geschützten Ort, vorzugsweise zentral und/oder mit einer zusätzlichen Abdeckung versehen, im Kraftfahrzeug (1) angebracht ist.

Fig. 1

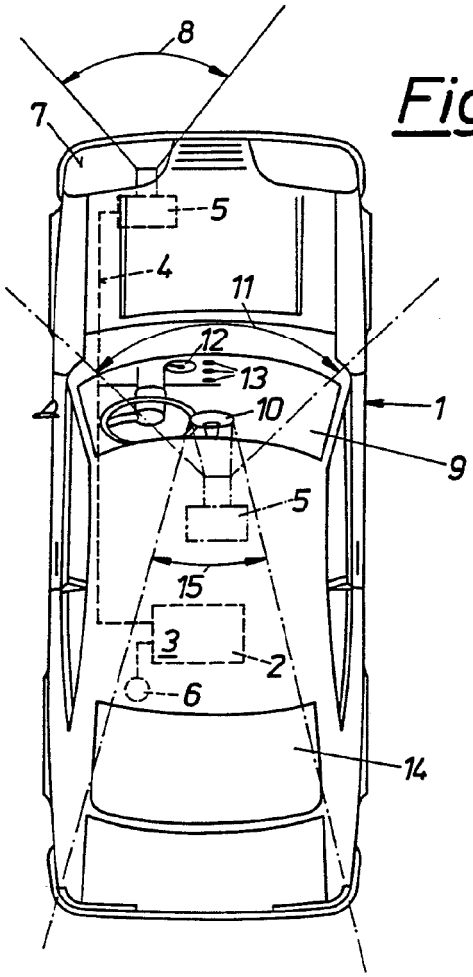
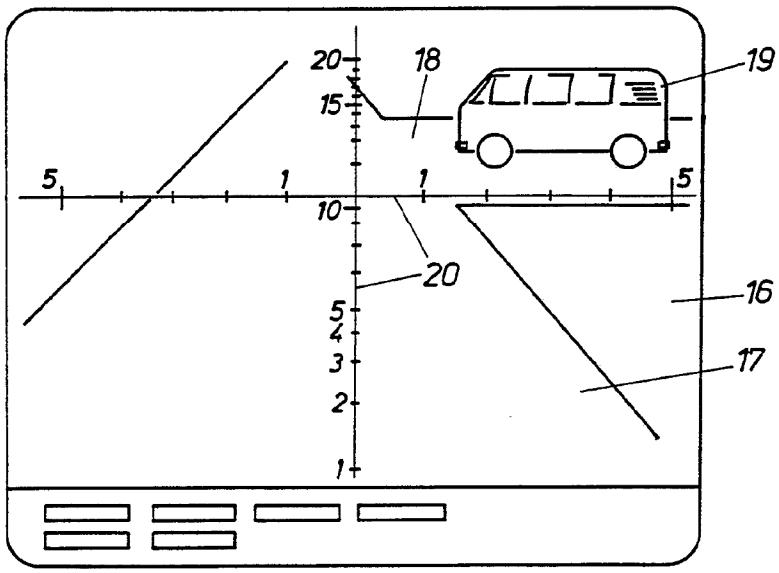


Fig. 2



INTERNATIONAL SEARCH REPORT

International Application No PCT/AT 88/00024

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.[4] G 07 C 5/08; B 60 R 11/04

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
Int.Cl.[4]	G 07 C; G 08 G; B 60 R

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	DE, A, 3015737 (EUMIG) 13 November 1980 see page 7, line 25 - page 9, line 20; page 11, lines 5-11; page 16, lines 1-12; page 20, line 22 - page 21, line 21; figures	1,2,8-10,12
X	Patent Abstracts of Japan, volume 11, No 103 (P-562) (2550), 01 April 1987, & JP, A, 61253419 (TATSUO GO) 11 November 1986	1
A		2,3,8,10,12
Y	EP, A, 0087398 (COLONNELLI) 31 August 1983 see page 2, line 1 - page 3, line 16; figures	1,3,4
Y	Patent Abstracts of Japan, volume 7, No 180 (P-215)(1325), 09 August 1983, &JP, A, 5885110 (MITSUHISA ICHIKAWA) 21 May 1983	1,3,4
A		2,8,10,12
Y	DE, A, 1630943 (PAYET) 25 March 1971 see page 2, line 19 - page 3, line 7 and lines 20-28; page 4, line 20 - page 5, line 10; figures	3,4
A		1

.../...

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
05 August 1988 (29.08.88)	29 August 1988 (29.08.88)
International Searching Authority	**Signature of Authorized Officer**
European Patent Office	

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	DE, A, 3422764 (FISCHER) 02 January 1986 see abstract; page 4, line 21 - page 5, line 20; page 9, lines 1-10; figures	1,4,8-10
A	DE, A, 3342898 (KRAUSS-MAFFEI) 05 June 1985 see abstract	5
A	DE, A, 3503351 (HOELTER) 21 August 1986 see abstract; figures	6
A	FR, A, 2542478 (BELOU) 14 September 1984 see abstract; figures	7
A	DE, A, 2728946 (LEITZ) 18 January 1979 see figures	11
A	DE, A, 3438737 (OCHS) 15 May 1985	
X,P	Patent Abstracts of Japan, Volume 12, No 1 (M-656) (2848), 06 January 1988, & JP, A, 62166135 (FUJI ELECTRIC CO. LTD) 22 July 1987	1,4,8

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. AT 8800024 SA 21989

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 22/08/88 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A- 3015737	13-11-80	Keine	
EP-A- 0087398	31-08-83	Keine	
DE-A- 1630943	25-03-71	Keine	
DE-A- 3422764	02-01-86	Keine	
DE-A- 3342898	05-06-85	Keine	
DE-A- 3503351	21-08-86	DE-A- 3502854	31-07-86
FR-A- 2542478	14-09-84	Keine	
DE-A- 2728946	18-01-79	Keine	
DE-A- 3438737	15-05-85	Keine	

EPO FORM P0479

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/AT 88/00024

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

Int Cl 4 G 07 C 5/08; B 60 R 11/04

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff[7]

Klassifikationssystem	Klassifikationssymbole
Int. Cl.4	G 07 C; G 08 G; B 60 R

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen[8]

III. EINSCHLÄGIGE VERÖFFENTLICHUNGEN[9]

Art*	Kennzeichnung der Veröffentlichung[11], soweit erforderlich unter Angabe der maßgeblichen Teile[12]	Betr. Anspruch Nr.[13]
X	DE, A, 3015737 (EUMIG) 13. November 1980 siehe Seite 7, Zeile 25 - Seite 9, Zeile 20; Seite 11, Zeilen 5-11; Seite 16, Zeilen 1-12; Seite 20, Zeile 22 - Seite 21, Zeile 21; Figuren	1,2,8-10, 12
X	Patent Abstracts of Japan, Band 11, Nr. 103 (P-562)(2550), 2. April 1987, & JP, A, 61253419 (TATSUO GO) 11. November 1986	1
A		2,3,8,10. 12
Y	EP, A, 0087398 (COLONNELLI) 31. August 1983 siehe Seite 2, Zeile 1 - Seite 3, Zeile 16; Figuren	1,3,4
Y	Patent Abstracts of Japan, Band 7, Nr. 180 (P-215)(1325), 9. August 1983,	1,3,4

./.

* Besondere Kategorien von angegebenen Veröffentlichungen[10]:

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IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
5. August 1988	29. 08. 88
Internationale Recherchenbehörde	Unterschrift des bevollmächtigten Bediensteten
Europäisches Patentamt	P.C.G. VAN DER PUTTEN

Formblatt PCT/ISA/210 (Blatt 2) (Januar 1985)

III. EINSCHLÄGIGE VERÖFFENTLICHUNGEN (Fortsetzung von Blatt 2)

Art *	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der maßgeblichen Teile	Betr. Anspruch Nr.
	& JP, A, 5885110 (MITSUHISA ICHIKAWA) 21. Mai 1983	
A	--	2,8,10,12
Y	DE, A, 1630943 (PAYET) 25. März 1971 siehe Seite 2, Zeile 19 - Seite 3, Zeile 7 und Zeilen 20-28; Seite 4, Zeile 20 - Seite 5, Zeile 10; Figuren	3,4
A	--	1
A	DE, A, 3422764 (FISCHER) 2. Januar 1986 siehe Zusammenfassung; Seite 4, Zeile 21 - Seite 5, Zeile 20; Seite 9, Zeilen 1-10; Figuren	1,4,8-10
A	-- DE, A, 3342898 (KRAUSS-MAFFEI) 5. Juni 1985 siehe Zusammenfassung	5
A	-- DE, A, 3503351 (HOELTER) 21. August 1986 siehe Zusammenfassung; Figuren	6
A	-- FR, A, 2542478 (BELOU) 14. September 1984 siehe Zusammenfassung; Figuren	7
A	-- DE, A, 2728946 (LEITZ) 18. Januar 1979 siehe Figuren	11
A	-- DE, A, 3438737 (OCHS) 15. Mai 1985	
X,P	-- Patent Abstracts of Japan, Band 12, Nr. 1 (M-656)(2848), 6. Januar 1988, & JP, A, 62166135 (FUJI ELECTRIC CO. LTD) 22. Juli 1987	1,4,8

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.

AT 8800024
SA 21989

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 22/08/88
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
DE-A- 3015737	13-11-80	Keine	
EP-A- 0087398	31-08-83	Keine	
DE-A- 1630943	25-03-71	Keine	
DE-A- 3422764	02-01-86	Keine	
DE-A- 3342898	05-06-85	Keine	
DE-A- 3503351	21-08-86	DE-A- 3502854	31-07-86
FR-A- 2542478	14-09-84	Keine	
DE-A- 2728946	18-01-79	Keine	
DE-A- 3438737	15-05-85	Keine	

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Für nähere Einzelheiten zu diesem Anhang : siehe Amtsblatt des Europäischen Patentamts, Nr.12/82

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : G07C 5/10	A1	(11) International Publication Number: WO 90/02388
		(43) International Publication Date: 8 March 1990 (08.03.90)

(21) International Application Number: PCT/NO89/00081

(22) International Filing Date: 9 August 1989 (09.08.89)

(30) Priority data:
883807 26 August 1988 (26.08.88) NO

(71) Applicant *(for all designated States except US)*: NORWEGIAN BIOTRONICS A/S [NO/NO]; Hanaveien 4, N-4300 Sandnes (NO).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : PETTERSEN, Kjell [NO/NO]; Hanaveien 4, N-4300 Sandnes (NO).

(74) Agent: HÅMSØ, Eivind; Håmsø Patentbyrå, P.O. Box 171, N-4301 Sandnes (NO).

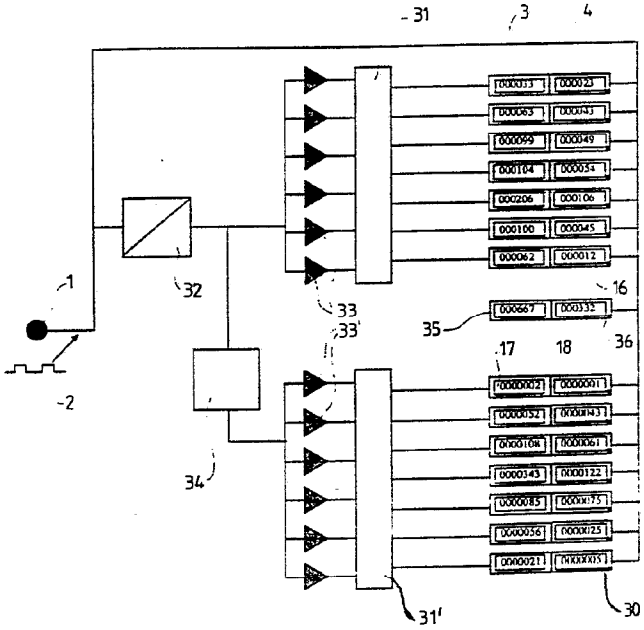
(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (European patent), DK, FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.

(54) Title: A METHOD FOR THE REGISTERING OF THE DRIVING PATTERN OF A MOTOR VEHICLE, AND AN APPARATUS IN THE FORM OF AN INTERVAL COUNTER FOR CARRYING OUT THE METHOD

(57) Abstract

A method and an apparatus for the registering of the driving pattern of a motor vehicle are adjusted to enable an evaluation of the total driving behavior. The speeds and the accelerations/retardations of the motor vehicle are being converted into pulse signals (2) and sorted into two different groups, one speed counter group (3-16) and one acceleration/retardation counter group (17-30), each being divided into sub-groups indicating number of kilometers driven within a first, a second, a third, etc., speed interval and a first, a second, a third, etc., acceleration/retardation interval, respectively. The sum of the kilometer statements of the sub groups of each group corresponds to the totally driven distance of the motor vehicle measured in kilometers. The apparatus comprises a pulse generator (1) adapted to be mountd to the propulsion system of the motor vehicle, e.g. wheels or gear box, and adapted to supply a pulse signal (2) simultaneously to all counters of both groups, each of which is assigned a logic circuit (31, 31′) controlled by comparators (33, 33′). The pulse generator (1) is connected to the comparators (33) of the speed counters via a pulse frequency/voltage-converter (32) connected to the comparators (33′) of the acceleration/retardation counters via a derivation circuit (33′) deriving speed into acceleration/retardation.



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A METHOD FOR THE REGISTERING OF THE DRIVING PATTERN OF A MOTOR VEHICLE, AND AN APPARATUS IN THE FORM OF AN INTERVAL COUNTER FOR CARRYING OUT THE METHOD

This invention relates to a method for the registering of the driving pattern of a motor vehicle, and an apparatus in the form of an interval counter for carrying out the method.

