What is claimed is:

1. An apparatus for a television program delivery system characterized by:

receiving means (272) for receiving television programs in analog or digital format, each having video and audio components, wherein the receiving means (272) includes at least one reception port;

coordinating means, connected to the receiving means (272), for coordinating the receipt of the television programs;

input means (262) for receiving input commands and specific information about each of the television programs;

database means (268), including a central processing unit (264), connected to the input means (262), for storing and supplying information about the television programs;

generation means (264), connected to the input means (262) and database means (268), for generating a program control information signal (276) based on the input from the input means (262) and the database means (268), the signal (276) containing specific identification about each television program in a subset of television programs received by the receiving means (272), including the date and time of display and the category into which the television program falls;

combining means (270), connected to the generation means (264) and receiving means (272), for combining the subset of television programs identified in the program control information signal (276) in preparation for transmission;

multiplexing means (290), including a multiplexer, connected to the combining means (270), for multiplexing the combined television programs and program control information signal (276) for transmission; and

transmitting means (292, 294, 296), including a modulator, connected to the multiplexing means (290), for simultaneously transmitting the multiplexed program control information signal (276) along with the multiplexed television programs so that video displays can be generated from the program control information signal and so that the downstream displays of the television programs can be selected and controlled by the viewers.

2. The apparatus of claim 1 further characterized by a conversion means (284), connected to the receiving means (272), for digitizing the television programs received in analog format.

3. The apparatus of claim 1 wherein the database means (268) further includes means for storing and for supplying information about the viewers.

4. The apparatus of claim 1 wherein the generation means (264) includes means for designating a set of television programs whose identities will be included in the program control information signal (276) so that the subset of television programs corresponds to one or more television program line-ups.

5. The apparatus of claim 1 wherein the input means (262) includes a local sensor and receptor which responds to voice, touch sensitive entries or input keys.

6. The apparatus of claim 1 wherein at least one of the television programs includes a television program which is continuously and repeatedly transmitted and wherein the program control information signal (276) continuously transmits the next incremental start time.

7. The apparatus of claim 1 wherein the central processing unit (264) combines and analyzes information from the database means and input entered from the input means (262) to generate the digital program control data information signal (276).

8. The apparatus of claim 1 wherein the apparatus is further characterized by internal video storage (267) of television programs in analog or digital format

and means for acquiring external feeds of television programming, both of which are accessible by and connected to the receiving means (272) whereby either internally stored programming or externally obtained programming can be converted by the converting means (284), combined by the combining means (270) and transmitted by the transmitting means (292, 294, 296) along with a related program control information signal (276).

9. The apparatus of claim 1 wherein the central processor unit (264) includes processing means for controlling the content of the program control information signal combined with software operating the processing means based on commands entered into input means (262), the combined processing means and software characterized by:

means (262, 264) for creating program lineups for transmission to viewers;

means (264, 268), connected to the creating means (262, 264) for prioritizing programs based on a plurality of factors including popularity of the program, its weighted importance and the bandwidth available to the viewer to receive the plurality of programs;

means (262), connected to the prioritizing means, for initiating allocation of different menus to different classes of viewers;

means (262), connected to the menu means, for initiating bandwidth allocations so that different program content is sent to different viewers; and

editing means (262), connected to the menu means, to design, create and change menus listing the variable content created by the prioritizing means and the allocation means.

10. The apparatus of claim 1 wherein the program control data information signal includes a category designation for each television program, each category designation selected from the group consisting of static programming, interactive services, pay for view, live sport specials, mini pays or data services.

11. The apparatus of claim 1 wherein the transmitting means (292, 294, 296) includes means for transmitting the signal to a plurality of selectable satellite transponders and wherein the apparatus is further characterized by means for grouping television programs into separate groups for transmission over selected transponders.

12. The apparatus of claim 1 wherein the transmitting means (292, 294, 296) includes means for transmitting the signal to a plurality of selectable satellites and the apparatus is further characterized by means for grouping television programs into separate groups for transmission to different geographical regions.

13. The apparatus as claimed in claim 1 wherein the database means (268) includes a plurality of databases and wherein the apparatus is further characterized by processing means for accessing the databases and processing the information therein to provide the requisite program control information signal, the databases including information concerning each scheduled Program, records representing the source from which each television program was obtained, optional display services available, available previews of television programs, program categories for each television program to be transmitted and price categories for each television program to be transmitted.

