated operational information;

(b) means to retrieve the generated operational information from the memory means; and

(c) means to transmit the generated operational information to the remote client.

58. The system according to claim 57, wherein the means to receive and the means to transmit are wireless communication means.

59. The system according to claim 58, wherein the wireless communication means is an infrared communication means.

60. The system according to claim 57, further comprising a means to transmit generated operational information to a remote client, in absence of a request from the client, when the generated operational information satisfies predetermined criteria.

61. The system according to claim 57, further comprising an Internet access means.

62. The system according to claim 61, wherein the Internet access means is compliant with IP V6 internet protocol and allows the server to act as a mobility agent.

63. The system according to claim 57, further comprising means to interface to a global positioning system (GPS) receiver.

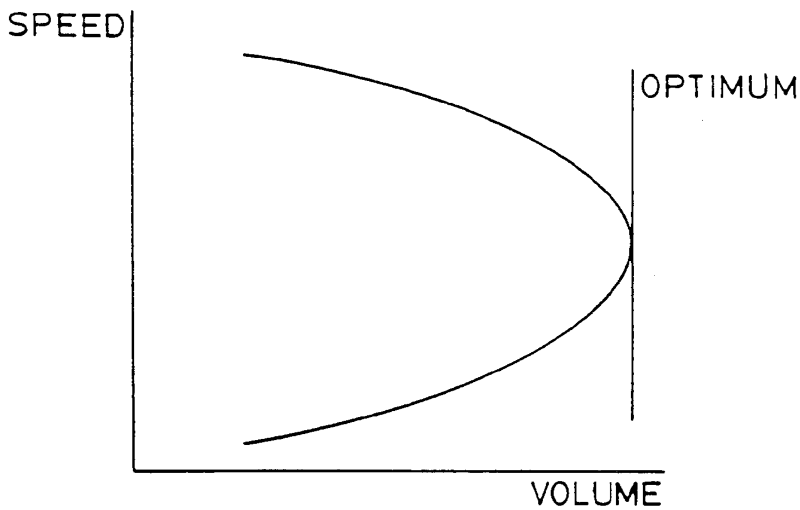



FIG. 1

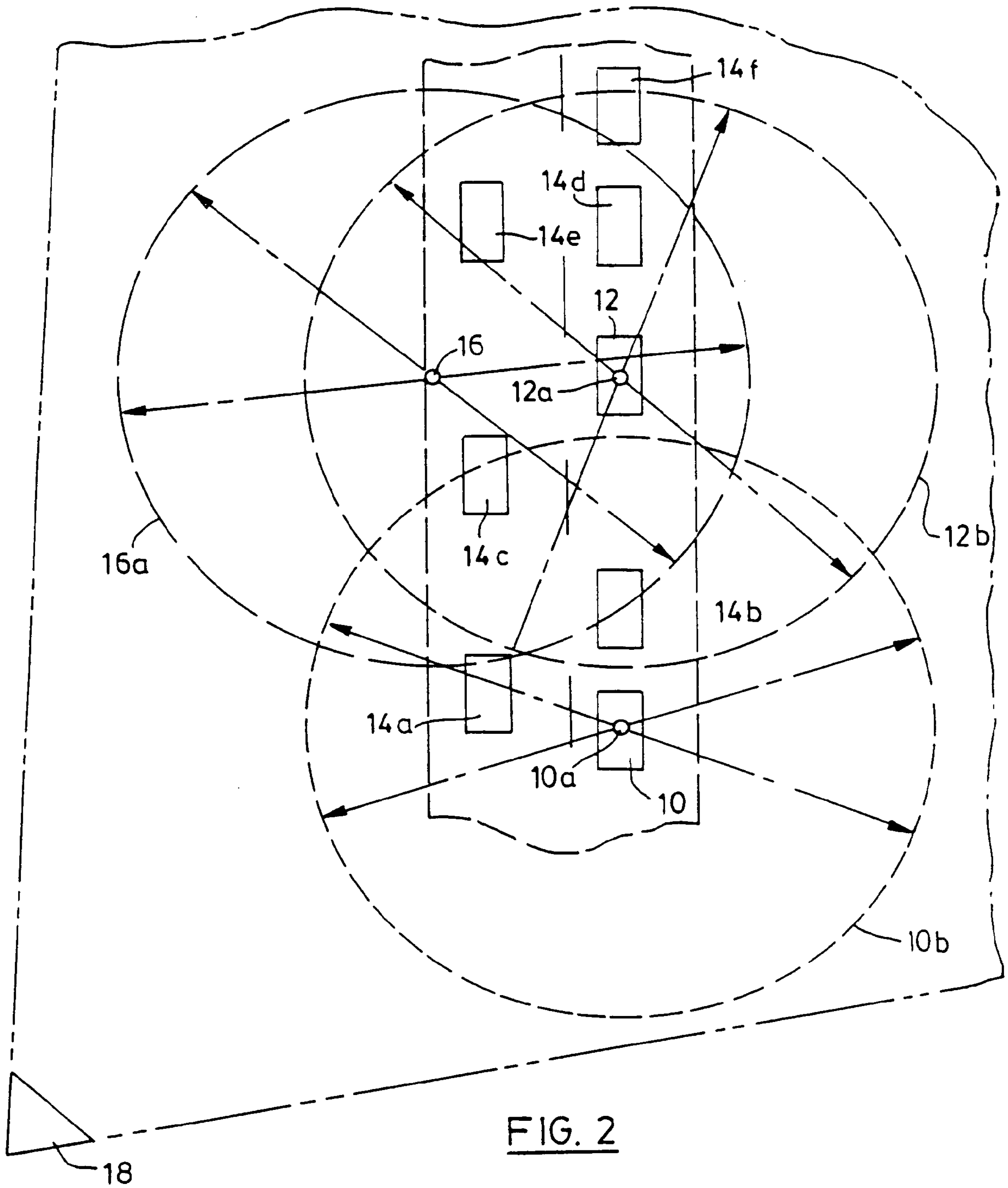



FIG. 2

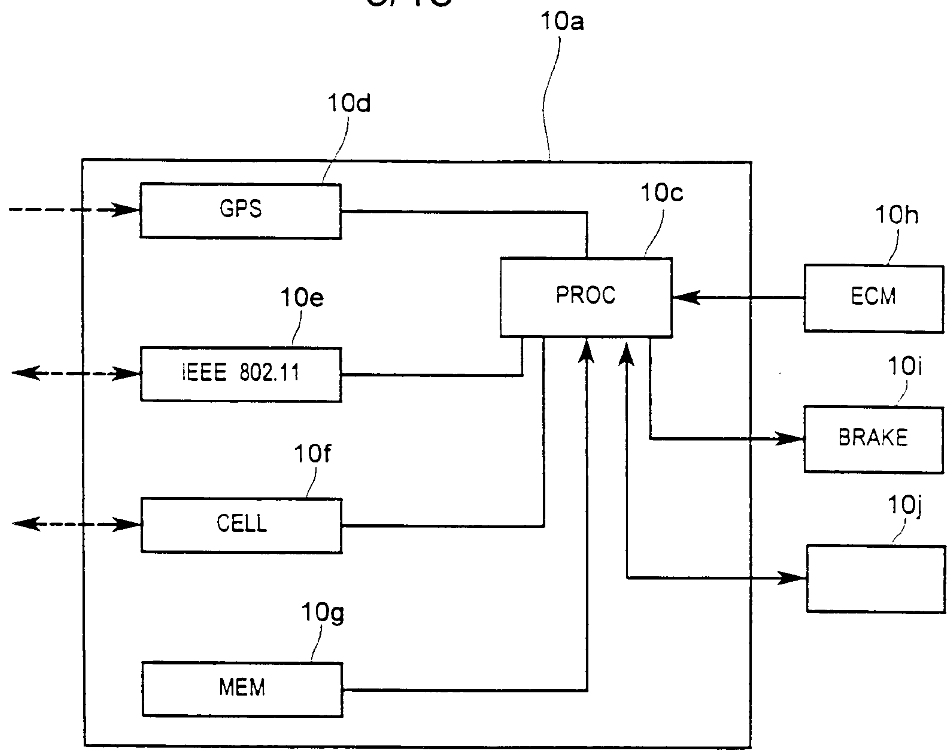

10a
10d
GPS
10c
10h
PROC
ECM
10e
IEEE 802.11
10i
BRAKE
10f
CELL
10j
10g
MEM

FIG. 2a

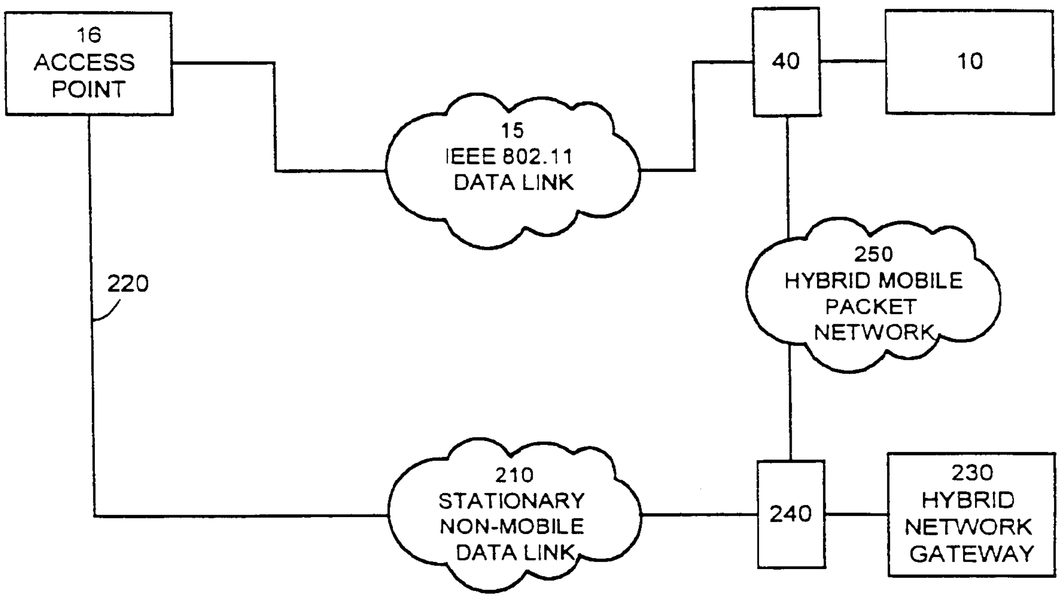



FIG. 3
Global system

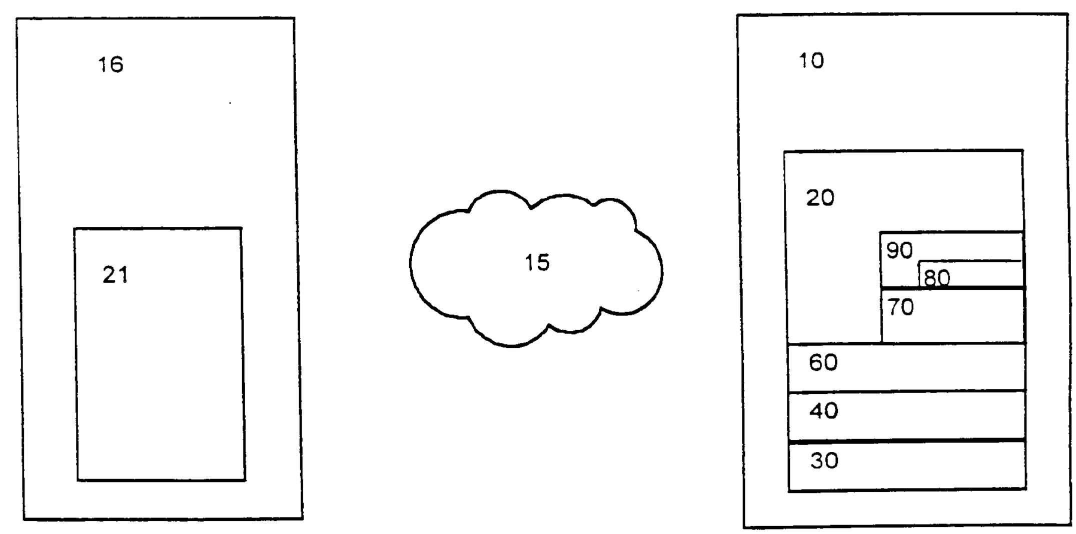



FIG. 4
IPv6 Stack for Hybrid Radio with Wireless LAN

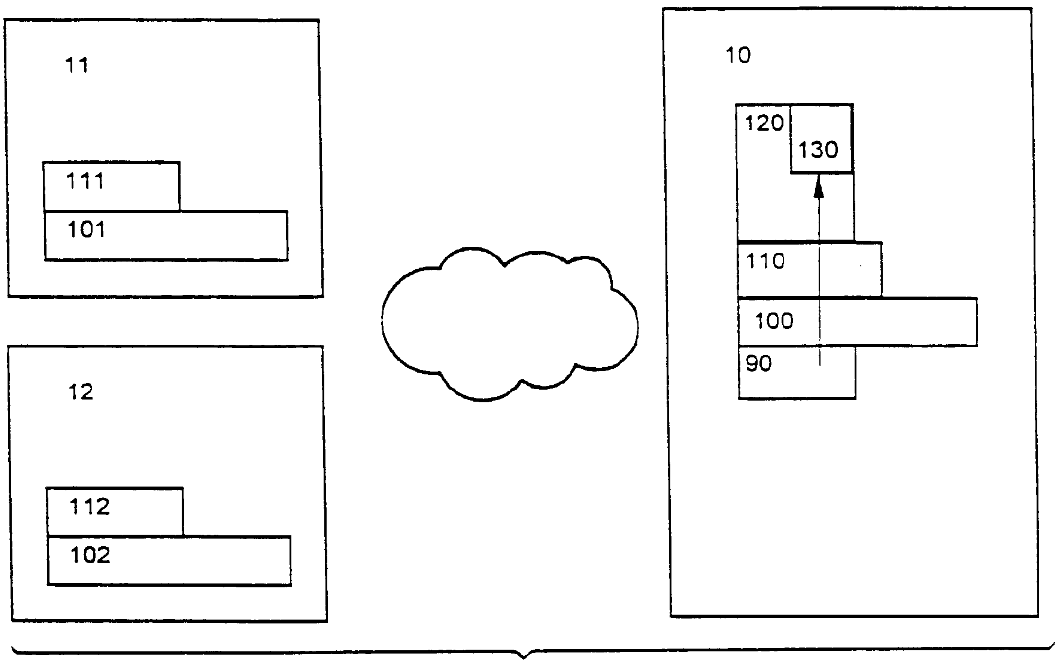



FIG. 5
Cluster Intelligence

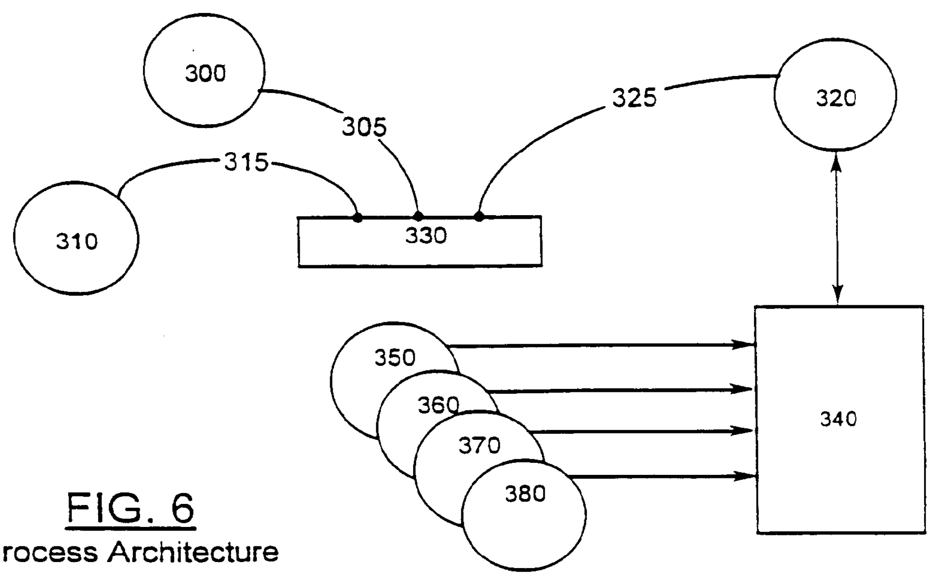



FIG. 6
Process Architecture

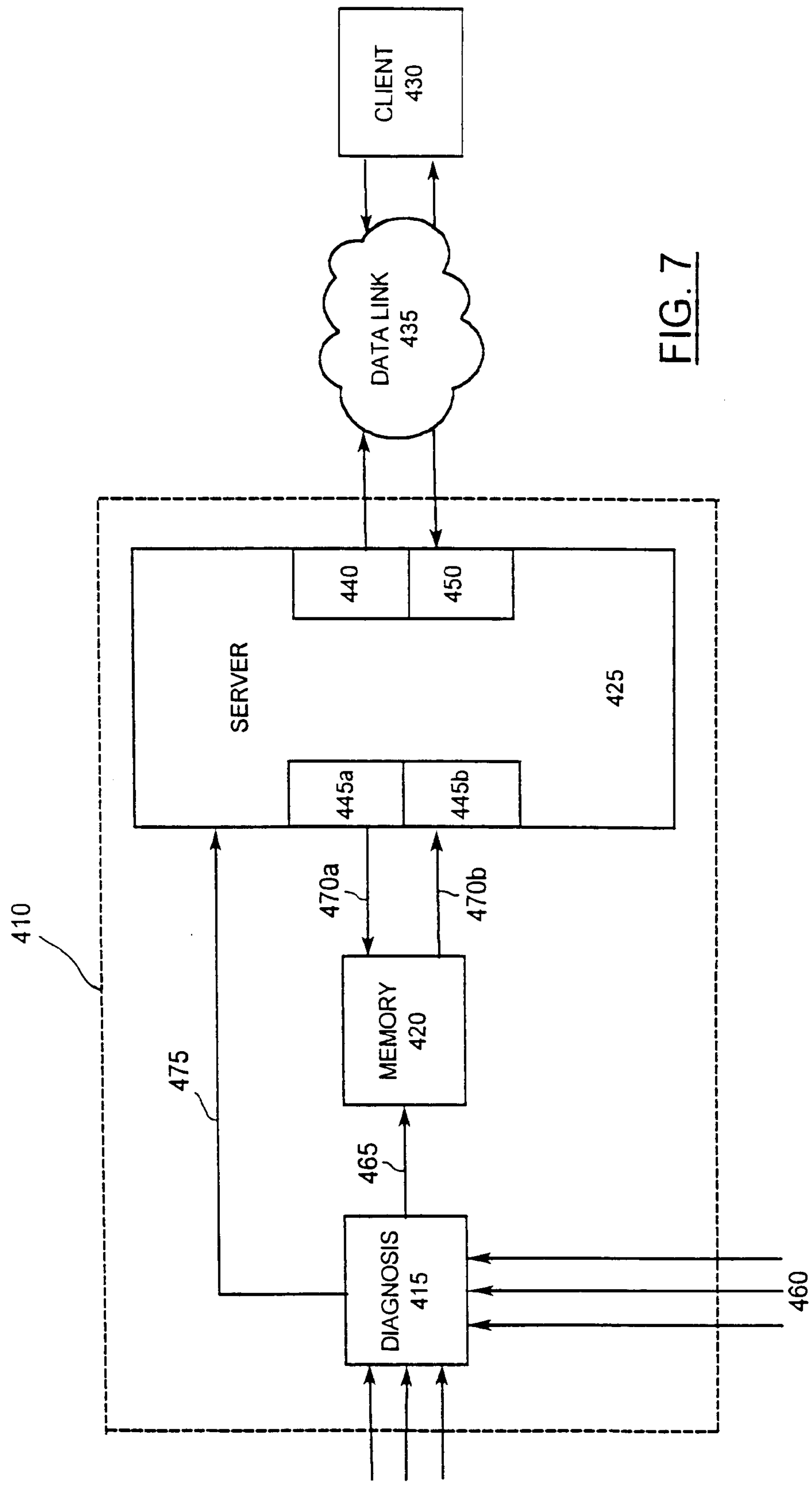

CLIENT
430
DATA LINK
435
SERVER
425
440
450
445a
445b
470a
470b
MEMORY
420
475
465
DIAGNOSIS
415
460
410

FIG. 7

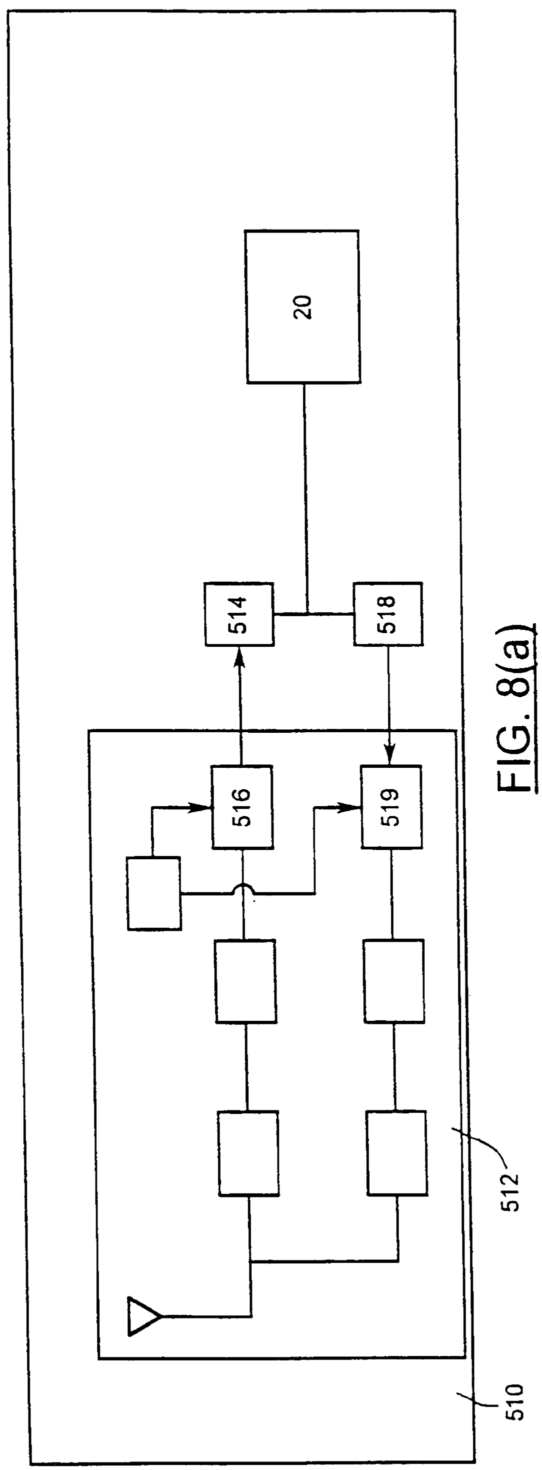



FIG. 8(a)

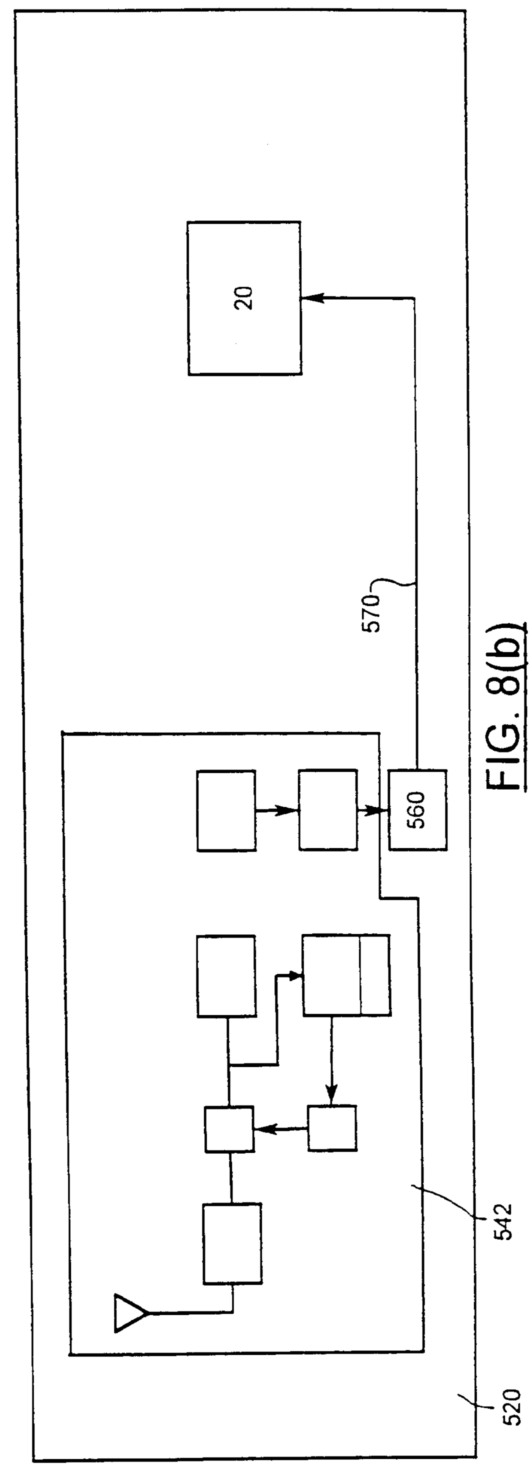



FIG. 8(b)

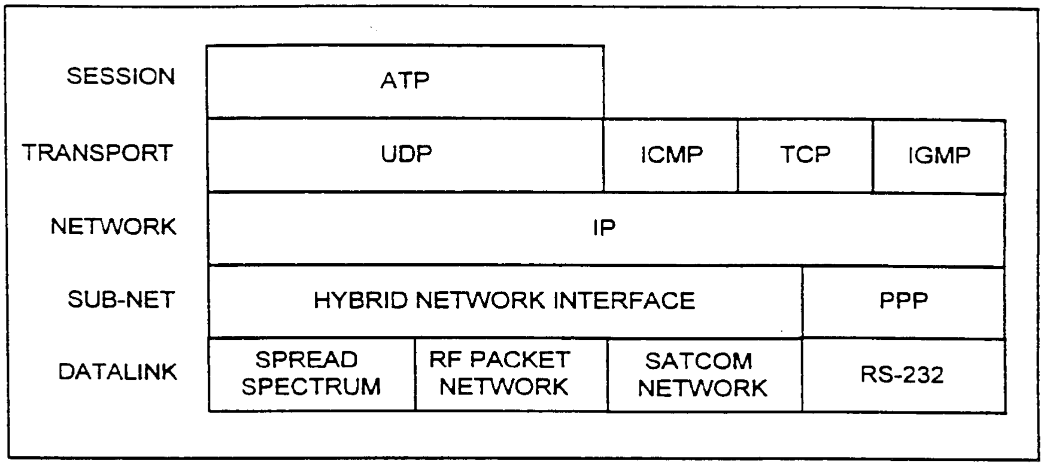



FIG. 9
Protocol Stack

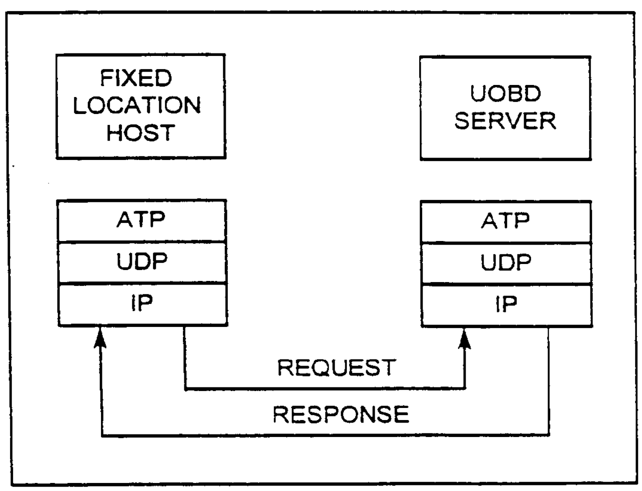



FIG. 10
Automotive Telemetry Protocol

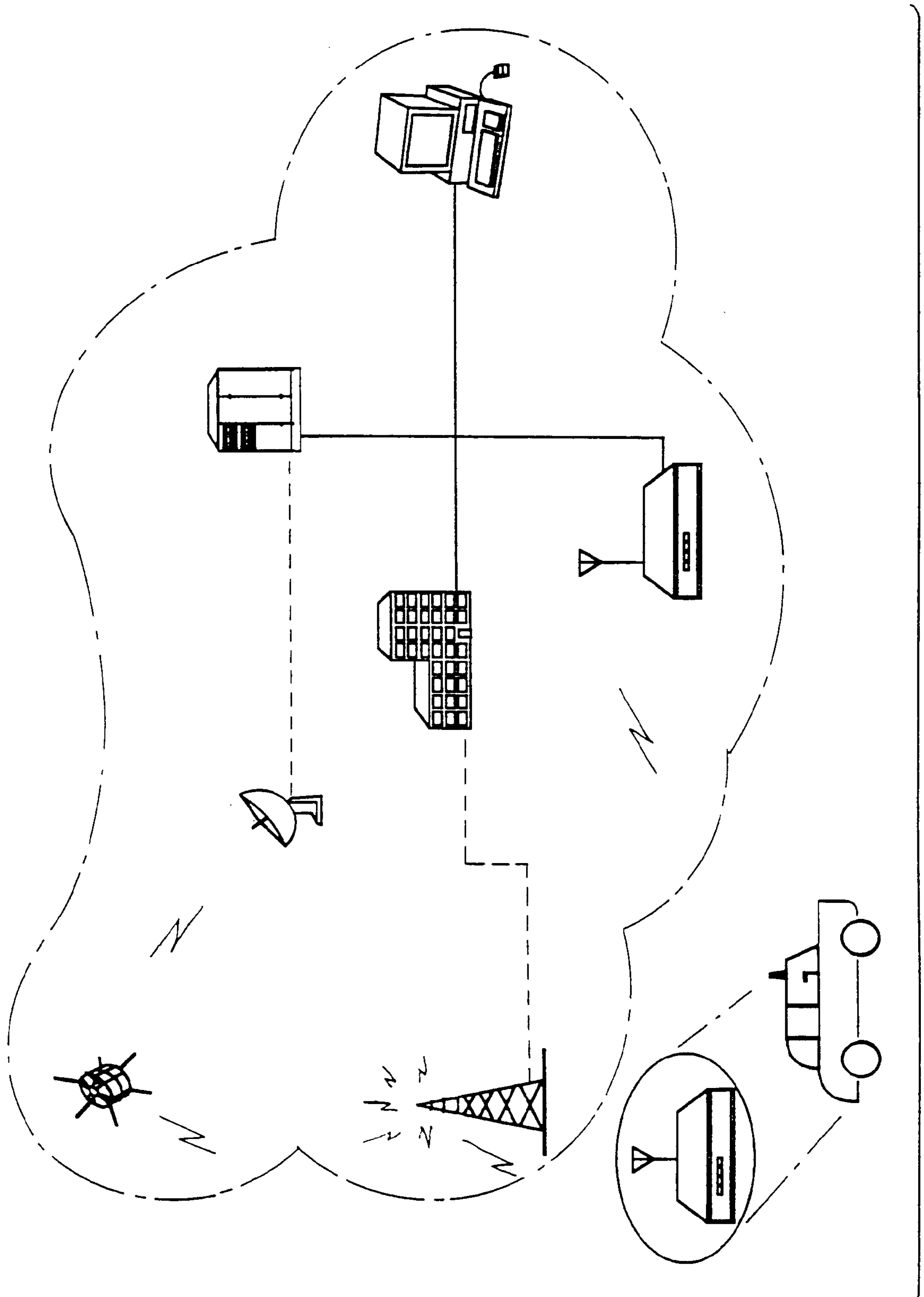


FIG. 11

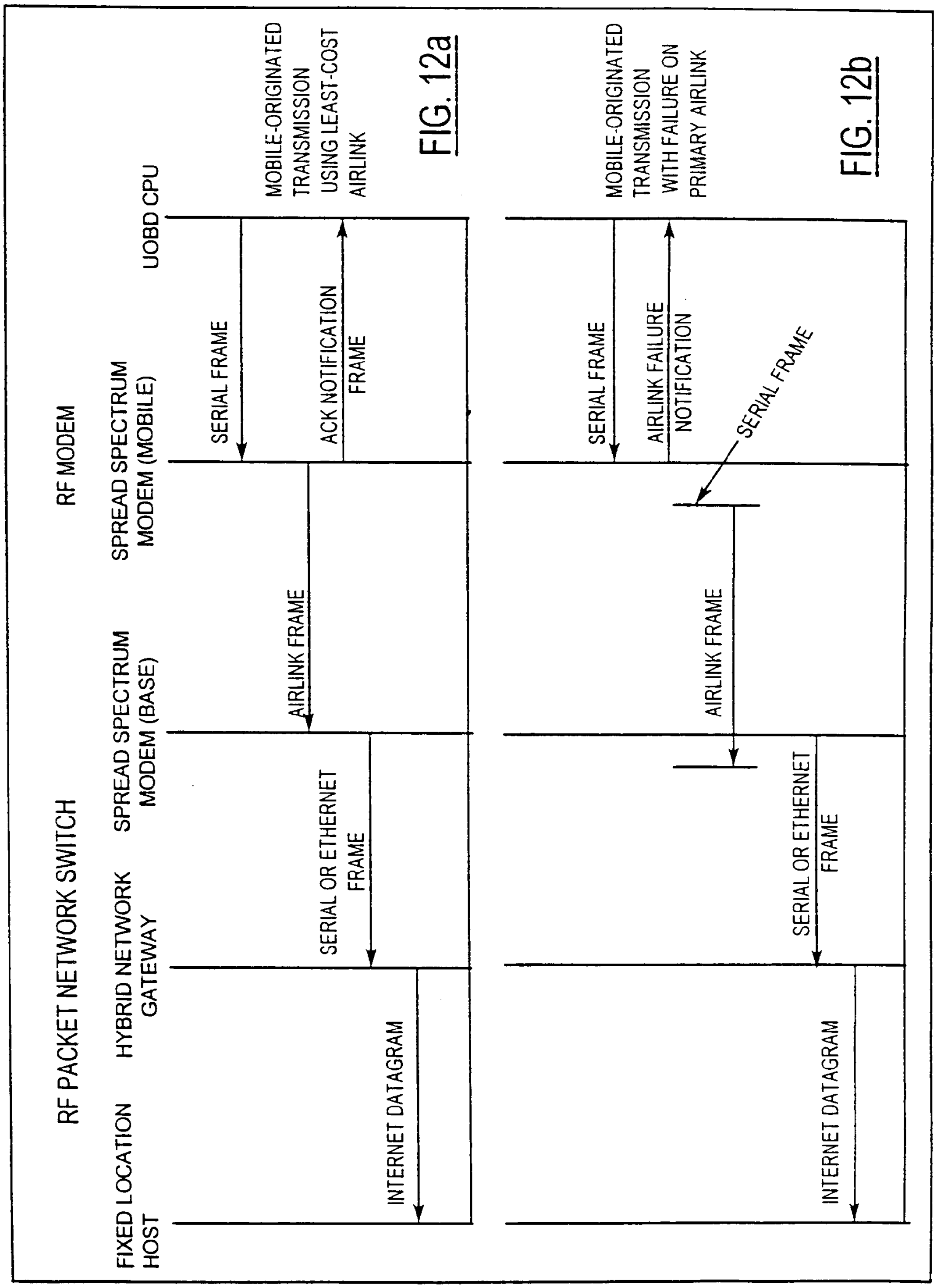



FIG. 12a

FIG. 12b

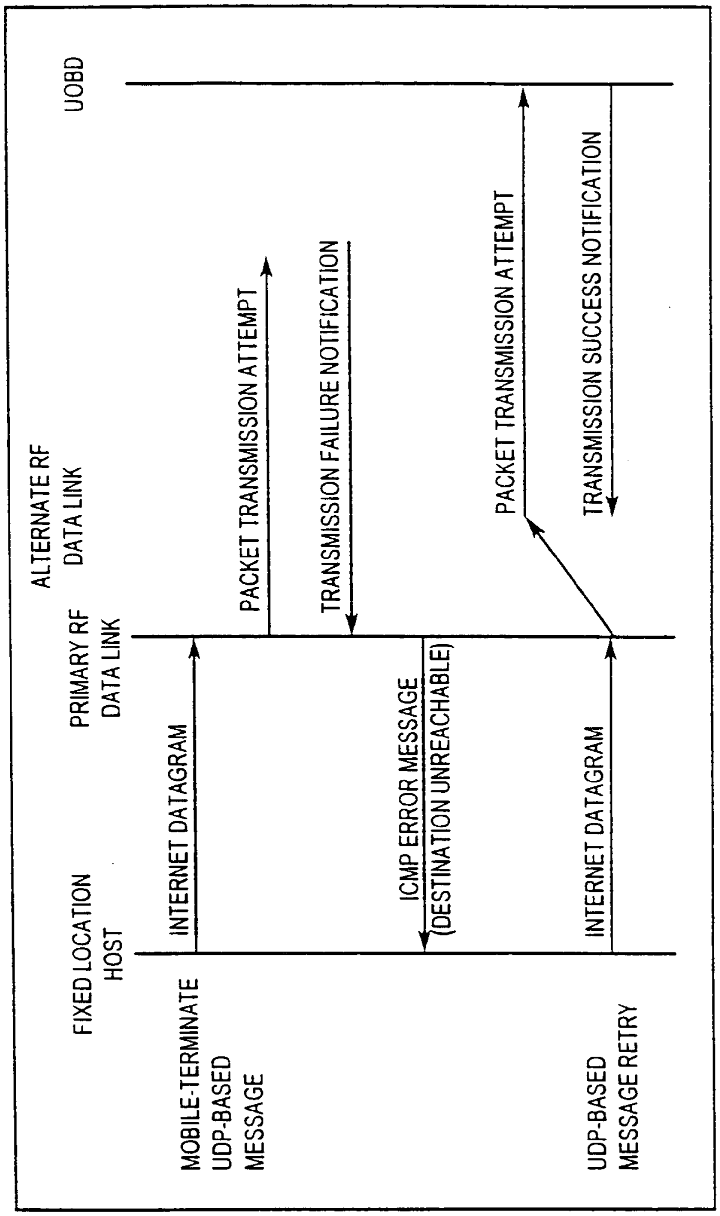



FIG. 13
Hybrid Network Gateway

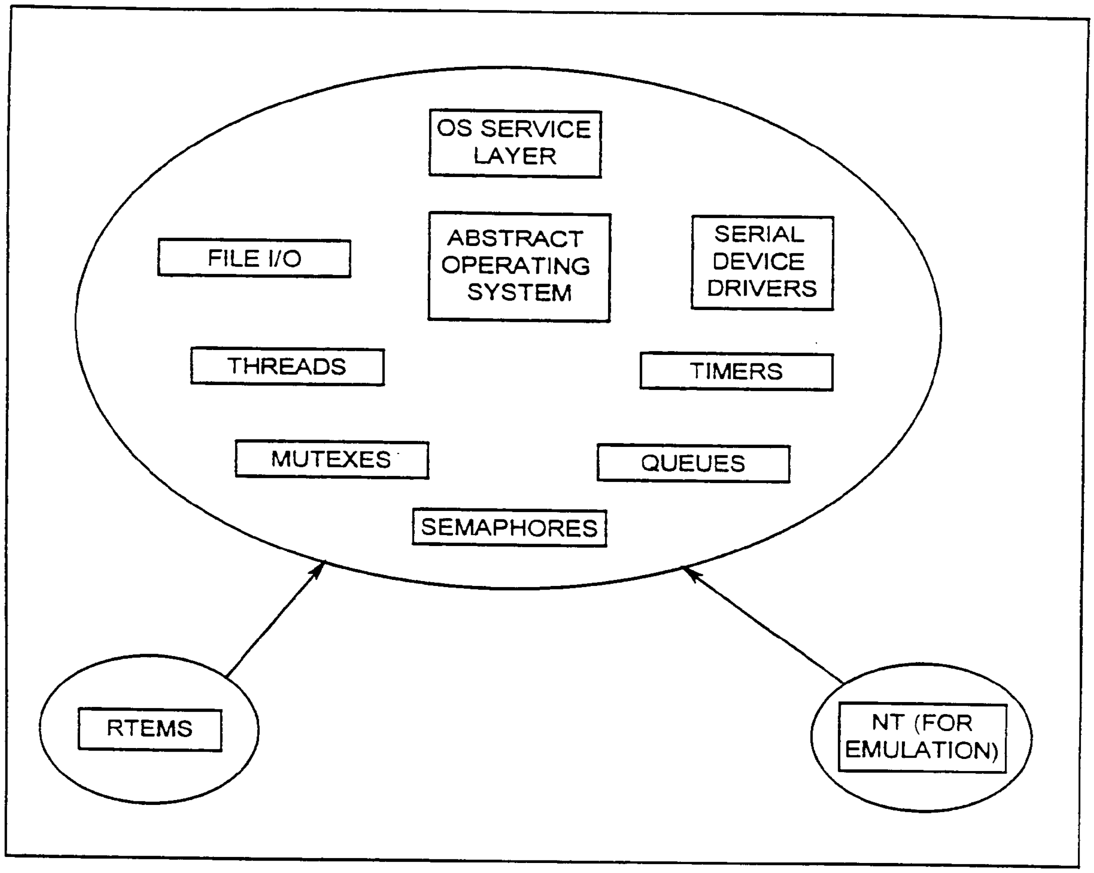



FIG. 14
Module Re-usability Real-time Operating Kernel

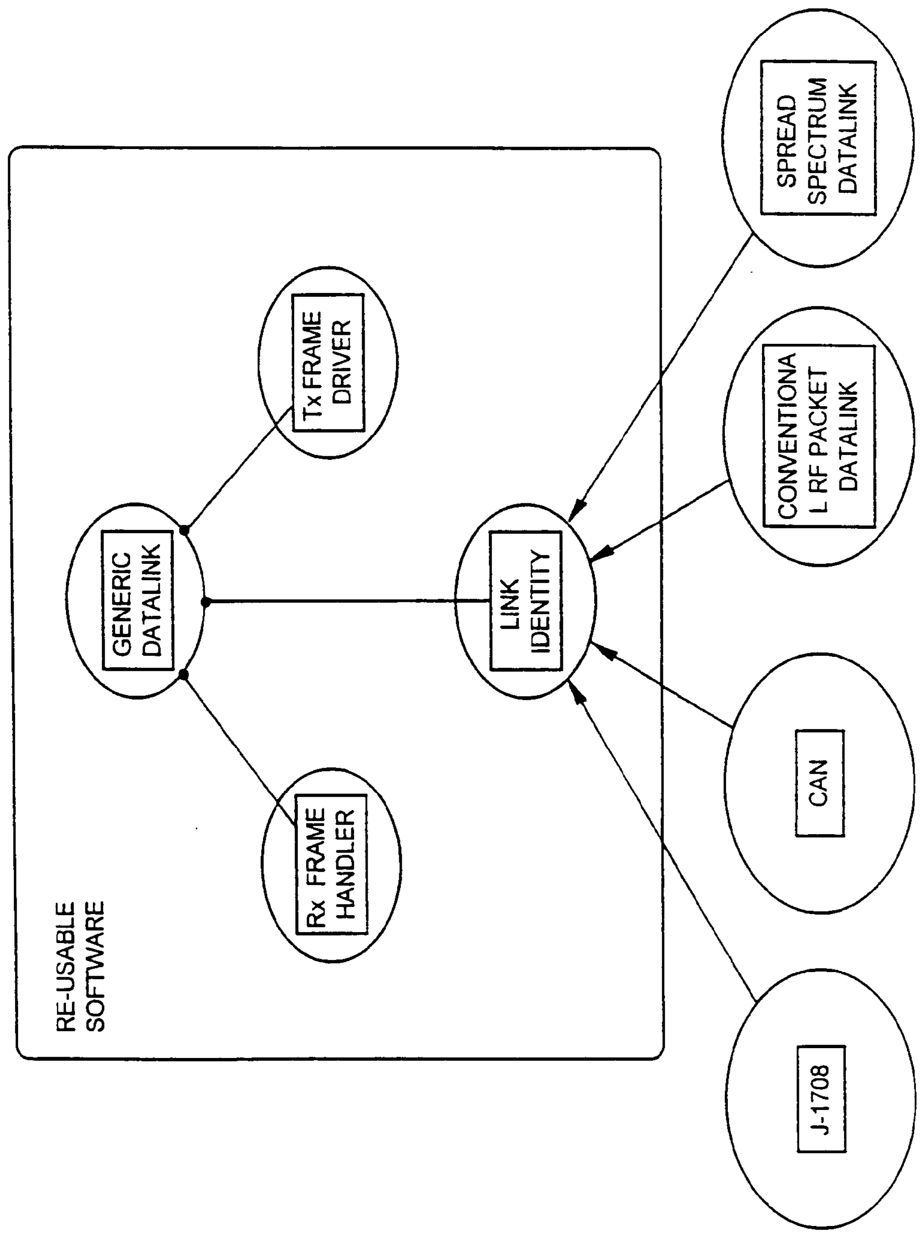



FIG. 15
Module Re-usability Data Link Layer

(19) (11) Publication number: **2000335450 A**

Generated Document.

# PATENT ABSTRACTS OF JAPAN

(21) Application number: **11150077**

(22) Application date: **28.05.99**

(51) Intl. Cl.: **B62D 41/00** G01D 9/00 G01P 15/00 G07C 5/00 G08B 21/00

| | |
|---|---|
| (30) Priority: | (71) Applicant: **TOYOTA MOTOR CORP** |
| (43) Date of application publication: **05.12.00** | (72) Inventor: **OTAKE HIROTADA**<br>**KIDO SHIGEYUKI** |
| (84) Designated contracting states: | (74) Representative: |

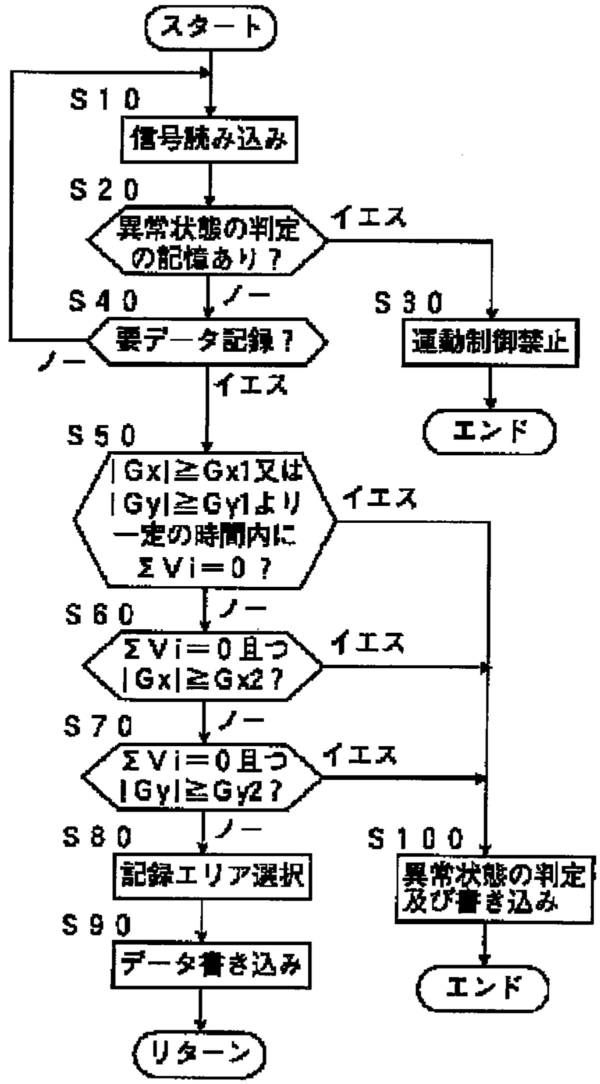
(54) **VEHICULAR DATA RECORDING DEVICE**

(57) Abstract:

PROBLEM TO BE SOLVED: To reliably store the traveling data just before a vehicle becomes an abnormal state.

SOLUTION: When recording of the traveling data of a vehicle is required (S40), the traveling data is recorded (S80, 90) in a nonvolatile memory by overwriting. When the vehicle becomes an abnormal state such as collision, recording is prohibited, and the recorded traveling data is maintained (S100). The judgement whether or not the vehicle becomes an abnormal state is performed on the basis of the judgement (S50) whether the vehicle becomes a stopped state within the specified time Tc from the time when an absolute value of the longitudinal acceleration Gx becomes not less than a reference value Gx1 or an absolute value of the lateral acceleration Gy becomes not less than a reference value Gy1, the judgement (S60) whether or not the vehicle is in the stopped state and an absolute value of the longitudinal acceleration Gx of the vehicle is not less than a reference value Gx2, and the judgement (S70) whether or not the vehicle is in the stopped state and an absolute value of the lateral acceleration Gy of the vehicle is not less than a reference value Gy2.





(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号

特開2000－335450

（P2000－335450A）

(43)公開日　平成12年12月５日(2000.12.5)

| (51)Int.Cl.⁷ | 識別記号 | ＦＩ | テーマコード（参考） |
|---|---|---|---|
| Ｂ６２Ｄ　41/00 | | Ｂ６２Ｄ　41/00 | ２Ｆ０７０ |
| Ｇ０１Ｄ　9/00 | | Ｇ０１Ｄ　9/00 | Ｋ　３Ｅ０３８ |
| | | | Ｔ　５Ｃ０８６ |
| Ｇ０１Ｐ　15/00 | | Ｇ０１Ｐ　15/00 | Ｄ |
| Ｇ０７Ｃ　5/00 | | Ｇ０７Ｃ　5/00 | |

審査請求　有　請求項の数５　ＯＬ　（全　８　頁）　最終頁に続く

(21)出願番号　特願平11－150077

(22)出願日　平成11年５月28日(1999.5.28)

(71)出願人　000003207
トヨタ自動車株式会社
愛知県豊田市トヨタ町１番地

(72)発明者　大竹　宏忠
愛知県豊田市トヨタ町１番地　トヨタ自動車株式会社内

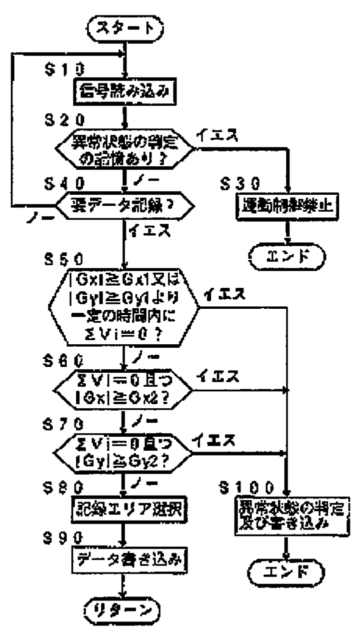
(72)発明者　城戸　滋之
愛知県豊田市トヨタ町１番地　トヨタ自動車株式会社内

(74)代理人　100071216
弁理士　明石　昌毅

最終頁に続く

(54)【発明の名称】　車輌用データ記録装置

(57)【要約】
【課題】　車輌が異常状態になる直前の走行データを確実に保存する。
【解決手段】　車輌の走行データの記録が必要であるときには（Ｓ４０）、不揮発性メモリに走行データを上書きにより記録する（Ｓ８０，９０）が，車輌が衝突の如き異常状態になると記録を禁止しそれまでに記録されている走行データを維持する（Ｓ１００）。車輌が異常状態になったか否かの判別は，前後加速度Ｇxの絶対値が基準値Ｇx1以上である状態又は横加速度Ｇyの絶対値が基準値Ｇy1以上である状態になった時点より所定の時間Ｔc以内に車輌が停止状態になったか否かの判別（Ｓ５０）車輌が停止状態にあり且つ車輌の前後加速度Ｇxの絶対値が基準値Ｇx2以上であるか否かの判別（Ｓ６０），車輌が停止状態にあり且つ車輌の横加速度Ｇyの絶対値が基準値Ｇy2以上であるか否かの判別（Ｓ７０）により行われる。



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【特許請求の範囲】

【請求項１】車両の走行データを記録する記録手段と、車両の異常状態を判定する異常状態判定手段と、前記異常状態判定手段の判定結果に基づき前記記録手段を制御する制御手段とを有する車両用データ記録装置に於いて、前記異常状態判定手段は車両の加速度の大きさが基準値以上であるか否かを判定する加速度判定手段と、車速が基準値以下であるか否かを判定する車速判定手段とを有し、前記加速度判定手段及び前記車速判定手段の判定結果に基づき車両の異常状態を判定することを特徴とする車両用データ記録装置。

【請求項２】前記異常状態判定手段は前記加速度判定手段により車両の加速度の大きさが基準値以上であると判定された時点より所定の時間以内に前記車速判定手段により車速が基準値以下であると判定されたときに車両の異常状態と判定することを特徴とする請求項１に記載の車両用データ記録装置。

【請求項３】前記異常状態判定手段は前記車速判定手段により車速が基準値以下であると判定され且つ前記加速度判定手段により車両の加速度の大きさが基準値以上であると判定されたときに車両の異常状態と判定することを特徴とする請求項１に記載の車両用データ記録装置。

【請求項４】前記車速判定手段は車速が実質的に０であるときに車速が基準値以下であると判定することを特徴とする請求項１乃至３の何れかに記載の車両用データ記録装置。

【請求項５】前記記録手段は車両の走行データを記憶する記憶手段を含み、該記憶手段に走行データを上書きにて書き込むことにより記録し、前記制御手段は前記異常状態判定手段により車両の異常状態が判定されたときには前記記録手段による記録を禁止することを特徴とする請求項１乃至４の何れかに記載の車両用データ記録装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、車両用データ記録装置に係り、更に詳細には車両の走行データを記録するデータ記録装置に係る。

【０００２】

【従来の技術】自動車等の車両のデータ記録装置の一つとして、例えば本願出願人の出願にかかる特開平７－２４９１３７号公報に記載されている如く、車両の走行データを記憶手段に順次上書き保存することにより記録し、車両の加速度の大きさが基準値以上であるときには車両が異常状態になったと判定して記憶手段に対する上書き保存を中止するよう構成されたデータ記録装置が従来より知られている。

【０００３】かかるデータ記録装置によれば、車両の走行データを記憶手段に順次上書き保存することにより記録されるので、記憶容量の大きい記憶手段は不要であり、また車両の加速度の大きさが基準値以上になったときには記憶手段に対する上書き保存が中止されるので、車両の加速度の大きさが基準値以上になる直前の走行データを確実に保存することができる。

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【０００４】

【発明が解決しようとする課題】しかし上述の如き従来のデータ記録装置に於いては、車両の加速度の大きさが基準値以上であるときに車両が異常状態になったと判定されるようになっているため、車両が異常状態になってもその異常状態を判定することができない場合がある。即ち車両の通常走行時にも車両の加速度が比較的高い値になる場合があるので、車両の加速度の大きさのみに基づき車両の異常状態が判定される場合には、異常状態判定の基準値を比較的高い値に設定せざるを得ず、そのため車両の衝突の如き異常状態が生じてもその異常状態が判定されず、従って車両が異常状態になる直前の走行データを保存することができない場合がある。

【０００５】本発明は、車両の加速度の大きさが基準値以上であるときに記憶手段に対する走行データの上書き保存が中止されるよう構成された従来のデータ記録装置に於ける上述の如き問題に鑑みてなされたものであり、本発明の主要な課題は、車両が異常状態になったときにはそのことを確実に判定することにより、車両が異常状態になる直前の走行データを確実に保存することである。

【０００６】

【課題を解決するための手段】上述の主要な課題は、本発明によれば、請求項１の構成、即ち車両の走行データを記録する記録手段と、車両の異常状態を判定する異常状態判定手段と、前記異常状態判定手段の判定結果に基づき前記記録手段を制御する制御手段とを有する車両用データ記録装置に於いて、前記異常状態判定手段は車両の加速度の大きさが基準値以上であるか否かを判定する加速度判定手段と、車速が基準値以下であるか否かを判定する車速判定手段とを有し、前記加速度判定手段及び前記車速判定手段の判定結果に基づき車両の異常状態を判定することを特徴とする車両用データ記録装置によって達成される。

【０００７】一般に、車両が衝突すると、衝突と同時に車両の減速度が急激に上昇して加速度の大きさが非常に大きい値になると共に車速が非常に小さい値に急激に低下するのに対し、車両の通常走行時に加速度の大きさが比較的大きくなる場合の車速は一般に比較的高い。また車両の衝突等により車両の加速度を検出するセンサの取り付け状態が異常になったり車両自体が異常に傾斜した状態になると、センサは車両の通常の走行時や停車時には示さない非常に高い値を定常的に示すようになる。従って車両の加速度に加えて車速を考慮することにより、車両の衝突の如き異常状態を確実に判定することができる。

【０００８】上記請求項１の構成によれば、加速度判定手段及び車速判定手段の判定結果に基づき車輌の異常状態が判定されるので、車輌の通常の走行時や停車時に加速度の大きさが比較的大きくなる場合を区別して車輌の異常状態を確実に判定することが可能になり、これにより車輌が異常状態になる直前の走行データを確実に保存することが可能になる。

【０００９】また本発明によれば、上述の主要な課題を効果的に達成すべく、上記請求項１の構成に於いて、前記異常状態判定手段は前記加速度判定手段により車輌の加速度の大きさが基準値以上であると判定された時点より所定の時間以内に前記車速判定手段により車速が基準値以下であると判定されたときに車輌の異常状態と判定するよう構成される（請求項２の構成）。

【００１０】請求項２の構成によれば、加速度判定手段により車輌の加速度の大きさが基準値以上であると判定された時点より所定の時間以内に車速判定手段により車速が基準値以下であると判定されたときに車輌の異常状態と判定されるので、車輌の加速度判定の基準値を高くする必要がなく、これにより車輌の異常状態が確実に判定される。

【００１１】また本発明によれば、上述の主要な課題を効果的に達成すべく、上記請求項１の構成に於いて、前記異常状態判定手段は前記車速判定手段により車速が基準値以下であると判定され且つ前記加速度判定手段により車輌の加速度の大きさが基準値以上であると判定されたときに車輌の異常状態と判定するよう構成される（請求項３の構成）。

【００１２】請求項３の構成によれば、車速判定手段により車速が基準値以下であると判定され且つ加速度判定手段により車輌の加速度の大きさが基準値以上であると判定されたときに車輌の異常状態と判定されるので、車輌の加速度判定の基準値を高くする必要がなく、これにより車輌の異常状態が確実に判定される。

【００１３】また本発明によれば、上述の主要な課題を効果的に達成すべく、上記請求項１乃至３の何れかの構成に於いて、前記車速判定手段は車速が実質的に０であるときに車速が基準値以下であると判定するよう構成される（請求項４の構成）。

【００１４】請求項４の構成によれば、車速が実質的に０であるときに車速が基準値以下であると判定されるので、車輌の通常走行時に加速度の大きさが比較的大きくなる状況に於いて車輌の異常状態と判定されることが確実に防止される。

【００１５】また本発明によれば、上述の主要な課題を効果的に達成すべく、上記請求項１乃至４の何れかの構成に於いて、前記記録手段は車輌の走行データを記憶する記憶手段を含み、該記憶手段に走行データを上書きにて書き込むことにより記録し、前記制御手段は前記異常状態判定手段により車輌の異常状態が判定されたときには前記記録手段による記録を禁止するよう構成される（請求項５の構成）。

【００１６】請求項５の構成によれば、異常状態判定手段により車輌の異常状態が判定されたときには記録手段による記録が禁止され、これにより車輌が異常状態になった時点以降のデータが記憶手段に上書きされること、換言すれば車輌が異常状態になる直前の走行データが消去されることが確実に防止される。

【００１７】

【課題解決手段の好ましい態様】本発明の一つの好ましい態様によれば、上記請求項１の構成に於いて、記録手段は車輌の走行データを記録すべきか否かを判定する記録判定手段と、走行データを記憶する記憶手段と、記録判定手段により走行データを記録すべき旨の判定が行われたときには記憶手段に走行データを書き込む手段とを有するよう構成される（好ましい態様１）。

【００１８】本発明の他の一つの好ましい態様によれば、上記好ましい態様１の構成に於いて、記録判定手段は所定の時間毎に車輌の走行データを記録すべきか否かを判定するよう構成される（好ましい態様２）。

【００１９】本発明の他の一つの好ましい態様によれば、上記請求項１の構成に於いて、車輌は走行時の車輌の運動安定化のための運動制御を行う運動制御装置を有し、記録判定手段は運動制御装置により運動制御が行われているときに走行データを記録すべき旨の判定を行うよう構成される（好ましい態様３）。

【００２０】本発明の他の一つの好ましい態様によれば、上記請求項１の構成に於いて、記録判定手段は車輌の横加速度を検出する手段を含み、車輌の横加速度の大きさが基準値以上であるときに走行データを記録すべき旨の判定を行うよう構成される（好ましい態様４）。

【００２１】本発明の他の一つの好ましい態様によれば、上記請求項２の構成に於いて、加速度判定手段は車輌の前後加速度の大きさが対応する基準値以上であるか否かを判定すると共に車輌の横加速度の大きさが対応する基準値以上であるか否かを判定し、加速度判定手段により車輌の前後加速度の大きさが対応する基準値以上であると判定された時点又は車輌の横加速度の大きさが対応する基準値以上であると判定された時点より所定の時間以内に車速判定手段により車速が基準値以下であると判定されたときに車輌の異常状態と判定するよう構成される（好ましい態様５）。

【００２２】本発明の他の一つの好ましい態様によれば、上記請求項３の構成に於いて、加速度判定手段は車輌の前後加速度の大きさが対応する基準値以上であるか否かを判定すると共に車輌の横加速度の大きさが対応する基準値以上であるか否かを判定し、車速判定手段により車速が基準値以下であると判定され且つ加速度判定手段により車輌の前後加速度の大きさが対応する基準値以上であると判定されたとき又は車速判定手段により車速

が基準値以下であると判定され且つ加速度判定手段により車輌の横加速度の大きさが対応する基準値以上であると判定されたときに車輌の異常状態と判定するよう構成される（好ましい態様６）。

【００２３】本発明の他の一つの好ましい態様によれば、上記請求項５の構成に於いて、記憶手段は複数の記憶エリアを有し、最も古い走行データを記憶している記憶エリアに走行データを上書きにて書き込むよう構成される（好ましい態様７）。

【００２４】

【発明の実施の形態】以下に添付の図を参照しつつ、本発明を好ましい実施形態について詳細に説明する。

【００２５】図１は運動制御装置が搭載された車輌に適用された本発明による車輌用走行データ記録装置の一つの好ましい実施形態を示す概略構成図、図２は図１に示された走行データ記録装置を示すブロック図である。

【００２６】図１に於て、１０FL及び１０FRはそれぞれ車輌１２の左右の前輪を示し、１０RL及び１０RRはそれぞれ車輌の左右の後輪を示している。各車輪の制動力は制動装置１４の油圧回路１６によりホイールシリンダ１８FR、１８FL、１８RR、１８RLの制動圧が制御されることによって制御されるようになっている。図には示されていないが、油圧回路１６はオイルリザーバ、オイルポンプ、種々の弁装置等を含み、各ホイールシリンダの制動圧は通常時には運転者によるブレーキペダル２０の踏み込み操作により駆動されるマスタシリンダ２２内の圧力に応じて運動制御用制御装置２４により制御される。

【００２７】車輪１０FR～１０RLに近接した位置にはそれぞれ各車輪の車輪速度Vｉ（ｉ＝fr、fl、rr、rl）を検出する車輪速度センサ２８FR、２８FL、２８RR、２８RLが設けられている。また車輌１２にはそれぞれ車体の前後加速度Gxを検出する前後加速度センサ３０、横加速度Gyを検出する横加速度センサ３２、操舵角θを検出する操舵角センサ３４が設けられている。各センサにより検出された値を示す信号は運動制御用制御装置２４に入力され、また運動制御用制御装置２４を経て走行データ記録用制御装置４０に入力される。

【００２８】運動制御用制御装置２４は車輪速度センサ２８FR～２８RLにより検出された車輪速度Vｉに基づき各車輪の制動スリップ率Rsを演算し、制動スリップ率Rsが基準値Rso（正の定数）以上になると当該車輪の制動スリップ率Rsが所定の範囲内になるよう制動力を増減するアンチスキッド制御を開始し、予め設定された終了条件が成立するとアンチスキッド制御を終了する。

【００２９】かくして運動制御用制御装置２４は車輪の制動スリップが過剰になり車輌の走行時の運動が不安定になる虞れがあるときには、制動装置１４と共働して車輪の制動スリップを適正化させることにより車輌の走行時の安定性を向上させる運動制御装置を構成しているが、後述の如く走行データ記録用制御装置４０より車輌の運動制御を禁止する旨の信号が入力されると、運動制御（アンチスキッド制御）を行わない。

【００３０】尚運動制御用制御装置２４により実行される運動制御としてのアンチスキッド制御は本発明の要旨をなすものではなく、当技術分野に於いて公知の任意の要領にて実行されてよい。また運動制御用制御装置２４はアンチスキッド制御に加えて制動力の制御によるトラクション制御や挙動安定化制御の如き他の運動制御をも行うようになっていてもよい。

【００３１】図２に示されている如く、走行データ記録用制御装置４０は例えばＣＰＵ４２とＲＯＭ４４とＲＡＭ４６と入出力ポート装置４８とを有しこれらが双方向性のコモンバス５０により互いに接続された一般的な構成のマイクロコンピュータ５２を含み、また外部記憶装置として不揮発性のメモリであるＥＥＰＲＯＭ５４を含んでいる。

【００３２】走行データ記録用制御装置４０は、後述の如く横加速度Gy又は運動制御用制御装置２４よりの情報に基づき各センサにより検出された状態量、即ち車輌の走行データを記録すべきか否かを定期的に判定し、走行データを記録すべき旨の判定が行われたときにはＥＥＰＲＯＭ５４に走行データを記録する。

【００３３】更に走行データ記録用制御装置４０は、車輪速度Vｉ、前後加速度Gx、横加速度Gyに基づき後述の如く車輌が異常状態になったか否かを判定し、車輌が異常状態になっていない旨の判定が行われたときには走行データの記録を許可するが、車輌が異常状態になった旨の判定が行われたときにはそれ以降の走行データが上書きにより記録されることを禁止する。

【００３４】図示の実施形態に於いては、ＥＥＰＲＯＭ４４は図３に示されている如く三つの記憶エリアM1～M3を有し、各記憶エリアはそれぞれ記録タイミングに関する識別情報としてのＩＤ番号を記憶するセクションS1と、車輪速度Vfr、Vfl、Vrr、Vrl、前後加速度Gx、横加速度Gy、操舵角θ、右前輪、左前輪、右後輪、左後輪の制動スリップ率Rsfr、Rsfl、Rsrr、Rsrlの各走行データを記憶するセクションS2と、車輌が異常状態になったか否かの判定結果を記憶するセクションS3とを有している。

【００３５】ＩＤ番号は例えば０～９の数字よりなり、データの記録順に０より順番に９まで使用され、９の次には０に戻って繰り返し使用される。またデータの記録は記憶エリアM1、M2、M3、M1、M2…の順に上書きにより繰り返し行われる。従って記憶エリアM1～M3のセクションS1に記録されたＩＤ番号により何れのデータが最新のデータであり何れのデータが最も古いデータであるかを判定することができる。

【００３６】尚図には詳細に示されていないが、運動制御用制御装置２４もＣＰＵとＲＯＭとＲＡＭと入出力ポート装置とを有し、これらが双方向性のコモンバスによ

り互いに接続された一般的な構成のマイクロコンピュータを含んでいる。

【００３７】次に図４に示されたフローチャートを参照して図示の実施形態に於ける車輌の走行データの記録制御について説明する。尚図４に示されたフローチャートによる制御は図には示されていないイグニッションスイッチの閉成により開始され、所定の時間毎に繰返し実行される。

【００３８】まずステップ１０に於いては車輪速度センサ２８FR～２８RLにより検出された車輪速度Ｖiを示す信号等が運動制御用制御装置２４を経て読み込まれると共に、運動制御用制御装置２４より運動制御としてのアンチスキッド制御が行われているか否かを示す信号が読み込まれる。尚各センサの検出値を示す信号はそれぞれ対応するセンサより直接読み込まれてもよい。

【００３９】ステップ２０に於いては何れかの記憶エリアのセクションＳ3に車輌が異常状態になったことを示す情報が記憶されているか否かの判別が行われ、肯定判別が行われたときにはステップ３０に於いて運動制御用制御装置２４に運動制御を禁止すべき旨の信号が出力された後走行データの記録制御が終了し、否定判別が行われたときにはステップ４０へ進む。

【００４０】ステップ４０に於いては車輌の走行データの記録が必要であるか否かの判別が行われ、否定判別が行われたときにはステップ１０へ戻り、肯定判別が行われたときにはステップ５０へ進む。

【００４１】尚走行データの記録が必要であるか否かの判別は、例えば車輌の横加速度Ｇyの絶対値が基準値Ｇyo（正の定数）以上であるか否かの判別及び運動制御用制御装置２４による運動制御（アンチスキッド制御又は他の運動制御）が行われているか否かの判別により行われ、横加速度Ｇyの絶対値が基準値Ｇyo以上である旨の判別又は運動制御用制御装置２４による運動制御が行われている旨の判別が行われたときに走行データの記録が必要であると判定されてよい。

【００４２】ステップ５０に於いては各車輪の車輪速度Ｖiの和ΣＶiが演算されると共に、前後加速度Ｇxの絶対値が基準値Ｇx1（正の定数）以上である状態又は横加速度Ｇyの絶対値が基準値Ｇy1（正の定数）以上である状態になった時点より所定の時間Ｔc（正の定数）以内に車輪速度の和ΣＶiが０になったか否かの判別、即ち車輌の前後加速度又は横加速度の大きさが非常に高い値になった後に車輌が停止したか否かの判別が行われ、肯定判別が行われたときにはステップ１００へ進み、否定判別が行われたときにはステップ６０へ進む。

【００４３】尚ステップ５０に於ける判別の基準値Ｇx1及びＧy1はそれぞれ車輌の通常の走行時（通常の加減速や坂道などでの走行を含む）に於いては生じない比較的大きい値に設定される。

【００４４】ステップ６０に於いては各車輪の車輪速度Ｖiの和ΣＶiが０であり且つ車輌の前後加速度Ｇxの絶対値が基準値Ｇx2（正の定数）以上であるか否かの判別、即ち車輌が停止状態にあり且つ検出される車輌の前後加速度の大きさが非常に高い値であるか否かの判別が行われ、肯定判別が行われたときにはステップ１００へ進み、否定判別が行われたときにはステップ７０へ進む。

【００４５】ステップ７０に於いては各車輪の車輪速度Ｖiの和ΣＶiが０であり且つ車輌の横加速度Ｇyの絶対値が基準値Ｇy2（正の定数）以上であるか否かの判別、即ち車輌が停止状態にあり且つ検出される車輌の横加速度の大きさが非常に高い値であるか否かの判別が行われ、肯定判別が行われたときにはステップ１００へ進み、否定判別が行われたときにはステップ８０へ進む。

【００４６】尚ステップ６０及び７０に於ける判別の基準値Ｇx2及びＧy2はそれぞれ車輌の通常の停車状態（坂道などでの停車を含む）に於いては生じない比較的大きい値に設定される。

【００４７】ステップ８０に於いてはＥＥＰＲＯＭ４４の記憶エリアM1～M3のうち最も古いデータが書き込まれている記憶エリアが今回のデータを記録するための記録エリアとして選択され、ステップ９０に於いては現サイクルに於いて読み込まれた車輌の走行データがステップ８０に於いて選択された記録エリアに上書きにより書き込まれ、しかる後ステップ１０へ戻る。

【００４８】ステップ１００に於いては車輌が衝突の如き異常状態にある旨の判定が行われ、記憶エリアM1～M3のうち前回走行データが記録されたエリアが記録エリアとして選択されると共に、車輌が衝突の如き異常状態にある旨の情報が選択された記録エリアのセクションＳ3に書き込まれ、しかる後ステップ１０へ戻る。

【００４９】かくして図示の実施形態によれば、ステップ２０に於いて車輌が事故後の状態の如き異常状態になっているか否かの判別が行われ、車輌が異常状態になっているときにはステップ２０に於いて肯定判別が行われ、ステップ３０に於いて運動制御用制御装置２４による運動制御が禁止されるので、異常な状態のセンサにより検出された異常な状態量に基づき不適切な運動制御が行われることを確実に防止することができる。

【００５０】また車輌が正常な状態にあるときには、ステップ２０に於いて否定判別が行われ、ステップ４０に於いて車輌の走行データの記録が必要であるか否かの判別が行われる。車輌が通常の走行状態にあるときにはステップ４０に於いて否定判別が行われることにより、走行データの記録は行われないが、車輌の横加速度の大きさが非常に高い値であるような状況に於いてはステップ４０に於いて肯定判別が行われ、ステップ５０～７０に於いて車輌が異常な状態になっている旨の判別が行われない限りステップ８０及び９０に於いて走行データが記録される。

【００５１】これに対し車輌が異常な状態になっているときには、ステップ５０〜７０の何れかに於いて肯定判別が行われ、ステップ１００に於いて異常状態の判定が行われると共にその情報が記録され、これによりＥＥＰＲＯＭ４４に対する上書きによる走行データの記録が禁止される。

【００５２】従って車輌が衝突等により異常状態になると、それ以降の走行データの記録は行われずそれまでにＥＥＰＲＯＭ４４に記憶されている走行データの記録が維持されるので、車輌が異常状態になる直前の走行データを確実に保存することができる。

【００５３】特に図示の実施形態によれば、車輌が異常な状態になっているか否かの判別はステップ５０〜７０により行われ、ステップ５０に於いては前後加速度$G_x$の絶対値が基準値$G_{x1}$以上である状態又は横加速度$G_y$の絶対値が基準値$G_{y1}$以上である状態になった時点より所定の時間$T_c$以内に車輌が停止状態になったか否かの判別が行われるので、車輌の衝突等により加速度の大きさが非常に大きくなった後車輌が停止したような異常な状態を確実に判定することができる。

【００５４】またステップ６０及び７０に於いては、それぞれ車輌が停止状態にあり且つ車輌の前後加速度$G_x$の絶対値が基準値$G_{x2}$以上であるか否かの判別及び車輌が停止状態にあり且つ車輌の横加速度$G_y$の絶対値が基準値$G_{y2}$以上であるか否かの判別が行われるので、車輌の衝突等により前後加速度センサ３０や横加速度センサ３２の取り付け状態が異常になったり車輌自体が異常に傾斜したような異常状態を確実に判定することができる。

【００５５】以上に於いては本発明を特定の実施形態について詳細に説明したが、本発明は上述の実施形態に限定されるものではなく、本発明の範囲内にて他の種々の実施形態が可能であることは当業者にとって明らかであろう。

【００５６】例えば上述の実施形態に於いては、ステップ５０に於いて前後加速度$G_x$の絶対値が基準値$G_{x1}$以上である状態又は横加速度$G_y$の絶対値が基準値$G_{y1}$以上である状態になった時点より所定の時間$T_c$以内に車輌が停止状態になったか否かの判別が行われるようになっているが、車輌の加速度$G_{xy}$が前後加速度$G_x$の２乗と横加速度$G_y$の２乗との和の平方根（$(G_x^2+G_y^2)^{1/2}$）として演算され、車輌の加速度$G_{xy}$の絶対値が基準値$G_{xy1}$（正の定数）以上である状態になった時点より所定の時間$T_c$以内に車輌が停止状態になったか否かの判別が行われてもよい。

【００５７】同様に上述の実施形態に於いては、ステップ６０及び７０に於いてそれぞれ車輌が停止状態にあり且つ車輌の前後加速度$G_x$の絶対値が基準値$G_{x2}$以上であるか否かの判別及び車輌が停止状態にあり且つ車輌の横加速度$G_y$の絶対値が基準値$G_{y2}$以上であるか否かの判別が行われるようになっているが、車輌が停止状態にあり且つ車輌の加速度$G_{xy}$の絶対値が基準値$G_{xy2}$（正の定数）以上であるか否かの判別が行われてもよい。

【００５８】また上述の実施形態に於いては、各車輪の車輪速度$V_i$の和$\Sigma V_i$が０であるか否かにより車速が０であり車輌が停止状態にあるか否かが判別されるようになっているが、車輌が停止状態にあるか否かの判別は車輪速度の和$\Sigma V_i$が基準値$V_o$（０に近い正の定数）以下であるか否かにより行われてもよく、また各車輪の車輪速度$V_i$のうちの最大値が基準値$V_{mo}$（０に近い正の定数）以下であるか否かにより行われてもよい。

【００５９】更に上述の実施形態に於いては、ＥＥＰＲＯＭ５４は三つの記憶エリア$M_1$〜$M_3$を有し、ＩＤ番号は０〜９の数字よりなっているが、これらの数は任意の数であってよく、またＥＥＰＲＯＭ５４に記録される車輌の走行データも任意のデータであってよい。

【００６０】

【発明の効果】以上の説明より明らかである如く、本発明の請求項１の構成によれば、車輌の通常の走行時や停車時に加速度の大きさが比較的大きくなる場合を区別して車輌の異常状態を確実に判定することができ、これにより車輌が異常状態になる直前の走行データを確実に保存することができる。

【００６１】また請求項２及び３の構成によれば、車輌の加速度判定の基準値を高く設定する必要がないので、車輌の異常状態を確実に判定することができ、請求項４の構成によれば、車輌の通常走行時に加速度の大きさが比較的大きくなる状況に於いて車輌の異常状態と判定されることを確実に防止することができる。

【００６２】また請求項５の構成によれば、車輌が異常状態になった時点以降のデータが記憶手段に上書きされることを確実に防止し、これにより車輌が異常状態になる直前の走行データが消去されることを確実に防止することができる。

【図面の簡単な説明】

【図１】運動制御装置が搭載された車輌に適用された本発明による車輌用走行データ記録装置の一つの好ましい実施形態を示す概略構成図である。

【図２】図１に示された走行データ記録装置を示すブロック図である。

【図３】走行データ記録装置のＥＥＰＲＯＭの記憶エリアを示す説明図である。

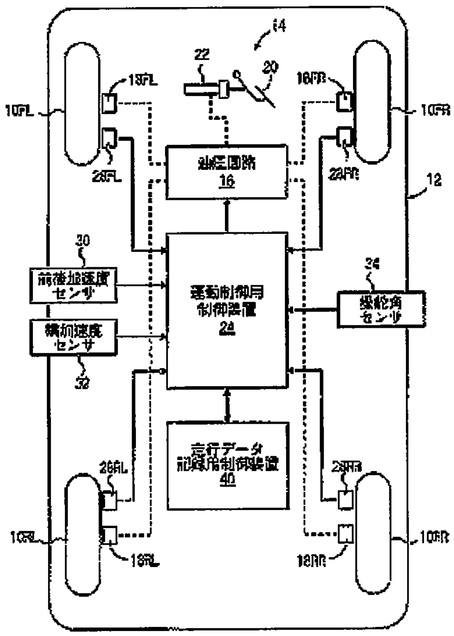
【図４】図示の実施形態に於ける走行データの記録制御ルーチンを示すフローチャートである。

【符号の説明】

１０FR〜１０RL…車輪
１４…制動装置
１６…油圧回路
２４…運動制御用制御装置
２８FR〜２８RL…車輪速度センサ

３０…前後加速度センサ
３２…横加速度センサ
３４…操舵角センサ
＊４０…走行データ記録用制御装置
５２…マイクロコンピュータ
＊ ５４…ＥＥＰＲＯＭ

【図１】




【図３】

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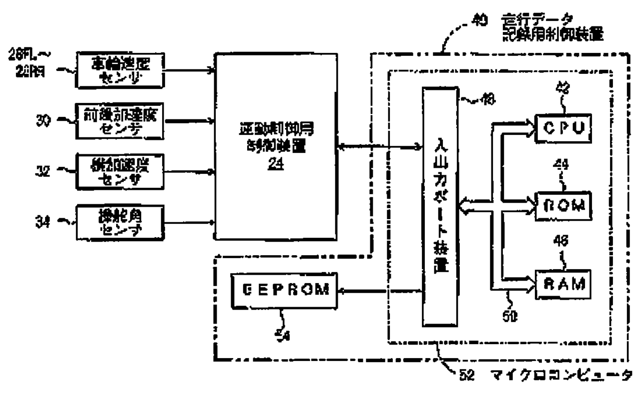
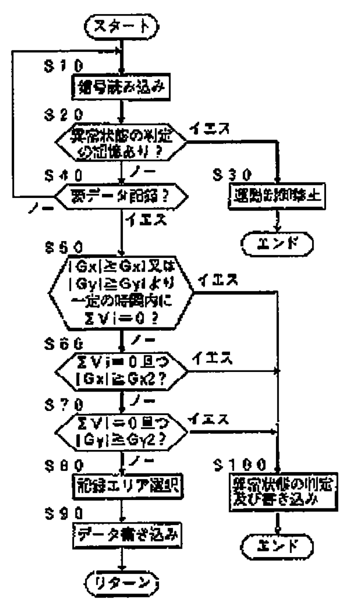
| | | M1 | M2 | M3 |
|---|---|---|---|---|
| S1 | | ＩＤ番号 | ＩＤ番号 | ＩＤ番号 |
| S2 | | 車輪速度 Vfr | 車輪速度 Vfr | 車輪速度 Vfr |
| | | 車輪速度 Vfl | 車輪速度 Vfl | 車輪速度 Vfl |
| | | 車輪速度 Vrr | 車輪速度 Vrr | 車輪速度 Vrr |
| | | 車輪速度 Vrl | 車輪速度 Vrl | 車輪速度 Vrl |
| | | 前後加速度 Gx | 前後加速度 Gx | 前後加速度 Gx |
| | | 横加速度 Gy | 横加速度 Gy | 横加速度 Gy |
| | | 操舵角 θ | 操舵角 θ | 操舵角 θ |
| | | スリップ率 Rsfr | スリップ率 Rsfr | スリップ率 Rsfr |
| | | スリップ率 Rsfl | スリップ率 Rsfl | スリップ率 Rsfl |
| | | スリップ率 Rsrr | スリップ率 Rsrr | スリップ率 Rsrr |
| | | スリップ率 Rsrl | スリップ率 Rsrl | スリップ率 Rsrl |
| S3 | | 判定結果 | 判定結果 | 判定結果 |

【図２】




【図４】



フロントページの続き

| (51)Int.Cl.⁷ | 識別記号 | F I | テーマコード（参考） |
|---|---|---|---|
| G08B 21/00 | | G08B 21/00 | U |

Fターム(参考) 2F070 AA01 AA20 CC04 CC11 DD01
FF12 FF20 GG01
3E038 AA07 BA09 BA12 BB05 CA05
CA07 CC03 GA01 HA05
5C086 AA54 BA22 CA21 CB40 DA40
EA45

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CLAIMS

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[Claim(s)]
[Claim 1] A record means to record the transit data of a vehicle, and an abnormal-condition judging means to judge the abnormal condition of a vehicle, An acceleration judging means by which, as for said abnormal-condition judging means, the magnitude of the acceleration of a vehicle judges whether it is beyond a reference value in the data recorder for vehicles which has the control means which controls said record means based on the judgment result of said abnormal-condition judging means, The data recorder for vehicles characterized by having a vehicle speed judging means to judge whether the vehicle speed is below a reference value, and judging the abnormal condition of a vehicle based on the judgment result of said acceleration judging means and said vehicle speed judging means.
[Claim 2] Said abnormal-condition judging means is a data recorder for vehicles according to claim 1 characterized by judging with the abnormal condition of a vehicle when it is judged with the vehicle speed being below a reference value by said vehicle speed judging means within predetermined time amount from the event of being judged with the magnitude of the acceleration of a vehicle being beyond a reference value by said acceleration judging means.
[Claim 3] Said abnormal-condition judging means is a data recorder for vehicles according to claim 1 characterized by judging with the abnormal condition of a vehicle when it is judged with the vehicle speed being below a reference value by said vehicle speed judging means and is judged with the magnitude of the acceleration of a vehicle being beyond a reference value by said acceleration judging means.
[Claim 4] Said vehicle speed judging means is a data recorder for vehicles given in claim 1 thru/or any of 3 they are. [ which is characterized by judging with the vehicle speed being below a reference value when the vehicle speed is 0 substantially ]
[Claim 5] It is a data recorder for vehicles given in claim 1 thru/or any of 4 record said record means by writing transit data in this storage means by overwrite including a storage means memorize the transit data of a vehicle, and they are. [ which is characterized by said control means forbidding record by said record means when the abnormal condition of a vehicle is judged by said abnormal-condition judging means ]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the data recorder for vehicles, and relates to the data recorder which records the transit data of a vehicle on a detail further.
[0002]
[Description of the Prior Art] The data recorder constituted so that the transit data of a vehicle might be recorded on a storage means by carrying out sequential overwriting, it might judge with the vehicle having been in the abnormal condition when the magnitude of the acceleration of a vehicle was beyond a reference value and the overwriting to a storage means might be stopped is conventionally known as indicated as one of the data recorders of vehicles, such as an automobile, by JP,7-249137,A concerning application of an applicant for this patent.
[0003] Since it is recorded by carrying out sequential overwriting of the transit data of a vehicle at a storage means according to this data recorder, the large storage means of storage capacity is unnecessary, and since the overwriting to a storage means is stopped when the magnitude of the acceleration of a vehicle becomes beyond a reference value, transit data just before the magnitude of the acceleration of a vehicle becomes beyond a reference value can certainly be saved.
[0004]
[Problem(s) to be Solved by the Invention] However, in the conventional data recorder like ****, since it is judged with the vehicle having been in the abnormal condition when the magnitude of the acceleration of a vehicle is beyond a reference value, even if a vehicle will be in an abnormal condition, the abnormal condition may be unable to be judged. namely, since the acceleration of a vehicle may become a comparatively high value also at the time of usual transit of a vehicle, when the abnormal condition of a vehicle is judged only based on the magnitude of the acceleration of a vehicle the reference value of an abnormal-condition judging -- a comparatively high value -- not setting up -- transit data just before it does not obtain, therefore the abnormal condition will not be judged even if the abnormal condition like the collision of a vehicle arises, therefore a vehicle will be in an abnormal condition may be unable to be saved
[0005] This invention is made in view of the problem like **** in the conventional data recorder constituted so that the overwriting of transit data to a storage means might be stopped, when the magnitude of the acceleration of a vehicle is beyond a reference value, and the main technical problems of this invention are certainly saving transit data just before a vehicle's will be in an abnormal condition by judging that certainly, when a vehicle will be in an abnormal condition.
[0006]
[Means for Solving the Problem] A record means by which main above-mentioned technical problems record the configuration of claim 1, i.e., the transit data of a vehicle, according to this invention, In the data recorder for vehicles which has an abnormal-condition judging means to judge the abnormal condition of a vehicle, and the control means which controls said record means based on the judgment result of said abnormal-condition judging means An acceleration judging means by which, as for said

abnormal-condition judging means, the magnitude of the acceleration of a vehicle judges whether it is beyond a reference value, It has a vehicle speed judging means to judge whether the vehicle speed is below a reference value, and is attained by the data recorder for vehicles characterized by judging the abnormal condition of a vehicle based on the judgment result of said acceleration judging means and said vehicle speed judging means.
[0007] Generally the vehicle speed in case the magnitude of acceleration becomes comparatively large to falling rapidly to a value with the very small vehicle speed while the deceleration of a vehicle will go up rapidly to a collision and coincidence if a vehicle generally collides, and becoming a value with the very large magnitude of acceleration at the time of usual transit of a vehicle is comparatively high. Moreover, when the installation condition of a sensor that the collision of a vehicle etc. detects the acceleration of a vehicle becomes unusual or the vehicle itself will be inclined unusually, a sensor comes to show regularly the very high value which is not shown at the time of the usual transit of a vehicle, and a stop. Therefore, by taking the vehicle speed into consideration in addition to the acceleration of a vehicle, the abnormal condition like the collision of a vehicle can be judged certainly.
[0008] According to the configuration of above-mentioned claim 1, since the abnormal condition of a vehicle is judged based on the judgment result of an acceleration judging means and a vehicle speed judging means, it becomes possible to certainly save transit data just before it will become possible to distinguish the case where the magnitude of acceleration becomes comparatively large at the time of the usual transit of a vehicle, and a stop, and to judge the abnormal condition of a vehicle certainly and a vehicle will be in an abnormal condition by this.
[0009] Moreover, according to this invention, that main above-mentioned technical problems should be attained effectively, in the configuration of above-mentioned claim 1, when it judges that the vehicle speed is below a reference value with said vehicle speed judging means within predetermined time amount from the event of being judged with the magnitude of the acceleration of a vehicle being beyond a reference value by said acceleration judging means, said abnormal-condition judging means is constituted so that it may judge with the abnormal condition of a vehicle (configuration of claim 2).
[0010] Since according to the configuration of claim 2 it is judged with the abnormal condition of a vehicle when it is judged with the vehicle speed being below a reference value by the vehicle speed judging means within predetermined time amount from the event of being judged with the magnitude of the acceleration of a vehicle being beyond a reference value by the acceleration judging means, it is not necessary to make the reference value of an acceleration judging of a vehicle high, and, thereby, the abnormal condition of a vehicle is judged certainly.
[0011] Moreover, according to this invention, that main above-mentioned technical problems should be attained effectively, in the configuration of above-mentioned claim 1, when it is judged with the vehicle speed being below a reference value by said vehicle speed judging means and judges that the magnitude of the acceleration of a vehicle is beyond a reference value with said acceleration judging means, said abnormal-condition judging means is constituted so that it may judge with the abnormal condition of a vehicle (configuration of claim 3).
[0012] Since according to the configuration of claim 3 it is judged with the abnormal condition of a vehicle when it is judged with the vehicle speed being below a reference value by the vehicle speed judging means and is judged with the magnitude of the acceleration of a vehicle being beyond a reference value by the acceleration judging means, it is not necessary to make the reference value of an acceleration judging of a vehicle high, and, thereby, the abnormal condition of a vehicle is judged certainly.
[0013] Moreover, according to this invention, that main above-mentioned technical problems should be attained effectively, in above-mentioned claim 1 thru/or which configuration of 3, when the vehicle speed is 0 substantially, said vehicle speed judging means is constituted so that it may judge with the vehicle speed being below a reference value (configuration of claim 4).
[0014] Since according to the configuration of claim 4 it is judged with the vehicle speed being below a reference value when the vehicle speed is 0 substantially, being judged with the abnormal condition of a vehicle in the situation that the magnitude of acceleration becomes comparatively large at the time of

usual transit of a vehicle is prevented certainly.