Recording of the driving pattern of a motor vehicle may be of interest for car owners as well as car insurance companies. The car insurance companies may fit the motor vehicles of their policy holders with the apparatus and read the same at equal intervals. On the basis of these readings, the company may e.g. set a more fair bonus arrangement, i.e. that policy holders having a "careful" driving pattern - low speeds and low accelerations - may be allotted a higher bonus. By that very fact that the policy holders know that their driving pattern is being controlled and recorded, many will be stimulated to change their driving pattern; this will again reduce driving speed, number of accidents, and consequently also the size of the disbursements from the insurance companies. Moreover, when leasing or renting motor vehicles it will be possible to control how the driving has occured. When motor vehicles are to be resold, the apparatus will give an indication of how the motor vehicle has been driven, whereby favorable/unfavorable driving pattern may influence the selling price quite substantially. Car owners may also take an interest in seeing their own driving pattern, for possibly comparing it with others.

The object of the present invention is to provide a method and an apparatus for the registering of the driving patterns of motor vehicles and thereby enable an evaluation of the total driving behavior.

This object is achieved through the features as set forth in the following claims.

In contrast with prior art apparatus for the purpose concerned, which only measure speed above a certain limit, i.e. record speed excesses and take note of these, the method and apparatus according to the invention are based on the registering of speed and acceleration/retardation and and on the sorting of these in different groups.

The apparatus uses the speed of the motor vehicle, i.e. driven distance per unit of time, to generate data describing the driving pattern of the motor vehicle. The apparatus is connected to the propulsion system of the motor vehicle, i.e. wheels or gear box, via a pulse generator adapted to generate a signal proportional to the speed of the motor vehicle. This signal is processed further in the apparatus so that individual kilometer counters are incremented; there being one counter for each speed interval, e.g. 0-10 km/h; 10-20 km/h and so forth. The sum of all counters will constitute the totally driven distance.

On the basis of the speed signal, the apparatus also generates a signal representing the acceleration/retardation (the time derivative of the speed) of the motor vehicle. This signal will be positive when accelerating and negative when decelerating. The acceleration/retardation-signal controls the kilometer counters counting the number of kilometers driven by the motor vehicle in the different areas of acceleration/retardation. Thus, the apparatus comprises two sets of counters, one set of which is

controlled by the speed signal of the motor vehicle, the other set being controlled by the acceleration/retardation-signal of the motor vehicle. Both sets of counters count the number of kilometers driven. By reading the apparatus, one may form oneself an idea of the driving pattern of the motor vehicle, the apparatus stating exact number of kilometers in the different speed zones and acceleration/retardation zones.

The interval counter according to the invention is far more versatile and advanced than prior art technique; this should also appear from the following description of an embodiment of the invention.

Said embodiment is diagrammatically illustrated in the accompanying drawing figure showing a circuit design of an interval counter for motor vehicles.

The interval counter shown comprises a pulse generator 1 which, in a manner not closer shown, is fitted for mounting on a propulsion system of a motor vehicle, i.e. wheels or gear box. The pulse generator 1 having a pulse frequency proportional to the speed of the vehicle, is adapted to give a certain number of pulses per kilometers driven.

Reference numeral 2 denotes a square wave puls from the pulse generator 1. The pulse signal 2 is simultaneously supplied to all of a row of counters.

The counters comprise fourteen speed counters 3, 4 ....16 in two sets, one set of which can be reset to zero, as well as fourteen acceleration/retardation counters 17, 18 ....30 in two sets, one set of which can be reset to zero, and being arranged in two separate groups each of which is assigned a logic circuit 31 and 31', respectively. When supplying the pulse signal 2, only one speed counter, say 3, and one

acceleration/retardation counter, say 17, activated at a time. The respective logic circuit 31, 31' controls which counter that is counting.

The pulse signal 2 enters simulatenously a pulse frequency/ voltage converter 32 adapted to convert from pulse frequency to voltage. From the voltage converter 32, a voltage signal proportional to the speed of the motor vehicle is generated. This voltage signal is supplied to a set of comparators 33 assigned the logic circuit 31 for the speed counters 3, 4 .... 16. The comparators 33 are each set on a separate speed level. The signal from these comparators 33 controls the logic circuit 31 which selects which of the speed counters that is to be active.

The voltage signal from the converter 32 is also supplied to a derivation circuit 34. From this circuit 34, a voltage signal proportional to the acceleration/retardation of the motor vehicle is achieved. This voltage signal is supplied to a set of comparators 33' assigned the logic circuit 31' for the acceleration/retardation counters 17, 18 ....30. The signal from these comparators 33' controls the logic circuit 31' which selects which of the acceleration/retardation counters that is to be active.

The apparatus/interval counter shown is likewise equipped with a total counter 35 acting as an ordinary kilometer counter. The sum of the speed counters 3, 4 .... 16 will show the very same distance driven as the total counter 35.

As mentioned, one set of counters in each group may be reset to zero. Also the total counter 35 is assigned such a counter 36. The resetable counters are being counted up in parallel to the other counters and will show the same figure. The only difference is that the users of the apparatus have the opportunity of resetting these counters

whenever this might be desirable. These counters will function in the same manner as a trip counter on a motor vehicle.

For the speed counters, an actual division would be in speed groups of 10 km/h, i.e. that a first counter counts the number of kilometers driven in the speed interval of 0-10 km/h, a second counter counting number of kilometers driven in the speed interval 10-20 km/h, and so forth. In order to restrict the number of counters, the apparatus may possibly be so adapted that all kilometers driven above an upper speed limit, e.g. 180 km/h, are counted by one counter.

For the acceleration/retardation counters, an actual division may be into accelerations/retardations from -10 $m/sec.^2$ to +10 $m/sec.^2$, using an interval width of 1 $m/sec.^2$

The physical implementation of the apparatus might comprise more counters than shown in the figure. However, only one display may be used and one multiplexer fetching one figure at a time. The method fo the invention may also be carried out using a microprocessor.

C l a i m s

1. A method for the registering of the driving pattern of a motor vehicle, i.e. the number of kilometers driven within a first, a second, a third, etc., speed interval, and the number of kilometers driven within a first, a second, a third, etc., acceleration/retardation interval, c h a r a c t e r i z e d i n that the speeds and accelerations/retardations of the motor vehicle are converted into pulse signals and sorted into different groups, each of which being divided into sub groups stating the number of kilometers driven within a first, a second, a third, etc., speed interval and a first, a second, a third, etc., acceleration/retardation interval, respectively, the sum of each group's sub groups' kilometer statements corresponding to the totally driven distance of the motor vehicle measured in kilometers.

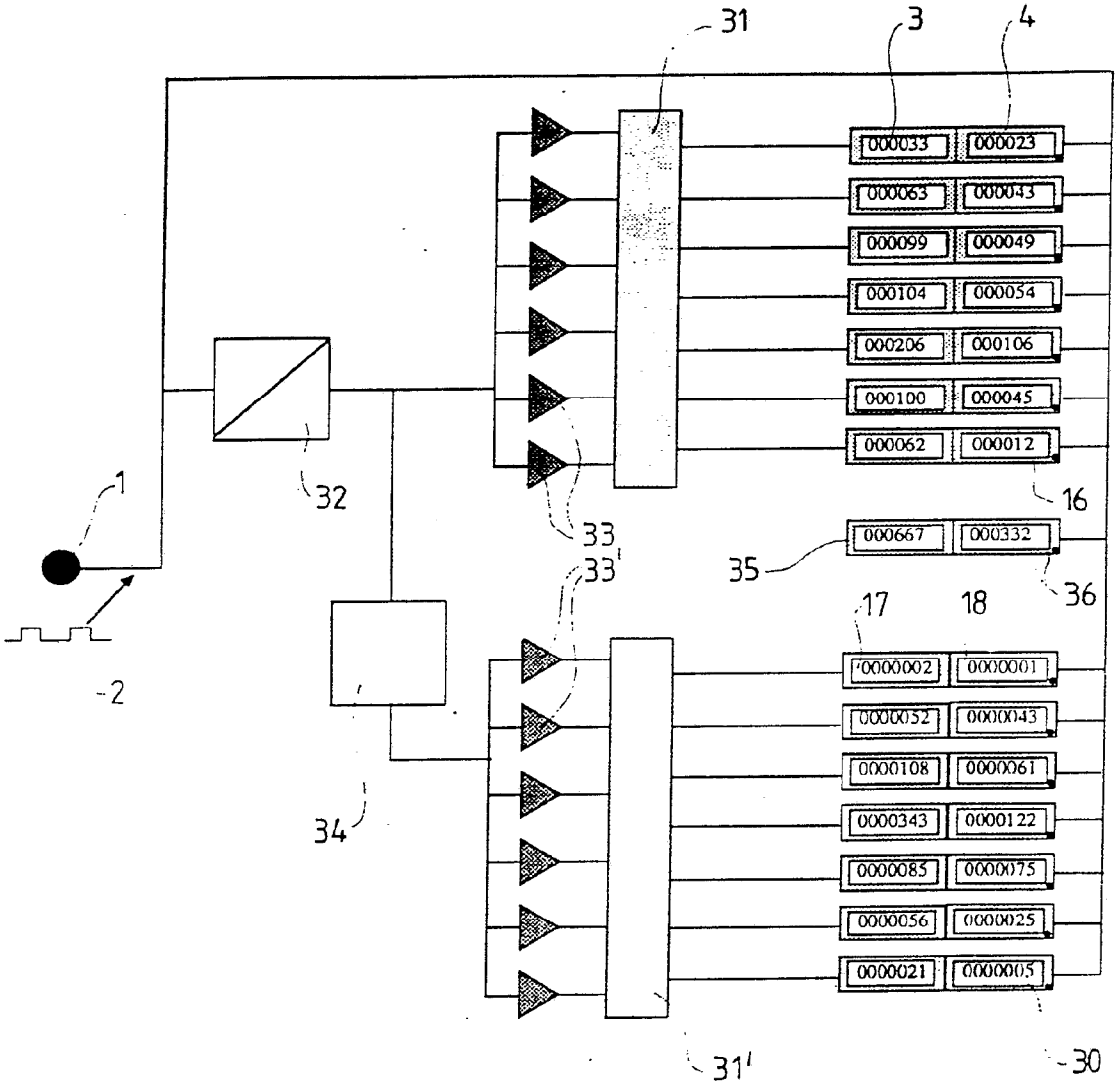
2. An apparatus for carrying out the method as defined in claim 1, c h a r a c t e r i z e d i n that it comprises two groups of counters (3-16, 17-30), one speed counter group (3-16) and one acceleration/retardation counter group (17-30), each assigned their separate logic circuit (31, 31') controlled by comparators (33, 33'), the comparators (33) of the speed counter group each being set at a separate speed level (e.g. 0-10 km/h, 10-20 km/h, etc.), the comparators (33') of the acceleration/retardation counter group each being set at a separate acceleration/retardation level (e.g. -1m/sec. , +1m/sec. , etc.), a pulse generator (1) having a pulse frequence proportional to the speed of the motor vehicle being adapted for mounting to the propulsion system of the motor vehicle, preferably wheels or gear box, and adapted to give a pulse signal (2) simultaneously to all counters of both groups, said pulse generator (1) being connected to the comparators (33) of the speed counters via a pulse frequence/voltage-converter (32)

connected to the comparators (33') of the acceleration/ retardation counters via a derivation circuit (34) deriving speed into acceleration/retardation.

3. Apparatus in accordance with claim 2, c h a r a c t e r i z e d i n that each counter of said two groups in series is connected to a similar counter resetable to zero.

4. Apparatus in accordance with claim 2 or 3, c h a r a c t e r i z e d i n that it is equipped with a total counter (35), to which, preferably, a resetable total counter (36) is connected in series, said total counters acting as ordinary kilometer counters.

1/1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INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 89/00081

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC4: G 07 C 5/10

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC4	G 07 C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE,DK,FI,NO as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4644368 (MUTZ) 17 February 1987, see column 7, line 59 - column 8, line 19; figure 4 --	1,2
A	EP, A2, 0189204 (CATERPILLAR MITSUBISHI LTD) 30 July 1986, see page 13, line 5 - line 11 --	1,2
A	EP, A2, 0129949 (HIDDEN-1 (PROPRIETARY) LIMITED) 2 January 1985, see page 13, line 3 - line 25 --	1,2
A	WO, A1, 87/04253 (TACOM LTDA) 16 July 1987, see page 6, line 26 - page 7, line 6 --	1,2

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* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1989-11-24	1989 -11- 30
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	HANS BANDELIN

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/NO 89/00081

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 4644368	17/02/87	DE-A-	3505068	19/06/86
		EP-A-	0191413	20/08/86
		JP-A-	61190687	25/08/86
EP-A2- 0189204	30/07/86	JP-A-	61170883	01/08/86
		CA-A-	1247743	27/12/88
		US-A-	4853859	01/08/89
		JP-A-	61170884	01/08/86
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EP-A2- 0129949	02/01/85	AU-D-	26062/84	20/12/84
WO-A1- 87/04253	16/07/87	AU-D-	68410/87	28/07/87
		EP-A-	0256026	24/02/88

ARRANGEMENT FOR RECORDING CAR DRIVING DATA WITH A TIME RESOLUTION ADAPTED TO THE SHAPE OF ANALOG MEASUREMENT SIGNALS

Patent number: WO9310510 (A1)
Publication date: 1993-05-27
Inventor(s): GRULER MARTIN [DE]; BACIC HELMUT [DE]; SCHULTZE HARTMUT [DE] +
Applicant(s): MANNESMANN KIENZLE GMBH [DE] +
Classification:
- international: ***G01D9/00; G06F17/40; G07C5/00; G07C5/08;*** **G01D9/00; G06F17/40; G07C5/00;** (IPC1-7): G07C5/08
- european: G07C5/08R2
Application number: WO1992EP02529 19921104
Priority number(s): DE19914136968 19911111

Also published as:
DE4136968 (C1)
ZA9208701 (A)
US5412570 (A)
SK72893 (A3)
PL169679 (B1)
more >>

Cited documents:
GB2046914 (A)
WO8805196 (A1)
GB2055469 (A)
FR2574928 (A1)
EP0118818 (B1)

Abstract not available for WO 9310510 (A1)
Abstract of correspondent: **DE 4136968 (C1)**

In order to record vehicle driving data with a higher resolution, in particular at the beginning of an accident, a memory control is disclosed which permanently scans with two different frequencies (f1 and f2) the analog measurement signals (1) detected by a measurement sensor of a data processing device suitable for a vehicle, once the analog signals have been digitalized, and which stores them in two parallel ring memories (22 and 23) clocked at the f1 and f2 frequencies. When an accident is recognized, the ring memory (22) clocked at the slower frequency is stopped once a determined follow-up time (9) has elapsed, and at the same time data storage in the ring memory (23) clocked at the higher frequency is immediately interrupted and transferred to another semiconductor memory (26) in order to maintain high-frequency data recording for the duration of the accident phase.