14. The apparatus as claimed in claim 1 wherein the database means (268) includes a plurality of databases, each database composed of multiple related sets of data, and wherein the apparatus is further characterized by processing means for accessing the databases and processing the information therein and management means for determining how to operate the apparatus so that it provides the requisite control information signal, the databases including:

means for storing information about each destination to which the apparatus transmits;

means for storing information about rights in or ownership in each program source;

means for storing information about price, promotion and packaging of each program broadcast;

means for storing information about the storage location of each internally stored program; and

means for storing information about marketing and customer.

15. The apparatus of claim 1 modified in that:

the apparatus is further characterized by an internal collection means, connected to the receiving means (272), for gathering television programs from internal sources and feeding the television programs from internal sources to the reception port;

the generation means (264) and the input means (262) are part of a packaging means for creating program control information and for packaging television programs using the program control information, the packaging means including:

the central processing unit (264);

the input means (262) which includes an interface, connected to the central processing unit (264), to enable the program packager to enter program line-up information, wherein the interface is operably connected to the central processing unit (264);

a storage means, connected to the central processing unit (264), for storing the entered program line-up information;

logic means (264), connected to the central processing unit (264), for arranging the stored program line-up information and for creating program control information; and

means (264), connected to the logic means (264), for generating a program control information signal (276) from the program control information;

the combining means (270) combines the set of television programs identified in the program control information signal (276) with the program control information signal(276) to create a combined signal, wherein the combining means includes a delivery control processor (270);

the multiplexing means (290) multiplexes the combined signal; and

the transmission means (292, 294, 296), transmits the combined signal.

16. The apparatus of claim 15, wherein

the packaging means includes means for generating menu configurations (324); and

the packaging means generates the program control information using the menu configurations.

17. The apparatus of claim 15 further characterized by:

means (264) for receiving unique cable franchise control information from cable franchises;

means (269, 328), connected to the receiving means (264), for storing the unique cable franchise control information, the storing means includes the cable franchise configuration database (328); and

wherein the generating means (264), connected to the storing means (328) comprises means for including the unique cable franchise control information signal in the generated program control information signal.

18. A method for delivering televisions programs in a television program delivery system characterized by the steps of:

(a) receiving (272) a plurality of television programs in analog or digital format, each having video and audio components;

(b) supplying (262) information about the received television programs, including information on the identities of the received television programs;

(c) storing (268) information supplied about the received television programs for use in the steps of delivering the received television programs;

(d) creating (400, 316, 318, 342) a plurality of program line-ups that identify received television programs using the stored information about the received television programs;

(e) generating (326, 442) a program control information signal (276) using one or more of the created program line-ups;

(f) preparing (332, 334) the program control information signal (276) and a plurality of the television programs identified in the program control information signal for transmission; and

(g) transmitting (292, 294, 296) the prepared program control information signal (276) and the prepared television programs for redistribution to subscriber locations, whereby, the prepared and transmitted television programs may be viewed by a subscriber.

19. The method of claim 18 wherein the preparing step includes a method of transmitting a plurality of programs to a cable headend (208), each of the plurality of programs corresponding to one of a plurality of genre categories, the transmitting including the steps of:

prioritizing (400) each of the programs by assigning to each of the programs one of a plurality of priority levels, the plurality of priority levels including a high priority level and progressively lower priority levels;

forming (400) a plurality of signals, each of the signals including programs corresponding to a single priority level;

appending (320) a header to each of the signals, wherein the header identifies the priority level for a corresponding signal, thereby enabling recognition by the cable headend; and transmitting (292, 294, 296) each of the headers and the corresponding signals to the cable headend (208).

20. The method of claim 18, wherein the preparing step includes a method of transmitting programs to a plurality of transponders, the method including the steps of:

prioritizing (400) each of the programs by assigning to each of the programs one of a plurality of priority levels, the plurality of priority levels including a high priority level and progressively lower priority levels;

forming (400) a plurality of signals, each of the signals including programs corresponding to a single priority level; and

transmitting (292, 294, 296) the plurality of signals to the plurality of transponders so that none of the transponders receives more than one of the signals.

21. The method of claim 20 further including the step of dynamically changing bandwidth allocation for at least one of the plurality of categories.