[0015] Moreover, according to this invention, it sets in above-mentioned claim 1 thru/or which configuration of 4 that main above-mentioned technical problems should be attained effectively. Said record means is recorded by writing transit data in this storage means by overwrite including a storage means to memorize the transit data of a vehicle. When the abnormal condition of a vehicle is judged by said abnormal-condition judging means, said control means is constituted so that record by said record means may be forbidden (configuration of claim 5).

[0016] According to the configuration of claim 5, when the abnormal condition of a vehicle is judged by the abnormal-condition judging means, record by the record means is forbidden, and it is prevented certainly that the data after the event of a vehicle being in an abnormal condition by this are overwritten by the storage means and that transit data if it puts in another way, just before a vehicle will be in an abnormal condition are eliminated.

[0017]

[The desirable mode of a technical-problem solution means] According to one desirable mode of this invention, it is constituted in the configuration of above-mentioned claim 1 so that it may have a record judging means judge whether a record means should record the transit data of a vehicle, a storage means memorize transit data, and the means that write in in transit data to a storage means when the judgment of the purport which should record transit data with a record judging means is performed (a desirable mode 1).

[0018] other one desirable voice of this invention -- if it depends like -- the above -- in the configuration of the desirable mode 1, it is constituted so that it may judge whether a record judging means should record the transit data of a vehicle for every predetermined time amount (desirable mode 2).

[0019] According to other one desirable mode of this invention, in the configuration of above-mentioned claim 1, a vehicle has kinematic-control equipment which performs kinematic control for motion stabilization of the vehicle at the time of transit, and when kinematic control is performed by kinematic-control equipment, a record judging means is constituted so that the purport which should record transit data may be judged (desirable mode 3).

[0020] In the configuration of above-mentioned claim 1, including a means to detect the lateral acceleration of a vehicle, when the magnitude of the lateral acceleration of a vehicle is beyond a reference value, according to other one desirable mode of this invention, a record judging means is constituted so that the purport which should record transit data may be judged (desirable mode 4).

[0021] According to other one desirable mode of this invention, it sets in the configuration of above-mentioned claim 2. It judges whether it is beyond the reference value with which the magnitude of the lateral acceleration of a vehicle corresponds while judging whether an acceleration judging means is beyond a reference value with which the magnitude of vehicle order acceleration corresponds. From the event of being judged with it being beyond the reference value with which the magnitude of the lateral acceleration of the event of being judged with it being beyond the reference value to which the magnitude of vehicle order acceleration corresponds with an acceleration judging means, or a vehicle corresponds, within predetermined time amount with a vehicle speed judging means When judged with the vehicle speed being below a reference value, it is constituted so that it may judge with the abnormal condition of a vehicle (desirable mode 5).

[0022] According to other one desirable mode of this invention, it sets in the configuration of above-mentioned claim 3. It judges whether it is beyond the reference value with which the magnitude of the lateral acceleration of a vehicle corresponds while judging whether an acceleration judging means is beyond a reference value with which the magnitude of vehicle order acceleration corresponds. It is judged with the vehicle speed being below a reference value by the vehicle speed judging means. With and an acceleration judging means When judged with it being beyond the reference value with which the magnitude of vehicle order acceleration corresponds Or when judged with it being beyond the reference value to which it is judged with the vehicle speed being below a reference value by the vehicle speed judging means, and the magnitude of the lateral acceleration of a vehicle corresponds with an acceleration judging means, it is constituted so that it may judge with the abnormal condition of a

vehicle (desirable mode 6).
[0023] According to other one desirable mode of this invention, in the configuration of above-mentioned claim 5, a storage means has two or more storage areas, and it is constituted so that transit data may be written in the storage area which has memorized the oldest transit data by overwrite (desirable mode 7).
[0024]
[Embodiment of the Invention] This invention is explained to a detail about a desirable operation gestalt, referring to drawing of attachment in the following.
[0025] The outline block diagram showing one desirable operation gestalt of the transit data recorder for vehicles by this invention by which drawing 1 was applied to the vehicle with which kinematic-control equipment was carried, and drawing 2 are the block diagrams showing the transit data recorder shown in drawing 1 .
[0026] In drawing 1 , 10floor line and 10FR show the front wheel of right and left of a vehicle 12, respectively, and 10RL and 10RR(s) show the rear wheel of right and left of a vehicle, respectively. The damping force of each wheel is controlled by controlling the braking pressure of wheel-cylinder 18FR, 18floor line, 18RR, and 18RL by the hydraulic circuit 16 of a damping device 14. Although not shown in drawing, sometimes, a hydraulic circuit 16 is usually controlled for the braking pressure of each wheel cylinder by the control unit 24 for kinematic control according to the pressure in the master cylinder 22 driven by treading-in actuation of the brake pedal 20 by the operator including an oil reservoir, a lubricating oil pump, various valve gears, etc.
[0027] Sensor 28FR, 28floor line, 28RR, and 28RL are prepared in the location close to wheel 10FR-10RL whenever [ wheel speed / which detects Vi (i=fr, fl, rr rl) whenever / wheel speed / of each wheel /, respectively ]. Moreover, the acceleration sensor 30 before and after detecting the car-body order acceleration Gx, respectively, the lateral acceleration sensor 32 which detects lateral acceleration Gy, and the steering angle sensor 34 which detects the steering angle theta are formed in the vehicle 12. The signal which shows the value detected by each sensor is inputted into the control device 24 for kinematic control, and is inputted into the control device 40 for transit data logging through the control device 24 for kinematic control.
[0028] If the braking slip ratio Rs of each wheel is calculated based on Vi whenever [ wheel speed / which was detected by sensor 28FR-28RL whenever / wheel speed ] and the braking slip ratio Rs becomes beyond a reference value Rso (forward constant), the control unit 24 for kinematic control will start the antiskid control which fluctuates damping force so that the braking slip ratio Rs of the wheel concerned may become within the limits of predetermined, and if the terminating condition set up beforehand is satisfied, it will end an antiskid control.
[0029] In this way, although the control unit 24 for kinematic control constitutes the kinematic-control equipment which raises the stability at the time of transit of a vehicle by having two incomes with a damping device 14, and rationalizing a braking slip of a wheel when there is a possibility that a braking slip of a wheel may become superfluous and the motion at the time of transit of a vehicle may become instability An input of the signal of the purport which forbids the kinematic control of a vehicle from the control device 40 for transit data logging like the after-mentioned does not perform kinematic control (antiskid control).
[0030] In addition, the antiskid control as kinematic control performed by the control device 24 for kinematic control does not make the summary of this invention, and may be performed in the way of well-known arbitration in this technical field. Moreover, in addition to an antiskid control, the control device 24 for kinematic control performs other kinematic control like the traction control by control of damping force, or behavior stabilization control.
[0031] The control unit 40 for transit data logging contains EEPROM54 which is the memory of a non-volatile as external storage, including the microcomputer 52 of a general configuration of that have CPU42, ROM44 and RAM46, and input/output port equipment 48, and these were mutually connected by the common bus 50 of bidirection as shown in drawing 2 .
[0032] The control unit 40 for transit data logging judges periodically whether the quantity of state detected by each sensor based on the information on lateral acceleration Gy or the control unit 24 for

kinematic control like the after-mentioned, i.e., the transit data of a vehicle, should be recorded, and when the judgment of the purport which should record transit data is performed, it records transit data on EEPROM54.

[0033] Furthermore, the control unit 40 for transit data logging judges whether based on Vi, the after acceleration Gx, and lateral acceleration Gy, the vehicle would be in the abnormal condition like the after-mentioned whenever [ wheel speed ], when the judgment of the purport from which the vehicle is not an abnormal condition is performed, record of transit data is permitted, but when the judgment of the purport that the vehicle would be in the abnormal condition is performed, it forbids that the transit data after it should be recorded by overwrite.

[0034] The section S1 where EEPROM44 has three storage areas M1-M3 in the operation gestalt of a graphic display in as shown in drawing 3 , and each storage area memorizes the ID number as identification information about record timing, respectively, Whenever [ wheel speed ] Vfr, Vfl, Vrr, Vrl, the order acceleration Gx, lateral acceleration Gy, It has the section S2 which memorizes each transit data of braking slip ratio Rsfr of the steering angle theta, a right front wheel, a left front wheel, a right rear wheel, and a left rear wheel, Rsfl, Rsrr, and Rsrl, and the section S3 which memorizes the judgment result of whether the vehicle would be in the abnormal condition.

[0035] An ID number consists of a figure of 0-9, in order of [ 0 ] record of data, is used to 9 in order, and is repeatedly returned and used for the degree of 9 by 0. Moreover, record of data is storage areas M1, M2, M3, M1, and M2. -- It is repeatedly carried out by overwrite in order. Therefore, it can judge whether which data are the newest data and are data with which oldest data by the ID number recorded on the section S1 of storage areas M1-M3.

[0036] Although not shown in **** at a detail, the control unit 24 for kinematic control also has CPU, ROM and RAM, and input/output port equipment, and these contain the microcomputer of a general configuration of having connected mutually with the common bus of bidirection.

[0037] Next, with reference to the flow chart shown in drawing 4 , record control of the transit data of the vehicle in the operation gestalt of a graphic display is explained. In addition, closing of the ignition switch which is not shown in drawing begins, and control by the flow chart shown in drawing 4 is repeatedly performed for every predetermined time amount.

[0038] While the signal which shows Vi whenever [ wheel speed / which was first detected by sensor 28FR-28RL whenever / wheel speed / in step 10 ] is read through the control unit 24 for kinematic control, the signal which shows whether the antiskid control as kinematic control is performed from the control unit 24 for kinematic control is read. The signal which shows the detection value of a **** sensor may be directly read from a corresponding sensor, respectively.

[0039] When record control of transit data is completed and negative distinction is performed after the signal of the purport which should forbid kinematic control to the control device 24 for kinematic control in step 30 was outputted, when distinction of whether the information which shows that the vehicle would be in the abnormal condition into the section S3 of which storage area in step 20 is memorized was performed and affirmation distinction was performed, it progresses to step 40.

[0040] When distinction of whether the transit data of a vehicle need to be recorded is performed in step 40, negative distinction is performed and return and affirmation distinction are performed to step 10, it progresses to step 50.

[0041] In addition, distinction of whether transit data need to be recorded For example, it is carried out by distinction of whether kinematic control (an antiskid control or other kinematic control) by distinction of whether the absolute value of the lateral acceleration Gy of a vehicle is beyond the reference value Gyo (forward constant) and the control device 24 for kinematic control is performed. When distinction of a purport to which kinematic control by the distinction of a purport or the control device 24 for kinematic control whose absolute value of lateral acceleration Gy is beyond the reference value Gyo is performed is performed, it may be judged with transit data needing to be recorded.

[0042] While sum sigmaVi of Vi calculates whenever [ wheel speed / of each wheel ] in step 50 Distinction of whether sum sigmaVi of whenever [ wheel speed ] was set to 0 from the event of the absolute value of the condition that the absolute value of the order acceleration Gx is more than reference-value Gx1 (forward constant), or lateral acceleration Gy being in the condition of being more than reference-value Gy1 (forward constant) within the predetermined time amount Tc (forward constant), That is, after the magnitude of vehicle order acceleration or lateral acceleration becomes a very high value, distinction of whether the vehicle stopped progresses to step 100, when a line crack and affirmation distinction are performed, and when negative distinction is performed, it progresses to step 60.

[0043] In addition, the reference values Gx1 and Gy1 of the distinction in step 50 are set as the comparatively large value which is not produced at the time of the usual transit of a vehicle (the transit in usual acceleration and deceleration, a usual slope, etc. is included), respectively.

[0044] Distinction of whether in step 60, sum sigmaVi of Vi is 0 whenever [ wheel speed / of each wheel ], and the absolute value of the vehicle order acceleration Gx is more than reference-value Gx2 (forward constant), That is, when distinction of whether the magnitude of the vehicle order acceleration with which a vehicle is in a idle state, and is detected is a very high value is performed and affirmation distinction is performed, it progresses to step 100, and when negative distinction is performed, it progresses to step 70.

[0045] Distinction of whether in step 70, sum sigmaVi of Vi is 0 whenever [ wheel speed / of each wheel ], and the absolute value of the lateral acceleration Gy of a vehicle is more than reference-value Gy2 (forward constant), That is, when distinction of whether the magnitude of the lateral acceleration of the vehicle with which a vehicle is in a idle state, and is detected is a very high value is performed and affirmation distinction is performed, it progresses to step 100, and when negative distinction is performed, it progresses to step 80.

[0046] In addition, the reference values Gx2 and Gy2 of the distinction in steps 60 and 70 are set as the comparatively large value which is not produced in the usual stop condition (the stop in a slope etc. is included) of a vehicle, respectively.

[0047] It is chosen as record area for the storage area in which the oldest data are written among the storage areas M1-M3 of EEPROM44 in step 80 to record these data, is written in the record area where the transit data of the vehicle read in the present cycle in step 90 were chosen in step 80 by overwrite, and returns to step 10 after an appropriate time.

[0048] It is written in the section S3 of the record area as which the information on the purport which has a vehicle in the abnormal condition like a collision while the area where the judgment of the purport which has a vehicle in the abnormal condition like a collision in step 100 was performed, and transit data were recorded last time among storage areas M1-M3 is chosen as record area was chosen, and returns to step 10 after an appropriate time.

[0049] According to the operation gestalt of a graphic display, distinction of whether in step 20, the vehicle is an abnormal condition like the condition after accident is performed in this way. Since affirmation distinction is performed in step 20 and the kinematic control by the control unit 24 for kinematic control is forbidden in step 30 when the vehicle is an abnormal condition It can prevent certainly that unsuitable kinematic control is performed based on the unusual quantity of state detected by the sensor of an unusual condition.

[0050] Moreover, when a vehicle is in a normal condition, negative distinction is performed in step 20 and distinction of whether the transit data of a vehicle need to be recorded is performed in step 40. By performing negative distinction in step 40, when a vehicle is in the usual run state Although record of transit data is not performed, in the situation as [ whose magnitude of the lateral acceleration of a vehicle is a very high value ], affirmation distinction is performed in step 40. Unless distinction of the purport from which the vehicle is in the unusual condition in steps 50-70 is performed, transit data are recorded in steps 80 and 90.

[0051] On the other hand, when the vehicle is in the unusual condition, while setting they to be [ any of steps 50-70 ], performing affirmation distinction and performing the judgment of an abnormal condition in step 100, the information is recorded, and, thereby, record of the transit data based on the overwrite to EEPROM44 is forbidden.

[0052] Therefore, if a vehicle will be in an abnormal condition by collision etc., since record of the

transit data which record of the transit data after it is not performed, but are memorized by EEPROM44 by then will be maintained, transit data just before a vehicle will be in an abnormal condition can certainly be saved.
[0053] Especially distinction of whether according to the operation gestalt of a graphic display, the vehicle is in the unusual condition is performed by steps 50-70. Since distinction of whether the vehicle would be in the idle state is performed within the predetermined time amount Tc from the event of the absolute value of the condition that the absolute values of the order acceleration Gx are one or more reference values Gx, or lateral acceleration Gy being in the condition of being one or more reference values Gy, in step 50 After the magnitude of acceleration becomes very large by the collision of a vehicle etc., the unusual condition that the vehicle stopped can be judged certainly.
[0054] Moreover, since a vehicle is in a idle state, respectively, distinction and the vehicle of whether the absolute values of the vehicle order acceleration Gx are two or more reference values Gx are in a idle state in steps 60 and 70 and distinction of whether the absolute values of the lateral acceleration Gy of a vehicle are two or more reference values Gy is performed An abnormal condition toward which the installation condition of the order acceleration sensor 30 or the lateral acceleration sensor 32 became unusual by the collision of a vehicle etc., or the vehicle itself inclined unusually can be judged certainly.
[0055] Although this invention was explained above about the specific operation gestalt at the detail, probably this invention will not be limited to an above-mentioned operation gestalt, and it will be clear for this contractor its for other various operation gestalten to be possible within the limits of this invention.
[0056] For example, it sets in an above-mentioned operation gestalt. Although distinction of whether the vehicle would be in the idle state is performed within the predetermined time amount Tc from the event of the absolute value of the condition that the absolute values of the order acceleration Gx are one or more reference values Gx, or lateral acceleration Gy being in the condition of being one or more reference values Gy, in step 50 The acceleration Gxy of a vehicle calculates as a square root (Gx2+Gy2) (1/2) of the sum of the square of the order acceleration Gx, and the square of lateral acceleration Gy. Distinction of whether the vehicle would be in the idle state may be performed within the predetermined time amount Tc from the event of the absolute value of the acceleration Gxy of a vehicle being in the condition of being more than reference-value Gxy1 (forward constant).
[0057] It sets in an above-mentioned operation gestalt similarly. Step 60 And although a vehicle is in a idle state in 70, respectively, distinction and the vehicle of whether the absolute values of the vehicle order acceleration Gx are two or more reference values Gx are in a idle state and distinction of whether the absolute values of the lateral acceleration Gy of a vehicle are two or more reference values Gy is performed A vehicle is in a idle state and distinction of whether the absolute value of the acceleration Gxy of a vehicle is more than reference-value Gxy2 (forward constant) may be performed.
[0058] Moreover, although it is distinguished whether the vehicle speed is 0 and a vehicle is in a idle state in an above-mentioned operation gestalt by whether sum sigmaVi of Vi is 0 whenever [ wheel speed / of each wheel ] Distinction of whether a vehicle is in a idle state may be performed by whether sum sigmaVi of whenever [ wheel speed ] is below the reference value Vo (forward constant near 0), and may be performed by whether the maximum of the Vi(s) is below the reference value Vwo (forward constant near 0) whenever [ wheel speed / of each wheel ].
[0059] Furthermore, in an above-mentioned operation gestalt, although EEPROM54 has three storage areas M1-M3 and the ID number consists of a figure of 0-9, these numbers may be the number of arbitration, and the transit data of the vehicle recorded on EEPROM54 may also be data of arbitration.
[0060]
[Effect of the Invention] According to the configuration of claim 1 of this invention, the case where the magnitude of acceleration becomes comparatively large at the time of the usual transit of a vehicle and a stop can be distinguished, the abnormal condition of a vehicle can be judged certainly, and transit data just before a vehicle will be in an abnormal condition by this can certainly be saved so that more clearly than the above explanation.
[0061] Moreover, since it is not necessary to set up the reference value of an acceleration judging of a

vehicle highly according to the configuration of claims 2 and 3, the abnormal condition of a vehicle can be judged certainly, and according to the configuration of claim 4, it can prevent certainly being judged with the abnormal condition of a vehicle in the situation that the magnitude of acceleration becomes comparatively large at the time of usual transit of a vehicle.
[0062] Moreover, according to the configuration of claim 5, it can prevent certainly that the data after the event of a vehicle being in an abnormal condition are overwritten by the storage means, and can prevent certainly that transit data just before a vehicle will be in an abnormal condition by this are eliminated.

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[Translation done.]

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## PRIOR ART

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[Description of the Prior Art] The data recorder constituted so that the transit data of a vehicle might be recorded on a storage means by carrying out sequential overwriting, it might judge with the vehicle having been in the abnormal condition when the magnitude of the acceleration of a vehicle was beyond a reference value and the overwriting to a storage means might be stopped is conventionally known as indicated as one of the data recorders of vehicles, such as an automobile, by JP,7-249137,A concerning application of an applicant for this patent.
[0003] Since it is recorded by carrying out sequential overwriting of the transit data of a vehicle at a storage means according to this data recorder, the large storage means of storage capacity is unnecessary, and since the overwriting to a storage means is stopped when the magnitude of the acceleration of a vehicle becomes beyond a reference value, transit data just before the magnitude of the acceleration of a vehicle becomes beyond a reference value can certainly be saved.

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[Translation done.]

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EFFECT OF THE INVENTION

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[Effect of the Invention] According to the configuration of claim 1 of this invention, the case where the magnitude of acceleration becomes comparatively large at the time of the usual transit of a vehicle and a stop can be distinguished, the abnormal condition of a vehicle can be judged certainly, and transit data just before a vehicle will be in an abnormal condition by this can certainly be saved so that more clearly than the above explanation.
[0061] Moreover, since it is not necessary to set up the reference value of an acceleration judging of a vehicle highly according to the configuration of claims 2 and 3, the abnormal condition of a vehicle can be judged certainly, and according to the configuration of claim 4, it can prevent certainly being judged with the abnormal condition of a vehicle in the situation that the magnitude of acceleration becomes comparatively large at the time of usual transit of a vehicle.
[0062] Moreover, according to the configuration of claim 5, it can prevent certainly that the data after the event of a vehicle being in an abnormal condition are overwritten by the storage means, and can prevent certainly that transit data just before a vehicle will be in an abnormal condition by this are eliminated.

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* NOTICES *



TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the conventional data recorder like ****, since it is judged with the vehicle having been in the abnormal condition when the magnitude of the acceleration of a vehicle is beyond a reference value, even if a vehicle will be in an abnormal condition, the abnormal condition may be unable to be judged. namely, since the acceleration of a vehicle may become a comparatively high value also at the time of usual transit of a vehicle, when the abnormal condition of a vehicle is judged only based on the magnitude of the acceleration of a vehicle the reference value of an abnormal-condition judging -- a comparatively high value -- not setting up -- transit data just before it does not obtain, therefore the abnormal condition will not be judged even if the abnormal condition like the collision of a vehicle arises, therefore a vehicle will be in an abnormal condition may be unable to be saved
[0005] This invention is made in view of the problem like **** in the conventional data recorder constituted so that the overwriting of transit data to a storage means might be stopped, when the magnitude of the acceleration of a vehicle is beyond a reference value, and the main technical problems of this invention are certainly saving transit data just before a vehicle's will be in an abnormal condition by judging that certainly, when a vehicle will be in an abnormal condition.

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MEANS

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[Means for Solving the Problem] A record means by which main above-mentioned technical problems record the configuration of claim 1, i.e., the transit data of a vehicle, according to this invention, In the data recorder for vehicles which has an abnormal-condition judging means to judge the abnormal condition of a vehicle, and the control means which controls said record means based on the judgment result of said abnormal-condition judging means An acceleration judging means by which, as for said abnormal-condition judging means, the magnitude of the acceleration of a vehicle judges whether it is beyond a reference value, It has a vehicle speed judging means to judge whether the vehicle speed is below a reference value, and is attained by the data recorder for vehicles characterized by judging the abnormal condition of a vehicle based on the judgment result of said acceleration judging means and said vehicle speed judging means.
[0007] Generally the vehicle speed in case the magnitude of acceleration becomes comparatively large to falling rapidly to a value with the very small vehicle speed while the deceleration of a vehicle will go up rapidly to a collision and coincidence if a vehicle generally collides, and becoming a value with the very large magnitude of acceleration at the time of usual transit of a vehicle is comparatively high. Moreover, when the installation condition of a sensor that the collision of a vehicle etc. detects the acceleration of a vehicle becomes unusual or the vehicle itself will be inclined unusually, a sensor comes to show regularly the very high value which is not shown at the time of the usual transit of a vehicle, and a stop. Therefore, by taking the vehicle speed into consideration in addition to the acceleration of a vehicle, the abnormal condition like the collision of a vehicle can be judged certainly.
[0008] According to the configuration of above-mentioned claim 1, since the abnormal condition of a vehicle is judged based on the judgment result of an acceleration judging means and a vehicle speed judging means, it becomes possible to certainly save transit data just before it will become possible to distinguish the case where the magnitude of acceleration becomes comparatively large at the time of the usual transit of a vehicle, and a stop, and to judge the abnormal condition of a vehicle certainly and a vehicle will be in an abnormal condition by this.
[0009] Moreover, according to this invention, that main above-mentioned technical problems should be attained effectively, in the configuration of above-mentioned claim 1, when it judges that the vehicle speed is below a reference value with said vehicle speed judging means within predetermined time amount from the event of being judged with the magnitude of the acceleration of a vehicle being beyond a reference value by said acceleration judging means, said abnormal-condition judging means is constituted so that it may judge with the abnormal condition of a vehicle (configuration of claim 2).
[0010] Since according to the configuration of claim 2 it is judged with the abnormal condition of a vehicle when it is judged with the vehicle speed being below a reference value by the vehicle speed judging means within predetermined time amount from the event of being judged with the magnitude of the acceleration of a vehicle being beyond a reference value by the acceleration judging means, it is not necessary to make the reference value of an acceleration judging of a vehicle high, and, thereby, the abnormal condition of a vehicle is judged certainly.
[0011] Moreover, according to this invention, that main above-mentioned technical problems should be

attained effectively, in the configuration of above-mentioned claim 1, when it is judged with the vehicle speed being below a reference value by said vehicle speed judging means and judges that the magnitude of the acceleration of a vehicle is beyond a reference value with said acceleration judging means, said abnormal-condition judging means is constituted so that it may judge with the abnormal condition of a vehicle (configuration of claim 3).
[0012] Since according to the configuration of claim 3 it is judged with the abnormal condition of a vehicle when it is judged with the vehicle speed being below a reference value by the vehicle speed judging means and is judged with the magnitude of the acceleration of a vehicle being beyond a reference value by the acceleration judging means, it is not necessary to make the reference value of an acceleration judging of a vehicle high, and, thereby, the abnormal condition of a vehicle is judged certainly.
[0013] Moreover, according to this invention, that main above-mentioned technical problems should be attained effectively, in above-mentioned claim 1 thru/or which configuration of 3, when the vehicle speed is 0 substantially, said vehicle speed judging means is constituted so that it may judge with the vehicle speed being below a reference value (configuration of claim 4).
[0014] Since according to the configuration of claim 4 it is judged with the vehicle speed being below a reference value when the vehicle speed is 0 substantially, being judged with the abnormal condition of a vehicle in the situation that the magnitude of acceleration becomes comparatively large at the time of usual transit of a vehicle is prevented certainly.
[0015] Moreover, according to this invention, it sets in above-mentioned claim 1 thru/or which configuration of 4 that main above-mentioned technical problems should be attained effectively. Said record means is recorded by writing transit data in this storage means by overwrite including a storage means to memorize the transit data of a vehicle. When the abnormal condition of a vehicle is judged by said abnormal-condition judging means, said control means is constituted so that record by said record means may be forbidden (configuration of claim 5).
[0016] According to the configuration of claim 5, when the abnormal condition of a vehicle is judged by the abnormal-condition judging means, record by the record means is forbidden, and it is prevented certainly that the data after the event of a vehicle being in an abnormal condition by this are overwritten by the storage means and that transit data if it puts in another way, just before a vehicle will be in an abnormal condition are eliminated.
[0017]
[The desirable mode of a technical-problem solution means] According to one desirable mode of this invention, it is constituted in the configuration of above-mentioned claim 1 so that it may have a record judging means judge whether a record means should record the transit data of a vehicle, a storage means memorize transit data, and the means that write in in transit data to a storage means when the judgment of the purport which should record transit data with a record judging means is performed (a desirable mode 1).
[0018] other one desirable voice of this invention -- if it depends like -- the above -- in the configuration of the desirable mode 1, it is constituted so that it may judge whether a record judging means should record the transit data of a vehicle for every predetermined time amount (desirable mode 2).
[0019] According to other one desirable mode of this invention, in the configuration of above-mentioned claim 1, a vehicle has kinematic-control equipment which performs kinematic control for motion stabilization of the vehicle at the time of transit, and when kinematic control is performed by kinematic-control equipment, a record judging means is constituted so that the purport which should record transit data may be judged (desirable mode 3).
[0020] In the configuration of above-mentioned claim 1, including a means to detect the lateral acceleration of a vehicle, when the magnitude of the lateral acceleration of a vehicle is beyond a reference value, according to other one desirable mode of this invention, a record judging means is constituted so that the purport which should record transit data may be judged (desirable mode 4).
[0021] According to other one desirable mode of this invention, it sets in the configuration of above-mentioned claim 2. It judges whether it is beyond the reference value with which the magnitude of the

lateral acceleration of a vehicle corresponds while judging whether an acceleration judging means is beyond a reference value with which the magnitude of vehicle order acceleration corresponds. From the event of being judged with it being beyond the reference value with which the magnitude of the lateral acceleration of the event of being judged with it being beyond the reference value to which the magnitude of vehicle order acceleration corresponds with an acceleration judging means, or a vehicle corresponds, within predetermined time amount with a vehicle speed judging means When judged with the vehicle speed being below a reference value, it is constituted so that it may judge with the abnormal condition of a vehicle (desirable mode 5).

[0022] According to other one desirable mode of this invention, it sets in the configuration of above-mentioned claim 3. It judges whether it is beyond the reference value with which the magnitude of the lateral acceleration of a vehicle corresponds while judging whether an acceleration judging means is beyond a reference value with which the magnitude of vehicle order acceleration corresponds. It is judged with the vehicle speed being below a reference value by the vehicle speed judging means. With and an acceleration judging means When judged with it being beyond the reference value with which the magnitude of vehicle order acceleration corresponds Or when judged with it being beyond the reference value to which it is judged with the vehicle speed being below a reference value by the vehicle speed judging means, and the magnitude of the lateral acceleration of a vehicle corresponds with an acceleration judging means, it is constituted so that it may judge with the abnormal condition of a vehicle (desirable mode 6).

[0023] According to other one desirable mode of this invention, in the configuration of above-mentioned claim 5, a storage means has two or more storage areas, and it is constituted so that transit data may be written in the storage area which has memorized the oldest transit data by overwrite (desirable mode 7).

[0024]

[Embodiment of the Invention] This invention is explained to a detail about a desirable operation gestalt, referring to drawing of attachment in the following.

[0025] The outline block diagram showing one desirable operation gestalt of the transit data recorder for vehicles by this invention by which drawing 1 was applied to the vehicle with which kinematic-control equipment was carried, and drawing 2 are the block diagrams showing the transit data recorder shown in drawing 1 .

[0026] In drawing 1 , 10floor line and 10FR show the front wheel of right and left of a vehicle 12, respectively, and 10RL and 10RR(s) show the rear wheel of right and left of a vehicle, respectively. The damping force of each wheel is controlled by controlling the braking pressure of wheel-cylinder 18FR, 18floor line, 18RR, and 18RL by the hydraulic circuit 16 of a damping device 14. Although not shown in drawing, sometimes, a hydraulic circuit 16 is usually controlled for the braking pressure of each wheel cylinder by the control unit 24 for kinematic control according to the pressure in the master cylinder 22 driven by treading-in actuation of the brake pedal 20 by the operator including an oil reservoir, a lubricating oil pump, various valve gears, etc.

[0027] Sensor 28FR, 28floor line, 28RR, and 28RL are prepared in the location close to wheel 10FR-10RL whenever [ wheel speed / which detects Vi (i=fr, fl, rr rl) whenever / wheel speed / of each wheel /, respectively ]. Moreover, the acceleration sensor 30 before and after detecting the car-body order acceleration Gx, respectively, the lateral acceleration sensor 32 which detects lateral acceleration Gy, and the steering angle sensor 34 which detects the steering angle theta are formed in the vehicle 12. The signal which shows the value detected by each sensor is inputted into the control device 24 for kinematic control, and is inputted into the control device 40 for transit data logging through the control device 24 for kinematic control.

[0028] If the braking slip ratio Rs of each wheel is calculated based on Vi whenever [ wheel speed / which was detected by sensor 28FR-28RL whenever / wheel speed ] and the braking slip ratio Rs becomes beyond a reference value Rso (forward constant), the control unit 24 for kinematic control will start the antiskid control which fluctuates damping force so that the braking slip ratio Rs of the wheel concerned may become within the limits of predetermined, and if the terminating condition set up beforehand is satisfied, it will end an antiskid control.

[0029] In this way, although the control unit 24 for kinematic control constitutes the kinematic-control equipment which raises the stability at the time of transit of a vehicle by having two incomes with a damping device 14, and rationalizing a braking slip of a wheel when there is a possibility that a braking slip of a wheel may become superfluous and the motion at the time of transit of a vehicle may become instability An input of the signal of the purport which forbids the kinematic control of a vehicle from the control device 40 for transit data logging like the after-mentioned does not perform kinematic control (antiskid control).
[0030] In addition, the antiskid control as kinematic control performed by the control device 24 for kinematic control does not make the summary of this invention, and may be performed in the way of well-known arbitration in this technical field. Moreover, in addition to an antiskid control, the control device 24 for kinematic control performs other kinematic control like the traction control by control of damping force, or behavior stabilization control.
[0031] The control unit 40 for transit data logging contains EEPROM54 which is the memory of a non-volatile as external storage, including the microcomputer 52 of a general configuration of that have CPU42, ROM44 and RAM46, and input/output port equipment 48, and these were mutually connected by the common bus 50 of bidirection as shown in drawing 2 .
[0032] The control unit 40 for transit data logging judges periodically whether the quantity of state detected by each sensor based on the information on lateral acceleration Gy or the control unit 24 for kinematic control like the after-mentioned, i.e., the transit data of a vehicle, should be recorded, and when the judgment of the purport which should record transit data is performed, it records transit data on EEPROM54.
[0033] Furthermore, the control unit 40 for transit data logging judges whether based on Vi, the after acceleration Gx, and lateral acceleration Gy, the vehicle would be in the abnormal condition like the after-mentioned whenever [ wheel speed ], when the judgment of the purport from which the vehicle is not an abnormal condition is performed, record of transit data is permitted, but when the judgment of the purport that the vehicle would be in the abnormal condition is performed, it forbids that the transit data after it should be recorded by overwrite.
[0034] The section S1 where EEPROM44 has three storage areas M1-M3 in the operation gestalt of a graphic display in as shown in drawing 3 , and each storage area memorizes the ID number as identification information about record timing, respectively, Whenever [ wheel speed ] Vfr, Vfl, Vrr, Vrl, the order acceleration Gx, lateral acceleration Gy, It has the section S2 which memorizes each transit data of braking slip ratio Rsfr of the steering angle theta, a right front wheel, a left front wheel, a right rear wheel, and a left rear wheel, Rsfl, Rsrr, and Rsrl, and the section S3 which memorizes the judgment result of whether the vehicle would be in the abnormal condition.
[0035] An ID number consists of a figure of 0-9, in order of [ 0 ] record of data, is used to 9 in order, and is repeatedly returned and used for the degree of 9 by 0. Moreover, record of data is storage areas M1, M2, M3, M1, and M2. -- It is repeatedly carried out by overwrite in order. Therefore, it can judge whether which data are the newest data and are data with which oldest data by the ID number recorded on the section S1 of storage areas M1-M3.
[0036] Although not shown in **** at a detail, the control unit 24 for kinematic control also has CPU, ROM and RAM, and input/output port equipment, and these contain the microcomputer of a general configuration of having connected mutually with the common bus of bidirection.
[0037] Next, with reference to the flow chart shown in drawing 4 , record control of the transit data of the vehicle in the operation gestalt of a graphic display is explained. In addition, closing of the ignition switch which is not shown in drawing begins, and control by the flow chart shown in drawing 4 is repeatedly performed for every predetermined time amount.
[0038] While the signal which shows Vi whenever [ wheel speed / which was first detected by sensor 28FR-28RL whenever / wheel speed / in step 10 ] is read through the control unit 24 for kinematic control, the signal which shows whether the antiskid control as kinematic control is performed from the control unit 24 for kinematic control is read. The signal which shows the detection value of a **** sensor may be directly read from a corresponding sensor, respectively.

[0039] When record control of transit data is completed and negative distinction is performed after the signal of the purport which should forbid kinematic control to the control device 24 for kinematic control in step 30 was outputted, when distinction of whether the information which shows that the vehicle would be in the abnormal condition into the section S3 of which storage area in step 20 is memorized was performed and affirmation distinction was performed, it progresses to step 40.
[0040] When distinction of whether the transit data of a vehicle need to be recorded is performed in step 40, negative distinction is performed and return and affirmation distinction are performed to step 10, it progresses to step 50.
[0041] In addition, distinction of whether transit data need to be recorded For example, it is carried out by distinction of whether kinematic control (an antiskid control or other kinematic control) by distinction of whether the absolute value of the lateral acceleration Gy of a vehicle is beyond the reference value Gyo (forward constant) and the control device 24 for kinematic control is performed. When distinction of a purport to which kinematic control by the distinction of a purport or the control device 24 for kinematic control whose absolute value of lateral acceleration Gy is beyond the reference value Gyo is performed is performed, it may be judged with transit data needing to be recorded.
[0042] While sum sigmaVi of Vi calculates whenever [ wheel speed / of each wheel ] in step 50 Distinction of whether sum sigmaVi of whenever [ wheel speed ] was set to 0 from the event of the absolute value of the condition that the absolute value of the order acceleration Gx is more than reference-value Gx1 (forward constant), or lateral acceleration Gy being in the condition of being more than reference-value Gy1 (forward constant) within the predetermined time amount Tc (forward constant), That is, after the magnitude of vehicle order acceleration or lateral acceleration becomes a very high value, distinction of whether the vehicle stopped progresses to step 100, when a line crack and affirmation distinction are performed, and when negative distinction is performed, it progresses to step 60.
[0043] In addition, the reference values Gx1 and Gy1 of the distinction in step 50 are set as the comparatively large value which is not produced at the time of the usual transit of a vehicle (the transit in usual acceleration and deceleration, a usual slope, etc. is included), respectively.
[0044] Distinction of whether in step 60, sum sigmaVi of Vi is 0 whenever [ wheel speed / of each wheel ], and the absolute value of the vehicle order acceleration Gx is more than reference-value Gx2 (forward constant), That is, when distinction of whether the magnitude of the vehicle order acceleration with which a vehicle is in a idle state, and is detected is a very high value is performed and affirmation distinction is performed, it progresses to step 100, and when negative distinction is performed, it progresses to step 70.
[0045] Distinction of whether in step 70, sum sigmaVi of Vi is 0 whenever [ wheel speed / of each wheel ], and the absolute value of the lateral acceleration Gy of a vehicle is more than reference-value Gy2 (forward constant), That is, when distinction of whether the magnitude of the lateral acceleration of the vehicle with which a vehicle is in a idle state, and is detected is a very high value is performed and affirmation distinction is performed, it progresses to step 100, and when negative distinction is performed, it progresses to step 80.
[0046] In addition, the reference values Gx2 and Gy2 of the distinction in steps 60 and 70 are set as the comparatively large value which is not produced in the usual stop condition (the stop in a slope etc. is included) of a vehicle, respectively.
[0047] It is chosen as record area for the storage area in which the oldest data are written among the storage areas M1-M3 of EEPROM44 in step 80 to record these data, is written in the record area where the transit data of the vehicle read in the present cycle in step 90 were chosen in step 80 by overwrite, and returns to step 10 after an appropriate time.
[0048] It is written in the section S3 of the record area as which the information on the purport which has a vehicle in the abnormal condition like a collision while the area where the judgment of the purport which has a vehicle in the abnormal condition like a collision in step 100 was performed, and transit data were recorded last time among storage areas M1-M3 is chosen as record area was chosen, and returns to step 10 after an appropriate time.

[0049] According to the operation gestalt of a graphic display, distinction of whether in step 20, the vehicle is an abnormal condition like the condition after accident is performed in this way. Since affirmation distinction is performed in step 20 and the kinematic control by the control unit 24 for kinematic control is forbidden in step 30 when the vehicle is an abnormal condition It can prevent certainly that unsuitable kinematic control is performed based on the unusual quantity of state detected by the sensor of an unusual condition.
[0050] Moreover, when a vehicle is in a normal condition, negative distinction is performed in step 20 and distinction of whether the transit data of a vehicle need to be recorded is performed in step 40. By performing negative distinction in step 40, when a vehicle is in the usual run state Although record of transit data is not performed, in the situation as [ whose magnitude of the lateral acceleration of a vehicle is a very high value ], affirmation distinction is performed in step 40. Unless distinction of the purport from which the vehicle is in the unusual condition in steps 50-70 is performed, transit data are recorded in steps 80 and 90.
[0051] On the other hand, when the vehicle is in the unusual condition, while setting they to be [ any of steps 50-70 ], performing affirmation distinction and performing the judgment of an abnormal condition in step 100, the information is recorded, and, thereby, record of the transit data based on the overwrite to EEPROM44 is forbidden.
[0052] Therefore, if a vehicle will be in an abnormal condition by collision etc., since record of the transit data which record of the transit data after it is not performed, but are memorized by EEPROM44 by then will be maintained, transit data just before a vehicle will be in an abnormal condition can certainly be saved.
[0053] Especially distinction of whether according to the operation gestalt of a graphic display, the vehicle is in the unusual condition is performed by steps 50-70. Since distinction of whether the vehicle would be in the idle state is performed within the predetermined time amount Tc from the event of the absolute value of the condition that the absolute values of the order acceleration Gx are one or more reference values Gx, or lateral acceleration Gy being in the condition of being one or more reference values Gy, in step 50 After the magnitude of acceleration becomes very large by the collision of a vehicle etc., the unusual condition that the vehicle stopped can be judged certainly.
[0054] Moreover, since a vehicle is in a idle state, respectively, distinction and the vehicle of whether the absolute values of the vehicle order acceleration Gx are two or more reference values Gx are in a idle state in steps 60 and 70 and distinction of whether the absolute values of the lateral acceleration Gy of a vehicle are two or more reference values Gy is performed An abnormal condition toward which the installation condition of the order acceleration sensor 30 or the lateral acceleration sensor 32 became unusual by the collision of a vehicle etc., or the vehicle itself inclined unusually can be judged certainly.
[0055] Although this invention was explained above about the specific operation gestalt at the detail, probably this invention will not be limited to an above-mentioned operation gestalt, and it will be clear for this contractor its for other various operation gestalten to be possible within the limits of this invention.
[0056] For example, it sets in an above-mentioned operation gestalt. Although distinction of whether the vehicle would be in the idle state is performed within the predetermined time amount Tc from the event of the absolute value of the condition that the absolute values of the order acceleration Gx are one or more reference values Gx, or lateral acceleration Gy being in the condition of being one or more reference values Gy, in step 50 The acceleration Gxy of a vehicle calculates as a square root (Gx2+Gy2)(1/2) of the sum of the square of the order acceleration Gx, and the square of lateral acceleration Gy. Distinction of whether the vehicle would be in the idle state may be performed within the predetermined time amount Tc from the event of the absolute value of the acceleration Gxy of a vehicle being in the condition of being more than reference-value Gxy1 (forward constant).
[0057] It sets in an above-mentioned operation gestalt similarly. Step 60 And although a vehicle is in a idle state in 70, respectively, distinction and the vehicle of whether the absolute values of the vehicle order acceleration Gx are two or more reference values Gx are in a idle state and distinction of whether the absolute values of the lateral acceleration Gy of a vehicle are two or more reference values Gy is

performed A vehicle is in a idle state and distinction of whether the absolute value of the acceleration Gxy of a vehicle is more than reference-value Gxy2 (forward constant) may be performed.
[0058] Moreover, although it is distinguished whether the vehicle speed is 0 and a vehicle is in a idle state in an above-mentioned operation gestalt by whether sum sigmaVi of Vi is 0 whenever [ wheel speed / of each wheel ] Distinction of whether a vehicle is in a idle state may be performed by whether sum sigmaVi of whenever [ wheel speed ] is below the reference value Vo (forward constant near 0), and may be performed by whether the maximum of the Vi(s) is below the reference value Vwo (forward constant near 0) whenever [ wheel speed / of each wheel ].
[0059] Furthermore, in an above-mentioned operation gestalt, although EEPROM54 has three storage areas M1-M3 and the ID number consists of a figure of 0-9, these numbers may be the number of arbitration, and the transit data of the vehicle recorded on EEPROM54 may also be data of arbitration.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram showing one desirable operation gestalt of the transit data recorder for vehicles by this invention applied to the vehicle with which kinematic-control equipment was carried.
[Drawing 2] It is the block diagram showing the transit data recorder shown in drawing 1 .
[Drawing 3] It is the explanatory view showing the storage area of EEPROM of a transit data recorder.
[Drawing 4] It is the flow chart which shows the record control routine of the transit data in the operation gestalt of a graphic display.
[Description of Notations]
10FR-10RL -- Wheel
14 -- Damping device
16 -- Hydraulic circuit
24 -- Control unit for kinematic control
28FR-28RL -- It is a sensor whenever [ wheel speed ].
30 -- Order acceleration sensor
32 -- Lateral acceleration sensor
34 -- Steering angle sensor
40 -- Control unit for transit data logging
52 -- Microcomputer
54 -- EEPROM

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[Translation done.]

* NOTICES *

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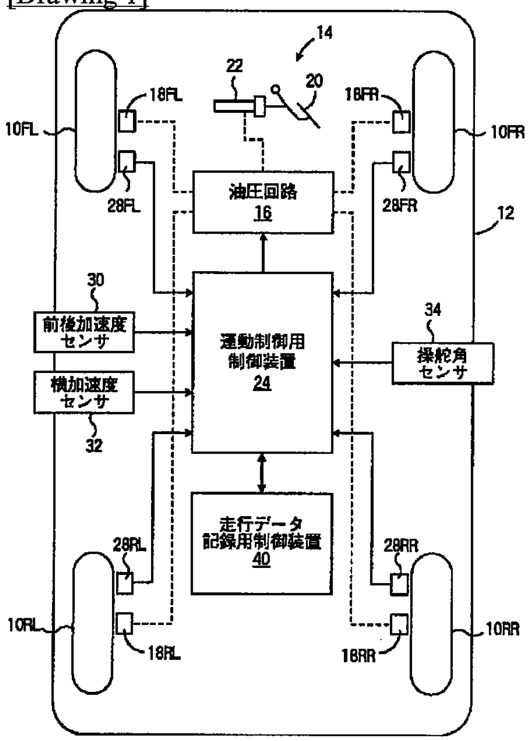
damages caused by the use of this translation.

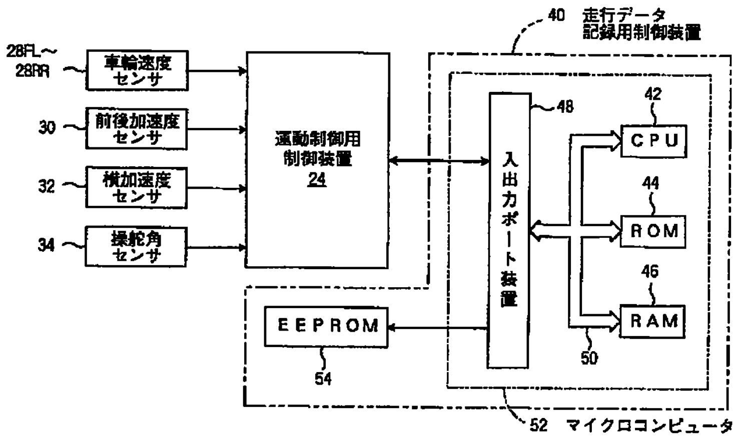
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]




[Drawing 2]

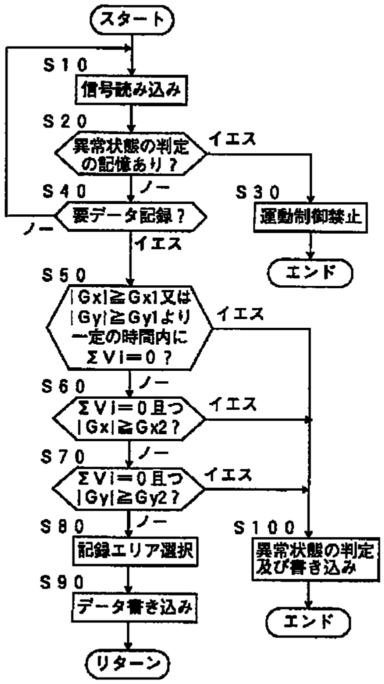



[Drawing 3]

54

| | M1 | M2 | M3 |
|---|---|---|---|
| S1 | ＩＤ番号 | ＩＤ番号 | ＩＤ番号 |
| S2 | 車輪速度 Vfr | 車輪速度 Vfr | 車輪速度 Vfr |
| | 車輪速度 Vfl | 車輪速度 Vfl | 車輪速度 Vfl |
| | 車輪速度 Vrr | 車輪速度 Vrr | 車輪速度 Vrr |
| | 車輪速度 Vrl | 車輪速度 Vrl | 車輪速度 Vrl |
| | 前後加速度 Gx | 前後加速度 Gx | 前後加速度 Gx |
| | 横加速度 Gy | 横加速度 Gy | 横加速度 Gy |
| | 操舵角 $\theta$ | 操舵角 $\theta$ | 操舵角 $\theta$ |
| | スリップ率 Rsfr | スリップ率 Rsfr | スリップ率 Rsfr |
| | スリップ率 Rsfl | スリップ率 Rsfl | スリップ率 Rsfl |
| | スリップ率 Rsrr | スリップ率 Rsrr | スリップ率 Rsrr |
| | スリップ率 Rsrl | スリップ率 Rsrl | スリップ率 Rsrl |
| S3 | 判定結果 | 判定結果 | 判定結果 |

[Drawing 4]

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[Translation done.]

# System enabling transfer of mileage and other vehicle data as registered, processed and stored by the system, to telecommunications and data networks outside the vehicle

**Publication number:** NL1016618 (A1)
**Publication date:** 2002-05-17
**Inventor(s):** KUITENBROUWER TIBOR BENEDIKTUS [NL] +
**Applicant(s):** SYSTEMATIC DESIGN V O F [NL] +
**Classification:**
**- international:** ***G07C5/00; G07C5/08;*** **G07C5/00**; (IPC1-7): G01C22/00; G06F17/60; G07C5/08
**- European:** G07C5/00T; G07C5/08R2
**Application number:** NL20001016618D 20001116
**Priority number(s):** NL20001016618 20001116

**Also published as:**
EP1207499 (A2)
EP1207499 (A3)
NL1016618 (C2)

Abstract not available for NL 1016618 (A1)
Abstract of corresponding document: **EP 1207499 (A2)**

System to be used in wheeled vehicles, for registration, processing and storage of data with respect to trips of the vehicle, comprising means for data transfer between the system according to the present invention and suitable electronic devices in said vehicle or in the proximity of said vehicle, characterised by the fact that the system according to the present invention comprises means to control at least one other electronic device in such manner that through said electronic device, trip data as registered, processed and stored by the system according to the present invention, is transferred to one or more telecommunications and/or datanetworks outside the vehicle.

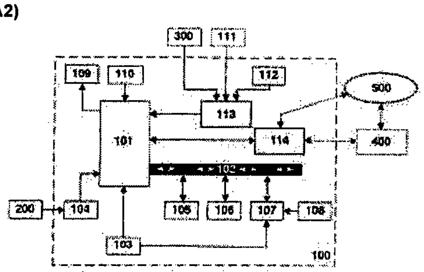

Fig. 1

(19) Bureau voor de Industriële Eigendom Nederland

(11) **1016618**

(12) C **OCTROOI**[20]

(21) Aanvrage om octrooi: **1016618**

(22) Ingediend: **16.11.2000**

(51) Int.Cl.⁷
**G07C5/08,** G01C22/00, G06F17/60

(41) Ingeschreven:
**17.05.2002 I.E. 2002/07**

(47) Dagtekening:
**27.01.2004**

(45) Uitgegeven:
**01.04.2004 I.E. 2004/04**

(73) Octrooihouder(s):
**Systematic Design V.o.f. te Delft.**

(72) Uitvinder(s):
**Tibor Benediktus Stanislas Sebastiaan Kuitenbrouwer te Amsterdam**

(74) Gemachtigde:
**Geen**

(54) **Inrichting welke het mogelijk maakt om door de inrichting geregistreerde, bewerkte en opgeslagen ritgegevens van een voertuig over te dragen naar telecommunicatie- en/of datanetwerken buiten het voertuig.**


(57) Inrichting bestemd voor gebruik in een voertuig, voor het registreren, bewerken en opslaan van gegevens met betrekking tot ritten van dat voertuig, omvattende voorzieningen voor gegevensoverdracht tussen de inrichting en daarvoor geschikte elektronische systemen in het voertuig en/of in de nabijheid van het voertuig, waarbij de inrichting volgens de uitvinding voorzieningen omvat om ten minste één ander elektronisch systeem in het voertuig of in de directe nabijheid van het voertuig, zodanig aan te sturen, dat via dit systeem de door de inrichting geregistreerde, bewerkte en opgeslagen ritgegevens worden overgedragen naar één of meerdere telecommunicatie- en/of datanetwerken buiten het voertuig.


NL C 1016618

De inhoud van dit octrooi komt overeen met de oorspronkelijk ingediende beschrijving met conclusie(s) en eventuele tekeningen.

**INRICHTING WELKE HET MOGELIJK MAAKT OM DOOR DE INRICHTING GEREGISTREERDE, BEWERKTE EN OPGESLAGEN RITGEGEVENS VAN EEN VOERTUIG OVER TE DRAGEN NAAR TELECOMMUNICATIE- EN/OF DATANETWERKEN BUITEN HET VOERTUIG**

{VERSIE 6 - 15-11-'00}

De uitvinding heeft betrekking op een inrichting voor gebruik in voertuigen, die het mogelijk maakt om gegevens met betrekking tot een rit van het voertuig, zoals een ritnummer, datum en tijdstip van het begin van een voertuigrit, datum en tijdstip van het einde van een voertuigrit, de kilometerstand aan het begin en aan het einde van een voertuigrit, en een aanduiding van de hoedanigheid van de rit, bijvoorbeeld privé, zakelijk, woon-werk, te registreren, te bewerken en over te dragen naar één of meerdere telecommunicatie- en/of datanetwerken buiten het voertuig.

Van oudsher is in automobielen en andere (motor)-voertuigen een inrichting aanwezig voor registratie van de door het voertuig afgelegde afstand. Ook heden ten dage zijn veel van deze "kilometertellers" nog gebaseerd op een mechanische conversie van wiel- of as-omwentelingen naar afgelegde afstand, welke wordt weergegeven via een mechanisch of elektronisch telwerk in het dashboard van het voertuig. Naast een mogelijkheid voor het registreren van de totale afstand die het voertuig heeft afgelegd sinds zijn ingebruikname, is vaak ook een mogelijkheid aanwezig om de per rit afgelegde afstand te registreren via een zogenaamde "dagteller", welke aan het begin van een rit op nul kan worden gesteld. Bij genoemde conversie van het aantal wiel- of as-omwentelingen naar afgelegde afstand, kunnen afwijkingen optreden in de orde van grootte van vijf procent.

Tegenwoordig vindt de genoemde afstandsmeting

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steeds vaker via elektro-mechanische opnemers plaats, teneinde de afstandsinformatie in elektronische vorm te kunnen verwerken in de regel- en besturingselektronica, die in de hedendaagse voertuigen een steeds belangrijkere plaats inneemt. De wiel- of as-omwentelingen worden daarbij weergegeven in de vorm van elektrische pulsen, waarbij het aantal pulsen per periode is gerelateerd aan de afstand die het voertuig tijdens deze periode heeft afgelegd. Hierbij dient te worden opgemerkt, dat de relatie tussen aantal pulsen per periode en afstand, afhankelijk is van voertuigparameters zoals de wieldiameter.

Een nauwkeurige registratie van de afstand die een voertuig aflegt, is om velerlei redenen van belang. Meer traditionele zaken waarbij deze registratie een rol speelt, zijn bijvoorbeeld het bepalen van de waarde van een voertuig bij aan- en verkoop, het bepalen van de tijdstippen waarop periodiek onderhoud aan het voertuig dient plaats te vinden, vaststelling van de huurprijs, bepaling van de uit te betalen kilometervergoeding bij zakelijk gebruik van een privé-voertuig, bepaling van de ritprijs bij bijvoorbeeld taxivervoer, of het registreren van het brandstofgebruik per kilometer.

Tegenwoordig is het economisch belang van (auto)-mobiliteit zeer groot. Daarbij beschikken veel bedrijven over een geleasd wagenpark, waarbij de eigendom, en meestal ook het beheer en het onderhoud van de voertuigen bij de leasemaatschappijen berust. Deze laatsten kunnen echter niet continu beschikken over actuele informatie met betrekking tot de voertuigen, zoals de actuele kilometerstand, om bijvoorbeeld te bepalen of er periodiek onderhoud aan het voertuig dient te worden gepleegd, of om te bepalen of het leasecontract dient te worden herzien, omdat er met het voertuig aanzienlijk meer kilometers worden afgelegd dan tevoren was begroot. De duurdere typen auto's beschikken incidenteel over uitgebreide sensor- en regelinrichtingen, met bijvoorbeeld de mogelijkheid om langs telecommunicatieve weg een melding naar de onderhoudsdienst te zenden met betrekking tot (op handen zijnde) storingen in de voertuigsystemen. Deze inrichtingen zijn echter kostbaar, waardoor toepassing hiervan voor het gemiddelde bedrijfswagenpark economisch niet haalbaar is. Bovendien zijn dergelijke inrichtingen in de meeste gevallen specifiek voor het betreffende merk, of zelfs voor het betreffende type auto. Flexibele toepassing hiervan in voertuigen van verschillend merk en/of type is hierdoor vrijwel uitgesloten.

In het octrooidocument US 5 673 018 wordt een relatief eenvoudige, passieve transponderinrichting beschreven, die wordt aangebracht op een wiel van een voertuig. Door middel van een sensor worden de wiel-omwentelingen geregistreerd en geconverteerd naar afgelegde afstand. De afstandsinformatie wordt opgeslagen in een elektronisch geheugen in de inrichting. Wanneer de transponder nu in het elektro-magnetische veld van een speciale zender/ontvanger terechtkomt, die bijvoorbeeld bij de ingang van een garage of een tankstation is geplaatst, zendt de transponder een signaal uit, bestaande uit een elektronische representatie van de afstandsinformatie, welke vervolgens wordt geregistreerd door de ontvanger. Deze inrichting heeft het nadeel dat de afstandsinformatie alleen op bepaalde locaties kan worden overgedragen. Verder is bij montage van de elektronica op bewegende delen aan de buitenzijde van het voertuig, in dit geval een wiel, de kans op beschadiging, en daardoor op storingen, groot.

Verder zijn inrichtingen bekend, waarbij voertuiggegevens van verschillende aard, door middel van infrarood licht worden overgedragen naar ontvangers buiten het voertuig. Ook hier geldt echter dat de gegevens alleen op bepaalde locaties kunnen worden overgedragen, en tevens dat er tussen de zender in het voertuig en de ontvanger buiten het voertuig een zichtverbinding noodzakelijk is.

Registratie van door een voertuig afgelegde afstand vervult verder een belangrijke functie, wanneer een onderscheid dient te worden gemaakt in zakelijk en privé afgelegde kilometers. Bij de meeste bedrijven met een wagenpark dat hoofdzakelijk bestaat uit geleasde voertuigen, is dat het geval. De belastingdienst past namelijk een fiscale bijtelling toe, wanneer het aantal met het voertuig afgelegde privé-kilometers een bepaalde drempel overstijgt. Om deze bijtelling te vermijden, dient een "sluitende" kilometerregistratie te worden gevoerd. Dit houdt tevens in, dat de als zakelijk opgegeven kilometers, aantoonbaar moeten kunnen worden toegerekend aan zakelijke activiteiten. Ter onderbouwing hiervan dient, naast de kilometerregistratie, tevens een nauwkeurige activiteitenregistratie plaats te vinden. Het handmatig bijhouden van beide genoemde registraties door bijvoorbeeld per rit de kilometerteller in het voertuig af te lezen, de tijdens de rit afgelegde afstand te bepalen en deze te noteren tezamen met de daarbij behorende, zakelijke activiteit, leidt in veel gevallen tot fouten en onnauwkeurigheden, en dientengevolge tot aanzienlijke, onnodige kosten.

In de loop der jaren zijn talloze systemen ontwikkeld, om genoemde problemen te verhelpen door automatisering van zowel de kilometer- als de activiteitenregistratie. Het octrooidocument US 5 541 858 beschrijft een inrichting, waarbij een draagbare eenheid, voorzien van onder andere een microprocessor, een RAM-geheugen, een display en een toetsenbord, in een houder in het voertuig kan worden geplaatst. Het systeem maakt gebruik van het elektronische signaal voor de kilometerteller, dat in de meeste voertuigen van vrij recent bouwjaar, reeds standaard aanwezig is. Daarnaast biedt het systeem aan de gebruiker de mogelijkheid om zakelijke activiteiten te registreren door hieraan numerieke codes toe te kennen. Aan elke ritregistratie kan nu een activiteitsregistratie, bijvoorbeeld het bezoek aan een bepaalde cliënt, worden toegewezen door het invoeren van de corresponderende code, waarna de informatie in de draagbare eenheid wordt opgeslagen. In de draagbare eenheid is verder een stekkeraansluiting aanwezig, via welke de geregistreerde informatie later naar bijvoorbeeld een personal computer kan worden overgedragen voor verdere verwerking.

Het document US 6 064 929 beschrijft een inrichting, waarbij de eerder genoemde, draagbare eenheid wordt gevormd door een draagbare personal computer (notebook, laptop), voorzien van software voor uitgebreide activiteitenregistratie. Het in het voertuig beschikbare elektronische signaal voor de kilometerteller, wordt via een kabel toegevoerd aan de computer en hierin gecombineerd met een tijds- en activiteitenregistratie.

Belangrijke nadelen van de twee laatstgenoemde, bekende inrichtingen, zijn dat de draagbare eenheid, respectievelijk de personal computer, persoonsgebonden zijn. Het is immers de verantwoording van de gebruiker om het apparaat naar bijvoorbeeld een kantoor te verplaatsen, alwaar de opgeslagen informatie kan worden uitgelezen om in bijvoorbeeld de bedrijfsadministratie te worden verwerkt. Het elektronische signaal voor de kilometerteller is echter afhankelijk van voertuiggebonden factoren, zoals bijvoorbeeld de wieldiameter. Bij gebruik van de genoemde systemen in een ander voertuig dan bij de voorafgaande registratie, dient hierdoor telkens vóór de eerste rit in dit volgende voertuig een kalibratie van de afstandsmeting te worden uitgevoerd. Dit houdt meestal in dat een gebruiker ten minste twee maal de stand van het telwerk van de kilometerteller van het voertuig dient in te voeren in de inrichting, hetgeen tot fouten en onnauwkeurigheden kan leiden. Bovendien brengt het registreren van bijvoorbeeld kilometerstanden met behulp van een draagbare, persoonsgebonden eenheid, zoals een draagbare computer, het nadeel met zich mee dat, wanneer het betreffende voertuig tussentijds door een andere persoon zou worden gebruikt, die niet beschikt over dezelfde draagbare eenheid, de kilometerregistratie niet meer "sluitend" is. De laatst geregistreerde kilometerstand in eerstgenoemde eenheid komt dan immers niet meer overeen met de actuele kilometerstand. Voorafgaande aan een volgende registratie met behulp van genoemde draagbare computer, dient een gebruiker dan ook wederom handmatig de actuele kilometerstand in het apparaat in te voeren, met de eerder genoemde nadelen tot gevolg.

De inrichting volgens de onderhavige uitvinding beoogt een oplossing te verschaffen voor de bezwaren van bekende inrichtingen op dit gebied. Hiertoe wordt een inrichting voorgesteld, bestemd voor gebruik in voertuigen, voor het registreren, bewerken en opslaan van gegevens met betrekking tot de ritten van dat voertuig. De inrichting omvat voorzieningen voor gegevensoverdracht tussen de inrichting en daarvoor geschikte, elektronische systemen in het voertuig en/of in de nabijheid van het voertuig. Onder deze elektronische systemen worden bijvoorbeeld mobiele telefoons en draagbare computers (zoals laptops, notebooks, palmtops, personal digital assistants) verstaan, die tegenwoordig vrij algemeen behoren tot de uitrusting van zakelijke berijders van voertuigen en die als zodanig, ten minste gedurende werkuren, in genoemde voertuigen aanwezig zijn.

De inrichting volgens de uitvinding kenmerkt zich door het feit, dat zij voorzieningen omvat om dergelijke elektronische systemen in het voertuig, of in de nabijheid van het voertuig, zodanig aan te sturen, dat via deze systemen de door de inrichting geregistreerde, bewerkte en opgeslagen gegevens met betrekking tot ritten van het voertuig, worden overgedragen naar één of meerdere telecommunicatie- en/of datanetwerken buiten het voertuig.

Hierdoor verkrijgt een gebruiker een ruime mate van vrijheid bij de keuze van het telecommunicatie- en/of datanetwerk via welke de gegevensoverdracht zal plaatsvinden, bijvoorbeeld een GSM-netwerk, satellietnetwerken, het Nederlandse Traxys-netwerk of het toekomstige UMTS (Universal Mobile Telecommunications System), en tevens bij de keuze van de vorm, waarin de communicatie zal plaatsvinden, bijvoorbeeld in de vorm van S.M.S.- (Short Message Service), Electronic mail berichten, of faxberichten. Een belangrijk voordeel van het gebruik van deze netwerken is dat het voertuig zich niet naar een specifieke locatie dient te begeven om de genoemde ritgegevens over te dragen. Elektronische systemen, zoals mobiele telefoons en draagbare computers, zijn algemeen beschikbaar en relatief goedkoop. Voor de overdracht van gegevens tussen de inrichting volgens de uitvinding en genoemde elektronische systemen, kan de inrichting gebruik maken van een scala aan communicatiestandaarden, zoals IrDA (Infrared Data Association) voor communicatie via infrarood licht, en Bluetooth voor radiocommunicatie over korte afstanden, welke door fabrikanten van bijvoorbeeld mobiele telefoons en draagbare computers in ruime mate worden ondersteund.

Systemen als de genoemde draagbare computers bieden daarbij flexibele mogelijkheden voor verdere verwerking van de ritgegevens ter plaatse, voor het toevoegen van extra gegevens en voor bijvoorbeeld het uitprinten van gegevens via een printer in het voertuig.

De inrichting volgens de uitvinding kan ook zelf voorzieningen omvatten voor de directe overdracht van door de inrichting geregistreerde, verwerkte en opgeslagen ritgegevens naar één of meerdere telecommunicatie- en/of datanetwerken buiten het voertuig. Hierbij kan bijvoorbeeld worden gedacht aan een ingebouwde zend/ontvangvoorziening voor het GSM-netwerk. Deze uitvoeringsvariant van de inrichting biedt voordelen wanneer er weinig interactie tussen het systeem volgens de uitvinding en een gebruiker van het voertuig nodig c.q. gewenst is. Dit kan bijvoorbeeld het geval zijn wanneer de functie van de inrichting volgens de uitvinding beperkt is tot het periodiek verzenden van ritgegevens naar bijvoorbeeld de beheerder van het wagenpark of naar een onderhoudsdienst. De voorzieningen voor gegevensoverdracht tussen de inrichting volgens de uitvinding en elektronische systemen in het voertuig, of in de nabijheid van het voertuig, zijn dan bijvoorbeeld slechts toegankelijk voor een bevoegde onderhoudsmedewerker, die voertuigspecifieke gegevens in het systeem moet invoeren of corrigeren. Voor deze invoer of correctie kan men dan bijvoorbeeld denken aan het gebruik van een infrarood afstandsbediening.

De door de inrichting volgens de uitvinding geregistreerde, bewerkte en opgeslagen ritgegevens omvatten tenminste een ritnummer, datum en tijdstip van het begin van een voertuigrit, datum en tijdstip van het einde van een voertuigrit, de kilometerstand aan het begin en aan het einde van een voertuigrit, en een aanduiding van het rittype. Onder de aanduiding van het rittype kan men bijvoorbeeld privé, zakelijk of woon-werk verstaan.

Via een elektronisch systeem in het voertuig, of in de nabijheid van het voertuig, dat geschikt is en voorzieningen omvat voor gegevensoverdracht tussen de inrichting volgens de uitvinding en bedoeld elektronisch systeem, kunnen aan de in de inrichting opgeslagen gegevens per voertuigrit, extra gegevens worden toegevoegd. Men kan hierbij denken aan gegevens omtrent de zakelijke activiteit waarmee de betreffende rit verband houdt, zoals een bezoek aan een bepaalde cliënt. Dergelijke gegevens kunnen worden toegevoegd via bijvoorbeeld een draagbare computer (laptops, notebooks, palmtops, personal digital assistants etc.). Op deze wijze kan een consistente combinatie van kilometerregistratie en activiteitenregistratie worden bewerkstelligd, hetgeen aanzienlijke fiscale voordelen kan opleveren. Verder kunnen genoemde extra gegevens bijvoorbeeld bestaan uit de locatie van het voertuig aan het begin en het einde van een rit, geleverd door bijvoorbeeld een in het voertuig aanwezig G.P.S.-systeem (Global Positioning System). Genoemde locatie van het voertuig zou eveneens kunnen worden bepaald door, bijvoorbeeld met behulp van een mobiele telefoon, automatisch te detecteren in welke cel van een cellulair netwerk voor mobiele communicatie het voertuig zich bevindt, en vervolgens de geografische locatie van deze cel te gebruiken als benadering van de locatie van genoemd voertuig. Daarnaast zouden extra gegevens aan de ritgegevens kunnen worden toegevoegd in de vorm van een elektronische representatie van gesproken woord. Hiervoor zou gebruik kunnen worden gemaakt van bijvoorbeeld een in de auto ingebouwde microfoon-installatie voor een mobiele telefoon, of van een microfoon/hoofdtelefoonset. Beiden worden tegenwoordig veelvuldig gebruikt. Hiermee verschaft de inrichting volgens de uitvinding grote flexibiliteit in het gebruik voor verschillende toepassingen, naast een eenvoudige wijze van gebruik.

Voor het verschaffen van een basisfunctionaliteit volgens de uitvinding, omvat de inrichting ten minste de volgende delen:

- een centrale besturings- en verwerkingseenheid, zoals een microprocessor, voorzien van een geschikte programmering voor de beoogde werking van de inrichting;
- een elektronisch geheugen voor opslag van voertuigspecifieke gegevens, zoals een voertuigidentificatiecode en gegevens voor kalibratie van het elektronische signaal voor de kilometerteller in het voertuig.
- een elektronisch geheugen voor opslag van door de inrichting geregistreerde en bewerkte ritgegevens.
- elektronische voorzieningen voor het bijhouden van datum en tijd.
- voorzieningen voor het detecteren of de contactschakelaar van het voertuig wordt bediend;
- voorzieningen voor het registreren van het in het voertuig aanwezige elektronische signaal voor de kilometerteller.
- een aansluiting via welke datacommunicatie via een kabel kan plaatsvinden met elektronische systemen buiten de inrichting;
- een uitvoervoorziening, geschikt voor het afgeven van een optische en/of akoestische waarschuwing aan een gebruiker van de inrichting.

De bovengenoemde delen kunnen alle worden gerealiseerd met behulp van algemeen verkrijgbare, relatief goedkope componenten.

Het genoemde elektronische signaal voor de kilometerteller kan met voordeel worden betrokken via een gestandaardiseerde stekkeraansluiting, welke in de meeste automobielen van recent bouwjaar aanwezig is ten behoeve van aansluiting van onder andere een autoradio. Door gebruik te maken van dit signaal, heeft men slechts rekening te houden met eenvoudige voertuigparameters, zoals de wieldiameter, en niet met complexe elektronische regel- en besturingssystemen in het voertuig, die bovendien vrijwel altijd merk- en/of type-specifiek zijn. Dit heeft het voordeel dat de inrichting volgens de uitvinding op relatief eenvoudige wijze kan worden gerealiseerd, ingebouwd en gekalibreerd.

Via de genoemde, gestandaardiseerde stekkeraansluiting, kan men tevens op eenvoudige wijze detecteren of de contactschakelaar van het voertuig wordt bediend, door detectie van significante overgangen in de elektrische spanning op de voedingsgeleider in genoemde stekkeraansluiting.

Genoemde uitvoervoorziening, geschikt voor het afgeven van een optische en/of akoestische waarschuwing aan een gebruiker van de inrichting, geeft bij voorkeur een waarschuwing aan een gebruiker, wanneer de beschikbare geheugencapaciteit voor opslag van ritgegevens tot beneden een bepaalde drempel is afgenomen. Laatstgenoemde situatie zou bijvoorbeeld kunnen optreden, wanneer wegens een storing in het elektronische systeem in het voertuig of in de nabijheid van het voertuig, via welke de inrichting volgens de uitvinding gegevens overdraagt naar een telecommunicatie- of datanetwerk buiten het voertuig, genoemde gegevensoverdracht gedurende een bepaalde periode niet kan plaatsvinden. Genoemde drempel in de geheugencapaciteit dient vanzelfsprekend zodanig te worden gekozen, dat bij normaal gebruik van de inrichting volgens de uitvinding, een gebruiker nog voldoende tijd heeft om technisch advies en ondersteuning in te roepen, alvorens er ritgegevens verloren zouden gaan.

Met voordeel kan de inrichting volgens de uitvinding zodanig zijn uitgevoerd, dat door de inrichting periodiek gegevens omtrent de door het voertuig afgelegde afstand per tijdseenheid worden afgeleid uit het eerder genoemde, elektronische signaal voor de kilometerteller, waarna deze gegevens worden opgeslagen in een elektronisch geheugen in de inrichting. Wanneer nu genoemde gegevens omtrent de door het voertuig afgelegde afstand per tijdseenheid, op zodanige wijze in genoemd elektronisch geheugen worden opgeslagen, waarbij genoemd geheugen een zodanige grootte heeft, dat hierin op elk tijdstip tijdens een voertuigrit de genoemde gegevens aanwezig zijn, voorzover die een direct aan dat tijdstip voorafgaande periode van bepaalde lengte betreffen, zou de inrichting volgens de uitvinding tevens kunnen fungeren als een calamiteitenrecorder, enigszins analoog aan de vluchtdatarecorder, ook wel "black box" genoemd, in vliegtuigen. Op elk tijdstip is namelijk in de inrichting volgens de uitvinding een overzicht aanwezig van de door het voertuig afgelegde afstand per tijdseenheid, geregistreerd over een bepaalde periode voorafgaand aan dat tijdstip. Wanneer de lengte van genoemde tijdseenheid nu wordt gekozen in de orde van grootte van een seconde, vormt de geregistreerde afstand per tijdseenheid een redelijk nauwkeurige maat voor de voertuigsnelheid. Na bijvoorbeeld een ongeval kunnen dergelijke gegevens waardevolle informatie verschaffen over bijvoorbeeld de toedracht en het verloop van het ongeval, zoals bijvoorbeeld de versnellingen en vertragingen van het voertuig.

In het eerder genoemde elektronische geheugen in de inrichting volgens de uitvinding, dat dient voor opslag van voertuigspecifieke gegevens, bevinden zich bijvoorbeeld gegevens voor het kalibreren van de afstandsmeting door de inrichting volgens de uitvinding. De inhoud van genoemd geheugen is daarom van primair belang voor het correct functioneren van de inrichting, en kan daarom met voordeel zodanig worden beveiligd door middel van encryptie van gegevens, dat genoemde gegevens slechts kunnen worden ingevoerd, uitgelezen en beveiligd door een daartoe bevoegde persoon.

Bij voorkeur omvat de inrichting volgens de uitvinding verder een invoervoorziening, die een gebruiker van de inrichting de mogelijkheid biedt om aan te geven of de inrichting de voertuigrit als zakelijk, privé, dan wel als woon-werk verkeer dient te registreren. In een eenvoudige uitvoering zou deze invoervoorziening slechts kunnen bestaan uit een schakelaar met drie standen.

De inrichting volgens de uitvinding kan voorzieningen omvatten voor het detecteren of de tankopening van de brandstoftank van het voertuig geopend of gesloten is. Dit geopend of gesloten zijn van de tankopening geeft een indicatie van de momenten wanneer er kennelijk brandstof wordt getankt. Registratie hiervan kan dienen ter ondersteuning van het voeren van een brandstofadministratie. Een dergelijke administratie wordt vaak gevoerd in aanvulling op de eerder genoemde afstands- en activiteitenregistraties. Leasemaatschappijen bieden vaak zogenaamde brandstofregelingen aan bij lease-auto's. Hierbij wordt dan een chipkaart verstrekt, waarmee de getankte brandstof kan worden afgerekend bij bijvoorbeeld tankstations. Registratie van het geopend of gesloten zijn van de tankopening van het voertuig, kan dan worden gebruikt voor het leggen van een administratief verband tussen een tanksessie van een bepaald voertuig, en een afrekening met de bij het voertuig behorende brandstofchipkaart.