PCT WELTORGANISATION FÜR GEISTIGES EIGENTUM
Internationales Büro
INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

(51) Internationale Patentklassifikation 5 : G07C 5/08

A1

(11) Internationale Veröffentlichungsnummer: WO 93/10510

(43) Internationales Veröffentlichungsdatum: 27. Mai 1993 (27.05.93)

(21) Internationales Aktenzeichen: PCT/EP92/02529

(22) Internationales Anmeldedatum: 4. November 1992 (04.11.92)

(30) Prioritätsdaten:
P 41 36 968.8 11. November 1991 (11.11.91) DE

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(81) Bestimmungsstaaten: AU, BR, CA, CS, FI, HU, JP, KR, NO, PL, US, europäisches Patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE).

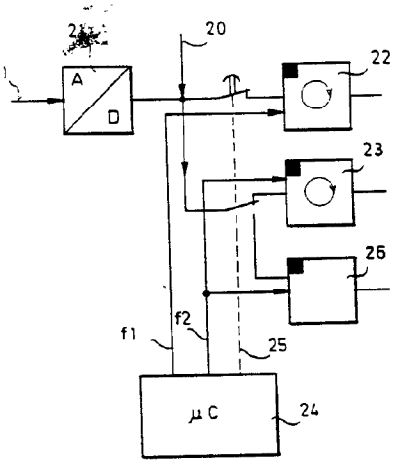
Veröffentlicht
Mit internationalem Recherchenbericht.

(54) Title: ARRANGEMENT FOR RECORDING CAR DRIVING DATA WITH A TIME RESOLUTION ADAPTED TO THE SHAPE OF ANALOG MEASUREMENT SIGNALS

(54) Bezeichnung: ANORDNUNG ZUR REGISTRIERUNG VON FAHRDATEN MIT EINER DER SIGNALFORM VON ANALOGEN MESSSIGNALEN ANPASSENDEN ZEITLICHEN AUFLÖSUNG

(57) Abstract

In order to record vehicle driving data with a higher resolution, in particular at the beginning of an accident, a memory control is disclosed which permanently scans with two different frequencies (f1 and f2) the analog measurement signals (1) detected by a measurement sensor of a data processing device suitable for a vehicle, once the analog signals have been digitalized, and which stores them in two parallel ring memories (22 and 23) clocked at the f1 and f2 frequencies. When an accident is recognized, the ring memory (22) clocked at the slower frequency is stopped once a determined follow-up time (9) has elapsed, and at the same time data storage in the ring memory (23) clocked at the higher frequency is immediately interrupted and transferred to another semiconductor memory (26) in order to maintain high-frequency data recording for the duration of the accident phase.



(57) Zusammenfassung

Zur höher auflösenden Registrierung von Fahrdaten, insbesondere zu Beginn von Unfallsituationen, wird eine Speichersteuerung vorgeschlagen, die die analogen Meßsignale (1), die von einer sensorischen Meßeinrichtung eines fahrzeugtauglichen Datenerfassungsgerätes erfaßt werden, nach ihrer Digitalisierung permanent mit zwei unterschiedlichen Frequenzen (f1 und f2) abtastet und in zwei parallel angeordneten, mit f1 und f2 getakteten Ringspeichern (22 und 23) speichert. Beim Erkennen eines Unfallereignisses wird der langsamer getaktete Ringspeicher (22) nach einer festgelegten Nachlaufzeit (9) gestoppt, gleichzeitig die Datenspeicherung des schnell getakteten Ringspeichers (23) sofort unterbrochen und zur Fortsetzung der schnell getakteten Registrierung für die Dauer der Unfallphase auf einen weiteren Halbleiterspeicher (26) umgeschaltet.

LEDIGLICH ZUR INFORMATION

Code, die zur Identifizierung von PCT-Vertragsstaaten auf den Kopfbögen der Schriften, die internationale Anmeldungen gemäss dem PCT veröffentlichen.

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Anordnung zur Registrierung von Fahrdaten mit einer der Signalform von analogen Meßsignalen anpassenden zeitlichen Auflösung

Die Erfindung betrifft eine Anordnung gemäß dem Oberbegriff des Hauptanspruchs.

Ein Datenerfassungsgerät zur Registrierung von Fahrdaten, die insbesondere im Hinblick auf Unfallsituationen für eine objektive Klärung der Schuldfrage den Unfallhergang durch Rekonstruktion der Bewegungsbahn des Fahrzeugs beweisbar machen sollen, wird durch die Meßsignale seiner Sensoren, die die Fahrdynamik des Fahrzeugs fortlaufend erfassen, im wesentlichen mit zwei signifikant unterschiedlichen Signalformen beaufschlagt.

Im normalen Fahrbetrieb werden überwiegend niederfrequente Signale mit relativ kleiner Signalamplitude erfaßt, die in der Regel über einen größeren Zeitraum aufzuzeichnen sind, wohingegen sich eine Unfallsituation dadurch auszeichnet, daß meist bedingt durch einen Stoßvorgang während eines kurzen Zeitraums höherfrequente Signale mit verhältnismäßig großer Signalamplitude zur Registrierung anstehen.

Da zum einen an ein derartiges Datenerfassungsgerät die Anforderung zu stellen ist, möglichst viele Daten aufzeichnen zu können, andererseits aber gerade bei einem kostensensiblen, für die breite Anwendung bestimmten fahrzeugtauglichen Gerät die Speicherkapazität in einem wirtschaftlich vertretbaren Rahmen gehalten werden muß, ergibt sich die Notwendigkeit, nach Anordnungen zu suchen, die eine Lösung für diese gegensätzlichen Forderungen aufzeigen.

Aus der EP-118 818 B1 ist bekannt, daß die von einem Unfalldatenschreiber sensorisch erfaßten Meßsignale in einem festen Takt abgetastet und als Fahrdaten abgespeichert werden. Eine fest eingestellte Taktfrequenz kann jedoch den oben genannten Forderungen nicht gerecht werden. Eine einzige für den

normalen Fahrbetrieb gewählte Taktfrequenz kann eine Unfallsituation, deren signifikante, analoge Meßsignale meist nur weniger als 1 Sek. anstehen, nicht ausreichend genau erfassen, weil die Auflösung, d. h. die Anzahl der zur Abspeicherung gelangenden Meßpunkte zu gering ist. Würde man hingegen ständig eine hohe Abtastrate wählen, erhielte man eine kaum sinnvolle Datenflut, die nur aufwendig zu handhaben ist.

Es mag nun der Gedanke aufkommen, die Abtastrate beim Eintritt des Unfallereignisses einfach angemessen zu erhöhen. Jedoch hat diese Maßnahme den erheblichen Nachteil, daß durch die unvermeidbare Reaktionszeit für den Frequenzsprung, die sich aus der benötigten Dauer zur Erkennung des Unfallereignisses, den elektronischen Signallaufzeiten und der Anschwingphase für die höhere Abtastfrequenz ergibt, gerade die Meßsignale der Anfangsphase des Unfallereignisses nicht hochauflösend erfaßt werden können.

Der Erfindung liegt nun die Aufgabe zugrunde, die bekannte Anordnung zur Registrierung von Fahrdaten so auszubilden, daß unter Berücksichtigung der begrenzten Speicherkapazität eine hohe zeitliche Auflösung der Signalform des analogen Meßsignals bei Auftreten eines Unfallereignisses bereits in dessen Anfangsphase sichergestellt ist.

Die Aufgabe wird durch die kennzeichnenden Merkmale des ersten Anspruchs gelöst. Die Unteransprüche zeigen vorteilhafte Weiterbildungen.

Die erfindungsgemäße Lösung stellt durch die permanent mit beiden Frequenzen in die Ringspeicher eingelesenen Daten sicher, daß die Meßsignale einer Unfallsituation bereits im Zeitpunkt ihres Entstehens mit einer hohen Abtastrate erfaßt werden. Durch die Unfalldetektion wird also kein Frequenzsprung ausgelöst. Die gewählte Speichersteuerung hat darüber hinaus den Vorteil, daß auch die Daten, die kurz vor dem Unfallereignis anstanden, ebenfalls mit einer hohen Auflösung erfaßt werden. Da die Speicherung der Meßsignale im mit der höheren Frequenz getakteten Ringspeicher zum Zeitpunkt der Unfallerkennung sofort angehalten

wird, bleiben damit die über die Schleifendauer gespeicherten Daten erhalten. Gerade dieser Vorteil verbessert in entscheidender Weise die Aussagekraft der mit dem Datenerfassungsgerät erfaßten Daten, da eine Rekonstruktion der Bewegungsbahn des Fahrzeugs durch fein strukturierte Meßdaten erheblich besser möglich wird. Denn gerade im unzweideutigen, möglichst lückenlosen Aufzeigen des Unfallhergangs besteht der Sinn und Zweck dieser Datenaufzeichnung.

Anhand von zwei Zeichnungen soll die Erfindung näher erläutert werden. Es zeigen

Fig. 1 die typischen zu detektierenden Signalformen;

Fig. 2 ein vereinfachtes Blockschaltbild der Speichersteuerung.

In Fig. 1 ist ein analoges Meßsignal 1, z. B. die Längs- oder Querbeschleunigung des Fahrzeugs, auf der Zeitachse 2 aufgetragen, wobei die Ordinate 3 den Betrag des Signals 1 angibt. Im normalen Fahrbetrieb, d. h. im Zeitabschnitt 4, ist der Absolutbetrag des Meßsignals verhältnismäßig gering; auch die Amplitudenschwankungen verlaufen relativ langsam. Kommt es nun zu einem Unfall, ändert sich der Betrag des Meßsignals 1 sprunghaft, wodurch eine festgelegte Schwelle 5 zur Auslösung der erfindungsgemäßen Speichersteuerung überschritten und das Unfallereignis als solches vom Gerät erkannt wird.

Es soll erwähnt werden, was der Einfachheit halber jedoch nicht ausführlich beschrieben wird, daß die Unfallerkennung auch Kriterien und Rechenoperationen einschließen kann, die über diese einfache Schwellwertüberschreitung hinausgehen. Für die Unfallerkennung können beispielsweise auch Verknüpfungen mit anderen Sensorsignalen herangezogen werden. Zusätzlich zur automatischen Unfallerkennung könnte die erfindungsgemäße Speichersteuerung auch manuell durch Betätigen eines Bedienelementes, z. B. der Warnblinkanlage, ausgelöst werden. Entscheidend ist, daß das Unfallereignis als solches erkannt wird und diese Erkennung den Ablauf der erfindungsgemäßen Speichersteuerung auslöst.

Die eigentliche Kollisionsphase 7 ist eine Teilzeit der Unfallaufzeichnungszeit 6 und wird zusätzlich zur normalen Datenaufzeichnung noch im schnell getakteten Datenspeicherungszweig mit hoher Auflösung aufgezeichnet. Die übergeordnete Unfallaufzeichnungszeit 6 endet entweder mit dem Stillstand 10 des Fahrzeugs, gekennzeichnet durch das Ausbleiben des analogen Meßsignals 1 oder nach Ablauf einer festgesetzten Nachlaufzeit 9, die mit dem Zeitpunkt des Eintretens des Auslösesignals 25 beginnt. Die Unfallaufzeichnungszeit 6, die insgesamt z. B. 45 Sekunden betragen kann, setzt sich damit aus einem Zeitabschnitt 8 vor dem Eintreten des Auslösesignals 25 und einer Nachlaufzeit 9 zusammen. Im normalen Fahrbetrieb genügt für die Datenspeicherung eine niederfrequente Abtastrate 11 (mit der Frequenz f1) der permanent von der sensorischen Meßeinrichtung erfaßten analogen Meßsignale 1, da die Abspeicherung von mehr Meßpunkten 13 den Informationsgehalt nicht in brauchbarer Weise erhöht. Jedoch während des eigentlichen Unfallereignisses sollen möglichst viele Meßpunkte 13 mit der durch die Frequenz f2 vorgegebenen höheren Abtastrate 12 bleibend abgespeichert werden.

Fig. 2 verdeutlicht die Speichersteuerung. Von der sensorischen Meßeinrichtung des Datenerfassungsgerätes werden kontinuierlich analoge Meßsignale 1 erfaßt und über einen A/D-Wandler 21 geführt. Diese digitalisierten Meßsignale werden – entweder direkt oder mit anderen zeitsynchron erfaßten, digitalen Signalen 20 zu Datenwörtern vereinigt - mindestens zwei parallel angeordneten Ringspeichern 22 und 23 zugeführt, die in einem unterschiedlichen Takt die Datenwörter einlesen. Die jeweiligen Taktfrequenzen f1 und f2, wobei f1 die Speicherfrequenz für den Ringspeicher 22 und f2 die für den Ringspeicher 23 bedeutet, werden von einer Steuereinheit 24 vorgegeben. Die Abtastfrequenzen f1 und f2 sind verschieden und sollen so gewählt sein, daß f1 geeignet ist, die niederfrequenten Meßsignale des normalen Fahrbetriebs abzutasten

und daß f2 entsprechend höherfrequent ist, um eine hohe Auflösung der in Unfallsituationen entstehenden hochfrequenteren Meßsignale zu ermöglichen. Es hat sich als zweckmäßig erwiesen, f1 zu 25 Hz und f2 zu 500 Hz zu wählen.