22. The method of claim 18 wherein the preparing step includes a method of transmitting a plurality of programs in a first amount of bandwidth for reception by a first cable headend (208), and in a second amount of bandwidth which is less than the first amount of bandwidth for a second cable headend (208), the method including the steps of:

prioritizing (400) each of the programs by assigning to each of the programs one of a plurality of priority levels, the plurality of priority levels including a high priority level and progressively lower priority levels;

dividing (320) the first amount of bandwidth so that each program category receives a portion of the first amount of bandwidth;

forming (320) a first allocation of bandwidth by allocating the first amount of bandwidth to high priority programs in each category;

continuing the forming (400) a first allocation step with the progressively lower priority levels until at least one of the following conditions occurs:

all programs are allocated;

all of the first amount of bandwidth is allocated;

dividing the second amount of bandwidth so that each program category receives a portion of the second amount of bandwidth;

forming (320) a second allocation of bandwidth by allocating the second amount of bandwidth to high priority programs in each category;

continuing the forming a second allocation step with the progressively lower priority levels until at least one of the following conditions occurs:

all programs are allocated;

all of the second amount of bandwidth is allocated;

transmitting the first allocation of bandwidth to the first cable headend (208); and

transmitting the second allocation of bandwidth to the second cable headend (208).

23. The method of claim 18 wherein the step of generating a program control information signal (276) for use by viewers using menus of available programming based on program line-up information includes the steps of:

obtaining and storing (400) program line-up information for each program, the program line-up information comprising, program name, program start time, program duration, program category and program price;

arranging (432) the program line-up information for all programs in a menu configuration;

creating (430) program control information using the program line-up information;

generating (442) a digital program control information data signal using the program control information; and

continuously transmitting (292, 294, 296) the digital program control information data signal simultaneously with the programs.

24. The method of claim 18 wherein the step of generating a program control information signal includes generating a program control information signal for transmission to viewers of a simultaneously transmitted plurality of television programs so that variable video displays of current and future programming can be generated and so that the downstream displays of the television programs can be selected and controlled by the viewers, the method including:

receiving (400) as input data entry, program names, start times (412), program duration and program category (302, 304, 306, 308, 310, 312) and price (414);

combining (402) the input data with stored marketing data (420, 422) including the frequency with which programs are watched by viewers and the demographics of viewers;

weighing (424) the data according to algorithms which assign a weight of importance to each type of data;

generating (430, 432) from the data a program line-up, and program position on menu formats;

displaying (434) the resulting draft menu for editing;

editing (436, 400) the menu; and

processing (438) the edited menu to generate (442) the program control information signal for transmission to viewers.

25. The method of claim 24 wherein digital program control information signal is transmitted to cable franchises and wherein the method further includes:

means (404) for receiving specific information relating to each cable franchise that receives the signal; and

means (404) for creating a customized signal (428) for each cable franchise.

26. The method of claim 24 wherein the program control information signal also contains information for identifying virtual channels for interactive services (304) and data services (312) available to viewers using service information (503), the method further including the steps of:

collecting service information (503) on the data services (312) available;

inventorying the interactive services (304) to be made available to the viewer;

assigning a virtual channel for the data services (312) and the interactive services (304);

determining method of upstream transmissions for interactive services (304); and

creating a menu for interactive services (304) and data services (312) for later processing.

27. The method of claim 18 wherein the step of creating a program line-up includes a method to assist a program packager to create a transmissible data information signal which organizes stored information on television programs available for viewing into program line-ups and generates (442) a program control information signal (276) from the program line-ups to enable selection of television programs for viewing by viewers, the method including the steps of:

receiving (400) information on television programs available for viewing;

organizing (430) the information on television programs available for viewing into program line-up information using stored computer instructions including a set of computer instructions for utilizing the stored data to optimize the selection of television programs to be watched by each viewer;

editing (436) the program line-up information;

generating (442) the program control information signal (276) using the program line-up information; and

transmitting (292, 294, 296) the program control information signal (276) as a digital data signal so that the television programs from which a viewer can choose will be displayed for selection by a viewer.

28. The method of claim 27 further including the steps of gathering of program watched information from viewers, and wherein the organizing step further includes:

targeting (402) a television program; and

managing (402) the yield of the programs watched information for the targeted program so that the targeted program yields higher programs watched information.