Bij voorkeur omvat de inrichting volgens de uitvinding voorzieningen voor gegevensoverdracht via infrarood licht tussen de inrichting volgens de uitvinding en elektronische systemen in het voertuig en/of in de nabijheid van het voertuig. Hiertoe kan bijvoorbeeld een zender/ ontvanger voor infrarood licht worden aangebracht op een voordelige plaats in het interieur van het voertuig. Veel elektronische systemen, als mobiele telefoons en draagbare computers (zoals laptops, notebooks, palmtops, personal digital assistants), welke tegenwoordig vrij algemeen behoren tot de uitrusting van zakelijke berijders van voertuigen, beschikken namelijk eveneens over voorzieningen voor gegevensoverdracht via infrarood licht. Verder zouden dan voertuigspecifieke gegevens in de inrichting volgens de uitvinding, door bijvoorbeeld een onderhoudsmedewerker eenvoudig kunnen worden ingevoerd of gecorrigeerd via bijvoorbeeld een infrarood afstandsbediening. Eventueel zou genoemde medewerker daarbij het interieur van het voertuig niet eens behoeven te betreden.

De eerder genoemde voorzieningen van de inrichting volgens de uitvinding, dienende voor gegevensoverdracht via infrarood licht, kunnen met voordeel zodanig worden ingericht, dat zij functioneren conform de zogenaamde "IrDA" (Infrared Data Association) communicatiestandaard. Elektronische systemen in het voertuig of in de nabijheid van het voertuig, die men met de inrichting volgens de uitvinding zou willen gebruiken, zoals mobiele telefoons en draagbare computers, bieden vaak al mogelijkheden voor gegevensoverdracht en/of aansturing via genoemde communicatiestandaard.

Gegevensoverdracht tussen elektronische apparatuur, vooral op automatiserings- en communicatiegebied, vindt steeds vaker plaats conform de de-facto communicatiestandaard "Bluetooth" voor radio-communicatie over korte afstanden. Het biedt daarom voordelen wanneer de inrichting volgens de uitvinding zodanige voorzieningen omvat, dat gegevensoverdracht tussen genoemde inrichting en elektronische systemen in het voertuig, of in de nabijheid van het voertuig, kan plaatsvinden conform laatstgenoemde standaard, die wordt ondersteund door grote producenten van automatisering- en communicatie-apparatuur.

De gegevens die door of met behulp van de inrichting volgens de uitvinding worden geregistreerd, zullen vaak dienen voor het nauwkeurig vaststellen van bijvoorbeeld de omvang van het privé-gebruik van een bedrijfsvoertuig, het aantal met een huurauto afgelegde kilometers enz. De financiële gevolgen daarvan komen meestal ten gunste van bijvoorbeeld de eigenaar, verhuurder, leasegever van het voertuig, maar ten laste van de gebruiker. Een dergelijke inrichting zal dus bestand dienen te zijn tegen pogingen tot ongewenste beïnvloeding of sabotage. Met uitzondering van de eerder genoemde in- en uitvoervoorzieningen en de eerder genoemde voorzieningen voor communicatie via infrarood licht, welke zich direct bereikbaar in het passagierscompartiment van een voertuig dienen te bevinden, is het voordelig om de overige delen van de inrichting volgens de uitvinding, zodanig in het voertuig te plaatsen, dat zij daarmee mechanisch vast zijn verbonden, en beschermd tegen onbevoegde toegang en/of beïnvloeding, zowel vanuit het passagierscompartiment van het voertuig, als van buiten het voertuig.

S.M.S. (Short Message Service) berichten zijn databerichten met een eenvoudige structuur, die efficiënt en goedkoop kunnen worden uitgewisseld via GSM (Global System for Mobile Communications) netwerken. Door de inrichting volgens de uitvinding geregistreerde, bewerkte en opgeslagen ritgegevens en eventuele extra toegevoegde gegevens, kunnen daarom doelmatig in de vorm van S.M.S.-berichten worden overgedragen naar GSM- of andere geschikte netwerken buiten het voertuig.

Verder kunnen de door de inrichting volgens de uitvinding geregistreerde, bewerkte en opgeslagen ritgegevens en eventuele extra toegevoegde gegevens, worden overgedragen naar geschikte telecommunicatie- en/of datanetwerken buiten het voertuig, in de vorm van electronic mail of faxberichten.

De inrichting volgens de uitvinding zal in het navolgende nader worden toegelicht aan de hand van een in de figuren schematisch weergegeven uitvoeringsvariant. Hierbij dient te worden opgemerkt dat de weergegeven uitvoeringsvariant slechts is gekozen ter illustratie, doch geenszins een beperking inhoudt van het toepassingsgebied van de uitvinding.

Figuur 1 toont schematisch een uitvoeringsvariant van de inrichting volgens de uitvinding.

Figuur 2 toont een datastructuur voor ritgegevens, welke met voordeel in de inrichting volgens de uitvinding kan worden toegepast.

Figuur 3 toont de datastructuur van een S.M.S. (Short Message Service) bericht.

Figuur 4 toont de datastructuur van de header (="kop") van een S.M.S. bericht.

In figuur 1 is een uitvoeringsvariant 100 van de inrichting volgens de uitvinding weergegeven. Deze omvat een centrale verwerkingseenheid 101, welke bij voorkeur wordt gevormd door een microcontroller, voorzien van RAM-geheugen (niet weergegeven) voor opslag van de programma-instructies voor de microcontroller en tussentijdse opslag van gegevens. De microcontroller is onder andere verbonden met een bussysteem 102 voor uitwisseling van gegevens met andere delen van de inrichting. Voor een dergelijke bussysteem zijn vele, gestandaardiseerde uitvoeringen bekend. Genoemd bussysteem 102 verbindt de microcontroller 101 met een eerste elektronisch geheugen 105 voor opslag van voertuigspecifieke gegevens, zoals kalibratiegegevens voor de kilometertelling en voertuigidentificatiegegevens, en daarnaast met een tweede elektronisch geheugen 106 voor opslag van ritgegevens en daaraan toegevoegde, extra gegevens, en met een zogenaamde "Real-time-clock" (RTC) 107, een elektronische voorziening welke de actuele datum en tijd bijhoudt. Het elektronische geheugen 106 is zodanig ingericht, dat wanneer dit geheugen door omstandigheden vol raakt, telkens de oudste opgeslagen ritregistratie verloren gaat, wanneer er een nieuwe registratie wordt opgeslagen. De RTC 107 kan worden ingesteld door de microcontroller 101 en is voorzien van een noodvoeding 108, bijvoorbeeld een (oplaadbare) batterij, welke ervoor zorgt dat de actuele datum en tijd ook worden bijgehouden wanneer er een onderbreking van de elektrische voeding van de inrichting volgens de uitvinding optreedt. Genoemde elektronische geheugens 105 en 106 zijn in figuur 1 fysiek gescheiden weergegeven, doch kunnen in de praktijk, samen met het RAM-geheugen van de microcontroller, in één en dezelfde elektronische component zijn geïntegreerd. Het handhaven van een fysieke scheiding tussen de genoemde geheugens kan echter wenselijk zijn, wanneer men bijvoorbeeld het geheugen 105 voor voertuigspecifieke gegevens, extra zou willen beschermen tegen ongewenste beïnvloeding van buitenaf. Laatstgenoemd geheugen bevat namelijk gegevens, die bij verminking de correcte werking van de inrichting volgens de uitvinding negatief zouden kunnen beïnvloeden. In het algemeen zullen genoemde voertuigspecifieke gegevens bij de ingebruikstelling van het voertuig worden ingevoerd door een daartoe bevoegde partij, bijvoorbeeld de beheerder van het wagenpark. Deze gegevens kunnen voor extra beveiliging bijvoorbeeld versleuteld in geheugen 105 worden opgeslagen. De verschillende elektronische geheugens kunnen met voordeel worden uitgevoerd als EE-PROM (Electrical Erasable Programmable Read Only Memory). In dat geval blijft namelijk de inhoud van genoemde geheugens behouden wanneer er een eventuele onderbreking in de voeding van de inrichting volgens de uitvinding optreedt. Zowel de microcontroller 101, als de RTC 107, worden door een oscillator 103 voorzien van de benodigde klokpulsen. Genoemde oscillator 103 wordt bij voorkeur uitgevoerd als een quartzkristal-oscillator. De inrichting volgens de uitvinding betrekt de benodigde elektrische voeding bij voorkeur uit het elektrische voedingssysteem 200 van het voertuig waarin de inrichting is ingebouwd. Deze voeding kan bijvoorbeeld worden betrokken via de ISO (International Standardization Organisation) gestandaardiseerde stekkeraansluiting, welke in de meeste automobielen van recent bouwjaar standaard aanwezig is voor aansluiting van bijvoorbeeld een autoradio. De inrichting volgens de uitvinding omvat verder een voedingsdeel 104, welke de elektrische voeding uit het voedingssysteem van het voertuig zodanig aanpast dat deze geschikt is voor de elektronische componenten waaruit de inrichting volgens de uitvinding is opgebouwd. Het voedingsdeel 104 kan verder bijvoorbeeld voorzieningen omvatten voor energiebesparing wanneer de inrichting volgens de uitvinding minder frequent wordt gebruikt. Voor het afgeven van een optische en/of akoestische waarschuwing aan een gebruiker van de inrichting volgens de uitvinding, kan de inrichting een uitvoervoorziening 109 omvatten. Deze uitvoervoorziening zou kunnen bestaan uit een display, één of meerdere diode-lampjes (LED's), een zoemer etc. of combinaties daarvan. Via genoemde uitvoervoorziening kan bijvoorbeeld informatie aan een gebruiker worden gegeven over de bedrijfstoestand van de inrichting, of een waarschuwing wanneer de opslagcapaciteit van het elektronische geheugen 106 voor opslag van ritgegevens, tot op zeker hoogte is benut. De inrichting volgens de uitvinding omvat verder een invoervoorziening 110, welke bij voorkeur eenvoudig is uitgevoerd, bijvoorbeeld in de vorm van een drie-standenschakelaar waarmee een gebruiker kenbaar kan maken of een voertuigrit dient te worden geregistreerd als zakelijk, privé of woon-werkverkeer, maar welke ook kan bestaan uit bijvoorbeeld een toetsenbord. In de meeste automobielen van recent bouwjaar wordt een elektronisch pulssignaal 300 gegenereerd, dat een maat vormt voor de door het voertuig afgelegde afstand. Een dergelijk pulssignaal 300 kan veelal worden betrokken via de eerder genoemde ISO-gestandaardiseerde stekkeraansluiting, welke in de meeste automobielen van recent bouwjaar standaard aanwezig is voor aansluiting van bijvoorbeeld een autoradio. De inrichting volgens de uitvinding omvat verder een voorziening 111, die het mogelijk maakt om te detecteren of de contactschakelaar van het voertuig wordt bediend, en voorzieningen 112, die het mogelijk maken om te detecteren of de tankopening van de brandstoftank van het voertuig geopend of gesloten is. Het genoemde detecteren of de contactschakelaar van het voertuig wordt bediend, kan bijvoorbeeld geschieden door detectie van significante spanningsovergangen op de voedingsgeleider van de eerder genoemde ISO-gestandaardiseerde stekkeraansluiting, welke in de meeste automobielen van recent bouwjaar standaard aanwezig is voor aansluiting van bijvoorbeeld een autoradio. De voorziening 113 brengt de door de voorzieningen 111 en 112 geleverde signalen en het pulssignaal 300 in een zodanige vorm, dat deze verder kunnen worden verwerkt door de microcontroller 101. Referentie 114 verwijst naar het communicatiedeel van de inrichting volgens de uitvinding. Dit communicatiedeel omvat voorzieningen voor het overdragen van gegevens tussen de inrichting volgens de uitvinding en elektronische systemen 400 in het voertuig of in de nabijheid van het voertuig. Deze elektronische systemen 400 kunnen bijvoorbeeld bestaan uit een mobiele telefoon en/of een draagbare computer (zoals laptop, notebook, palmtop, personal digital assistant). De genoemde voorzieningen voor gegevensoverdracht kunnen bijvoorbeeld bestaan uit een eenvoudige kabel, maar ook uit een zend/-ontvanginrichting voor infrarood licht of voor radiocommunicatie over korte afstand. De inrichting volgens de uitvinding kan via het communicatiedeel 114 de genoemde elektronische systemen 400 zodanig aansturen, dat laatstgenoemde systemen gegevens, welke door de inrichting volgens de uitvinding worden aangeleverd, overdragen naar telecommunicatie- en/of datanetwerken buiten het voertuig. Op deze wijze kunnen ritgegevens en eventuele extra gegevens bijvoorbeeld in de vorm van S.M.S. (Short Message Service) berichten, of electronic mail berichten, via een mobiele telefoon worden overgedragen naar bijvoorbeeld een leasemaatschappij of onderhoudsdienst. De gegevensoverdracht tussen het communicatiedeel 114 van de inrichting volgens de uitvinding en genoemde mobiele telefoon kan dan bijvoorbeeld plaatsvinden via een kabel of via infrarood licht, bijvoorbeeld conform de IrDA (Infrared Data Association) communicatiestandaard. Wanneer de inrichting volgens de uitvinding volledig autonoom dient te functioneren en interactie met een gebruiker, bijvoorbeeld voor het plaatsen van een mobiele telefoon, of het aanschakelen van een draagbare computer, ongewenst is, kan het communicatiedeel 114 ook zelf voorzieningen als bijvoorbeeld een zend/ontvang-inrichting omvatten, voor directe overdracht van gegevens naar bijvoorbeeld een netwerk voor mobiele telecommunicatie. Via genoemde elektronische systemen 400 kunnen verder aan de ritgegevens die zijn opgeslagen in geheugen 106, extra gegevens worden toegevoegd. Via een draagbare computer kunnen bijvoorbeeld gegevens betreffende de zakelijke activiteit waaraan de betreffende rit dient te worden toegerekend, worden toegevoegd. Via een GPS (Global Positioning System) systeem kunnen gegevens betreffende de locatie van het voertuig aan het begin en aan het einde van de rit worden toegevoegd, en via het microfoonsysteem van een mobiele telefoon kan een gesproken mededeling worden toegevoegd. Tevens zou een elektronisch systeem 400 kunnen bestaan uit een infrarood afstandsbediening, via welke een daartoe bevoegde persoon de voertuigspecifieke gegevens in het elektronische geheugen 105 zou kunnen invoeren, uitlezen of corrigeren. De inrichting volgens de uitvinding biedt een gebruiker aldus grote vrijheid en flexibiliteit in de mate van gebruikersinteractie en keuze voor communicatiemedia. Door gebruik te maken van gestandaardiseerde wijzen van gegevensoverdracht kan de functionaliteit eenvoudig worden uitgebreid met behulp van bijvoorbeeld GPS-systemen, welke tegenwoordig steeds vaker in voertuigen aanwezig zijn. Verder kunnen alle genoemde delen van de inrichting volgens de uitvinding worden gerealiseerd met behulp van algemeen verkrijgbare standaardcomponenten, en maakt de inrichting gebruik van voorzieningen die tegenwoordig in de meeste voertuigen standaard beschikbaar zijn.

Ritgegevens en eventuele extra gegevens worden bij voorkeur in het elektronische geheugen 106 opgeslagen volgens de datastructuur weergegeven in figuur 2. De inrichting volgens de uitvinding functioneert in principe continu, hoewel het eerder genoemde voedingsdeel 104 voorzieningen kan omvatten om de inrichting bij gering gebruik geheel of gedeeltelijk uit te schakelen. Het detecteren van bepaalde gebeurtenissen, in het navolgende aangeduid als "registratiegebeurtenissen", hebben echter tot gevolg dat de inrichting volgens de uitvinding in ieder geval automatisch in een bedrijfstoestand wordt gebracht, die geschikt is om een dergelijke gebeurtenis te registreren. In het eenvoudigste geval bestaat een registratiegebeurtenis uit het bedienen van de contactschakelaar van het voertuig, ongeacht of hierdoor tevens de motor wordt gestart of gestopt, en uit het openen of sluiten van de tankopening van de brandstoftank van het voertuig. Beide registratiegebeurtenissen hebben tot gevolg dat er een ritregistratie plaatsvindt, welke conform de datastructuur van figuur 2 in het geheugen 106 wordt opgeslagen. Elke basis-ritregistratie bestaat daarbij uit een datablok ter grootte van 20 bytes (8 bits per byte). De eerste twee bytes RN van genoemd datablok bevatten een ritnummer. Ritnummers worden opeenvolgend toegekend bij het optreden van een registratiegebeurtenis, bijvoorbeeld het bedienen van de contactschakelaar of het openen van de tankopening van de brandstoftank van het voertuig. Van de real-time-clock 107 ontvangt de microcontroller 101 de actuele datum en tijd van het begin van de registratiegebeurtenis en voegt deze toe aan de ritregistratie, in de vorm van de vier bytes DT1. In de drie bytes KM1 wordt de stand van de kilometertelling aan het begin van een rit opgeslagen. Bij ingebruikstelling van de inrichting wordt de initiële kilometerstand door een daartoe bevoegde persoon in het geheugen 105 ingevoerd. Op basis van de in hetzelfde geheugen 105 ingevoerde kalibratiegegevens, wordt het pulssignaal 300, dat tijdens beweging van het voertuig wordt gegenereerd, geconverteerd naar de afgelegde afstand, waarmee de kilometerstand bij elke ritregistratie wordt verhoogd. De drie bytes KM2 bevatten de kilometerstand aan het einde van een rit, de vier bytes DT2 bevatten datum en tijd van het einde van die rit. Gezien het feit dat het openen van de tankopening van de brandstoftank van het voertuig geldt als registratiegebeurtenis en tevens geregistreerd wordt als begin van een rit, en het feit dat een voertuig zich in het algemeen niet verplaatst tijdens het tanken van brandstof, moge het duidelijk zijn dat de kilometerstand aan het begin en aan het einde van een tanksessie aan elkaar gelijk zullen zijn. De byte RT bevat een aanduiding van het type van de rit. Als rittype zou men bijvoorbeeld onderscheid kunnen maken in "zakelijk", "privé", "woon-werk-verkeer" of "tanken". Zoals eerder beschreven, kunnen via elektronische systemen in het voertuig of in de nabijheid van het voertuig, zoals mobiele telefoons, draagbare computers, GPS-systemen etc., gegevens aan een ritregistratie worden toegevoegd. Hiervoor kunnen de bytes XTR in figuur 2 worden gebruikt. Het zou echter kunnen voorkomen, dat de ritregistratie plus extra gegevens niet kan worden opgeslagen in 20 bytes. In dat geval kunnen er extra datablokken van 20 bytes aan een ritregistratie worden toegevoegd, en kan de eerste (meest linkse) byte XTR in figuur 2 worden gebruikt als teller, om aan te geven hoeveel datablokken er nog volgen voor de betreffende ritregistratie. Bij eenvoudige ritregistraties, waarbij bijvoorbeeld geen elektronische representaties van spraak als extra gegevens worden toegevoegd, is het niet waarschijnlijk dat een ritregistratie meer dan 2 blokken van 20 bytes zal omvatten. Wanneer de grootte van het geheugen 106 voor opslag van ritgegevens bijvoorbeeld slechts 8 Kilobyte (=8192 bytes) zou bedragen, zouden er in genoemd geval meer dan 400 ritregistraties in kunnen worden opgeslagen. Zoals in het bovenstaande is beschreven, zou via de voorziening 109 een optische en/of akoestische waarschuwing aan een gebruiker van een inrichting volgens de uitvinding kunnen worden afgegeven, wanneer de beschikbare capaciteit van het geheugen 106 beneden een bepaalde waarde is gedaald. In het algemeen zal een dergelijke situatie echter slechts optreden, wanneer door bijvoorbeeld een storing in het communicatiedeel 114 van de inrichting, in een elektronisch systeem 400 (zoals een mobiele telefoon) of in het externe telecommunicatie- en/of datanetwerk 500, gedurende lange tijd geen overdracht van ritgegevens naar een telecommunicatie- of datanetwerk buiten het voertuig kan plaatsvinden. Genoemde drempel voor de geheugencapaciteit dient vanzelfsprekend wel zodanig te worden gekozen, dat een gebruiker, na te zijn gewaarschuwd door de inrichting, in het algemeen nog voldoende tijd heeft om deskundige hulp in te roepen, alvorens het geheugen 106 vol is en er ritgegevens verloren gaan.

Het communicatiedeel 114 van de inrichting volgens de uitvinding, zou bijvoorbeeld een mobiele telefoon zodanig kunnen aansturen, dat de ritgegevens uit het elektronisch geheugen 105 periodiek in de vorm van een S.M.S. (Short Message Service) bericht worden overgedragen naar bijvoorbeeld een GSM (Global System for Mobile Communications) netwerk. Figuur 3 toont een voorkeurs datastructuur van een S.M.S. bericht voor het verzenden van ritgegevens en extra gegevens door de inrichting volgens de uitvinding. Het bericht bevat een header (="kop") ter grootte van 20 bytes, en 6 datablokken van 20 bytes elk. Dit brengt de totale lengte van het bericht op 140 bytes. De datablokken kunnen in dit geval ritregistraties van de inrichting volgens de uitvinding zijn. Figuur 4 toont een voorkeursstructuur voor de header van een S.M.S. bericht bij gebruik met de inrichting volgens de uitvinding. De twee bytes BN bevatten het berichtnummer, de byte VNS het versienummer van de gebruikte software. De twee bytes CHK omvatten een zogenaamde CHecKsum (="controlegetal"), welke dient om bij ontvangst de onverminkte overdracht van het bericht te verifiëren. De zes bytes ID bevatten een identificatie van het zendende voertuig. Deze identificatie kan bijvoorbeeld het kenteken van het voertuig zijn, gecodeerd in ASCII (American Standard Code for Information Interchange). De negen bytes XTR zijn vrij te gebruiken voor verzending van extra gegevens. Naast het gebruik van S.M.S. berichten, zouden de ritgegevens bijvoorbeeld eenvoudig kunnen worden verzonden in de vorm van email- of faxberichten.

Het moge duidelijk zijn dat de uitvinding niet beperkt is tot de hierboven beschreven uitvoeringsvariant, en dat er binnen het kader van de uitvinding vele varianten en aanvullingen mogelijk zijn.

CONCLUSIES

1. Inrichting bestemd voor gebruik in een voertuig, voor het registreren, bewerken en opslaan van gegevens met betrekking tot ritten van dat voertuig, omvattende voorzieningen voor gegevensoverdracht tussen de inrichting en daarvoor geschikte elektronische systemen in het voertuig en/of in de nabijheid van het voertuig, met het kenmerk dat de inrichting volgens de uitvinding voorzieningen omvat om ten minste één ander in het voertuig of in de directe nabijheid van het voertuig aanwezig elektronisch systeem, zodanig aan te sturen, dat via dit systeem de door de inrichting geregistreerde, bewerkte en opgeslagen ritgegevens worden overgedragen naar één of meerdere telecommunicatie- en/of datanetwerken buiten het voertuig.

2. Inrichting volgens conclusie 1, met het kenmerk dat de inrichting zelf voorzieningen omvat voor overdracht van genoemde ritgegevens naar één of meerdere telecommunicatie- en/of datanetwerken buiten het voertuig.

3. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat de door de inrichting geregistreerde, bewerkte en opgeslagen ritgegevens, ten minste omvatten een ritnummer, datum en tijdstip van het begin van een voertuigrit, datum en tijdstip van het einde van een voertuigrit, de kilometerstand aan het begin en aan het einde van een voertuigrit, en een aanduiding van het rittype.

4. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat aan de in de inrichting opgeslagen gegevens betreffende een rit, extra gegevens kunnen worden toegevoegd via een elektronisch systeem in het voertuig of in de nabijheid van het voertuig, dat geschikt is, en voorzieningen omvat voor gegevensoverdracht tussen de inrichting volgens de uitvinding en bedoeld elektronisch systeem.

5. Inrichting volgens conclusie 4, met het kenmerk dat genoemde extra gegevens bestaan uit een elektronische representatie van de locatie van het voertuig aan het begin en aan het einde van een rit.

6. Inrichting volgens conclusie 5, met het kenmerk dat genoemde elektronische representatie van de locatie van het voertuig wordt bepaald door automatisch te detecteren in welke cel van een cellulair netwerk voor mobiele communicatie het voertuig zich bevindt, en vervolgens de geografische locatie van deze cel te gebruiken als benadering van de locatie van genoemd voertuig.

7. Inrichting volgens conclusie 4, met het kenmerk dat genoemde extra gegevens bestaan uit een elektronische representatie van spraak.

8. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat deze inrichting ten minste de volgende delen omvat:

- een centrale besturings- en verwerkingseenheid, zoals een microprocessor, voorzien van een geschikte programmering voor de beoogde werking van de inrichting;
- een elektronisch geheugen voor opslag van voertuigspecifieke gegevens, zoals een voertuigidentificatie-

code en gegevens voor kalibratie van het elektronische signaal voor de kilometerteller in het voertuig;

- een elektronisch geheugen voor opslag van door de inrichting geregistreerde en bewerkte ritgegevens;

- elektronische voorzieningen voor het bijhouden van datum en tijd;

- voorzieningen voor het detecteren of de contactschakelaar van het voertuig wordt bediend;

- voorzieningen voor het registreren van het in het voertuig aanwezige elektronische signaal voor de kilometerteller;

- een aansluiting via welke datacommunicatie via een kabel kan plaatsvinden met elektronische systemen buiten de inrichting;

- een uitvoervoorziening, geschikt voor het geven van een optische en/of akoestische waarschuwing aan een gebruiker van de inrichting.

9. Inrichting volgens conclusie 8, met het kenmerk dat het genoemde detecteren of de contactschakelaar van het voertuig wordt bediend, geschiedt door het detecteren van significante overgangen in de spanning op de voedingsgeleider van de gestandaardiseerde stekkeraansluiting, die in de meeste automobielen van recent bouwjaar aanwezig is ten behoeve van aansluiting van onder andere een autoradio.

10. Inrichting volgens conclusie 8, met het kenmerk dat het genoemde elektronische signaal voor de kilometerteller, door de inrichting wordt betrokken via de gestandaardiseerde stekkeraansluiting, die in de meeste automobielen van recent bouwjaar aanwezig is ten behoeve van aansluiting van onder andere een autoradio.

11. Inrichting volgens conclusie 8, met het kenmerk dat de genoemde uitvoervoorziening, geschikt voor het afgeven van een optische en/of akoestische waarschuwing aan een gebruiker van de inrichting, deze waarschuwing afgeeft wanneer de beschikbare geheugencapaciteit voor opslag van ritgegevens tot beneden een bepaalde drempel is afgenomen.

12. Inrichting volgens conclusie 8, met het kenmerk dat door de inrichting periodiek gegevens omtrent de door het voertuig afgelegde afstand per tijdseenheid worden afgeleid uit het genoemde elektronische signaal voor de kilometerteller, waarna deze gegevens worden opgeslagen in een elektronisch geheugen in de inrichting.

13. Inrichting volgens conclusie 12, met het kenmerk dat genoemde gegevens omtrent de door het voertuig afgelegde afstand per tijdseenheid, op zodanige wijze in genoemd elektronisch geheugen worden opgeslagen, en dat genoemd geheugen een zodanige capaciteit heeft, dat hierdoor een gegevensbuffer ontstaat, waarin te allen tijde een hoeveelheid van de meest recent geregistreerde gegevens, ter grootte van genoemde capaciteit van genoemd geheugen, aanwezig is.

14. Inrichting volgens conclusie 8, met het kenmerk dat de inhoud van genoemde elektronische geheugens voor opslag van voertuigspecifieke gegevens en voor opslag van ritgegevens, door middel van encryptie van gegevens zodanig zijn beveiligd, dat genoemde gegevens slechts kunnen worden ingevoerd, uitgelezen en gewijzigd door een daartoe bevoegde persoon.

15. Inrichting volgens een van de voorgaande con-

clusies, met het kenmerk dat de inrichting een invoervoorziening omvat, die een gebruiker van de inrichting de mogelijkheid biedt om aan te geven of de inrichting de voertuigrit als zakelijk, privé, dan wel als woon-werk verkeer dient te registreren.

16. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat de inrichting voorzieningen omvat die het mogelijk maken om te detecteren of de tankopening van de brandstoftank van het voertuig geopend of gesloten is.

17. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat de inrichting voorzieningen omvat voor gegevensoverdracht via infrarood licht tussen de inrichting volgens de uitvinding en elektronische systemen in het voertuig en/of in de nabijheid van het voertuig.

18. Inrichting volgens conclusie 17, met het kenmerk dat de genoemde voorzieningen voor gegevensoverdracht via infrarood licht, functioneren conform de zogenaamde "IrDA" (Infrared Data Association) communicatiestandaard.

19. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat de inrichting zodanige voorzieningen omvat, dat gegevensoverdracht tussen de inrichting volgens de uitvinding en elektronische systemen in het voertuig en/of in de nabijheid van het voertuig, kan plaatsvinden conform de zogenaamde "Bluetooth" de-facto communicatiestandaard voor radiocommunicatie over korte afstanden.

20. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat verschillende delen van de inrichting volgens de uitvinding, zodanig in het voertuig zijn geplaatst, dat zij daarmee mechanisch vast zijn verbonden en beschermd tegen onbevoegde toegang en/of beïnvloeding, zowel vanuit het passagierscompartiment van het voertuig, als van buiten het voertuig.

21. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat de door de inrichting geregistreerde, bewerkte en opgeslagen ritgegevens en eventuele extra toegevoegde gegevens, in de vorm van S.M.S. (Short Message Service) berichten worden overgedragen naar telecommunicatie- en/of datanetwerken buiten het voertuig.

22. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat de door de inrichting geregistreerde, bewerkte en opgeslagen ritgegevens en eventuele extra toegevoegde gegevens, in de vorm van electronic mail berichten worden overgedragen naar telecommunicatie- en/of datanetwerken buiten het voertuig.

23. Inrichting volgens een van de voorgaande conclusies, met het kenmerk dat de door de inrichting geregistreerde, bewerkte en opgeslagen ritgegevens en eventuele extra toegevoegde gegevens, in de vorm van faxberichten worden overgedragen naar telecommunicatie- en/of datanetwerken buiten het voertuig.

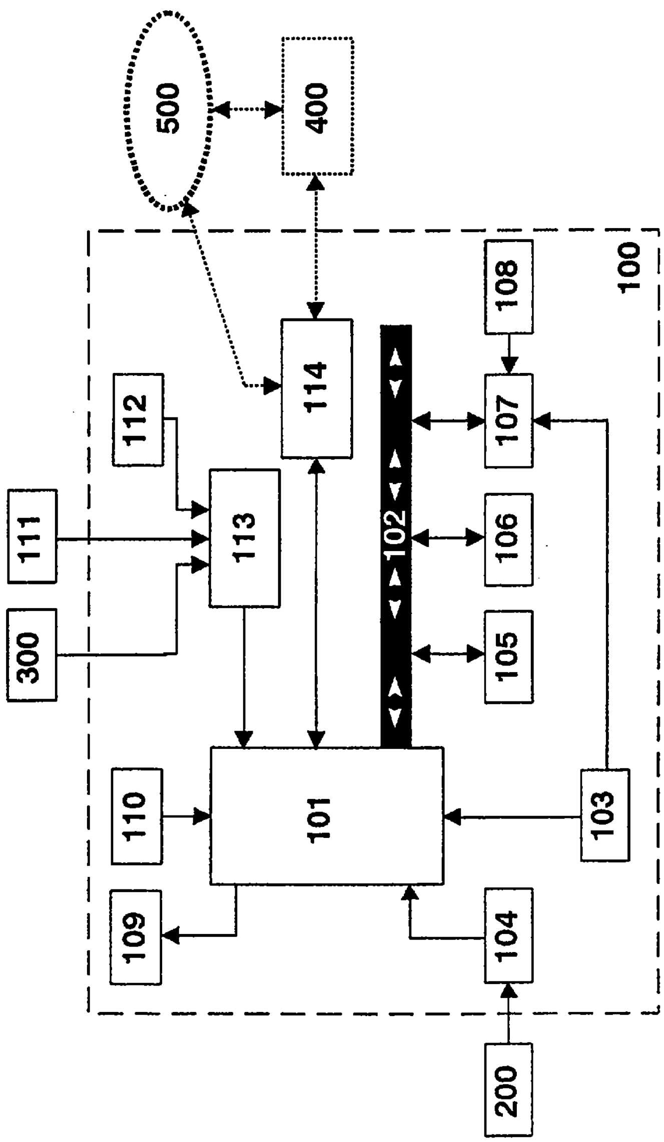


Fig. 1

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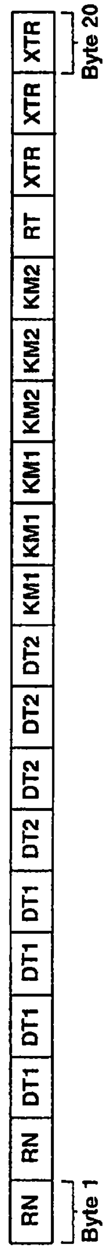


Fig. 2

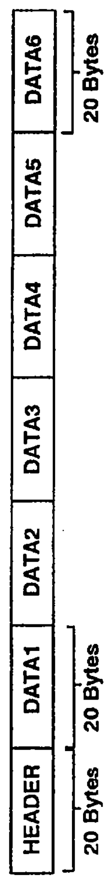


Fig. 3

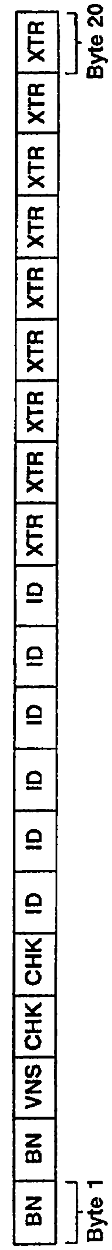


Fig. 4

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**Bureau voor de Industriële Eigendom**

## RAPPORT BETREFFENDE HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

Octrooiaanvrage Nr.:

NO 134978
NL 1016618

### VAN BELANG ZIJNDE LITERATUUR

| Categorie | Vermelding van literatuur met aanduiding voor zover nodig, van speciaal van belang zijnde passages | Van belang voor conclusie(s)Nr.: | Internationale classificatie |
|---|---|---|---|
| X | GB 2 345 824 A (MINORPLANET LTD) 19 Juli 2000 (2000-07-19) * samenvatting; conclusies; figuren * * bladzijde 3, regel 8 - bladzijde 5, regel 27 * * bladzijde 6, regel 21 - bladzijde 9, regel 10 * * bladzijde 12, regel 4 - bladzijde 13, regel 2 * * bladzijde 16, regel 14 - bladzijde 19, regel 26 * | 1-5, 20-23 | G07C5/08 G01C22/00 G06F17/60 |
| Y | | 6-8, 10-14, 16,17,19 | |
| | --- | | |
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| Y | | 8,10-13 | **Onderzochte gebieden van de techniek** G07C G08G G01C |
| | --- | | |
| X | GB 2 317 791 A (MINORPLANET LTD) 1 April 1998 (1998-04-01) * samenvatting; conclusies; figuren * * bladzijde 6, regel 1 - bladzijde 8, regel 15 * | 1-5 | |
| | --- | | |
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| A | | 3,6,8 | |
| | --- | | |
| | -/-- | | |

Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op :.................

2

| Plaats van onderzoek | Datum waarop het onderzoek werd voltooid | Vooronderzoeker (EOB) |
|---|---|---|
| 'S-GRAVENHAGE | 6 November 2003 | Meyl, D |

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## RAPPORT BETREFFENDE HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

Octrooiaanvrage Nr.:

NO 134978
NL 1016618

### VAN BELANG ZIJNDE LITERATUUR

| Categorie | Vermelding van literatuur met aanduiding voor zover nodig, van speciaal van belang zijnde passages | Van belang voor conclusie(s)Nr.: | Internationale classificatie |
|---|---|---|---|
| X | US 4 188 618 A (WEISBART EMANUEL S)<br>12 Februari 1980 (1980-02-12)<br>* samenvatting; conclusies; figuren *<br>--- | 1,2 | |
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Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op :................

2

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06-11-2003

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| | | |
|---|---|---|
| (51) International Patent Classification 6 : G06F 17/40 | A1 | (11) International Publication Number: WO 97/13208<br>(43) International Publication Date: 10 April 1997 (10.04.97) |

(21) International Application Number: PCT/US95/12459

(22) International Filing Date: 6 October 1995 (06.10.95)

(71) Applicant (*for all designated States except US*): SCIENTIFIC-ATLANTA, INC. [US/US]; One Technology Parkway, South, Norcross, GA 30092 (US).

(72) Inventor; and
(75) Inventor/Applicant (*for US only*): HOUSER, Peter, B. [US/US]; 14574 High Pine Street, Poway, CA 92064 (US).

(74) Agents: POTENZA, Joseph, M. et al.; Banner & Allegretti, Ltd., Suite 1100, 1001 G Street, N.W., Washington, DC 20001 (US).

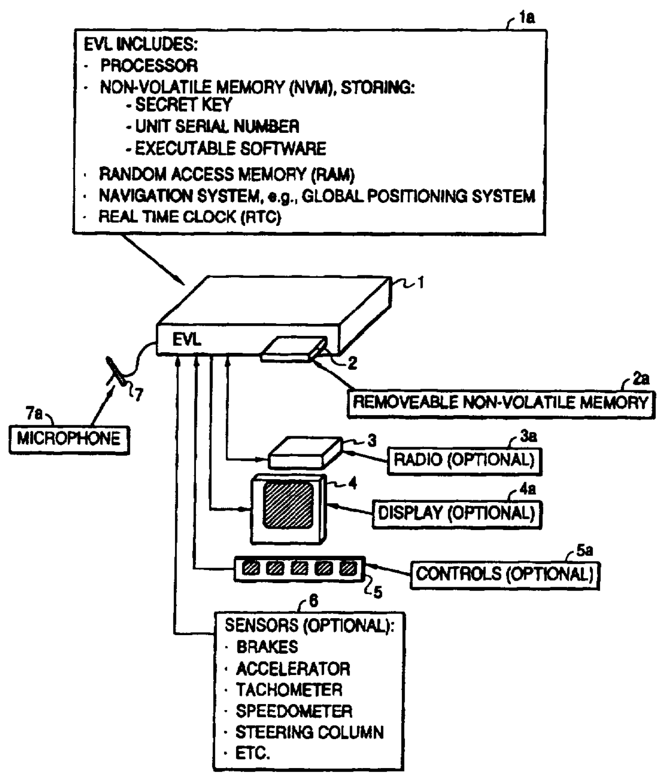
(81) Designated States: CA, JP, MX, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

**Published**
*With international search report.*

(54) Title: ELECTRONIC VEHICLE LOG

(57) Abstract

A method and apparatus for maintaining an electronic vehicle log (1) involves the formation of protected data packets (411) which are electronically signed by certified users. The electronic vehicle log (1) preferably comprises a secure non-volatile memory (2) that may be removed from the vehicle (200). Preferably the apparatus, referred to herein as a date processing interface unit (DPIU) (1), has access to date and real time of day and location data so that the protected data packets (411) further include, besides data to be protected, the date and time of day and the location of the vehicle (200) for comparison with expected data as further protection against fraudulent or forged data entry. Preferably, on-board sensors (6) collect in-transit monitoring and cargo monitoring data for access by various certified users. Event data such as governmental inspection or border crossing data may be entered into the log by governmental authorities.



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# ELECTRONIC VEHICLE LOG

## BACKGROUND OF THE INVENTION

### 1. Technical Field

This invention relates to the field of electronic vehicle logs used particularly in commercial vehicles and, more particularly, to a data collection and processing system for a vehicle serving multiple users including the driver, the owner/operator and governmental authorities. Even more particularly, the invention is directed to securing access to particular data by such users via the application of evolving "smart" or "flash" card, public key/private key encryption and electronic signature, speech recognition and speaker verification and global positioning or other navigation system technologies.

### 2. Description of the Related Arts

Many vehicles, particularly those used commercially, must maintain legally auditable records of their usage. These records may include and not be limited to include data items such as license or registrations issued, insurance coverage, the routes traveled, gross and tare (cargo exclusive of container and vehicle) weight measured at weigh stations, driver and duration of driving, safety inspection results, border crossing approval, exhaust pollution measurements and the like. In addition to vehicle related items, additional data may be required concerning the cargo and any tariffs or other fees paid on that cargo. Other records may also be required or used by the driver, the owner/operator (if different), and governmental authorities or agencies.

For the purposes of the present application, vehicle credential data is defined as data describing the vehicle, the carrier, cargo, driver, and passengers independently of the transit involved. Vehicle credential data may thus include the following data, the following list being exemplary of such data: vehicle registration, vehicle insurance, driver's license, driver's credentials, driver's safety record and health, cargo manifest and shipping invoice, tariff-related documentation, and declared itinerary or intended route data.

In-transit data is defined for the purposes of the present application as data obtained during transit or in route (whether the vehicle is in motion or not). Such data may be acquired by periodically monitoring sensors on the vehicle to determine how the vehicle is being used. Exemplary data falling into this category of data include: date and time of data collection, vehicle speed, brake usage, steering wheel motion, engine RPM, engine temperature, cargo container temperature, engine vibration and other health metrics, and vehicle location from a navigation source such as the so-called Global Positioning System (GPS) or equivalent data gathering system.

Cargo monitoring data is defined for the purposes of this application as data related to either the status or security of the cargo, for example, whether the cargo seal has been maintained or broken.

Next, event record data is defined for the purposes of this application as data recorded in transit for particular events effecting the vehicle or cargo or both. Typical events include: vehicle weight, for example, obtained during a weight-in-motion or stationary scale weighing, vehicle environmental, emissions or safety status checks, for example, determined at an inspection facility, border crossing data, either state or national, hazardous material (HAZMAT) warnings or transit regime changes (when the vehicle starts motion or has stopped).

Finally, route monitoring data is defined for the purposes of the present application as data obtained through monitoring the vehicle in transit to compare with the above-defined vehicle credential data for an intended route. This data is preferably collected through the application of a navigation system such as GPS or other equivalent system as well.

Typically in the past, such records, if maintained at all, have been manually maintained in a handwritten log or plurality of such logs, augmented by inspection records from various agencies or authorities and maintained by the driver. However, such handwritten logs are inherently subject to inadvertent inaccuracies, as well as to intentional fraud or forgery. In addition, such handwritten records cannot be easily transferred for inspection.

Ebaugh et al., US Patent No. 5,303,163, describes a configurable vehicle monitoring system having first and second configuration levels for an owner/operator and a driver respectively. Besides being able to independently configure data in memory, each is independently able to access certain data of interest to that party alone. The data that can be gathered and analyzed includes miles per gallon, fuel consumed, trip time, idle time, fuel consumed and other pertinent information relevant to fleet or vehicle operation. For example, according to Figure 7 thereof, a printout may be obtained showing these and other data. The owner/operator may obtain an indication of the period of time the vehicle is operated in excess of the 65 mile per hour overspeed limit. Similarly, apparatus disclosed by Ishibashi, US Patent No. 5,379,219, and Komatsu, US Patent No. 5,249,127 suggest the tracking of speed over time and, per Figure 3 of the '219 patent, the allocation of memory among ID data, speed data, travel distance data and optional area. The '127 patent suggests that, memory size requirements being indeterminate and expensive, data compression devices be provided for assuring efficient utilization of memory.

It has further been recognized that portability of the collected data is required. One means of achieving portability is via an external memory module (US 4,757,454, 5,185,700 or 5,249,127). Also, radio or generally wireless radio communication may provide data mobility from one user to another (US 4,804,937, 5,185,700 or WO 90/09645).

The so-called global positioning system described, for example, by Taylor et al., US Patent No. 4,445,118 and O'Neil et al. US Patent No. 4,839,656 has been implemented in an electronic vehicle log by Haendel et al., US Patent No. 5,359,528. Haendel et al. describe that a change in state boundary and a log of miles within a particular state may be automatically obtained without driver intervention.

All of these systems suffer from a lack of security of access by a particular user and may be falsified if and when the provided weak security systems fail. It is an object therefore of the present invention to describe a system whereby multiple users of a system may configure or obtain access to memory of an electronic vehicle log. It is a further object of the present invention to provide a system wherein security is enhanced via adaptation of evolving technologies of speech recognition and speaker verification, public/private key data encryption and decryption, flash or smart card (key) access and/or electronic signature record verification and access.

**SUMMARY OF THE PRESENT INVENTION**

In accordance with the present invention, an electronic vehicle log (EVL) comprises a processor for processing data, a memory for storing software algorithms and fixed data, preferably non-volatile in nature, a secret key unique to the vehicle log, and a unit serial number that is unique to that unit (hereinafter, an EVL identifier), a removable non-volatile log memory for securely recording data and a navigation and time-of-day and date input data circuit. In one embodiment, there may be further provided a microphone input for receiving user speech coupled to the processor (for example, via an analog to digital converter) and a memory for storing digitized voice samples. Optional sensors are coupled to the log for providing for the input of data for vehicle and cargo, for example, through an external interface, in particular, a wireless interface. For example, through one external wireless interface, an EVL may acquire event data such as weight-in-motion (WIM) data. Those who would obtain access to data or input data are provided with a public key which is likewise unique to the vehicle log. Moreover, any data entries are signed with an electronic signature for verifying the entered data, for example, comprising a calculated hash value encrypted with the secret key.

When the vehicle is to be used, the driver inserts the removable non-volatile log memory for the duration of the trip. For example, a driver may obtain access and log into the EVL by inputing their speech, a password or a biometric after inserting their card memory. Upon successful verification of the password or biometric and, if appropriate, verification of the speaker's identity in a well known manner, the driver-unique data is used to decrypt a secret key member of a public key encryption pair. When data is to be logged by the driver, protected data packets (PDP's) containing this log data are generated with digital signatures formed by encrypting digital hash values with this secret key member of the public key pair.

Protected data packets (PDP's) are transmitted to a requesting user via electronic means, for example, wireless, telephone modem or a memory card. The requesting user has a trusted (escrowed) copy of the public key of the above-referenced public key pair, the public key pair including the secret key (securely stored in and never released from EVL memory) used for forming the electronic signature. The secret key should be protected and secured as closely as possible and should not be transmitted (otherwise, it might be intercepted by an uncertified individual). The public key is used to verify that the electronic signature of the PDP is accurate. Correct verification of the electronic signature then confirms the data source (the driver-protected secret key) and the integrity of the data (since the hash value matches the PDP data).

A governmental authority may obtain access by a defined process. One example of such a process for obtaining an early transmission of vehicle data in advance of a border crossing or like event is described by the following. The agency wishing to receive secure data generates a public key encryption pair different from that used by the driver and distributes the public key portion to any person or system desiring to transmit secure data. The public key portion is stored in EVL memory. A profile of a commercial vehicle and a cargo may be extracted from the vehicle via a card memory or may be electronically extracted by wireless means prior to the vehicle's departure and delivered to the authority with the stored public key portion. The EVL generates a private encryption key and uses it to encrypt PDP's with their corresponding digital signatures. The EVL encrypts this private encryption key using the public key and transmits that information to the agency receiving the data. The receiving agency decrypts the EVL private encryption key using the secret key portion of the key pair and then decrypts the PDP's using the decrypted key. The profile and public key are transmitted via a centralized authority data base to regional data bases for distribution to checkpoints, port of entry border crossings and the like along the intended route of the vehicle.

As the vehicle approaches the inspection facility, the vehicle is polled or interrogated, for example, preferably by wireless means in advance of reaching the facility, so the vehicle need not stop its movement. The vehicle transmitted profile data is compared with the previously transmitted profile data and the inspector may preclear the vehicle through the inspection station. If the inspection data is a weigh station, for example, and data is to be entered into the log by the authority, an electronic signature is utilized to verify the entered data, preventing subsequent modifications of the logged information. Moreover, at the time the entry is made, the vehicle position and time from the global positioning system may be automatically and simultaneously recorded, allowing detection of fraudulent entries. As the vehicle crosses the border, a short range communications system may be used to verify that the vehicle crossing the border is the vehicle which received the preclearnace to cross.

It is also possible that the vehicle may carry all the profile information in the EVL and transmit the data via wireless means to the authority just a few minutes before the approval (for example, preapproval at a border crossing) event. In this case and in that described above as well, some sort of short-range transmission is useful as the vehicle crosses the border to physically confirm that the vehicle currently crossing the border is the same as the one that provided the profile and credentials and received preapproval to cross.

An authorized individual such as an inspector or police officer creates a digital credential in a generating device's memory, for example, a laptop personal computer. A secret key of a public key pair is used to generate a digital signature for the credential data. The credential and signature are transmitted to the EVL using various means, possibly including wireless means, direct input (typing), or memory card transfer. This transfer may be encrypted as discussed above as desired. for wireless or other secure data transmission. The credential and signature are formed into a PDP and logged as described above for the driver data logging operation. When the credential is subsequently transmitted to a requesting agency, the agency will use a trusted copy of the public key portion to verify the electronic signature of the PDP.

Other features and advantages of the present invention will be explained by reference to the drawings and the following detailed description of the present invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is an overview drawing of an electronic vehicle log according to the present invention;

Figure 2A is a system overview drawing showing the interface between a vehicle 200 carrying an electronic vehicle log of Figure 1 with a governmental or other authority and Figure 2B shows vehicle 200 with expanded boxes describing data that may be stored in DPIU 210 including an electronic vehicle log of the present invention;

Figure 3 is a schematic block diagram of the electronic vehicle log of Figure 1 for maintenance in a vehicle; Figure 3A provides a first embodiment, Figure 3B provides a second embodiment and Figure 3C provides a third embodiment;

Figure 4A provides an overview of the key and security features of the present invention in flow diagram form and Figure 4B shows a table showing the use of different public key pairs by different entities for accessing the data stored in the EVL

400 of Figure 4A;

Figure 5A provides a table of examples of data maintained in an in-vehicle data base of memory of the in-vehicle unit of Figure 4; Figure 5B comprises a table showing data elements and characteristics recoverable through utilization of the present invention and their characteristics; and

Figures 6A and 6B provide a table showing service, application, technology or product availability, demonstrable feature and utilization of the present invention.

**DETAILED DESCRIPTION OF THE PRESENT INVENTION**

Referring to Figure 1, there is shown an overview drawing of the electronic vehicle log of the present invention. The present device is intended to be placed in a vehicle, hence, the present invention is described herein as an in-vehicle data processing unit. The log is described herein as electronic because it generally operates via electronic circuits including at least memory circuits and a data processor. The present invention is characterized as a log because the memory of the present invention substitutes for prior art hand-written log books typically used by drivers of vehicles, especially commercial vehicles.

The electronic vehicle log (EVL) 1 is described by box 1a as comprising a package of elements suitably housed to be mounted in a vehicle, for example, in an operator compartment or secure area therein or proximate thereto. One mounting arrangement would be to provide a bracket mounting plate permanently secured to the vehicle. The EVL housing, herein referred to as a data processing interface unit (DPIU) then is removably secured thereto by mechanical locking apparatus so that the DPIU may be removed from the vehicle as necessary. The mechanical locking apparatus should be tamper-resistant so that the EVL itself cannot be surreptitiously moved from one vehicle to another without detection. (To accomplish this objective, electronic tamper detection may be employed). Preferably, the DPIU housing is adapted to receive a removable security module as will be further described herein which is the electronic vehicle log itself.

The EVL housing 1 (DPIU) contains a processor, preferably a microprocessor and a non-volatile memory coupled thereto for storing at least secret key data, secret EVL unit serial number data and executable software. The EVL 1 further may comprise a random access memory that typically is volatile for storing data on a temporary basis and a real time clock (typically a software algorithm that is preferably periodically updated). Most processors require a clock oscillator output that is controlled for providing processor operation clocking functions. This clock can provide a clocking input to a real time clock algorithm as is well known in the art. However, for greater security, an independent clock source may be used or an internal isolated hardware clock circuit (not shown). A navigation system such as the Global Positioning System (GPS) or Loran or other system can provide the independent clock source or periodic indications as to true time for synchronizing a local real time clock as is likewise known in the art. Of course, another important function of GPS or other known equivalent systems is the provision of periodic location data in the form of earth latitude and longitude data and even altitude data that may be compared with a map or intended route and thus provide specific data as to real time of day and route location. A further description of preferred embodiments of EVL 1 will be provided in connection with applicant's description of Figure 3.

EVL housing 1 has insertable therein a removable non-volatile memory module 2 described by box 2a which becomes the log in place of known paper logs or other known electronic logs. In accordance with the present invention, the log memory 2 stores secured or protected data packets output from the EVL included processor as will be further described in connection with Figure 4.

The EVL 1, according to the present invention, may communicate with governmental authorities via radio 3, according to box 3a which may be optional or through wired or other means. Certainly by radio is intended communication via all radio frequencies including light frequencies or via laser or other known means that is wireless in nature. As will be further described herein in the example depicted in Figure 2 of a border crossing, the EVL communicates with an inspection facility for border preclearance before reaching the border via wireless means, so the vehicle need not stop.

The EVL 1 may be provided with a display or other output means 4. The display, as indicated by descriptive box 4a, may be optional. The display may comprise a liquid crystal display, cathode ray tube display, light emitting diode or other display. Other output means may comprise a printer or speech synthesis means or other output means. All such means provide the user (typically the vehicle operator) with feedback of proper operation, an indication that the vehicle is being polled, clearance to proceed, log data, if appropriate, and other information.

Controls 5, as described by box 5a, are likewise optional. The controls typically comprise a keyboard, keypad or related switch control but may comprise speech receiving means 7 described by box 7a as a microphone such as an electret microphone or digital microphone. Also, both keys and microphones may be provided. The microphone may be eliminated if speech input is not contemplated by one designing a system according to the present invention. The controls may be keys representing, for example, numeric or alphabetic characters for inputing the operator's identity, password or other data as will be described further herein. If necessary the microphone is coupled to the processor of the present invention via an analog to digital converter for sampling the voice input and converting the input to digital samples.

Finally, in accordance with Figure 1, sensors 6 may be provided which are only generally described. These may comprise brake sensors, accelerator sensors, tachometer or mileage sensors, speedometer sensors, steering column sensors, tire pressure monitoring sensors, cargo bonding sensors, cargo temperature or smoke or fire sensors, driver alcohol (breath) detection sensors and the like which may be coupled to EVL 1 by wired or wireless means.

In-transit, cargo and route monitoring data use sensors which are preferably mounted on the vehicle and locally communicate with the EVL using fixed communications channels (cabling or short-range radio signals). Credentials and event data recording typically requires acquiring data from systems separate from the EVL housing 1 which are not permanently mounted on the vehicle. For example, a customs agent may be empowered to record a credential within the EVL which indicates that paperwork is in place and tariffs paid to allow expedited international or state border crossings as will be described further in reference to the example of Figure 2. This credential information is placed within the EVL by any number of transmission methods and via security means including direct entry, via a removable credential memory, via direct connection and via radio connection.

In regard to direct entry, the EVL 1 may provide a keyboard and limited display for manual entry of the information. This may be relatively tedious and insecure. The entry process may include the agent (inspector) specifying an encryption key, either public or private, which may be used in a signature process for authenticating entered data. The process may involve speech recognition and voice entry of the data in combination with a keyboard/display or alone. The process may further comprise speaker identification or verification processes known in the art for confirming a subject's claimed identity based upon a digitized speech sample.

Removable credentials are preferred. If the EVL memory is removable, it may be placed in a data entry device belonging to the agent and the electronic credential or event data copied into the memory. When the memory device is replaced into the EVL 1, the newly acquired data will be processed as a normal PDP as described below in connection with Figure 4.

Direct connection may be cumbersome. The EVL may be directly cabled to the agent's data entry device, using a media such as an RS 232 serial data channel or equivalent serial or parallel connector. Data processing in this case is comparable to that when using removable credentials.

Finally radio connection may be preferable for, for example, coupling to mobile police forces, air such as helicopter carrying radio, or roadside radio polling stations so the vehicle may transmit in motion. Radio may be used to receive or transmit credential and event data. One example is a weight in motion (WIM) station operated by a governmental authority. A WIM sensor may, when interrogated by the EVL, transmit the vehicle's weight to the EVL for storage.

As will be further described in connection with Figure 2, an agent uses a personal computer or workstation to generate, for example, border crossing or inspection credential data. An agent-specific secret key is used to embed their electronic signature within the credential data transferred to the EVL 1. Thus, the data may not be accessible to the driver or even the vehicle system operator. When the credential data is later transmitted to an authorizing agent (such as the border crossing inspector), the corresponding public key is used to decrypt the signature, thereby authenticating the source and permitting preclearance of the vehicle.

Now, referring to Figure 2, one application of the present invention will be described, namely a border crossing, to demonstrate the interrelationships among the elements of Figure 1 which may be assembled in combination to perform any desired application of the present invention. Figure 2 generally represents in diagrammatic form the events at a border crossing of a vehicle 200 equipped with the EVL 1 (Figure 1) of the present invention (represented as box 210). Other applications will be described subsequently herein. Vehicle 200 may be a truck, for example, approaching a border crossing 202 which may be a state or international border along a route 201. There are three zones of route 201 the vehicle 200 is expected to pass through. Zone 205 comprises a reporting zone. Zone 206 comprises an evaluation/clearance zone. Zone 207 comprises an inspection zone for performing a detailed inspection, as necessary, of vehicle 200 or health check of the vehicle's driver. The arrows on route 201 indicate the expected direction of passage of vehicle 200.

Referring briefly to Figure 2B, there is shown a typical vehicle 200 and blocks 261-266 summarizing data that may be related thereto. Block 261 describes motor vehicle data such as ID number, EVL or DPIU identification number and status, vehicle weight and registration data. Driver data 262 comprises their identification, their licenses, safety record, transit log and safety biometrics among other data. Carrier data 263 includes identification, location, registration, insurance, licenses and permits, ICC, PUC, USDOT records, violations and offenses and fees paid records. Cargo data 266 includes trailer identification, invoice, manifest, HAZMAT warnings, gross and tare weight, export declaration, inspection record, tariff record and crossing approval data. Together, these data 261, 262, 263 and 266 may be vehicle credential data as used in the context of the present application.

Transit security block 264 refers to electronic bonding data, route verification data and time-in-travel verification data.

Safety and environmental data block 265 refers to a combination of event data and in transit data. In particular, block 265 refers to inspection records, emission records on-board sensor records and HAZMAT warnings.

Typically at a border 202 or proximate thereto is an inspection facility 203. At the inspection facility, work stations, shown as computer workstations, 204 are provided governmental employees, such as inspectors. The work stations and/or inspection facility 203 preferably communicate with vehicle 200 which may be moving by wireless means. The PC-based inspector workstations 204 are described by box 220. The workstations function to interface with an interface unit described by block 210 usually referred to herein as the EVL of vehicle 200 and to roadside sensors of a polling station (not shown). These sensors respond as a vehicle passes a polling station in motion to obtain data from the EVL. These may not need be "roadside" but may be "fly over" and thus mounted in aircraft such as helicopters or other traveling vehicles such as police vehicles. In any event, the workstations 220 function to record electronic credentials either downloaded in advance or provided from the EVL 210 of the vehicle 200. The workstation 204 may interface with centralized databases to obtain data that is not stored in the workstation as necessary. Finally, it is desirable if the workstations 204 are networked together for intercommunication and interchangeability. That is, if one workstation is occupied, a first spare workstation is allocated to an new incoming vehicle 200 to the system.

The work stations 204 and/or inspection facility 203 generally are provided with an EVL interface unit for interfacing with the in-vehicle EVL 1 of vehicle 200. The functions of this interface unit are described by box 210 which couples the inspection facility 203 or workstation 204 or both with the EVL resident in vehicle 200. This interface unit carries and provides credentials/manifests/inspection records collected for a vehicle. The interface unit also collects multi-sensor reports from on-board sensors on the commercial vehicles such as vehicle 200, for example, on odometer readings, brakes, cargo bondings and the like as optionally provided. Moreover, the interface unit provides vehicle to roadside (or fly over) polling stations communication between the EVL and the governmental employees such as inspectors and inspection stations such as weight-in-motion measuring stations. The latter data may be recorded in the EVL as will be described in connection with Figure 4 as protected data packets. Another function of the interface unit is general information management and the updating of the EVL data base and records due to governmental activity. For example, the opportunity for preclearance of a vehicle through an inspection station is one type of data that may be entered into the EVL. Finally, the interface unit provides electronic security in accordance with the security features described by Figure 4. Communications to and from the vehicle 200, especially if wireless, are preferably secured from interception by coding and/or encryption as desired.

In operation, a vehicle 200 moves along route 201 into a reporting zone 205. The vehicle 200 may initiate radio contact with inspection facility 203 or the vehicle may be polled via roadside or other monitors. Meanwhile, manifests for the vehicle and associated data are preferably electronically downloaded by a broker (a carrier or other party) for storage at the facility 203. Current manifests of expected vehicles are provided to individual inspector workstations 204. Responsive to a polling signal or associated with a request for preclearance initiated by the vehicle, the vehicle data of particular vehicle 200 is provided via wireless means to inspection facility 203 and compared at workstations 204 with downloaded data, such as manifest data. On-board the vehicle, the driver may be provided with a display indicating the EVL is being monitored and thereby reported to him. Moreover, a report or record of the monitoring activity may be stored in the EVL along with a real time of day and location indication as will be subsequently described herein.

The vehicle then enters an evaluation/clearance zone 206. The governmental authority such as an inspector assesses the records/data obtained from the EVL at his workstation 204. If the inspector is satisfied, the inspector communicates a bypass or, if not satisfied, a no-go signal to the truck. Of course, the EVL records and updates itself according to the bypass or no-go signal. As the vehicle approaches the border 202, roadside monitors may poll the vehicle in transit as it crosses the border to assure that the vehicle crossing the border is in fact the vehicle given preclearance to cross. There exists the possibility that preclearance may not have been received in a timely manner even though preclearance could have been granted as the vehicle enters the inspection area 207. Vehicles not receiving timely preclearance and vehicles whose credentials are suspect may be signaled to stop in inspection zone 207.

As the vehicle 200 moves it will enter a detailed inspection area indicated as such on route 201. Inspection zone 207 corresponds thereto and, at the area, a detailed inspection of vehicles which fail or do not timely receive preclearance occurs. Vehicles which may not receive preclearance (not permitted to bypass the station) may include those providing a cargo bonding breakage signal, an indication of improper or errored credentials or manifest data and the like or presenting safety issues such as faulty brake or related signals. Whether or not monitored, driver health issues may also be checked (for example, vision or drug/alcohol levels). The inspections may be random, i.e., ordered as a result of proper dàta reporting but nevertheless a no-go signal is signaled to the particular vehicle 200. If the vehicle safety, driver health or driver safety (overspeed or erratic activity) are signaled as problematical, each of these in turn may be checked or inspected.

Thus, as described above, an embodiment of the present invention may provide for a vehicular data processing method for use by a vehicle in crossing a border comprising the steps of initiating a request for preclearance or automatically receiving a polling signal; responsive to a polling signal, transmitting at least vehicle credential data; and receiving a bypass signal or a stop signal, the bypass signal indicating that the vehicle may pass and the stop signal indicating the vehicle must stop. Preferably the data is transmitted in a secure manner as will be further described in connection with Figure 4. Other related methods that will be further described herein include the automatic monitoring of safety equipment, driver credential, driver health or driver safety by police, the automatic monitoring of cargo bonding devices and cargo temperature, cargo weight, tariff payment and the like.

Now referring to Figure 3A, there is shown one alternative embodiment of an electronic vehicle log according to the present invention. A further embodiment is described by Figure 3B and yet a third embodiment is described by Figure 3C. From a study of each embodiment, one of skill in the art will be prepared to design an electronic vehicle log for a particular application and/or vehicle type and, in accordance with Figure 4, design an appropriate security method and means depending on the level of security desired.

Figure 3A shows an in-vehicle data processing interface unit. Box 300 exemplifies a housing for housing components of an EVL according to the present invention. The EVL system apparatus 300 includes, for example, a radio or other vehicle-to-roadside, vehicle-to-vehicle or vehicle-to-aircraft communications apparatus 301. Examples of short range devices that may be used include a Hughes Radio or Mark IV (MkIV) units or other similar radio systems known in the art or so-called automatic vehicle identification units. Longer range communication may be cellular radio via telephone modem or 220MHz radio manufactured by Scientific-Atlanta and other suppliers. Also, Qualcomm Omnitrax provides longer range communications.

Apparatus 301 is coupled between a suitable antenna (via link 309) and computer processing unit 302. Similarly situated is systems applications apparatus 303 for, for example, receiving GPS or Loran or other location and time update data via an antenna via link 310. Other functions of apparatus 303 include security and built-in-test (BIT) test circuitry. Processing set 302 and systems applications apparatus 303 may be powered by the vehicle battery via a 12-volt power inverter or other circuitry 304. Computer processing set 302 houses the processor, non-volatile (software algorithm) memory, PCMCIA (card or module) receiver, analog/digital interfaces as necessary, operator/machine interfaces as necessary and built-in test circuitry. The plug-in security EVL module is represented by both 307a and 308a for storing fixed and variable data respectively via respective links 307 and 308. Fixed data 307a of an EVL includes and should not be considered to be limited to include cab identification data, truck line identification data, registration data, location data and the like. Variable data 308a may be considered to include and not be limited to include driver identification data, trailer identification data, load identification data, route data, initial weight data, credentials and fees data, hazardous material data and safety inspection data.

Of course, one purpose of the device 300 and log 307a, 308a is to provide via antenna(s) 309 certain outputs 310a responsive to certain external inputs 309a. Inputs 309a comprise the polling request and the identification of the poller. Once the polling request is made, data returned and authorization determined a preclearance authorization signal is another input. Yet another input may be a request to stop for a detailed inspection as has been already described above that may be an alternative to a preclearance authorization signal. The outputs 310a, typically provided in response to a poll, comprise the identification, classification and location of the vehicle and driver. As necessary, a preclearance request signal may be generated. Other credentials necessary for polling site preclearance are provided as necessary. The safety/health of the vehicle/operator may be output. Also, there may be provided a mileage and fuel report for purposes of comparing with intended route and typical fuel consumption figures.

Processor 302 is linked to on-board sensors via link 305 which may be wired or wireless. Vehicle sensor data 305a comprises driver condition data (for example, alcohol sensors for intoxication determination), load condition/security (temperature, bonding), vehicle condition (engine temperature)/security and the like and internal data processing unit security sensing (the BIT test) among others too numerous to list.

Processor 302 is also linked, for example, as necessary to alternatives to known short range roadside polling devices via known in the art systems described above such as automatic vehicle identification systems. These devices return data to the inspection facility responsive to inspection facility initiated polling requests by alternative means.

Thus, there is provided apparatus for maintaining an electronic log of vehicular activity for an automatic border crossing comprising radio apparatus for communicating with an inspection facility and for periodically receiving time and location data. Protected data packets as electronically signed and stored in variable data EVL 308a as will be described in connection with Figure 4.

Yet another preferred embodiment of an in-vehicle unit is shown in Figure 3B. While the whole of Figure 3B is labeled as an Electronic Vehicle Log, Figure 3B is similar to Figure 3A in that box 350 represents a housing in which are situated elements including a processor and memory and connections are shown to other elements outside the housing such as the EVL log media 370 preferably comprising a disk, flash memory, card or other NVM. For simplicity, Figure 3B does not show a microphone, all the optional sensors, the antennas for wireless communication and the like shown in Figures 1 or Figure 3A.

In particular, within box 300 are a bus system 356 for coupling various circuits together and providing intercommunication at a sixteen bit level such as an International Standards Authority (ISA) standard bus system known in the art. The ISA bus 356 provides 16 bit data lines and 24 bit address lines for addressing and retrieving data from memories connected thereto. Connected to the bus 356 are a processor 351, a PCMCIA controller 352, a flash memory 353, a volatile memory 354 and an interface controller such as a quad serial interface controller 355. Sample capacities, not intended to be limiting the present invention, are 512 kbytes for volatile memory 354 and flash memory 353.

Processor 351 provides the intelligence for the unit and may comprise, for example, an ELAN 80386 integrated processor or other microprocessor. The "386" processor has internal random access memory and program memory which may be insufficient for the present purposes. Consequently, external flash memory 353 and volatile memory 354 are provided for providing sufficient capacity for the tasks at hand. Flash memory 353 is non-volatile and amy store fixed data such as the unit identification, algorithms and the like in permanent secure form. Volatile memory preferably random access memory provides working space for processor 351.

Controllers 352 and 355 provide slave control of input/output functions for the processor 351. PCMCIA controller 352 is coupled to the EVL credentials non-volatile memory 370 which may be in the form of one or more disks, flash memories, smart cards or other like removable secure memory which may be inserted into yet another processor (personal computer, mainframe, or like computer) for loading credential data prior to vehicle departure.

In particular, credentials may be inserted briefly into the PCMCIA slot, read into EVL volatile memory, and the credentials then removed freeing the slot. Alternatively, the credentials may be left in the EVL during the entire transit. In this case, the log may be placed on the same physical device as the credentials, or the spare PCMCIA slot 390 may be used as the EVL log memory device.

Controller 352 also handles input functions from a global positioning system card 380 known in the art. This card may be coupled to an antenna for periodically receiving real time of day and location data and storing the data in buffer memory for use by processor 351 for forming protected data packets as will be further described herein. The card may be clocked by a local oscillator and have an internal real time of day clock algorithm which is periodically maintained at a correct time of day by a satellite downlink signal received at an antenna (not shown).

Controller 352 also interfaces with a spare card that may be used for storing credentials, may comprise an analog interface or an interface to another bus system such as a vehicle bus system for collecting vehicle data (engine temperature, ignition, oil, fuel consumption, odometer and the like). The PCMCIA card 390 may have other applications which come to mind from a further study of the present invention.

Finally, controller 355 provides a plurality of, for example, RS232 serial line interfaces to, for example, digital cellular communications apparatus or Type 3 AVI tags for roadside-to-vehicle short range communications via link 395, to other wireless communications via link 396, to additional sensors, such as digital sensors via link 397 different from those supported by card 390 and/or accessible through a vehicle bus and to a user interface via link 398 such as a keyboard, speech interface and/or display or speech synthesis interface.

These elements together perform the following functions. The processor 351 provides overall processing control and includes the internal capabilities to control two PCMCIA ports on its own, namely ports for PCMCIA cards 360 and 370. One (the EVL media or card 370) has already been described. The other is analog acquisition card 360 providing eight connections each for continuous and discrete analog signals, with the continuous signals typically digitized to 8 or 12 bits of resolution, for reception of such vehicle data as ignition switch position, speed, steering, brake accelerator data, tachometer data, electronic cargo bonding data and the like.

Some processors 351 desirably provide on-board One Time Programmable (OTP) memory which may be used to securely record the EVL-unique secret key and identification number. These are most desirably maintained as closed to the function of forming protected data packets as possible and desirably are not removed to FLASH memory 353 for fear of being intercepted and known by one not intended to possess them.

The FLASH memory 353 then is more desirably used for permanently storing the executable software. The memory 353 may be loaded at the time of manufacture with the EVL-unique secret key and identification number if that data is not included in the processor's (351) on-board OTP memory. All memory capacities, bus sizes, capabilities and speeds are nominal. For example, the unit may provide DRAM and FLASH memory sizes from 256 kilobytes to 1024 kilobytes or larger by utilizing alternate sized chips currently available. Currently available PCMCIA analog acquisition cards provide four to eight channels each of continuous or discrete inputs, but higher densities are anticipated and can be incorporated without changes to the unit's (300) hardware. Flexibility is enhanced using a PCMCIA design supporting cards for multiple functions and tasks. Alternatively the corresponding circuitry may be directly incorporated onto the unit's motherboard (similar to the design of Figure 3A) or placed onto a daughterboard interfacing the ISA bus 356. The latter design may have a lower EVL hardware cost.

A third embodiment will be quickly described with reference to Figure 3C. In this embodiment, box 320 represents the data processing and information management function. Data processing power has been increased to the level of an integrated 486 type microprocessor 322 with approximately 256 kilobytes of flash memory 321 and 1 megabyte of DRAM 323. The processor interfaces with a data and information display and control function 335 including a keyboard or other input (not shown), touchscreen, or LCD, LCD controller and memory 336.

To receive input and provide output externally, there are provided parallel port 341 of the processor and serial port 342 of an external interface 340. Through the external interface 340, there pass cellular phone data, roadside reader or tag data, GPS data, satellite communications data (such as LEOSAT) and Qualcomm OmniTrax data.

There is also provided a PC-104 mezzanine interface.

To obtain vehicle and other sensor data, there is an eight channel analog sensor interface 330 designated 331 through which multi-sensor data is acquired. As has already been described, the sensors obtain safety, emission, cargo security and vehicle security and safety data among other data.

EVL data information storage and retrieval are represented by box 325 including a first and second PCMCIA interface 326 and 327 for electronic credential data of driver, cargo and vehicle.

Now referring to Figure 4, the operation of processors 302, 351 or equivalent processors will be described in connection with the formation of protected data packets (PDP's). Generally, Figure 4 represents the creation of the log memory of the Electronic Vehicle Log (EVL) 1 of the present invention. The protection provided for EVL memory 430 is described by outer dashed line box 433 as comprising a password and/or speaker verification. Via link 431 an EVL-unique secret key is provided to processor and DRAM 400 (for example, processor 302, 351).

Via link 401, the processor gathers the vehicle location data and via link 402 the processor gathers date and real time data, for example, from the same source 303 or 380 as described earlier in connection with Figures 3A and 3B.

Processor 400 also obtains vehicle sensor data via link 403, credentials and event data via link or links 404 and cargo status data via link 405.

The output of the processor 400 is a protected data packet forwarded via link 420 to a non-volatile log memory 410, for example, similar in form to variable data 308a or memory 370. An expanded view of the contents of a protected data packet 411 of the present invention is represented by block 411. The protected data packet 411 contains logged information 420a, a real time of day and date stamp 420b, a vehicle location stamp 420c, the unique vehicle identification 420d and an electronic signature 420e formed as will be described herein.

Logged information 420a may represent a printed page scanned from a page scanner or more data and thus may comprise megabytes of memory. On the other hand, a date and time stamp 420b may comprise just a hundred bytes of memory or less, for example, representing approximately twenty ASCII characters. Vehicle location data 420c including latitude and longitude may require ten to twenty bytes. Likewise, a vehicle identifier 420d may comprise just the equivalent of about twenty ASCII characters. On the other hand, the electronic signature 420e may require 200 bytes of data.

In general, the EVL log data will be generated using the following steps: 1) Data for logging will be acquired from various sources including, but not limited to, on-vehicle sensors, external systems and cargo monitors. The types of data logged and methods for acquiring the data have been described already above. 2) When a log entry is to be made, the EVL processor 400 will obtain the current date and time of day, vehicle location (at least in the form of latitude and longitude and possibly in the form of map location data such as route and mileage along a route from a given point), the EVL secret key and the EVL unique identification data. The processes for obtaining that data have likewise been described above. 3) The EVL processor prepares a protected data packet (PDP) using the information from step 2. The processor computes the packet's electronic signature 420e using a secure hash algorithm, a public key encryption algorithm and the EVL secret key. The PDP is then stored on the data logging medium (card, disk or the like).

Public key/private key encryption algorithms are known in the art including one formerly licensed through PKP Partners (a partnership of RSA and Cylink, which has recently been ordered dissolved by an arbitrator in California). Another is promoted through the National Institute of Standards and Technologies in Gaithersburg, Maryland (N.I.S.T.). US Patents numbered 4,405,829, 4,424,414, 4,200,770, 4,218,582, 4,995,082 and 5,231,668 describe this technology.

Once the data has been logged into the EVL, various methods may be used to transmit or transport the PDP's to other systems which may require the information (owners, drivers or governmental authorities). Additional encryption techniques may be used during transmission to prevent information from becoming available to unauthorized third parties who may be tapping the communications channel.

Now, data logging, authenticated data distribution, secure data transmission and credential storage operations will be described with reference to Figures 4A and 4B. Figure 4B shows the public key encryption pairs used by different authorities. First, data logging will be described in the context of the driver entering log data by way of example. When the vehicle is to be used, the driver inserts the removable non-volatile log memory 430 for the duration of the trip. For example, a driver may obtain access and log into the EVL by inputing their speech, a password or a biometric 433 after inserting their card memory 430. Upon successful recognition of the password or biometric and/or verification of the speaker's identity or after completion of both processes, the driver-unique data is used to decrypt a secret or private key member (for example, 451a which is never released from secure memory) of a public key encryption pair 451a and 451b. When data is to be logged by the driver, protected data packets containing this log data are generated with digital signatures formed by encrypting digital hash values with this secret key member 451a of the public key pair.

Now, authenticated data distribution will be described. Protected data packets (PDP's) 420 are transmitted to a requesting user via electronic means, for example, wireless, telephone modem or a memory card. The requesting user has a trusted (escrowed) copy of the public key 451b of the above-referenced public key pair 451a, 451b, the pair including the secret key 451a (which never leaves secure memory) used for forming the electronic signature. The public key 451b is used to verify that the electronic signature of the PDP is accurate. Correct verification of the electronic signature then confirms the data source (the driver-protected secret key 451a) and the integrity of the data (since the hash value matches the PDP data).

Secure data transmission from one party to another or intra-party will now be described. A governmental authority may obtain access by a defined process. One example of such a process for obtaining an early transmission of vehicle data in advance of a border crossing or like event is described by the following. The agency wishing to receive secure data generates a public key encryption pair 452a, 452b different from that used by the driver and distributes the public key portion 452b to any person or system desiring to transmit secure data. The public key portion 452b is stored in EVL memory. A profile of a commercial vehicle and a cargo may be extracted from the vehicle via a card memory or may be electronically extracted by wireless means prior to the vehicle's departure and delivered to the authority with the stored public key portion 452b. The EVL generates a private encryption key 431 and uses it to encrypt PDP's with their corresponding digital signatures. The EVL encrypts this private encryption key 431 using the public key 452b and transmits that information to the agency receiving the data. The receiving agency decrypts the EVL private encryption key 431 using the secret key portion 452a of the key pair 452a, 452b and then decrypts the PDP's using the decrypted key 431. The profile and public key 452b are transmitted via a centralized authority data base to regional data bases for distribution to checkpoints, port of entry border crossings and the like along the intended route of the vehicle.

As the vehicle approaches the inspection facility, the vehicle is polled or interrogated, for example, preferably by wireless means in advance of reaching the facility so the vehicle need not stop its movement. The vehicle transmitted profile data is compared with the previously transmitted profile data and the inspector may preclear the vehicle through the inspection station. If the inspection data is a weigh station, for example, and data is to be entered into the log by the authority, an electronic signature is utilized to verify the entered data, preventing subsequent modifications of the logged information. Moreover, at the time the entry is made, the vehicle position and time from the global positioning system may be automatically and simultaneously recorded, allowing detection of fraudulent entries. As the vehicle crosses the border, a short range communications system may be used to verify that the vehicle crossing the border is the vehicle which received the preclearance to cross.

It is also possible that the vehicle may carry all the profile information in the EVL and transit the data via wireless means to the authority just a few minutes before arrival or before the approval (for example, preapproval at a border crossing) event. In this case and in that described above as well, some sort of short range transmission is useful as the vehicle crosses the border to physically confirm that the vehicle crossing the border is the same as the one that provided the profile and credentials data and received preapproval to cross.

Finally, credential data storage will be described in some detail. An authorized individual such as an inspector or police officer creates a digital credential in a generating device's memory, for example, a laptop personal computer. A secret key 454a of a public key pair 454a, 454b is used to generate a digital signature for the credential data. The credential and signature are transmitted to the EVL using various means, possibly including wireless means, direct input (typing), or memory card transfer. This transfer may be encrypted as discussed above as desired. for wireless or other secure data transmission. The credential and signature are formed into a PDP and logged as described above for the driver data logging operation. When the credential is subsequently transmitted to a requesting agency, the agency will use a trusted copy of the public key portion 454b to verify the electronic signature of the PDP.

The EVL will internally store the data for subsequent display, processing or transmission. Much of the data stored will be sensitive. For example, the tariff-related data may be used to facilitate international border crossing and if this data could be electronically forged, it would result in a loss of revenue or worse. The storage techniques described above respond to this need for data security. The storage approach is also related to the data reception and transmission approaches described above and further in the following discussion.

A wide variety of media and storage techniques are currently available, several have been described above. One form is a removable non-volatile memory. This may comprise flash memory or other non-volatile memory adapted to form a removable unit such as a PCMCIA card. One or more of these cards may comprise the EVL.

Another memory is a removable disk drive. This may comprise a floppy disk drive or removable hard disk drive such as one, likewise mounted on a PCMCIA card. This may likewise be secure enough to form an EVL.

An internal non-volatile memory or disk drive may likewise comprise an EVL. This storage device may be hosted entirely within the EVL housing 300, 350 of Figures 3A or 3B. In one embodiment, it may not be removed without destruction of the data contained within.

In yet another embodiment of the present invention, an internal volatile memory may be used as an EVL if protected from erasure, for example, by a battery pr other power back-up device permanently associated therewith.

On the other hand, removable memory will allow a certified person to place credentials or event data on the storage device by removing it from the EVL housing, placing it into another electronic device (such as a portable computer), and writing the credentials in a secure manner onto the memory device. Non-volatile memory would require an interface between the EVL housing and the certified persons' electronic device. This interface could be either wired or wireless (radio frequency).

Typically each discrete group of information to be protected is processed by assembling the data in an area of volatile memory. The date and time of the packet creation are obtained from a reliable source and added to the packet. GPS and a clock internal to the EVL are possible sources. The position of the vehicle at the time of the packet creation are obtained from a reliable source and added to the packet. GPS and Loran are possible sources. The EVL unique identification data is obtained and added to the packet. A secure hash value is computed for the packet from the above-acquired data. The secure hash value is then encrypted using the EVL unique secret key from a public key encryption key pair. The encrypted secure hash value, then, is the electronic signature for the packet which may be recovered by those having the key to the exclusion of others. Packets with their corresponding signatures are stored in the EVL on the various storage media chosen for the application as described above.

The addition of reliable date, time of day, and location data is a significant security feature. It can prevent an unscrupulous person skilled in the art of computer hardware and software manipulation from forging protected data packets and inserting them into the EVL memory when the EVL is at a location inconsistent with the legitimate position or at a time inconsistent with an expected time of day for legitimate packet creation.

To prevent unscrupulous, technically adept persons from obtaining illicit access to the EVL Secret Key and creating forged PDP's, the EVL secret key and EVL unique identification data may be further protected using other cryptographic or other technologies. For example, the EVL secret key and identification data may be encrypted by a password known only by the user (such as the driver). The user (driver) would be required to enter their password prior to the start of transit or the entry of their data. The unencrypted data would be maintained only as long as the vehicle travels and adheres to an intended route or defined itinerary prestored with the password of the driver.

As a further security means, PDP generation may be contingent upon successful completion of a Speaker Verification function within the EVL. For example, the EVL may include a speaker verification (identity verification) and speech recognition (password recognition) subsystem or subsystems which verbally accepts the password used to decrypt the EVL secret key and EVL identification data. If the registered vehicle driver's voice is not confirmed (through speaker verification, for example), then the PDP encryption is not performed.

Figure 5A provides a table as an example of a memory table of protected data packets that may be maintained in an in-vehicle database (EVL) according to the method of Figure 4. One item may be the vehicle identification data which uniquely identify at least the vehicle. In particular, however, for a particular trip, the data ideally describes a unique driver, a unique cab and a unique trailer or trailers if pulling more than one trailer at a time or during a route. Vehicle classification data may describe the type of vehicle/trailer(s) and an oversize or overweight condition. For example, some states require no trailer(s) having a greater length than a predetermined length for safety reasons as automobiles allegedly are unable to pass such long trailers. Vehicle height limits are important for bridge and tunnel construction. Weight limits are imposed for highways because overweight vehicles are an important cause of the failure of roadways over time.