Bei der Erkennung eines Unfallereignisses löst die Steuereinheit 24 ein Auslösesignal 25 aus, das die fortlaufende Abtastung und Speicherung der Meßsignale in den Ringspeichern 22 und 23 stoppt. Dieses Stoppen der Speicherung der Meßsignale in den Ringspeichern 22 und 23 - und damit das Konservieren der Speicherinhalte - erfolgt für beide Speicher nach unterschiedlichen Kriterien und zu unterschiedlichen Zeiten. Das Anhalten der Speicherung im Ringspeicher 22, der mit der niederen Frequenz f1 die Meßsignale speichert, wird zeitlich verzögert, so daß die Aufzeichnung in diesem Speicher mit dem Stillstand 10 des Fahrzeugs oder spätestens nach Ablauf der festgelegten Nachlaufzeit 9 endet. Diese Nachlaufzeit 9 kann zur Erfassung des Geschehens nach dem eigentlichen Unfall auf ca. 15 Sekunden festgelegt werden. Beim Eintreffen des Auslösesignals 25 wird die Speicherung der Meßsignale im Ringspeicher 23, der mit der hohen Frequenz f2 speichert, angehalten und die nachfolgenden Daten werden mit der Frequenz f2 in einen weiteren, parallel angeordneten, elektronischen Halbleiterspeicher 26, der kein Ringspeicher ist, eingelesen. Diese Speicherung erfolgt solange, wie das die Unfallsituation kennzeichnende Auslösesignal 25 anliegt. Erlischt das Auslösesignal 25, beendet der Speicher 26 die hochfrequente Datenabspeicherung in der bevorzugten Ausführung auch zeitverzögert nach einer kurzen Nachlaufzeit 14, für die sich 100 ms als ausreichend erwiesen haben. Dadurch stehen hochfrequent abgetastete Fahrdaten über die Schleifendauer 15 des Ringspeichers 23 und die Aufzeichnungsdauer des Speichers 26 zur Verfügung, wobei sich die Aufzeichnungsdauer des Speichers 26 aus der der Kollisionsphase 7 entsprechenden Dauer des Auslösesignals 25 und einer festgelegten Nachlaufzeit 14 zusammensetzt.

Der Übersichtlichkeit halber sind die Zeitabschnitte 14 und 15 in Fig. 1 zwar größenordnungsmäßig richtig im Verhältnis zur Dauer der Kollisionsphase 7 eingezeichnet, jedoch liegen in diesen Zeitabschnitten 14 und 15 tatsächlich eine Vielzahl von Meßpunkten 13. In der bevorzugten Ausführung sind es jeweils etwa 50 Meßpunkte.

Diese fein strukturierten Fahrdaten können derart dem groben Raster der im Ringspeicher 22 abgelegten Daten zeitlich zugeordnet werden, daß beim Eintreten des Auslösesignals 25 in beiden Ringspeichern 22 und 23 jeweils die aktuelle Uhrzeit, falls das Datenerfassungsgerät mit einer Echtzeituhr ausgerüstet ist, oder eine andere geeignete Markierung mit abgespeichert werden. Dadurch ist es bei der späteren Auswertung der gespeicherten Daten möglich, beide durch die unterschiedlichen Abtastfrequenzen f1 und f2 gebildeten Zeitraster miteinanander in Beziehung zu setzen.

Zur Registrierung von Folgeunfällen kann die hier beschriebene Anordnung in dem Datenerfassungsgerät mehrfach ausgeführt sein. Insbesondere ist in der bevorzugten Ausführungsform der schnell getaktete Datenspeicherungszweig, bestehend aus dem Ringspeicher 23 und dem Halbleiterspeicher 26, mehrfach ausgeführt, um mehrere Stoßvorgänge, die sich innerhalb der Nachlaufzeit 9, die dem übergeordneten Ringspeicher 22 zugeordnet ist, ereignen und deren Dauer im Verhältnis zur Nachlaufzeit 9 sehr kurz sind, jeweils einzeln aufzeichnen zu können. Jeder neue Stoßvorgang aktiviert dann den nächsten parallelen Datenspeicherungszweig, sooft noch ein freier Datenspeicherungszweig dieser Art vorhanden ist.

Patentansprüche:

1. Anordnung zur Registrierung von Fahrdaten mit einer der Signalform von analogen Meßsignalen anpassenden zeitlichen Auflösung,
gekennzeichnet durch die folgenden Merkmale:
   a.) die analogen Meßsignale (1), die von einer sensorischen Meßeinrichtung eines Datenerfassungsgerätes zum Zwecke der Registrierung der Bewegung eines Fahrzeugs fortlaufend erfaßt werden, werden nach ihrer Digitalisierung in einem A/D-Wandler (21) ständig von einer Steuereinheit (24) mit zwei unterschiedlichen Frequenzen (f1; f2) abgetastet und in zwei parallel angeordneten, mit den Frequenzen (f1; f2) getakteten Ringspeichern (22; 23) gespeichert;
   b.) beim Erkennen eines Unfallereignisses stoppt die Steuereinheit (24) durch ein Auslösesignal (25) zeitverzögert die Speicherung der Meßsignale im mit der niederen Frequenz (f1) getakteten Ringspeicher (22), wodurch die Speicherung der Meßdaten im Ringspeicher (22) nach einer Nachlaufzeit (9) oder durch den Stillstand (10) des Fahrzeuges beendet wird;
   c.) die Steuereinheit (24) unterbricht beim Auftreten des Auslösesignals (25) auch die weitere Speicherung der Meßsignale im mit der höheren Frequenz (f2) getakteten Ringspeicher (23) und veranlaßt die Speicherung der Meßsignale in einem weiteren, zum Ringspeicher (23) parallel angeordneten und mit der höheren Frequenz (f2) getakteten Halbleiterspeicher (26) für die Dauer, in der das Auslösesignal (25) vorliegt, sowie gegebenenfalls zuzüglich einer festen Nachlaufzeit (14) nach Abklingen des Auslösesignals (25).

2. Anordnung nach Anspruch 1,
dadurch gekennzeichnet,
daß bei Auftreten des Auslösesignales (25)
in den beiden Ringspeichern (22 und 23) zur Korrelierung
ihrer Dateninhalte eine Markierung gesetzt wird.

3. Anordnung nach Anspruch 1 oder 2,
dadurch gekennzeichnet,
daß der mit der höheren Frequenz (f2) getaktete
Datenspeicherungszweig, bestehend aus dem Ringspeicher (23)
und dem Halbleiterspeicher (26), innerhalb der Anordnung
mehrfach parallel ausgeführt ist, wobei jeweils durch einen
neuen Stoßvorgang innerhalb der Nachlaufzeit (9) der nächste
noch freie Datenspeicherungszweig dieser Art aktiviert
wird.

4. Anordnung nach einem der vorangegangenen Ansprüche,
dadurch gekennzeichnet,
daß die gesamte Anordnung zur Registrierung von
Folgeunfällen in gleicher Weise mehrfach im
Datenerfassungsgerät aufgebaut ist.

5. Anordnung nach Anspruch 1 oder 2,
dadurch gekennzeichnet,
daß das Auslösesignal (25) zusätzlich zur automatischen
Auslösung manuell durch Betätigen eines unfallrelevanten
Bedienelementes ausgelöst wird.

1/2

FIG.1

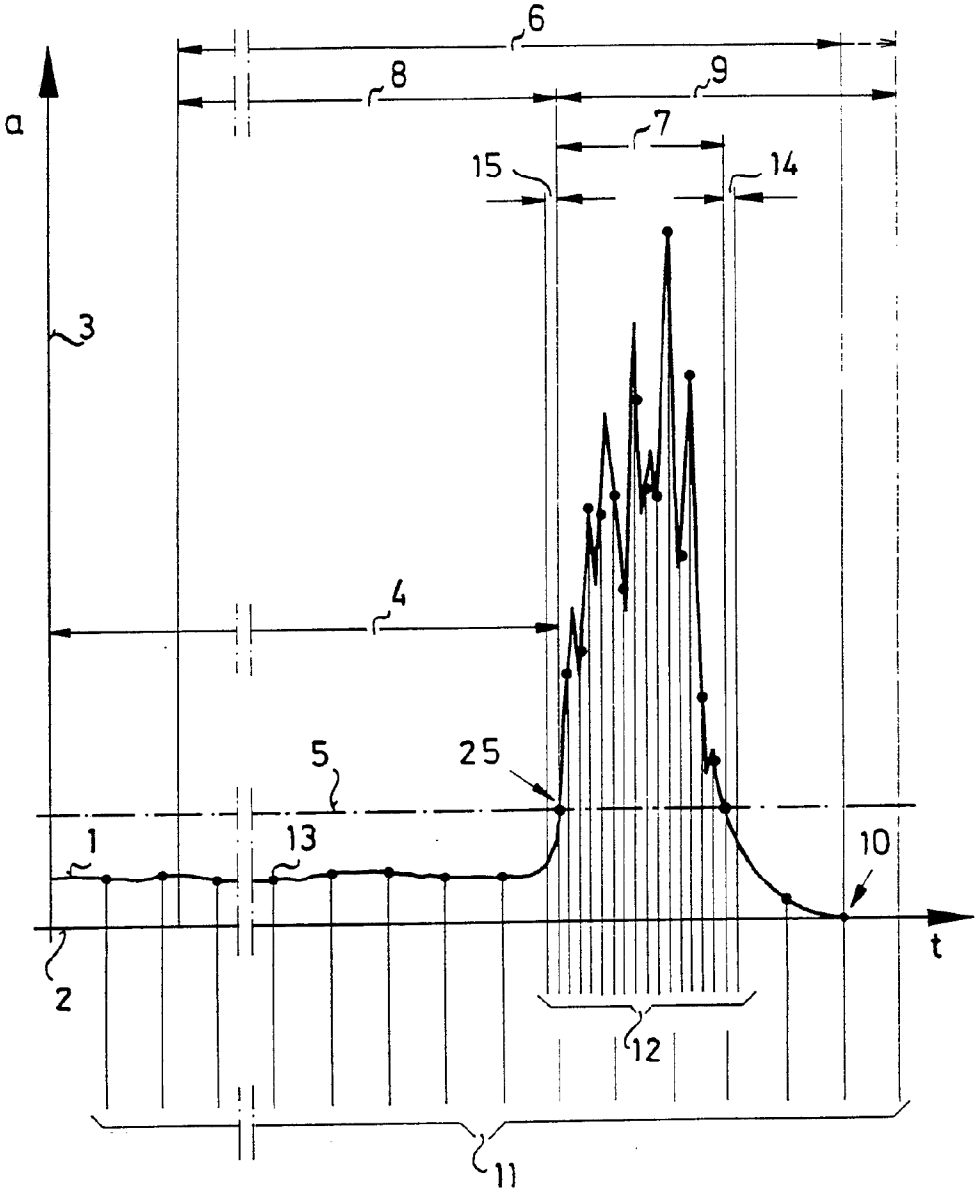
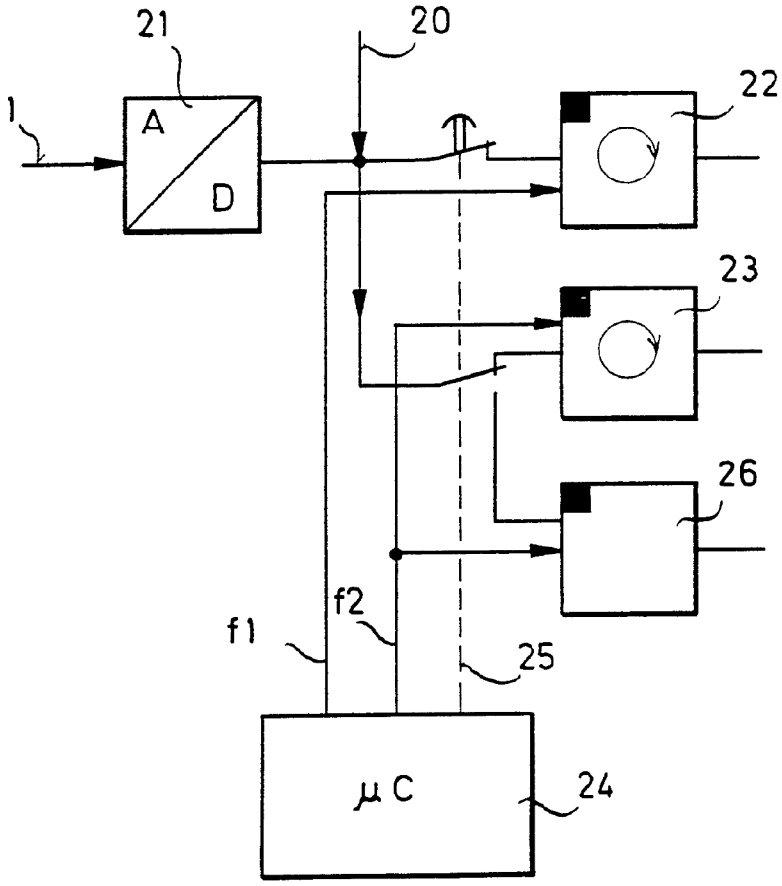


FIG.2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 92/02529

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.[5] G07C5/08

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)