29. The method of claim 27 wherein at least one of the television programs is a program service including a time limited series of programming offered for a defined time each day for a limited number of calendar days and wherein the program control information signal (276) includes information providing an identification and description of the service, the starting and stopping dates and the times each day that the service can be viewed by the viewers.

30. The method of claim 18 wherein the step of creating a program line-up includes a method to create program services containing at least one program and an interstitial audio/video for transmission, the method, including the following steps:

obtaining (461) one or more programs and interstitial audio/video;

creating (460) events including:

combining (462) one or more programs with one or more interstitial audio/video so that an event is longer than the one or more combined programs; and

creating (464) an event identification for recalling the event;

generating program services including:

integrating one or more events using the event identification so that there are no disruptions to the programs or interstitial audio/video;

determining (318) calendar days that the program service will be transmitted;

defining (400) time of day that the program service will be transmitted; and

transmitting (292, 294, 296) the program service containing the integrated events on the determined calendar days at the defined time.

31. The method of claim 30 wherein program services are paid for by viewers, the method further including the steps of:

creating a mini-pay consisting of one or more program services; and

assigning a price to the mini-pay.

32. The method of claim 18 characterized in that the step of creating a program line-up includes a method for creating near video on demand service using programs wherein the near video on demand service is transmitted from a central location for distribution to subscribers, including:

designating (400) a program to be available to subscribers more than once during a day;

evaluating (400) the length of the designated program;

creating (400) program start times using the evaluated length of the program;

organizing (430) a program line-up with the designated program and the program start times so that the program appears in the program line-up more than once and wherein more than one designated programs is in the program line-up; and

wherein the step of generating (442) a program control information signal (276) uses the organized program line-ups.

33. The method of claim 32 wherein programs may be demanded within fifteen minutes, the step of creating program start times includes:

dividing the evaluated program length into multiple fifteen minutes segments and one last segment; and

identifying interstitial audio/video to be added to the last segment.

34. The method of claim 32 wherein a monitor is used, the method further characterized by:

graphically (438) reorganizing the program line up using a monitor before generating the program control information signal.

35. The method of claim 18 characterized in that the step of creating a program line-up includes a method for creating near video on demand service using programs wherein the near video on demand service is transmitted from a central location for distribution to subscribers, including:

designating (400) a program to be available to subscribers more than once;

evaluating (400) the length of the designated program;

creating (400) program start times using the evaluated length of the program;

organizing (430) a program line-up using the program start times (412) so that the program appears in the program line-up more than once;

generating (434) a program control information signal using the organized program line-up; and

transmitting (292, 294, 296) the program control information signal (276) and the designated program to subscribers, wherein the designated program is transmitted to subscribers at the designated programs start times (412).

36. The method of claim 18 further including method for compiling and using program watched data (420) containing information on programs wherein

program watched data is received from one or more remote locations, the method further characterized by the steps of:

receiving (402) program watched data;

designating (402) a program for analysis;

compiling (402) the received program watched data (420) for the designated program; and

using the compiled program watched data (420) in the formation of a program line-up including:

determining (430) whether the compiled data is favorable for placing the designated program in a particular time slot; and

allotting (430) a time slot for the designated program in the program line up.

37. The method of claim 35 wherein menus having menu space are filled using the program watched data, further characterized by the step of:

allocating menu space for the designated program using the program line-up.

38. The method of claim 18 wherein the packaging step includes a method for allocating a given amount of bandwidth for a plurality of television programs from the programs received by the receiving means (272), each of the programs corresponding to one of a plurality of genre categories, the allocation method including the steps of:

prioritizing (400) each of the programs by assigning to each of the programs one of a plurality of priority levels, the plurality of priority levels including a high priority level and progressively lower priority levels, whereby programs having a higher priority level will be accepted by systems having a limited bandwidth;

dividing the given amount of bandwidth so that each program category receives a portion of the given amount of bandwidth;

allocating (326) the given amount of bandwidth to high priority programs in each category; and

continuing the allocating step with the progressively lower priority levels until at least one of the following conditions occurs:

all programs are allocated,

all of the given amount of bandwidth is allocated.