Another data item is cargo description. Their are various types including "hazardous" cargos that require special handling and special routing. Quantity must be logged and maintained for certain tariffs are based on quantity rather than weight or size. Cargo security is important to the trucker as well as the owner of the cargo. The cargo security is protected by bonding, by assuring environmental factors and the like. The cargo destination may vary with the route. Cargo is deposited and new cargo is picked up requiring new credential data be entered.

Route data comprises the following: intended route and intended stops along the way, alternate routes, expected times of arrival and destinations along the route. This data may be stored in the form of maps and compared with GPS data by appropriate algorithms to determine deviations from intended routes.

Safety information can contain inspections, dates of inspections, records of the inspections, and measurements taken. For example, brakes, engine failure, tire safety and the like, signal indicators and the like may be regarded over time.

Other credential data includes licenses permits, inspections, reports, trip logs of other trips, and manifests. This data is not intended to be entirely inclusive.

Over time, data may be tabulated and summarized and output in the form of Figure 5B. For example, brake performance can demonstrate over time the mechanical status and history of the cab and trailer(s) brakes. Moreover, over time, the driver status and history may be recorded. For example, the driver can collect road mileage, time or duration of travel for the mileage logged and health record. More particularly, the driver's vision, alcohol or drug record and the like can be maintained with the driver's identification. Figure 5B also refers to environmental systems for detecting temperature, pressure and the like which are factors of the environment of the vehicle, driver and cargo. Inspection records and on-board monitors and sensor data is recorded in an environmental system table over time.

Figures 6A and 6B provide charts showing several applications of the present invention identified as to service, application, technology or product applicable for providing that application, what can be demonstrated and its use. Figure 6B is merely a continuation of Figure 6A.

The following services are performed by the present invention in combination with external systems as required: commercial fleet management so that a fleet operator may maintain data on their fleet of vehicles, emergency notification and personal security, hazardous material and incident notification, commercial vehicle electronic clearance and administrative procedures for state and international border crossing, automated roadside safety inspections and on-board safety monitoring. The reader will please refer to the charts for application, technology or product available, demonstration and utilization information for each of these.

Thus there has been shown and described an electronic vehicle log and security method therefore by which different users may apply their own electronic signatures and secure their own data for later retrieval. Data packets are protected from unscrupulous individuals who would forge data by not only protecting the packets via public key/private key encryption but by voice security and real time of day and location data. Deviations from the present invention may be practiced for any more of the services of Figures 6A and 6B or other services that may come to mind from a reading of the present application. Any pending applications or patents mentioned above should be deemed to be incorporated by reference as to any material contained therein that is essential to a proper understanding of the present invention's manufacture or use. The present invention should only be deemed to be limited by the scope of the claims which follow.

**WHAT IS CLAIMED IS:**

1. Apparatus for maintaining a log of credential data secure from an uncertified user comprising

a processor for forming protected data packets comprising at least the credential data and an electronic signature representing a certified user and

a memory for storing the protected data packets.

2. Log maintenance apparatus according to claim 1 further comprising means for providing date and time of day data for inclusion in the protected data packets.

3. Log maintenance apparatus according to claim 2 further comprising an interface to said processor for receiving vehicle location data.

4. Log maintenance apparatus according to claim 1 further comprising an interface to sensors for sensing in-transit data.

5. Log maintenance apparatus according to claim 1 further comprising an interface to means for obtaining cargo monitoring data.

6. Log maintenance apparatus according to claim 1 further comprising an interface to means for obtaining event data.

7. Log maintenance apparatus according to claim 3 wherein said protected data packets comprise credential data, date and time data, vehicle location data vehicle identification data and the electronic signature.

8. Log maintenance apparatus according to claim 3 further comprising a microphone coupled to said processor, said processor receiving voice samples via the microphone for comparison with voice data stored in the memory.

9. A vehicular data processing method for use by a vehicle in interacting with an in-transit facility comprising the steps of:

communicating with the in-transit facility;

receiving a polling signal;

responsive to the polling signal, transmitting at least vehicle credential data; and

receiving a bypass signal or a stop signal, the bypass signal indicating that the vehicle may pass and the stop signal indicating the vehicle must stop.

10. The data processing method of claim 9 wherein

preliminary to the transmitting step, generating protected data packets comprising the credential data and an electronic signature.

11. The data processing method of claim 10 wherein

preliminary to the transmitting step, collecting data representing the date and time of day for inclusion in the protected data packet.

12. The data processing method of claim 9 wherein

preliminary to the transmitting step, collecting data representing the location of the vehicle for inclusion in the protected data packet.

13. The data processing method of claim 9 wherein

preliminary to the transmitting step, collecting data representing a unique vehicle identification for inclusion in the protected data packet.

14. The data processing method of claim 9 wherein the electronic signature comprises a secure hash value computed for the packet encrypted using a secret key from a public key encryption key pair.

15. A method of generating protected data packets for storage in an electronic vehicle log comprising the steps of

collecting data to be protected,

collecting data representing date and time of day,

collecting vehicle location data,

retrieving vehicle identification data,

generating an electronic signature from one or more of the collected and retrieved data, and

storing the protected data packet including the data to be protected, the date and time of day, the vehicle location, the vehicle identification and the electronic signature.

16. The method of claim 15 wherein said electronic signature is generated by performing the steps of computing a secure hash value for the packet and encrypting the secure hash value using the secret key of a public key encryption key pair.

17. The method of claim 15 further comprising the steps of a user speaking a password for comparison with a password stored for the user.

18. The method of claim 15 further comprising the steps of

storing a private encryption key,

encrypting protected data packets for transmission using the private encryption key and

transmitting the protected packet using a public key pair different from one used in generating the electronic signature.

19. The method of claim 15 comprising the steps of

generating event data and

generating a further electronic signature for the event data using a public key pair different from one used in generating the electronic signature.

20. The method of claim 15 comprising the steps of

storing intended vehicle route data,

comparing the collected vehicle location data with the intended vehicle route data and

determining if the protected data packet is valid from the result of the comparison step.

FIG. 1

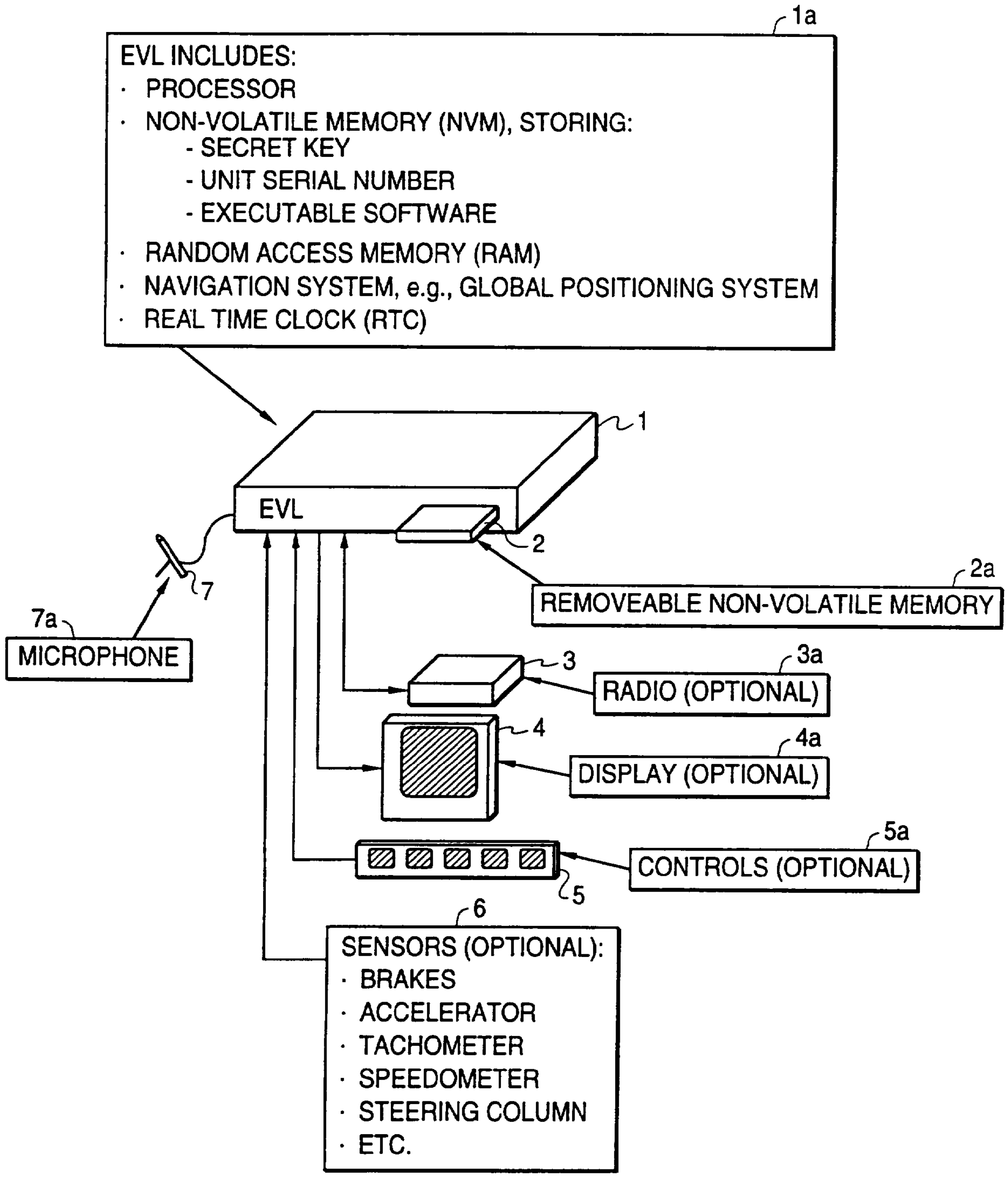

1a
EVL INCLUDES:
· PROCESSOR
· NON-VOLATILE MEMORY (NVM), STORING:
- SECRET KEY
- UNIT SERIAL NUMBER
- EXECUTABLE SOFTWARE
· RANDOM ACCESS MEMORY (RAM)
· NAVIGATION SYSTEM, e.g., GLOBAL POSITIONING SYSTEM
· REAL TIME CLOCK (RTC)
1
EVL
2
2a
REMOVEABLE NON-VOLATILE MEMORY
7
7a
MICROPHONE
3
3a
RADIO (OPTIONAL)
4
4a
DISPLAY (OPTIONAL)
5a
CONTROLS (OPTIONAL)
5
6
SENSORS (OPTIONAL):
· BRAKES
· ACCELERATOR
· TACHOMETER
· SPEEDOMETER
· STEERING COLUMN
· ETC.

FIG. 2A

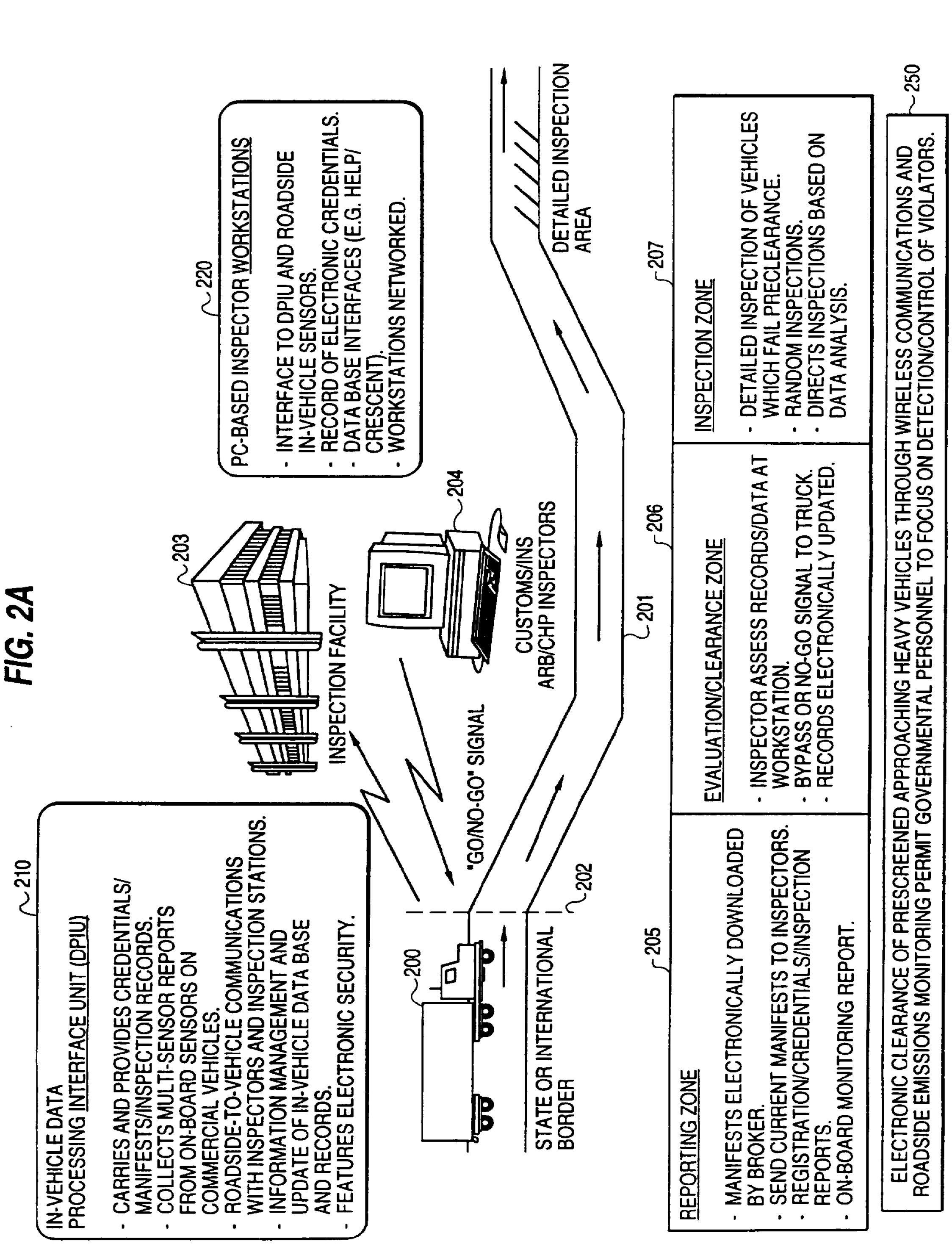

IN-VEHICLE DATA PROCESSING INTERFACE UNIT (DPIU)
· CARRIES AND PROVIDES CREDENTIALS/ MANIFESTS/INSPECTION RECORDS.
· COLLECTS MULTI-SENSOR REPORTS FROM ON-BOARD SENSORS ON COMMERCIAL VEHICLES.
· ROADSIDE-TO-VEHICLE COMMUNICATIONS WITH INSPECTORS AND INSPECTION STATIONS.
· INFORMATION MANAGEMENT AND UPDATE OF IN-VEHICLE DATA BASE AND RECORDS.
· FEATURES ELECTRONIC SECURITY.
210
200
STATE OR INTERNATIONAL BORDER
202
"GO/NO-GO" SIGNAL
INSPECTION FACILITY
203
CUSTOMS/INS ARB/CHP INSPECTORS
204
201
PC-BASED INSPECTOR WORKSTATIONS
· INTERFACE TO DPIU AND ROADSIDE IN-VEHICLE SENSORS.
· RECORD OF ELECTRONIC CREDENTIALS.
· DATA BASE INTERFACES (E.G. HELP/ CRESCENT).
· WORKSTATIONS NETWORKED.
220
DETAILED INSPECTION AREA
205
REPORTING ZONE
· MANIFESTS ELECTRONICALLY DOWNLOADED BY BROKER.
· SEND CURRENT MANIFESTS TO INSPECTORS.
· REGISTRATION/CREDENTIALS/INSPECTION REPORTS.
· ON-BOARD MONITORING REPORT.
206
EVALUATION/CLEARANCE ZONE
· INSPECTOR ASSESS RECORDS/DATA AT WORKSTATION.
· BYPASS OR NO-GO SIGNAL TO TRUCK.
· RECORDS ELECTRONICALLY UPDATED.
207
INSPECTION ZONE
· DETAILED INSPECTION OF VEHICLES WHICH FAIL PRECLEARANCE.
· RANDOM INSPECTIONS.
· DIRECTS INSPECTIONS BASED ON DATA ANALYSIS.
ELECTRONIC CLEARANCE OF PRESCREENED APPROACHING HEAVY VEHICLES THROUGH WIRELESS COMMUNICATIONS AND ROADSIDE EMISSIONS MONITORING PERMIT GOVERNMENTAL PERSONNEL TO FOCUS ON DETECTION/CONTROL OF VIOLATORS.
250

FIG. 2B

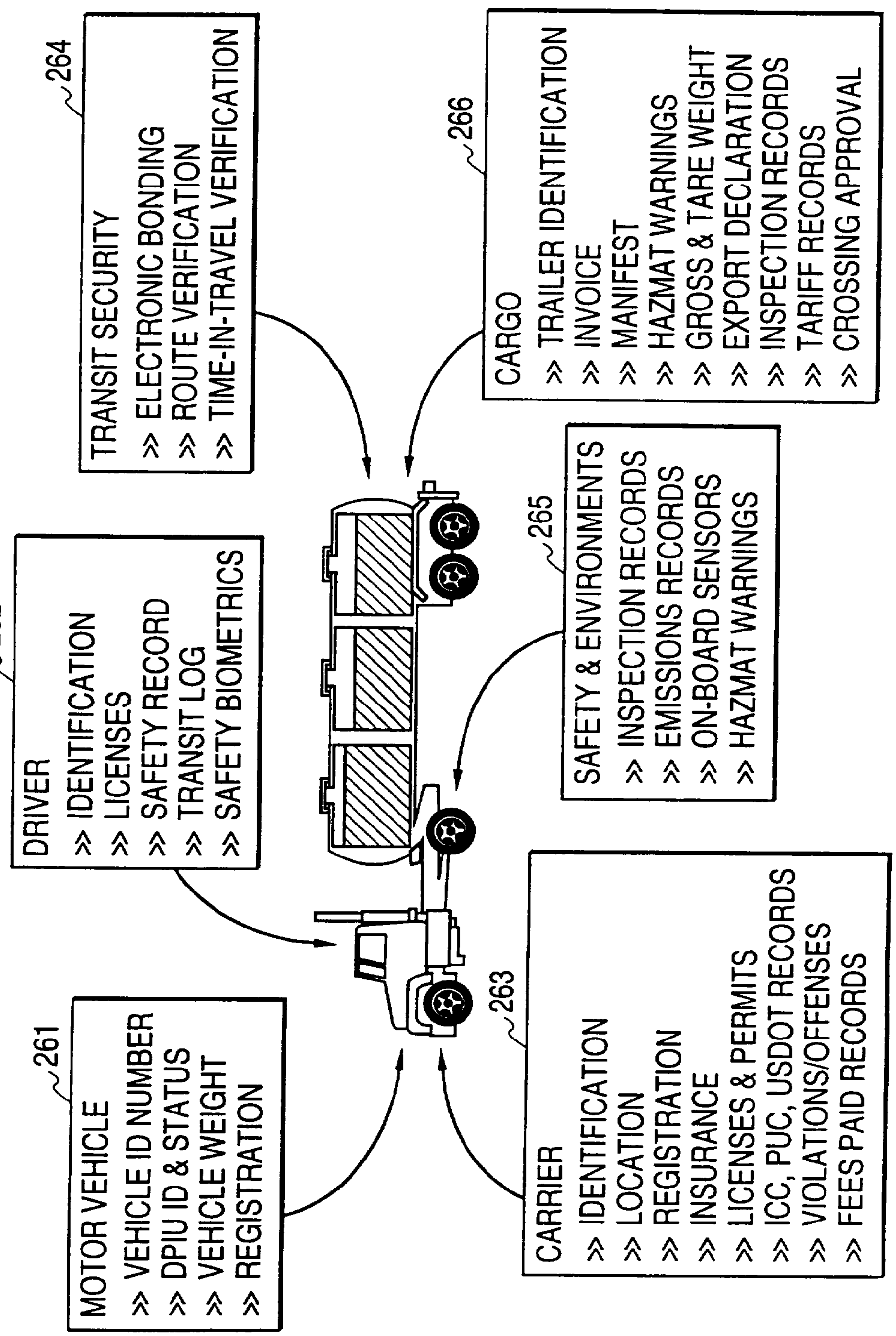

TRANSIT SECURITY
» ELECTRONIC BONDING
» ROUTE VERIFICATION
» TIME-IN-TRAVEL VERIFICATION
264
CARGO
» TRAILER IDENTIFICATION
» INVOICE
» MANIFEST
» HAZMAT WARNINGS
» GROSS & TARE WEIGHT
» EXPORT DECLARATION
» INSPECTION RECORDS
» TARIFF RECORDS
» CROSSING APPROVAL
266
DRIVER
» IDENTIFICATION
» LICENSES
» SAFETY RECORD
» TRANSIT LOG
» SAFETY BIOMETRICS
262
SAFETY & ENVIRONMENTS
» INSPECTION RECORDS
» EMISSIONS RECORDS
» ON-BOARD SENSORS
» HAZMAT WARNINGS
265
MOTOR VEHICLE
» VEHICLE ID NUMBER
» DPIU ID & STATUS
» VEHICLE WEIGHT
» REGISTRATION
261
CARRIER
» IDENTIFICATION
» LOCATION
» REGISTRATION
» INSURANCE
» LICENSES & PERMITS
» ICC, PUC, USDOT RECORDS
» VIOLATIONS/OFFENSES
» FEES PAID RECORDS
263

FIG. 3A

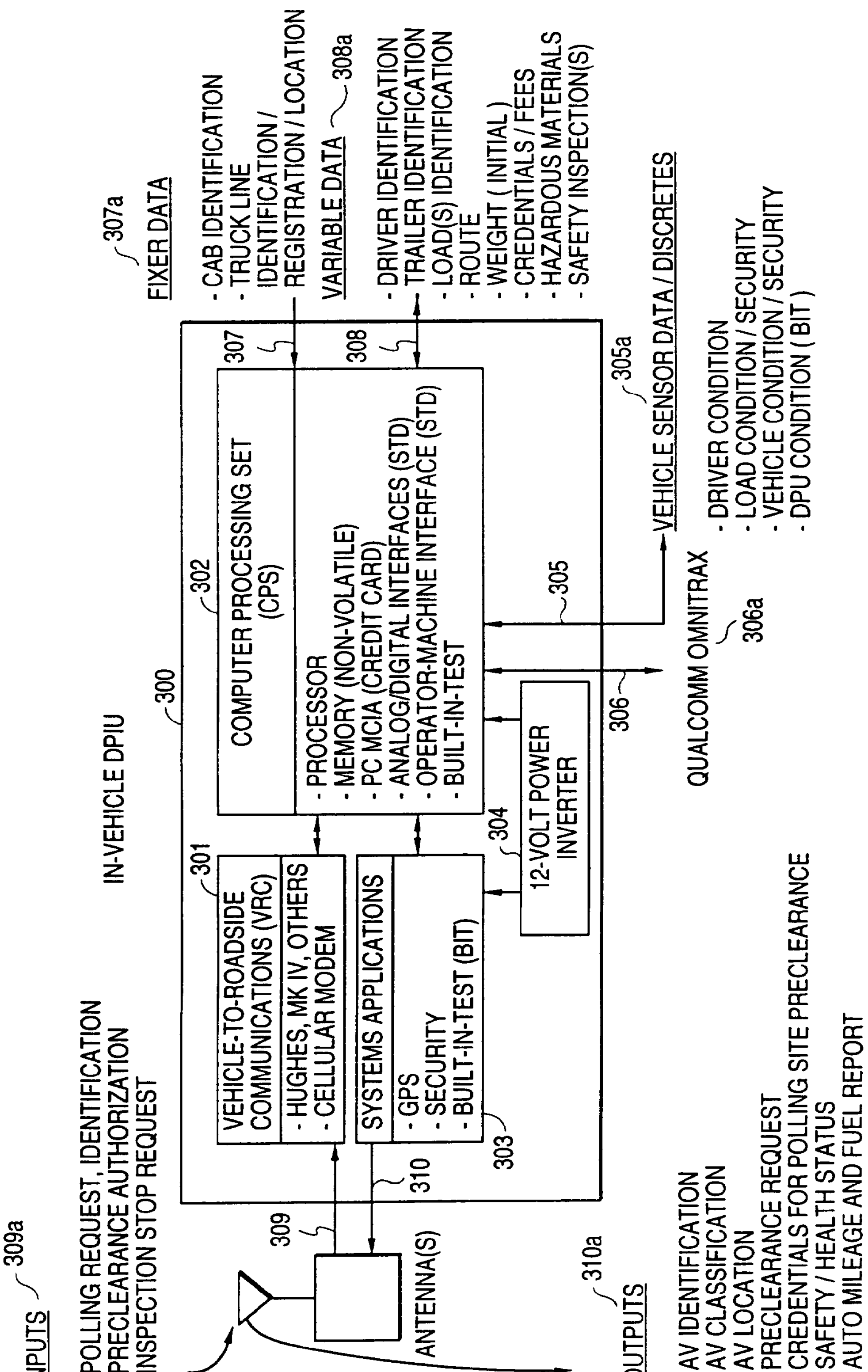

IN-VEHICLE DPIU
300
INPUTS
309a
- POLLING REQUEST, IDENTIFICATION
- PRECLEARANCE AUTHORIZATION
- INSPECTION STOP REQUEST
ANTENNA(S)
309
310
VEHICLE-TO-ROADSIDE COMMUNICATIONS (VRC)
301
- HUGHES, MK IV, OTHERS
- CELLULAR MODEM
SYSTEMS APPLICATIONS
- GPS
- SECURITY
- BUILT-IN-TEST (BIT)
303
12-VOLT POWER INVERTER
304
COMPUTER PROCESSING SET (CPS)
302
- PROCESSOR
- MEMORY (NON-VOLATILE)
- PC MCIA (CREDIT CARD)
- ANALOG/DIGITAL INTERFACES (STD)
- OPERATOR-MACHINE INTERFACE (STD)
- BUILT-IN-TEST
306
305
307
308
QUALCOMM OMNITRAX
306a
FIXER DATA
307a
- CAB IDENTIFICATION
- TRUCK LINE IDENTIFICATION / REGISTRATION / LOCATION
VARIABLE DATA
308a
- DRIVER IDENTIFICATION
- TRAILER IDENTIFICATION
- LOAD(S) IDENTIFICATION
- ROUTE
- WEIGHT ( INITIAL )
- CREDENTIALS / FEES
- HAZARDOUS MATERIALS
- SAFETY INSPECTION(S)
VEHICLE SENSOR DATA / DISCRETES
305a
- DRIVER CONDITION
- LOAD CONDITION / SECURITY
- VEHICLE CONDITION / SECURITY
- DPU CONDITION ( BIT )
OUTPUTS
310a
- AV IDENTIFICATION
- AV CLASSIFICATION
- AV LOCATION
- PRECLEARANCE REQUEST
- CREDENTIALS FOR POLLING SITE PRECLEARANCE
- SAFETY / HEALTH STATUS
- AUTO MILEAGE AND FUEL REPORT

FIG. 3B

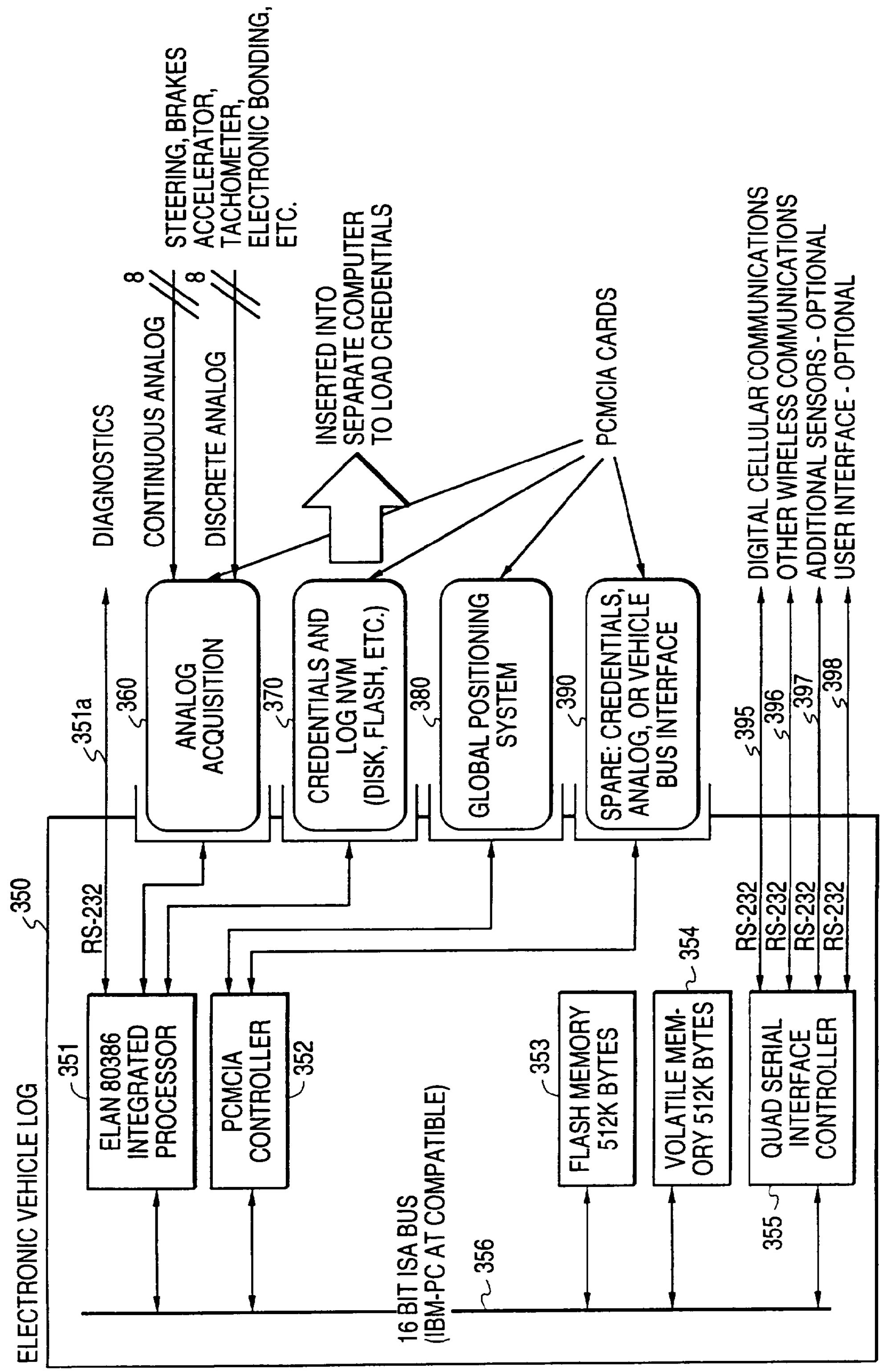

ELECTRONIC VEHICLE LOG
350
ELAN 80386 INTEGRATED PROCESSOR
351
PCMCIA CONTROLLER
352
FLASH MEMORY 512K BYTES
353
VOLATILE MEMORY 512K BYTES
354
QUAD SERIAL INTERFACE CONTROLLER
355
16 BIT ISA BUS (IBM-PC AT COMPATIBLE)
356
RS-232
351a
DIAGNOSTICS
ANALOG ACQUISITION
360
CONTINUOUS ANALOG
DISCRETE ANALOG
8
8
STEERING, BRAKES ACCELERATOR, TACHOMETER, ELECTRONIC BONDING, ETC.
CREDENTIALS AND LOG NVM (DISK, FLASH, ETC.)
370
INSERTED INTO SEPARATE COMPUTER TO LOAD CREDENTIALS
GLOBAL POSITIONING SYSTEM
380
SPARE: CREDENTIALS, ANALOG, OR VEHICLE BUS INTERFACE
390
PCMCIA CARDS
RS-232
RS-232
RS-232
RS-232
395
396
397
398
DIGITAL CELLULAR COMMUNICATIONS
OTHER WIRELESS COMMUNICATIONS
ADDITIONAL SENSORS - OPTIONAL
USER INTERFACE - OPTIONAL

FIG. 3C

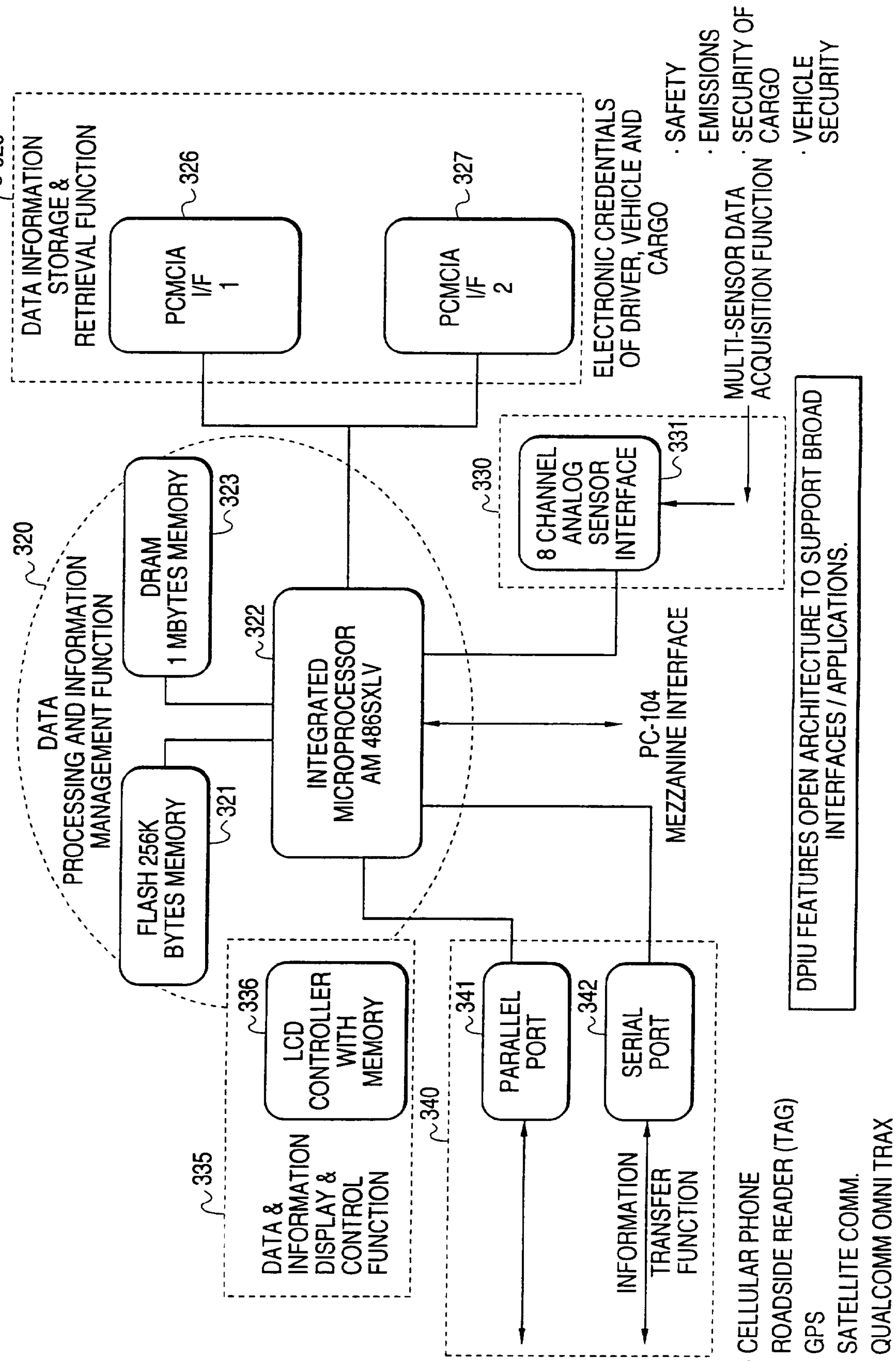

DATA INFORMATION STORAGE & RETRIEVAL FUNCTION
325
PCMCIA I/F 1
326
PCMCIA I/F 2
327
ELECTRONIC CREDENTIALS OF DRIVER, VEHICLE AND CARGO
. SAFETY
. EMISSIONS
. SECURITY OF CARGO
. VEHICLE SECURITY
MULTI-SENSOR DATA ACQUISITION FUNCTION
8 CHANNEL ANALOG SENSOR INTERFACE
331
330
DATA PROCESSING AND INFORMATION MANAGEMENT FUNCTION
320
DRAM 1 MBYTES MEMORY
323
INTEGRATED MICROPROCESSOR AM 486SXLV
322
FLASH 256K BYTES MEMORY
321
PC-104 MEZZANINE INTERFACE
DPIU FEATURES OPEN ARCHITECTURE TO SUPPORT BROAD INTERFACES / APPLICATIONS.
LCD CONTROLLER WITH MEMORY
336
DATA & INFORMATION DISPLAY & CONTROL FUNCTION
335
PARALLEL PORT
341
SERIAL PORT
342
340
INFORMATION TRANSFER FUNCTION
. CELLULAR PHONE
. ROADSIDE READER (TAG)
. GPS
. SATELLITE COMM.
. QUALCOMM OMNI TRAX

FIG. 4A

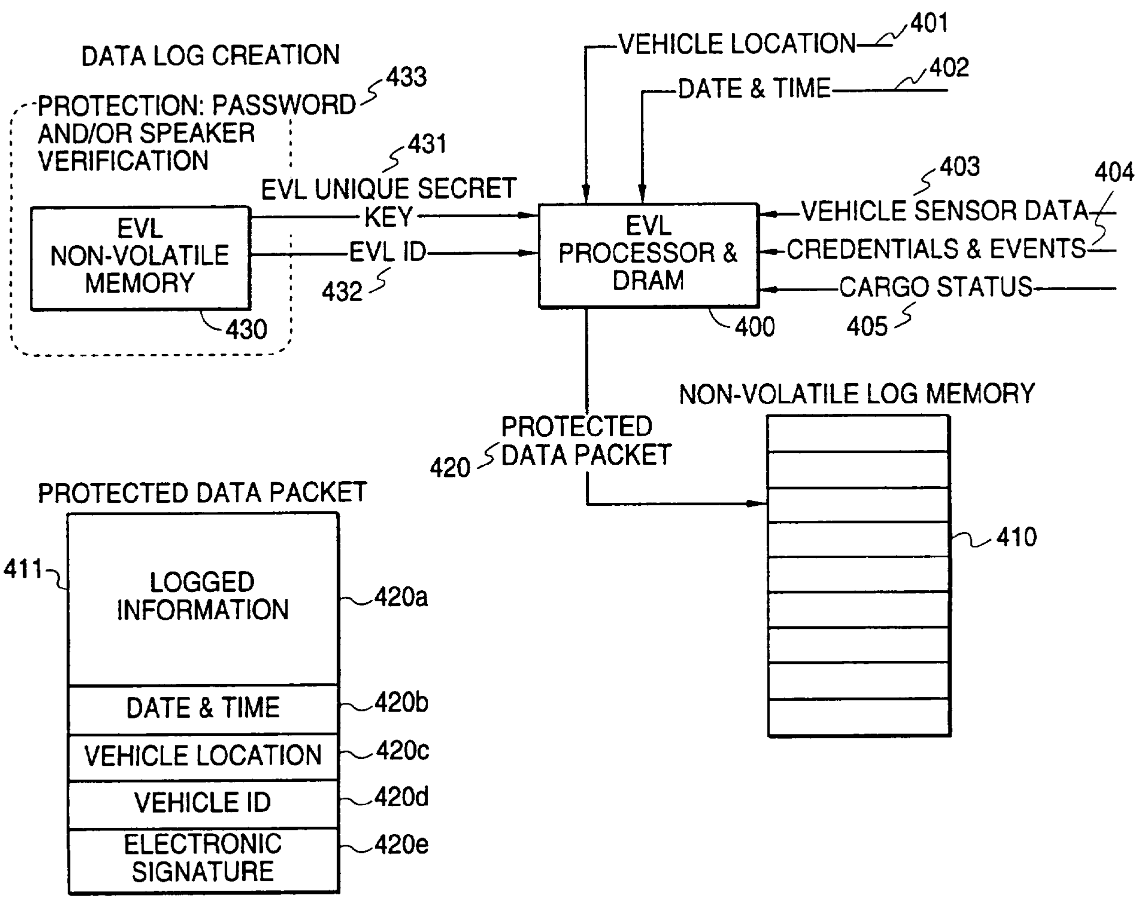



FIG. 4B

| | | DRIVER | 3RD PARTY AUTHORITY | OWNER-TRUSTED AUTHORITY |
|---|---|---|---|---|
| PUBLIC KEY PAIR | PRIVATE KEY | 451a | 452a | 454a |
| | PUBLIC KEY | 451b | 452b | 454b |
| | EVL KEY | | 431 | |

SUBSTITUTE SHEET (RULE 26)

FIG. 5A

| ITEM | CONTENTS |
| --- | --- |
| VEHICLE IDENTIFICATION | DRIVER, CAB, TRAILER(S) |
| VEHICLE CLASSIFICATION | TYPE OF VEHICLE/TRAILER(S) OVERSIZE/OVERWEIGHT |
| CARGO | TYPE / QUANTITY / SECURITY DESTINATION |
| ROUTE | ROUTES / STOPS/ DESTINATIONS / TIMES |
| SAFETY INFORMATION | INSPECTION DATES / RECORDS / MEASUREMENTS |
| CREDENTIALS | LICENSES / PERMITS / INSPECTIONS / REPORTS/ TRIP LOGS / MANIFESTS |

FIG. 5B

| ELEMENT | CHARACTERISTICS |
| --- | --- |
| BRAKE PERFORMANCE | MECHANICAL STATUS |
| DRIVER STATUS / HISTORY | ROAD MILES/ TIME / HEALTH RECORD |
| MAINTENANCE RECORDS | HISTORY / VIOLATIONS |
| ENVIRONMENTAL SYSTEM | INSPECTION RECORDS / ON-BOARD MONITORS |

FIG. 6A

| SERVICE | APPLICATION | TECHNOLOGY OR PRODUCT APPLICABLE | DEMONSTRATION | UTILIZATION |
|---|---|---|---|---|
| COMMERCIAL FLEET MANAGEMENT | - COMMERCIAL VEHICLE PRECLEARANCE SERVICE AT REAL TIME COMMUNICATIONS OF INFORMATION BETWEEN COMMERCIAL VEHICLE DRIVERS, DISPATCHERS AND INTERMODAL TRANSPORTATION PROVIDERS.<br>- REAL TIME ROUTE PLANNING AND RE-PLANNING.<br>- JUST-IN-TIME DELIVERY AND PICK-UP CAPABILITY.<br>- REAL TIME TRAFFIC INFORMATION.<br>- ELECTRONIC PURCHASING CREDENTIALS FOR SHIPMENTS.<br>- AUTO MILEAGE AND FUEL REPORTING AND AUDITING | - COMMUNICATIONS INFRA-STRUCTURE.<br>- AUTOMATIC VEHICLE/DRIVER MONITOR/ID SYSTEM.<br>- ADVANCED INFORMATION MANAGEMENT<br>- ROUTE PLANNING AND RE-PLANNING<br>- ADVANCED TRAFFIC INFORMATION/MANAGEMENT SYSTEM.<br>- MILEAGE AND FUEL USAGE MONITORING AND RECORDING. | - IN-VEHICLE-TO-ROAD-SIDE (DISPATCHER) COMMUNICATIONS NETWORK SERVICE.<br>- ON-BOARD SENSORS AND PROCESSORS.<br>- TWO-WAY DIGITAL AND VOICE COMMUNICATIONS SYSTEM.<br>- COMMUNICATIONS/DATA SECURITY. | - PRIVATE SECTOR:<br>- TRUCK LINES AND TRANSPORTATION PROVIDERS (RR). |
| EMERGENCY NOTIFICATION AND PERSONAL SECURITY | - IMMEDIATE NOTIFICATION OF AN INCIDENT AND IMMEDIATE REQUEST FOR ASSISTANCE.<br>-DRIVER SECURITY (MANUALLY INITIATED NOTIFICATION AND REQUEST FOR SUPPORT).<br>- MECHANICAL BREAKDOWNS.<br>- TRUCK JACKING.<br>- NON-INJURY ACCIDENTS.<br>- AUTOMATED COLLISION NOTIFICATION/ REQUEST FOR ASSISTANCE.<br>- TRAFFIC CONGESTION INCIDENT/ POTENTIAL NOTIFICATION AND REQUEST FOR SUPPORT. | - VEHICLE/DRIVER POSITION AND ID.<br>- CARGO ID.<br>- ID OF INCIDENT AND TYPE OF SUPPORT REQUIRED.<br>- EMERGENCY SERVICES COMMUNICATIONS.<br>- NETWORK-IN-VEHICLE-TO-ROADSIDE COMMUNICATIONS.<br>- ADVANCED INFORMATION MANAGEMENT SYSTEM. | N/A | -CARRIERS/TRUCK LINES.<br>- EMERGENCY SERVICE.<br>- MECHANICAL REPAIR SERVICES.<br>-AUTOMATED TRAFFIC INFORMATION MANAGEMENT CENTERS. |
| HAZARDOUS MATERIAL AND INCIDENT NOTIFICATION | - MONITORING INTERMODAL TRANSPORTA-TION OF HAZMAT.<br>- NOTIFICATION OF HAZMAT SHIPMENT THROUGH CITY, STATE, COUNTRY.<br>- NOTIFICATION OF INCIDENT INVOLVING HAZMAT SHIPMENT. | - DIRECTION OF RESPONSE TEAMS TO INCIDENT.<br>- NOTIFICATION OF ENFORCE-MENT AGENCIES OF SHIP-MENTS.<br>- ID, CLASS AND LOCATION OF SHIPMENT.<br>- PRECLEARANCE CREDENTIALS. | N/A | - HAZMAT SHIPMENT VEHICLES.<br>- GOVERNMENT AGENCIES.<br>- RESPONSIBLE FLEET MANAGEMENT. |

FIG. 6B

| SERVICE | APPLICATION | TECHNOLOGY OR PRODUCT APPLICABLE | DEMONSTRATION | UTILIZATION |
|---|---|---|---|---|
| COMMERCIAL VEHICLE ELECTRONIC CLEARANCE AND ADMINISTRATIVE PROCESSES | - DOMESTIC PRECLEARANCE.<br>- WEIGHT<br>- CREDENTIAL<br>- SAFETY/HEALTH<br>- CARGO<br>- BORDER PRECLEARANCE. | - VEHICLE TO/FROM ROADSIDE COMMUNICATIONS.<br>- INFORMATION EXCHANGE SYSTEM SECURE.<br>- HIGH-SPEED WEIGHT-IN-MOTION SYSTEMS.<br>- VEHICLE POSITION MONITORING AND ID - AVC.<br>- DRIVER AND DRIVER RECORDS MONITORING. | - IN-VEHICLE PROCESSOR/DATA BASE/COMMUNICATIONS INTERFACE.<br>- COMMUNICATIONS NETWORK: VEHICLE-TO ROADSIDE PROCESSOR AND ROAD-SIDE PROCESSOR-TO-CENTRAL CONTROL. | - STATES.<br>- CARRIERS (TRUCKS AND RAIL)<br>- COUNTRIES:<br>- CANADA.<br>- MEXICO.<br>- USA. |
| AUTOMATED ROADSIDE SAFETY INSPECTION | - SUPPORT PRECLEARANCE CAPABILITY.<br>- SAFETY OF HIGHWAYS.<br>- BREAKS.<br>- DRIVER CONDITIONS.<br>- VEHICLE SYSTEMS.<br>- SAFETY PERFORMANCE RECORD OF CARRIER, VEHICLE, DRIVER INSPEC-TION AND VERIFICATION.<br>- CORRECTIVE ACTIONS ORDERED AND TAKEN REVIEW. | - DRIVER/VEHICLE HISTORY FILES REAL TIME UPDATE.<br>- COMMUNICATIONS VEHICLE TO CENTRAL VEHICLE DATA BASE.<br>- VEHICLE MONITORING SYSTEM ON-BOARD DIAGNOSTIC.<br>- VEHICLE/DRIVER ID AND CREDENTIALS REVIEW. | - IN-VEHICLE PROCESSOR WITH CREDIT CARD MEMORY FOR SAFETY/HEALTH HISTORY.<br>- COMMUNICATIONS NETWORK AND INTERFACE FOR REAL TIME UPDATE OF RECORDS. | - ROADSIDE INSPECTIONS<br>- STATE/FEDERAL.<br>- TRUCK LINES.<br>- PRECLEARANCE. |
| ON-BOARD SAFETY MONITORING | - COMMERCIAL VEHICLE PRECLEARANCE SERVICE AT CHECKPOINTS AND BORDER.<br>- SUPPORT AUTOMATED ROADSIDE SAFETY INSPECTION SERVICE.<br>- REAL TIME MONITORING CRITICAL COMPONENTS OF VEHICLE, CARGO, AND DRIVER. | - ON-BOARD SENSING/MONITOR-ING THE SAFETY STATUS OF THE VEHICLE, CARGO AND DRIVER.<br>- COMMUNICATIONS OF SAFETY/HEALTH STATUS TO OFF-BOARD NODE-VEHICLE-TO-ROADSIDE.<br>- VEHICLE ID, DRIVER ID.<br>- ON-BOARD PROCESSOR.<br>- MONITORING/SENSING AND COLLECTING THE CONDITION OF CRITICAL VEHICLE COMPONENTS; BRAKES, TIRES, LIGHTS, SUSPENSION, STEERING, ETC.<br>- SHIFT IN CARGO OR CARGO STATUS SENSING.<br>- DRIVER HEALTH AND SAFETY MONITORING/REPORTING. | - IN-VEHICLE PROCESSOR/DATA BASE/COMMUNICATIONS INTERFACE.<br>- SAFETY/HEALTH MONITORING SYSTEM ON-BOARD-DIAGNOSTIC AND WARNING SYSTEM.<br>- COMMUNICATIONS NETWORK VEHICLE-TO-ROADSIDE NODE.<br>- INTERROGATION OF VEHICLE PROCESSOR. | - CARRIERS.<br>- NATIONAL ROADWAY SAFETY.<br>- VEHICLE SAFETY INSPECTION AT MAINLINE SPEEDS. |

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/12459

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :G06F 17/40
US CL :364/424.02, 424.04, 550; 340/988, 426, 464, 825.31,825.34
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 364/424.02, 424.03, 424.04, 441, 550, 551.01; 340/988, 425.5, 426, 438, 464, 825.31,825.34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>---<br>Y<br>---<br>A | US, A, 4,754,255 (SANDERS ET AL) 28 June 1988, Figures 1, 3, and 5; column 2; column 3, lines 1-24; column 6, lines 46--68; column 7, lines 1+. | 1-2<br>------<br>3-8,16,18<br>-----<br>9-14,15,17,19-20 |
| X<br>---<br>Y<br>---<br>A | US, A, 5,416,706 (HAGENBUCH) 16 May 1995, Figures 12-13, 14a-f. | 15,20<br>----<br>3-5,7,16-19<br>----<br>9-14 |
| Y<br>---<br>A | US, A, 5,185,700 (BEZOS ET AL) 09 February 1993, Abstract; Figures 1-3 and 9-10 | 6,19<br>----<br>9-14 |

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
27 NOVEMBER 1995

Date of mailing of the international search report
01 FEB 1996

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703) 305-3230

Authorized officer
B. Hayden for
COLLIN W. PARK
Telephone No. (703) 305-9754

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/12459

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US, A, 4,856,072 (SCHNEIDER ET AL) 08 August 1989, Abstract; Figurs 1, 2, and 3c | 8,17 |
| A | US, A, 3,624,608 (ALTMAN ET AL) 30 November 1971, entire document. | 1-20 |
| A | US, A, 3,665,397 (DI NAPOLI ET AL) 23 May 1972, entire document. | 1-20 |
| A | US, A, 4,804,937 (BARBIAUX ET AL) 14 February 1989, entire document. | 1-20 |
| A | US, A, 4,910,493 (CHAMBERS ET AL) 20 March 1990, entire document. | 1-20 |
| A | US, A, 4,949,263 (JURCA) 14 August 1990, entire document. | 1-20 |
| A | US, A, 5,249,127 (KOMATSU) 28 September 1993, entire document. | 1-20 |
| A | US, A, 5,303,163 (EBAUGH ET AL) 12 April 1994, entire document. | 1-8,15-20 |
| A | US, A, 5,307,349 (SHLOSS ET AL) 26 April 1994, entire document. | 9-14 |
| A | US, A, 5,347,274 (HASSET) 13 September 1994, entire document. | 1-20 |
| A | US, A, 5,359,522 (RYAN) 25 October 1994, entire document. | 1-8,15-20 |
| A | US, A, 5,359,528 (HAENDEL ET AL) 25 October 1994, entire document. | 1-20 |
| A | US, A, 5,379,219 (ISHIBASHI) 03 January 1995, entire document. | 1-8,15-20 |
| A | US, A, 5,425,032 (SHLOSS ET AL) 13 June, 1995, entire document. | 9-14 |

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/12459

**Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [ ] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. [ ] Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. [X] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**
[ ] The additional search fees were accompanied by the applicant's protest.
[ ] No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet(1))(July 1992)★

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-8 and 15-20, drawn to a system of generating and maintaining a log.
Group II, claims 9-14, drawn to a method for use by a vehicle for interacting with an in-transit facility.

The inventions listed as Groups I and II do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:
Group I lacks the technical features of Group II representing its inventive concept, "communicating with the in-transit facility," "receiving a polling signal" from an in-transit facility, "transmitting vehicle credential data" to the facility, and "receiving a bypass or a stop signal." Further, Group II lacks the technical features of Group I, forming and storing "protected data packets."

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 629 978 A1**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number : **94303963.6**

(51) Int. Cl.$^5$ : **G07C 5/08**

(22) Date of filing : **02.06.94**

(30) Priority : **02.06.93 US 71077**

(43) Date of publication of application : **21.12.94 Bulletin 94/51**

(84) Designated Contracting States : **CH DE ES FR GB IT LI**

(71) Applicant : **TRANSPORTATION RECORDING SYSTEMS, INC.**
**302 South Jones Street**
**Barneveld, Wisconsin 53507 (US)**

(72) Inventor : **Carmody, C. Scott**
**302 South Jones Street**
**Barneveld, Wisconsin 53507 (US)**
Inventor : **Kron, Gregory M.**
**14625 West Park Avenue**
**New Berlin, Wisconsin 53151 (US)**

(74) Representative : **Carpenter, David**
**MARKS & CLERK,**
**Alpha Tower,**
**Suffolk Street Queensway**
**Birmingham B1 1TT (GB)**

(54) **System for recording expense type information in combination with information pertaining to one or more operating characteristics of a vehicle.**

(57) A system for monitoring certain vehicle operating information and recording other date includes a vehicle interface unit (22) permanently mounted to a vehicle, and a data recorder unit (20) removably interconnectable with the vehicle interface unit (22). The vehicle interface unit (22) receives signals from the vehicle through the vehicle's interface connector (24), such as signals pertaining to distance travelled and other operating characteristics, e.g. operation of headlights, directional signals, brakes or seat belts, and such signals are communicated through a communications link to the data recorder unit (20). The data recorder unit (20) includes a memory in which such information is stored, and the data recorder unit (20) can be disconnected from the vehicle interface unit (22) and interconnected with an external device such as a computer or printer for outputting information stored in the memory. The data recorder unit (20) can also be used to store other information, such as pertaining to business expenses or the like.

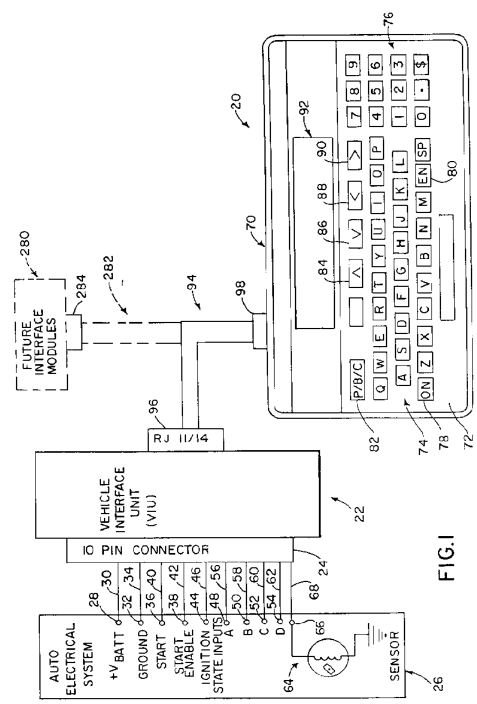



FIG.1

EP 0 629 978 A1

Jouve, 18, rue Saint-Denis, 75001 PARIS

This invention relates to a system for use in combination with a vehicle to monitor and record certain information pertaining to operation of the vehicle along with other information manually input by the operator, such as for use in tracking expenses.

Generally, it is beneficial for persons who use a vehicle in connection with a business to keep track of the number of miles traveled by the vehicle for business purposes. When the vehicle owner is an individual using his or her personal vehicle for business purposes, this information can typically be used to generate a deduction on the person's income tax returns. When the owner of the vehicle is an employer, it is important to keep track of the amount of miles logged by the employee both for business and personal purposes.

In the past, a typical method of keeping track of business and personal use of a vehicle has been to maintain a written log in which the operator enters by hand the date of operation and information allowing the operator to calculate the number of business miles traveled, typically start and stop readings taken from the vehicle's odometer. One drawback to this type of system is that it relies on the operator to accurately record the necessary information. Another drawback is that, if the operator wishes to keep track of other expenses, such as meals, lodging, entertainment or the like, the operator must keep a separate log of such information, thus generating separate sets of records for related expense information. Another drawback is that the operator must diligently record expense information including vehicle mileage in order to keep an accurate record, which is often easily overlooked.

It is an object of the present invention to provide a system for monitoring and recording information pertaining to vehicle operation for assisting an operator to accurately track and record business or personal use of the vehicle. It is a further object of the invention to provide a system enabling the operator to input and record other information, such as expenses pertaining to meals, lodging and entertainment. It is a further object of the invention to provide such a system which is user-friendly, making it as easy as possible for an operator to provide an accurate and reliable record of information pertaining to expenses and vehicle operation. A further object of the invention is to provide such a system which is relatively simple in its components and operation, yet which provides highly satisfactory performance.

In accordance with one aspect of the invention, a vehicle monitoring and data recording system includes a vehicle interface unit adapted for interconnection with the electrical system of the vehicle for sensing one or more operating characteristics of the vehicle, and for outputting a first set of data signals indicative of the sensed vehicle operating characteristic. The system further includes a portable recorder unit adapted for removable interconnection with the vehicle interface unit. The portable recorder unit includes a memory, an input for receiving the first set of data signals from the vehicle interface unit, and a manually operable data entry device. The input provides the first set of data signals to the memory, and the manually operable data entry device allows an operator to input data, to thereby output a second set of data signals to the memory in response thereto. A processor is interconnected with the memory, and the recorder unit is disconnectable from the vehicle interface unit and connectable to an external device, such as a computer or printer, for outputting to the external device a third set of data signals from the memory which includes the first and second sets of data signals. The vehicle interface unit is in the form of a module interconnected via a series of buses with the electrical system of the vehicle, with each bus providing a signal to the module indicative of the status of one of the vehicle's operating characteristics. The vehicle interface unit includes a processor interconnected with the buses for processing signals provided thereby and for generating the first set of data signals in response thereto. The vehicle interface unit may be interconnected with the ignition system of the vehicle, so as to prevent vehicle ignition unless the portable recorder unit is connected to the vehicle interface unit. The vehicle interface unit receives signals from the vehicle indicative of distance traveled by the vehicle, such as the signals provided to the vehicle's odometer. The manually operable data entry device is preferably in the form of a keypad, which allows an operator to input a signal to the memory indicative of the business or personal nature of the vehicle mileage. In addition to vehicle mileage, the vehicle interface unit may be interconnected with the electrical system of the vehicle to monitor other vehicle operating characteristics, such as brake operation, directional signal operation, seat belt use and headlight operation.

The invention further contemplates a method of monitoring vehicle operating characteristics and recording data. The method involves sensing one or more vehicle operating characteristics, and generating a first set of data signals indicative of the one or more sensed vehicle operating characteristics. The first set of data signals are stored in a portable recorder unit removably interconnected with the vehicle. The method further involves generating a second set of data signals by manual operation of a data entry device; storing the second set of data signals in the portable recorder unit; disconnecting the portable recorder unit from the vehicle and interconnecting the portable recorder unit with an external device such as a printer or computer; and outputting to the external device a third set of data signals which includes the first and second sets of data signals. The particulars of the method are substantially in accordance with the foregoing summary.

Various other features, objects and advantages of the invention will be made apparent from the following description taken together with the drawings.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

Fig. 1 is a schematic representation of the vehicle monitoring and data recording system of the invention, showing the vehicle interface unit interconnected with the vehicle's electrical system and the portable recorder unit interconnected with the vehicle interface unit;

Fig. 2 is a schematic representation showing interconnection of the portable recorder unit with an external device such as a computer or printer;

Fig. 3 is a schematic representation of the components of the vehicle interface unit of the system of Fig. 1; and

Fig. 4 is a schematic representation of the components of the portable recorder unit of the system of Fig. 1.

Referring to Fig. 1, a vehicle monitoring and data recording system constructed according to the invention generally includes a portable data recorder unit (DRU) 20 and a stationary vehicle interface unit (VIU) 22 connected via a connector 24 with the electrical system of a vehicle. Typically, the vehicle's electrical system includes an interface connector, shown generally at 26, located within the interior compartment of the vehicle. Interface connector 26 includes a series of terminals to which vehicle interface unit 22 is connected via a series of buses interconnected with connector 24. Such terminals include a power terminal 28 which supplies power to VIU 22 from the vehicle via a bus 30; a ground terminal 32 providing ground potential to VIU 22 through connector 24 and a bus 34; a start terminal 36 and a start enable terminal 38 providing signals to VIU 22 through connector 24 and buses 40, 42, respectively; an ignition terminal 44 providing an ignition signal to VIU 22 through connector 24 and a bus 46, and oparating state terminals 48, 50, 52 and 54 providing input signals to VIU 22 through connector 24 and buses 56, 58, 60 and 62, respectively. State inputs A-D at terminals 48-54 may be that such as the vehicle's headlights, directional signals, brakes, seat belt indicators or the like.

Vehicle interface connector 26 further includes an odometer sensor 64 which provides pulses to a terminal 66 which are communicated via a bus 68 and connector 24 to VIU 22. Each pulse generated by sensor 64 is indicative of a predetermined distance traveled by the vehicle, which enables the vehicle odometer to output a mileage reading and the vehicle speedometer to output an instantaneous indication of the speed at which the vehicle is traveling.

DRU 20 includes a housing 70 having a front panel 72. A standard QWERTY keypad, shown generally at 74 is mounted to front panel 72, along with a numeric keypad 76, a power key 78, an "enter" key 80, and a personal/business/commute (P/B/C) key 82. A series of cursor movement keys 84, 86, 88 and 90 are also mounted to housing front panel 72. A display 92, such as an LCD display, is mounted to housing front panel 72 above keypad 74.

DRU 20 and VIU 22 are interconnected with each other via a conventional six-wire RJ11/14 shielded power and communications cable 94. RJ11/14 connectors or ports 96, 98 are provided on VIU 22 and DRU 20, respectively, for receiving the ends of cable 94. Cable 94 can be disconnected from either or both of connectors 96, 98, enabling DRU 20 to be removably connected to VIU 22.

As shown in Fig. 2, DRU 20 can be interconnected with external devices, such as a computer 100 or a printer 102, equipped with communication ports 104, 106, respectively. Computer 100 and printer 102 are adapted for interconnection with DRU 20 by communication links 108, 110, respectively. Preferably, DRU 20 is connectable to either one or the other of computer 100 or printer 102, so as to enable information contained within DRU 20 to either be downloaded into a data storage device associated with computer 100 or to be printed through printer 102.

The components of VIU 22 are illustrated in Fig. 3. As noted previously, VIU 22 is interposed between vehicle interface connector 26 and DRU 20, with DRU 20 being removably connectable to VIU 22 through communication ports 96.

VIU 22 concludes a programmable microcontroller 112. Microcontroller 112 receives power from the vehicle through voltage and current protection circuit 114 interconnected with the vehicle's power source, such as a battery, via line 30, and ground potential through line 32; a voltage regulator 116 interconnected with voltage and current protection circuit 114 via a line 118; and a power conditioning circuit 120 interconnected with voltage regulator 116 via a line 122, and with microcontroller 112 via a line 124. Microcontroller 112 receives input voltage signals through a signal voltage conditioning circuit 126, which is interconnected with start terminal line 40, start enable terminal line 42, ignition line 46, and vehicle operating state input lines 56, 58, 60 and 62. These input voltage signals are provided to microcontroller 112 through lines 128, 130, 132, 134, 136, 138 and 140, respectively.

A manually operable bypass switch 142 is interconnected between start line 40 and start enable line 42. A start enable relay 144 receives power from a line 146 interconnected with line 118, and is interconnected with start enable line 42 and with start line 40 through a line 148. Start enable relay 144 is interconnected with microcontroller 112 through a line 150.

Vehicle mileage pulse line 68 is interconnected with microcontroller 112 through a low level signal conditioning circuit 152 having an enabling circuit

153, and a line 154. An RS-232 communications transceiver 156 including an enabling circuit 158 transmits signals to microcontroller 112 through a line 160, and receives signals from microcontroller 112 through a line 162. Enabling circuit 158 of transceiver 156 is interconnected with microcontroller 112 via a line 164, which in turn is interconnected with enabling circuit 153 of low level signal conditioning circuit 152 via a line 166. A conventional resonator 168 is interconnected with microcontroller 112 through lines 170, 172.

Through communication port 96, protected voltage and ground potential is provided to DRU 20 through lines 174, 176, respectively. Cable 94 includes a line 178 which transmits signals from microcontroller through transceiver 156 to DRU 20, and a line 180 which transmits signals from DRU 20 to microcontroller 112 through transceiver 156.

Fig. 4 illustrates the components of DRU 20. DRU 20 includes a programmable microcontroller 184 interconnected with a conventional resonator 186 via a line 188. DRU 20 further includes an RS-232 transceiver 190, which is interconnected with lines 178, 180 from VIU 22 through DRU communication port 98. Transceiver 190 transmits signals to microcontroller 184 through a line 192, and receives signals from microcontroller 184 through a line 194. Transceiver 190 further includes an enabling circuit 196, which is interconnected with microcontroller 184 through a line 198.

DRU 20 is further equipped with a rechargeable battery 200, which is charged by a charge circuit 202 and lines 204, 206 and 208. Charge circuit 202 is interconnected with power line 210, which in turn is interconnected with lines 174, 176 from VIU 22 for transmitting power to DRU 20. Line 208 further provides power to an LCD intensity control 212. Power is supplied from battery 200 or charge circuit 202 to a voltage drop circuit 214 and to microcontroller 184 through a line 216. Similarly, power is supplied from charge circuit 202 to a voltage regulator circuit 218 including an enabling circuit 220. A line 222 extends between voltage regulator 218 and a program memory 224, and a line 226 extends between voltage regulator circuit 218 and microcontroller 184. A line 228 interconnects voltage regulator enabling circuit 220 with microcontroller 184.

A line 230 extends between power line 222 and transceiver 190.

Microcontroller 184 is further interconnected with a contrast control circuit 232 through a line 234, and contrast control circuit 232 in turn is interconnected with transceiver 190 through a line 236 and with an LCD controller/driver circuit 238 through a line 240. Power is supplied to LCD controller/driver circuit 238 through a line 242 from power line 222. Microcontroller 184 is interconnected with intensity control circuit 212 through a line 244.

Power is supplied to microcontroller 184 from battery 200 through line 216, or from charge circuit 202 through voltage regulator 218 and a line 246 extending between microcontroller 184 and power line 222.

Program memory 224 is interconnected with microcontroller 184 through a line 248, and a nonvolatile RAM 250 is interconnected with microcontroller 184 through lines 252, 254. A clock 256 having a crystal 258 is interconnected with RAM 250 through a line 260, and with microcontroller 184 through a line 262.

An audible beeper 264 is interconnected with microcontroller 184 through a line 266. Microcontroller 184 is interconnected with LCD controller/driver circuit 238 through a line 268, and LCD 92 is interconnected with LCD controller/driver circuit 238 through a line 270. LCD back light intensity control circuit 212 is interconnected with an LCD back light 272 through a line 274.

In operation, the above-described components function as follows. Initially, VIU 22 is interconnected with vehicle interface connector 26, and is mounted in an inconspicuous location within the interior of the vehicle. To operate, DRU 20 is connected to VIU 22 using communication and power cable 94, and DRU power key 78 is depressed to provide power to DRU 20 through VIU 22, or from battery 200. Upon power-up of DRU 20, a unique identifying signal is communicated from DRU 20 to VIU 22, and VIU microcontroller 112 is programmed so as to allow vehicle operation only by a person (or persons) possessing a DRU 20 having an acceptable identifying code. When the code of DRU 20 and the preprogrammed acceptable code(s) of VIU 22 match, VIU microcontroller 112 sends a signal through line 150 to start enable relay circuit 144, which functions to interconnect start terminal 36 and start enable terminal 38 of vehicle interface connector 26, thus allowing ignition of the vehicle.

As an alternative, bypass switch 142 can be operated to interconnect start terminal 36 with start enable terminal 38.

Upon ignition of the vehicle, DRU microcontroller 184 sends a signal through line 266 to actuate beeper 264, to provide an audible prompt to the operator. The operator then depresses P/B/C key 82 to select whether the mileage to be driven is personal, business or for commuting, and such information is communicated to DRU microcontroller 184 and a corresponding legend appears on display 92. As the vehicle is operated, the distance pulses from vehicle interface connector terminal 66 are communicated to VIU microcontroller 112 through pulse signal conditioning circuit 152 and line 154. This information is then communicated to DRU microcontroller 184 through VIU transceiver 156 and DRU transceiver 196, and DRU microcontroller 184 then converts such signals into mileage information, which is communicated to and stored in RAM 250. Simultaneously, date and time information is communicated to RAM 250 from clock 256.

Each time the operator changes the designation of the mileage traveled by depressing P/B/C key 82, such information is communicated to DRU microcontroller 184 and to RAM 250, along with date and time information from clock 256. This enables the operator to accurately keep track of business, personal and commuting miles, along with the dates and times such mileage was covered.

At the same time mileage information is communicated through DRU microcontroller 184 to RAM 250, other information pertaining to vehicle operating characteristics is communicated from state input terminals 48, 50, 52 and 54 of vehicle interface connector 26 to RAM 250 through DRU microcontroller 184 and VIU microcontroller 112. For instance, such information may pertain to characteristics such as operation of the vehicle head-lights, directional signals, brake lights or seat belt indicator. This information is stored in RAM 250 for a predetermined amount of time, e.g. five or ten minutes. If desired, this vehicle operating characteristic information can be extracted from RAM 250, so as to enable a person to determine these vehicle operating characteristics for the preceding five or ten minute time period, which may be useful in accident investigations or the like.

When the operator is finished operating the vehicle, DRU 20 is disconnected from VIU 22, and the operator can then carry DRU 20 along in a briefcase, purse or the like. Information pertaining to other expenses incurred by the operator can be input into DRU 20 using QWERTY keypad 74 and numeric keypad 76. Such information is displayed on display 92, and simultaneously stored in RAM 250 through DRU microcontroller 184.

Whenever desired, the operator interconnects DRU 20 with either computer 100 or printer 102. By depressing appropriate buttons of keypad 74, the information stored in DRU RAM 250 is either downloaded into computer 100 or communicated to printer 102 for printing a hard copy of an expense report. When communicating information to computer 100, such information can be interfaced with an expense management program or the like so as to enable such information to be incorporated thereinto.

Appropriate software is loaded into program memory 224 through DRU microcontroller 184 to carry out the above steps. The software stored in program memory 224 can be modified or replaced as desired, permitting DRU 20 to be field programmable for accommodating software updates and/or custom programs for specific user requirements.

Referring back to Fig. 1, other devices, shown generally as future interface modules 280, can be interconnected with DRU 20 through a communication link 282 and a connector 284. For example, such devices may include a portable communication device such as a radio transmitter or a cellular telephone. A communication device such as this enables an operator to relay information contained within DRU RAM 250 to a remote receiving device, such as a radio receiver or other cellular communication device, for communicating information from RAM 250 to a remote station. Representative applications for this type of system include transmitting expense information from traveling sales personnel to a central expense tracking facility, or transmitting transportation service information to a central facility. For example, a transportation service for disabled individuals can input a unique identifying code for each user, and information pertaining to the distance the user was transported can automatically be transmitted to a central processing facility for enabling the transportation service to rapidly generate a bill for such transportation services rendered to that individual. Numerous other applications for the system of the invention are contemplated, utilizing either transmitting or receiving equipment.

Various alternatives and embodiments are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter regarded as the invention.

## Claims

1. A vehicle monitoring and data recording system for use with a vehicle, comprising:

   a vehicle interface unit adapted for interconnection with the electrical system of the vehicle for sensing one or more vehicle operating characteristics and for outputting a first set of data signals indicative of the sensed vehicle operating characteristics; and

   a portable recorder unit adapted for removable interconnection with the vehicle interface unit, comprising a memory; an input for receiving the first set of data signals from the vehicle interface unit and for providing the first set of data signals to the memory; a manually operable data entry device for allowing an operator to input data and for outputting a second set of data signals in response thereto to the memory; and a processor interconnected with the memory; wherein the data recorder unit is disconnectable from the vehicle interface unit and connectable to an external device for selectively outputting, to the external device, a third set of data signals from the memory which includes at least the first and second sets of data signals.

2. The system of claim 1, wherein the vehicle interface unit comprises a module interconnected via a series of lines with the vehicle electrical system,

each line providing a signal to the vehicle interface unit module indicative of one of the vehicle's operating characteristics.

**3.** The system of claim 2, wherein the vehicle interface unit includes a processor interconnected with the lines for processing signals received from the lines and generating the first set of data signals in response thereto.

**4.** The system of claim 3, wherein the vehicle interface unit is interconnected with the ignition system of the vehicle and includes an arrangement for preventing vehicle ignition unless the data recorder unit is connected to the vehicle interface unit.

**5.** The system of claim 4, wherein the vehicle ignition system includes a start terminal and a start enable terminal, and wherein the ignition preventing arrangement comprises a circuit including the processor for detecting connection of the data recorder unit to the vehicle interface unit.

**6.** The system of claim 5, wherein the vehicle interface unit includes a programmable device for entering a unique identifying code for each individual authorized to operate the vehicle, and wherein the vehicle interface unit processor functions to prevent vehicle ignition by an unauthorized individual.

**7.** The system of claim 1, wherein the vehicle interface unit is interconnected with the input to the vehicle's odometer to receive data signals therefrom and to enable monitoring of the vehicle's mileage.

**8.** The system of claim 7, wherein the manually operable data entry device comprises a keypad including a key allowing an operator to input a signal to the memory of the data recorder unit indicative of business or personal operation of the vehicle.

**9.** The system of claim 7, wherein the vehicle interface unit is further interconnected with the electrical system of the vehicle to sense one or more of the following vehicle operating characteristics; brake operation, directional signal operation, and headlight operation, and seat belt operation.

**10.** The system of claim 1, wherein the vehicle interface unit is interconnected with an electrical interface connector associated with the vehicle for receiving signals therefrom indicative of one or more of the vehicle operating characteristics.

**11.** A method of monitoring vehicle operating conditions and recording data, comprising the steps of:

sensing one or more vehicle operating characteristics;

generating a first set of data signals indicative of the one or more sensed vehicle operating characteristics;

storing the first set of data signals in a portable recorder unit removably interconnected with the vehicle;

generating a second set of data signals by manual operation of a data entry device;

storing the second set of data signals in the portable recorder unit;

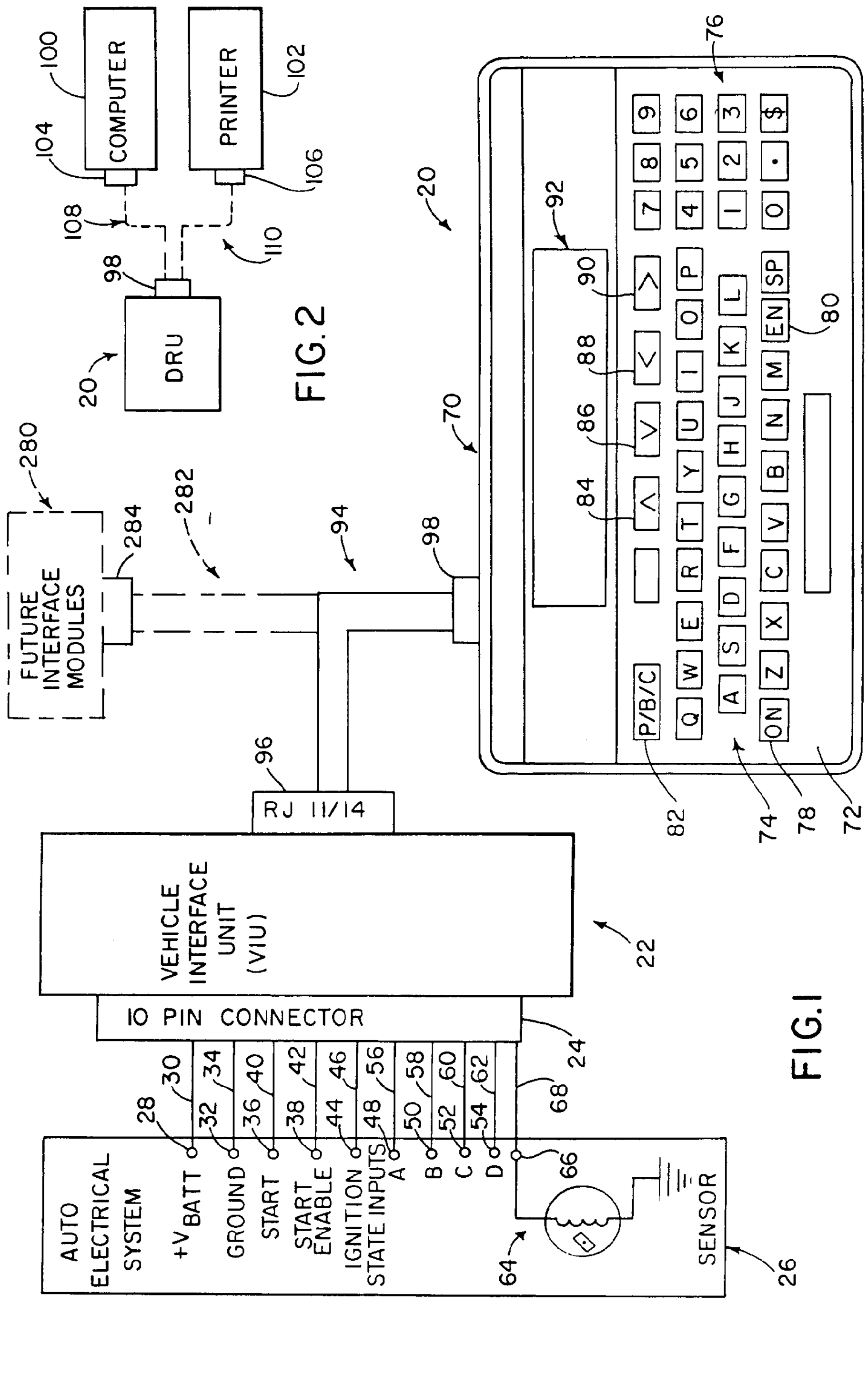
disconnecting the portable recorder unit from the vehicle and interconnecting the portable recorder unit with an external device; and

selectively outputting, to the external device, a third set of data signals from the portable recorder unit which includes at least the first and second sets of data signals.

**12.** The method of claim 11, wherein the step of sensing one or more vehicle operating characteristics is carried out by permanently mounting a vehicle interface unit to the electrical system of the vehicle for receiving signals therefrom indicative of one or more vehicle operating characteristics, wherein the portable recorder unit is removably interconnectable with the vehicle interface unit.

**13.** The method of claim 12, wherein the step of generating a second set of data signals by manual operation of a data entry device is carried out by manual operation of a keypad provided on the portable recorder unit.

**14.** The method of claim 13, wherein the step of generating a second set of data signals comprises generating a set of data signals indicative of personal or business use of the vehicle by manual operation of the keypad.