Int. Cl.[5] G07C ; G01P

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.
A	GB,A,2 046 914 (APAG) 19 November 1980 see page 2, line 72 - line 100 see page 3, line 23 - line 64 see page 4, line 4 - line 77; figures	1
A	WO,A,8 805 196 (SZÉKELY) 14 July 1988 see page 5, line 5 - page 7, line 34; figures	1
A	GB,A,2 055 469 (MOTO METER) 4 March 1981 see page 1, line 105 - page 2, line 63; figures	1,5

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

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Date of the actual completion of the international search	Date of mailing of the international search report
16 February 1993 (16.02.93)	9 March 1993 (09.03.93)
Name and mailing address of the ISA EUROPEAN PATENT OFFICE Facsimile No.	Authorized officer Telephone No

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 92/02529

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR,A,2 574 928 (ETAT FRANCAIS) 20 June 1986 see page 2, line 24 - page 4, line 31; figures	1,2
A	EP,A,0 118 818 (LICENTIA) 19 September 1984 cited in the application see column 7, line 17 - column 8, line 50; figures	1,4
A	EP,A,0 087 398 (COLONNELLI) 31 August 1983	

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9202529
SA 66267

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2046914	19-11-80	CH-A- 638329	15-09-83
		BE-A- 882548	16-07-80
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EP-A-0118818	19-09-84	DE-A- 3405757	04-10-84
		WO-A- 8403359	30-08-84
		JP-T- 60500637	02-05-85
		US-A- 4638289	20-01-87
EP-A-0087398	31-08-83	None	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/EP 92/02529

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

Int.Kl. 5 G07C5/08

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff [7]

Klassifikationssytem	Klassifikationssymbole
Int.Kl. 5	G07C ; G01P

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen [8]

III. EINSCHLAGIGE VEROFFENTLICHUNGEN [9]

Art.°	Kennzeichnung der Veröffentlichung [11], soweit erforderlich unter Angabe der maßgeblichen Teile [12]	Betr. Anspruch Nr. [13]
A	GB,A,2 046 914 (APAG) 19. November 1980 siehe Seite 2, Zeile 72 - Zeile 100 siehe Seite 3, Zeile 23 - Zeile 64 siehe Seite 4, Zeile 4 - Zeile 77; Abbildungen	1
A	WO,A,8 805 196 (SZÉKELY) 14. Juli 1988 siehe Seite 5, Zeile 5 - Seite 7, Zeile 34; Abbildungen	1
A	GB,A,2 055 469 (MOTO METER) 4. März 1981 siehe Seite 1, Zeile 105 - Seite 2, Zeile 63; Abbildungen	1,5

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IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
16.FEBRUAR 1993	09. 03. 93
Internationale Recherchenbehörde	**Unterschrift des bevollmächtigten Bediensteten**
EUROPAISCHES PATENTAMT	MEYL D.

Formblatt PCT/ISA/210 (Blatt 2) (Januar 1985)

III. EINSCHLAGIGE VEROFFENTLICHUNGEN (Fortsetzung von Blatt 2)

Art °	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der maßgeblichen Teile	Betr. Anspruch Nr.
A	FR,A,2 574 928 (ETAT FRANCAIS) 20. Juni 1986 siehe Seite 2, Zeile 24 - Seite 4, Zeile 31; Abbildungen ---	1,2
A	EP,A,0 118 818 (LICENTIA) 19. September 1984 in der Anmeldung erwähnt siehe Spalte 7, Zeile 17 - Spalte 8, Zeile 50; Abbildungen ---	1,4
A	EP,A,0 087 398 (COLONNELLI) 31. August 1983 -----	

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT
ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.

EP 9202529
SA 66267

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 16/02/93
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Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
GB-A-2046914	19-11-80	CH-A-	638329	15-09-83
		BE-A-	882548	16-07-80
		DE-A,C	2929168	16-10-80
		FR-A,B	2454142	07-11-80
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EP-A-0087398	31-08-83	Keine		

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(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)

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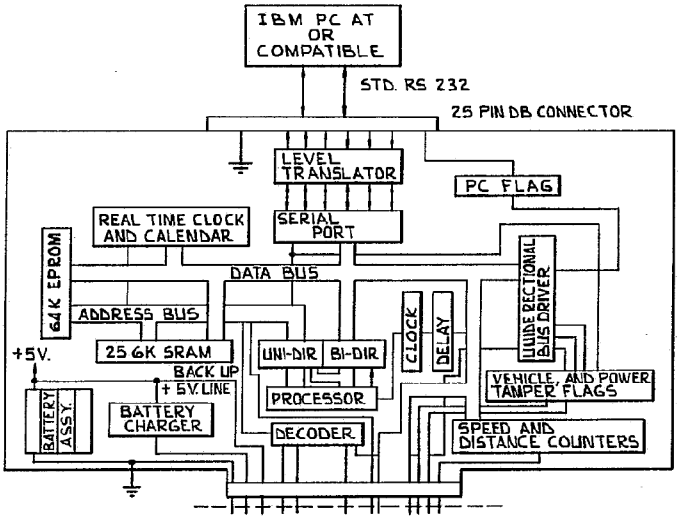
(81) Designated States: AU, BR, CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, MC, NL, SE).

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.

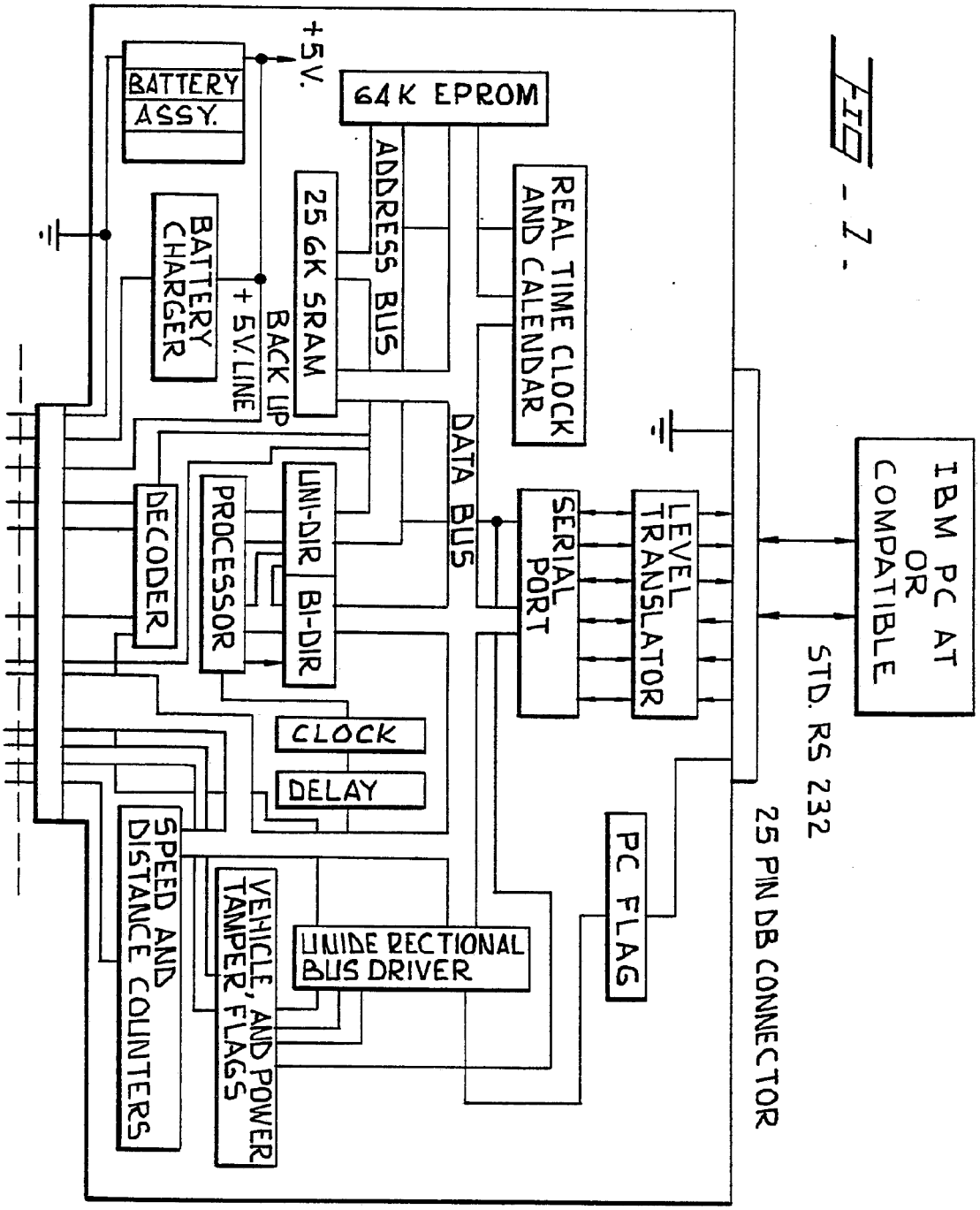
4. The device set forth in claim 3 wherein said second memory means includes non-volatile means for storing said identification information.

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.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25 PIN DB CONNECTOR
CLOCK
DELAY
PC FLAG
SPEED AND DISTANCE COUNTERS
VEHICLE, AND POWER TAMPER, FLAGS
UNIDE RECTIONAL BUS DRIVER

FIG - 1 -

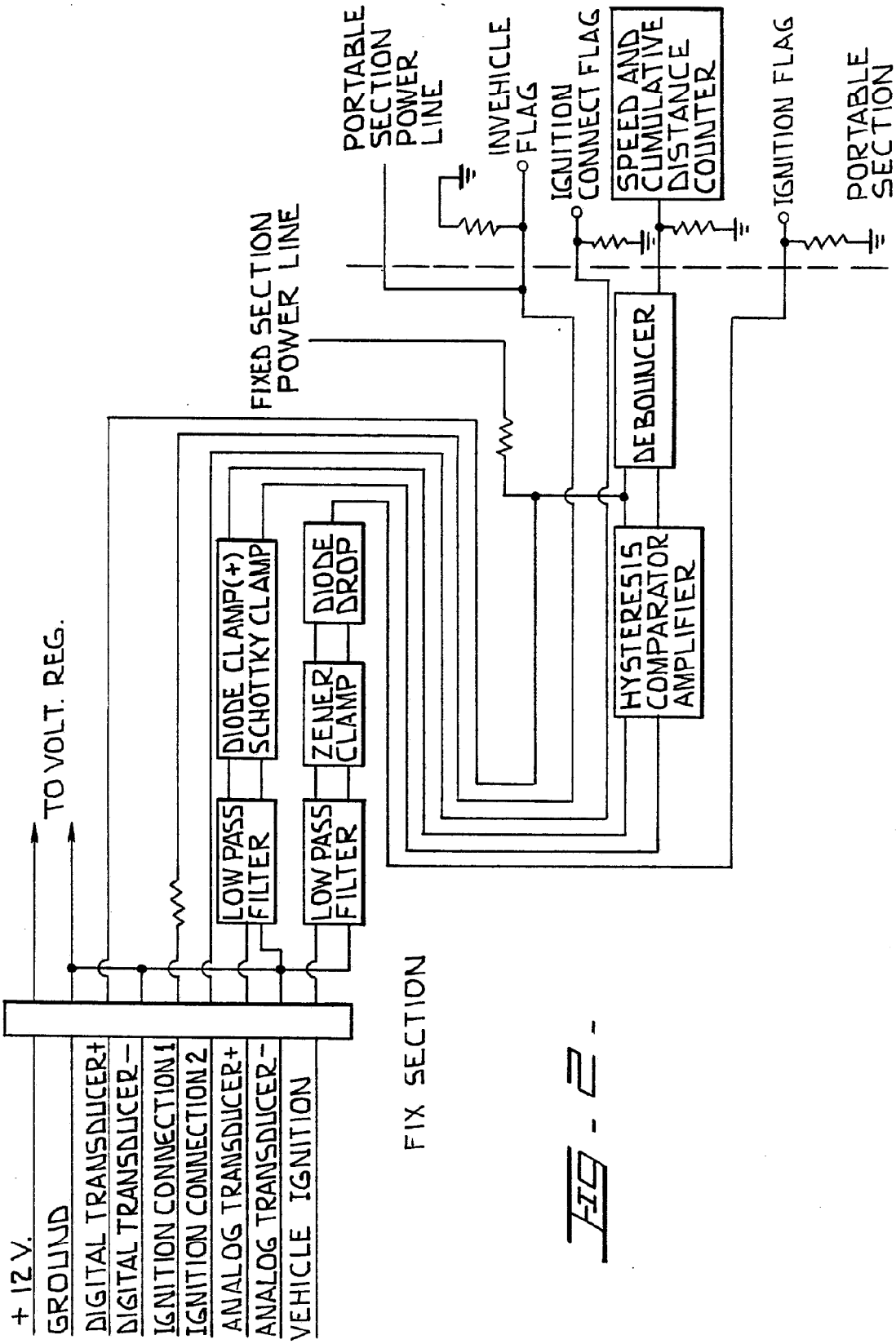
+12 V.
GROUND
DIGITAL TRANSDUCER+
DIGITAL TRANSDUCER-
IGNITION CONNECTION 1
IGNITION CONNECTION 2
ANALOG TRANSDUCER+
ANALOG TRANSDUCER-
VEHICLE IGNITION
TO VOLT. REG.
DIODE CLAMP(+) SCHOTTKY CLAMP
ZENER CLAMP
DIODE DROP
LOW PASS FILTER
LOW PASS FILTER
FIXED SECTION POWER LINE
PORTABLE SECTION POWER LINE
INVEHICLE FLAG
IGNITION CONNECT FLAG
SPEED AND CUMULATIVE DISTANCE COUNTER
IGNITION FLAG
PORTABLE SECTION
DEBOUNCER
HYSTERESIS COMPARATOR AMPLIFIER
FIX SECTION