39. An operations center for use by a program packager to provide a television program delivery system, said operations center comprising:

a reception port for receiving television programs;

external collection means for gathering television programs from external sources and feeding television programs from external sources to said reception port;

internal collection means, connected to said reception port, for gathering television programs from internal sources and feeding said television programs from internal sources to said reception port;

a converter for converting any of said television programs that are in non-digital format to digital format;

packaging means for creating program control information and for packaging said digital format television programs using said program control information, said packaging means comprising:

a central processing unit;

an interface, connected to the central processing unit, to enable a program packager to enter program line-up information, wherein said interface is operably connected to said central processing unit;

storage means, connected to the central processing unit, for storing said entered program line-up information;

logic means, connected to the central processing unit, for arranging said stored program line-up information and for creating the program control information; and means, connected to the logic means, for generating a digital program control information signal from the program control information;

combining means for creating a combined signal, said combined signal comprising the packaged digital format programs and the digital program control information signal; and

transmission means, operably connected to said packaging means, for transmitting said combined signal.

40. The operations center of claim 39, wherein

said packaging means comprises means for generating menu configurations; and

said packaging means generates said program control information using said menu configurations.

41. The operations center of claim 39, said operations center further comprising:

means for receiving unique cable franchise control information from cable franchises;

means, connected to the receiving means, for storing said unique cable franchise control information; and

wherein said generating means is connected to the storing means and comprises means for including said unique cable franchise control information in said generated digital program control information signal.

42. A method for remotely generating a program control information signal for use by viewers using menus of available programming based on program line-up information, said method comprising the steps of:

obtaining and storing program line-up information for programs, the program line-up information comprising, program name, program start time, program duration, program category and program price;

arranging said program line-up information for said programs in a menu configuration;

creating program control information using said program line-up information;

generating a digital program control information data signal using said program control information; and

continuously transmitting said digital program control information data signal simultaneously with said programs.

43. A method of generating a digital program control data information signal for transmission to viewers receiving a simultaneously transmitted plurality of television programs so that variable video displays of current and future programming can be generated and so that the downstream displays of the television programs can be selected and controlled by the viewers, the method uses stored marketing data, algorithms, and menus, the method comprising:

receiving input data, including program names, start times, program duration or program category and price;

combining the input data with the stored marketing data comprising the frequency with which programs are watched by viewers and the demographics of viewers;

weighing the combined data according to algorithms which assign a weight of importance to each type of data;

generating from the weighted data a program line-up and program positions on menu formats resulting in a draft menu;

displaying the resulting draft menu for editing;

editing the draft menu; and

processing the edited menu to generate the digital program control data information signal for transmission to viewers.

44. The method of claim 43 wherein the digital program control data information signal is transmitted to cable franchises and wherein the method further comprises:

receiving specific information relating to each cable franchise that receives the signal; and

creating a customized signal for each cable franchise.

45. The method of claim 43 wherein the digital program control data information signal also contains information for identifying virtual channels for interactive services and data services available to viewers using service information, the method further comprising:

collecting service information on the data services available;

inventorying the interactive services to be made available to the viewer:

assigning a virtual channel for the data services and the interactive services;

determining method of upstream transmissions for interactive services; and

creating a menu for interactive services and data services for later processing.

46. A method to assist a program packager to create a transmissible data information signal which organizes stored information on television programs available for viewing into program line-ups and generates a program control information signal from the program line-ups to enable selection of television programs for viewing by viewers, the method comprising:

receiving information on television programs available for viewing;

organizing the information on television programs available for viewing into program line-up information using stored computer instructions including a set of computer instructions for utilizing stored data to optimize the selection of television programs to be watched by each viewer;

editing the program line-up information;

generating the program control information signal using the program line-up information; and

transmitting the program control information signal as a digital data signal so that the television programs from which a viewer can choose will be displayed for selection by a viewer.

47. The method of claim 46 further comprising gathering of program watched information from viewers, and wherein the organizing step further comprises:

targeting a television program; and

managing the yield of the programs watched information for the targeted program so that the targeted program yields higher programs watched information.

48. The method of claim 46 wherein at least one of the television programs is a program service comprising a time limited series of programming offered for a defined time each day for a limited number of calendar days and wherein the program control information signal comprises information providing an identification and description of the service, the starting and stopping dates and the times each day that the service can be viewed by the viewers.