COMPUTER
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VEHICLE INTERFACE UNIT (VIU)
RJ 11/14
10 PIN CONNECTOR
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+V BATT
GROUND
START
START ENABLE
IGNITION STATE INPUTS
A
B
C
D
SENSOR
P/B/C
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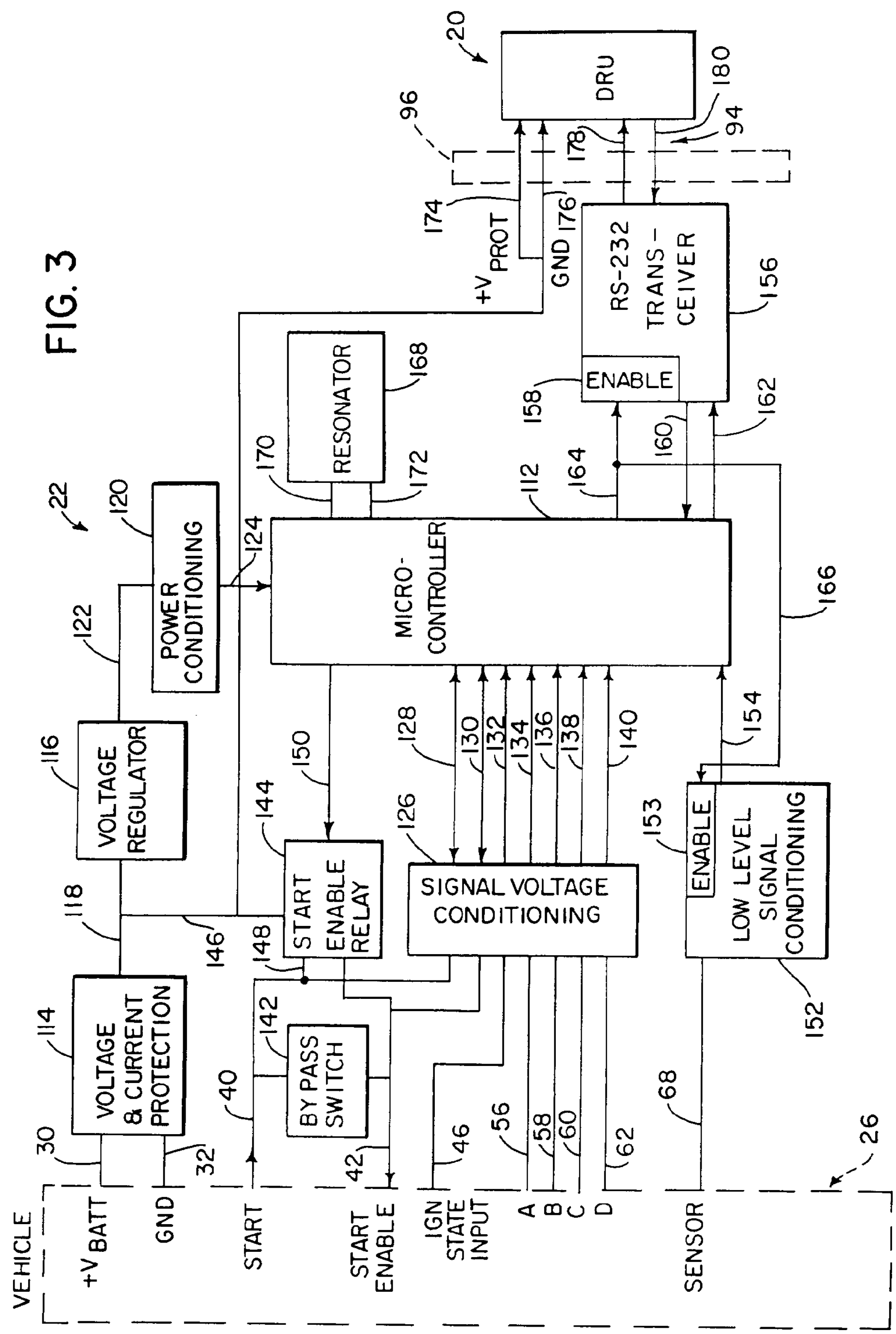
EN
SP

FIG.2

FIG.1

FIG. 3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ENABLE
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& CURRENT
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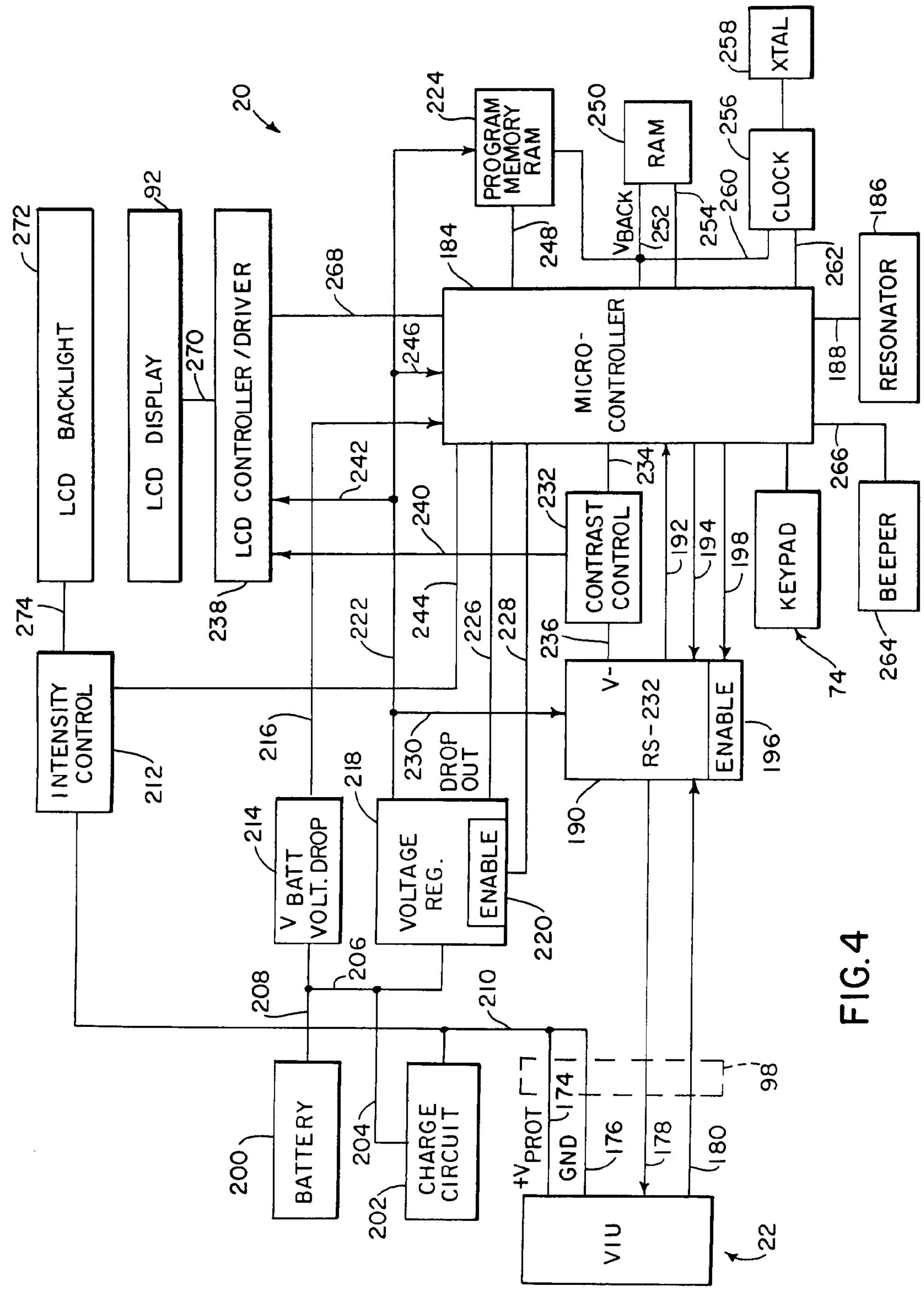
LCD BACKLIGHT
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PROGRAM MEMORY RAM
RAM
XTAL
CLOCK
MICRO-CONTROLLER
RESONATOR
CONTRAST CONTROL
KEYPAD
BEEPER
INTENSITY CONTROL
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FIG.4

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# EUROPEAN SEARCH REPORT

Application Number
EP 94 30 3963

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.5) |
|---|---|---|---|
| X | DE-A-31 47 314 (WESSER)<br>* page 5, line 19 - page 9, line 26 *<br>* page 10, line 15 - page 19, line 8; figures * | 1,2,7,8 | G07C5/08 |
| Y | | 9-14 | |
| A | | 4-6 | |
| Y | EP-A-0 224 616 (GELHORN)<br>* column 3, line 29 - column 7, line 4; claims; figures * | 1-14 | |
| Y | DE-A-32 21 399 (KIENZLE)<br>* page 4, line 17 - page 7, line 26 *<br>* page 8, line 30 - page 9, line 30; claim 1; figures * | 1-3,7,8 | |
| A | | 9-12 | |
| Y | GB-A-2 244 582 (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY)<br>* abstract; claims; figures *<br>* page 2, line 29 - page 3, line 18 * | 4-6 | |
| A | | 1,2,11 | TECHNICAL FIELDS SEARCHED (Int.Cl.5)<br>G07C |
| A | GB-A-2 119 095 (GOLDCREST ELECTRONICS)<br>* page 2, line 17 - page 3, line 26 *<br>* page 3, line 56 - page 4, line 22 *<br>* page 6, line 5 - line 51; figures * | 1-3,5, 7-12 | |
| A | WO-A-92 22043 (WB ELECTRONIC)<br>* page 14, line 20 - page 15, line 29 *<br>* page 19, line 13 - page 20, line 5; figures * | 1-3,7-14 | |

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 30 September 1994 | Meyl, D |

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|---|---|---|---|
| A | WO-A-82 02785 (DYRDAK)<br>* page 3, line 10 - line 34 *<br>* page 5, line 5 - page 6, line 8 *<br>* page 9, line 22 - page 11, line 21; figures *<br>--- | 1,7-11 | |
| A | US-A-4 939 652 (STEINER)<br>--- | | |
| A | EP-A-0 495 104 (K.K. KOMATSU SEISAKUSHO)<br>----- | | |
| | | | TECHNICAL FIELDS SEARCHED (Int.Cl.5) |

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| | | | |
|---|---|---|---|
| **(51) International Patent Classification 5 :** G06F 13/00 | A1 | **(11) International Publication Number:** | **WO 93/21583** |
| | | **(43) International Publication Date:** | 28 October 1993 (28.10.93) |

**(21) International Application Number:** PCT/US92/02968

**(22) International Filing Date:** 13 April 1992 (13.04.92)

**(71) Applicant** *(for all designated States except US):* VEHICLE COMPUTER CORPORATION [US/US]; 8200 N.W. 27 Street, Suite 114, Miami, FL 33122 (US).

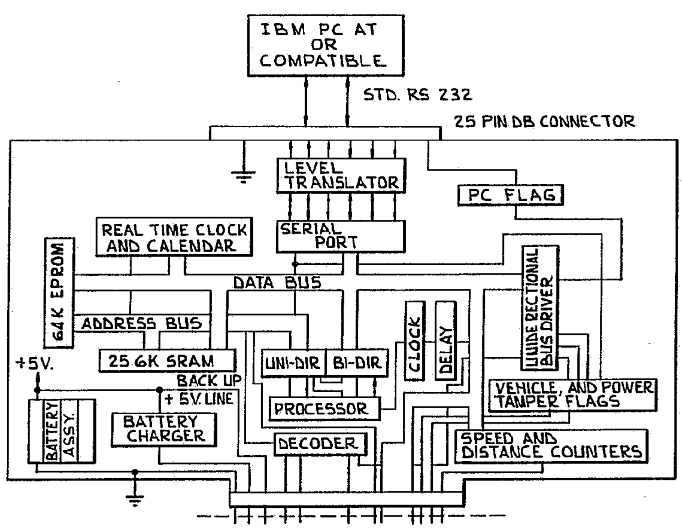
**(72) Inventor; and**
**(75) Inventor/Applicant** *(for US only)* : PARRA, Pedro, S. [US/US]; 8200 N.W. 27 Street, Suite 114, Miami, FL 33122 (US).

**(74) Agent:** SANCHELIMA, Jesus; Sanchelima and Associates, 235 S.W. Le Jeune Rd., Miami, FL 33134 (US).

**(81) Designated States:** AU, BR, CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, MC, NL, SE).

**Published**
*With international search report.*

**(54) Title:** A SYSTEM FOR MEASURING AND RECORDING DATA FOR A MOTOR VEHICLE




**(57) Abstract**

A device (10) for measuring and recording accurate, complete, dated and timed history for the moving speed of a specific motor vehicle. The device (10) includes a removable section (12) and a fixed section (14) identified by a unique code number stored in memory. Device (10) is micro-processor based, bus compatible with personal computers and features low power consumption to allow back-up battery operation during vehicle power source interruptions. Transducer interface circuit (20) picks up pulses that are proportional to the distance traveled. Speed and distance counters receive these pulses and send this information to the data bus. Memory (156) and processor (150) process and store the speed history of the vehicle being monitored, along with other information such as when and for how long the ignition circuit of the vehicle is activated.

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# I. TITLE:

"A SYSTEM FOR MEASURING AND RECORDING DATA FOR A MOTOR VEHICLE"

# II. TECHNICAL FIELD

This invention relates to a low power portable device for measuring and recording date, time, motor vehicle speed, distance traveled and identifying vehicle code number over a continuous basis over an extended period of time to document the activities of the vehicle.

# III. BACKGROUND ART

Applicant believes that the closest reference correspond to U.S. Patent No. **4,344,136** issued to **Panik** and **No. 4,697,278** issue to **Fleischer**. However, **Panik** differs from the present invention because it fails to record the date and time of events, namely, the speed of the vehicle, in continuous manner as to provide a complete history of the speed of the vehicle. Further, it does not record the identity of a vehicle being monitored.

Other patents describing the closest subject matter provide for a number of more or less complicated features that fail to solve the problem in an efficient and economical way. None of these patents suggest the novel features of the present invention.

## IV. SUMMARY OF THE INVENTION

It is one of the main purposes of the present invention to provide a device that can document the speed of a vehicle along a continuous period of time and continuously providing said speed value at any given time.

It is another object of this invention to store the information stated in the previous paragraph in a digital storage memory assembly.

It is still another object of the present invention to provide a device that can accurately and reliable document the speed of a motor vehicle at any time during a predetermined period of time.

It is yet another object of this invention to provide a device that can be used to study and compare the driving habits of drivers and to more accurately derive inferences from the information obtained.

It is another object of this invention to provide a device that can only be used on a particular vehicle, and through pre-assigned passwords, determines, and records who drove the vehicle.

It is another object of this invention to provide a device that includes a back-up battery assembly that permits it to be disconnected from the vehicle's battery circuit without losing the information.

It is yet another object of this invention to provide a device that detects and records when electrical and/or mechanical connections and/or structures are interrupted or altered.

## V. BRIEF DESCRIPTION OF THE DRAWINGS

With the above and other related objects in view, the invention consists in the details of construction and combination of parts as will be more fully understood from the following description, when read in conjunction with the accompanying drawings in which:

*Figure 1* is a block schematic representation of the present invention showing the portable and non-portable assemblies with the connections to the vehicle speed transducer, to the vehicle battery and to the ignition cable at the bottom and the connections to a personal computer serial port at the top.

*Figure 2* shows a block schematic of the vehicle and transducer interface shown in figure 1.

*Figure 3* illustrates a schematic of the circuit used for processing the signals from the digital and analog transducers as well as the vehicle ignition circuits.

# VI. DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is generally referred to with numeral 10, as shown in Figure 1, and it basically includes two assemblies, namely a portable removable assembly 12 and a non-portable fixed assembly 14 that remains at all times attached to the motorized vehicle where it is installed. Portable assembly 12 is removably connected to a non-movable assembly 14 through connectors 115 and 15. Movable assembly 12 is also capable of being connected to personal computer P.C. In the preferred embodiment shown in figure 1 an RS232 serial port is used for this connection.

For assembly convenience, the portable section should be separated from the non-portable section of the black box. The non-portable section of the black box should be securely bolted to the vehicle chassis. Electrically, the non-portable section includes: a voltage regulator 13, non-volatile identification memory PROM 40, latch circuit 23, Serial Number LED 21, Contact LED 60 and 70, vehicle and transducer interface circuit 20, mating connector and socket 11 and 11' to the vehicle wiring. Mechanically, it provides a sturdy frame to which the portable section is securely attached.

As best seen in figure 2, vehicle and transducer interface circuit 20 includes transducer low pass filter 32, diode and schotby clamps 34, hysteresis comparator amplifier 36, debouncer circuit 38 providing a signal at point Z that is removably connected to speed and distance counter circuit 120.

Also, interface 20 includes vehicle ignition low pass filter 31, zener clamp 33 and diode 35. Furthermore, interface 20 includes in vehicle flag 37 which provides a signal to the portable section indicating that connection 15 and 115 are engaged. Finally, interface 20 includes a closed loop that detects when the vehicle ignition circuit is being tampered with and they are labeled as ignition connections 1 and 2 in figure 2.

The portable section can be programmed to work only with a given fixed or non-removable section. To implement this, the serial number of the portable section is required to match the serial number of the non-portable section and a recognition signed is sent from micro-processor 150 to the serial number LED circuit 21 in the non-portable section. The decoder is the portable section allows micro-processor 150 to enable the I.D. PROM, it learns the identity of the non-portable section. When micro-processor 150 enables latch circuit 23, the latter drives serial number LED circuit 21 making it flash for several seconds.

The portable section is enclosed in a metallic box which fits into the non-portable section in a drawer-like fashion, being kept in place by a security lock; it provides a carry-on handle for ease of transportation. Electrically, it includes an eight-bit micro-processor, 256K SRAM, 64K instruction PROM, real time clock and calendar, event counter, system static clock, serial controller interface, RS232 driver/receiver, bus drivers/receivers, glue logic, four 1.25 volt re-chargeable batteries and mating connectors to the non-portable section and to the RS232 port of personal computer (P.C.).

When the batteries of the portable section are charged and a vehicle is ready for installation, the proper date and time, speed and distance equivalence factors, initial vehicle odometer mileage non-portable section and portable section identification numbers, and memory initialization conditions can be set using the appropriate software with the AT type P.C.

A properly initialized portable section will recognize and store the I.D. number of a non-portable section at the time and date that a mating occurs. Alternatively, with appropriate changes in the **PROM** software, it can be made to recognize a given I.D. number of the non-portable section before any recording of events begin. Recognition is signaled by means of a flashing LED for approximately 10 seconds.

When the portable section is plugged into the non-portable section, the former's batteries are being charged, preferably with the Trickle Charge Method, through a battery charging network driven by the voltage regulator in the non-portable section fed by the vehicle battery.

The portable section "recognizes" when it is connected to the non-portable section or to the P.C. RS232 terminal. It also "recognizes" when the vehicle battery or the ignition wire are disconnected and reconnected. The portable section can also infer when the vehicles's transducer terminals are disconnected. When plugged into the non-portable section in the proper manner, two LED's are lit on a continuous basis. Whenever a disconnection or re-connection is detected, the corresponding time and date are stored. In addition, the non-portable section I.D. number is fetched after reconnection for storage and/or comparison, depending on the instructions in the software used.

When the portable and non-portable section are properly mated in the vehicle, all motion events (or lack of motion) will be detected, analyzed, evaluated, timed and dated to provide interpreted information relevant for management and supervision of vehicle and driver activities. Only data which is considered of management interest will be stored; the remaining data will be discarded to save storage memory space. In general, one month's worth of data will be retained in RAM memory. Long range historical Data can be stored in P.C. memory and hard disk. Information is retrieved and stored into P.C. by unplugging the portable section from the non-portable section and connecting it to the RS232 terminal of a P.C. through the appropriate interface cable. Suitable P.C. software can be used to organize and display the information in a meaningful format.

If the batteries contained in the portable section must be replaced, all information contained in this section's memory must be transferred to P.C. (personal computer) memory. Otherwise, data not previously transferred and stored in the P.C. recorded will be permanently lost. After battery replacement, the clock/calendar and SRAM in the portable section must be reset with the appropriate P.C-based initial installation software.

The operation of the present invention can be generalized to work in the following manner. When the vehicle where the present invention is utilized is in motion, analog speed transducer T produces a number of wave forms per unit of time which is proportional to the rotational speed of the drive shaft which are in turn proportional to the speed of the vehicle. The output of transducer T is sent to transducer interface circuit 120 in non-movable assembly 14 which amplifies and provides predetermined suitable voltage levels for subsequent processing of this information. When a digital transducer is used, its output is directly wired to a debouncing circuit, bypassing the amplifiers clamping circuit and filter. Thirty-two bit speed and distance counter 120 is connected to the output of transducer interface circuit 20 through connectors 15 and 115 to count the number of pulses generated within a predefined sampling period. In this manner, the speed value at a particular moment is obtained, by counting the number of pulses detected in a short time intervals (normally every second).

In addition, the change in pulse count between predefined events and the cumulative count of the distance counter yields the distance traveled between events by the vehicle being monitored and its cummulative odometer reading respectively.

When presence or absence of the motion induced pulses described above are used in conjunction with the voltage sensed by the ignition wire connection, accurate conclusions can be reached regarding a driver's habits and usage of the vehicle being monitored. Precision, real time clock and calendar circuit 140 is implemented, preferably with OKI Semiconductor M6242B (Real Time Clock/Calendar I.C.), which is micro-processor compatible. The function of circuit 140 is to provide the appropriate date and time when events pertinent to the vehicle's movement occur. It also identifies the time at which other events occur such as the removal and reconnection of portable section 12, or the interruption of the electrical connections of the vehicle. Time and date are also cross-referenced with total mileage and non-portable unit I.D. number is also stored and memory in compared for a match upon plug-in of the portable section to the non-portable section in the vehicle, as previously described. The non-portable section 14 is preferably assigned a unique identification number or information that can be required to match an interrogation from portable section 12 before it operates.

Micro-processor 80c88 150 is paced by an 82c85 static clock 160 and provides the "decision making" capability within the system. It takes Initial and subsequent instruction from a non-volatile 64K EPROM circuit 154 and stores/retrieves data and instructions into/from a 256K SRAM (static RAM) memory circuit 156.

The RS232 computer interface is implemented with an 82c52 UART (Universal Asynchronous Receiver and Transmitter) 158 and a MAX 235 device 159 (manufactured by Maxim Co) both of which provide the required capability for exchanging serial information between portable assembly 12 and a personal computer.

Low power dissipation is critical for proper performance of this system because of its back-up battery operation requirement. Accordingly, CMOS is the preferred technology due to its static operation capability and its inherent low power performance.

## ASSEMBLY AND START-UP PHASE

Transducer T is connected to the vehicle transmission or to the speedometer cable in a manner well known in the vehicle instrumentation industry so that electrical pulses are generated as the vehicle drive shaft turns. The output terminal of the speed/distance transducer T is connected to either the digital input terminal or the analog input terminal in connector assembly 11 depending on the nature of the transducer. Wires connected to the vehicle's battery terminals are also connected through connector 11, to non-portable section 14 to power up the voltage regulator 13. This regulator 13 provides regulated power to all electronic components under normal operating conditions. The last connections made to non-portable section 14 are the ignition line voltage and the ignition disconnect sensing wire. Good engineering practice dictates the use of appropriate shielding techniques to minimize unwanted electrical noise disturbance of the desired signal.

# VII. INDUSTRIAL APPLICABILITY

The availability of a device for continuously and selectively recording the speed history of a vehicle and the distance traveled by such vehicle is quite desirable. Such a device is useful for individuals responsible for the operation of large fleets who could then characterize the actions of the drivers over predetermined periods of time. The information can also be processed in order to make pertinent statistical inferences.

The foregoing description is believed to convey the best understanding of the objectives and advantages of the present invention. Different embodiments may be made of the inventive concept of this invention. It is to be understood that all matter disclosed herein is to be interpreted merely as illustrative, and not in a limiting sense.

# VIII. CLAIMS

What is claimed is:

1. A micro-processor based system for measuring and recording dated and timed history for the moving speed of a specific motor vehicle having first battery means and an ignition circuit and a drive axle and including **a fixed section** having sensing means to detect the rotation of the drive axle in said vehicle and including an output that generates electrical pulses in proportion to the rate of rotation and said fixed section having interface means for shaping and filtering said pulses having an input connected to the output of said sensing means and also including an interface means output so that said pulses produce a signal on the output of said interface means and said interface means being powered by said first battery means and said system further including a removable section, comprising:

A. means for counting the pulses on said interface means' output and being connected to the output of said interface means and including a counting means' output;

B. micro-processor means including clock means and data bus means connected to said counting means output so that the outputs from said means for counting said pulses can be processed by said micro-processor means;

C. real time clock and calendar means including a real time clock means' output connected to said data bus means;

D. first memory means for storing data and programming instructions having a memory means' output connected to said data bus and connected to said micro-processor means and having sufficient capacity to store the necessary program instructions to cause said micro-processor means to read the outputs of said means for counting said pulses and real time clock means selectively and to periodically record the information obtained from said means for counting said pulses and real time clock means over a given time period thereby storing a measurement for traveled distance and speed at a given time;

E. second battery means for powering said means for counting, micro-processor means, real time clock and calendar means and first memory means; and

F. means for accessing and transferring said stored information wherein said interface means is permanently mounted to said vehicle thereby defining a fixed section of said device and said means for counting said pulses, micro-processor means, real time clock means, first memory means, means for accessing and transferring said stored information are removably mounted and connected to said interface means thereby defining a removable section of said device.

**2.** The device set forth in claim 1 wherein said fixed section includes second memory means for storing predetermined identification information and said removable section including means for detecting said predetermined identification information.

3. The device set forth in claim 2 wherein said first memory means includes non-volatile means for storing program instructions.

4. The device set forth in claim 3 wherein said second memory means includes non-volatile means for storing said identification information.

5. The device set forth in claim 4 wherein said removable section further includes means for detecting engagement and disengagement from said fixed section and means to record in said first memory means when said engagement and disengagement occurred.

6. The device set forth in claim 5 wherein said removable section includes means for detecting the activation of the ignition circuit in said vehicle and means to record in said first memory means when said activation occurred and ceased.

7. The device set forth in claim 6 wherein said first memory means includes further program instructions that cause said micro -processor to store in said first memory means non-zero outputs and a predetermined number of zero outputs before an at-rest code is stored thereby minimizing the use of storage capacity in said first memory means when said vehicle is idle over a predetermined amount of time.

8. The device set forth in claim 7 wherein said microprocessor can be programmed to selectively store non-zero within predetermined treshold.

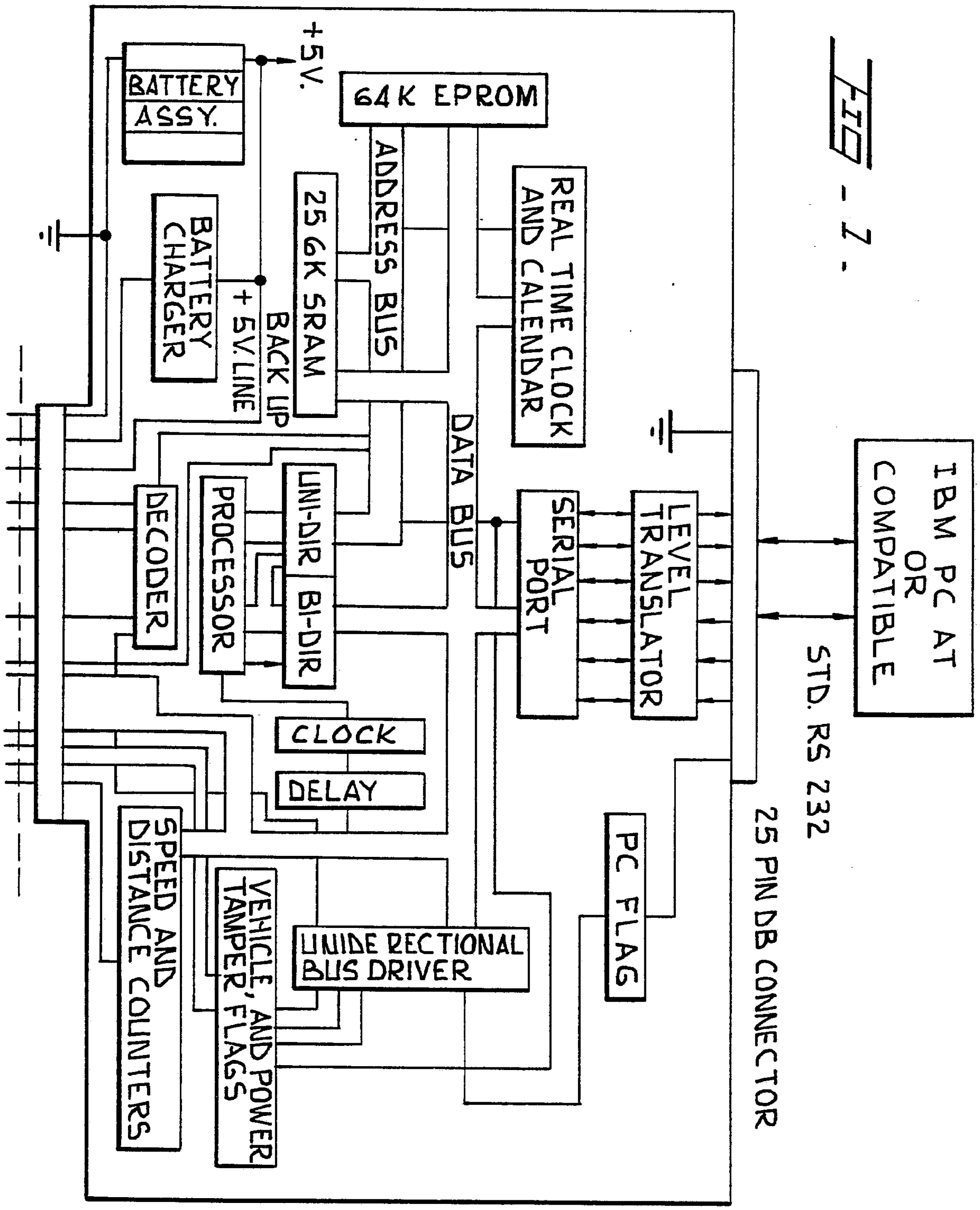
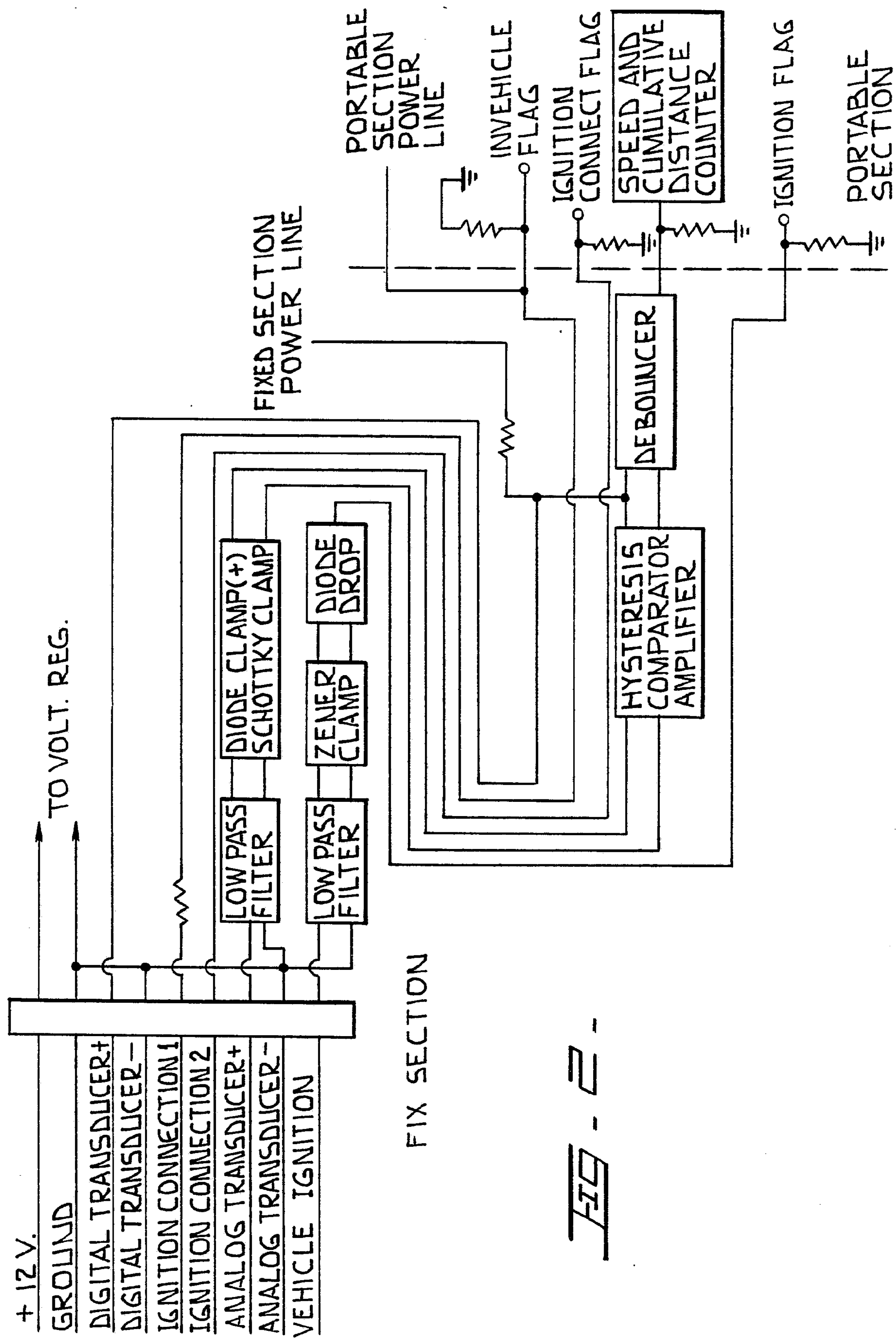
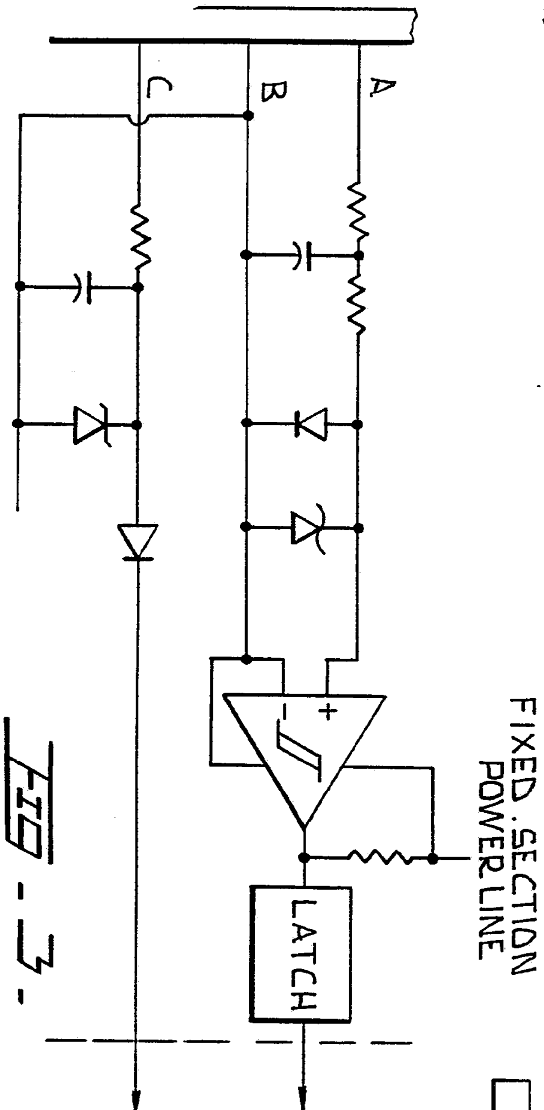

BATTERY ASSY.
+5V.
64K EPROM
ADDRESS BUS
REAL TIME CLOCK AND CALENDAR
BATTERY CHARGER
+ 5V. LINE
BACK UP
256K SRAM
DATA BUS
DECODER
PROCESSOR
UNI-DIR
BI-DIR
SERIAL PORT
LEVEL TRANSLATOR
IBM PC AT OR COMPATIBLE
STD. RS 232
25 PIN DB CONNECTOR
CLOCK
DELAY
PC FLAG
UNIDE RECTIONAL BUS DRIVER
VEHICLE, AND POWER TAMPER FLAGS
SPEED AND DISTANCE COUNTERS

FIG - 1 -



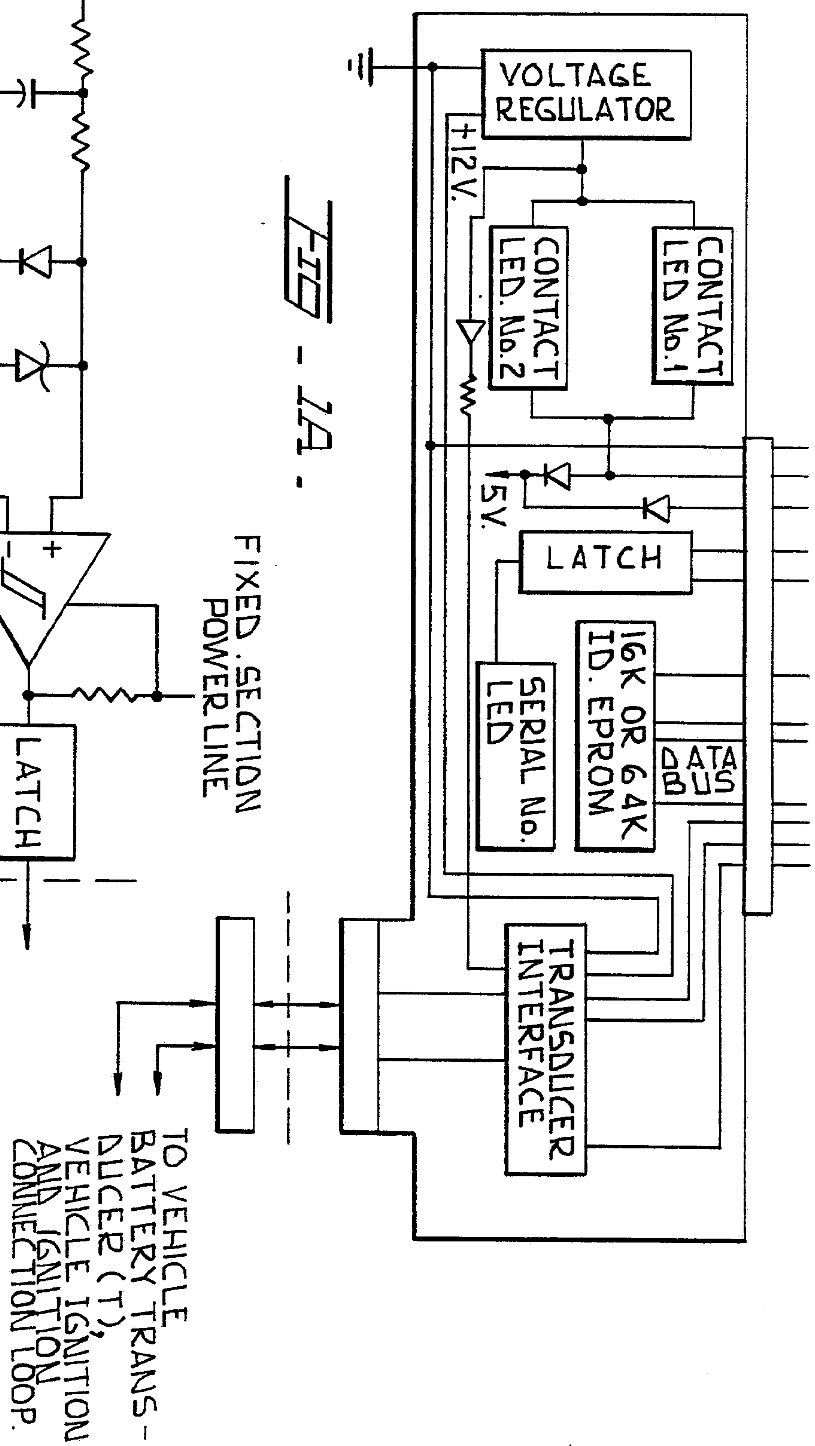
PORTABLE SECTION POWER LINE
INVEHICLE FLAG
IGNITION CONNECT FLAG
SPEED AND CUMULATIVE DISTANCE COUNTER
IGNITION FLAG
PORTABLE SECTION
FIXED SECTION POWER LINE
DEBOUNCER
HYSTERESIS COMPARATOR AMPLIFIER
DIODE CLAMP(+) SCHOTTKY CLAMP
DIODE DROP
ZENER CLAMP
LOW PASS FILTER
LOW PASS FILTER
TO VOLT. REG.
+ 12 V.
GROUND
DIGITAL TRANSDUCER+
DIGITAL TRANSDUCER−
IGNITION CONNECTION 1
IGNITION CONNECTION 2
ANALOG TRANSDUCER+
ANALOG TRANSDUCER−
VEHICLE IGNITION
FIX SECTION


FIG-2-



A
B
C
LATCH
FIXED .SECTION
POWER LINE


FIG - 3 -



VOLTAGE
REGULATOR
+12V.
CONTACT
LED. No.2
CONTACT
LED No.1
5V.
LATCH
16K OR 64K
ID. EPROM
SERIAL No.
LED
DATA
BUS
TRANSDUCER
INTERFACE
TO VEHICLE
BATTERY TRANS-
DUCER (T),
VEHICLE IGNITION
AND IGNITION
CONNECTION LOOP.


FIG - 1A -

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/US92/02968

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) :G06F 13/00
US CL :364/424.03, 424.04; 377/24.1; 340/438
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 364/424.03, 424.04; 377/24.1; 340/438 364/424.01,561 ; 377/24,26 ; 340/439

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US,A, 4,939,652 (Steiner) 03 July 1990 See the entire document. | 1-8 |
| A | US,A, 4,638,289 (Zottnik) 20 January 1987 See Fig. 1. | 1-8 |
| A | US,A, 4,853,856 (Hanway) 01 August 1989 See Fig. 2. | 1-8 |
| A | US,A, 4,685,061 (Whitaker) 04 August 1987 See the entire document. | 1-8 |
| A | US,A, 5,046,007 (McCrery et al.) 03 September 1991 See Fig. 2. | 1-8 |
| A | US,A, 4,992,943 (McCracken) 12 February 1991 See Fig. 4. | 1-8 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 07 AUGUST 1992 | 08 OCT 1992 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231 | GARY CHIN |
| Facsimile No. NOT APPLICABLE | Telephone No. (703) 308-1394 |

Form PCT/ISA/210 (second sheet)(July 1992)★

(19)

(11) Publication number: **05104985 A**

Generated Document.

# PATENT ABSTRACTS OF JAPAN

(21) Application number: **03263862**

(51) Intl. Cl.: **B60K 41/00** F02D 29/02 F02D 45/00

(22) Application date: **11.10.91**

| | |
|---|---|
| (30) Priority: | (71) Applicant: **NISSAN MOTOR CO LTD** |
| (43) Date of application publication: **27.04.93** | (72) Inventor: **ISHIGAMI KAZUHIRO** |
| (84) Designated contracting states: | (74) Representative: |

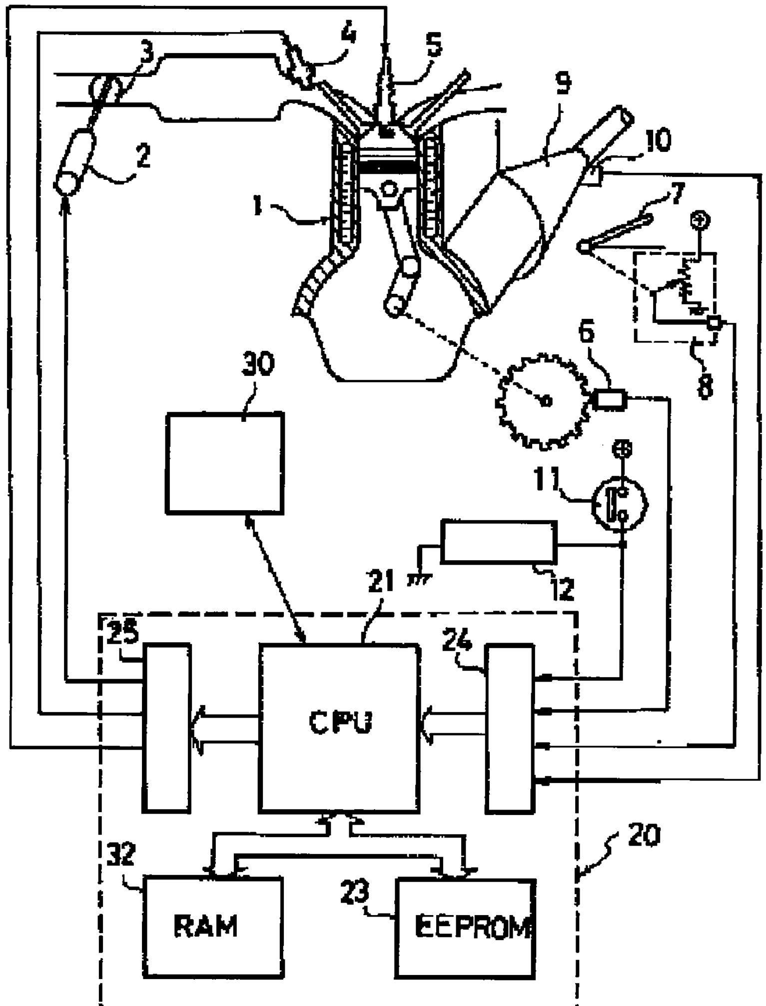
(54) **DATA RECORDING DEVICE FOR AUTOMOBILE**

(57) Abstract:

PURPOSE: To record data even in case of an accident by a driving error by detecting a car stoppage time before an engine stoppage by combination of at least two of a car velocity, an engine rotation number, and an ignition switch off, and recording and holding driving data before and after car stoppage for about three times before the engine stoppage.

CONSTITUTION: For a control unit 20, signals from a crank angle sensor 6, an accelerate-ion sensor 8 for detecting a stepped angle of an acceleration pedal, a car velocity sensor 10 to detect a car velocity based on an output shaft rotation of a transmission 9, and an ignition switch 11 are inputted, and a CPU 21 detects these constantly for using them for control, and it records the data in a RAM 32. A car stoppage is determined when the car velocity becomes 0km/h, and after recording the data till about 10sec. passes after the car stoppage, the data in the RAM 32 are transferred to an EPROM 23. An engine stoppage is determined by the ignition switch 11, and data for the engine stoppage are recorded and held in the EPROM 23.





(19)日本国特許庁（JP）　(12) **公開特許公報**（A）　(11)特許出願公開番号

特開平5－104985

(43)公開日　平成5年(1993)4月27日

| (51)Int.Cl.5 | | 識別記号 | 庁内整理番号 | FI | 技術表示箇所 |
| --- | --- | --- | --- | --- | --- |
| B60K | 41/00 | | 8920－3D | | |
| F02D | 29/02 | L | 9248－3G | | |
| | 45/00 | 376 B | 8109－3G | | |

審査請求　未請求　請求項の数2(全 9 頁)

(21)出願番号　特願平3－263362

(22)出願日　平成3年(1991)10月11日

(71)出願人　000003997
日産自動車株式会社
神奈川県横浜市神奈川区宝町2番地

(72)発明者　石上　和宏
神奈川県横浜市神奈川区宝町2番地　日産自動車株式会社内

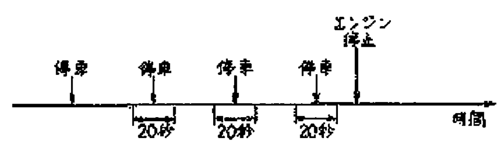
(74)代理人　弁理士　笹島　富二雄

(54)【発明の名称】　自動車用データ記録装置

(57)【要約】

【目的】　運転ミスによる事故の場合にも高い確率でデータを記録できるようにする。

【構成】　車速，エンジン回転数又はイグニッションスイッチのオン・オフの少なくとも2つの組合わせにより，エンジン停止前の停車時を検出する。そして，エンジン停止前の3回程度の停車時について、停車前後の運転データを記録保持する。



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【特許請求の範囲】

【請求項１】自動車の車速、エンジン回転数又はイグニションスイッチのオン・オフを検出する手段を有すると共に、これらの少なくとも２つの組合わせにより決定されるタイミングで自動車の運転データを記録する手段を有することを特徴とする自動車用データ記録装置。

【請求項２】前記タイミングはエンジン停止前の停車時であることを特徴とする請求項１記載の自動車用データ記録装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、自動車用データ記録装置に関し、詳しくは、自動車の異常発生時の運転データを記録する装置に関する。

【０００２】

【従来の技術】従来この種の自動車用データ記録装置として、電子システム診断テスターと呼ばれるものを車載してコントロールユニットに接続し、これを自動記録モードに設定しておくことにより、コントロールユニットの不具合判定の最新結果の異常発生時及びエンスト時に、異常発生前後の自動車の運転データが自動的に記録されるようにしたものがある（日産自動車株式会社発行「日産コンサルト　電子システム診断テスター　取扱説明書　エンジン編」第27頁参照）。これにより、故障時に記録されたデータから、故障原因を確率良く推定することができる。

【０００３】従来例について更に詳述する。エンジン制御用コントロールユニットは、ＣＰＵ、ＲＡＭ、ＥＥＰＲＯＭ及び入出力回路を含んで構成されるが、これに、ＣＰＵと通信によりデータ交換ができる電子システム診断テスターが接続される。このようなシステムにおいて、ＣＰＵは、常時、エンジン回転数やアクセル開度等を検出し、制御に用いる他に、ＲＡＭにデータを記録する。この場合、ＲＡＭには20秒間分のデータを記録する領域が確保されており、20秒周期でデータを上書きして記録する。

【０００４】そして、エンジン回転数が20rpm 以下になったときにエンストと判断し、エンスト後10秒経過するまでデータを記録後、ＲＡＭ内の所定領域のデータをＥＥＰＲＯＭの所定領域に移す。これにより、図７に示すように、エンスト検出前10秒間とエンスト検出後10秒間のデータがＥＥＰＲＯＭ内に記憶される。

【０００５】記録動作の詳細は、図８のフローチャートに示すプログラムの通りである。このプログラムは10msec毎に繰り返し実行され、毎回、エンジン回転数が20rpm 以下であるか否かによりエンスト判定を行い（Ｓ51）、エンストでない場合は、フラグＦＭＥＭＯを０にして（Ｓ52）後、アドレスカウンタＮをカウントアップする（Ｓ53）。尚、Ｎが2000になったときは０に戻し（Ｓ54，Ｓ55）、これにより０～1999までのカウントアップを繰り返し行わせる。

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【０００６】そして、記録データ$D_1$～$D_{10}$を入力し（Ｓ56）、０～1999までを繰り返すＮに対応するＲＡＭ内のＮ×10番地～Ｎ×10＋９番地に書込んで記録する（Ｓ57）。$D_1$～$D_{10}$の値は、例えばエンジン回転数であったり、エンジン冷却水温であったりする。このようにして、エンジン回転中は、最新のデータをＲＡＭの所定領域に上書きしつつ順番に書込むことにより、常時、20秒間分のデータを記録する。

【０００７】エンストした場合は、エンスト後10秒経過したか否かを判定し（Ｓ58）、10秒経過する前は、上記のＲＡＭへの記録を続け（Ｓ53～Ｓ57）、10秒経過した時点で、フラグＦＭＥＭＯの判定（Ｓ59）後、ＦＭＥＭＯ＝１として（Ｓ60）から、20秒間分のデータをＲＡＭの０番地～ 19999番地から読出し、ＥＥＰＲＯＭの０番地～ 19999番地に書込む（Ｓ61）。また、このときの最新のデータ位置を示すアドレスカウンタＮの値を同じくＥＥＰＲＯＭの20000,20001番地に書込む（Ｓ62）。この後は、フラグＦＭＥＭＯの判定（Ｓ59）により、電源がオフとなる。

【０００８】このようにすることにより、データ$D_1$～$D_{10}$について、エンスト前10秒間とエンスト後10秒間のものをＥＥＰＲＯＭに記憶保持することができる。そして、電子システム診断テスターの要求により、通信機能を用いて、記憶保持したエンスト前後のデータを送信することができる。以上が自動車用データ記録装置の従来例である。この例では、エンスト時の場合について説明したが、エンストを故障発生時としても同様に記録保持できることは明らかである。

【０００９】

【発明が解決しようとする課題】しかしながら、このような従来の自動車用データ記録装置にあっては、エンスト時や故障検出時に記録することはできるが、運転者の運転ミスにより、例えばブレーキペダルとアクセルペダルとを誤って踏み違いをして、事故が発生したような場合には、故障ではないので、データは記録されず、このために事故時に原因を究明できないという問題点があった。

【００１０】このような場合に問題になるのは、特に事故発生時であるので、事故を検出してデータを記憶保持する方式が容易に考えられる。そして、これを実施するには、例えば、既に商品化されているエアバッグの判断部分を用いる等の方法が考えられる。しかし、これでは、軽度の事故では検出できないし、これに要する費用も高い等の問題点があった。

【００１１】本発明は、このような従来の問題点に鑑み、運転ミスの場合にも高い確率でデータを記録でき、かつ安価な自動車用データ記録装置を提供することを目的とする。

【００１２】

【課題を解決するための手段】このため、本発明は、自動車用データ記録装置において、図1に示すように、自動車の車速、エンジン回転数又はイグニションスイッチのオン・オフを検出する手段を有すると共に、これらの少なくとも2つの組合わせにより決定されるタイミングで自動車の運転データを記録する手段を有する構成としたものである。

【0013】ここで、前記タイミングはエンジン停止前の停車時とするのが望ましい。

【0014】

【作用】本発明においては、一般的に事故発生時には車両を停止させること、そして現場保存後あるいは保存中、又は交通の支障がある場合は車両を片付けた後、一旦エンジンを止めるのが普通であることに着目した。このように、事故発生時は停車し、その付近でエンジンを止めるのが普通であるので、逆に言えば、事故があったとすれば、それは、エンジン停止前の1～3回程度の停車時であるといえる。

【0015】そこで、本発明では、車速、エンジン回転数又はイグニッションスイッチのオン・オフの少なくとも2つの組合わせにより，エンジン停止前の停車時を検出し，その前後のデータを記録保持するようにする。停車を検出する方法としては，車速を見るのが一般的であるが，エンジン回転数が所定値以下であることをもって停車と判定してもよい。

【0016】また、エンジン停止前を検出する方法としては，イグニッションスイッチのオン状態を検出することが一般的であるが、エンジン回転数により判定してもよい。よって，車速、エンジン回転数又はイグニッションスイッチのオン・オフの少なくとも2つの組合わせにより，データ記録のタイミングを決定する。

【0017】このようにすることにより、限られたメモリサイズの中で，高い確率で事故を検出できる。

【0018】

【実施例】以下に本発明の一実施例を説明する。図2にデータ記録装置のシステム図を示す。尚、以下では電子式スロットル制御を含むエンジン制御用コントロールユニットに対するデータ記録装置を例にとって説明する。

【0019】図2において，エンジン1への吸入空気量は，スロットルアクチュエータ2によりスロットル弁3が開閉駆動されて制御され，燃料供給量は燃料噴射弁4により制御される。そして，エンジン1内の吸入混合気は点火時期を制御されつつ点火栓5により点火されて燃焼する。ここで，スロットルアクチュエータ2，燃料噴射弁4及び点火栓5は、コントロールユニット20からの信号により制御される。

【0020】この制御のため、コントロールユニット20には，エンジン回転数を検出するクランク角センサ6、アクセルペダル7の踏み角（アクセル開度）を検出するアクセルセンサ8、トランスミッション9の出力軸回転より車速を検出する車速センサ10及びイグニッションスイッチ11からの信号が入力されている。尚、図中12は車両電気負荷を示している。

【0021】コントロールユニット20は、CPU21，RAM22，EEPROM23，入力回路24及び出力回路25を含んで構成されている。そして、コントロールユニット20には電子システム診断テスター30が接続され，この電子システム診断テスター30は、CPU21と通信によりデータ交換ができる。

【0022】このようなシステムにおいて、CPU21は，常時、エンジン回転数やアクセル開度等を検出し、制御に用いる他に、RAM22にデータを記録する。この場合，RAM22には20秒間分のデータを記録する領域が確保されており，20秒周期でデータを上書きして記録する。そして、車速が0km/hになったときに停車と判断し，停車後10秒経過するまでデータを記録後、RAM22内のデータをEEPROM23に移す。

【0023】また、イグニッションスイッチ11によりエンジン停止を判断し、図3に示すように、エンジン停止（イグニッションスイッチ11オフ）前3回分の停車前後のデータをEEPROM23上に記憶保持する。尚，EEPROM23には，図4に示すように，20秒間分のデータ（停車前10秒間と停車後10秒間のデータ）を3×10＝30個記録する領域が確保されており、図3に示したエンジン停止前3回分の停車前後のデータを，10個記録保持できる。

【0024】記録動作の詳細は、図5及び図6（図6は図5の続き）のフローチャートに示すプログラムの通りである。このプログラムは10msec毎に繰り返し実行される。ステップ1（図にはS1と記してある。以下同様）では，基本的に停車時にデータを記録保持するようにするため，車速センサ10からの信号に基づいて車速が0km/hであるか否かを判定する。尚、エンジン回転数が所定値以下であることをもって停車時と判定してもよい。

【0025】車速が0km/hでない場合は、ステップ2でフラグFMEMOを0にして後、ステップ3でRAM用アドレスカウンタNをカウントアップする。尚，Nが2000になったときは0に戻し（ステップ4，5），これにより0～1999までのカウントアップを繰り返し行わせる。そして、ステップ6で記録データ$D_1$～$D_{10}$を入力し，ステップ7で0～1999までを繰り返すNに対応するRAM内のN×10番地～N×10＋9番地に書込んで記録する。

【0026】このようにして、車速が0Km/hより大きい場合は、最新のデータをRAM22の所定領域（0～19999番地）に上書きしつつ順番に書込むことにより，常時，20秒間分のデータを記録する。車速が0km/hとなった場合は、ステップ8で10秒経過したか否かを判定し，10秒経過する前は、ステップ3～7を実行して，上記のRAM22への記録を続ける。

【００２７】10秒経過後は、ステップ９でのフラグＦＭＥＭＯの判定後、ステップ10でＦＭＥＭＯ＝１としてから、ステップ11へ進む。ステップ11では、ＥＥＰＲＯＭ23の600060，600061番地（図４のＭ格納用エリア）から後述するステップ20～22によりエンジン停止毎にカウントアップされて０～９までを繰り返すエンジン停止カウンタＭの値を読出す。このカウンタＭはＥＥＰＲＯＭ23の上位アドレス指定用として用いられる。

【００２８】次にステップ12で停車カウンタＬをカウントアップする。尚、Ｌが３になったときは０に戻し（ステップ13，14），これにより０～２までのカウントアップを繰り返し行わせる。従って、このカウンタＬは停車毎にカウントアップされて０～２までを繰り返すもので，ＥＥＰＲＰＭ23の下位アドレス指定用として用いられる。

【００２９】そして、ステップ15では，20秒分の記録データをＲＡＭ22の０番地～19999番地から読出し，ＥＥＰＲＯＭ23の（Ｍ×３＋Ｌ）×20000 番地～（Ｍ×３＋Ｌ）×20000 ＋19999 番地へ書込む。また、ステップ16では，最新のデータ位置を示すカウンタＮの値を，ＥＥＰＲＯＭ23のＮ格納用エリア（図４参照；600000～600059番地）のうち，600000+（Ｍ×３＋Ｌ）×２，600000＋（Ｍ×３＋Ｌ）×２＋１番地に書込む。

【００３０】これにより，Ｌが０～２までを繰り返すことで，ＥＥＰＲＯＭ23の（Ｍ×３）×20000 番地～（Ｍ×３＋２）×20000 ＋19999 番地の領域に、常に最新の３回分の停車前後のデータが上書きされつつ記録されるようになる。この後は、ＦＭＥＭＯ＝１であるので、ステップ９からステップ17（図６）へ進む。

【００３１】ステップ17では、イグニッションスイッチ11がオンか否かを判定し，オフとなった場合は，ステップ18でオフ後10秒経過したか否かを判定し、10秒経過した場合にステップ19へ進む。すなわち，エンジン停止をイグニションスイッチ11がオフとなって10秒後であることで検出し、ステップ19へ進む。尚，エンジン停止をエンジン回転数より判断してもよい。

【００３２】ステップ19では、ＥＥＰＲＯＭ23の600060，600061番地からエンジン停止カウンタＭの値を読出して，ステップ20でエンジン停止カウンタＭの値をカウントアップする。尚、Ｍが10になったときは０に戻し（ステップ21，22）、これにより０～９までのカウントアップを繰り返し行わせる。次のステップ23では，カウントアップされたエンジン停止カウンタＭの値をＥＥＰＲＯＭ23の600060，600061番地へ書込む。

【００３３】これにより，次の始動後の走行時は，ＥＥＰＲＯＭ23の別の領域に，最新の３回分の停車前後のデータの記録保持が行われる。このように本実施例では、Ｍは０～９までの値をとるようになっており、データを例えば自動車整備工場で読出すときまでに、それまでの10回分の走行について、全てエンジン停止前３回分、計30回分の停車前後20秒間のデータを記憶保持できる。

【００３４】そして、この中に事故時のデータがあるのはかなり高い確率となる。

【００３５】

【発明の効果】以上説明したように，本発明によれば、事故を検出するために、車速、エンジン回転数，イグニションスイッチの２つ以上の組合わせを用いることにより，検出精度を上げ、且つエアバッグ等に用いられる事故判断機能等を用いることなく安価に検出できるようにすることにより，安価な自動車用データ記録装置を実現することができる。

【図面の簡単な説明】

【図１】 本発明の構成を示す機能ブロック図

【図２】 本発明の一実施例を示すデータ記録装置のシステム図

【図３】 同上実施例のデータ記録のタイミング図

【図４】 同上実施例のＥＥＰＲＯＭ記録領域を示す図

【図５】 同上実施例のフローチャート（その１）

【図６】 同上実施例のフローチャート（その２）

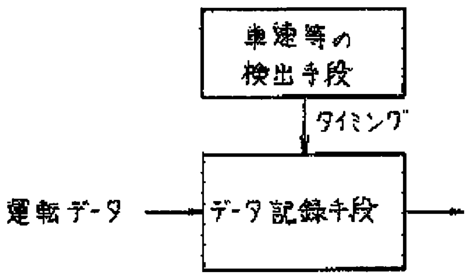
【図７】 従来例を示すデータ記録のタイミング図

【図８】 同上従来例のフローチャート

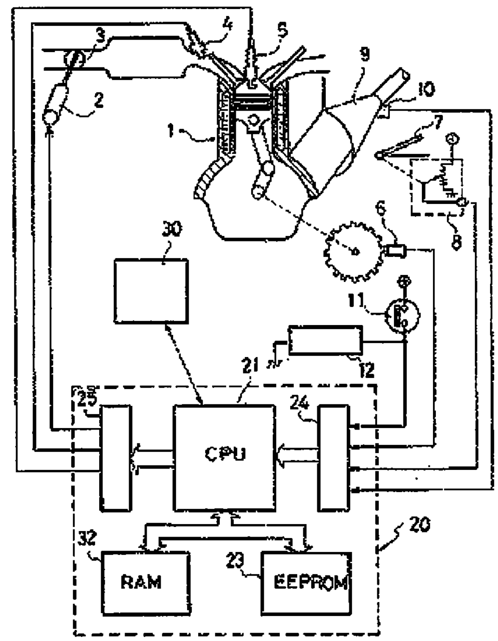
【符号の説明】

1 エンジン
6 クランク角センサ
10 車速センサ
11 イグニッションスイッチ
20 コントロールユニット
21 ＣＰＵ
22 ＲＡＭ
23 ＥＥＰＲＯＭ
30 電子システム診断テスター

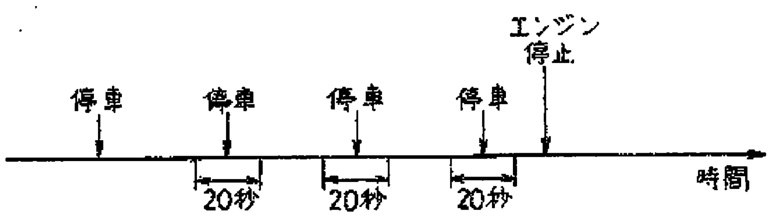
【図1】


車速等の
検出手段
タイミング
運転データ
データ記録手段

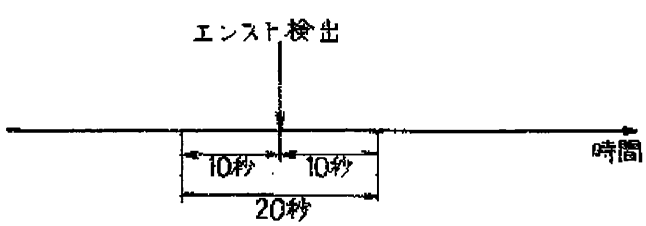
【図2】


1
2
3
4
5
6
7
8
9
10
11
12
20
21
23
24
25
30
32
CPU
RAM
EEPROM

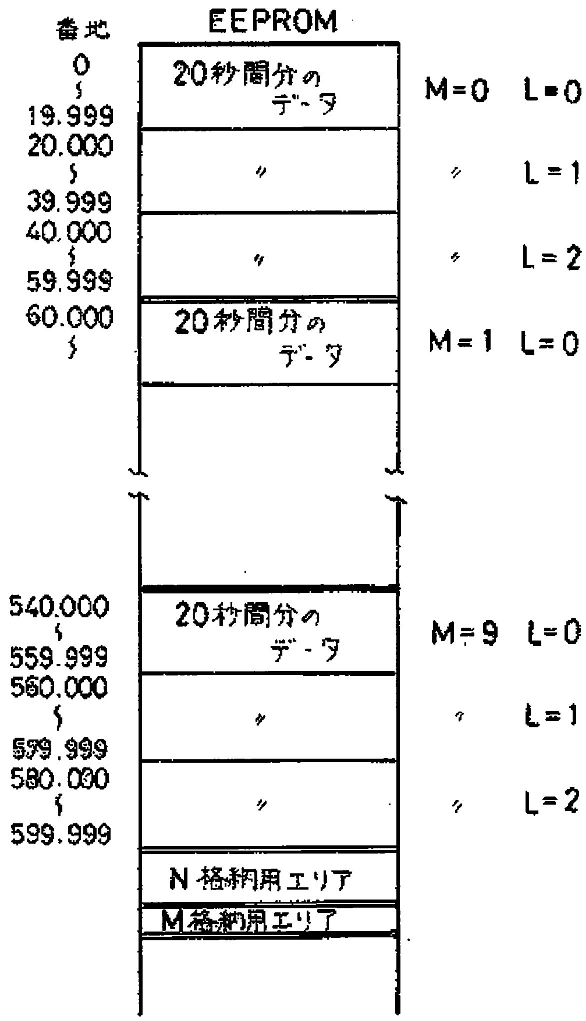
【図3】


エンジン
停止
停車
停車
停車
停車
20秒
20秒
20秒
時間

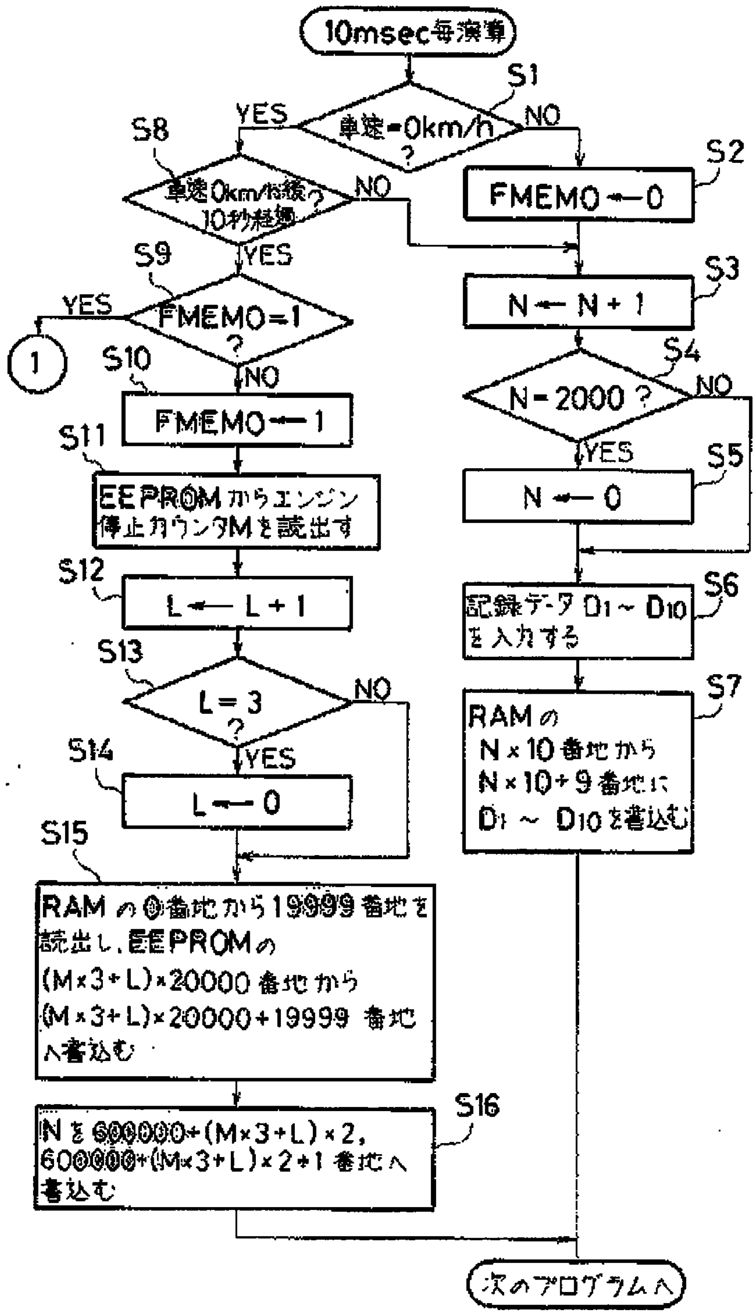
【図7】


エンスト検出
10秒
10秒
20秒
時間

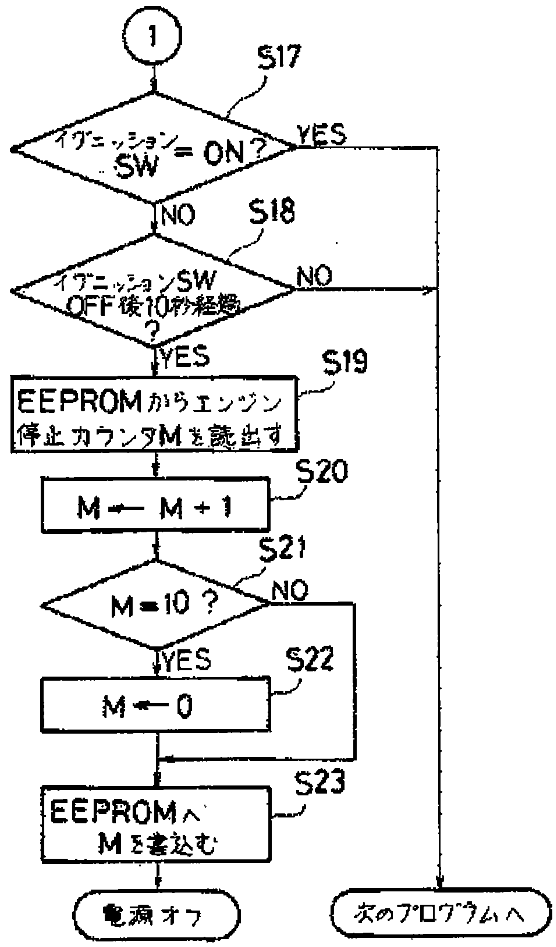
【図4】


番地
EEPROM
0
19.999
20秒間分のデータ
M=0 L=0
20.000
39.999
〃
〃 L=1
40.000
59.999
〃
〃 L=2
60.000
20秒間分のデータ
M=1 L=0
540.000
559.999
20秒間分のデータ
M=9 L=0
560.000
579.999
〃
〃 L=1
580.000
599.999
〃
〃 L=2
N格納用エリア
M格納用エリア

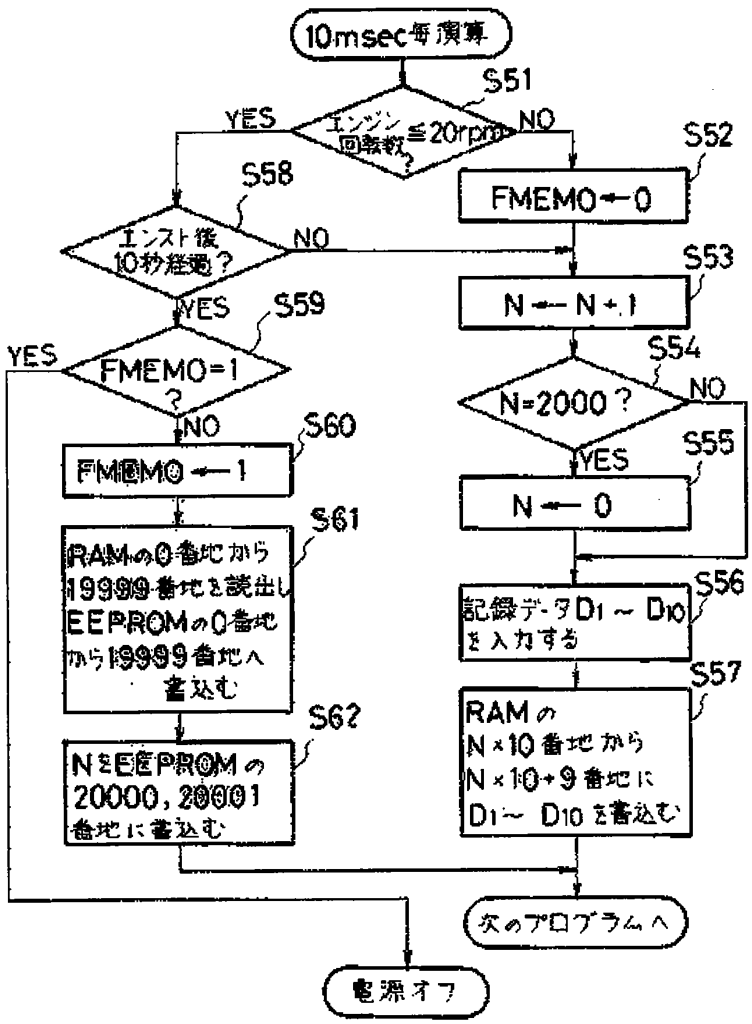
【図5】


10msec毎演算
S1
車速＝0km/h?
YES
NO
S2
FMEMO←0
S8
車速0km/h後10秒経過?
NO
YES
S3
N←N＋1
S9
FMEMO＝1?
YES
1
S10
NO
FMEMO←1
S4
N＝2000?
NO
YES
S5
N←0
S11
EEPROMからエンジン停止カウンタMを読出す
S12
L←L＋1
S6
記録データD1～D10を入力する
S13
L＝3?
NO
YES
S7
RAMの N×10番地から N×10＋9番地に D1～D10を書込む
S14
L←0
S15
RAMの0番地から19999番地を読出し，EEPROMの (M×3＋L)×20000番地から (M×3＋L)×20000＋19999番地へ書込む
S16
Nを600000＋(M×3＋L)×2，600000＋(M×3＋L)×2＋1番地へ書込む
次のプログラムへ

【図6】


1
S17
イグニッションSW＝ON？
YES
NO
S18
イグニッションSW OFF後10秒経過？
NO
YES
S19
EEPROMからエンジン停止カウンタMを読出す
S20
M←M＋1
S21
M＝10？
NO
YES
S22
M←0
S23
EEPROMへMを書込む
電源オフ
次のプログラムへ

【図8】


10msec毎演算
S51
エンジン回転数≦20rpm?
YES
NO
S52
FMEMO←0
S58
エンスト後10秒経過?
NO
S53
N←N+1
YES
S59
YES
FMEMO=1?
S54
N=2000?
NO
NO
S60
FMEMO←1
YES
S55
N←0
S61
RAMの0番地から19999番地を読出しEEPROMの0番地から19999番地へ書込む
S56
記録データD1～D10を入力する
S57
RAMのN×10番地からN×10+9番地にD1～D10を書込む
S62
NをEEPROMの20000,20001番地に書込む
次のプログラムへ
電源オフ

* NOTICES *



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CLAIMS

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[Claim(s)]
[Claim 1] The data recorder for automobiles characterized by having a means to record the performance data of an automobile to the timing determined with these at least two combination while having a means to detect turning on and off of the vehicle speed of an automobile, an engine speed, or an ignition switch.
[Claim 2] Said timing is a data recorder for automobiles according to claim 1 characterized by being at the stop time before an engine shutdown.

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[Translation done.]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the equipment which records the performance data at the time of the abnormal occurrence of an automobile in detail about the data recorder for automobiles.
[0002]
[Description of the Prior Art] As this kind of a data recorder for automobiles conventionally by mounting what is called an electronic system diagnostic circuit tester, connecting with a control unit, and setting this as automatic-recording mode At the time of the abnormal occurrence of the newest result of a nonconformity judging of a control unit, and an engine failure There are some on which the performance data of the automobile before and behind an abnormal occurrence was recorded automatically (refer to the Nissan Motor Co., Ltd. issuance "Nissan KONSARUTO electronic system diagnostic circuit tester operation manual engine editing" 27th page). Thereby, a cause of fault can be presumed with a sufficient probability from the data recorded at the time of failure.
[0003] The conventional example is explained further in full detail. Although the control unit for engine control is constituted including CPU, RAM, EEPROM, and an I/O circuit, CPU and the electronic system diagnostic circuit tester which can do the data exchange by communication link are connected to this. In such a system, always CPU detects an engine speed, an accelerator opening, etc., and uses them for control, and also it records data on RAM. In this case, the field which records the data for for 20 seconds is secured to RAM, and data are overwritten and recorded in a cycle of 20 seconds.
[0004] And an engine speed is 20rpm. The data of the predetermined field in [ after recording data ] RAM are moved to the predetermined field of EEPROM until it judges it as an engine failure and 10 seconds pass after an engine failure, when it becomes below. Thereby, as shown in drawing 7 , the data for [ before engine failure detection ] 10 seconds and for 10 seconds after engine failure detection are memorized in EEPROM.
[0005] The detail of record actuation is as the program shown in the flow chart of drawing 8 . For this program, it performs repeatedly every 10msec(s) and each time and an engine speed are 20rpm. Whether it is the following performs an engine failure judging (S51), when it is not an engine failure, Flag FMEMO is set to 0 and an address counter N is counted up the back (S52) (S53). In addition, when N is set to 2000, it returns to 0 (S54, S55), and thereby, count-up to 0-1999 is repeated, and is made to perform.
[0006] And the record data D1 - D10 are inputted (S56), and it writes in and records on Nx10th - the Nx10+9th street in RAM corresponding to N which repeats even 0-1999 (S57). The value of D1 - D10 is an engine speed, or is engine-coolant water temperature. Thus, the data for for 20 seconds are always recorded by writing in in order during an engine revolution, overwriting the newest data to the predetermined field of RAM.
[0007] When an engine failure is carried out, before it judges whether 10 seconds passed after the engine failure (S58) and 10 seconds pass it When record to the above-mentioned RAM is continued (S53-S57) and 10 seconds pass The data for for (S60) to 20 seconds are written in 0th - the 19999th street of read-

out and EEPROM from 0th - the 19999th street of RAM as FMEMO=1 after the judgment (S59) of Flag FMEMO (S61). Moreover, similarly the value of the address counter N which shows the newest data location at this time is written in the 20000 or 200001st street of EEPROM (S62). After this, a power source becomes off by the judgment (S59) of Flag FMEMO.
[0008] By doing in this way, storage maintenance of the thing for [ before an engine failure ] 10 seconds and for 10 seconds after an engine failure can be carried out about data D1 - D10 at EEPROM. And the data before and behind the engine failure which carried out storage maintenance can be transmitted by demand of an electronic system diagnostic circuit tester using communication facility. The above is the conventional example of the data recorder for automobiles. Although this example explained the case at the time of an engine failure, it is clear that the record maintenance of the engine failure can be similarly carried out as a time of failure generating.
[0009]
[Problem(s) to be Solved by the Invention] However, since it was not failure when a step on difference was carried out accidentally [ accelerator pedal / a brake pedal and ] and accident occurred by an operator's service abuse although it was recordable at the time of an engine failure and fault detection if it was in such a conventional data recorder for automobiles, data were not recorded, for this reason had the trouble that a cause could not be studied in case of accident.
[0010] In such a case, since it is especially becoming a problem at the occurrence time of accident, the method which detects accident and carries out storage maintenance of the data is considered easily. And in order to carry this out, approaches, such as using the decision part of the air bag already commercialized, can be considered. However, now, in slight accident, it could not detect and the costs which this takes also had troubles, such as being high.
[0011] This invention aims at being able to record data by the high probability also in the case of a service abuse, and offering the cheap data recorder for automobiles in view of such a conventional trouble.
[0012]
[Means for Solving the Problem] For this reason, in the data recorder for automobiles, this invention is considered as the configuration which has a means to record the performance data of an automobile to the timing determined with these at least two combination while it has a means to detect turning on and off of the vehicle speed of an automobile, an engine speed, or an ignition switch, as shown in drawing 1 .
[0013] Here, as for said timing, it is desirable to consider as the time of the stop before an engine shutdown.
[0014]
[Function] In this invention, when there is generally trouble of traffic after stopping a car and on-site preservation or during preservation at the time of the occurrence of accident, after putting away a car, it usually came out to once stop an engine and it paid its attention to a certain thing. Thus, it stops at the time of the occurrence of accident, and if there was accident when saying to reverse since the engine was usually stopped near the, it can be said that it is it at the about one - three stop time before an engine shutdown.
[0015] So, in this invention, the time of the stop before an engine shutdown is detected, and it is made to carry out record maintenance of the data before and behind that with the vehicle speed, an engine speed, or at least two combination of turning on and off of an ignition switch. Although it is common to see the vehicle speed as an approach of detecting a stop, you may judge with a stop with an engine speed being below a predetermined value.
[0016] Moreover, although it is common to detect the ON state of an ignition switch as an approach of detecting engine shutdown before, you may judge by the engine speed. Therefore, the vehicle speed, an engine speed, or at least two combination of turning on and off of an ignition switch determine the timing of data logging.
[0017] By doing in this way, accident is detectable by the high probability in the limited memory size.
[0018]

[Example] One example of this invention is explained below. The system chart of a data recorder is shown in drawing 2 . In addition, below taking the case of the data recorder to the control unit for engine control including electronic formula throttle control, it explains.
[0019] In drawing 2 , closing motion actuation of the throttle valve 3 is carried out by the throttle actuator 2, the inhalation air content to an engine 1 is controlled, and the amount of fuel supply is controlled by the fuel injection valve 4. and the inhalation in an engine 1 -- having ignition timing controlled, it is lit by the ignition plug 5 and gaseous mixture burns. Here, the throttle actuator 2, a fuel injection valve 4, and an ignition plug 5 are controlled by the signal from a control unit 20.
[0020] The signal from the crank angle sensor 6 which detects an engine speed, the accelerator sensor 8 which accelerator BEDARU 7 steps on and detects an angle (accelerator opening), the speed sensor 10 which detects the vehicle speed from the output-shaft revolution of transmission 9, and an ignition switch 11 is inputted into the control unit 20 for this control. In addition, 12 in drawing shows car electric load.
[0021] The control unit 20 is constituted including CPU21, RAM22, EEPROM23, the input circuit 24, and the output circuit 25. And the electronic system diagnostic circuit tester 30 is connected to a control unit 20, and this electronic system diagnostic circuit tester 30 can do the data exchange by communication link with CPU21.
[0022] In such a system, always CPU21 detects an engine speed, an accelerator opening, etc., and uses them for control, and also it records data on RAM22. In this case, the field which records the data for for 20 seconds is secured to RAM22, and data are overwritten and recorded in a cycle of 20 seconds. And the data in [ after recording data ] RAM22 are moved to EEPROM23 until it judges it as a stop and 10 seconds pass after a stop, when the vehicle speed becomes 0 km/h.
[0023] Moreover, an engine shutdown is judged with an ignition switch 11, and as shown in drawing 3 , storage maintenance of the data before and behind the stop of front [ an engine shutdown (ignition switch 11 OFF) ] 3 batch is carried out on EEPROM23. In addition, the field which records 10= 30 3x data for for 20 seconds (data for [ before a stop ] 10 seconds and for 10 seconds after a stop) as shown in drawing 4 is secured to EEPROM23, and the ten-piece record maintenance of the data before and behind the stop of front [ engine shutdown ] 3 batch shown in drawing 3 can be carried out.
[0024] The detail of record actuation is as the program shown in the flow chart of drawing 5 and drawing 6 ( drawing 6 is a continuation of drawing 5 ). This program is performed repeatedly every 10msec(s). Step 1 (it is described as S1 in drawing.) In order to carry out record maintenance of the data fundamentally in it being the same as that of the following at the time of a stop, based on the signal from a speed sensor 10, it judges whether the vehicle speed is 0 km/h. In addition, you may judge with the time of a stop with an engine speed being below a predetermined value.
[0025] When the vehicle speed is not 0 km/h, Flag FMEMO is set to 0 at step 2, and the address counter N for RAM is counted up at step 3 the back. In addition, when N is set to 2000, it returns to 0 (steps 4 and 5), and thereby, count-up to 0-1999 is repeated, and is made to perform. And it writes in and records on Nx10th - the Nx10+9th street in RAM corresponding to N which inputs the record data D1 - D10 at step 6, and repeats even 0-1999 at step 7.
[0026] Thus, when the vehicle speed is larger than 0 km/h, the data for for 20 seconds are always recorded by writing in in order, overwriting the newest data to the predetermined field (the 0-19999th street) of RAM22. When the vehicle speed becomes 0 km/h, before it judges whether 10 seconds passed and 10 seconds pass it at step 8, steps 3-7 are performed and record to above-mentioned RAM22 is continued.
[0027] After the judgment of the flag FMEMO in step 9, after setting after 10-second progress to FMEMO=1 at step 10, it progresses to step 11. At step 11, the value of the engine shutdown counter M which counts up for every engine shutdown by steps 20-22 later mentioned from the 600060 or 600061st street (area for M storing of drawing 4 ) of EEPROM23, and repeats even 0-9 is read. This counter M is used as an object for upper address assignment of EEPROM23.
[0028] Next, the stop counter L is counted up at step 12. In addition, when L is set to 3, it returns to 0 (steps 13 and 14), and thereby, count-up to 0-2 is repeated, and is made to perform. Therefore, this

counter L is counted up for every stop, and is used as an object for lower address assignment of EEPRPM23 [ 2 / 0-].
[0029] And at step 15, they are read-out and 23 EEPROMs x(Mx3+L) 20000 from 0th - the 19999th street of RAM22 about the record data for 20 seconds. Address -(Mx3+L) x20000+19999 It writes in an address. Moreover, at step 16, the value of the counter N which shows the newest data location is written in the 2nd [ 600000+(Mx3+L) x] 600000+(Mx3+L) x2+1 street among the area for N storing of EEPROM23 (refer to drawing 4 ; the 600000-600059th street).
[0030] Thereby, they are 23 EEPROMs x(Mx3) 20000 by L repeating even 0-2. Address -(Mx3+2) x20000+19999 It comes to be recorded on it, the data before and behind the stop of the three newest batches always being overwritten by the field of an address. Since it is FMEMO=1 after this, it progresses to step 17 ( drawing 6 ) from step 9.
[0031] At step 17, when an ignition switch 11 judges whether it is ON and becomes off, it judges whether 10 seconds passed after off at step 18, and when 10 seconds pass, it progresses to step 19. That is, 10 seconds after an ignition switch 11 becomes off, an engine shutdown is detected because it is, and it progresses to step 19. In addition, an engine shutdown may be judged from an engine speed.
[0032] In step 19, the value of the engine shutdown counter M is read from the 600060 or 600061st street of EEPROM23, and the value of the engine shutdown counter M is counted up at step 20. In addition, when M is set to 10, it returns to 0 (steps 21 and 22), and thereby, count-up to 0-9 is repeated, and is made to perform. At the following step 23, the value of the counted-up engine shutdown counter M is written in the 600060 or 600061st street of EEPROM23.
[0033] Thereby, record maintenance of the data before and behind the stop of the three newest batches is performed to another field of EEPROM23 at the time of the transit after the next start up. Thus, in this example, M can carry out [ by ] storage maintenance of the data for [ before and after a stop ] 20 seconds of front [ engine shutdown ] 3 batch and a total of 30 batches altogether about transit of the ten batches till then, when taking the value to 0-9 and reading data in a service station.
[0034] And it becomes a quite high probability that the data in case of accident are in this.
[0035]
[Effect of the Invention] The cheap data recorder for automobiles can be realized by enabling it to detect cheaply, without using the accident judgment function used for raising, an air bag, etc. in detection precision by using the vehicle speed, an engine speed, and two combination or more of an ignition switch in order to detect accident according to this invention, as explained above.