FIG - 2 -

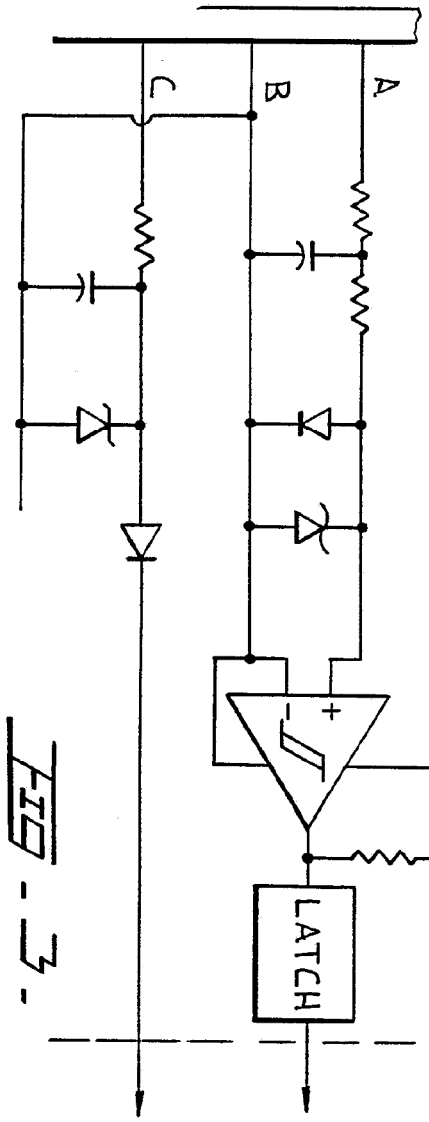
C
B
A
+
-
LATCH

FIG - 3 -

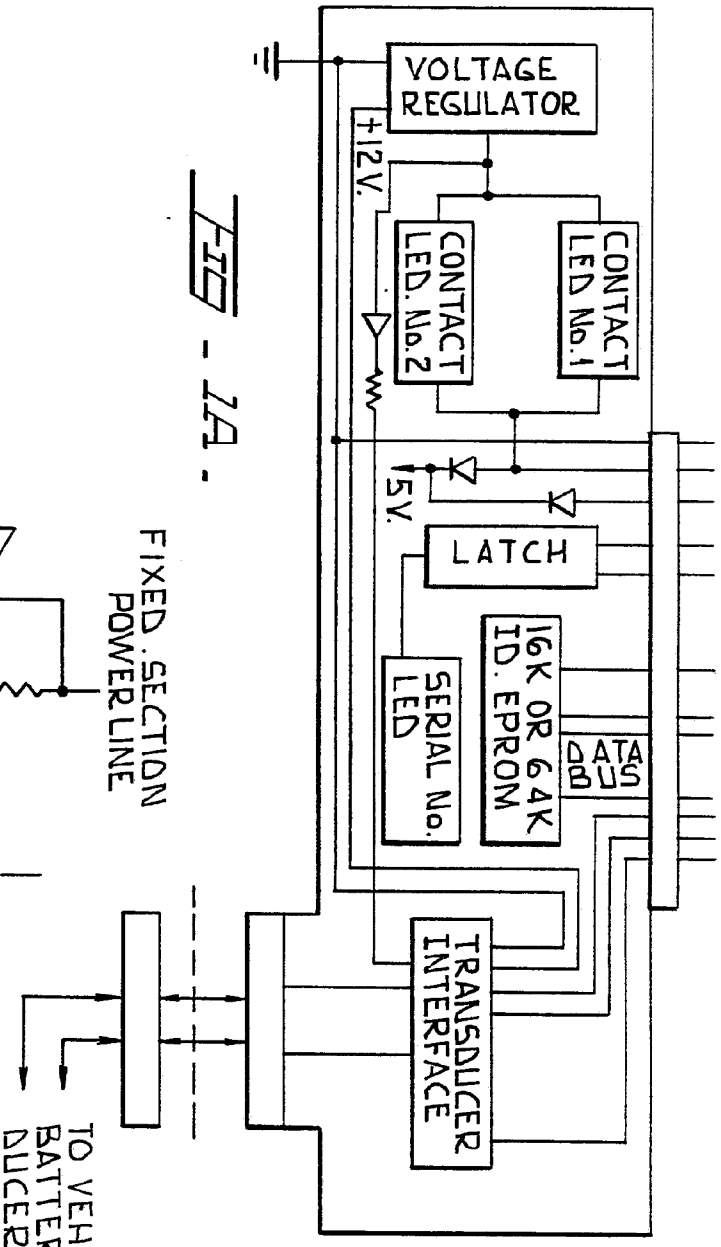
VOLTAGE REGULATOR
+12V.
CONTACT LED. No.2
CONTACT LED No.1
15V.
LATCH
16K OR 64K ID. EPROM
DATA BUS
SERIAL No. LED
TRANSDUCER INTERFACE
FIXED SECTION POWER LINE
TO VEHICLE BATTERY TRANS-DUCER (T), VEHICLE IGNITION AND IGNITION CONNECTION LOOP.

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:	"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
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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
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Form PCT/ISA/210 (second sheet)(July 1992)*

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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : G06F 13/00, 15/20	A1	**(11) International Publication Number:**	**WO 94/04975**
		(43) International Publication Date:	3 March 1994 (03.03.94)

(21) International Application Number: PCT/US93/07500

(22) International Filing Date: 9 August 1993 (09.08.93)

(30) Priority data:
930,158 14 August 1992 (14.08.92) US

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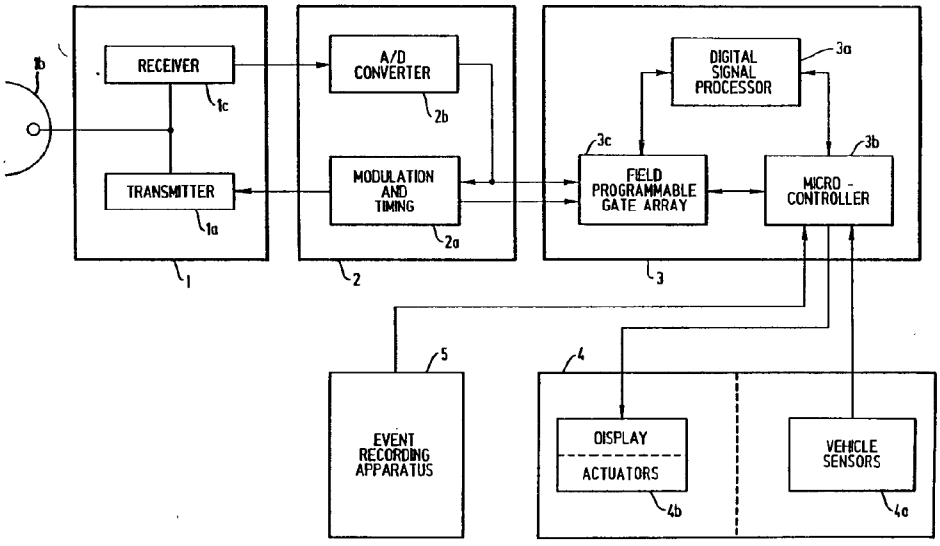
(81) Designated States: AU, BR, CA, KR, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
With amended claims.

(54) Title: RECORDING OF OPERATIONAL EVENTS IN AN AUTOMOTIVE VEHICLE



(57) Abstract

An apparatus and method for recording operational events in an automotive radar system (1). The invention provides an Event Recording Apparatus (ERA) (5) that records selectable vehicle performance, operational status, and/or environment information, including information useful for accident analysis and updated software for use by a system processor (22) capable of reading data from the ERA (5). The preferred embodiment of the ERA (5) comprises a non-volatile solid-state memory card (20), a memory card adapter (21) located in a vehicle, and a microprocessor (22), either as part of the memory card (20) or embedded in a system within the vehicle, for controlling the storage of data within the memory card (20).

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RECORDING OF OPERATIONAL EVENTS IN AN AUTOMOTIVE VEHICLE

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to automotive radar systems, and more particularly to an apparatus and method for recording operational events in an automotive radar system.

Description of Related Art

In the automotive field, a number of electronic devices exist that record data on various aspects of vehicle performance and/or environment information. Such devices have used magnetic tape and paper strips to record such information. These devices primarily function as trip monitors, storing information such as trip distance, trip time, miles per gallon consumed, and average speed.

A drawback of such devices is that magnetic tapes and paper strips are susceptible to the detrimental effects of heat and vibration commonly found in an automotive environment. A further drawback is that prior art automotive recording devices have not been used in conjunction with an automotive radar system to record such information as the closing rate (CR) between the recording vehicle and targets located by the vehicle's radar system, the distance (D) between the recording vehicle and targets, vehicle speed (VS), and such vehicle performance and environment information as braking pressure, vehicle acceleration or deceleration in one or more dimensions, rate of turning of the vehicle, steering angle, hazard levels determined from a radar system processor, target direction, and cruise control status, to name a few.

Further, it is believed that such automotive recording devices have not been used to record information to be used for accident reconstruction.

Most commercial aircraft and some private aircraft are equipped with an event recording device commonly called a "black box". This device records pertinent data from the aircraft's major subsystems as the aircraft is operating. If an accident occurs, the "black box" generally can be retrieved from the aircraft and the recorded information extracted to determine the status of subsystems of the aircraft just before the accident. Such information is then used to reconstruct the events leading up to the accident, and can help determine the cause of the accident. Black box recording devices have proven invaluable in aircraft accident reconstruction. However, this type of technology is quite expensive, and its use has been limited to more expensive vehicles such as aircraft. In addition, it is believed that all such devices operate using a cumbersome magnetic tape to record data. These devices also tend to be larger, heavier, and consume more power than would be acceptable for automotive use.

In the area of automobile accident reconstruction, an accident analyst determines how an accident most probably occurred by measuring, among other things, the length of skid marks, the extent of vehicle and nearby property damage, and the condition of the road at the time of the accident. This method of reconstructing accidents has been shown to be expensive and inaccurate at times. Accordingly, it would be desirable for automotive vehicles to have a system that would function as an event recording "black box". Such a system should record information relating to the vehicle and the environment around the vehicle prior to an accident. Such data should be readable after an accident for use in reconstructing the events leading

up to the accident. An accident could then be reconstructed using real historical data, as opposed to post-accident estimated data.

In addition to recording data useful for accident reconstruction, it would also be desirable for such a device to record more standard vehicle performance, operational status, and/or environment data. In addition, it would be desirable that such a device be configurable for a driver's particular preferences, or to provide an authorization function that prohibits unauthorized personnel from driving the vehicle, and/or to provide a convenient means for upgrading system-wide software for an automotive electronic control system or an automotive radar system.

The present invention meets these objects and provides an advance over the prior art.

SUMMARY OF THE INVENTION

The preferred embodiment of the present invention is particularly well-adapted to be used in conjunction with an automotive radar system. The invention provides a removable, externally readable, non-volatile solid-state memory Event Recording Apparatus (ERA) that records selectable vehicle performance, operational status, and/or environment information. In particular, the ERA records information useful for accident analysis.

In addition, the preferred embodiment of the present invention can be used to store updated software for use by a system processor capable of reading data from the ERA.

More particularly, the preferred embodiment of the inventive ERA comprises a non-volatile solid-state memory card, a memory card adapter located in a vehicle, and a microprocessor, either as part of the memory card or embedded in a system within the vehicle, for controlling the storage of data within the memory

card. The ERA system is configured to store such vehicle information as, for example, the closing rate (CR) between the recording vehicle and targets located by the vehicle's radar system, the distance (D) between the recording vehicle and targets, vehicle speed (VS), and such vehicle performance and environment information as braking pressure, vehicle acceleration or deceleration in one or more dimensions, rate of turning of the vehicle, steering angle, hazard levels determined from a radar system processor, target direction, cruise control status, vehicle engine RPM, brake temperature, brake line hydraulic pressure, windshield wiper status (to determine if it is raining), fog light status, defroster status, and geographic positioning information (e.g., from a global positioning system). In addition, the ERA can be configured to function as a common trip monitor, recording such information as distance travelled, average speed, miles-per-gallon, fuel remaining, compass direction of travel, etc. The device can also record vehicle maintenance information, such as coolant temperature, oil temperature, engine temperature, transmission fluid temperature, engine timing, and more.

The details of the preferred embodiment of the present invention are set forth in the accompanying drawings and the description below. Once the details of the invention are known, numerous additional enhancements and changes will become obvious to one skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is an overall block diagram showing the invention being used in conjunction with an automotive radar system using digital signal processing.

FIGURE 2 is a block diagram of a RAM card in accordance with the present invention, shown connected

to the radar system microcontroller and a non-volatile memory device.

FIGURE 3 is a timing diagram of a Write cycle to a RAM card in accordance with the present invention.

FIGURE 4 is a timing diagram of a Read cycle from a RAM card in accordance with the present invention.

FIGURE 5 is a detailed block diagram of a RAM card in accordance with the present invention.

FIGURE 6 ia a block diagram of an interface between a RAM card in accordance with the present invention and a personal computer.

Like reference numbers and designations in the various drawings refer to like elements.

DETAILED DESCRIPTION OF THE INVENTION

Throughout this description, the preferred embodiment and examples shown should be considered as exemplars, rather than limitations on the present invention.

FIGURE 1 is an overall block diagram showing the invention being used in conjunction with an automotive radar system using digital signal processing. Such a system is described in greater detail in co-pending U.S. Patent Application Serial No. 07/930,066, entitled MULTIFREQUENCY, MULTI-TARGET AUTOMOTIVE RADAR SYSTEM USING DIGITAL SIGNAL PROCESSING and assigned to the assignee of the present invention. This radar system is referenced by way of example. However, the invention could be readily adapted to be used in conjunction with other automotive radar systems known in the art, such as the systems described in U.S. Patent No. 4,673,937, entitled AUTOMOTIVE COLLISION AVOIDANCE AND/OR AIR BAG DEPLOYMENT RADAR, and U.S. Patent No. 4,916,450, entitled RADAR SYSTEM FOR HEADWAY CONTROL OF A VEHICLE, both of which are assigned to the assignee of the present invention.

Using the present ERA invention in conjunction with such a radar system allows recording of important data relating to obstacles in the path of the vehicle that were detected by the radar system. This type of information is particularly useful in accident reconstruction.

Referring to FIGURE 1, a receiver/transmitter module 1 transmits a Doppler radar signal from a radar transmitter 1a via a radar antenna 1b, and receives reflected radar echoes in a receiver 1c through the antenna 1b. A control module 2 coupled to the receiver/transmitter module 1 contains a modulation and timing circuit 2a that controls the transmission of the Doppler radar beam, and an A/D converter 2b for converting the received echo signal into a digital data stream. A signal processing module 3 includes a digital signal processor (DSP) 3a, a microcontroller 3b, and a field programmable gate array 3c, configured to control the flow of digital radar data to the DSP 3a under the control of the microcontroller 3b. The signal processing module 3 is also coupled to an input/output module 4.

The input/output module 4 which provides information from a variety of vehicle sensors 4a to the microcontroller 3b for use in calculating the hazard level presented by targets indicated from the received radar signal and/or to indicate the operational status and environment of the vehicle. Commonly known sensors may be used, for example, to measure vehicle speed, engine temperature, oil pressure, engine RPM, oil temperature, transmission fluid temperature, coolant temperature, and other values relating to the environment or performance of the vehicle. The signal processing unit 3 itself generates information from the transmitted and received radar signal, such as the closing rate (CR) of a target with respect to the vehicle, the distance (D) of various targets, and the

direction of movement (towards or away from) of the targets with respect to the vehicle. Additional information can be obtained by providing other sensors, such as a brake pedal pressure sensor, brake hydraulic line pressure sensor, tire pressure, accelerometer sensors (for example, fore and aft acceleration/deceleration, and/or left and right (yaw) acceleration of the vehicle), turning rate, turn angle, and/or impact sensors (such as the type used to trigger vehicle air bags), windshield wiper status (to determine if it is raining), fog light status, defroster status, and geographic positioning information. Recording some or all of this data or similar relevant data would make accident reconstruction more reliable and less expensive.

The input/output module 4 also has a display and/or actuators 4b, for displaying indications to a user and/or controlling various aspects of vehicle operation (for example, flashing a dashboard warning light to a user if a vehicle is approaching too rapidly, and/or, in extreme conditions, automatically activating the vehicle brakes and/or air bag).

Also coupled to the microcontroller 3b is an Event Recording Apparatus (ERA) 5, described more fully below.

FIGURE 2 shows a more detailed block diagram of the preferred embodiment of the present ERA invention, showing a RAM card 20 coupled through an interface receptacle 21 to a microcontroller 22 (which may be the microcontroller 3b shown in FIGURE 1, but can be an independent microcontroller coupled to the microcontroller 3b). In the preferred embodiment, the microcontroller 22 includes a real-time clock. The microcontroller 22 is also coupled to a non-volatile memory device 23. "Non-volatile" means that the data stored in the memory device 23 will be retained even if power is interrupted to the device. In the preferred

embodiment, the memory device 23 is a "flash" programmable memory device available from a number of suppliers. Such devices are electrically alterable, but retain their data even after power is removed from the device. Alternatively, the memory device 23 may comprise, for example, dynamic RAM with a battery backup and refresh circuitry, static RAM with a battery backup, electrically alterable read-only memory, or other solid-state, non-volatile memory technologies known in the art.

The microcontroller 22 and non-volatile memory device 23 are coupled in known fashion by Address and Data buses, and read/write control lines FLASHWP, RD, WR, as shown, such that the microcontroller 22 can read data from, and write data to, the non-volatile memory device 23. The memory device 23 is preferably used to store programs to be executed by the microcontroller 22 for control of all, or various aspects, of the components shown in FIGURE 1.

In the preferred embodiment, the interface between the RAM card receptacle 21 and the microcontroller 22 is kept as simple as possible. Preferably, a standard 3-wire (not including power and ground) serial interface bus is used, which has a clock line CLK for the data transfer clock, a DQ line bidirectional data line, and an $\overline{\text{RST}}$ line to enable/disable the RAM card 20. The 3-wire bus is coupled to the microcontroller 22 as shown.

An advantage of the simple 3-wire serial interface bus preferred for use with the present invention is that it is well known, simple to implement, and requires a minimum amount of interface connection between the RAM card 20 and the microcontroller 22. However, other interfaces could be used, such as the more complete RS232 serial interface standard. As another alternative, the RAM card receptacle 21 could be an adapter compatible with the Personal Computer

Memory Card International Association (PCMCIA) interface. As yet another alternative, a fiber optic connection could be used, which would give the system greater immunity from electromagnetic interference.

The RAM card 20 comprises one or more non-volatile memory devices and appropriate control and interface circuitry. The RAM card 20 may comprise, for example, dynamic RAM with a battery backup and refresh circuitry, static RAM with a battery backup, flash memory devices, electrically alterable read-only memory, or other solid-state, non-volatile memory technologies known in the art. The data storage capacity of the RAM card 20 is a matter of design choice and available integrated circuit chip capacity and size. In the illustrated embodiment, the capacity of the RAM card 20 is at least 32 kBytes.

The RAM card 20 may be custom designed, or may be a commercial product. In the preferred embodiment of the present invention, the RAM card 20 comprises a model DS6417 "CyberCard" from Dallas Semiconductor, Inc.

In the preferred embodiment, the microcontroller 22 begins a data transfer to the RAM card 20 by sending a 56-bit protocol word to the RAM card 20. Referring to FIGURES 3 and 4, all data transfers to and from the RAM card 20 are initiated by setting the $\overline{RST}$ input to a logical "1". Each data transfer is terminated by resetting the $\overline{RST}$ signal to a logical "0". In the preferred embodiment, the protocol word includes a command byte, 2 bytes for the starting address where data storage or retrieval will begin, and a cyclic redundancy check (CRC) byte or word that ensures all bits have been transmitted correctly.

After the desired operation (e.g., Read or Write) is specified by the 56-protocol word, a first byte is read from or written to the designated address a bit at a time. The address is then automatically incremented

to the next location, and a next byte is read or written. As desired, the microcontroller 22 can write any data from the non-volatile memory device 23 to the RAM card 20, or vice versa.

Referring to FIGURE 3, for a Write cycle to the RAM card 20, the data input bits and the command word bits on the DQ line must be valid during the rising edge of the clock signal CLK. Referring to FIGURE 3, for a Read cycle from the RAM card 20, data bits read out of the RAM card 20 must be valid during the falling edge of the clock signal CLK. When data transfers are terminated by the reset of the $\overline{RST}$ signal, the transition of the $\overline{RST}$ signal from a logical "1" to a logical "0" must occur during a logical "1" state of the clock signal CLK. This simple protocol ensures a generally error-free transfer of data to and from the RAM card 20.

FIGURE 5 is a more detailed block diagram of the RAM card 20 in accordance with the present invention. A serial port buffer 51 serves as the electrical interface to the preferred 3-wire serial bus shown in FIGURE 2. The serial port buffer 51 is coupled to a serial-to-parallel byte-wide converter 52, which converts serial data to and from byte-wide parallel data. The converter 52 responds to the clock signal CLK and $\overline{RST}$ input to accept data from or transmit data to the data line DQ. The converter 52 also controls a non-volatile memory 54 through the use of a data/control buffer 53, as provided by the manufacturer.

In the illustrated embodiment, the memory 54 is a static RAM with sustaining power supplied by a battery 55, permitting the RAM card 20 to be removed from the RAM card receptacle 21. The battery backup also protects against data loss if the power from the RAM card receptacle 21 is interrupted due to system failure or an accident.

If fixed-size data blocks are used, data stored in the memory 54 is delimited by an implicit block size. If variable-size data blocks are used, the data preferably contain internal record and field length counts and/or unique delimiters, so that the blocks can be read back in a meaningful manner. Such variable-size record structures are well-known in the art. However, for simplicity of implementation, the preferred embodiment of the invention uses fixed-size data blocks.

In operation, a RAM card 20 would be inserted into the RAM card receptacle 21. In the preferred embodiment, selected data would be gathered from the vehicle sensors 4a and/or the signal processing module 3 by the microcontroller 22, typically after the vehicle is started. The data is stored into the RAM card 20 by the microcontroller 22 at periodic intervals, which may be determined by time and/or by distance traveled. The microcontroller 22 may also do some computation on the data, such as determining a miles-per-gallon value or average speed, to derive processed data for storage in the RAM card 20.

In general, data blocks would be stored in the RAM card 20 beginning at the first location in the memory 54. The address is incremented to point to successive storage locations for storing subsequent data blocks.

Different modes of operation can be used. In a first mode, selected data is stored approximately every 0.5 seconds, until the memory 54 on the RAM card 20 is full (which, in the illustrated embodiment, takes about 15 minutes). Thereafter, the address sent to the RAM card 20 by the microcontroller 22 is reset to the first address used, causing the oldest data in the memory 54 to be overwritten with new data (i.e., the memory 54 is operated as a circular queue). This provides a "moving window" of the last 15 minutes of operation (or longer, if longer intervals or a larger capacity memory 54 are

used). Recording can be stopped when external power to the RAM card 20 is turned off (for example, when the vehicle is turned off voluntarily or because of an accident), or when the vehicle is not moving. If desired, a delayed turn-off time can be used to continue recording for some period of time after external power is removed, to record, for example, such things as the engine coolant temperature as a measure of residual heat in the engine.

In a second mode of operation, the memory 54 is divided, in a static or dynamic fashion, into multiple logical "pages" for storing independent sets of data. A "current" page may be used to record a moving window of, for example, selected data from the last 5 or 10 minutes of operation, as described above for the first mode of operation. One or more additional pages can be used to record, for example, selected data (which need not be the same items of data stored in the current page) for fixed or variable time periods for later analysis. Such data may include, for example, information related to vehicle maintenance. In such a case, when a page fills up, writing stops, in order to preserve an archival record of the selected data. A page would be "reset" after a read-out of the data or upon execution of a specific command, permitting new data to be written to the page.

In one variation of the second mode of operation, a first page may be used to record a moving window of selected data. If an accident occurs, the first page of data is "frozen", and a next page is used for subsequent recording. An accident condition may be detected automatically, or indicated by activation of a manual switch. In this manner, data can be captured for later analysis of the accident.

In another variation of the second mode of operation, recording to a page other than the current page may be triggered by an unusual event, such as a

vehicle operational or performance value exceeding a preset threshold value, or an accident. For instance, it may be desirable to record drive train sensor values only if one or more values, such as engine temperature, exceed a threshold value. As another example, such recording may be triggered by an unusual condition that may indicate an accident, such as a sudden acceleration or deceleration, sudden application of the brakes, activation of an air bag, etc. Recording can also be triggered manually. Recording such information on a separate page in memory, and only upon being triggered by a particular event, permits capturing data for later analysis of vehicle and/or driver performance.

In a third mode of operation, the recording rate may be increased upon the occurrence of an unusual condition, such as a sudden acceleration or deceleration, sudden application of the brakes, activation of an air bag, etc., in order to store more data values surrounding the event, for later analysis.

One skilled in the art would recognize that variations and combinations of these modes of operation could be implemented with the present invention as a matter of design choice.

The selected data may be any of the values mentioned above, or similar values. Further, not all of the values selected need be recorded at the same rate. For example, information that can change rapidly, such as the status of the brake system, vehicle speed, turning conditions, and other information useful for accident reconstruction purposes, may be recorded very frequently (e.g., every 0.2 seconds). Information that changes more slowly, or is less pertinent to accident reconstruction, such as engine temperature, coolant temperature, etc., may be recorded less frequently (e.g., every 5 seconds, or every mile).

To read out the data collected in the RAM card 20, the RAM card 20 is removed from the interface receptacle on the automotive system and inserted in a similar interface coupled to a personal computer. The data can then be displayed on the computer or stored on a different memory device, such as a floppy disk or a hard drive in the computer.

FIGURE 6 ia a block diagram of an interface between the RAM card 20 and a personal computer (PC) 60. An interface receptacle 21, identical to the interface receptacle 21 in the vehicle system, is coupled to a bidirectional connector 61 that is connected to a parallel port of the PC 60. The signal lines between the PC 60 and the RAM card 20 are preferably the standard 3-wire serial bus described above. The bidirectional connector 61 may also provide a parallel interface signal pass-through so that a standard parallel interface device, such as a printer (not shown), may still be coupled to the PC 60 through the parallel port. Such pass-through type connectors are well-known in the art.

When a RAM card 20 is removed from a vehicle system, the card is inserted into the interface receptacle 21 for data retrieval by the PC 60. Data is then read out of the RAM card 20 under control of the microcomputer of the PC, using the same process described above with respect to the microcontroller 22. That is, data is transmitted serially through the bidirectional connector 61, through the parallel port and to the microcontroller. The microcontroller converts the serial data to parallel form under software control, in known fashion.

Once data has been retrieved from the RAM card 20, it can be displayed on the PC in a variety of ways, such as in various tabular forms, depending on whether the information represents accident reconstruction information, trip monitoring information, maintenance

information, or other information. The manner of presentation of the data is a matter of design choice.

Since the RAM card 20 is removable and relatively inexpensive, each driver of a particular vehicle, such as a fleet car or bus, could be given a personalized RAM card 20. Thus, the ERA invention can be used to monitor the performance of particular drivers, including characteristics such as average driving speed, braking and acceleration habits, typical "headway" distance (i.e., the distance from the vehicle immediately in front in the same lane, as determined by the radar system), etc.