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[Translation done.]

* NOTICES *



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PRIOR ART

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[Description of the Prior Art] As this kind of a data recorder for automobiles conventionally by mounting what is called an electronic system diagnostic circuit tester, connecting with a control unit, and setting this as automatic-recording mode At the time of the abnormal occurrence of the newest result of a nonconformity judging of a control unit, and an engine failure There are some on which the performance data of the automobile before and behind an abnormal occurrence was recorded automatically (refer to the Nissan Motor Co., Ltd. issuance "Nissan KONSARUTO electronic system diagnostic circuit tester operation manual engine editing" 27th page). Thereby, a cause of fault can be presumed with a sufficient probability from the data recorded at the time of failure.
[0003] The conventional example is explained further in full detail. Although the control unit for engine control is constituted including CPU, RAM, EEPROM, and an I/O circuit, CPU and the electronic system diagnostic circuit tester which can do the data exchange by communication link are connected to this. In such a system, always CPU detects an engine speed, an accelerator opening, etc., and uses them for control, and also it records data on RAM. In this case, the field which records the data for for 20 seconds is secured to RAM, and data are overwritten and recorded in a cycle of 20 seconds.
[0004] And an engine speed is 20rpm. The data of the predetermined field in [ after recording data ] RAM are moved to the predetermined field of EEPROM until it judges it as an engine failure and 10 seconds pass after an engine failure, when it becomes below. Thereby, as shown in drawing 7 , the data for [ before engine failure detection ] 10 seconds and for 10 seconds after engine failure detection are memorized in EEPROM.
[0005] The detail of record actuation is as the program shown in the flow chart of drawing 8 . For this program, it performs repeatedly every 10msec(s) and each time and an engine speed are 20rpm. Whether it is the following performs an engine failure judging (S51), when it is not an engine failure, Flag FMEMO is set to 0 and an address counter N is counted up the back (S52) (S53). In addition, when N is set to 2000, it returns to 0 (S54, S55), and thereby, count-up to 0-1999 is repeated, and is made to perform.
[0006] And the record data D1 - D10 are inputted (S56), and it writes in and records on Nx10th - the Nx10+9th street in RAM corresponding to N which repeats even 0-1999 (S57). The value of D1 - D10 is an engine speed, or is engine-coolant water temperature. Thus, the data for for 20 seconds are always recorded by writing in in order during an engine revolution, overwriting the newest data to the predetermined field of RAM.
[0007] When an engine failure is carried out, before it judges whether 10 seconds passed after the engine failure (S58) and 10 seconds pass it When record to the above-mentioned RAM is continued (S53-S57) and 10 seconds pass The data for for (S60) to 20 seconds are written in 0th - the 19999th street of read-out and EEPROM from 0th - the 19999th street of RAM as FMEMO=1 after the judgment (S59) of Flag FMEMO (S61). Moreover, similarly the value of the address counter N which shows the newest data location at this time is written in the 20000 or 200001st street of EEPROM (S62). After this, a power source becomes off by the judgment (S59) of Flag FMEMO.
[0008] By doing in this way, storage maintenance of the thing for [ before an engine failure ] 10 seconds

and for 10 seconds after an engine failure can be carried out about data D1 - D10 at EEPROM. And the data before and behind the engine failure which carried out storage maintenance can be transmitted by demand of an electronic system diagnostic circuit tester using communication facility. The above is the conventional example of the data recorder for automobiles. Although this example explained the case at the time of an engine failure, it is clear that the record maintenance of the engine failure can be similarly carried out as a time of failure generating.

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[Translation done.]

## EFFECT OF THE INVENTION

[Effect of the Invention] The cheap data recorder for automobiles can be realized by enabling it to detect cheaply, without using the accident judgment function used for raising, an air bag, etc. in detection precision by using the vehicle speed, an engine speed, and two combination or more of an ignition switch in order to detect accident according to this invention, as explained above.

[Translation done.]

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, since it was not failure when a step on difference was carried out accidentally [ accelerator pedal / a brake pedal and ] and accident occurred by an operator's service abuse although it was recordable at the time of an engine failure and fault detection if it was in such a conventional data recorder for automobiles, data were not recorded, for this reason had the trouble that a cause could not be studied in case of accident.
[0010] In such a case, since it is especially becoming a problem at the occurrence time of accident, the method which detects accident and carries out storage maintenance of the data is considered easily. And in order to carry this out, approaches, such as using the decision part of the air bag already commercialized, can be considered. However, now, in slight accident, it could not detect and the costs which this takes also had troubles, such as being high.
[0011] This invention aims at being able to record data by the high probability also in the case of a service abuse, and offering the cheap data recorder for automobiles in view of such a conventional trouble.
[0012]

[Translation done.]

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MEANS

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[Means for Solving the Problem] For this reason, in the data recorder for automobiles, this invention is considered as the configuration which has a means to record the performance data of an automobile to the timing determined with these at least two combination while it has a means to detect turning on and off of the vehicle speed of an automobile, an engine speed, or an ignition switch, as shown in drawing 1 .
[0013] Here, as for said timing, it is desirable to consider as the time of the stop before an engine shutdown.

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[Translation done.]

* NOTICES *



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OPERATION

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[Function] In this invention, when there is generally trouble of traffic after stopping a car and on-site preservation or during preservation at the time of the occurrence of accident, after putting away a car, it usually came out to once stop an engine and it paid its attention to a certain thing. Thus, it stops at the time of the occurrence of accident, and if there was accident when saying to reverse since the engine was usually stopped near the, it can be said that it is it at the about one - three stop time before an engine shutdown.
[0015] So, in this invention, the time of the stop before an engine shutdown is detected, and it is made to carry out record maintenance of the data before and behind that with the vehicle speed, an engine speed, or at least two combination of turning on and off of an ignition switch. Although it is common to see the vehicle speed as an approach of detecting a stop, you may judge with a stop with an engine speed being below a predetermined value.
[0016] Moreover, although it is common to detect the ON state of an ignition switch as an approach of detecting engine shutdown before, you may judge by the engine speed. Therefore, the vehicle speed, an engine speed, or at least two combination of turning on and off of an ignition switch determine the timing of data logging.
[0017] By doing in this way, accident is detectable by the high probability in the limited memory size.

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[Translation done.]

* NOTICES *



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EXAMPLE

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[Example] One example of this invention is explained below. The system chart of a data recorder is shown in drawing 2 . In addition, below taking the case of the data recorder to the control unit for engine control including electronic formula throttle control, it explains.
[0019] In drawing 2 , closing motion actuation of the throttle valve 3 is carried out by the throttle actuator 2, the inhalation air content to an engine 1 is controlled, and the amount of fuel supply is controlled by the fuel injection valve 4. and the inhalation in an engine 1 -- having ignition timing controlled, it is lit by the ignition plug 5 and gaseous mixture burns. Here, the throttle actuator 2, a fuel injection valve 4, and an ignition plug 5 are controlled by the signal from a control unit 20.
[0020] The signal from the crank angle sensor 6 which detects an engine speed, the accelerator sensor 8 which accelerator BEDARU 7 steps on and detects an angle (accelerator opening), the speed sensor 10 which detects the vehicle speed from the output-shaft revolution of transmission 9, and an ignition switch 11 is inputted into the control unit 20 for this control. In addition, 12 in drawing shows car electric load.
[0021] The control unit 20 is constituted including CPU21, RAM22, EEPROM23, the input circuit 24, and the output circuit 25. And the electronic system diagnostic circuit tester 30 is connected to a control unit 20, and this electronic system diagnostic circuit tester 30 can do the data exchange by communication link with CPU21.
[0022] In such a system, always CPU21 detects an engine speed, an accelerator opening, etc., and uses them for control, and also it records data on RAM22. In this case, the field which records the data for for 20 seconds is secured to RAM22, and data are overwritten and recorded in a cycle of 20 seconds. And the data in [ after recording data ] RAM22 are moved to EEPROM23 until it judges it as a stop and 10 seconds pass after a stop, when the vehicle speed becomes 0 km/h.
[0023] Moreover, an engine shutdown is judged with an ignition switch 11, and as shown in drawing 3 , storage maintenance of the data before and behind the stop of front [ an engine shutdown (ignition switch 11 OFF) ] 3 batch is carried out on EEPROM23. In addition, the field which records 10= 30 3x data for for 20 seconds (data for [ before a stop ] 10 seconds and for 10 seconds after a stop) as shown in drawing 4 is secured to EEPROM23, and the ten-piece record maintenance of the data before and behind the stop of front [ engine shutdown ] 3 batch shown in drawing 3 can be carried out.
[0024] The detail of record actuation is as the program shown in the flow chart of drawing 5 and drawing 6 ( drawing 6 is a continuation of drawing 5 ). This program is performed repeatedly every 10msec(s). Step 1 (it is described as S1 in drawing.) In order to carry out record maintenance of the data fundamentally in it being the same as that of the following at the time of a stop, based on the signal from a speed sensor 10, it judges whether the vehicle speed is 0 km/h. In addition, you may judge with the time of a stop with an engine speed being below a predetermined value.
[0025] When the vehicle speed is not 0 km/h, Flag FMEMO is set to 0 at step 2, and the address counter N for RAM is counted up at step 3 the back. In addition, when N is set to 2000, it returns to 0 (steps 4 and 5), and thereby, count-up to 0-1999 is repeated, and is made to perform. And it writes in and records on Nx10th - the Nx10+9th street in RAM corresponding to N which inputs the record data D1 - D10 at

step 6, and repeats even 0-1999 at step 7.
[0026] Thus, when the vehicle speed is larger than 0 km/h, the data for for 20 seconds are always recorded by writing in in order, overwriting the newest data to the predetermined field (the 0-19999th street) of RAM22. When the vehicle speed becomes 0 km/h, before it judges whether 10 seconds passed and 10 seconds pass it at step 8, steps 3-7 are performed and record to above-mentioned RAM22 is continued.
[0027] After the judgment of the flag FMEMO in step 9, after setting after 10-second progress to FMEMO=1 at step 10, it progresses to step 11. At step 11, the value of the engine shutdown counter M which counts up for every engine shutdown by steps 20-22 later mentioned from the 600060 or 600061st street (area for M storing of drawing 4) of EEPROM23, and repeats even 0-9 is read . This counter M is used as an object for upper address assignment of EEPROM23.
[0028] Next, the stop counter L is counted up at step 12. In addition, when L is set to 3, it returns to 0 (steps 13 and 14), and thereby, count-up to 0-2 is repeated, and is made to perform. Therefore, this counter L is counted up for every stop, and is used as an object for lower address assignment of EEPRPM23 [ 2 / 0-].
[0029] And at step 15, they are read-out and 23 EEPROMs x(Mx3+L) 20000 from 0th - the 19999th street of RAM22 about the record data for 20 seconds. Address -(Mx3+L) x20000+19999 It writes in an address. Moreover, at step 16, the value of the counter N which shows the newest data location is written in the 2nd [ 600000+(Mx3+L) x] 600000+(Mx3+L) x2+1 street among the area for N storing of EEPROM23 (refer to drawing 4 ; the 600000-600059th street).
[0030] Thereby, they are 23 EEPROMs x(Mx3) 20000 by L repeating even 0-2. Address -(Mx3+2) x20000+19999 It comes to be recorded on it, the data before and behind the stop of the three newest batches always being overwritten by the field of an address. Since it is FMEMO=1 after this, it progresses to step 17 ( drawing 6 ) from step 9.
[0031] At step 17, when an ignition switch 11 judges whether it is ON and becomes off, it judges whether 10 seconds passed after off at step 18, and when 10 seconds pass, it progresses to step 19. That is, 10 seconds after an ignition switch 11 becomes off, an engine shutdown is detected because it is, and it progresses to step 19. In addition, an engine shutdown may be judged from an engine speed.
[0032] In step 19, the value of the engine shutdown counter M is read from the 600060 or 600061st street of EEPROM23, and the value of the engine shutdown counter M is counted up at step 20. In addition, when M is set to 10, it returns to 0 (steps 21 and 22), and thereby, count-up to 0-9 is repeated, and is made to perform. At the following step 23, the value of the counted-up engine shutdown counter M is written in the 600060 or 600061st street of EEPROM23.
[0033] Thereby, record maintenance of the data before and behind the stop of the three newest batches is performed to another field of EEPROM23 at the time of the transit after the next start up. Thus, in this example, M can carry out [ by ] storage maintenance of the data for [ before and after a stop ] 20 seconds of front [ engine shutdown ] 3 batch and a total of 30 batches altogether about transit of the ten batches till then, when taking the value to 0-9 and reading data in a service station.
[0034] And it becomes a quite high probability that the data in case of accident are in this.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] The functional block diagram showing the configuration of this invention
[Drawing 2] The system chart of the data recorder in which one example of this invention is shown
[Drawing 3] The timing chart of data logging of an example same as the above
[Drawing 4] Drawing showing the EEPROM record section of an example same as the above
[Drawing 5] The flow chart of an example same as the above (the 1)
[Drawing 6] The flow chart of an example same as the above (the 2)
[Drawing 7] The timing chart of data logging showing the conventional example
[Drawing 8] The flow chart of the conventional example same as the above
[Description of Notations]
1 Engine
6 Crank Angle Sensor
10 Speed Sensor
11 Ignition Switch
20 Control Unit
21 CPU
22 RAM
23 EEPROM
30 Electronic System Diagnostic Circuit Tester

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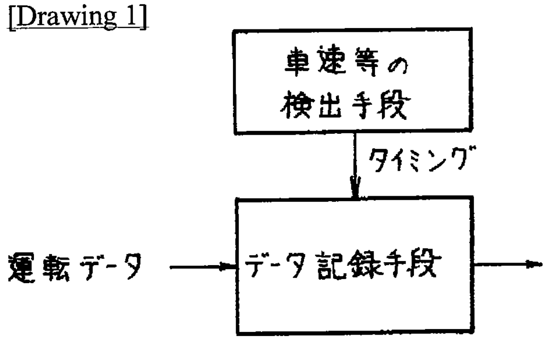
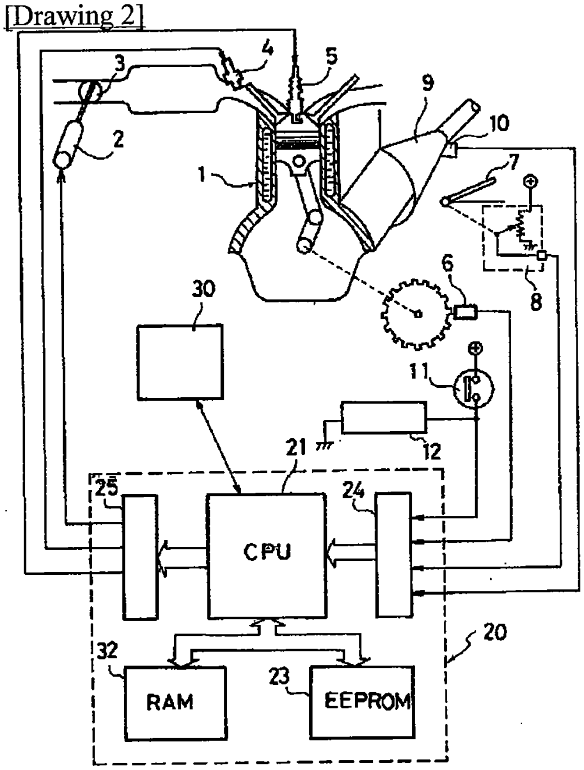
DRAWINGS

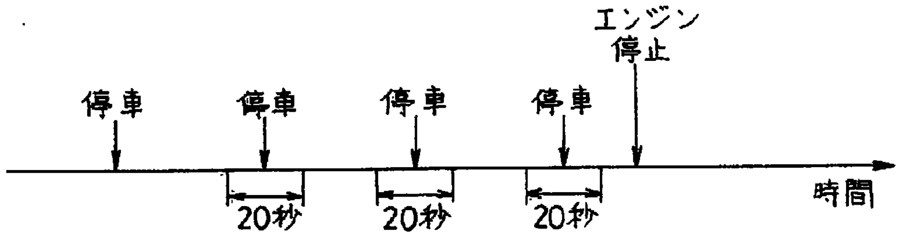
[Drawing 1]



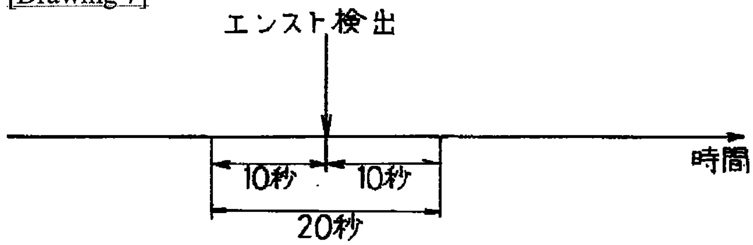

[Drawing 2]



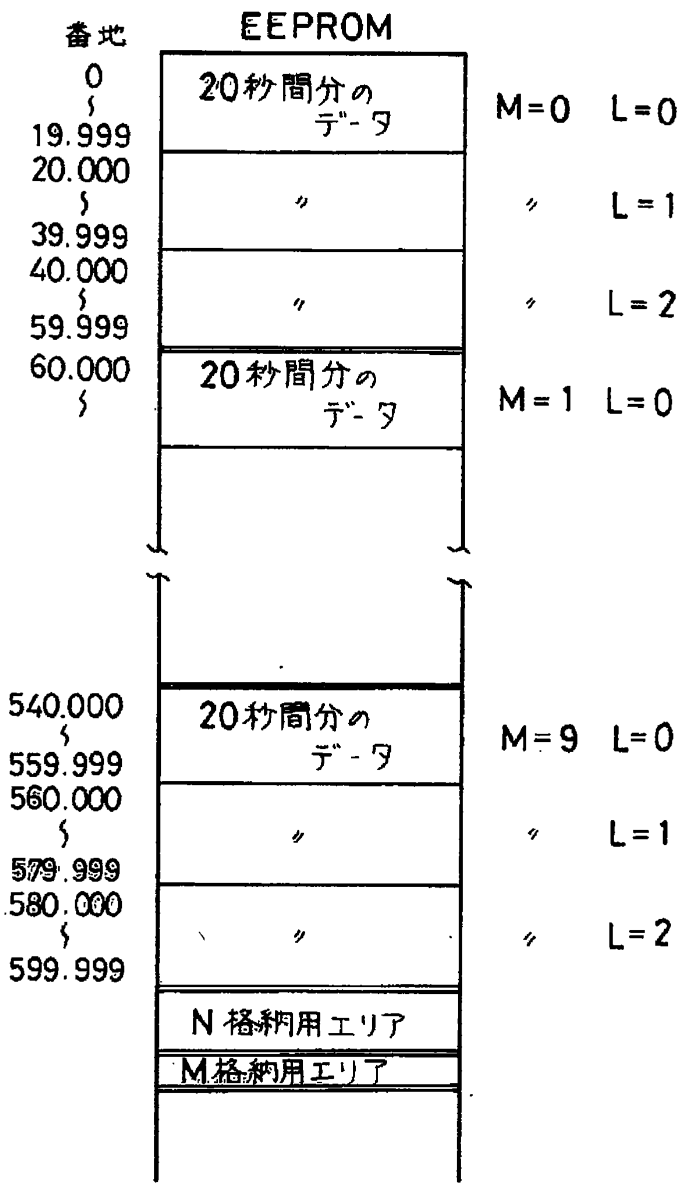

[Drawing 3]




[Drawing 7]

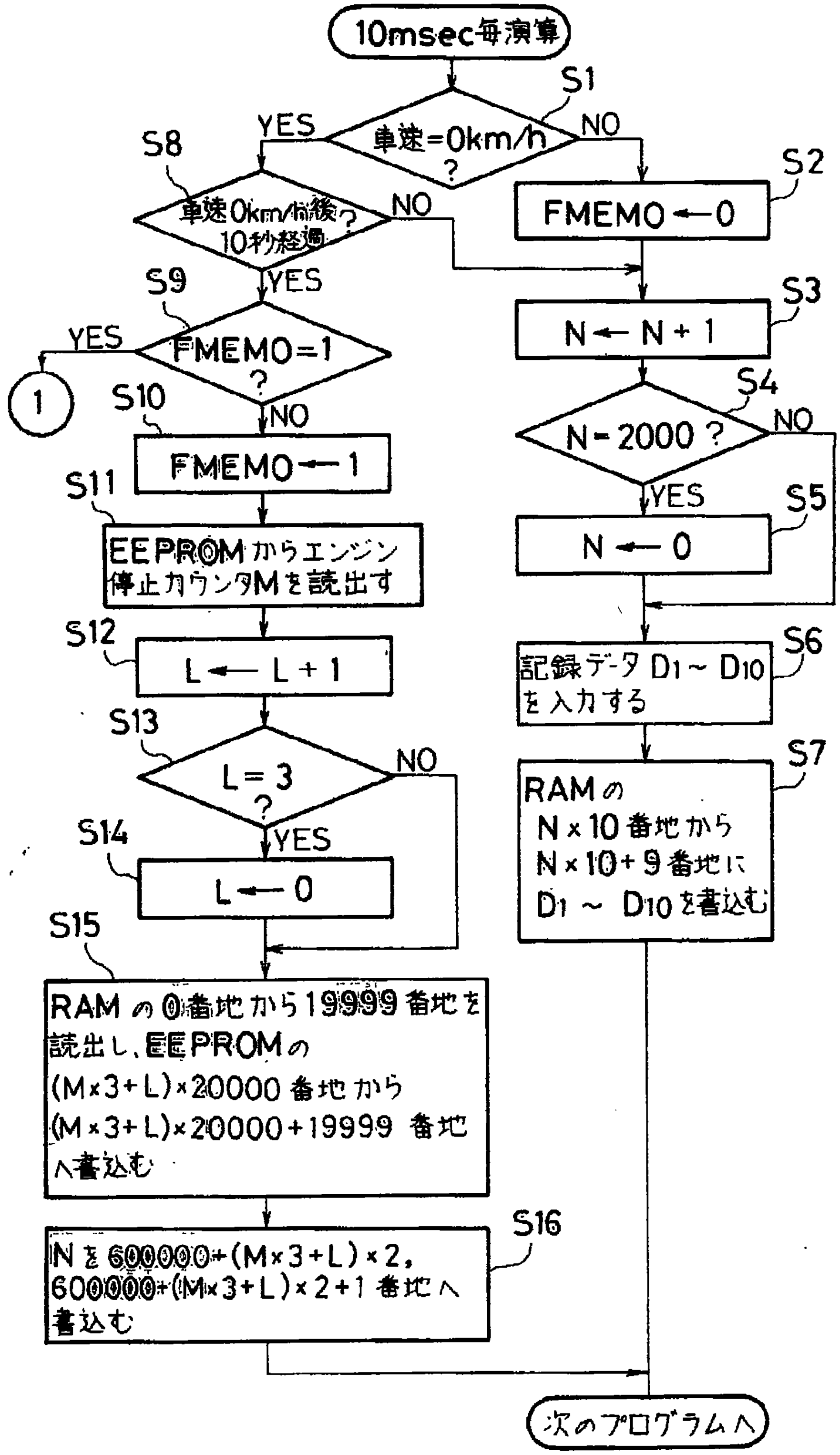



[Drawing 4]

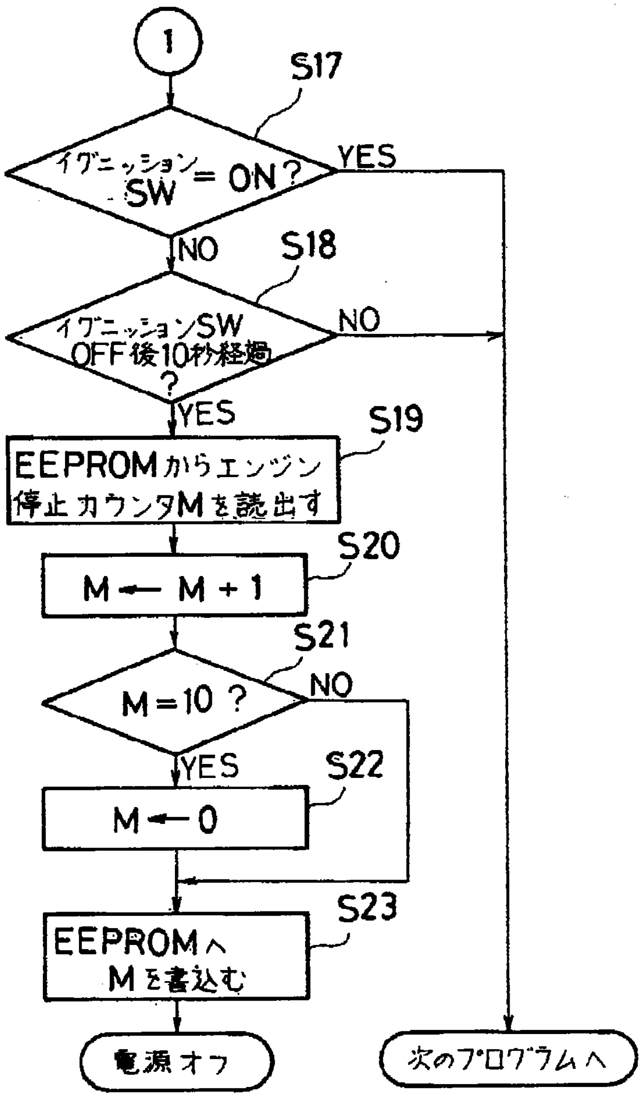


番地
EEPROM
0
19.999
20秒間分のデータ
M=0 L=0
20.000
39.999
〃
〃 L=1
40.000
59.999
〃
〃 L=2
60.000
20秒間分のデータ
M=1 L=0
540.000
559.999
20秒間分のデータ
M=9 L=0
560.000
579.999
〃
〃 L=1
580.000
599.999
〃
〃 L=2
N格納用エリア
M格納用エリア

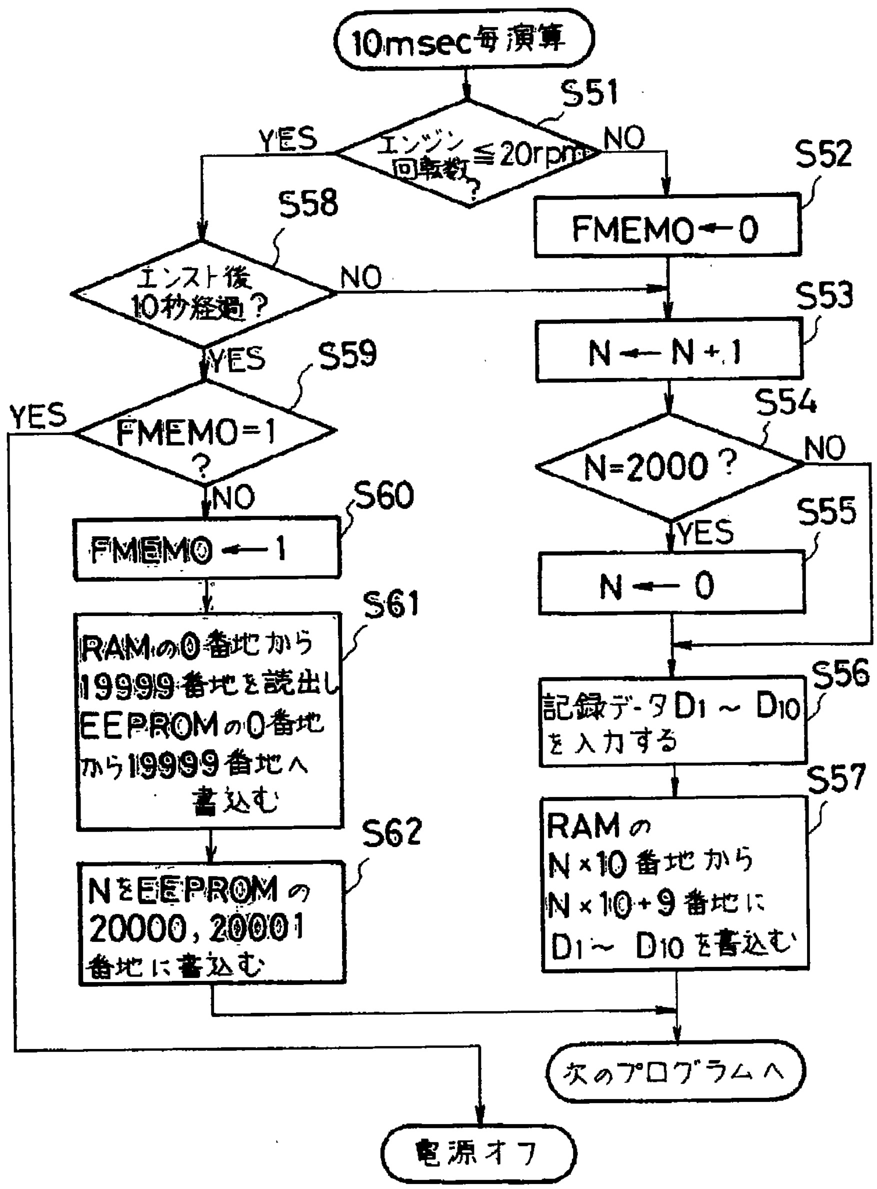

[Drawing 5]


10msec毎演算
S1
車速=0km/h ?
YES
NO
S2
FMEMO ← 0
S8
車速0km/h後10秒経過?
NO
YES
S3
N ← N + 1
S9
FMEMO=1 ?
YES
1
NO
S4
N = 2000 ?
NO
YES
S10
FMEMO ← 1
S5
N ← 0
S11
EEPROMからエンジン停止カウンタMを読出す
S6
記録データ D1 ~ D10 を入力する
S12
L ← L + 1
S13
L = 3 ?
NO
YES
S7
RAMの N×10番地から N×10+9番地に D1 ~ D10 を書込む
S14
L ← 0
S15
RAMの0番地から19999番地を読出し、EEPROMの(M×3+L)×20000番地から(M×3+L)×20000+19999番地へ書込む
S16
Nを600000+(M×3+L)×2, 600000+(M×3+L)×2+1番地へ書込む
次のプログラムへ

[Drawing 6]


1
S17
イグニッションSW = ON?
YES
NO
S18
イグニッションSW OFF後10秒経過?
NO
YES
S19
EEPROMからエンジン停止カウンタMを読出す
S20
M ← M + 1
S21
M = 10 ?
NO
YES
S22
M ← 0
S23
EEPROMへMを書込む
電源オフ
次のプログラムへ

[Drawing 8]

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I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office, Commissioner for Patents, via the EFS pursuant to 37 CFR §1.8 on: Date: May 26, 2010 Name: David P. Lindner – Reg. No. 53,222

Signature:

BRINKS HOFER GILSON &LIONE

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: Ling et al.

Appln. No.: 12/132,487

Filed: June 3, 2008

For: VEHICLE MONITORING SYSTEM

Attorney Docket No.: 12654/42

Examiner: James A. Kramer

Group Art Unit: 3693

Confirmation No.: 7812

# TRANSMITTAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

**Attached is/are:**

☒ Transmittal (p.1); Supplemental Information Disclosure Statement (pp. 2-6); and Form PTO 1449 (pp. 7-10); Copies of Twelve Foreign Patent Documents (B77-B86); and Twenty-Two Non Patent Literature References (B87-B108).

**Fee calculation:**

☒ No additional fee is required.

☐ Small Entity.

☐ An extension fee in an amount of $_____ for a ___-_ month extension of time under 37 CFR § 1.136(a).

☐ A petition or processing fee in an amount of $______ under 37 CFR § 1.17(p).

☐ An additional filing fee has been calculated as shown below:

| | | | | | | Small Entity | | | Not a Small Entity | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Claims Remaining After Amendment | | Highest No. Previously Paid For | Present Extra | | Rate | Add'l Fee | OR | Rate | Add'l Fee |
| Total | | Minus | | | | x $26= | | | x $52= | |
| Indep. | | Minus | | | | x 110= | | | x $220= | |
| First Presentation of Multiple Dep. Claim | | | | | | +$195= | | | + $390= | |
| | | | | | | Total | $ | | Total | $ |

**Fee payment:**

☐ Please charge Deposit Account No. 23-1925 in the amount of $_________ for ______________.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

Respectfully submitted,

May 26, 2010
Date

David P. Lindner (Reg. No. 53,222)

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Signature: David P. Lindner

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## SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

In accordance with the duty of disclosure under 37 CFR §1.56 and §§1.97-1.98, and more particularly in accordance with 37 CFR §1.97(b), Applicants hereby cite the following references:

| U.S. PATENT DOCUMENTS | | |
|---|---|---|
| DOCUMENT NO. | DATE | NAME |
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Applicants are enclosing Form PTO-1449 (four sheets), along with a copy of each listed reference for which a copy is required under 37 CFR §1.98(a)(2). Pursuant to the undersigned attorney's obligation and duties under 37 CFR §§ 1.56 and 1.98(a)(3) and (c), either English language abstracts, partial translations, or full translations are included for patent documents which are not in English for the express purpose of providing a concise explanation of the references to the Patent and Trademark Office with the opportunity to evaluate the same. Applicants respectfully request the Examiner's consideration of the above references and entry thereof into the record of this application.

Additionally, Applicants respectfully request that the examiner review the claims and prosecution history, including any Office Actions issued by the USPTO for co-pending related serial numbers 10/764,076, filed January 23, 2004, and 11/868,827, filed October 8, 2007.

By submitting this Statement, Applicants are attempting to fully comply with the duty of candor and good faith mandated by 37 CFR §1.56. As such, this Statement is not intended to constitute an admission that any of the enclosed references, or other information referred to therein, constitutes "prior art" or is otherwise "material to patentability," as that phrase is defined in 37 CFR §1.56(a).

The Applicants have calculated no fee to be due in connection with the filing of this Information Disclosure Statement. However, the Director is authorized to charge any fee deficiency associated with the filing of this Information Disclosure Statement to a deposit account, as authorized in the Transmittal accompanying this Information Disclosure Statement.

Respectfully submitted,

May 26, 2010
Date

David P. Lindner
(Reg. No. 53,222)

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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 7297109 |
| **Application Number:** | 12132487 |
| **International Application Number:** | |
| **Confirmation Number:** | 7812 |
| **Title of Invention:** | VEHICLE MONITORING SYSTEM |
| **First Named Inventor/Applicant Name:** | Raymond Scott Ling |
| **Customer Number:** | 00757 |
| **Filer:** | James A. Collins/Magdalena Pieczonka |
| **Filer Authorized By:** | James A. Collins |
| **Attorney Docket Number:** | 12654/42 |
| **Receipt Date:** | 26-MAR-2010 |
| **Filing Date:** | 03-JUN-2008 |
| **Time Stamp:** | 17:12:11 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | NPL Documents | A150--Vetronix_Corp_Presentation_Advances_in_Scan_Tool_Technology.pdf | 342454<br>4d84c1c2c29e94eb2738d3298a4f45c66556c423 | no | 13 |

**Warnings:**

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|---|---|---|---|---|---|
| 2 | NPL Documents | A151--Vetronix_Corp_Presentation_Vetronix_Crash_Data_Retrieval_System_Presentation.pdf | 4477558<br>3de2863f476fa556adadf23c26fc3d56a911cb57 | no | 29 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | NPL Documents | A152--Vetronix_Corp_Press_Release--Vetronix_Corp_Launches_CDR.pdf | 139750<br>2573c69edc1e84d519d325c394240e32261fe347 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | NPL Documents | A153--Vetronix_Press_Release--Vetronix_Corp_to_Provide_AutoConnect.pdf | 55369<br>943c80006dc35a31d8c3f82e0eb24c7dd3997a06 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | NPL Documents | A154--WKGM-TV6_Check.PDF | 13125<br>83b26dad9e90ce937bb51895828ce8d0fd952957 | no | 1 |
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**<u>New Applications Under 35 U.S.C. 111</u>**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

| FORM PTO-1449 | SERIAL NO. 12/132,487 | CASE NO. 12654-42 |
|---|---|---|
| **LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT** | FILING DATE June 3, 2008 | GROUP ART UNIT 3693 |
| (use several sheets if necessary) APPLICANT(S): Raymond Scott Ling et al. | | CONFIRMATION NO. 7812 |

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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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| (use several sheets if necessary) | APPLICANT(S): Raymond Scott Ling et al. | |

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| (use several sheets if necessary) | APPLICANT(S): Raymond Scott Ling et al. | |

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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

| FORM PTO-1449 | SERIAL NO. 12/132,487 | CASE NO. 12654-42 |
|---|---|---|
| **LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT** | FILING DATE June 3, 2008 | GROUP ART UNIT 3693 |
| (use several sheets if necessary) | APPLICANT(S): Raymond Scott Ling et al. | |

| EXAMINER INITIAL | | **OTHER ART – NON PATENT LITERATURE DOCUMENTS** **(Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published.** |
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## Individual evaluation system for motorcar risk

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|---|---|
| **Publication number:** | EP0700009 (A2) |
| **Publication date:** | 1996-03-06 |
| **Inventor(s):** | MINGUIJON PEREZ SALVADOR [ES] + |
| **Applicant(s):** | MINGUIJON PEREZ SALVADOR [ES] + |
| **Classification:** | |
| **- international:** | ***G06Q40/00; G06Q99/00;*** **G06Q40/00; G06Q99/00;** (IPC1-7): G06F17/60 |
| **- European:** | G06Q40/00D; G06Q99/00 |
| **Application number:** | EP19950500123 19950828 |
| **Priority number(s):** | ES19940001925 19940901 |

**Also published as:**

- EP0700009 (A3)
- EP0700009 (B1)
- ES2108613 (A1)
- ES2108613 (B1)

**Cited documents:**

- FR2533049 (A1)
- FR2647930 (A1)
- US5046007 (A)
- BE1000765 (A6)
- WO9002388 (A1)


Abstract of **EP 0700009 (A2)**

The vehicle carries an electronic data processor linked to a speedometer, accelerometer, internal clock and calendar for checking and recording types of traffic hazard, duration of journey and other data related to safety. It can receive electromagnetic signal from the roadside related e.g. to speed limits, icing conditions and traffic jams, and can exchange data by wireless communication with a service station.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 700 009 A2

(12) **EUROPÄISCHE PATENTANMELDUNG**

(43) Veröffentlichungstag:
**06.03.1996 Patentblatt 1996/10**

(51) Int Cl.$^{6}$: **G06F 17/60**

(21) Anmeldenummer: **95500123.5**

(22) Anmeldetag: **28.08.1995**

(84) Benannte Vertragsstaaten:
**DE FR GB IT**

(30) Priorität: **01.09.1994 ES 9401925**

(71) Anmelder: **Minguijon Perez, Salvador**
**E-50005 Zaragoza (ES)**

(72) Erfinder: **Minguijon Perez, Salvador**
**E-50005 Zaragoza (ES)**

(54) **Individuelle-Bewertungssystem für das Risiko an selbstangetrieben Fahrzeuge**

(57) Unter die Indivieduelle-Bewertungssystem für das Risiko an selbsangetrieben-Fahrzeuge stellt sich ein Handlungsweise und elektronisches-Einrichtung vor, die die persönliches Versicherungsprämie in Funktion des ubernehmendes wirkliches Risiko-Schätzung erlaubt, in Basis nach die bestehende Wechselbeziehungen berechnet zwischen dieses und messbar Parameter im eigenen Fahrzeug.

Man stell ein strategisches-Betriebs Einfürhrung-Profil vor.

EP 0 700 009 A2

Printed by Jouve (FR), 18, rue Saint-Denis, 75001 PARIS

**Beschreibung**

TECHNISCHES-SEKTOR

Diese Patent-Zweck-System passt im elektronische Tecnologie, Informatik, Datenaustausch an und beschreibt ein neues alternatives oder ergänzendes-Prozess für den Versicherunsbeitrag der Fahrzeug-Versicherungs-Firmen, sowie der Ausrüstung um diese durchfüren zu können.

TECHNISCHE-STAND

In die letzten Jahre haben sich bei der Automobil-Sektor mehrmalige und verschiedenen Computer-Verwendungen vorgeschlagen, als Beispielweise Regulierungs-und Verkehrs-Führung Systeme, selbstaktivierende Fahrbahnmarkierungen, Nachunfälle Registriergeräte (scharze-Kasten) selbs-Befund-Anlagen oder vorbeugende Instandhaltung usw.

In Wirklichkeit, kommen diese Projekte trotz dieser Verwendungs-Nutzbarkeit, mit sehr wichtigen Grenzen-Implantations an. Einerseits, einigen diese Verwendungen brauchen höheres Strukturierungen-Kosten um das Produkt fur den Benutzer reizvoll zu machen, und andererseits gibt es Verwendungen die die Investitionen in der minimun-notwendige-Ausrüstung nicht nachweisen können, um diese in der Mittelkasse Fahrzeuge montieren zu können.

Um diese Grenze zu beseitigen zeigt das Projetkt eine geschäftliches annehmbare Möglichkeit mit ein erheblicheleistungfahiger Computer in der automobil anzurichten, mit eine Daten-Netzanschluss vorgeschaltet, die eine Basis für diese und zukunftigen Dienst eine bedächtige Durchdringungen einsetzen sollte.

Um dieses Ziel zur erreichen, sollten man ein Produkt suchen die als Bespannung auftreten konnte, um der fehlerhafte-Kreis gebildet durch die notwendige Infrastruktur und der reizvolles Produkt abbrechen zu können.

Andererseits befinden wir uns mit ein Automobil-Service-Sektor, so wie die Versicherungs-Firmen sind, die bei einen malgelhafte Markt wegen irhe schwere Segmentierung bewegen, aus diesen Grund haben sie mit ihren Kunden schwere Beziehungen.

Diese Unterlagen entwickelt die industrielle- und unternehmerisch Möglichkeit Fahrzeuge mit einen Risiko elektroniches Angabegerät auszurüsten, die kurzfristig bei ihre 2-wichtigen Kunden (Automobilbesitzer und Versicherungfirma) gut ankommmen würden, so dass kurzlang-fristig andere zusatzliche Funktionen übernehmen würden.

ERKLÄRUNG

Diese Ausrüstung besteht aus ein elektronisches Datenverarbeiter, mit der Fähigkeiten Daten zu bechaffen, insbesondere von Automobil-Arbeitsweise und Strassenmarkierung, um das Risiko der Fahr-Typ die man durchführt zu bewerten, so dass einerseits mit der Benutzer durch indikationen ausübt um der Gefahr zu vermindern und andererseits zeitweise Zutritt zur Daten-Zugang um Ubertragung des Risiko-Information damit der Versicherunsbeitrag berechnet werden kann, und dabei das Programm erneut aktualisiert werden kann.

Die erhaltenen Automobil-signale konnten eine grosse Variation zeigen je nachdemm wie dieses Risiko-Genauigkeit bewerten möchtet, als Bassis variente könnte es bei enen Geschwindigkeitsensor und ein Beschleuinigungmesser-Einheit liegen, die zusammen mit den internes Uhr und Kalender der Prozessors den durchgeführte Fahrt-Risiko-Art, Strekendauer und Erfüllungszeit prüfen und aufnehmen könnte.

Zusätzlich wäre möglich, Daten wie bei den Sicherheitsgurt, Reifendruck, Sicherheitabstand, usw. einzutragen.

Die Zwischen-Verbindung mit die Strasse könnte es sich mit ein kleines elektromagnetisches Empfangsgeräte in der Automobil durchführen, so dass Passivsignale auf Laufflâche-Strassen empfangen könnte, z.B. feste Gechwindindigkeitgrenzen, Bauarbeiten-Zeichen usw. oder selbstaktiv.signale wie Eissignale, Verkehrs-Stauung. Der prozessor könnte selbstverständlich die zusammenhängenden zwischen diese Zeichen und die durchgeführte Überführung überwachen. Man muss hier bemerken, dass diese aktive Zeichen ein Minimun verbraucht-Energie brauchen, und so mit die aktuelle Zeichen-Problem beseitigen würde, die eigentlich das grösste Kostenproblem der Elektrikanschluss ist.

Die Informationaustausch mit die Daten-Netz würde sich bei die Servicestation über eine Kabellos-anschluss durchfüren. Die Information die bereits nach festgelegten Angaben der Versicherungsfirma bearbaitet wurden ermitteln die Einschätzungsgefahr für ein gewissene Zeit dauer, dadurch würde der Versicherungsbeitrag berechnet und auch statistischen-Daten Beschaffung um dem Risiko-Bewertunggssystem zu verbessert. Anderseits würde man die neue Gefahr Bewertungs-Programm-Revision erhalten, die den Prozessor ihre Verbesserung ermöglichen kann.

Der Ausrüstung wäre in der Lage, Informationübermittlung an der Fahrer um Risiko zu vermindern und Massnahme zu ergreifen wie zum beispiel Hochgeschwindigkeit, nötige Fahrpausen usw. Der Ausrüstung könnte ausserdem den Benutzer die Identifikations, sogar ein Alkohol-oder Reflex-Test verlangen.

Die vorausgesehene Datenaustausch-Verbindung könnte auch für Eingans-Daten der Instandhaltung durch speziallisierte Werkstätte benutzen, so dass der Prozessor auch der Sicherheitssystem-Stand bewerten könnte und Instandhaltung-wirkungen zu empfehlen.

ART WIE DIE ERFINDUNG VERWENDUNGS-EMPFÄNGLICH IST

So wie beim "Technische Stand" geklärt ist, gibtns beim Automobil viele Projekte über Computer-und Kommunikation-Anlage verbindungen, die trotz seine durchführbar fachtechnisch, eine überschreitbar-Grenze beim Mark-Eindringung-option erreichen zu können die eine gewiessene Rentabilität gewährleistet.

Die Vorstellungssystem bei diesen Bericht hat die Besonderheit in zwei verschiedenen Aktivitäten zu trennen und diese über Firmen die schon eine bestimmte Infrastruktur beim Mark haben, auszunützen. Dass heisst, dass eine Servicefirma für datenverarbeitung zuständig ist und eine elektroniche-Automobil Firma die physikalischen-Anlagen betreut.

**Patentansprüche**

**1**-HANDLUNGSWEISE FÜR DIE EINZEL BEWERTUNG DES RISIKO BEIM SELBSTFAHRENDE-AUTOMOBILE, dessen letzte Zweck ist, dass die Automobil Versicherungs-Firmen den Beitrag nach den einzel Gefahr seinen Kunden einpassen, und zu diesem Zweck wird das Automobil mit einem Anschaffungssystem und Information-Vorbehandlung ausgestattet, und die Daten vom der eigene Automobil und ihre Umgebung aufnihmt. Diese Information ist gesammelt und bewertet nach den Risikofaktor und danach wird die Versicherung bei trage erstellt

1.1 HANDLUNGSWEISE FÜR DIE EINZEL BEWERTUNG DES RISIKO BEIM SELBSTFAHRENDE-AUTOMOBILE gemäss vorige Ansprüche, gekenntgezeichnet weil die verfolgte Information von eigen-Automobil stammt; zum beispiel Auswanderungsstrecke, der Betreibsablauf-Zeit der Automobil, Information über dir Fahrstrecke-Geschwindigkeit, Fahrstrecke dauer, benutztes Automobil-platzes, Automobil gesamt Gewicht, Sicherheits-Gurtel Benutzung, Information über die Beschleunigung in irgendwelche erleidende 3-Dimensionen während der Benutzung und Automobil, wirksame Sicherheits System-Zustand.

1.2 HANDLUNGSWEISE FÜR DIE EINZEL BEWERTUNG DES RISIKO BEIM SELBSTFAHRENDE-AUTOMOBILE gemäss vorigen Ansprüche, gekenntgezeichnet weil sie Einrictungen besitzen die man erlaubt mit der Fahrer in beide Richtungen verständigen zu können, so dass einerseis über den Risikogründen die sie verwirken, informiert, beispielweise ungeeignete Geschwindigkeit, zu viel Pausenlos-Strecke, irgendeine Sicherheitssystem Fehler oder überprüfungs-notwendigkeit usw. und andererseits, Information über den Fahrer zu bekommen als beispielweise Identifikation, Reflexen-Probe, Alkoholprobe usw. So dass der System bezüglich Fahr-Sicherheit, ein wichtiges Rolles spielt.

1.3 HANDLUNGSWEISE FÜR DIE EINZEL BEWERTUNG DES RISIKO BEIM SELBSTFAHRENDE-AUTOMOBILE gemäss vorigen Ansprüche, gekenntgezeichnet weil Verbindungs-möglichkeiten mit Automobil Wartungs-Werkstätten verfügt, so dass bei ihre Kalkulations-Routine die Korrelatives oder Präventive Instandhaltungs-Aktivitäten berücksichtig werden.

1.4 HANDLUNGSWEISE FÜR DIE EINZEL BEWERTUNG DES RISIKO BEIM SELBSTFAHRENDE-AUTOMOBILE gemäss vorigen Ansprüche, gekenntgezeichnet wegen die Datennetz Benutzung, so dass die installierte Geräte am Automobil Daten sammeln und bewerten, die zum Datensammler übertragen werden in Tankstellen undurchsichtlich für de Benutzer und ausserden kann man in dieser Moment die Programation der Geräte aktualisieren. Die Datensammler werden regelmässig mit ein zentral Ausrüstung schalten und diese wird die erhaltene Information verarbeiten und zu Verfügung der Versicherungsfirmen gestell. Andererseits, mit die erhaltene Daten werden die Gefahrbeziehungen ständig überprüfen und die Programe aktuallisiert.

1.5 HANDLUNGSWEISE FÜR DIE EINZEL BEWERTUNG DES RISIKO BEIM SELBSTFAHRENDE-AUTOMOBILE gemäss vorigen Ansprüche, gekenntgezeichnet, weil elektromagnetisches-Verbindungsmöglichkeiten , damit passive oder aktive Signalisierung auf der Strasse erfass werden kann, so dass bei seinen Risikoschätzung-Routinen die Fahrangemessenheit diese Signalisierung in Betracht beachten.

**2.** ELEKTRONISCHES-AUSRÜSTUNG FÜR DIE INDIVIDUELLE BEWERTUNG DES RISIKO BEIM SEBBSFAHRENDE-AUTOMOBILE dessen letzte Zeweck ist die Anschaffung, Behandlung, Sammlung und Informations-Prozesse über wer?, wann?, wie? und in welche Umstände die Motorfahrzeug benutzen werden, derart dass von ausreichende Daten verfügt um das Versicherungsbeitrag auf den tatsächliches Verwendunganzuwenden zur ermöglichen. Er ist über eine Informations-Netz errichtet worden die die Informationaustausch zwischen ein Zentral-System und die erwebene-und vorbehandelte Informations-Fahrzeug-Anschlüsse erlaubt.

2.1 ELEKTRONISCHES-AUSRÜSTUNG FÜR DIE INDIVIDUELLE BEWERTUNG DES RISIKO BEIM SEBBSFAHRENDE-AUTOMO-

BILE gemäss vorige Ansprüge, gekenntgezeichnet weil jeder selbstfahrende-Fahrzeug ein Anschaffungs-Ausrustung und Informations-Vorbehandlung verfügt, durch en Mikro-Datenverarbeiter errichtet um die angerichteten Schätzung-Routinen mit folgende peripherer Elementen durchzuführen; Display, Tastatur und akustische Warnung für ihre Wechselwirkung mit den Fahrer, Kabellose-Schaltungen für Strassen Vervindungen mit aktive oder pasive-Signalisierung und mit die Instandhaltung-Ausrüstung und Daten-Banken-System, Ausrüstung die Beschaffung von Binär-Digitals oder Analoge-Daten die direkt oder indirekte-Verbindung um das Automobil-Sicherheit zu beschaffen, sebstätig Spannungsquelle und zuletzt, die Ausrüstung Sicherheitssystem-Verwendung und diese nur mit der zuständiger Personal manipulieren zu können.

2.2 ELEKTRONISCHES-AUSRÜSTUNG FÜR DIE INDIVIDUELLE BEWERTUNG DES RISIKO BEIM SEBBSFAHRENDE-AUTOMOBILE gemäss vorigen Ansprüche, gekenngezeichnet weil die sammeln und Aktualisierungs-Daten durch ein Einsammeln-Daten Ausrüstung durchgeführt wird, dessen grundlegende Struktur aus ein Computer mit anschluss möglichkeiten an beweglichen Ausrüstungen, und Modem-Verbindung zur einen Datennetz für Informations-Austausch mit der Zentral Ausrüstung.

2.3 ELEKTRONISCHES-AUSRÜSTUNG FÜR DIE INDIVIDUELLE BEWERTUNG DES RISIKO BEIM SEBBSFAHRENDE-AUTOMOBILE gemäss vorigen Ansprüche, gekenngezeichnet weil das Netz gebildet aus Mobil-Ausrüstung, Daten-Sammlug-Ausrüstung und Zentral-Computer ist so ausgestattet, dass in beiden Richtungen arbeiten kann, so das dass System andere Funktionen aufnehmen könnte, so wie Unterstützung für Instandhaltung des Fahrzeuges, oder Daten Bearbeitung für die Fahrzeugsherteller, Kreditzahlung, automatiche Identifizierung des Fahrzeugs, Fernsteuerung, übermitteln Topographischen-Informationen, Touristik usw.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 935 208 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.08.1999 Bulletin 1999/32

(51) Int. Cl.[6]: G06F 17/60

(21) Application number: 98305539.3

(22) Date of filing: 10.07.1998

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 11.07.1997 US 897060

(71) Applicants:
- Cahall, Peter S.
  Longwood, Florida 32779 (US)
- Campisi, James M.
  Sanford, Florida 32771 (US)

(72) Inventors:
- Cahall, Peter S.
  Longwood, Florida 32779 (US)
- Campisi, James M.
  Sanford, Florida 32771 (US)
- Resnick, Larry
  Winter Park, Florida 32792 (US)
- Greene, Jr., Lowell H.
  Heathrow, Florida 32746 (US)
- McGrew, Charles R.
  Longwood, Florida 32779 (US)
- Branscomb, John D.
  Lilburn, Georgia 30247 (US)
- Millwood, Timothy S.
  Alpharetta, Georgia 30201 (US)
- Eisenberg, Steven A.
  Atlanta, Georgia 30327 (US)

(74) Representative:
Brandon, Paul Laurence
APPLEYARD LEES,
15 Clare Road
Halifax, West Yorkshire HX1 2HY (GB)

# (54) Integrated insurance system and system method

(57) A computerised integrated insurance financing system. Specifically, the computerised insurance system is capable of handling an insurance transaction from the development of an appropriate insurance contract with the client through the management of the client's insurance information during the life of the contract. Initially, census data is received from a potential client in the form of computer records representing a plurality of individuals to be insured. After being reviewed and standardised, the census data is used to perform a pecuniary loss analysis The data from the pecuniary loss analysis is used to generate insurance illustrations and a financial analysis for the client. Once an appropriate insurance contract is finalised, the system generates the insurance contract, and related documentation, and the census data is used to manage the client's insurance information during the life of the contract.

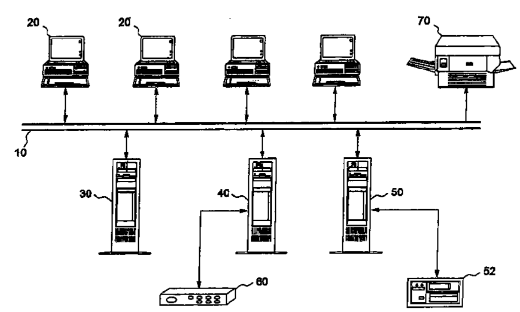


Fig. 1

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Printed by Xerox (UK) Business Services
2.16.7/3.6

## Description

**[0001]** The invention relates to a computer network and to a computerised integrated insurance financing system. More particularly, the computerised insurance system is capable of handling an insurance transaction from the development of an appropriate insurance contract with a client through the management of the client's insurance information during the life of the contract.

**[0002]** As used herein "client" includes an offshore captive corporation or trust which is a purchaser or potential purchaser of life insurance for the purpose of funding or financing benefit liabilities in favour of its parent corporation or grantor. Initially, census data is received from a client in the form of computer records representing a plurality of individuals to be insured. After being reviewed and standardised by the computer system, the census data is used to perform a pecuniary loss analysis. Asset requirements are measured based upon insurance liabilities and/or employee benefit liabilities. The data from the pecuniary loss analysis and the asset measurements are then analyzed by the computer system in order to generate life insurance coverage amounts consistent with applicable insurable interest laws, insurance liabilities and/or employee benefit liabilities. Insurance illustrations and a detailed financial analysis are provided for the client. Once an appropriate life insurance contract is finalised, the system generates the life insurance contract and related documentation. All of the data previously generated is used to automatically manage by the computer system the client's insurance information during the life of the contract.

**[0003]** The present invention is also directed to the computerised design, sale and management of life insurance plans for offshore captive insurance companies located outside of the United States and offshore trusts located outside of the United States except Voluntary Employee Beneficiary Associations (VEBA's) in which the client or trust insures a large number of individuals, such as employees, under a single group contract or several individual contracts. Such an insurance contract might be used to finance insurance liabilities, employee death benefits, worker's compensation benefits, health insurance benefits, disability income benefits and non-qualified retirement benefits. Such an insurance plan can provide tax benefits to a client if the contract qualifies as insurance under applicable laws.

**[0004]** Two possible uses for such a computerised integrated insurance system are 1) the automated design, sale and management of offshore captive insurance programs and 2) the automated design, sale and management of offshore trusteed insurance programs. A captive insurance company or a company sponsored trust, can accept contributions from a parent company to insure employees of related entities for the purpose of financing various insurance liabilities and employee benefit liabilities.

**[0005]** With use by a captive, the captive insurance company pays premiums to an offshore life insurance company. The computer system determines the amount of available insurance coverage under applicable insurable interest laws, measures captive insurance company assets needed to satisfy insurance liabilities and determines the amount of assets which may be efficiently deployed in insurance contracts to improve after-tax investment yields, minimise investment risk, satisfy future liquidity requirements and shift insurance risk from the captive insurance company to an offshore insurance company.

**[0006]** With use by a client sponsored offshore trust (except a VEBA) the trust pays premiums to an offshore life insurance company. The computer system determines the amount of insurance coverage available under applicable insurable interest laws, determines the amount of employee benefit liabilities and measures the amount of assets required to finance those liabilities. The computer system then illustrates information on how to efficiently deploy those assets in life insurance contracts to improve after-tax investment yields, minimise investment risk, satisfy future liquidity requirements and shift insurance risk from the trust to an offshore insurance company.

**[0007]** Known computerised insurance systems are unable to handle an insurance transaction from the complete development of an appropriate insurance plan through the management of the client's insurance information during the life of the contract. This is particularly true with respect to companies which have complex insurance liabilities and/or complex employee benefit liabilities and insure a large number of individuals in a single transaction. In general, known insurance systems are quite limited in that they do not encompass most or all functions required to perform a complete computerised integrated process which encompasses development, analysis, production and management of an insurance contract. Thus, known insurance systems are fragmented and utilise separate pecuniary loss analyzers, illustrators, insurance liability measurement systems, benefit liability estimation systems, asset measurement systems and client insurance information management programs.

**[0008]** Because presently known insurance systems handle an insurance transaction in a fragmented manner, they lack the cohesiveness, flexibility and economies of scale that a computerised integrated insurance system would provide If the insurance transaction were integrated and streamlined, the reduced cost could be passed along to the client. Increased profits on the sale of such insurance are also possible.

**[0009]** Moreover, since data generated by one known insurance system must be transferred from system to system during the transaction, many of which are not compatible, it takes significantly longer to complete than if the entire process were integrated in a single computer system. Given the length of time required to perform pecuniary loss analysis, financial analyses, measure insurance and liabilities employee benefit liabilities, determine asset requirements, and generate financial computer-based illustrations, only a small number of scenarios are generally created for a company whether by a computer or manually. Further, the ease with which interdependent computer calculations can be made is lacking. An integrated computerised insurance transaction, on the other hand, enables a large number of different insurance scenarios to be easily generated for a prospective client based on that client's individual needs in a timely and cost efficient manner. The financial implications of the various plans can also be quickly shown to the client on a cost efficient basis. Moreover, the plans can be rapidly modified based on feedback from the client. This greater flexibility allows optimum cost efficient insurance plans to be generated for the client.

**[0010]** It is thus apparent from the above that there exists a significant need in the art for a computer based integrated insurance system.

**[0011]** It is therefore an aim of preferred embodiments of this invention to provide an integrated computerised insurance system capable of handling transactions in which a plurality of individuals will be insured under a single group contract or several individual contracts.

**[0012]** It is another aim of preferred embodiments of this invention to provide an integrated computerised insurance system capable of handling an insurance transaction more quickly and efficiently, resulting in more precise measurements, than non-integrated insurance systems.

**[0013]** It is another aim of preferred embodiments of this invention to provide a computerised insurance system capable of inputting client census data, performing pecuniary loss analysis, measuring insurance liabilities, measuring employee benefit liabilities, determining asset requirements, performing a comprehensive financial analysis, generating the final insurance contract and managing the client's insurance information during the life of the contract.

**[0014]** Briefly described, the present invention provides a computer system which smoothly integrates these functions in an integrated computer architecture which is capable of designing and managing an insurance contract.

**[0015]** The present invention also provides a computerised method for implementing an integrated insurance system, comprising the steps of: (1) inputting client census data for a plurality of individuals in the form of computer records; (2) automatically performing a pecuniary loss analysis on the census data to classify individuals into cells and determine appropriate insurance coverage amounts under applicable laws; (3) automatically determining asset requirements based upon insurance liabilities and employee benefit liabilities; (4) performing a computerised financial analysis based upon captive insurance company asset requirements and/or trust asset requirements; (5) preparing computer-generated insurance illustrations based on the results of the pecuniary loss analysis, the measurements of assets and underlying insurance liabilities and employee benefit liabilities; (6) creating a final insurance contract and related documentation; and (7) managing through such computer system the client's insurance information and assets utilised to offset insurance and employee benefit liabilities during the life of the contract.

**[0016]** The present invention also provides an apparatus for implementing an integrated insurance system, comprising: (1) an inputting census data unit for a plurality of individuals in the form of computer records; (2) a pecuniary loss analyzer for the census data to classify individuals into cells and determine appropriate insurance coverage amounts under applicable laws; (3) an asset requirements unit to determine asset requirements based upon insurance liabilities and employee benefit liabilities; (4) a financial analysis unit to perform a financial analysis based upon captive insurance company asset requirements and/or trust asset requirements; (5) an illustrator for preparing insurance illustrations based on the results of the pecuniary loss analysis, the measurement of assets and underlying insurance liabilities and employee benefit liabilities; (6) a document generator for creating a final insurance contract and related documentation; and (7) a managing unit to manage the client's insurance information and assets utilised to offset insurance and employee benefit liabilities during the life of the contract.

**[0017]** The present invention provides the features set out in the appended claims.

Figure 1 is a block diagram of the hardware arrangement used in a preferred embodiment of the present invention.

Figure 2 is a block diagram of the functional components of a preferred embodiment of the present invention.

Figure 3 is a block data flow overview diagram according to a preferred embodiment of the present invention.

Figures 4A to 4C are block flow diagrams showing the integrated insurance system according to a preferred embodiment of the present invention.

Figures 5A to 5H are block flow diagrams showing the census data analysis process according to a preferred embodiment of the present invention.

Figure 5I is a sample menu displayed during the census data analysis according to a preferred embodiment of the present invention.

Figures 6A to 6J are block flow diagrams showing the pecuniary loss analysis process according to a preferred embodiment of the present invention.

Figures 7A to 7D are block flow diagrams showing the insurance illustration process according to a preferred embodiment of the present invention.

Figures 8A and 8B are block flow diagrams showing the financial analysis process according to a preferred embodiment of the present invention.

Figures 9A to 9E are block flow diagrams showing the client information management process according to a preferred embodiment of the present invention.

**[0018]** Referring now in detail to the drawings wherein like parts are designated by like reference numerals throughout, there is illustrated in Figure 1 a diagram of the hardware arrangement used in a preferred embodiment of the present invention. An Ethernet backbone 10 connects a number of workstations 20, servers 30, 40, 50 and printer 70. The workstations 20 can be IBM PC compatible machines, running Microsoft MS-DOS and Windows 3.1.1, or Microsoft Windows NT, versions 3.51 and higher. The workstations 20 require the following hardware components: 16MB of RAM, a 500MB hard drive, and a colour VGA video display. It should be noted, however, that other components can be used.

**[0019]** The database server 30, the file server 40 and the backup server 50 can be Intel Pentium based IBM PCs running Novell Netware versions 3.11 or higher, or Microsoft Windows NT Server version 3.51 or higher. Each server 30, 40, 50 requires the following minimums: 64MB RAM and a hard drive.

**[0020]** The database server 30 accepts queries from workstations 20 and returns data sets from a centralised database. The database server 30 also provides data warehousing, backup and data fault tolerance.

**[0021]** The file server 40 performs file and print sharing services and authenticates internal login requests. The file server 40 can also handle external data flow via modems 60.

**[0022]** The backup server 50 provides fault tolerance through continuous on-line backup to tape, and can double as the file server 40 or the database server 30 in the event either server fails.

**[0023]** It will be understood by those skilled in the art that this hardware embodiment is only one of many ways that can be used to implement the integrated insurance system. Although multiple server and workstation processors are shown, their functions could be handled by a single computer if multi-user access is not required. Alternately, instead of the Ethernet backbone 10 the various processors could be connected through other local area network (LAN) topologies such as Token-Ring, wide area networks (WAN), switched telephone networks, such as a public or packet switched network environment such as the Internet. Internet connectivity enhances the system to provide World Wide Web access to databases, and the transmission and reception of e-mail Messaging to automate client reporting, and claim notification from remote sites. For example, census data or claim information could be received from a remote site through the Internet.

**[0024]** Figure 2 is an overview diagram of the functional components of a preferred embodiment of the present invention. The census analyzer 500 receives raw census data from the client. As explained in detail with respect to Figures 5A to 5I, the census analyzer can (1) review input census data representing a plurality of people to be insured; (2) provide a subset of data to a third party for validation; (3) compare present census data with past census data from the same client; and (4) convert the census data into a standardized format.

**[0025]** After the census data has been standardized by the census analyzer 500, the pecuniary loss analyzer 600 processes the data based on input control parameters. As explained in detail with respect of Figures 6A to 6J, the pecuniary loss analyzer 600 calculates the insurable interest that a potential client has in each individual in the census. The pecuniary loss analyzer 600 categorises each individual to be insured and places them in a representative "cell".

**[0026]** These cells of data are used by the illustrator 700. As explained in detail with respect of Figures 7A to 7D, the illustrator 700 adjusts the data in the cells and generates insurance ledgers for presentation to a potential client. The financial analyzer 800 also generates reports regarding the potential client, as explained in detail with respect to Figures 8A and 8B. Next, the final contract generator 100 creates the final contract and related documentation. Finally, the insurance plan is administered by the client insurance information manager 900 as explained in detail with respect to Figures 9A to 9E.

**[0027]** Figure 3 is a data flow overview diagram of a preferred embodiment of the present invention. Data is received from a potential client by the census analyzer 500 in the form of input census data 90. The census analyser 500 can also access prior census data 91 from the same client. The input census data 90 and prior census data 91 can be compared to generate census comparison reports. The census analyzer also converts the input census data 90 into a standardised format, as represented by standardised census data 92.

**[0028]** The standardised census data 92 is used by the pecuniary loss analyzer 600, along with operator input control parameters, to classify individuals into representative cells 80. The cells 80 are adjusted by the illustrator 700 and are used by the financial analyzer 800 to create reports based on operator input control parameters. When an appropriate contract is approved, the final census data 95 is created. The final census data 95 is used by the client insurance information manager 900 to administer the insurance plan. The administration of the plan includes the generation of death benefit paper work, claim status results and financial reports to client.

Process Overview

**[0029]** Figures 4A to 4C are block flow diagrams showing an overview of the process of the integrated insurance system according to a preferred embodiment of the invention.

**[0030]** As shown in Figure 4A, census data is received from a potential client (step 400) and reviewed (step 402). This process is described in greater detail with respect of Figures 5A to 5I. The data is then input to the pecuniary loss module (step 404).

**[0031]** A pecuniary loss analysis is conducted on an aggregate and an individual basis (step 405). This process is described in greater detail with respect to Figures 6A to 6J. The results of the pecuniary loss analysis are reviewed and analyzed by the client (step 406). If the results are not satisfactory, the assumptions used during the pecuniary loss analysis can be revised and the pecuniary loss analysis can be repeated (steps 408 and 410).

**[0032]** If the results of the pecuniary loss analysis are satisfactory, life insurance projections, or illustration ledgers, are produced (step 412) and a financial analysis is performed as shown in Figure b (step 414). These processes are described in greater detail with respect to Figures 7A to 7D and 8A and 8B. The results of the insurance illustration and financial analysis can then be reviewed (step 416). If the results are not satisfactory, the assumptions used during the insurance illustration and financial analysis can be revised and these functions can be repeated (steps 418 and 420).

**[0033]** When the result of all of the above steps is optimized, the client decides whether or not insurance will be purchased. If insurance is not purchased, that is the end of the transaction (steps 422 and 424). If insurance is purchased, the case is underwritten and issued and the system generates the final insurance contract and related documentation (step 428).

**[0034]** Once the contract is in effect, the system can administer the insurance plan. This process is described in greater detail with respect to Figures 9A to 9E. The plan's administration includes processing death benefit claims as shown in Figure 4C (step 430). The system can also update monthly asset values and monitor the value of funds in the plan (step 432). Financial reports for the insurance company are generated and all relevant data is stored (steps 436 and 438). Finally, the system can prepare an annual plan review, showing historical financial performance and re-projecting future performance based on updated assumptions, to be presented to client (steps 440 and 442).

Census Data Analysis

**[0035]** The insurance transaction begins when raw census data is received from the client. The census data contains a plurality of computer records representing the individuals to be insured. Such a computer record might contain the individual's name, social security number, sex, date of birth and salary. The received census data is reviewed for completeness and standardized. Newly received census data can be compared to census data previously received from the same client to determine which individuals have been added or deleted. The system also generates a computer file that can by used by a third party to verify that the social security numbers are valid. Figures 5A to 5H are block flow diagrams showing this census data analysis process.

**[0036]** As shown in Figure 5A, the user is first presented with a menu listing the census data analysis choices (step 510). Such a menu is shown in Figure 5I. The menu includes an option to return to the higher level menu (step 512), select a help screen (step 514), save the parameters currently entered (step 516) or load a set of parameters that were previously stored (step 518).

**[0037]** The user can also select to perform a census data analysis (step 520). First, parameters are converted to usable alpha or numeric formats (step 521). These values are then verified to determine, for example, that the date of birth is valid, (step 522) and tested for overlap of specified fields on output files (step 523). Next, the disk files are opened (step 524) and the system is ready to perform the process shown in Figure 5B.

**[0038]** The processes shown in Figures 5B to 5G compare the input client census data, or the Update File, with previously received client census data, or the Master File. The Update File represents the input census data 90 and the Master File represents the prior census data 91 shown in Figure 3. The comparison generates three output files: (1) a list of individuals in both the input and the previously received census data called the Match File; (2) a list of individuals added to the census called the Unmatched date File; and (3) a list of individuals deleted from the census called the Unmatched Master File. It is important to note that both the Master and Update Files are sorted by their social security number or any other unique identifier "Key" to simplify the comparison.

**[0039]** As shown in Figure 5B if both the end of the Master File (End=Y) and the end of the Update File (End=Y) have been reached,the comparison is finished and the process shown in Figure 5H is executed (step 525). If End=Y, End=N and the end of the Update File has been reached, SEPTATE is set to infinite and the process shown in Figure 5C is executed (steps 527 and 528). If End=N and the end of the Update File has been reached, the process shown in Figure 5C is executed. If both End and End are not Y, and it is not the end of the Update File (step 526), an update record is read and the update count is increased (steps 529 and 555).

**[0040]** The number of update records that have been read is displayed (step 556) and the social security number, or "key," is extracted and verified (step 557). The system checks for duplicate update records (step 558) and the process shown in c is executed.

**[0041]** As shown in Figure 5C, if both End=Y and End=Y, the comparison is finished and the process shown in Figure 5H is executed (step 548). If End=Y, End=N and the end of the Master File has been reached, SSMast is set to infinite and the process shown in Figure 5D is executed (steps 552 and 554). If End=N and the end of the Master File has been reached, the process shown in Figure 5D is executed. If both End and End are not Y, and the end of the Master File has not been reached (step 550), a master record is read and the master count is increased (step 559 and 560).

**[0042]** The number of master records that have been read is displayed (step 561) and the key is extracted and verified (step 562). The system then checks for duplicate master records (step 563) and the process shown in Figure 5D is executed.

**[0043]** As shown in Figure 5D, a social security number in the Master File is compared to a social security number in the Update File. If the social security number in the Master File, or SSMast, is less than the social security number in the Update File, or SEPTATE, a terminated employee has been detected and the process shown in Figure 5E is executed (step 564). If SSMast is greater then SEPTATE, a new participant is detected and the process shown in Figure 5F is executed (step 565).

**[0044]** If SSMast is equal to SEPTATE, (step 570) a match has been found. The matched count is therefore increased by one and a matched record is built from the Master and Update Files (steps 570 and 572). The matched record is written to the match file (step 574). If the end of the Master File has been reached, End is set to Y, SSMast is set to infinite (steps 576, 578 and 582). If the end of the Master File has not been reached and the End of the Update File has been reached, End is set to Y and SEPTATE is set to infinite (steps 580, 581 and 583). In any event, the process shown in Figure 5E is executed.

**[0045]** The process executed when a terminated participant has been discovered, that is a record has been found in the Master File that is not present in the Update File, is shown in Figure 5E. If End equals N, the unmatched master count is increased by one and, if desired, an unreported master record is built and written to the unreported master file (steps 584, 530, 531, 532 and 533).

**[0046]** If the end of the Master File is not detected, the process shown in Figure 5C is executed (step 534). If the end of the Master File is detected, End is set to Y, SSMast is set to infinite and the process shown in Figure 5F is executed (steps 535 and 536).

**[0047]** The process executed when a newly added participant has been discovered, that is a record has been found in the Update File that is not present in the Master File, is shown in Figure 5F. If End equals N, the unmatched master count is increased by one and, if desired, an unreported master record is built and written to the unreported Master File (steps 537, 538, 539, 540 and 541).

**[0048]** If the end of the Update File is not detected, the process shown in Figure 5G is executed (step 542). If the end of the Update Pile is detected, End is set to Y, SSUpdate is set to infinite, and the process shown in Figure 5G is executed (steps 543 and 544).

**[0049]** As shown in Figure 5G, if both the end of the Master File (End=Y) and the end of the Update File (End=Y) have been reached, the comparison is finished and the process shown in Figure 5H is executed (step 545). If End or End are N and the end of the Update File has been reached, the process shown in Figure 5D is executed (step 564). If End or End are N and the end of the Update File has not been reached, the next update record is read and the update count is increased by 1 (steps 547 and 585). The number of update records is displayed and the social security number or "key", is extracted and verified (steps 586 and 55). The system then checks for duplicate update records (step 551) and the process shown in Figure 5D is executed.

**[0050]** As shown in Figure 5H, at the end of the comparison, the data files are closed (step 587). A report is printed (step 588) listing the results in the form of (1) individuals in both the input and the previously received census data; (2) individuals added to the census called the Unmatched Update File; and (3) individuals deleted from the census called the Unmatched Master File.

**[0051]** Thus, as shown in Figures 5A to 5H, the census data analysis ("CDA") module can compare two distinct sequential ASCII files, each comprised of fixed records of employee information. The fields in each record of one file can differ in form and substance from the fields in each record of the other file in all but one respect. Records in both files must each contain one "key" field, the value of which is unique within the file, and which is used as an identifier for that particular record. In the preferred embodiment, the social security number is used for this purpose. Both files are first sorted in order of the key and the program scans through both files simultaneously looking for records from both files with matching keys. Matching records contain a combination of data which relate to a single employee. The program take selected fields from each record to create a composite output record.

**[0052]** One input file is designated as the Master file while the other is referred to as the Update fife. The program allows the user to specify the disk location of each input file and to specify the location of the fields in each record of that file. The user then describes the desired layout of as many as three separate output files created as a result of the matching process. The first of a file of matched records where fields from both Master and Update records are merged together and selected to create combined and updated output records. The next option is to create a file of unmatched Master records. The records on this file can be redesigned by the user from any of the fields on the Master File. Similarly, a file of unmatched Update records can be created.

[0053] Consider a Master File of policy issue information for all of the originally insured participants of a particular client. Several years after plan inception a current employee census is prepared. This Update file contains such items as current salary and state of residence. From the matched records, the CDA module is able to create a file of all current employees who were previously insured. This single file could contain both policy data as well as current salary and state of residence information for each insured active employee.

[0054] A file of records created or copied from the unmatched Master records could also be created. These would be records for people who were originally insured, but are not currently employed and are thus either terminated, retired or deceased. Finally, a file of information for potential new entrants to the plan could be created from the unmatched Update records of current employees.

[0055] The program allows the flexibility to simply reformat the layout of existing files and create output files with any combination of either matched or unmatched Master or Update records. It is also useful for simply tabulating the total numbers of matched or unmatched records without ever having to create any output files.

Pecuniary loss Analysis

[0056] The reviewed and standardized census data is then used to perform a pecuniary loss analysis. Figures 6A to 6J are block flow diagrams showing the pecuniary loss analysis process according to a preferred embodiment of the present invention. The analysis is based on a set of parameters controlled by the operator. For example, the operator might select projected rates of inflation over the life of the contract, the average amount of life insurance provided to employees based on their salary, the normal retirement age for employees, the maximum and minimum premiums the client wishes to pay per individual, and which state's (or country's) laws and regulations will be used in the analysis. As a result of the pecuniary loss analysis, each individual in the census is classified, or placed in a "cell", based on the insurable interest the client has in the individual. If the results of the pecuniary loss analysis are not acceptable to the client, the parameters can be modified and other pecuniary loss analysis can be performed.

[0057] As shown in Figures 6A, the user is first presented with a menu listing the pecuniary loss analysis choices (step 610). The menu includes an option to return to the higher level menu (step 612), select a help screen (step 614), to save the parameters currently entered (step 616) or to load parameters previously stored (step 618).

[0058] When the appropriate control parameters have been entered or loaded, the user can also select to perform the pecuniary loss analysis. Initially, parameters are converted to usable alpha or numeric formats (step 620).

[0059] A vector or stream of annual health cost trend rates is created (step 622). This process is described in detail in Figure 6G. The health cost trend rate is taken for each year and used to calculate a health cost (steps 670, 671 and 674.). The process is repeated until either the ultimate rate or the individual's retirement age has been reached (steps 672 and 673).

[0060] Referring back to Figure 6A, a vector of premium bands is created (step 623). This process is described in detail in Figure 6H. A maximum and minimum annual premium for each individual is selected for the client. For example, the client might wish to pay between $400 and $1,000 for each individual to be insured. A number of premium bands is also selected for the client. For example the client may wish to categorise individuals into three groups, or bands. The premium band size is then computed (steps 680 and 682). Using the above examples, three bands would be created: $400 to $600; $600 to $800 and $800 to $1,000. The bands are displayed (steps 681 and 683) are computed until the maximum premium is reached (step 684).

[0061] Returning to Figure 6A, the client's premium rates are loaded (step 624) and state workers' compensation benefit rates are computed as shown in Figure 6B (step 625).

[0062] As shown in Figure 6B, four brackets are set between the client's minimum and maximum premium values. The parameters for the states are verified and the standardized census data file is opened so that the data can be accessed (steps 627 and 628). A record representing an individual to be insured is read and the data is parsed into the appropriate fields (step 629). The individual's applicable state, such as New York or Virginia, and date of birth are then verified (steps 630 and. 631). If the date of birth is not valid, it is set to an unrealistic number, which forces the individual to be excluded form the insurance calculations.

[0063] As shown in Figure 6C, the field representing the sex of the individual is verified. If the value of this field is not valid, it is to set to "M" for male, as a default. The system then sets a flag if the applicable state for the individual is an "active health" state (step 633). That is, the flag is set if the state considers the health costs for the individual to be recoverable. The age is calculated based on the individual's date of birth (step 634). The age is considered invalid if the individual is under 20 or over 65 years of age.