As another aspect of the invention, the ERA can be used to provide an authorization function that prohibits unauthorized personnel from driving a vehicle. Since each driver can be given a personalized RAM card 20, each RAM card 20 can be "keyed" with an electronic "signature" to work only with a particular vehicle. Anyone without a RAM card 20 "keyed" to a vehicle could not drive the vehicle. The "keying" signature may be as simple or as sophisticated as desired, and may be, for instance, a numeric code stored in the first address of the memory 54 of the RAM card 20. A matching code would be stored in the non-volatile memory device 23. The microcontroller 22 would read the pre-stored code in the RAM card 20 and compare the code with the corresponding code read from the non-volatile memory device 23. If no match occurred, the vehicle would not be enabled to operate. In addition, each RAM card 20 may have an "expiration" date coded therein, such that the vehicle would not be enabled to operate if the card had expired.

As another example, in order to enforce mandatory rest stops, a RAM card 20 and microcontroller 22 combination could be programmed to disable the vehicle for a fixed period of time after a stop, or until an authorization code was provided by a dispatcher (such a

code could be provided to the microcontroller 22 by means of a 10-key keypad, for example).

As another aspect of the invention, the ERA can be used to load upgraded or updated computer programs (software) into the vehicle system. In this mode of operation, new software is loaded into a RAM card 20 through, for example, a PC 60, before insertion of the RAM card 20 into a vehicle system. The microcontroller 22 in the vehicle system reads the new program data out of the RAM card 20, converts it from serial to parallel form, and stores it in the non-volatile memory device 23 coupled to the microcontroller 22. The uploaded software may be for an automotive electronic control system or an automotive radar system, or both. This feature circumvents the time consuming and cumbersome task of removing the control system from the vehicle to load a software upgrade.

This aspect of the invention can also be used to "customize" or "personalize" the operational characteristics of a vehicle to a driver's preferences. For example, each driver of a fleet vehicle or bus can use the RAM card 20 to upload into the vehicle the driver's preferences relating to desired headway distance, warning thresholds, or any other parameter that can be set through a vehicle's electronic control system.

Although the preferred embodiment of the invention is illustrated as being used in conjunction with an automotive radar system, it should be understood that the invention can be used in conjunction with any microcontroller-based or microcomputer-based automotive electronic system that gathers data about various vehicle performance and environment factors and can control the loading of such information into a memory device.

Further, as automotive technology progresses, the subsystems in a vehicle likely will communicate via a

vehicle-wide system serial data bus. The ERA is able to accommodate this technological advance since the invention can be coupled to a serial system bus without major modification. This would allow the invention to record information from other subsystems on the serial bus for accident reconstruction, trip monitoring, or other tasks. The microcontroller 22 would be coupled to the system serial bus, and could either monitor activity on the bus and store relevant information it encounters, or take an active role on the bus by requesting relevant information from other subsystems and then storing such information.

As another aspect of the invention, a second ERA 5 could be mounted in a vehicle. A first ERA 5 system can be used to record information pertinent to the vehicle regardless of the identity of the driver (e.g., vehicle maintenance information), while a second ERA 5 system can be used to record information pertinent to each driver on the driver's personal RAM card 20. If desired, the first ERA 5 system may be non-removable, in which case the RAM card 20 and interface receptacle 21 can be replaced with a non-volatile RAM circuit directly coupled to the microcontroller 22.

Thus, the present invention records data until an event, such as an accident, stops the recording. In the preferred embodiment, the RAM card 20 can then be removed and the events leading up to the event read back using a standard personal computer with a matching interface. The invention is thus extremely useful for accident reconstruction as well as more standard vehicle performance, operational status, and/or environment data. In addition, the invention is configurable for a driver's particular preferences, and optionally provides an authorization function that prohibits unauthorized personnel from driving a vehicle, and provides a convenient means for upgrading system-wide software for an automotive electronic

control system or an automotive radar system. The RAM card 20 also uses rugged and durable technology that is suitable for integration into an automotive system.

A number of embodiments of the present invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the invention is not to be limited by the specific illustrated embodiment, but only by the scope of the appended claims.

WHAT IS CLAIMED IS:

1. An event recording apparatus for use in an automotive vehicle having at least one data generating means, each for sensing an environmental or an operational parameter of the automotive vehicle and for generating corresponding data values, comprising:
   (a) a removable data storage card including non-volatile memory means for storing data, and a first interface means for transmitting data from the memory means and for receiving data for storage in the memory means;
   (b) an interface adapter, adapted to removably receive the data storage card and mountable in the automotive vehicle, and including a second interface means for transmitting data to the first interface means of the data storage card and for receiving data from the first interface means of the data storage card;
   (c) controller means, coupled to the interface adapter and to at least one data generating means, for receiving data values from at least one data generating means and transmitting such received data values through the interface adapter for storage in the data storage card.

2. An event recording apparatus for use in an automotive vehicle environment, comprising:

(a) a removable data storage card including non-volatile memory means for storing data, and a first interface means for transmitting data from the memory means and for receiving data for storage in the memory means;

(b) an interface adapter, adapted to removably receive the data storage card and mountable in an automotive vehicle, and including a second interface means for transmitting data to the first interface means of the data storage card and for receiving data from the first interface means of the data storage card;

(c) at least one data generating means, adapted to be mounted in an automotive vehicle, each for sensing an environmental or an operational parameter of the automotive vehicle and for generating corresponding data values;

(d) controller means, coupled to the interface adapter and to at least one data generating means, for receiving data values from at least one data generating means and transmitting such received data values through the interface adapter for storage in the data storage card.

3. An event recording apparatus for use in an automotive vehicle having at least one data generating means, each for sensing an environmental or an operational parameter of the automotive vehicle and for generating corresponding data values, comprising:

(a) an electronic removable data storage card including non-volatile memory means for storing data, and a first serial interface means for transmitting data from the memory means and for receiving data for storage in the memory means;

(b) an interface adapter, adapted to removably receive the data storage card and mountable in the automotive vehicle, and including a second serial interface means for transmitting data to the first serial interface means of the data storage card and for receiving data from the first serial interface means of the data storage card;

(c) controller means, coupled to the interface adapter and to at least one data generating means, for receiving data values from at least one data generating means and periodically transmitting such received data values through the interface adapter for storage in the data storage card.

4. The event recording apparatus of claims 1, 2, or 3, wherein the controller means further includes means for reading data from the data storage card.

5. The event recording apparatus of claim 4, further including a system non-volatile memory means for storing data read from the data storage card.

6. The event recording apparatus of claim 5, wherein the data read from the data storage card comprises at least one computer program.

7. The event recording apparatus of claim 5, wherein the controller means further includes means for enabling or disabling the automotive vehicle from operating, and wherein the data read from the data storage card comprises an authorization code in response to which the controller means enables the automotive vehicle if the authorization code is valid, and disables the automotive vehicle if the authorization code is invalid.

8. The event recording apparatus of claim 5, wherein the controller means further includes means for enabling or disabling the automotive vehicle from operating, and wherein the data read from the data storage card comprises an expiration code in response to which the controller means enables the automotive vehicle if the expiration code is valid, and disables the automotive vehicle if the expiration code is invalid.

9. The event recording apparatus of claim 5, wherein the controller means further includes means for controlling functions of the automotive vehicle in response to data values read from the data storage card.

10. The event recording apparatus of claim 5, wherein the system non-volatile memory means includes one of: dynamic RAM with a battery backup and refresh circuitry; static RAM with a battery backup; flash memory; and electrically alterable read-only memory.

11. The event recording apparatus of claim 3, wherein the first and second interface means communicate over a 3-wire serial bus.

12. The event recording apparatus of claims 1, 2, or 3, wherein the non-volatile memory means includes one of: dynamic RAM with a battery backup and refresh circuitry; static RAM with a battery backup; flash memory; and electrically alterable read-only memory.

13. The event recording apparatus of claims 1, 2, or 3, wherein the data stored in the data storage card relates to events internal to the vehicle.

14. The event recording apparatus of claim 13, wherein the data relating to events external to the vehicle is selected from one or more of: a hazard level determined from a radar system mounted in the automotive vehicle; automotive vehicle speed; braking pressure; acceleration or deceleration in one or more dimensions; rate of turning; steering angle; cruise control status; vehicle engine RPM; brake temperature; brake line hydraulic pressure; distance travelled; average speed; miles-per-gallon; fuel remaining; compass direction of travel; coolant temperature; oil temperature; engine temperature; transmission fluid temperature; engine timing; impact; tire pressure; windshield wiper status; fog light status; defroster status; and geographic positioning information.

15. The event recording apparatus of claims 1, 2, or 3, wherein the data stored in the data storage card relates to events external to the vehicle.

16. The event recording apparatus of claim 15, wherein the data relating to events external to the vehicle is selected from one or more of: the closing rate between the automotive vehicle and targets located by a radar system mounted in the automotive vehicle; the distance between the automotive vehicle and such targets; and target direction.

17. The event recording apparatus of claims 1, 2, or 3, further including a computer interface adapter means, adapted to removably receive a data storage card and adapted to be coupled to a computer, and including a third interface means for transmitting data from the computer to the first interface means of the data storage card and for receiving data from the first interface means of the data storage card.

18. The event recording apparatus of claims 1, 2, or 3, wherein the data stored in the data storage card is normally stored at a first rate, but is stored at a second rate upon the occurrence of a selected event.

19. The event recording apparatus of claims 1, 2, or 3, wherein data storage is commenced upon the occurrence of a selected event.

20. The event recording apparatus of claims 1, 2, or 3, wherein data storage is terminated upon the occurrence of a selected event.

21. The event recording apparatus of claims 1, 2, or 3, wherein the non-volatile memory means includes multiple logical data pages for storing independent sets of data.

22. A method for recording events relating to an automotive vehicle having at least one data generating means, each for sensing an environmental or an operational parameter of the automotive vehicle and for generating corresponding data values, comprising the steps of:

(a) providing a removable data storage card including non-volatile memory means for storing data, and a first interface means for transmitting data from the memory means and for receiving data for storage in the memory means;

(b) providing an interface adapter, adapted to removably receive the data storage card and mountable in the automotive vehicle, and including a second interface means for transmitting data to the first interface means of the data storage card and for receiving data from the first interface means of the data storage card;

(c) receiving data values from at least one data generating means;

(d) transmitting such received data values through the interface adapter;

(e) storing the transmitted data in the data storage card.

23. The method for recording events of claim 22, further including the steps of:
(a) providing a computer interface adapter means, adapted to removably receive a data storage card and adapted to be coupled to a computer, and including a third interface means for transmitting data from the computer to the first interface means of the data storage card and for receiving data from the first interface means of the data storage card;
(b) reading into a computer data stored in the data storage card.

24. The method for recording events of claim 22, wherein the data stored in the data storage card relates to events internal to the vehicle.

25. The method for recording events of claim 24, wherein the data relating to events external to the vehicle is selected from one or more of: a hazard level determined from a radar system mounted in the automotive vehicle; automotive vehicle speed; braking pressure; acceleration or deceleration in one or more dimensions; rate of turning; steering angle; cruise control status; vehicle engine RPM; brake temperature; brake line hydraulic pressure; distance travelled; average speed; miles-per-gallon; fuel remaining; compass direction of travel; coolant temperature; oil temperature; engine temperature; transmission fluid temperature; engine timing; impact; tire pressure; windshield wiper status; fog light status; defroster status; and geographic positioning information.

26. The method for recording events of claim 22, wherein the data stored in the data storage card relates to events external to the vehicle.

27. The method for recording events of claim 26, wherein the data relating to events external to the vehicle is selected from one or more of: the closing rate between the automotive vehicle and targets located by a radar system mounted in the automotive vehicle; the distance between the automotive vehicle and such targets; and target direction.

28. The method for recording events of claim 22, wherein the data stored in the data storage card is normally stored at a first rate, but is stored at a second rate upon the occurrence of a selected event.

29. The method for recording events of claim 22, wherein data storage is commenced upon the occurrence of a selected event.

30. The method for recording events of claim 22, wherein data storage is terminated upon the occurrence of a selected event.

31. The method for recording events of claim 22, wherein the non-volatile memory means includes multiple logical data pages for storing independent sets of data.

32. An event recording apparatus for use in an automotive vehicle having at least one data generating means, each for sensing an environmental or an operational parameter of the automotive vehicle and for generating corresponding data values, comprising:
    (a) a data storage unit having a non-volatile memory for storing data, and means for transmitting data from the memory and for receiving data for storage in the memory;
    (b) controller means, coupled to the data storage unit and to at least one data generating means, for receiving data values from at least one data generating means and transmitting such received data values to the data storage unit for storage in the non-volatile memory.

33. The event recording apparatus of claim 32, wherein the data stored in the data storage unit relates to events internal to the vehicle.

34. The event recording apparatus of claim 32, wherein the data stored in the data storage unit relates to events external to the vehicle.

AMENDED CLAIMS

[received by the International Bureau on 12 January 1994 (12.01.94); original claims 4-7, 33 and 34 cancelled; original claims 1-3, 8-10, 14, 22-32 amended and renumbered; new claim 29 added; other claims unchanged and renumbered (10 pages)]

1. An event recording apparatus for use in an automotive vehicle having at least one data generating means, each for sensing an environmental or an operational parameter of the automotive vehicle and for generating corresponding data values, comprising:

(a) a removable data storage card including non-volatile memory means for storing data, and a first interface means for transmitting data from the memory means and for receiving data for storage in the memory means;

(b) an interface adapter, adapted to removably receive the data storage card and mountable in the automotive vehicle, and including a second interface means for transmitting data to the first interface means of the data storage card and for receiving data from the first interface means of the data storage card;

(c) controller means, coupled to the interface adapter and to at least one data generating means, for receiving data values from at least one data generating means and transmitting such received data values through the interface adapter for storage in the data storage card, the controller means including means for reading data from the data storage card;

wherein the data read from the data storage card comprises at least one program.