[0064] If either (1) the age of the individual or (2) the state are not valid, nothing more can be done and the record for the next individual is read (step 635).

[0065] If the age and state are valid, the normal retirement age (NRA) for the individual is calculated, which determines when health premium payments will no longer represent an insurable interest (steps 636 and 637). After the normal retirement age is calculated, a determination is made: based upon user input, as to whether or not a non-qualified retirement income benefit liability (NQRIB) is present. If NQRIB is yes, then the NQRIB flag is set to "Y". The system then branches to the NQRIB module as shown in Figure 6J. Various parameters, some calculated, issue age, retirement age, some input, retirement payout period interest rates, plan type, are loaded (step 690). The system determines whether the NQRIB is a defined benefit (DB) or defined contribution (DC) plan (step 691).

**[0066]** In the case of a DB NQRIB, the benefit liability may be entered as flat amount or defined by formula (steps 692 , 694 and 697). If defined by formula, the expression evaluator will parse and load the benefit formula.

**[0067]** In the case of a DC NQRIB, the deferral amount may be entered as a vector of deferral amounts or defined by formula (steps 693, 696 and 697). If defined by formula, the expression evaluator will parse and load the deferral vector.

**[0068]** Once the benefit/deferral amounts are loaded, the retirement income liability (RIL) payout is calculated (step 698). The RIL is stored for later comparison to the CalcSumBen result as well as for use by the insurance illustration system, for targeting cash value and death benefit purposes.

**[0069]** Returning to Figure 6C, after calculating the age to stop health premium payments (step 637) the process shown in Figure 6D is executed. As shown in Figure 6D, the health care premium cost per year for the individual's state is calculated step 640). This is done for all the specified states until the final year of the insurance contract, or the final year that health insurance will be provided for the individual, is reached (step 642). The workers' compensation survivor's benefit is calculated based on the individual's salary (step 644). When the maximum benefits for all of the years have been determined, the sum of the individual's death benefit, health cost and workers' compensation is stored (step 645). When the sum of all the benefits is calculated, the system checks to see if the NQRIB flag is set to "Y". When the flag is yes the system will reset the sum of all benefits to the lesser of RIL or the current sum of all benefits.

**[0070]** This number represents the insurable interest the client has in the individual, not including life insurance. The process shown in Figure 6E is then executed.

**[0071]** Returning now to Figure 6E, the individual's premium bracket is increased (step 654) or decreased (656) based on the new benefit value and the face insurance value (steps 651, 652 and 653). The amount of life insurance based on the new premium bracket is re-calculated. These steps are repeated until an appropriate premium bracket is selected. When the appropriate premium bracket is selected, a final benefit value is calculated using the appropriate recovery amount and the value previously computed and stored in step 645 (step 657). The process shown in Figure 6F is then executed.

**[0072]** As shown in Figure 6F, if the total value of benefits is greater than the face amount (step 660), a valid record is established (step 661) and, after the appropriate counters are updated and the record is packed (step 662), the output record is written. If the total value of benefits is not greater than the face amount, the user can select whether or not the record should be saved (step 664). In either case, if the end of the standardized census file has not been reached, the record for the next individual is processed (step 665). If the end of the standardized census file has been reached, the pricing and state analysis file is saved and pecuniary analysis reports are printed (steps 666 and 667).

**[0073]** Thus, the pecuniary loss analysis combines information regarding several types of benefits, provided to each member of a group of individuals in the census, with the individual's data. This is used to determine the total of the client's insurable interest in each of the chosen individuals on a pecuniary loss basis. This pecuniary loss analysis may be subjected to situs constraints of the transaction and or the residence of the insured. As this is done, the module determines an amount of life insurance for each employee that would reimburse the employer for its insurable interest at the employee's death at a level no higher than the pecuniary loss. Generally, the amount of coverage is chosen as the amount provided by one of several fixed levels of premium, very similar to a defined contribution type approach. The program uses an iterative process to solve for the appropriate premium level. As an alternative, the system may be given an aggregate employer benefit liability and would then calculate the insurance levels and premiums per insured, a defined benefit approach.

**[0074]** Normally, the employer's estimated pecuniary loss is comprised of four components. First, the amount of the employer provided pre-retirement death benefit is determined. This is generally based upon a pay related formula including the application of a salary scale to anticipate future increases in the actual benefit. Next, the state of residence of each employee may be used to determine the specific workers' compensation survivor's benefit payable in that state. Assumptions are made as to each employee's dependent status at death. For employees residing in states (under the insured residence approach) with modern insurable interest statutes, a total of the trended employer provided health care cost is also included. Finally, an amount which represents the accumulated value of the actual life insurance premium payments (time value adjusted) made by the employer is added to the other items.

**[0075]** The module contains a great deal of flexibility in its ability to deal with specified groupings of employees and special benefits unique to individual clients. It also generates various reports and data files which are used to communicate the results of its analysis and to provide input to other software for specific pricing and plan performance analysis.

Insurance Illustration

**[0076]** The pecuniary loss analysis generates data in the form of representative "cells". These cells are used to create insurance illustrations, or ledgers, for the client. Figures 7A to 7D are block flow diagrams showing the insurance illustration process according to a preferred embodiment of the present invention. The ledgers are created based on another set of parameters controlled by the operator. These parameters might include the client's cash flow requirements and funding objectives. The illustration reviews, and if necessary revises, every cell for each year of the insurance contract. The review includes calculations to determine whether the contract is a modified endowment contract MEC) and comply with § 7702(b) of the Internal Revenue Code of 1986 as Amended ("Code"). As before, the input parameters can be modified, and another illustration can be created, if the results of the illustration are not acceptable.

**[0077]** As shown in Figure 7A, census data is created and verified (steps 710 and 712). A menu is used to set up input parameters from the census data (step 714) and a compensation level, or profit level, is set for the sale of the insurance plan (step 716). Product loads, such as break points, state premium taxes and deferred acquisition cost ("DAC") tax considerations are calculated (step 718) as are product cost of insurance ("COI") charges (step 720). Finally, a probability table representing mortality assumptions is either read from a prestored file or generated (step 722) and the cash value and/or asset deployment allocation is read or calculated.

**[0078]** As shown in Figure 7B, cash flow parameters, such as the size of assets to be invested and the dates that assets are to be deposited to, or removed from, the plan, are defined (step 724). The client's funding objectives are also defined at this point (step 726). For example, the client may wish to build the cash value of the plan to a predetermined value by a specific date.

**[0079]** A death benefit level is calculated based on the census data and the premium levels committed to by the client (step 728). Each cell is then analyzed and adjusted on a per year basis. The death benefit is increased based on the plan's qualification as a modified endowment contract ("MEC") (steps 730 and 732). This is because distributions from a MEC are taxed to the extent of any income in the contract and there can be an additional tax on the amount of any taxable income distributed from a MEC. Also, loans from a MEC are treated and taxed as distributions.

**[0080]** The death benefit is also increased based on compliance with Section 7702(f) (7) (b) of the Code steps 740 and 742). This is because section 7702 sets out certain requirements that a policy must satisfy in order to be considered "life insurance" for tax purposes. The process then determines how to handle distributions in excess of the basis (step 750). For example, it must be decided if loans on the plan will be allowed. Finally, the process shown in Figure 7C is executed.

**[0081]** As shown in Figure 7C, current values and values that will be guaranteed based on certain assumptions are calculated (steps 752 and 754). These values are often required by the Securities and Exchange Commission (SEC) or state insurance regulators. If the last year of the contract has not been reached, the next year is then analyzed (step 756). Optionally, the process can also determine whether the calculated values are within present target ranges (steps 758 and 760). The target ranges may also be loaded from the values stored as retirement income liability from the pecuniary loss analysis. If not, the target amounts can be updated and the analysis can be repeated (steps 764 and 766). If such targeting has not been selected, or if the values fall within the target ranges, the process of Figure 7D is executed (step 762).

Financial Analysis

**[0082]** Figures 8A and 8B are block flow diagrams showing the financial analysis process according to a preferred embodiment of the present invention. The purpose of the financial analysis process and financial analyzer device is to analyze the insurance purchase and its financial impact on the client. The financial analysis can be conducted with respect to offshore captive asset deployment, as well as a company sponsored trust that funds employee benefit liabilities. The analysis measures insurance cash value (assets), it's allocation among various investment strategies (short, intermediate & long term), pre-tax and net after tax financial impact at various discount rates and the underlying cost structure of the insurance contract. Additionally, the analysis allows for matching of current and future liquidity requirements with cash flows that the insurance contracts generate, in terms of death benefits, cash value withdrawals and loans. The analysis clearly demonstrates the advantage to deploying assets offshore, through a captive insurance company, or a company sponsored trust. The financial analysis calculates the amount of assets that may be effectively deployed in insurance to maximise investment yields, minimise investment risk, shift insurance risk and satisfy future liquidity requirements.

**[0083]** The system calculates approximately 150 different tabulated variables that include the areas of: insurance analysis, income statement, balance sheet, cash flow analysis, earnings analysis, insurance product loads and expenses, alternative use of funds analysis, net present value analysis, earnings per share, return on investment, internal rates of return and the ability to customise additional variables, on an ad-hoc basis, as the client may request. These variables are tabulated and may be selectively chosen to generate standard, as well as customised, reports to meet the client's needs.

**[0084]** Referring now to Figure 8A, the user is first presented with a menu listing the financial analysis choices (step 810). The menu includes an option to return to the higher level menu (step 812), select a help screen (step 814), to save the parameters currently entered (step 816) or to load parameters previously stored (step 818).

**[0085]** When the appropriate control parameters have been entered or loaded, the user can also select to perform the financial analysis (step 820). Initially, a 100 by 150 matrix is set up (step 822) and insurance illustration data is loaded (step 824). Corporate tax rates, discount rates and use of money rates can also be loaded (steps 826, 828, 830).

**[0086]** As shown in Figure 8B, a calculation methodology is selected and all of the financial analysis calculations are completed (steps 840, 850 and 860). After the calculations are complete, the report parameters can be loaded and the reports are generated (steps 870, 880, 890).

Client Information Management

**[0087]** Once an appropriate insurance contract is finalised, the system generates the insurance contract, and related documentation, and the census data is used to manage the client's insurance information during the life of the contract. Figures 9A to 9E are block flow diagrams showing the client information management process according to a preferred embodiment of the present invention. At this point, the census data is frozen and used to manage the client's insurance related information. Death benefit claims can be processed, an individual's insurance data can be edited and financial reports can be generated for the client. Because the insurance system is entirely integrated, all of these functions are automated.

**[0088]** System Administrators have access to insurance information for multiple clients and to housekeeping and databases directly. System Administrators are presented with a menu (step 906) that allows them to return to the main menu (step 909). This menu also lets the user: sweep a database as described with respect to Figure 98; perform data management; and perform finance and accounting functions.

**[0089]** As shown in Figure 9B, when the System Administrator elects to perform a sweep, an output file is created containing the social security number of the insured individuals which is then sent to a third party for validation (step 980). Sweep results are received from the third party, imported into the system and displayed (steps 981 and 982). Next, the data is reviewed and discrepancies are identified and flagged as described with respect of Figure 9C (step 970). Invalid social security numbers are resolved and, if necessary, death benefit claim are generated. The client is notified of any discrepancies (step 983) and an internal report is also generated containing the results of the sweep (step 984). When the sweep is completed, the system returns to the system administration menu (step 906 in Figure 9A).

**[0090]** Figure 9C illustrates the processing required to identify and flag discrepancies as discussed with respect to step 970 in Figure 9B. In particular, if an individual has a different last name, and is not a female having the same date of birth, the record is marked as containing a discrepancy (steps 971 and 972). If an individual has a different last name and is a female having the same date of birth, a marital status change is assumed and the record is not marked as containing a discrepancy (step 973).

**[0091]** Figure 9D shows the main menu displayed for the client information management system process. A portion of the screen will display a list of selected claims related to the insurance plan (step 920). The user is also presented with a menu listing the client information management system choices (step 910). The menu includes options to perform a claim search (step 950), generate reports (step 940), alter the status of an individual from deceased to living (steps 930 and 931), and edit an existing claim or create a new death benefit claims (step 920).

**[0092]** If the user selects the creation of a new death benefit claim, a new claim record is created (step 921) using the individual's census data and the client's insurance policy information (step 922). The remaining steps, shown in Figure 9E, are the same as those performed when the user selects to edit an existing claim from the main menu.

**[0093]** As shown in Figure 9E, financial transaction history information is retrieved (step 923) and the edit claim screen is displayed (step 960). The edit claim screen includes options to view general information about the claim, possibly to interface with other databases (steps 927 and 928), obtain a summary of claim financial transactions (step 926), view overall policy information (step 925). enter or edit insured data (step 924) and create death benefit claim paperwork.

**[0094]** If the user elects to create death benefit claim paperwork, the system will automatically generate a request for a death certificate (step 961). This includes a cover letter to the appropriate governmental records office, and the required fee, based on the zip code where the death occurred. After the death certificate is received (step 962), the information to process the claim is transmitted (step 963). Finally, once the insurance proceeds are received (step 964), the funds are distributed to the appropriate party through a wire transfer (step 965).

**[0095]** Thus, the client information management system ("CIMS") module is designed to automate the process of handling death claims, insured information, client billings, accounting servicing and overall plan administration. This is accomplished by providing a centralized database and interface that provides all necessary reporting and output to complete any of these functions.

**[0096]** The CIMS workstation application is an application which runs on all current versions of Microsoft Windows version 3.1 and higher. The main interface is a "desktop", by which a plan administrator, accountant, financial analyst or supervisor, can view the status of current claims in process, paid claims, policy, plan and insured information. Claims can be edited, inputting data as it is received, until the entire claim is processed. New claims can be identified to the system individually, or in a batch/sweep process, by matching the master insured list against databases of deceased individuals. The system allows a use to process a claim completely in a single sitting, or step by step, as each required step is completed. The system tracks the status of partially completed claims, displaying the status of each claim on the desktop, and if desired, prioritizing claim activity by status, time since notification, or by client. The system allows the user to identify critical steps in the process, such as ordering and receiving documentation, auditing and transferring payments. The CIMS application generates most of the paperwork involved in claims processing, and reporting on policy information. Death certificate orders, notification of pending and paid claims to clients and carriers, and cover letters and fax forms, can be generated to the laser printers on the network.

**[0097]** The CIMS application also handles the financial and accounting computations as well as policy data during the life of a policy. Premium payments, loans, withdrawals, cash values, interest calculations, and all transaction reversals, are all tracked by the system. All of these items are available for display, calculation and reporting at the carrier level, client level, policy level and insured level.

**[0098]** The overall system is built around a PC based Client/Server network architecture, utilising software and operating systems that will run on a variety of operating systems. The database server runs an SQL database engine, and contains all of the data tables required. It receives data requests in the form of queries from workstation clients and returns the necessary information. It also schedules database backups and provides fault protection through transaction processing, and by being supplied by uninterrupted and conditioned power.

**[0099]** The system also contains two other servers. A file server provides file and print sharing services, both for the CIMS application, and other office functions, such as word processing. The file server also handles login authentication to the Local Area Network (LAN). A backup server is in place to backup data on the file server, and archive copies of the SQL database, for disaster recovery. This server also provides fault tolerance by being able to stand in place of one of the other two servers, in the event of a hardware failure.

**[0100]** PC workstations access the CIMS data engine via the LAN, and run a client application of CIMS, which formulates the data queries sent to the SQL server, and provide output and reporting to the end users.

**[0101]** In preferred embodiments the invention comprises a system enabling faster processing within the hardware implementation.

**[0102]** Although preferred embodiments are specifically illustrated and described herein, it will be appreciated that modifications and variations of the present invention are covered by the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

**[0103]** The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

**[0104]** All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

**[0105]** Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

**[0106]** The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

## Claims

1. A computerised integrated insurance system method, comprising the steps of:

    inputting census data for a plurality of individuals in the form of computer records;
    performing a pecuniary loss analysis based on pecuniary loss parameters and said computer records to classify said individuals into representative cells;
    preparing insurance illustrations based on said representative cells;
    performing a financial analysis based on financial parameters and said representative cells;
    creating a final insurance contract and related documentation based on said representative cells; and

managing insurance information during the life of said contract based on said computer records.

2. A computerised integrated insurance system method, comprising the steps of:

inputting census data for a plurality of individuals in the form of computer records;
analysing said computer records; and
managing insurance information during the life of said contract based on said computer records.

3. A computerised integrated insurance system method according to claim 1 or claim 2, wherein said step of inputting census data further comprises the step of comparing said computer records to prior census data.

4. A computerised integrated insurance system method according to claim 2, wherein said step of analysing said computer records further comprises the step of performing a pecuniary loss analysis based on pecuniary loss parameters and said computer records to classify said individuals into representative cells.

5. A computerised integrated insurance system method according to claim 1 or claim 4, wherein said step of performing a pecuniary loss analysis can be repeated using modified pecuniary loss parameters.

6. A computerised integrated insurance system method according to any one of claims 1, 4 or 5, wherein said step of performing a pecuniary loss analysis calculates an insurable interest for each of said individuals in said input census data.

7. A computerised integrated insurance system method according to claim 4, wherein said step of analysing said computer records further comprises the step of preparing insurance illustrations based on said representative cells.

8. A computerised integrated insurance system method according to claim 7, wherein said step of preparing insurance illustrations includes adjusting said representative cells based on compliance with insurance laws and regulations.

9. A computerised integrated insurance system method according to claim 7 or claim 8, wherein said step of analysing said computer records further comprises the step of performing a financial analysis based on financial parameters and said representative cells.

10. A computerised integrated insurance system method according to claim 9, wherein said step of performing a financial analysis can be repeated using modified financial parameters.

11. A computerised integrated insurance system method according to claim 9 or claim 10, further comprising the step of creating a final insurance contract and related documentation based on said representative cells.

12. A computerised integrated insurance system, comprising:

a census analyzer (500) to input census data for a plurality of individuals in the form of computer records;
a pecuniary loss analyzer (600) to perform a pecuniary loss analysis based on pecuniary loss parameters and said computer records and classify said individuals into representative cells;
an illustrator (700) to prepare insurance illustrations based on said representative cells;
a financial analyzer (800) to perform a financial analysis based on financial parameters and said representative cells;
a final contract generator (100) to create a final insurance contract and related documentation based on said representative cells; and
an insurance information manager (900) to manage insurance information during the life of said contract based on said computer records.

13. A computerised integrated insurance system, comprising:

a census analyser (500) to input census data for a plurality of individuals in the form of computer records;
an analyzer (600) to analyze said computer records; and an insurance information manager (900) to manage insurance information during the life of said contract based on said computer records.

14. A computerised integrated insurance system according to claim 12 or claim 13, wherein said census analyzer (500) compares said computer records to prior census data.

15. A computerised integrated insurance system according to claim 13, wherein said analyzer (600) further comprises a pecuniary loss analyzer (600) to perform a pecuniary loss analysis based on pecuniary loss parameters and said computer records and classify said individuals into representative cells.

**16.** A computerised integrated insurance system according to claim 12 or claim 15, wherein the pecuniary loss. analyzer (600) can perform more than one pecuniary loss analysis based on modified pecuniary loss parameters.

**17.** A computerised integrated insurance system according to claim 12 or claim 15 wherein said pecuniary loss analyzer (600) calculates an insurable interest for each of said individuals in said input census data.

**18.** A computerised integrated insurance system according to claim 15, wherein said analyzer further comprises an illustrator (700) to prepare insurance illustrations based on said representative cells.

**19.** A computerised integrated insurance system according to claim 15 or claim 18, wherein said illustrator (700) adjusts said representative cells based on compliance with insurance laws and regulations.

**20.** A computerised integrated insurance system according to claim 18 or claim 19, wherein said analyzer further comprises a financial analyzer (800) to perform a financial analysis based on financial parameters and said representative cells.

**21.** A computerised integrated insurance system according to claim 15 or claim 20, wherein said financial analyser (800) can perform more than one financial analysis based on modified financial parameters.

**22.** A computerised integrated insurance system according to any one of claims 15, 20 or 21 further comprising a final contract generator (100) to create a final insurance contract and related documentation based on said representative cells.

**23.** A method for implementing an integrated insurance system using a computer system, said method comprising the steps of:

receiving census data for a plurality of individuals into the computer system;
performing a pecuniary loss analysis based on pecuniary loss parameters and said census data to classify said individuals into representative cells;
preparing insurance illustrations based on said representative cells;
performing a financial analysis based on financial parameters and said representative cells;
creating a final insurance contract and related documentation based on said representative cells; and
managing insurance information with the computer system using information generated with said census data.

**24.** A computer network comprising a plurality of electronic numerical computers networked together, which network is adapted and configured to operate according to any preceding claim.

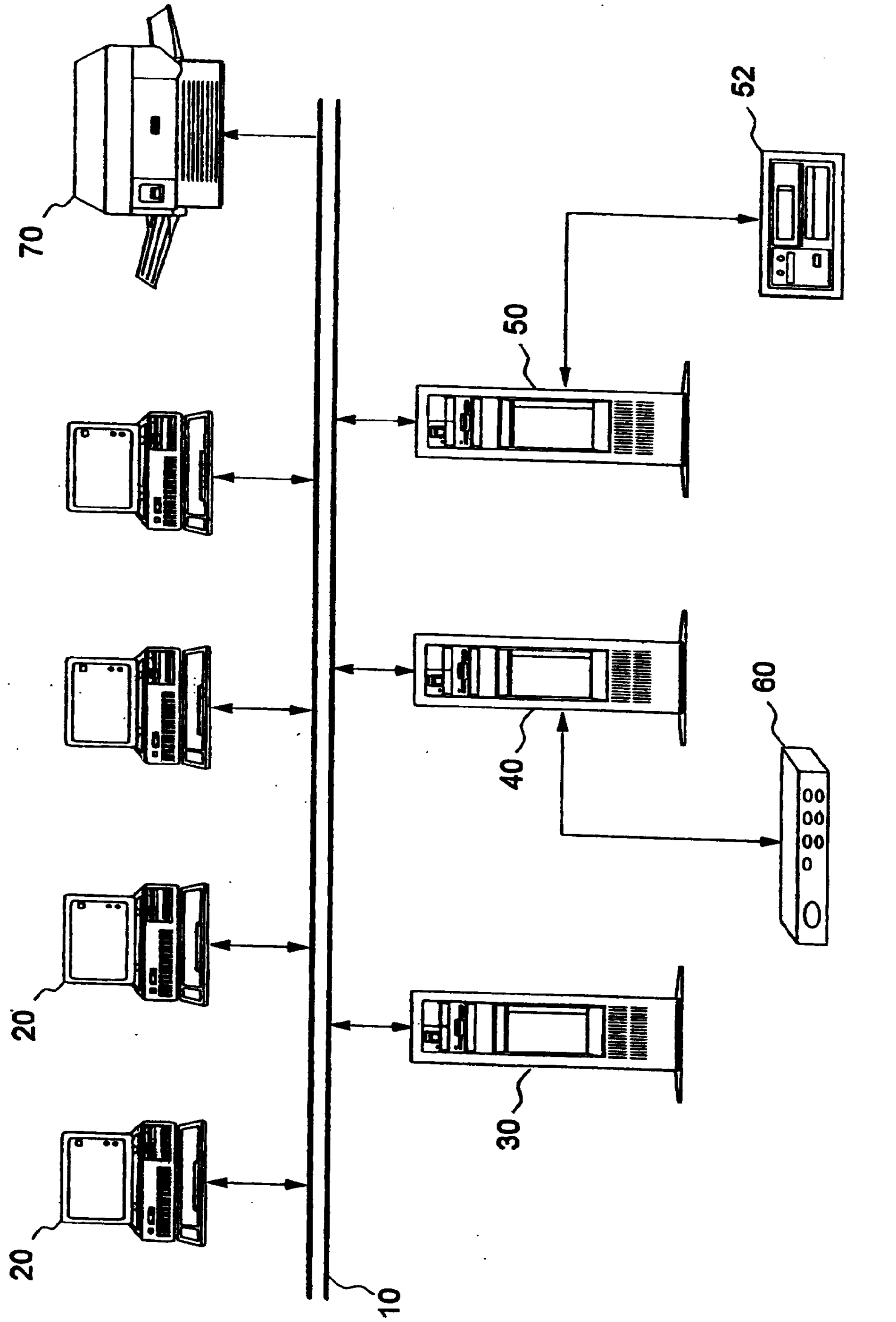



Fig. 1

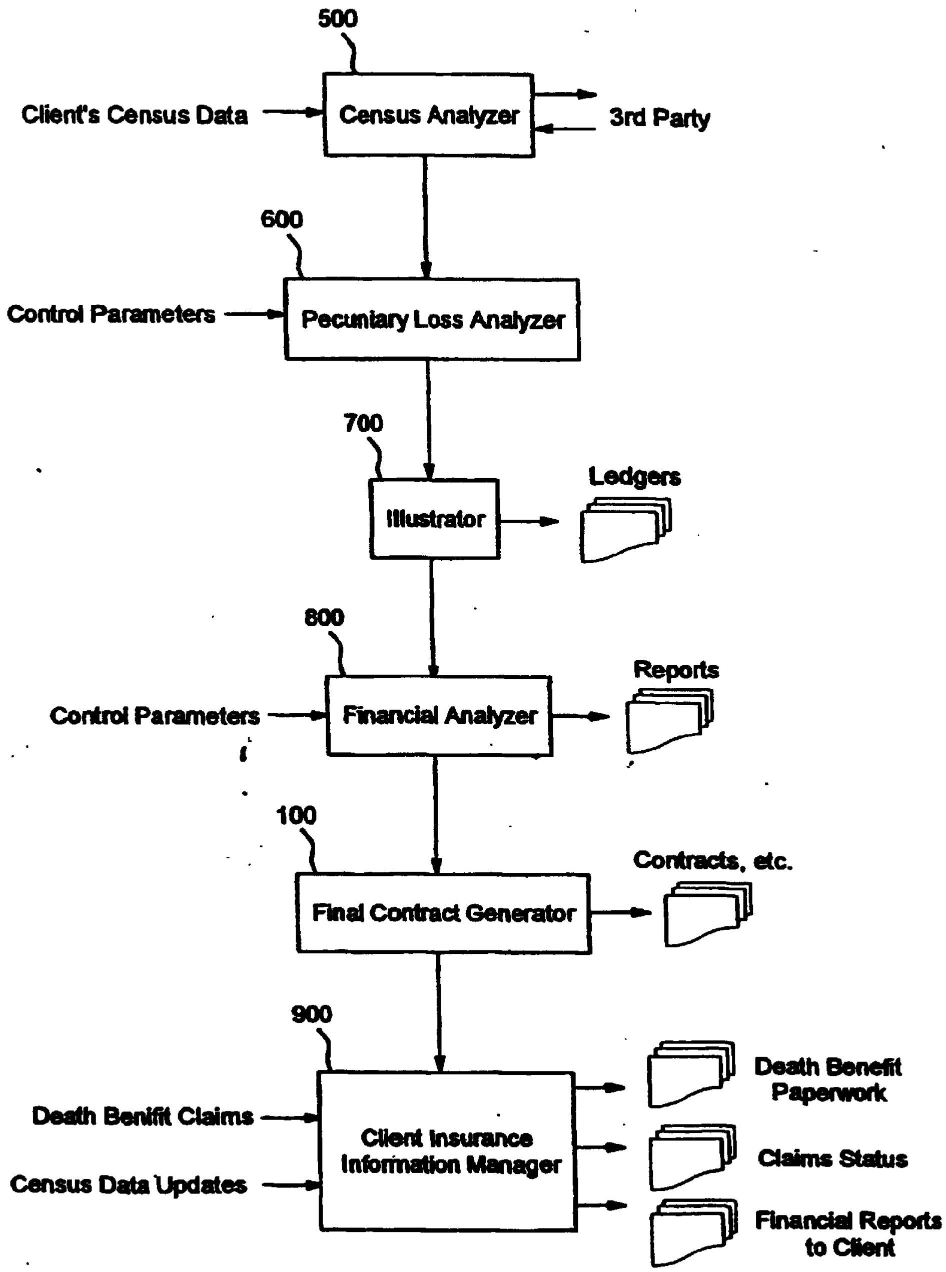

500
Client's Census Data
Census Analyzer
3rd Party
600
Control Parameters
Pecuniary Loss Analyzer
700
Illustrator
Ledgers
800
Control Parameters
Financial Analyzer
Reports
100
Final Contract Generator
Contracts, etc.
900
Death Benifit Claims
Census Data Updates
Client Insurance Information Manager
Death Benefit Paperwork
Claims Status
Financial Reports to Client

FIG. 2

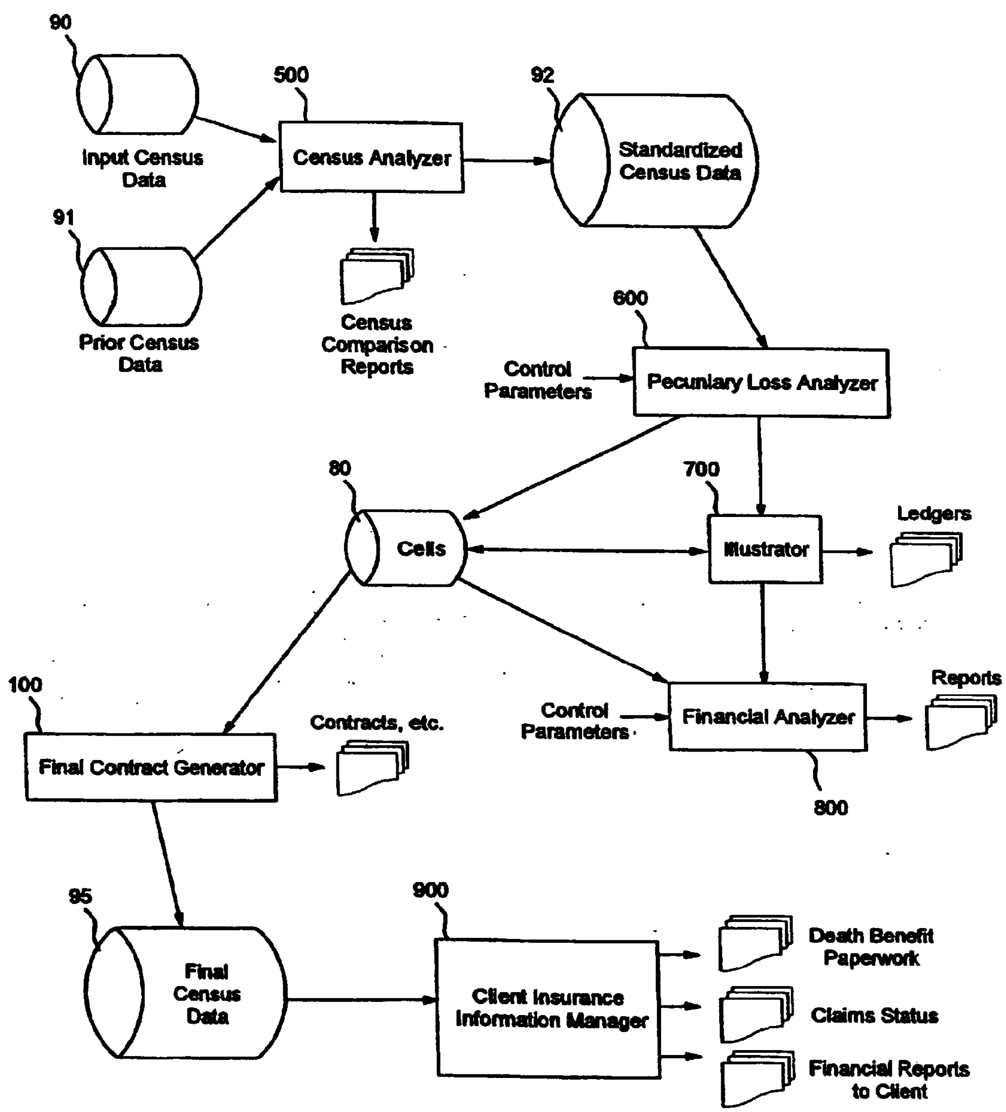

90
Input Census Data
91
Prior Census Data
500
Census Analyzer
Census Comparison Reports
92
Standardized Census Data
600
Control Parameters
Pecuniary Loss Analyzer
80
Cells
700
Illustrator
Ledgers
100
Final Contract Generator
Contracts, etc.
Control Parameters
Financial Analyzer
Reports
800
95
Final Census Data
900
Client Insurance Information Manager
Death Benefit Paperwork
Claims Status
Financial Reports to Client

FIG. 3

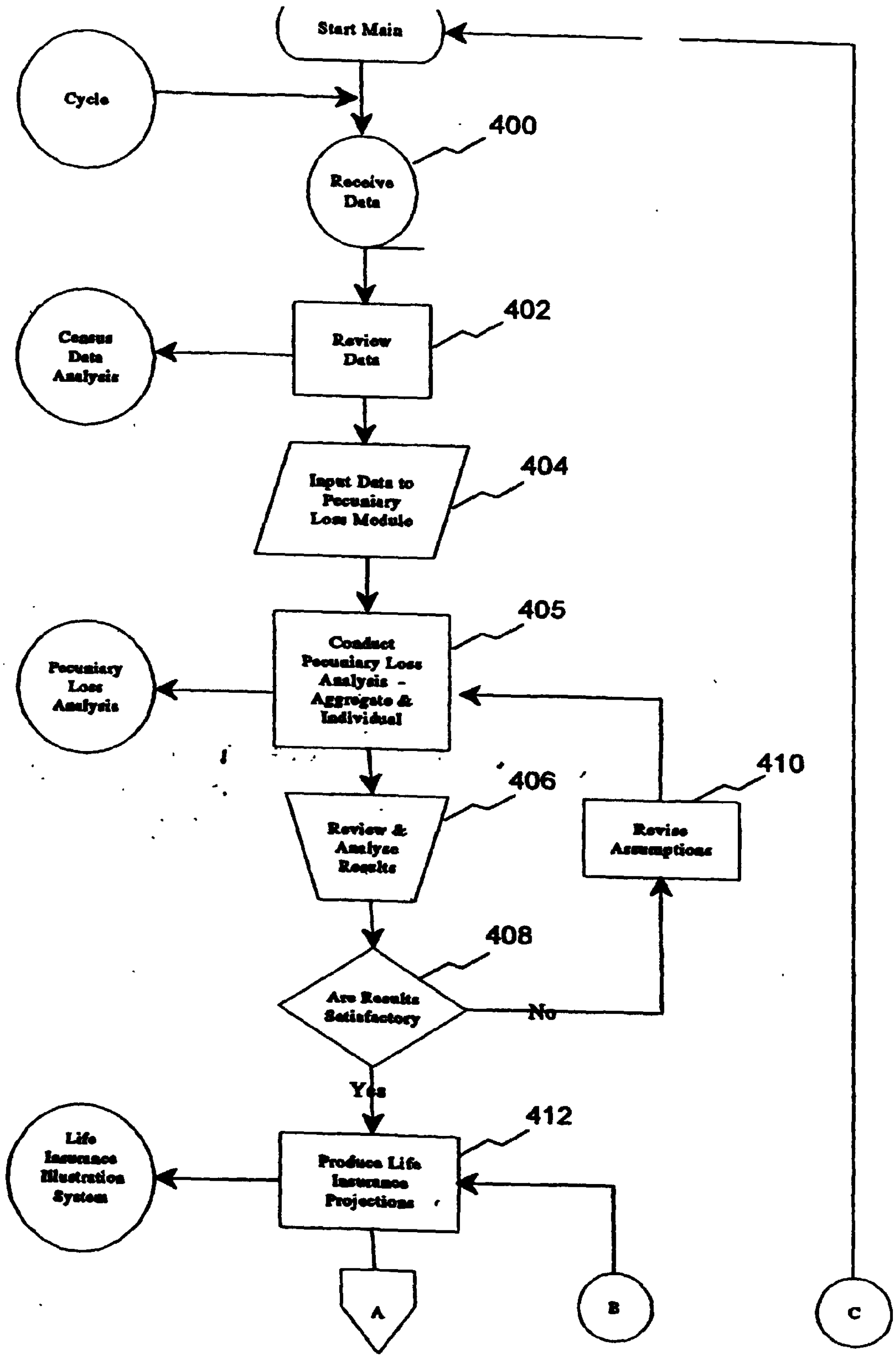

Start Main
Cycle
400
Receive Data
402
Census Data Analysis
Review Data
404
Input Data to Pecuniary Loss Module
405
Pecuniary Loss Analysis
Conduct Pecuniary Loss Analysis - Aggregate & Individual
406
410
Review & Analyze Results
Revise Assumptions
408
Are Results Satisfactory
No
Yes
412
Life Insurance Illustration System
Produce Life Insurance Projections
A
B
C

FIG. 4a

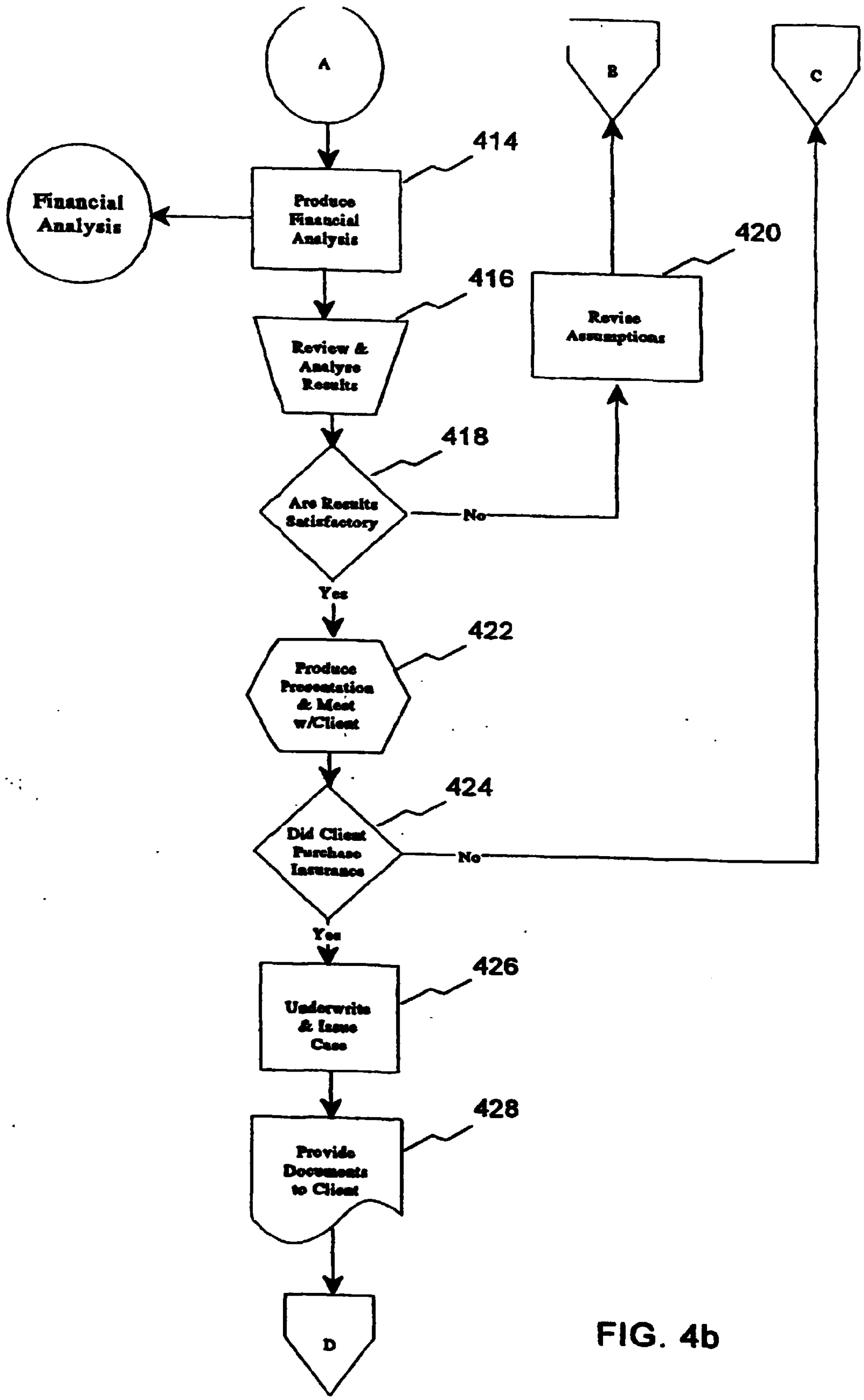

A
B
C
414
Financial Analysis
Produce Financial Analysis
416
420
Review & Analyze Results
Revise Assumptions
418
Are Results Satisfactory
No
Yes
422
Produce Presentation & Meet w/Client
424
Did Client Purchase Insurance
No
Yes
426
Underwrite & Issue Case
428
Provide Documents to Client
D

FIG. 4b

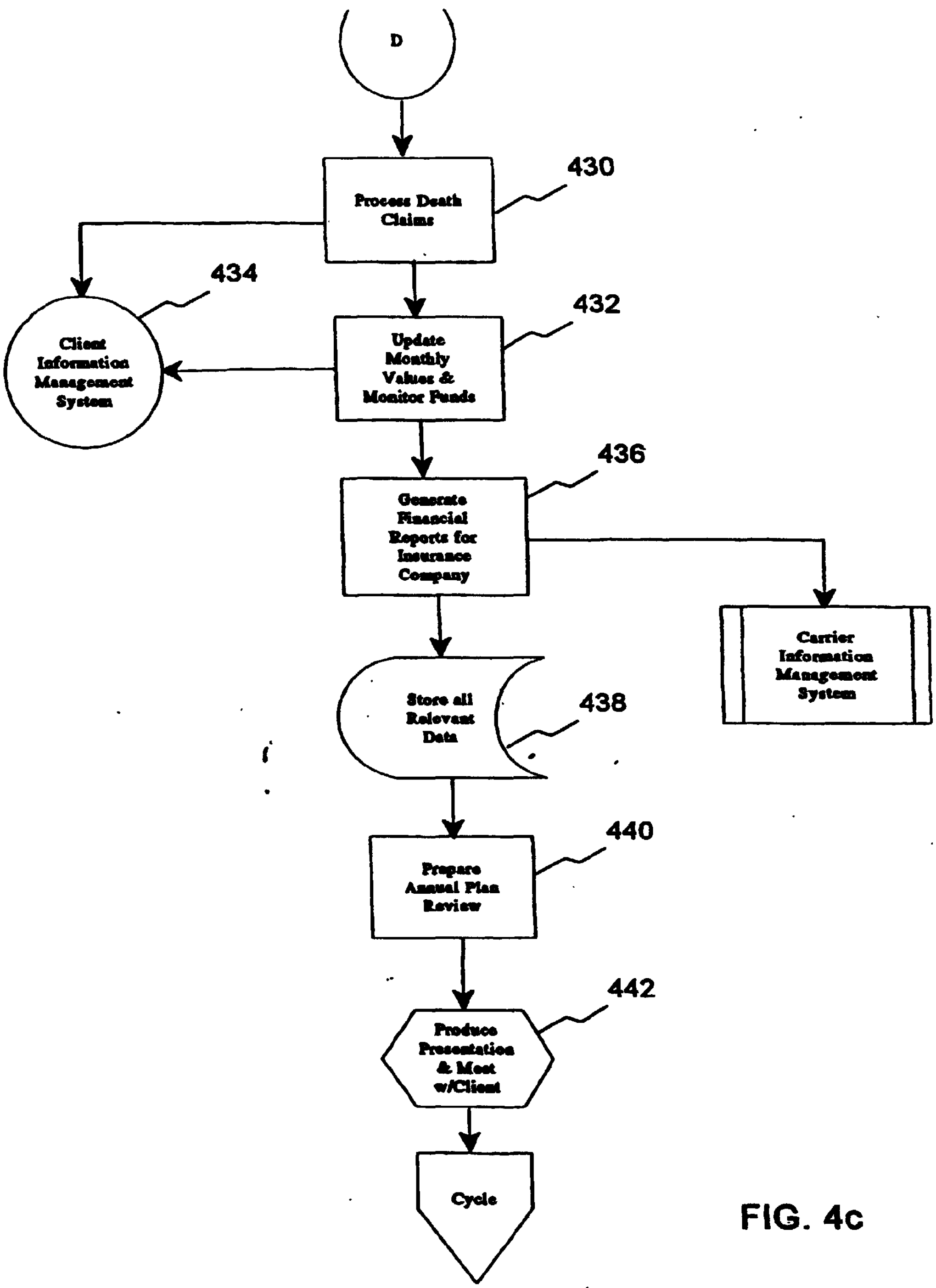

D
Process Death Claims
430
Client Information Management System
434
Update Monthly Values & Monitor Funds
432
Generate Financial Reports for Insurance Company
436
Carrier Information Management System
Store all Relevant Data
438
Prepare Annual Plan Review
440
Produce Presentation & Meet w/Client
442
Cycle

FIG. 4c

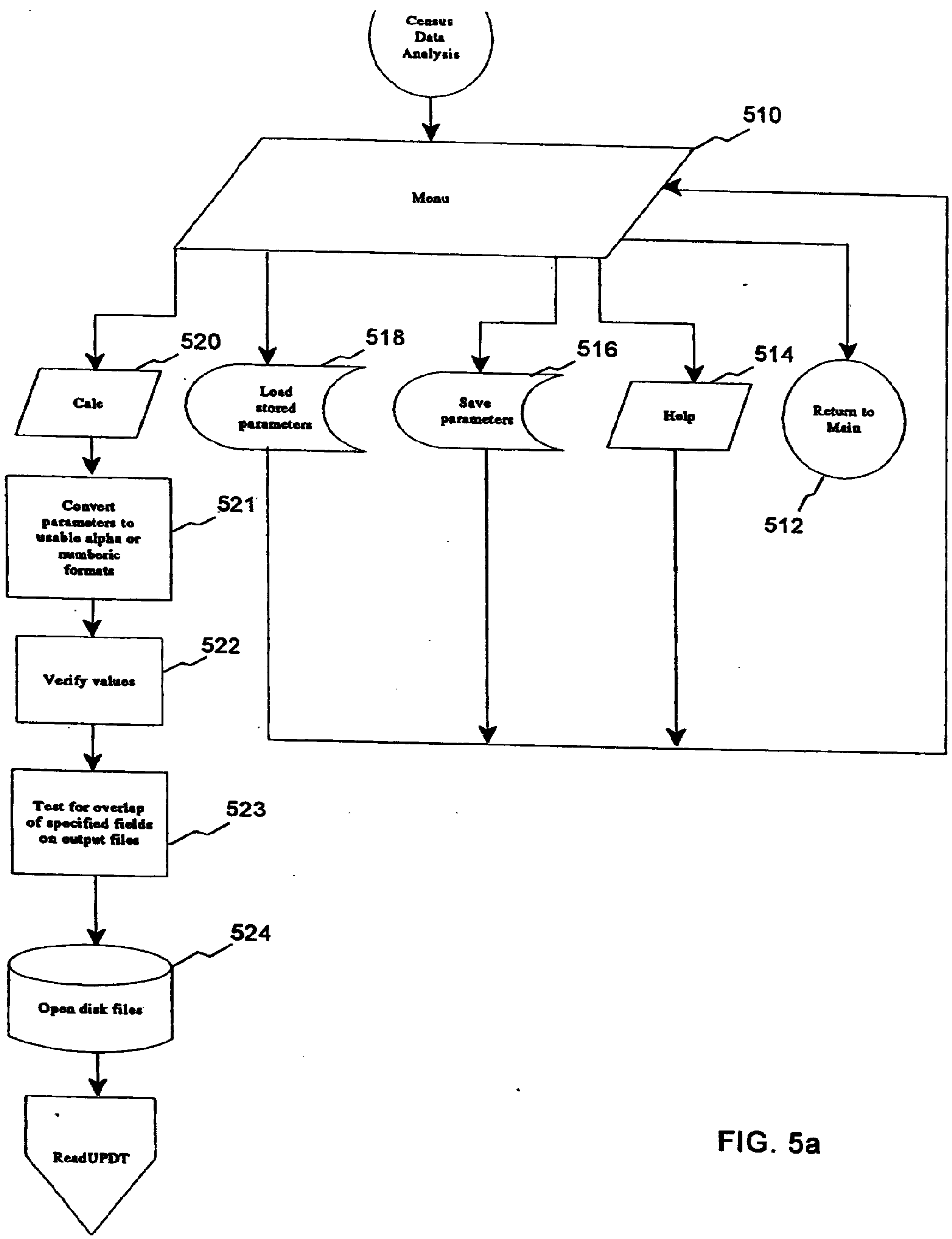

Census Data Analysis
510
Menu
520
Calc
518
Load stored parameters
516
Save parameters
514
Help
Return to Main
512
Convert parameters to usable alpha or numberic formats
521
Verify values
522
Test for overlap of specified fields on output files
523
524
Open disk files
ReadUPDT

FIG. 5a

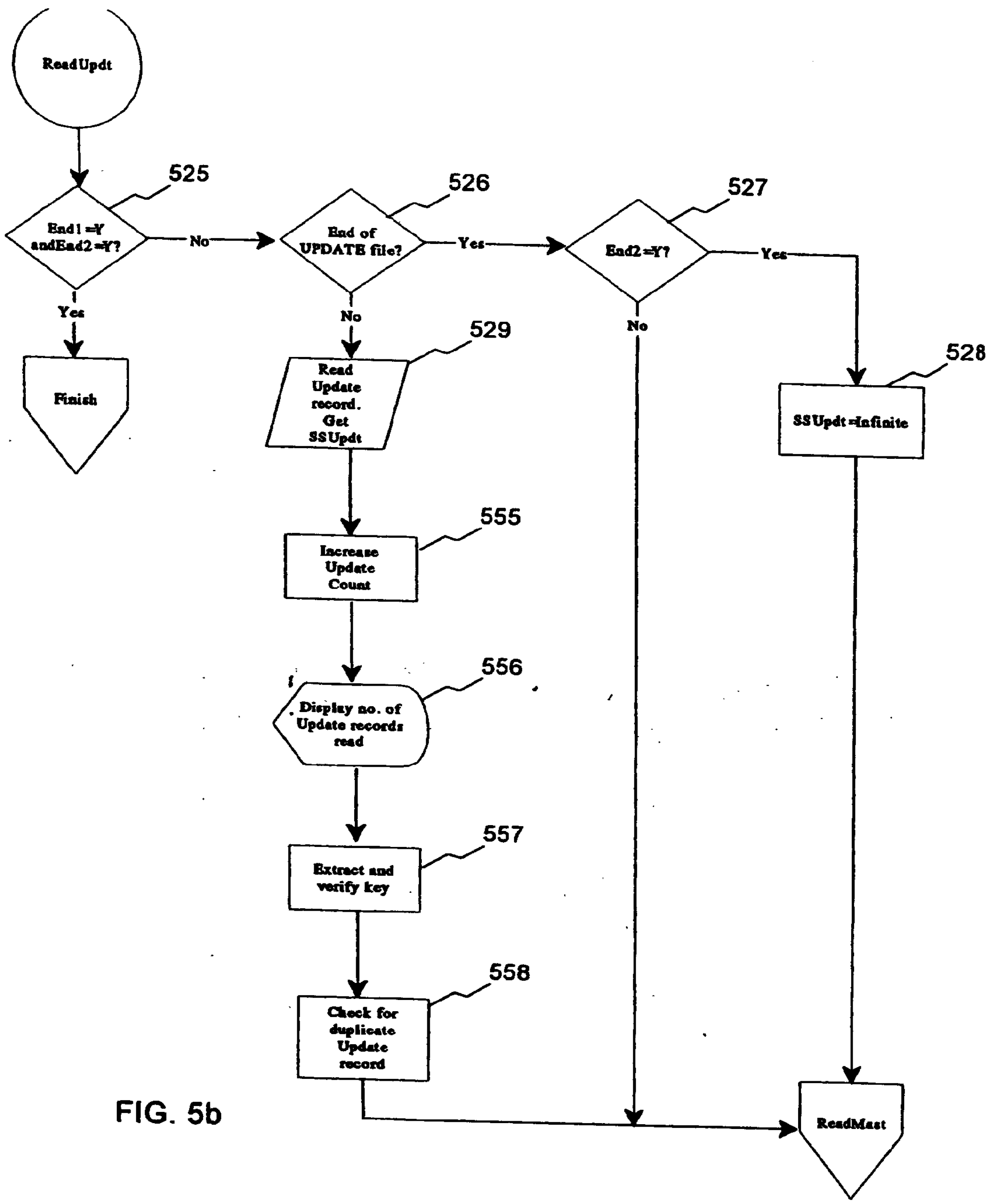

ReadUpdt
525
End1 =Y andEnd2 =Y?
No
Yes
Finish
526
End of UPDATE file?
Yes
No
527
End2 =Y?
Yes
No
528
SSUpdt =Infinite
529
Read Update record. Get SSUpdt
555
Increase Update Count
556
Display no. of Update records read
557
Extract and verify key
558
Check for duplicate Update record
ReadMast

FIG. 5b

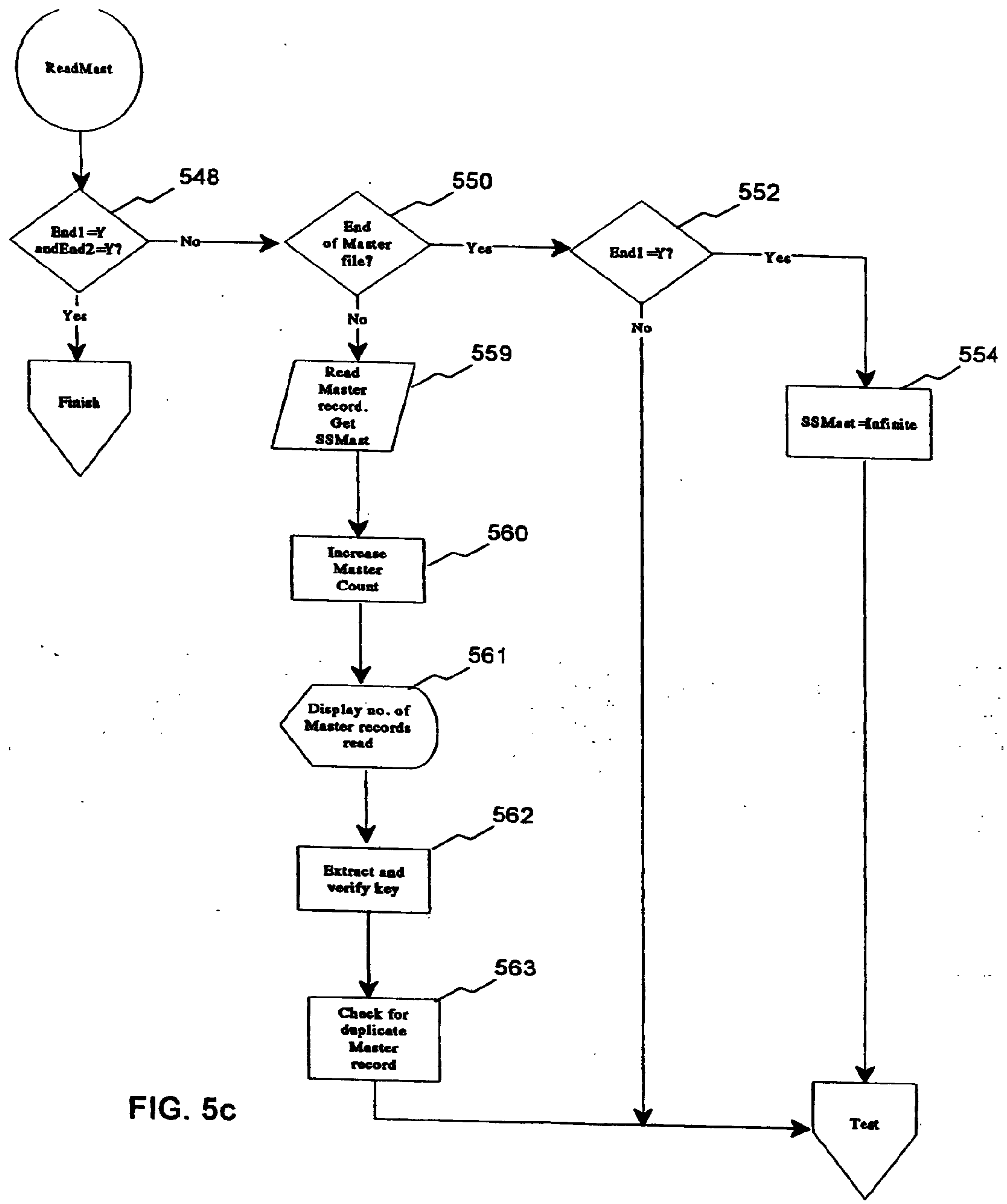

ReadMast
548
End1=Y andEnd2=Y?
No
Yes
Finish
550
End of Master file?
Yes
No
552
End1=Y?
Yes
No
559
Read Master record. Get SSMast
554
SSMast=Infinite
560
Increase Master Count
561
Display no. of Master records read
562
Extract and verify key
563
Check for duplicate Master record
Test

FIG. 5c

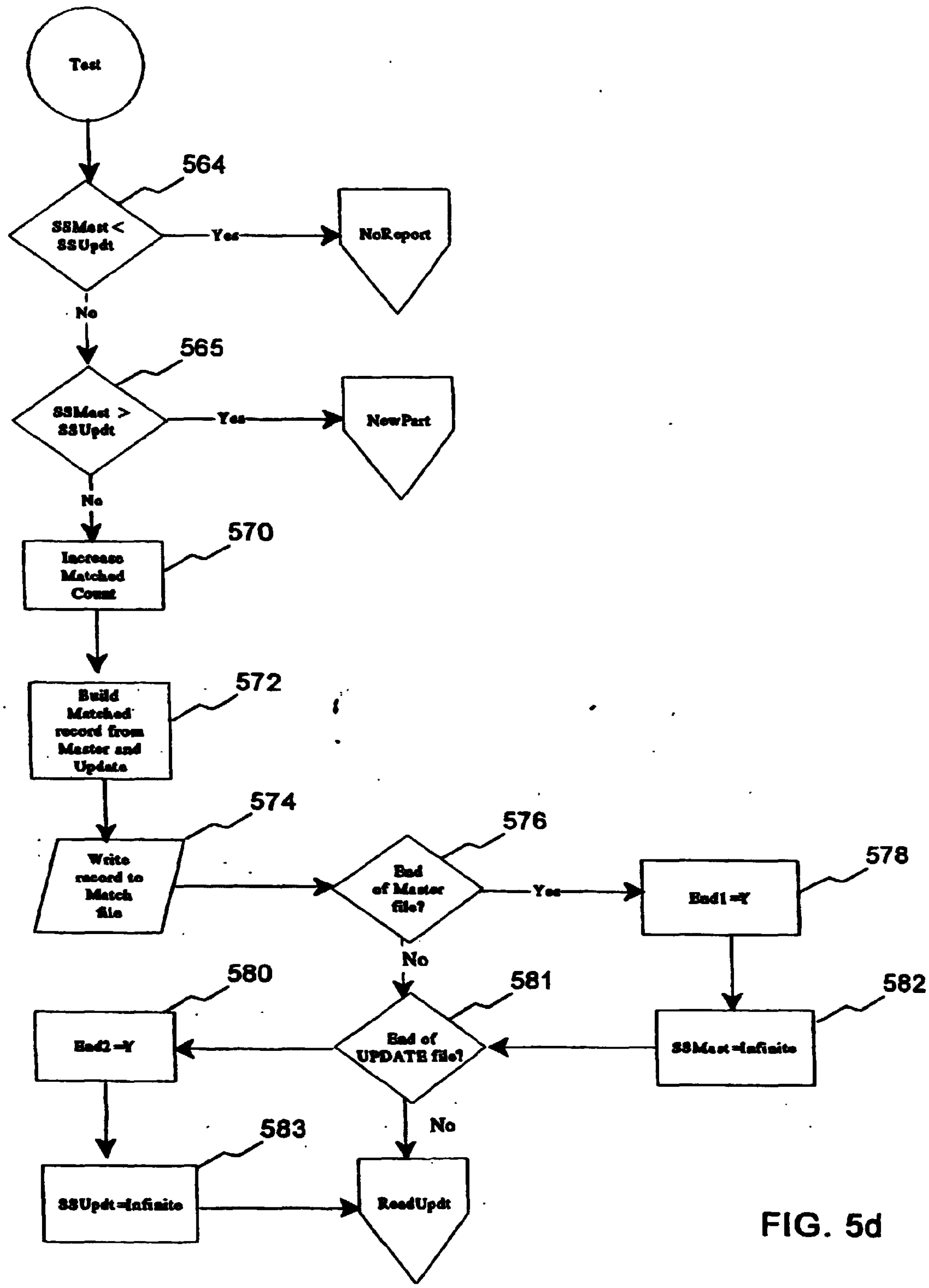

Test
564
SSMast < SSUpdt
Yes
NoReport
No
565
SSMast > SSUpdt
Yes
NewPart
No
570
Increase Matched Count
572
Build Matched record from Master and Update
574
Write record to Match file
576
End of Master file?
Yes
578
End1 =Y
No
580
581
582
End2 =Y
End of UPDATE file?
SSMast =Infinite
583
No
SSUpdt =Infinite
ReadUpdt

FIG. 5d

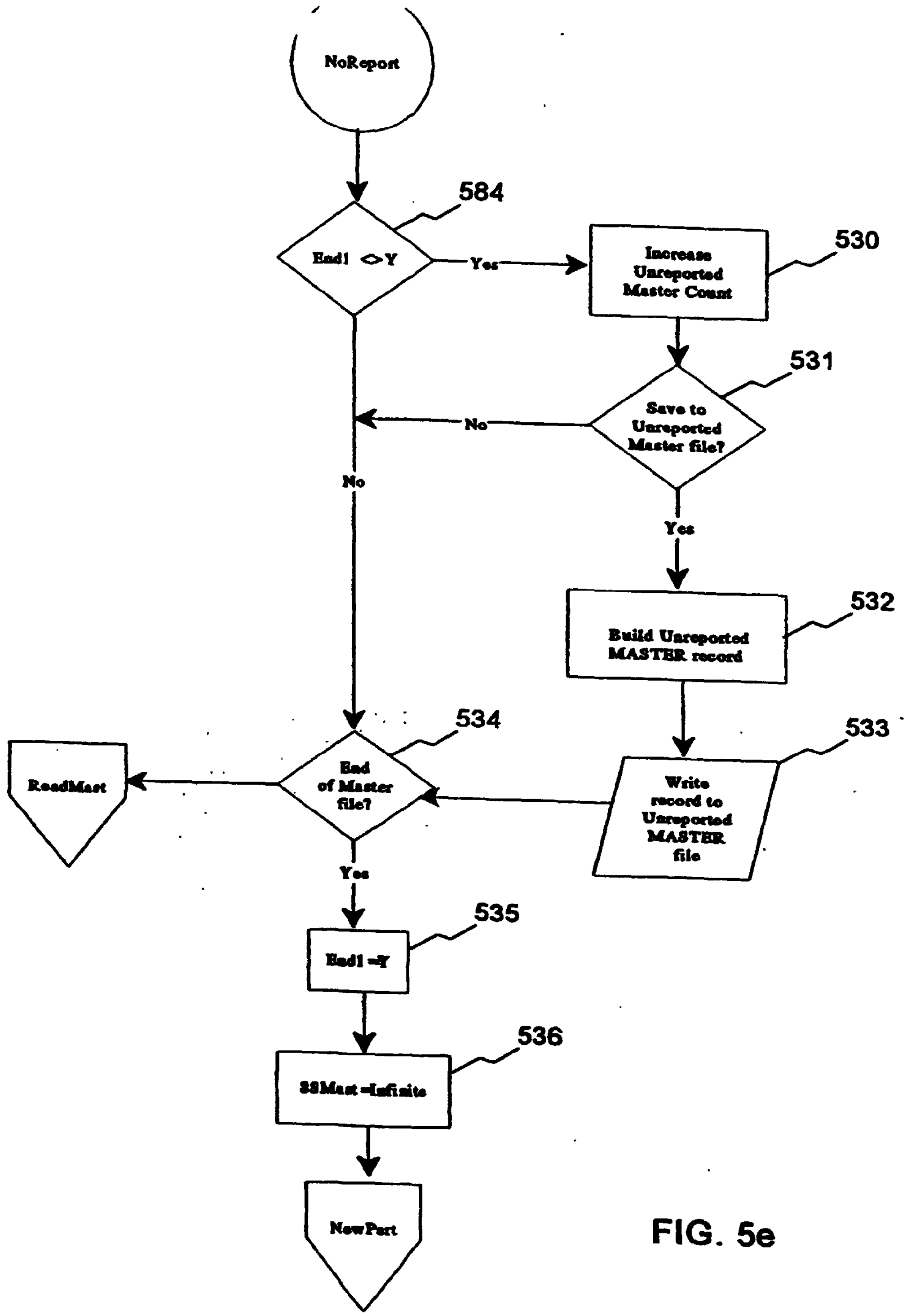

NoReport
584
End1 <>Y
Yes
530
Increase Unreported Master Count
531
Save to Unreported Master file?
No
No
Yes
532
Build Unreported MASTER record
533
Write record to Unreported MASTER file
534
End of Master file?
ReadMast
Yes
535
End1 =Y
536
SSMast =Infinite
NewPart

FIG. 5e

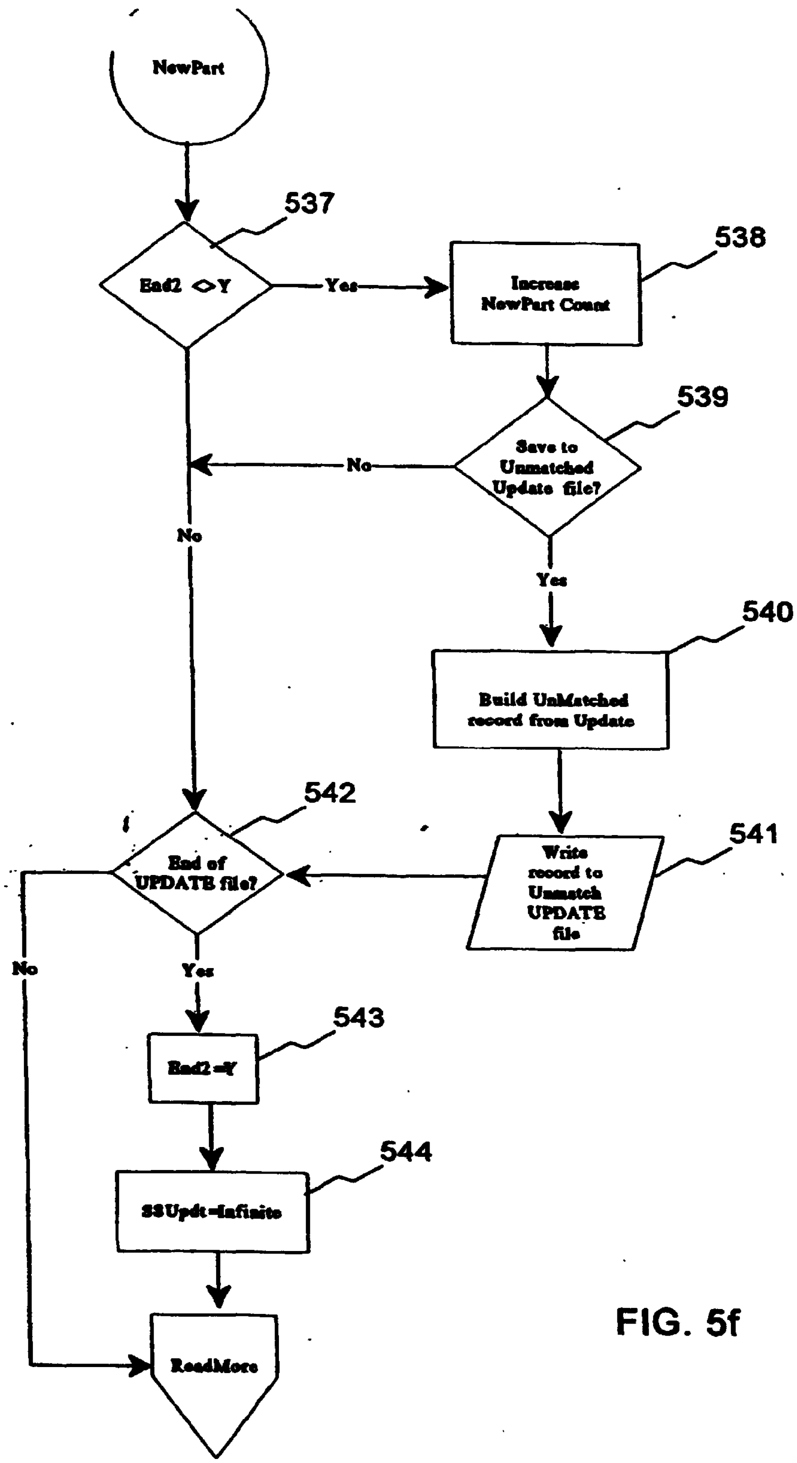

NewPart
537
End2 <>Y
Yes
538
Increase NewPart Count
539
Save to Unmatched Update file?
No
No
Yes
540
Build UnMatched record from Update
542
541
End of UPDATE file?
Write record to Unmatch UPDATE file
No
Yes
543
End2 =Y
544
SSUpdt =Infinite
ReadMore

FIG. 5f

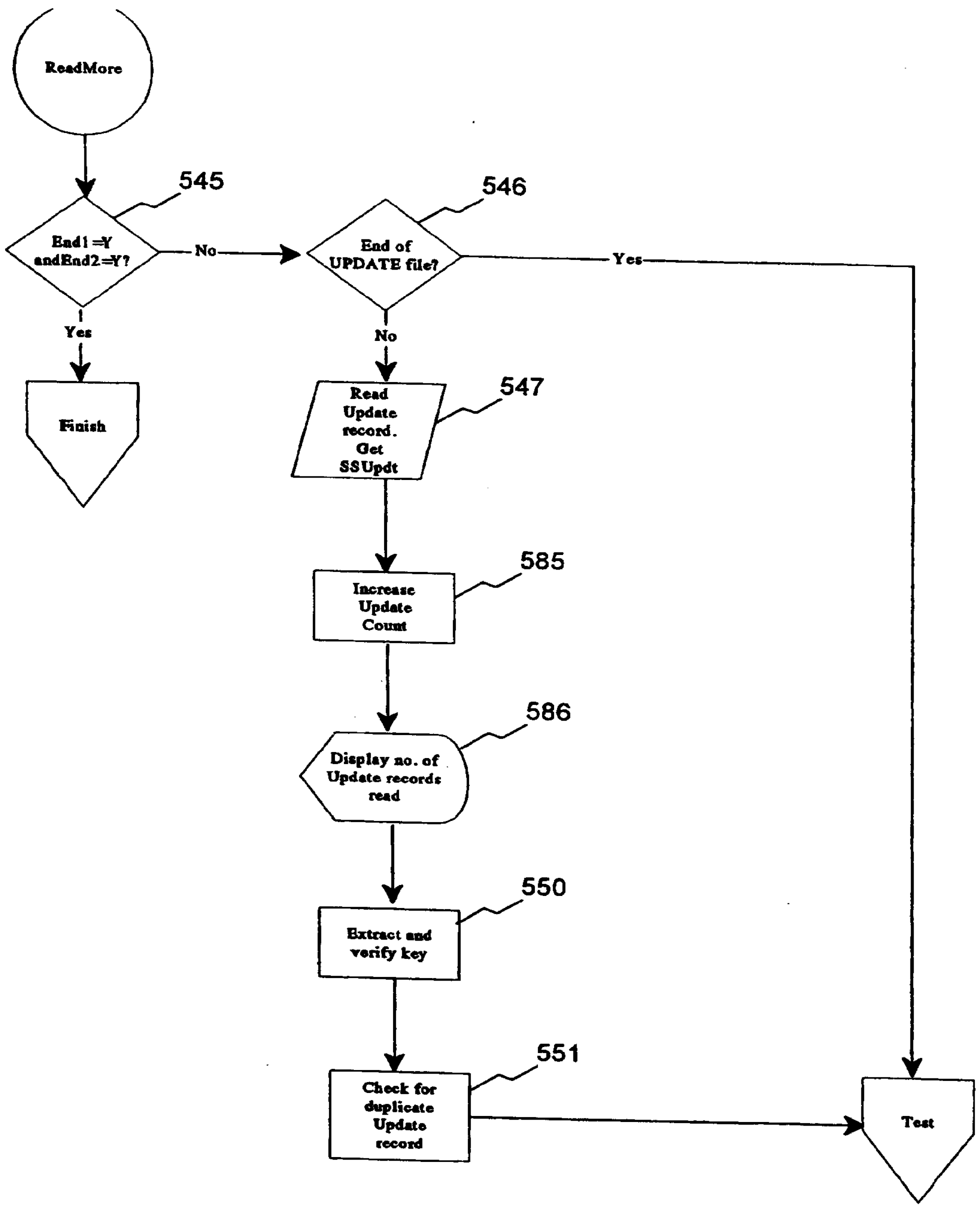

ReadMore
545
End1=Y andEnd2=Y?
No
Yes
Finish
546
End of UPDATE file?
Yes
No
547
Read Update record. Get SSUpdt
585
Increase Update Count
586
Display no. of Update records read
550
Extract and verify key
551
Check for duplicate Update record
Test

FIG. 5g

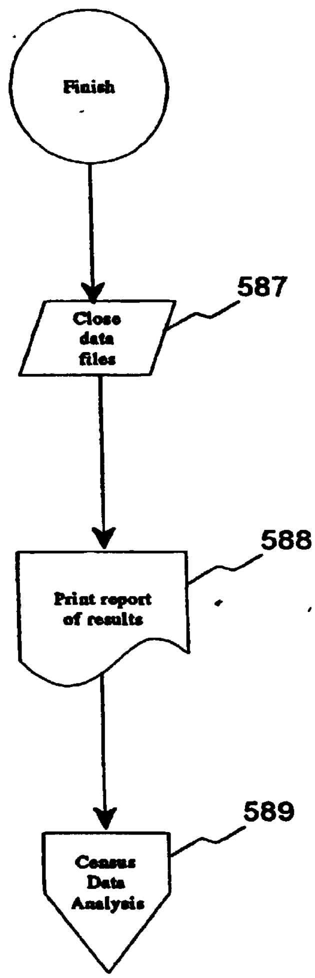

Finish
587
Close
data
files
588
Print report
of results
589
Census
Data
Analysis

FIG. 5h

```
   MTCHMERG          Match/Merge Files          ver. 2.1  06/01/95
 MA       put File=
 UPDATE Input File=
 MATCH: Output File=
 MASTER-No Match: O/P File=
 UPDATE-No Match: O/P File=
                MASTER File  UPDATE File  MATCH      MAST-No Mtch  UPDT-No Mtch
 FIELD(Match)   Pos  Len     Pos  Len     Pos Oflt   Pos Oflt      Pos Oflt
 Soc. Sec. No.
 Name
 Sex
 D.O.Birth
 D.O.Employ
 Salary
 Job
 Location
 State of Res
 Pay Status
 Union Status
 Zip Code
 Print to:          F1-Help  F3-Run  F5-Save  F7-Load  F9-Quit
```

590

Fig. 5i

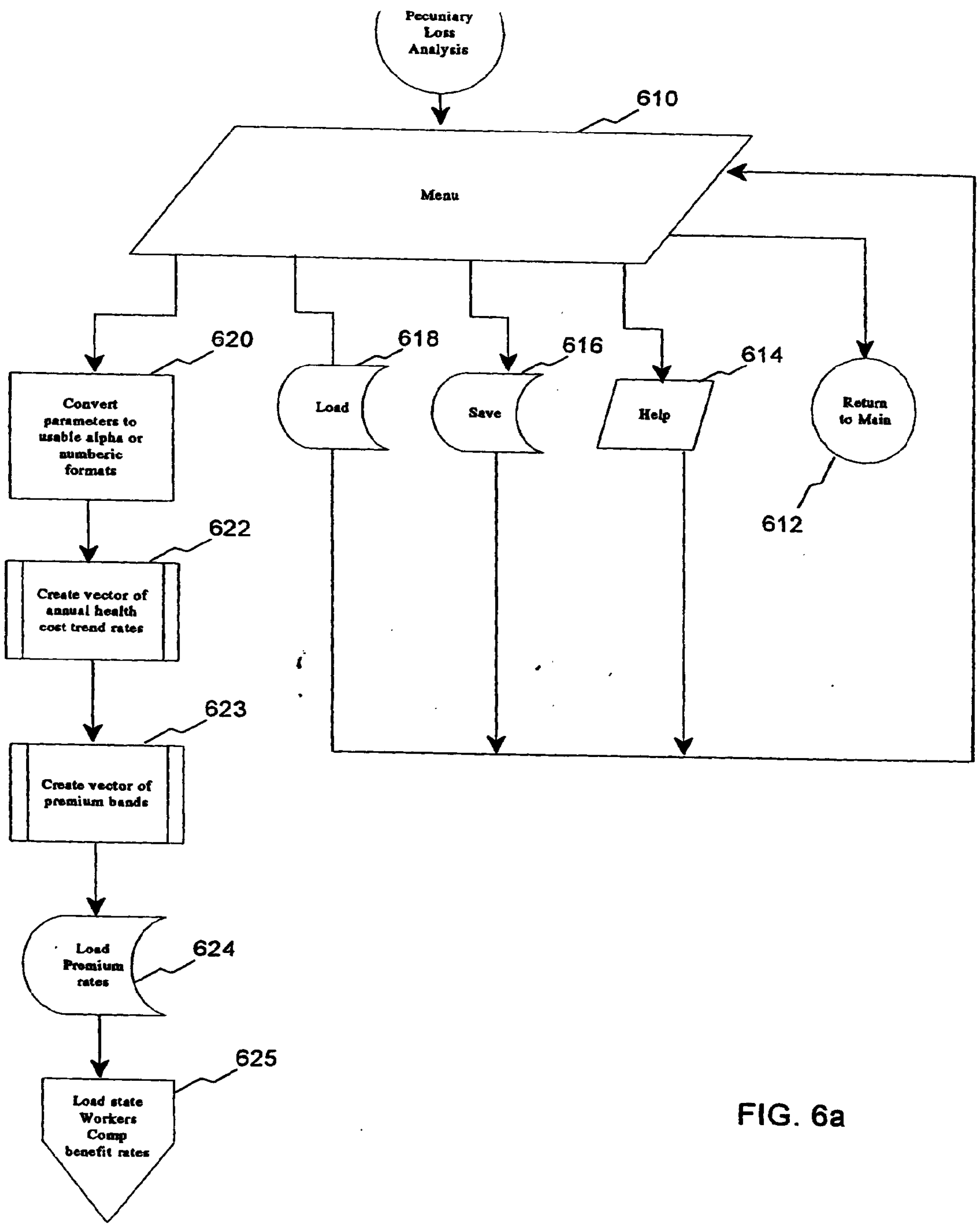

Pecuniary Loss Analysis
610
Menu
620
Convert parameters to usable alpha or numberic formats
618
Load
616
Save
614
Help
Return to Main
612
622
Create vector of annual health cost trend rates
623
Create vector of premium bands
Load Premium rates
624
625
Load state Workers Comp benefit rates

FIG. 6a

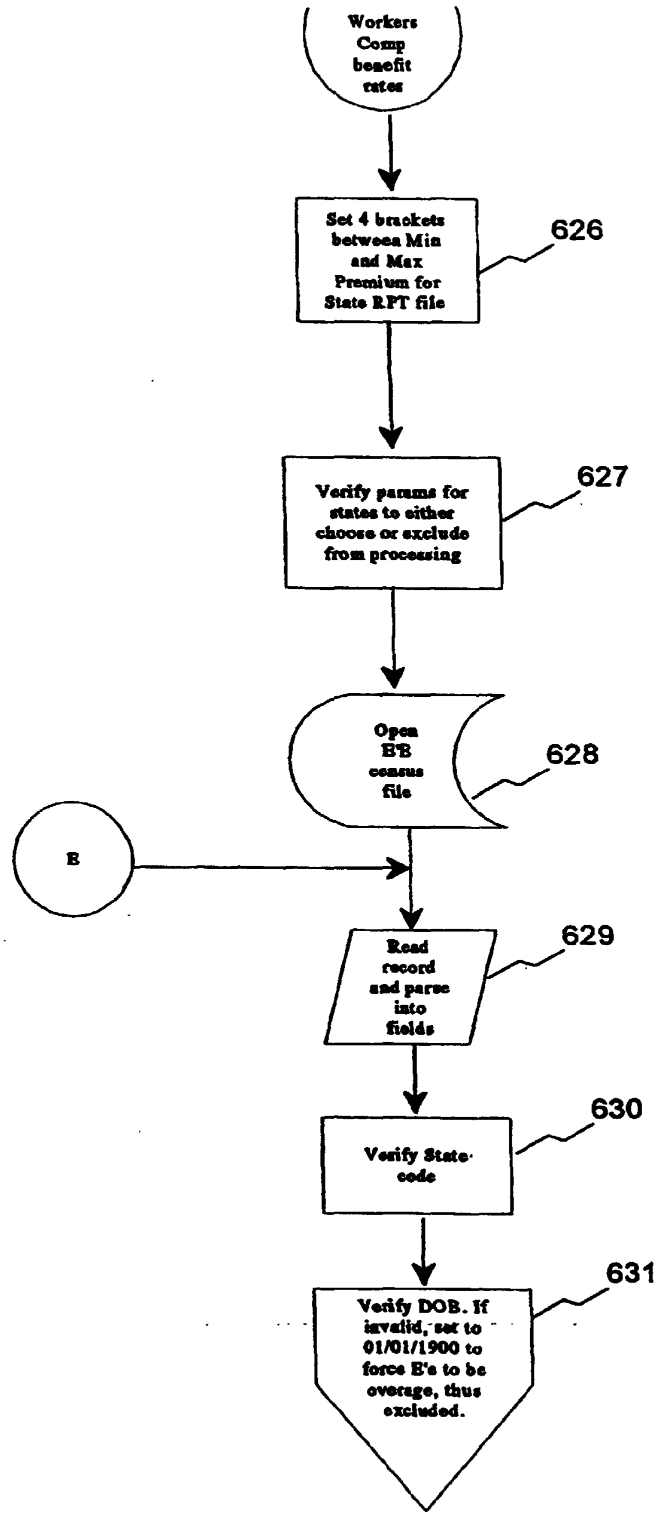

Workers Comp benefit rates
Set 4 brackets between Min and Max Premium for State RPT file
626
Verify params for states to either choose or exclude from processing
627
Open EB census file
628
E
Read record and parse into fields
629
Verify State code
630
Verify DOB. If invalid, set to 01/01/1900 to force E's to be overage, thus excluded.
631

FIG. 6b

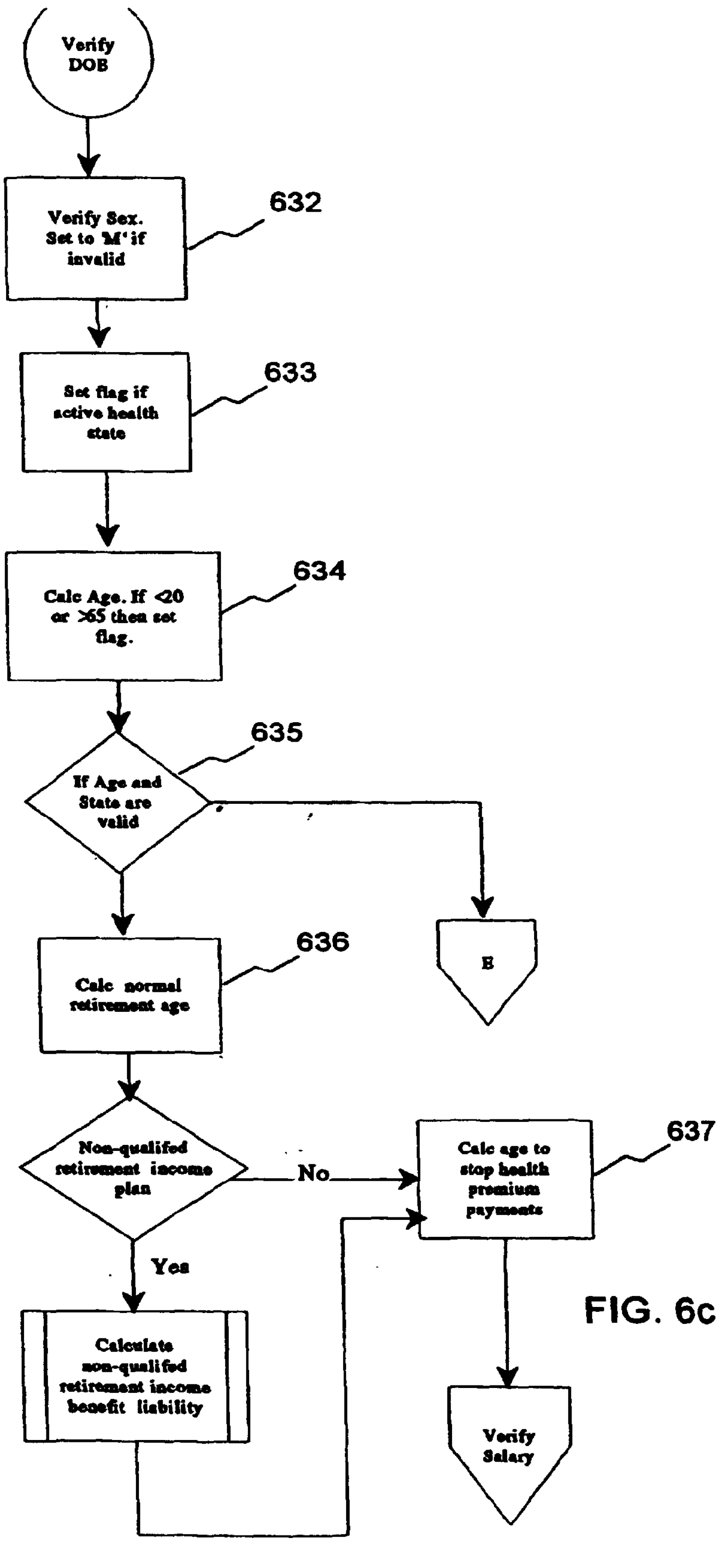

Verify DOB
Verify Sex. Set to 'M' if invalid
632
Set flag if active health state
633
Calc Age. If <20 or >65 then set flag.
634
If Age and State are valid
635
E
Calc normal retirement age
636
Non-qualifed retirement income plan
No
Yes
Calc age to stop health premium payments
637
Calculate non-qualifed retirement income benefit liability
Verify Salary

FIG. 6c

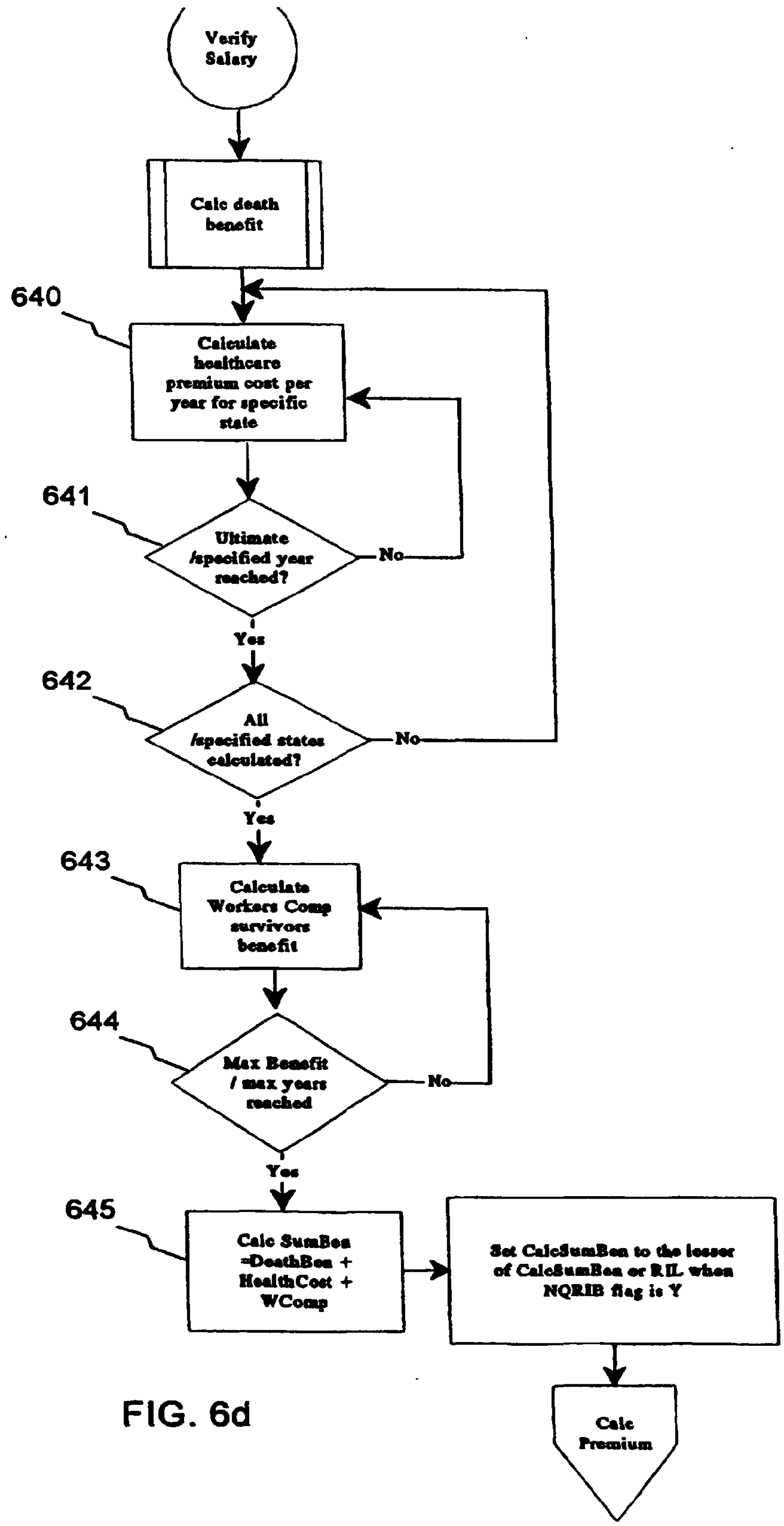

Verify Salary
Calc death benefit
640
Calculate healthcare premium cost per year for specific state
641
Ultimate /specified year reached?
No
Yes
642
All /specified states calculated?
No
Yes
643
Calculate Workers Comp survivors benefit
644
Max Benefit / max years reached
No
Yes
645
Calc SumBen =DeathBen + HealthCost + WComp
Set CalcSumBen to the lesser of CalcSumBen or RIL when NQRIB flag is Y
Calc Premium

FIG. 6d

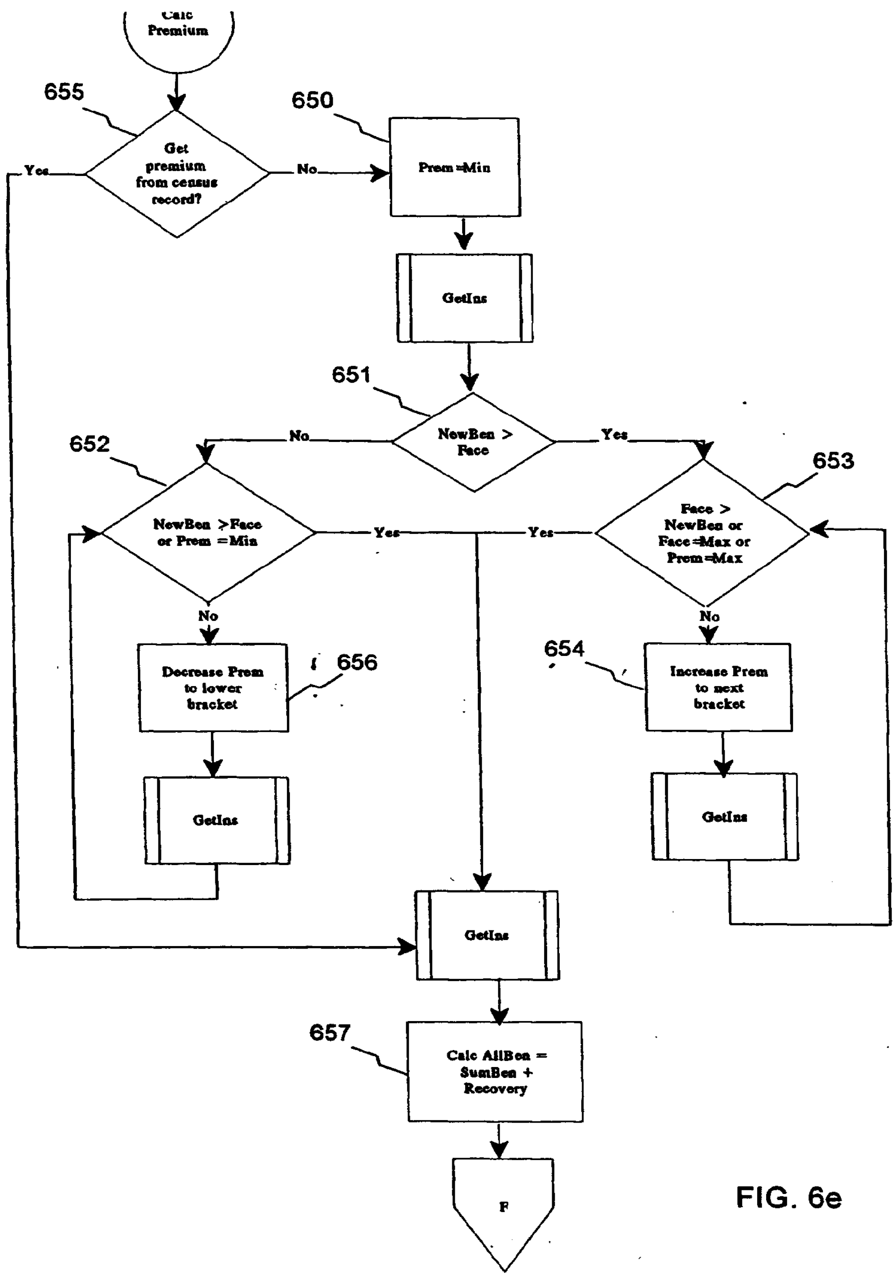

Calc Premium
655
Get premium from census record?
Yes
No
650
Prem =Min
GetIns
651
NewBen > Face
No
Yes
652
NewBen >Face or Prem =Min
Yes
No
653
Face > NewBen or Face=Max or Prem=Max
Yes
No
656
Decrease Prem to lower bracket
GetIns
654
Increase Prem to next bracket
GetIns
GetIns
657
Calc AllBen = SumBen + Recovery
F

FIG. 6e

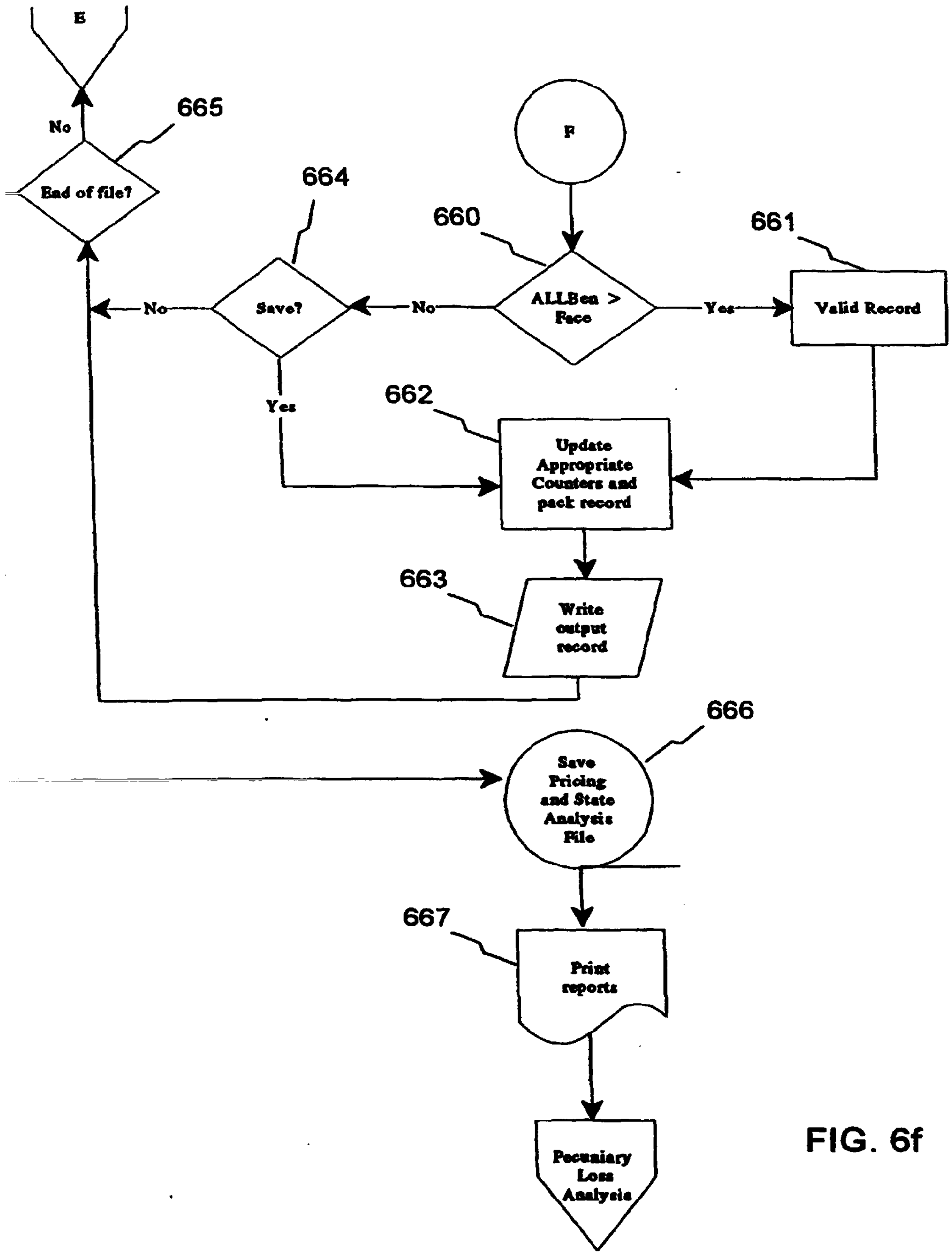

E
665
No
End of file?
664
660
F
661
Save?
No
No
ALLBen > Face
Yes
Valid Record
Yes
662
Update Appropriate Counters and pack record
663
Write output record
666
Save Pricing and State Analysis File
667
Print reports
Pecuniary Loss Analysis

FIG. 6f

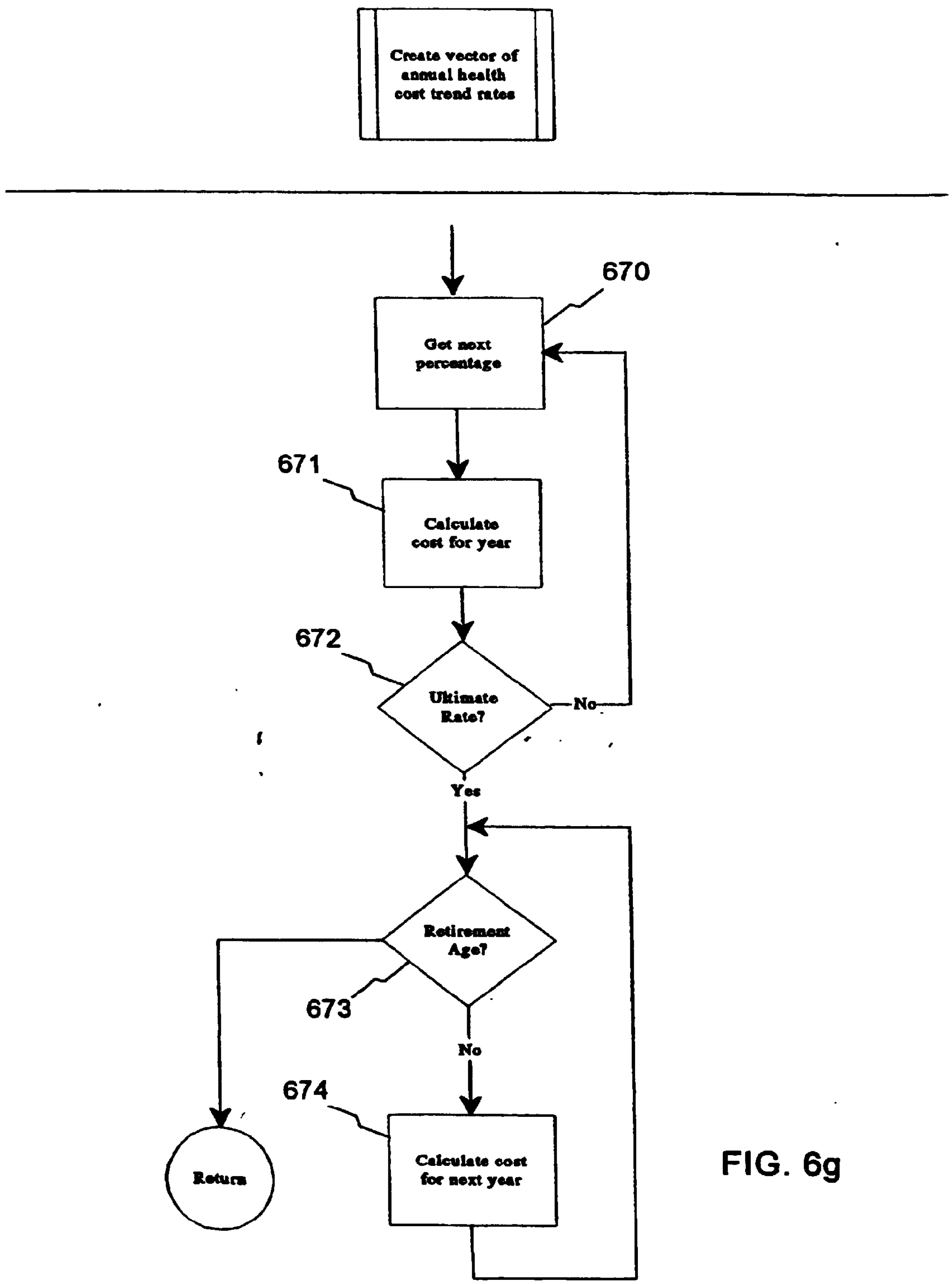

Create vector of annual health cost trend rates
670
Get next percentage
671
Calculate cost for year
672
Ultimate Rate?
No
Yes
Retirement Age?
673
No
674
Return
Calculate cost for next year

FIG. 6g

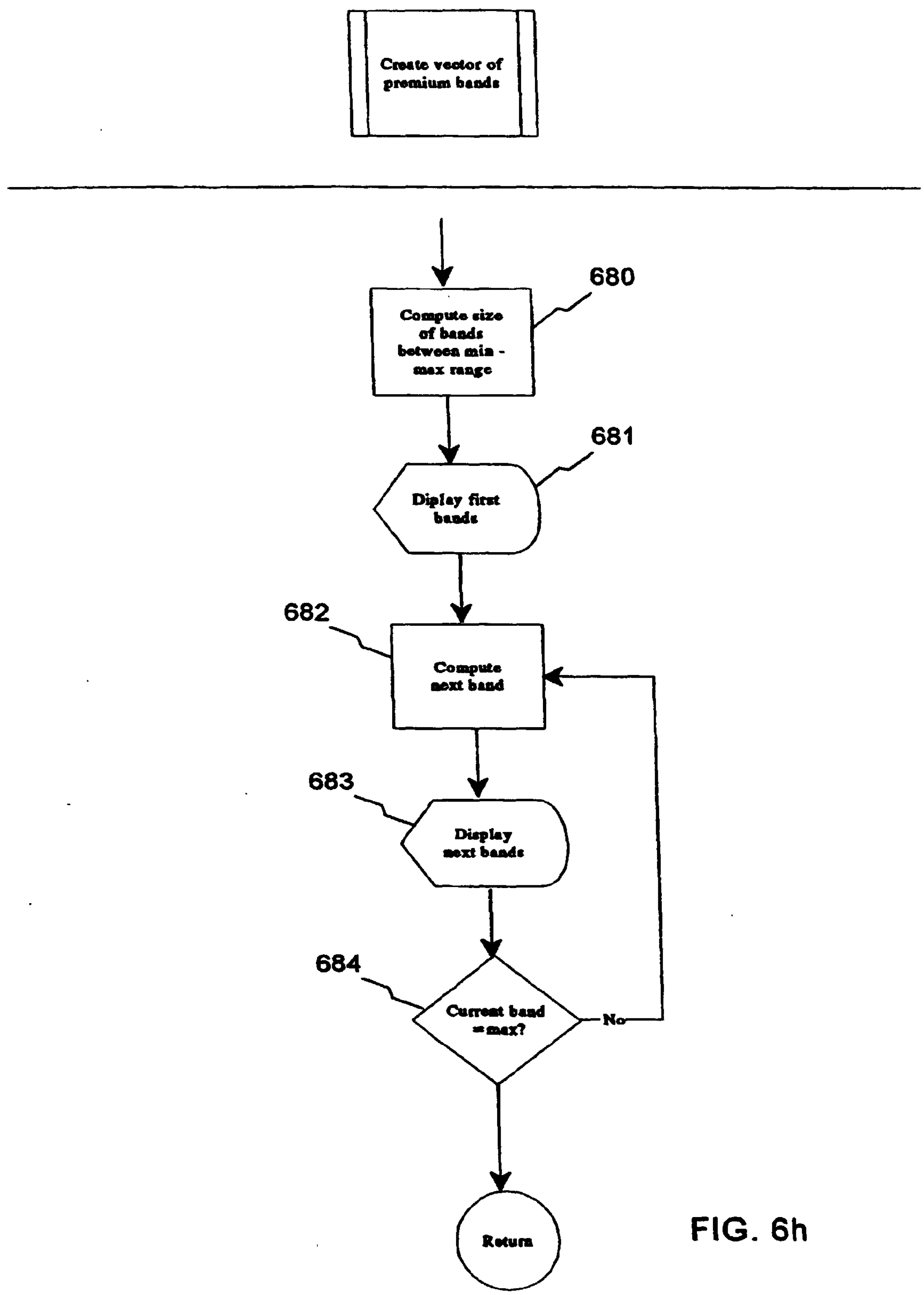

Create vector of premium bands
680
Compute size of bands between min - max range
681
Diplay first bands
682
Compute next band
683
Display next bands
684
Current band = max?
No
Return

FIG. 6h

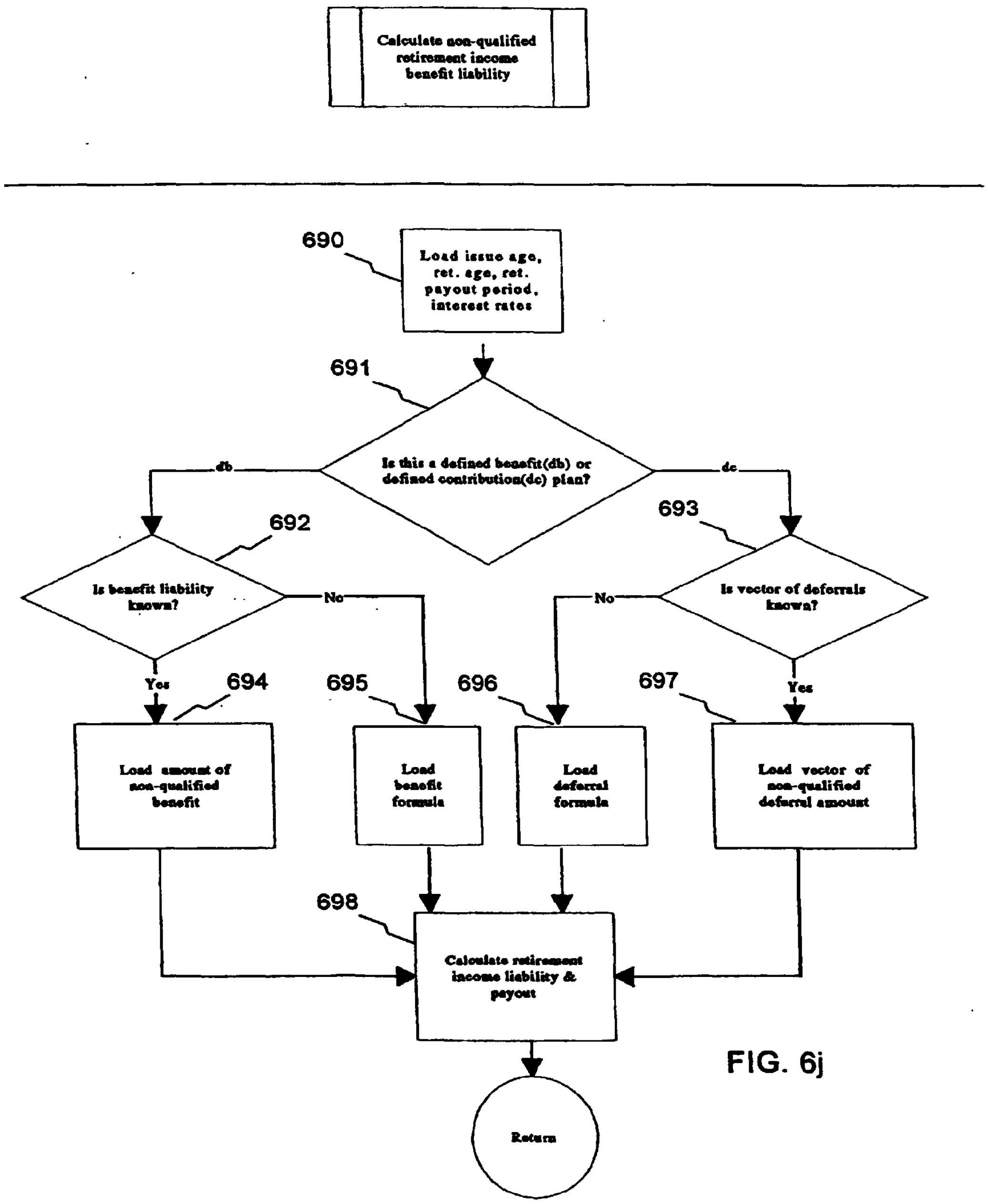

Calculate non-qualified retirement income benefit liability
690
Load issue age, ret. age, ret. payout period, interest rates
691
Is this a defined benefit(db) or defined contribution(dc) plan?
db
dc
692
Is benefit liability known?
693
Is vector of deferrals known?
No
No
Yes
Yes
694
695
696
697
Load amount of non-qualified benefit
Load benefit formula
Load deferral formula
Load vector of non-qualified deferral amount
698
Calculate retirement income liability & payout
Return

FIG. 6j

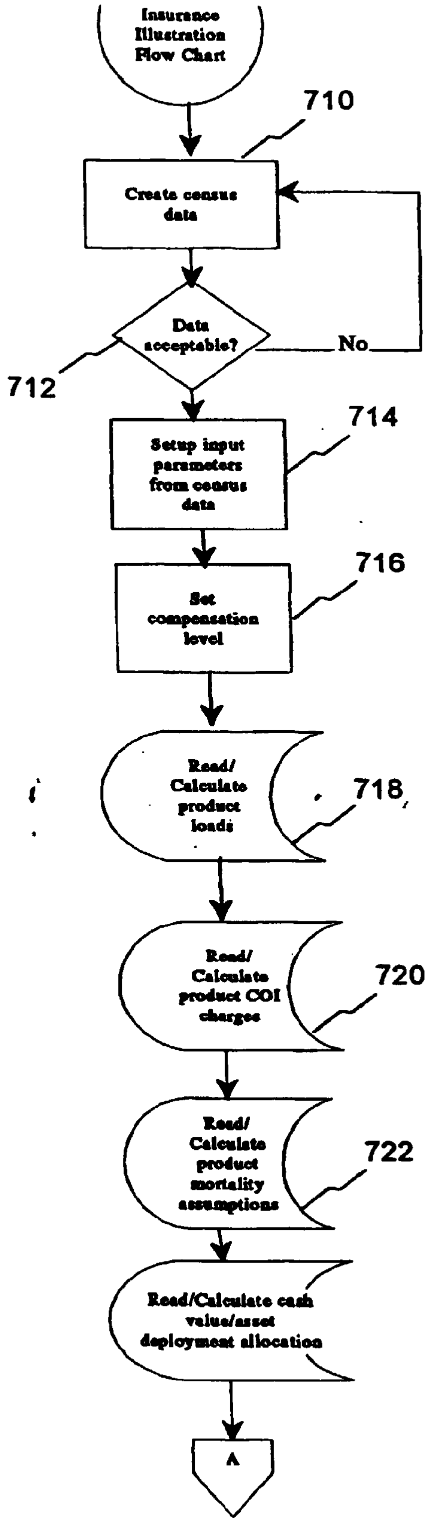

Insurance Illustration Flow Chart
710
Create census data
Data acceptable?
No
712
714
Setup input parameters from census data
716
Set compensation level
Read/ Calculate product loads
718
Read/ Calculate product COI charges
720
Read/ Calculate product mortality assumptions
722
Read/Calculate cash value/asset deployment allocation
A

FIG. 7a

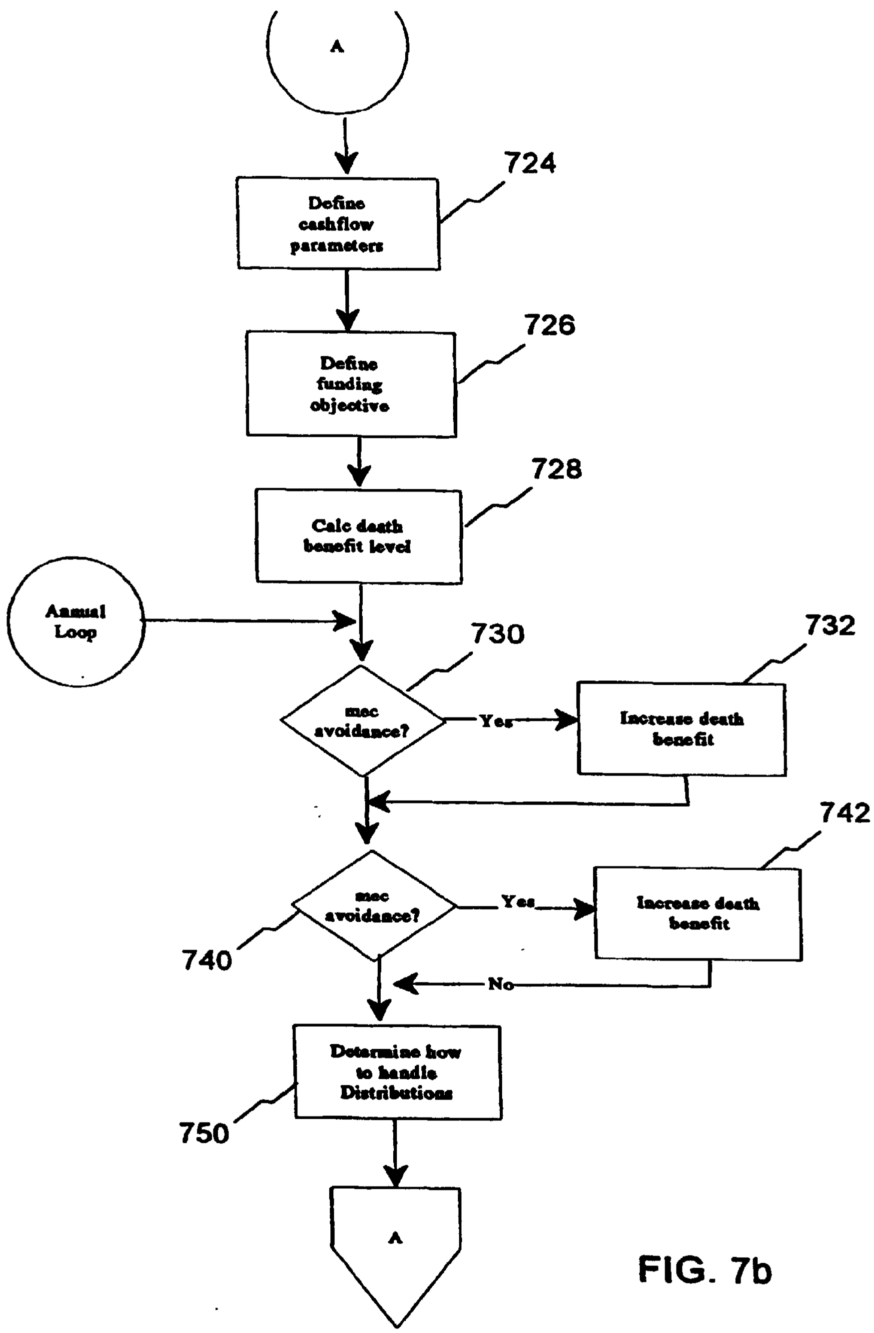

A
724
Define cashflow parameters
726
Define funding objective
728
Calc death benefit level
Annual Loop
730
mec avoidance?
Yes
732
Increase death benefit
742
mec avoidance?
Yes
Increase death benefit
740
No
Determine how to handle Distributions
750
A

FIG. 7b

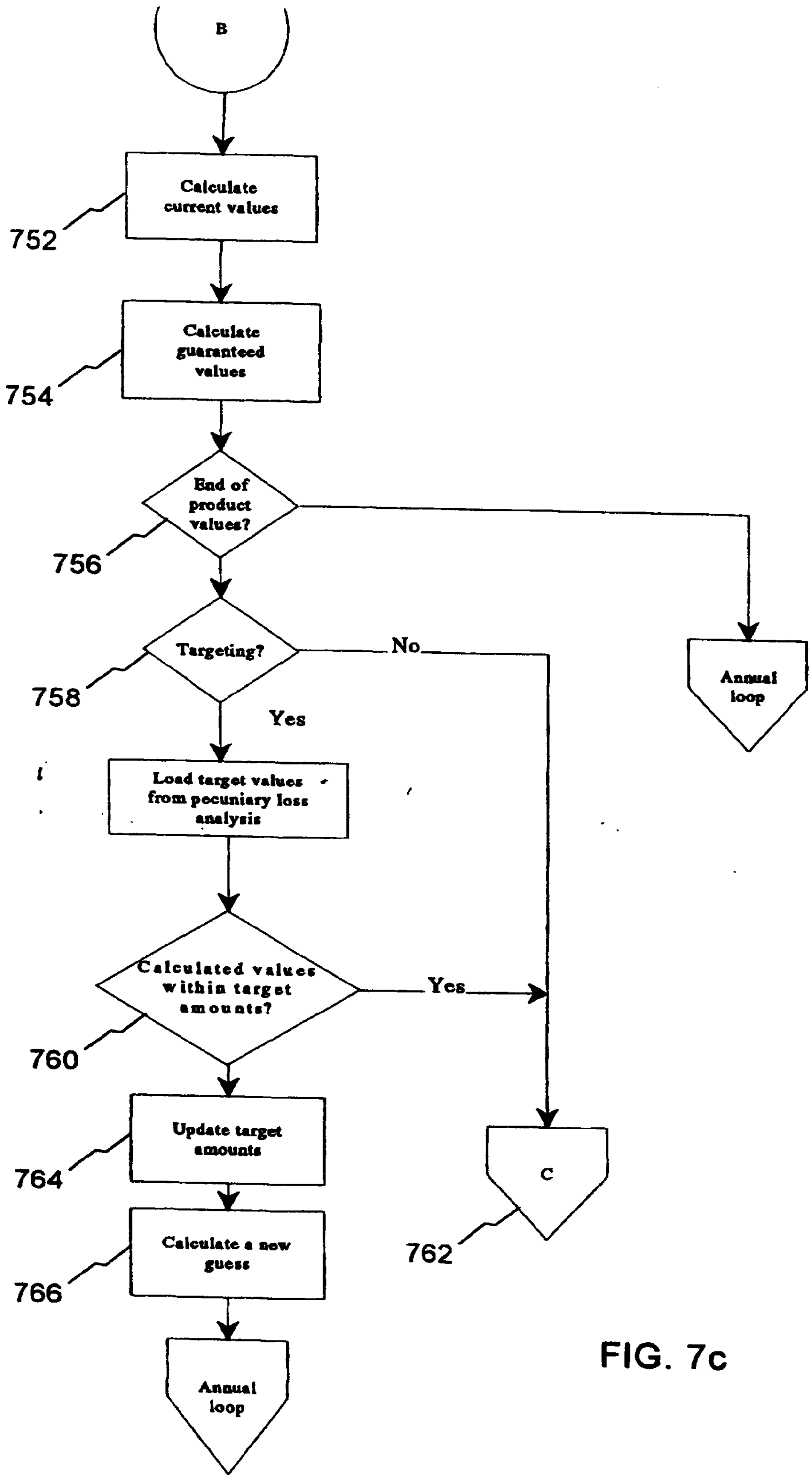

B
Calculate current values
752
Calculate guaranteed values
754
End of product values?
756
Targeting?
No
758
Yes
Annual loop
Load target values from pecuniary loss analysis
Calculated values within target amounts?
Yes
760
Update target amounts
764
C
Calculate a new guess
766
762
Annual loop

FIG. 7c

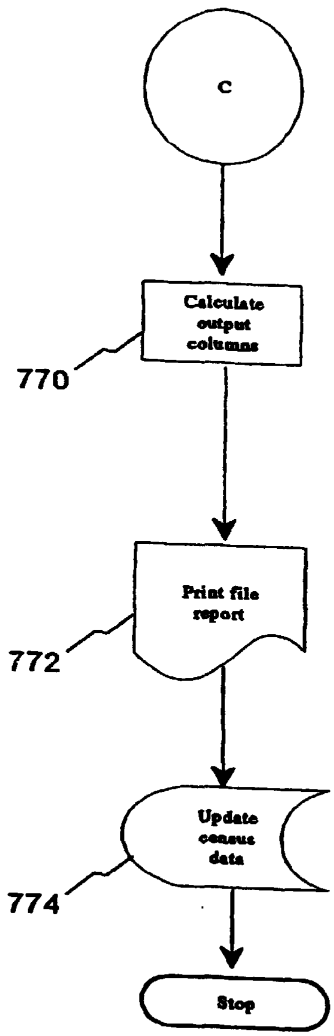

C
Calculate output columns
770
Print file report
772
Update census data
774
Stop

FIG. 7d

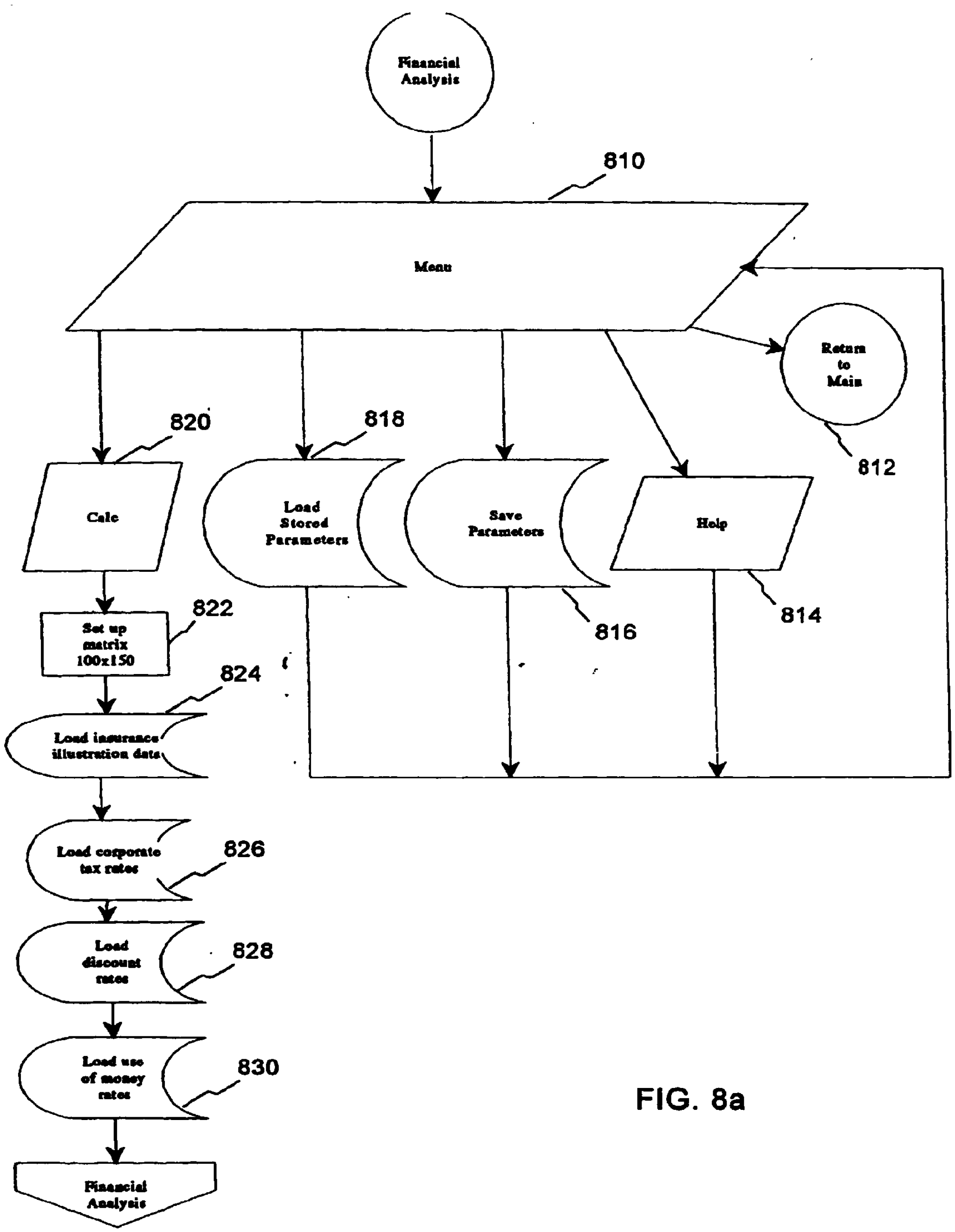

Financial Analysis
810
Menu
Return to Main
812
820
818
Calc
Load Stored Parameters
Save Parameters
Help
814
816
822
Set up matrix 100x150
824
Load insurance illustration data
Load corporate tax rates
826
Load discount rates
828
Load use of money rates
830
Financial Analysis

FIG. 8a

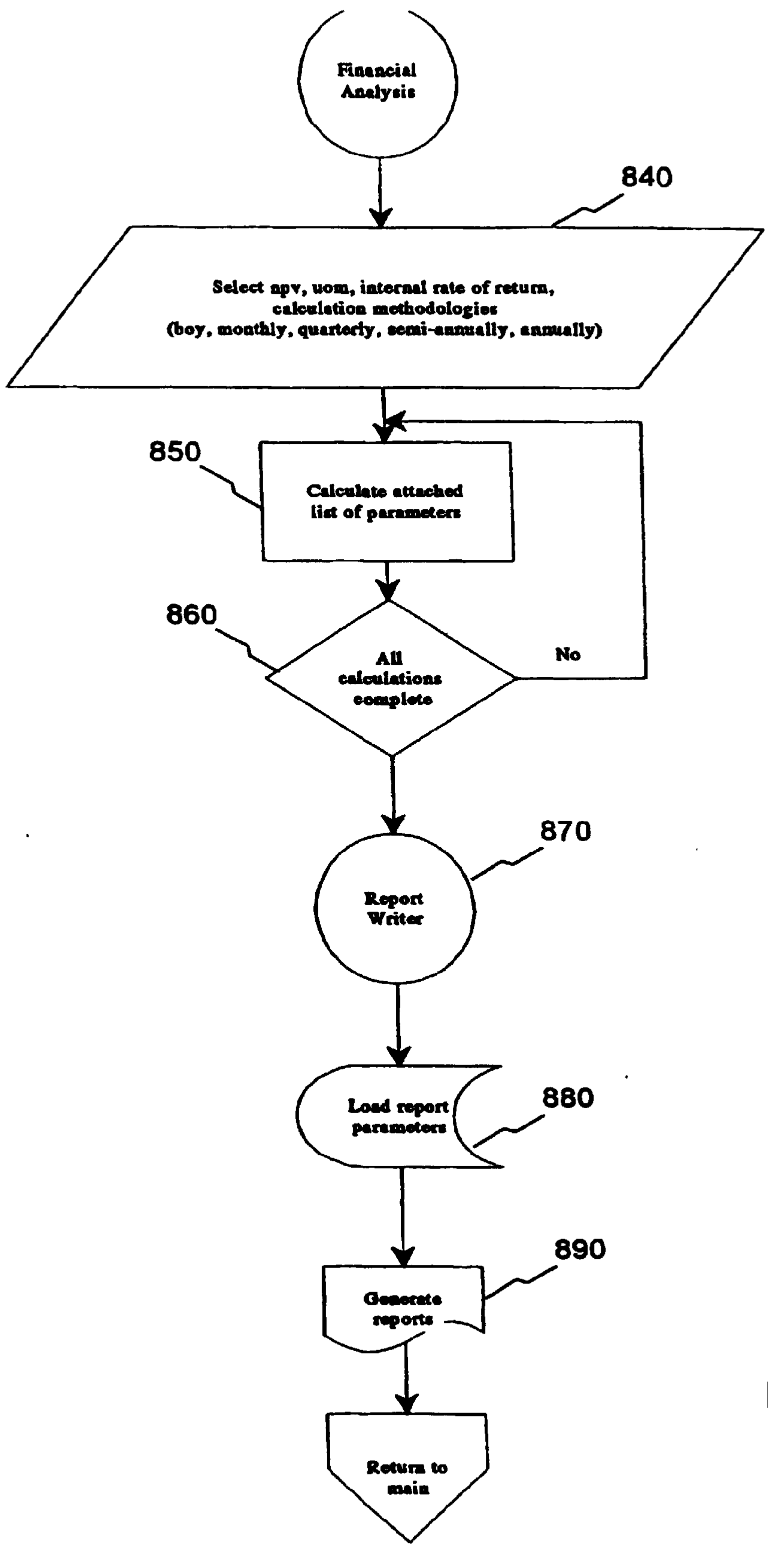

Financial Analysis
840
Select npv, uom, internal rate of return, calculation methodologies (boy, monthly, quarterly, semi-annually, annually)
850
Calculate attached list of parameters
860
All calculations complete
No
870
Report Writer
880
Load report parameters
890
Generate reports
Return to main

FIG. 8b

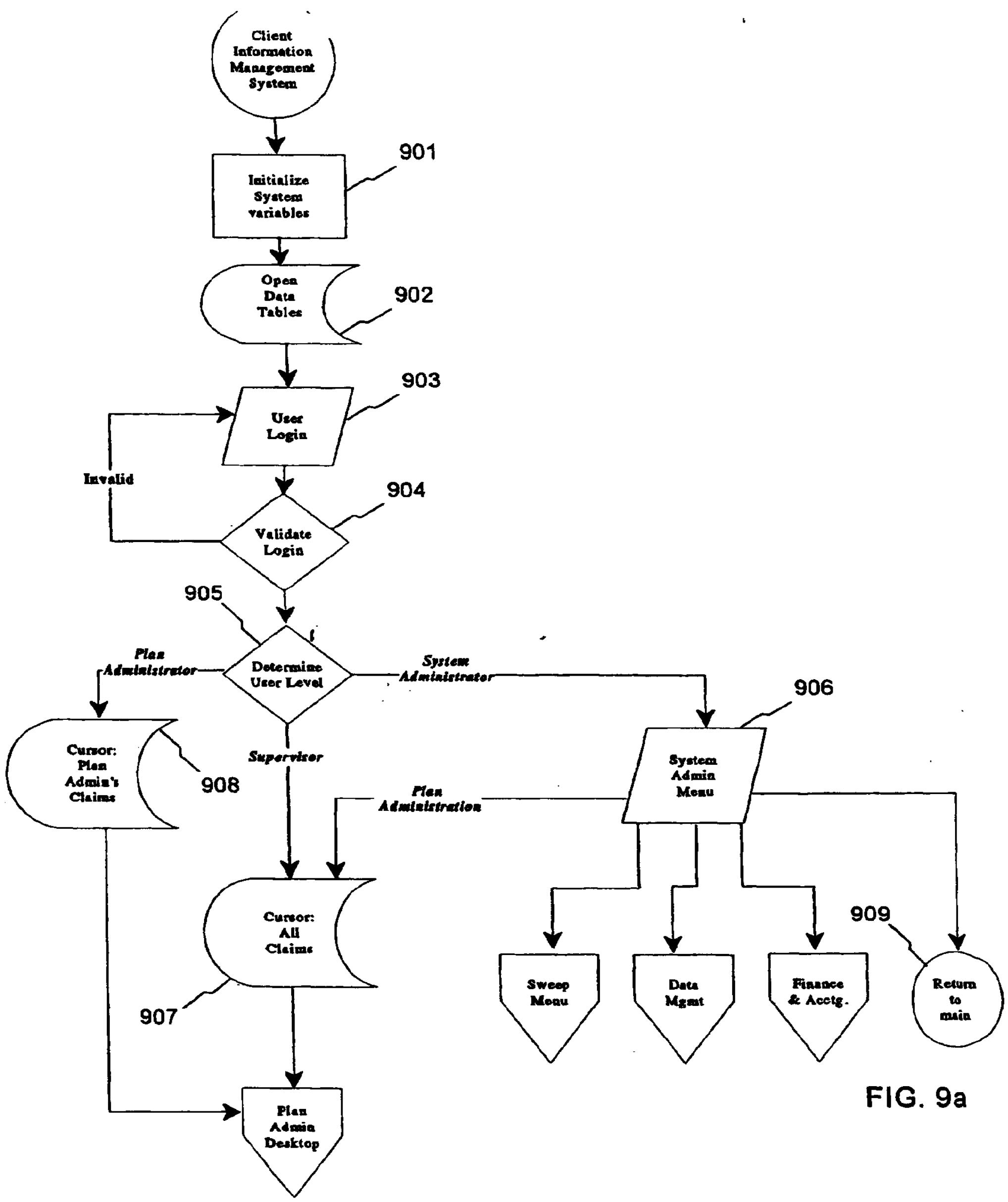

Client Information Management System
Initialize System variables
901
Open Data Tables
902
User Login
903
Invalid
Validate Login
904
905
Determine User Level
Plan Administrator
System Administrator
Supervisor
906
System Admin Menu
Cursor: Plan Admin's Claims
908
Plan Administration
Cursor: All Claims
907
909
Sweep Menu
Data Mgmt
Finance & Acctg.
Return to main
Plan Admin Desktop

FIG. 9a

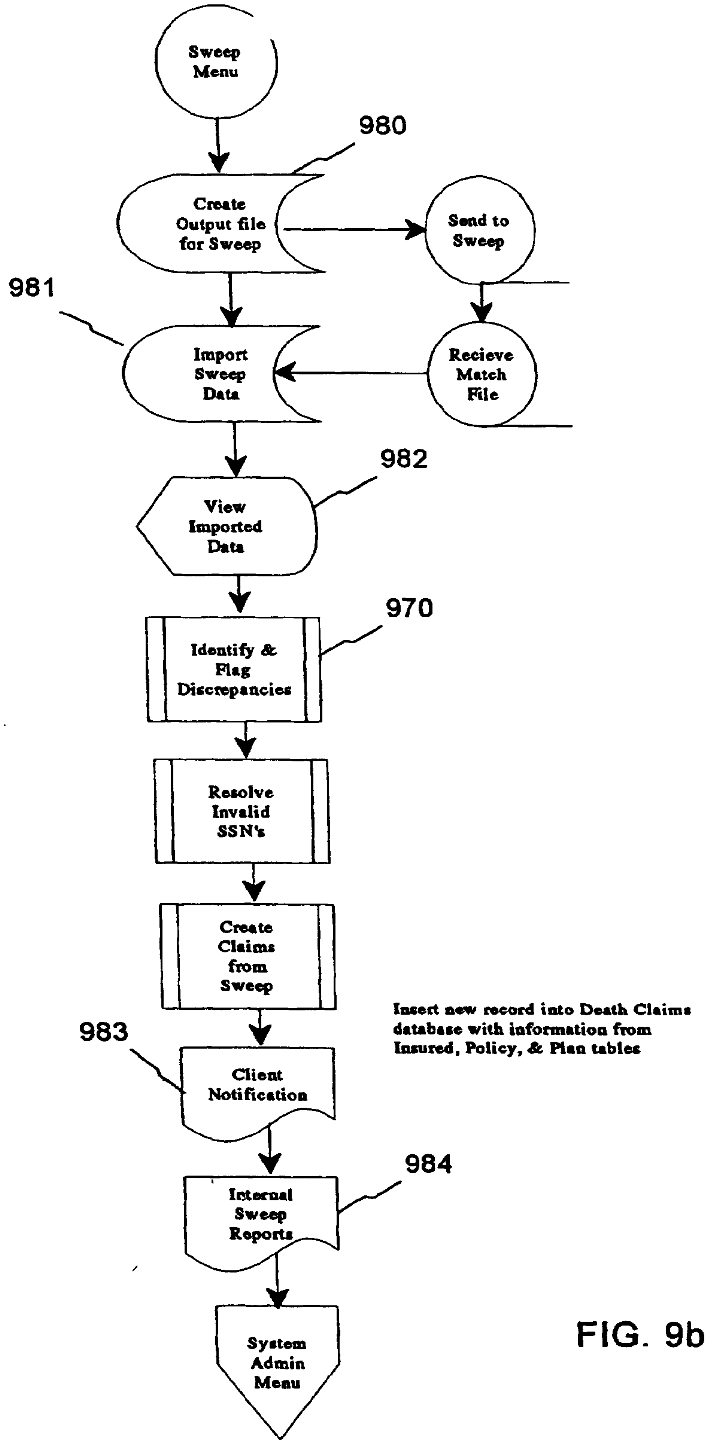

Sweep Menu
980
Create Output file for Sweep
Send to Sweep
981
Import Sweep Data
Recieve Match File
982
View Imported Data
970
Identify & Flag Discrepancies
Resolve Invalid SSN's
Create Claims from Sweep
Insert new record into Death Claims database with information from Insured, Policy, & Plan tables
983
Client Notification
984
Internal Sweep Reports
System Admin Menu

FIG. 9b

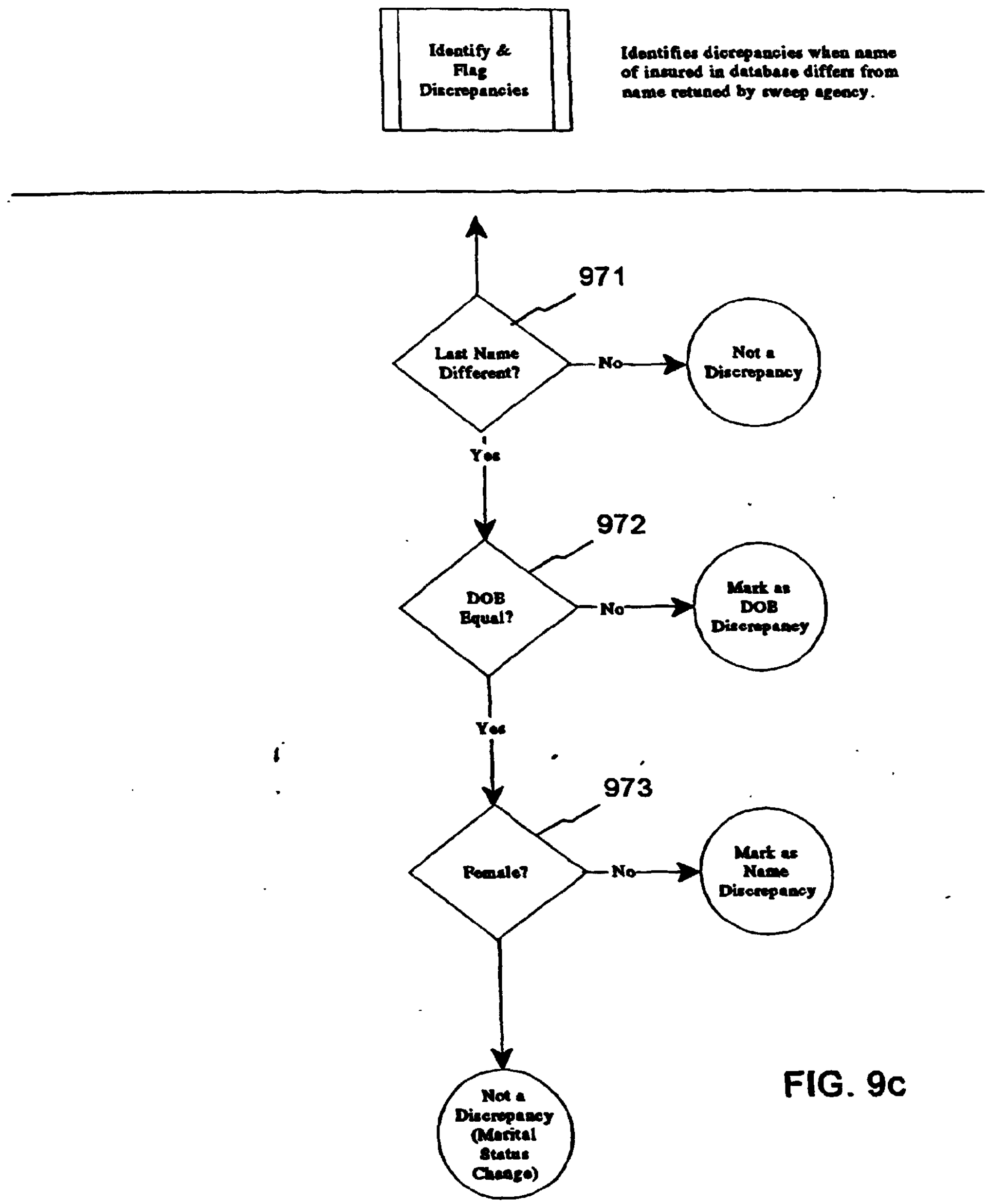

Identify & Flag Discrepancies
Identifies dicrepancies when name of insured in database differs from name retuned by sweep agency.
971
Last Name Different?
No
Not a Discrepancy
Yes
972
DOB Equal?
No
Mark as DOB Discrepancy
Yes
973
Female?
No
Mark as Name Discrepancy
Not a Discrepancy (Marital Status Change)

FIG. 9c

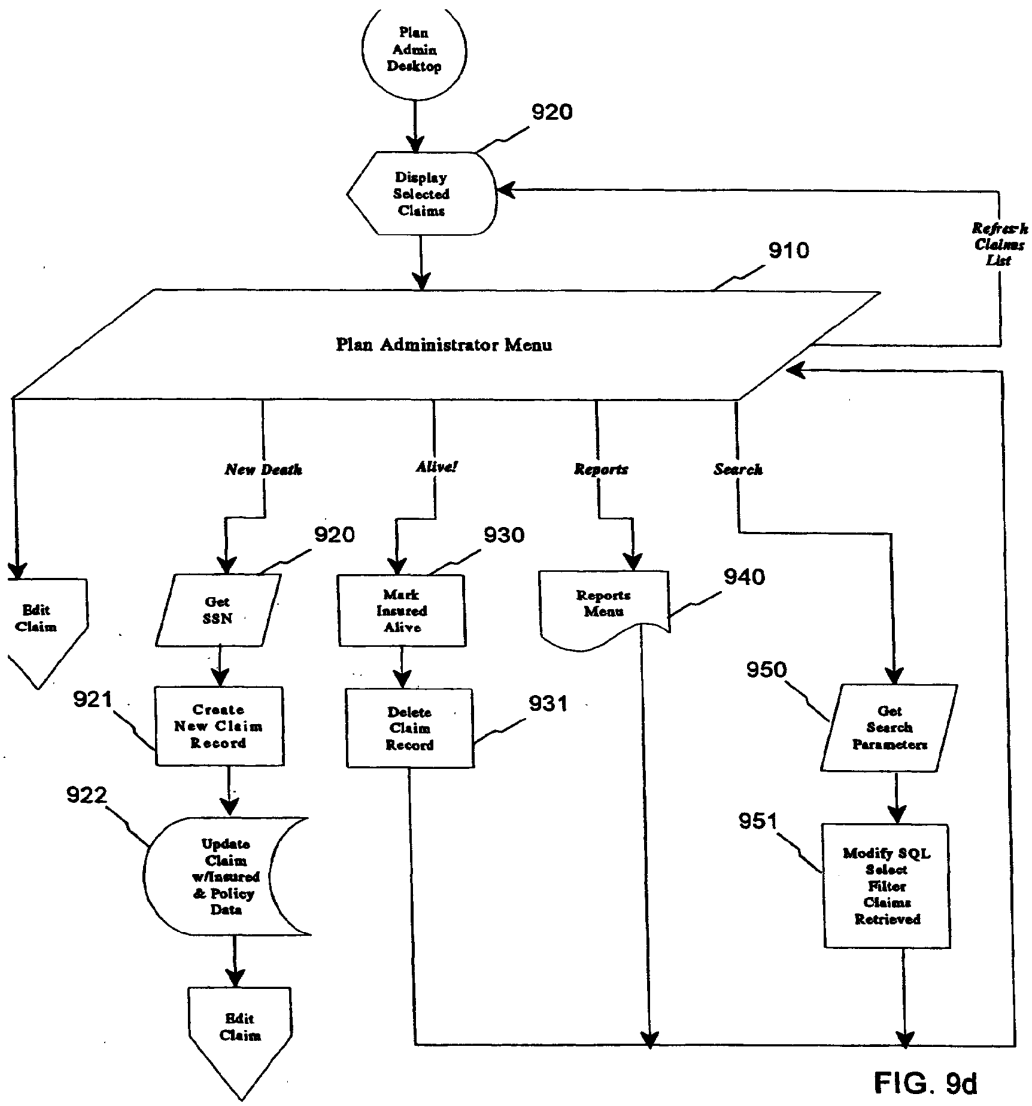

Plan Admin Desktop
920
Display Selected Claims
910
Refresh Claims List
Plan Administrator Menu
New Death
Alive!
Reports
Search
920
930
940
Edit Claim
Get SSN
Mark Insured Alive
Reports Menu
950
921
Create New Claim Record
Delete Claim Record
931
Get Search Parameters
922
951
Update Claim w/Insured & Policy Data
Modify SQL Select Filter Claims Retrieved
Edit Claim

FIG. 9d

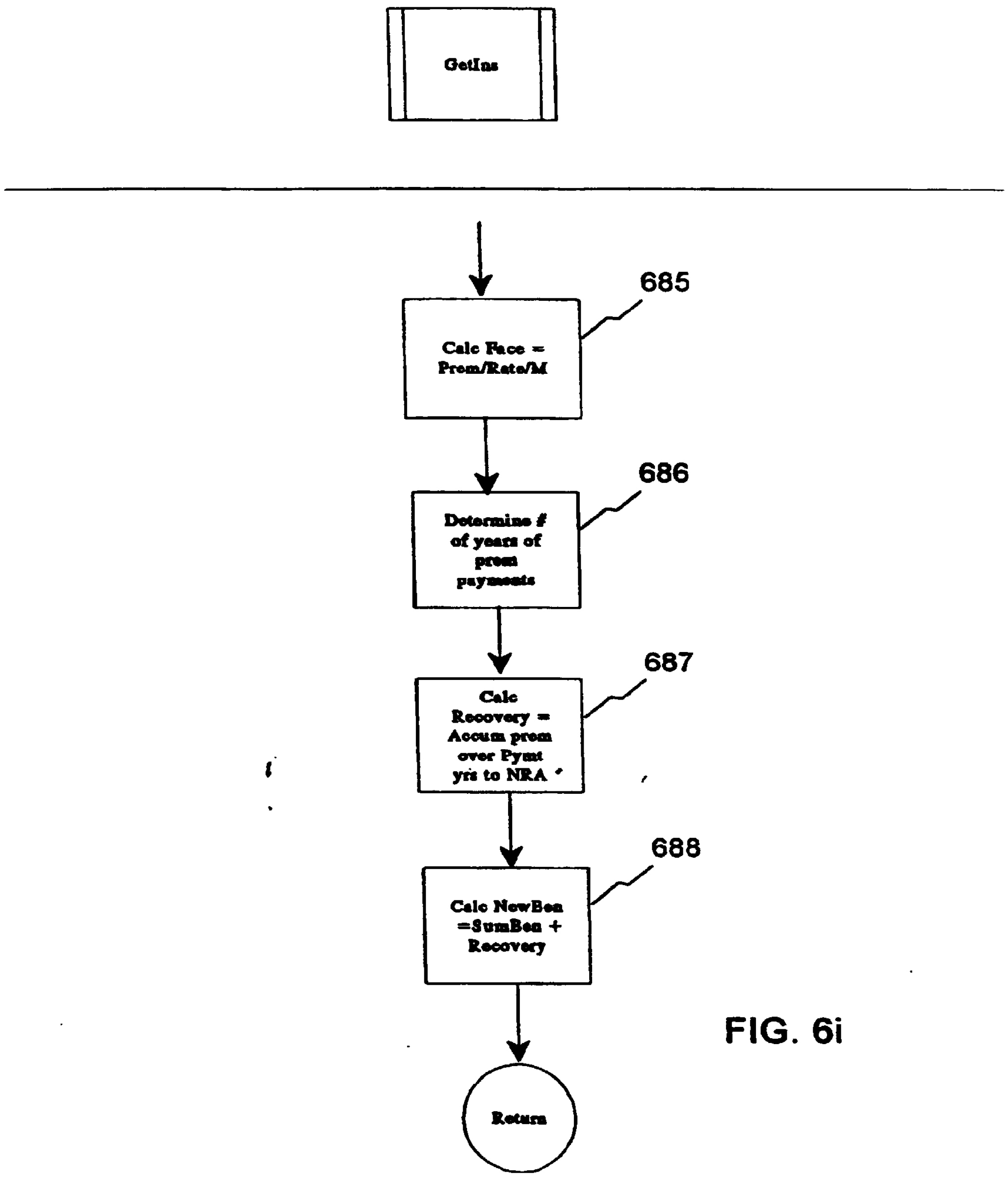

GetIns
685
Calc Face = Prem/Rate/M
686
Determine # of years of prem payments
687
Calc Recovery = Accum prem over Pymt yrs to NRA
688
Calc NewBen =SumBen + Recovery
Return

FIG. 6i

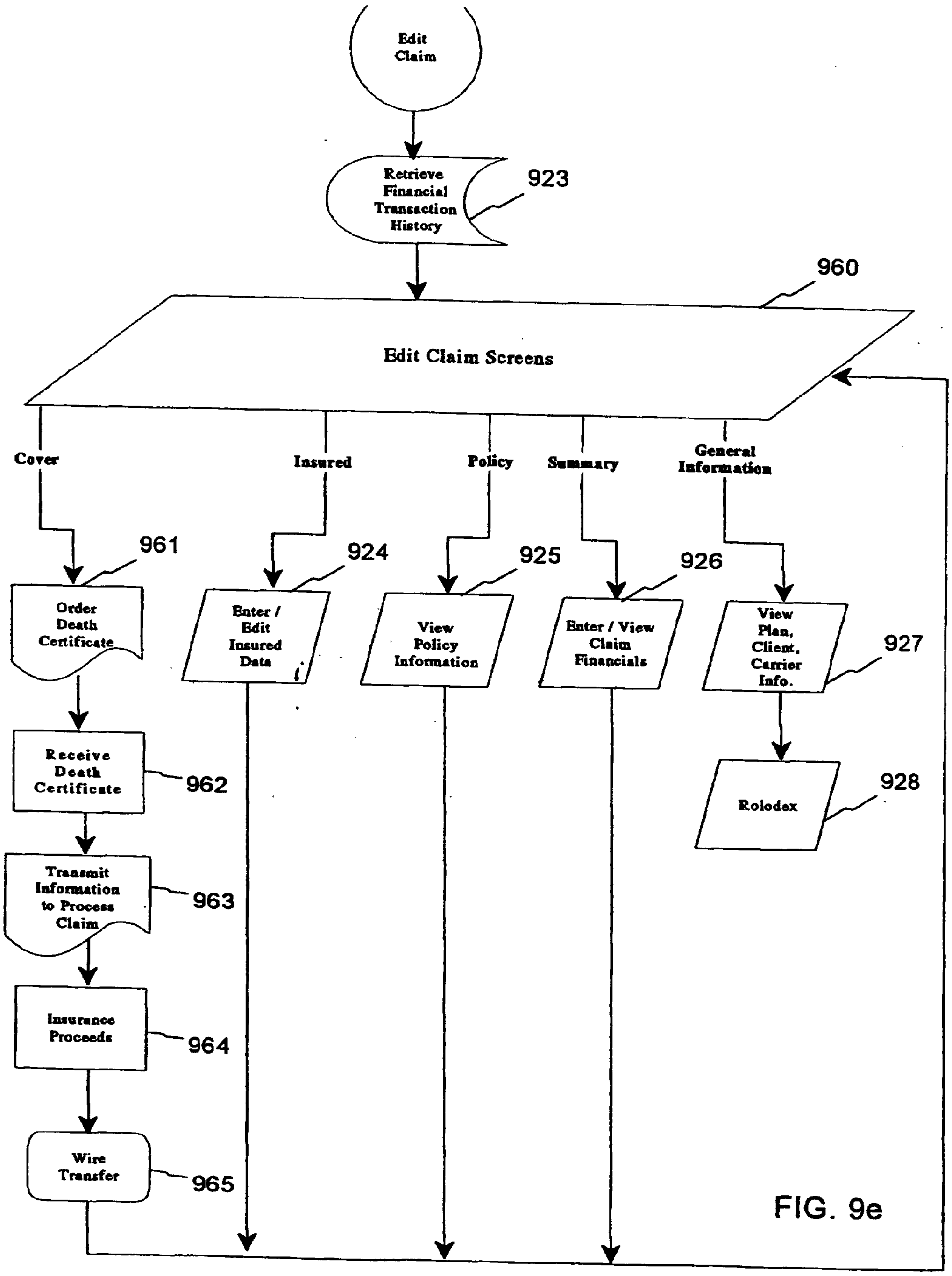

Edit Claim
Retrieve Financial Transaction History
923
960
Edit Claim Screens
Cover
Insured
Policy
Summary
General Information
961
924
925
926
Order Death Certificate
Enter / Edit Insured Data
View Policy Information
Enter / View Claim Financials
View Plan, Client, Carrier Info.
927
Receive Death Certificate
962
Rolodex
928
Transmit Information to Process Claim
963
Insurance Proceeds
964
Wire Transfer
965

FIG. 9e

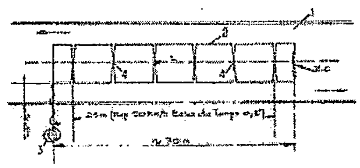
# Installation for individual monitoring of the driving of motor vehicles

**Publication number:** FR2533049 (A1)
**Publication date:** 1984-03-16
**Inventor(s):**
**Applicant(s):** MALON JEAN PIERRE [FR] +
**Classification:**
**- international:** ***G06F17/40; G07C5/08; G08G1/0967;*** **G06F17/40; G07C5/00; G08G1/0962;** (IPC1-7): G07C5/08; B60K35/00; G01P11/02
**- European:** G08G1/052; G06F17/40; G07C5/08R4; G08G1/042
**Application number:** FR19820015307 19820909
**Priority number(s):** FR19820015307 19820909

**Also published as:**
FR2533049 (B3)

Abstract of **FR 2533049 (A1)**

Installation for individual monitoring of the driving of motor vehicles, characterised in that it essentially comprises, on one hand on-board equipment comprising sensor, calculating and recording members, mounted on the said vehicles, and on the other hand fixed infrastructural equipment, 3, 21, intended to selectively supply particular signals to the on-board equipment, on the basis of their installation on the roadway 1, of the type of vehicle involved and the infraction noted.



(19) RÉPUBLIQUE FRANÇAISE

INSTITUT NATIONAL
DE LA PROPRIÉTÉ INDUSTRIELLE

PARIS

(11) N° de publication : **2 533 049**
(à n'utiliser que pour les commandes de reproduction)

(21) N° d'enregistrement national : **82 15307**

(51) Int Cl³ : G 07 C 5/08; B 60 K 35/00; G 01 P 11/02.

# (12) DEMANDE DE BREVET D'INVENTION — A1

(22) **Date de dépôt :** 9 septembre 1982.

(30) **Priorité**

(43) **Date de la mise à disposition du public de la demande :** BOPI « Brevets » n° 11 du 16 mars 1984.

(60) **Références à d'autres documents nationaux apparentés :**

(71) **Demandeur(s) :** *MALON Jean-Pierre.* — FR.

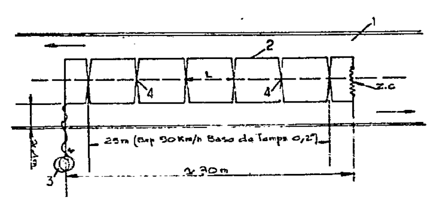
(72) **Inventeur(s) :** Jean-Pierre Malon.

(73) **Titulaire(s) :**

(74) **Mandataire(s) :** Plasseraud.

(54) **Installation pour le contrôle individuel de la conduite des véhicules automobiles.**

(57) Installation pour le contrôle individuel de la conduite des véhicules automobiles, caractérisée en ce qu'elle comporte essentiellement, d'une part des équipements de bord comprenant des organes capteurs, de calcul et enregistreurs, montés sur lesdits véhicules, et d'autre part des équipements fixes d'infrastructure 3, 21, destinés à fournir ponctuellement des signaux particuliers aux équipements de bord, en fonction de leur emplacement sur la chaussée 1, du genre de véhicule concerné, et de l'infraction visée.




FR 2 533 049 - A1

D — Vente des fascicules à l'IMPRIMERIE NATIONALE, 27, rue de la Convention — 75732 PARIS CEDEX 15

Installation pour le contrôle individuel de la conduite des véhicules automobiles.

Depuis maintenant quelques années, les pouvoirs publics, conscients du lourd préjudice social et humain qu'entraînent les accidents de la route, ont été amenés à prendre des mesures diverses afin de lutter contre ce fléau.

Néanmoins, toutes les mesures prises n'ont permis d'aboutir à des résultats substantiels que grâce au contrôle de leur application par les forces de l'ordre. La "peur du gendarme" a, en effet, entraîné un meilleur respect des vitesses ainsi que du code de la route et du port de la ceinture de sécurité. L'ensemble de ces mesures a fait baisser dans de bonnes proportions le nombre d'accidents et de morts, bien que leurs contrôles d'application soient ponctuels, aléatoires, et non permanents.

Il est permis de penser qu'un équipement de contrôle permanent installé à bord de chaque véhicule permettrait d'aboutir à un nouveau palier plus satisfaisant du nombre d'accidents.

Cet équipement, de très faibles dimensions, d'un coût relativement faible, pourrait enregistrer, mémoriser et visualiser en permanence, jour et nuit, tous les jours de l'année et par tout temps l'attitude des conducteurs dont les véhicules en seraient équipés.

Une infrastructure au sol, d'un coût qui apparaît raisonnable devant l'ampleur du fléau, permettrait, en divers points du réseau routier, de contrôler chaque véhicule équipé, d'enregistrer et de mémoriser à bord par exemple les infractions suivantes :

1° - les excès de vitesse de 5 à 25 % ;

2° - les excès de vitesse supérieurs à 25 % ;

3° - les fautes graves telles que le non respect du signal "stop" ou d'un feu rouge, et le franchissement des bandes continues, ces fautes de conduite étant données surtout à titre indicatif, notamment quant aux amplitudes des dépassements de vitesse, qui pourraient être différentes, ou même quant à la nature ou à la gravité des infractions à sanctionner.

L'exploitation de ces informations relevées périodiquement (par exemple touts les six mois) permettrait de définir une échelle de sanctions et une modulation des barèmes d'assurance.

Ce contrôle permanent de l'attitude de conduite ne devrait pas être contraignant ou devenir obsessionnel, la seule attitude à adopter étant enfin le respect du code de la route.

En l'état actuel, il y a probablement une certaine obsession d'une partie des conducteurs, car ceux-ci ont par habitude et par goût tendance à enfreindre ou à jouer avec les règles établies, l'obsession venant du contrôle aléatoire toujours possible, qui leur donne l'impression d'une victoire quant ils ne sont pas pris, et d'une grande injustice quand ils le sont. Ils ont alors l'impression d'être victimes du hasard, qui leur serait tout particulièrement défavorable. De là, ils prétendent que les contrôles se font en des points bien particuliers, le climat général devient mauvais, et le nombre d'accidents reste en très faible diminution.

Le contrôle continu et individuel des attitudes de conduite serait sans discussion possible, les fautes enregistrées étant sans conteste de la seule responsabilité du conducteur. S'il était généralisé, tous les conducteurs seraient égaux devant le code, puisque tous soumis au même contrôle, sans que le hasard intervienne ; ainsi chacun prendrait en charge sa propre responsabilité.

Le but de la présente invention est par suite l'élaboration d'une installation pour le contrôle individuel de la conduite des véhicules automobiles qui satisfasse à ces conditions.

A cet effet, conformément à la présente invention, cette installation comportera essentiellement des équipements de bord comprenant des organes capteurs, de calcul et enregistreurs, montés sur les véhicules, et des équipements fixes d'infrastructure, destinés à fournir ponctuellement des signaux particuliers auxdits équipements de bord, en fonction de leur emplacement sur la chaussée, du genre de véhicule concerné, et de l'infraction visée.

Une installation conforme à l'invention pourra encore être caractérisée en ce qu'un équipement fixé d'infrastructure comprend, à l'emplacement de la chaussée auquel on désire effectuer une surveillance, essentiellement une ligne de transmission divisée en séquences par les croisements successifs, espacés de façon appropriée, en fonction de la vitesse limite imposée audit emplacement, des deux conducteurs qui la constituent, cette ligne étant alimentée en courant alternatif de fréquence déterminée par un poste d'alimentation individuel et étant avantageusement bouclée sur son impédance caractéristique Zc, et en ce que lesdits organes capteurs, qui font partie de l'équipement de bord des véhicules, comprennent chacun deux bobines détectrices branchées de manière à fournir à leur sortie, lors du franchissement de ladite ligne de transmission par le véhicule, des signaux ponctuels qui, après mise en forme par un circuit approprié, fourniront aux organes de calcul et enregistreurs du véhicule (boîtier d'interprétation) des impulsions d'espace dont l'espacement dans le temps sera représentatif, au moins, de la vitesse moyenne dudit véhicule entre les deux croisements correspondants de ladite ligne de transmission et pourra être comparé à un temps de base.

Dans le cas où l'on désirera contrôler les vitesses proprement dites, l'installation pourra se caractériser en outre en ce que ladite ligne de transmission s'étend sur la chaussée (en étant éventuellement incluse dans le revêtement) en chevauchant deux voies de roulement adjacentes, de sorte que, tout en ayant une largeur notablement inférieure à celle de la chaussée, elle puisse permettre un contrôle de la vitesse des véhicules passant sur l'une ou l'autre desdites voies, dans un sens ou dans l'autre.

Quelle que soit l'infraction visée, il pourra être opportun que, sur chaque véhicule équipé, ledit organe capteur soit disposé sous le véhicule de sorte à être à une distance relativement faible de la surface de roulement, et (pour les véhicules ayant le volant à gauche) approximativement au tiers latéral gauche de la largeur du véhicule.

Une installation conforme à l'invention pourra encore se caractériser en ce que la ligne de transmission est divisée en séquences de longueurs égales (croisements des conducteurs équidistants), à l'exception de deux séquences d'identification de longueur notablement plus grande, placées aux extrémités de la ligne et permettant de différencier les limitations de vitesse imposées en fonction du type de véhicule concerné (véhicules à hautes performances, véhicules à performances moyennes, poids lourds).

Selon un mode de réalisation particulièrement avantageux, notamment pour le contrôle du franchissement des bandes continues (d'interdiction de dépassement ou analogues), l'installation pourra se caractériser en ce que la ligne de transmission est disposée au-dessus de ladite bande , en dépassement de chaque côté, mais en étant notablement moins large qu'une ligne de transmission de contrôle de vitesse, et en ce que les séquences ont une longueur réduite, correspondant à une vitesse maximale autorisée très faible (de l'ordre de 10 km/h).

Par ailleurs, pour le contrôle des franchissements interdits sans arrêt, tels que signaux de "Stop" ou feux rouges, ou encore pour le contrôle d'interdiction d'emprunter certaines parties de la chaussée (telles que voies de gauche des chaussées à plusieurs voies pour les poids lourds ou voies d'urgence d'autoroutes pour tous les véhicules sauf les véhicules autorisés), on pourra prévoir, conformément à l'invention, que la ligne de transmission s'étend sur au moins une partie notable de la largeur de la zone à surveiller et est constituée de séquences relativement courtes correspondant à une limitation de vitesse maximale très faible (de l'ordre de

10 km/h).

Avantageusement, pour le contrôle du franchissement des signaux de "Stop", ladite ligne de transmission est située en amont du signal, tandis que, pour le contrôle du franchissement des feux rouges (de carrefours et annalogues), ladite ligne de transmission est située en aval du feu et est contrôlée par l'état dudit feu.

Cette disposition pourra éviter de sanctionner les conducteurs des véhicules qui s'arrêteraient à un feu rouge après une forte décélération.

Toutefois, on peut encore, grâce à l'invention, effectuer un contrôle non plus de la vitesse, mais de la décélération des véhicules, et ceci en prévoyant, à titre de variante, que la longueur des séquences successives de la ligne de transmission suit, vue dans le sens de la circulation , un décrément calculé pour permettre de contrôler la décélération des véhicules.

En tout cas, on pourra toujours prévoir, selon une disposition complémentaire intéressante, que la ligne de transmission présente une configuration qui lui est propre, par exemple quant à la longueur variable et à la répartition des séquences successives qui la composent, ce qui permet de coder les signaux qu'elle fournit et de l'identifier.

Avantageusement, d'autre part, une installation conforme à l'invention pourra aussi être caractérisée en ce que lesdits moyens de calcul et enregistreurs des équipements de bord des véhicules sont du type à circuits logiques en faisant avantageusement appel à la technique des micro-processeurs, et sont associés à des moyens d'affichage, notamment digitaux, permettant au conducteur, ainsi qu'aux autorités concernées, de constater le nombre des pénalités encourues, et éventuellement le temps total de marche du véhicule entre deux contrôles.

Une remise à zéro des compteurs pourra être effectuée par une personne autorisée qui pourra avoir accès à un bouton de remise à zéro, par exemple situé derrière