49. A method to create program services containing at least one program and an interstitial audio/video for transmission, comprising:

obtaining one or more programs and interstitial audio/video;

creating events comprising:

combining one or more programs with one or more interstitial audio/video so that an event is longer than the one or more combined programs; and creating an event identification for recalling the event;

generating program services comprising:

integrating one or more events using the event identification so that there are no disruptions to the programs or interstitial audio/video;

determining calendar days that the program services will be transmitted:

defining time of day that the program services will be transmitted; and

transmitting the program services containing the integrated events on the determined calendar days at the defined time.

50. The method of claim 49 wherein program services are paid for by viewers, the method further comprising:

creating a mini-pay consisting of one or more program services; and

assigning a price to the mini-pay.

51. A method for generating a program control information signal for near video on demand service using programs wherein the near video on demand service is transmitted from a central location for distribution to subscribers, comprising:

designating a program to be available to subscribers more than once during a day;

evaluating the length of the designated program;

creating program start times using the evaluated length of the program;

organizing a program line-up with the designated program and the program start times so that the program appears in the program line-up more than once and wherein more than one designated program is in the program line-up;

generating the program control information signal using the organized program line up for transmission.

52. The method of claim 51 wherein designated programs may be demanded within fifteen minutes, the step of creating program start times comprises:

dividing the evaluated program length into multiple fifteen minutes segments and one last segment; and

identifying interstitial audio/video to be added to the last segment.

53. The method of claim 51 wherein a monitor is used further comprising:

graphically reorganizing the program line up using a monitor before generating the program control information signal.

54. A method for creating near video on demand service using programs wherein the near video on demand service is transmitted from a central location for distribution to subscribers, comprising the steps of:

designating a program to be available to subscribers more than once;

evaluating the length of the designated program;

creating program start times using the evaluated length of the program;

organizing a program line-up using the program start times so that the program appears in the program line-up more than once;

generating a program control information signal using the organized program line-up;

transmitting the program control information signal and the designated program to subscribers, wherein the designated program is transmitted to subscribers at the designated program's start times.

55. A method for compiling and using program watched data containing information on programs wherein the program watched data is received from one or more remote locations, comprising the steps of:

receiving the program watched data;

designating a program for analysis;

compiling the received program watched data for the designated program; and

using the compiled program watched data in the formation of a program line-up comprising:

determining whether the compiled data is favorable for placing the designated program in a particular time slot; and

allotting a time slot for the designated program in the program line up.

56. The method of claim 55, wherein menus having menu space are filled using the received program watched data, further comprising the step of:

allocating menu space for the designated program using the program line-up.

57. A centralized operating center for packaging a large number of diverse television programs for selective remote display by viewers, the operating center comprising:

means for receiving television programs in analog or digital format, each having video and audio components;

means, connected to the receiving means, for coordinating the receipt of the television programs;

input means for receiving input commands and specific information about each of the television programs;

database means, connected to the input means, for storing and supplying information about the television programs, comprising:

a central processing unit that analyzes information from the database means and the input means to generate a program control information signal, the signal contains specific identification concerning each television program received by the receiving means, including the date and time of display and the category into which the television program falls;

means, connected to the database means and receiving means, for combining the subset of television programs identified in the program control information signal in preparation for transmission;

multiplexing means, connected to the combining means, for multiplexing the combined television programs and the program control information signal for transmission; and

transmitting means, connected to the multiplexing means, for simultaneously transmitting the multiplexed program control information signal along with the multiplexed television programs so that video displays can be generated from the program control information signal and so that the downstream displays of the television programs can be selected and controlled by the viewers.

58. A centralized operating center for packaging a large number of diverse television programs for selective remote display by viewers using information about television programs, the operating center comprising:

a receiver, wherein television programs are received in analog or digital format, each having video and audio components;

a keyboard, wherein input commands are entered;

a memory, wherein the information about the television programs is stored;

a processor, operably connected to the memory and keyboard, wherein a program control information signal is generated using information stored in the memory and commands entered on the keyboard, the program control information signal containing specific identification concerning each television program in a subset of television programs received by the receiver, including the date and time of display comprising:

a combiner, operably connected to the processor and receiver, wherein the subset of television programs identified in the program control information signal are combined in preparation for transmission;

a multiplexer. connected to the combiner, wherein the combined television programs and the program control information signal are multiplexed for transmission; and

a transmitter, connected to the multiplexer, wherein the multiplexed program control information signal is simultaneously transmitted along with the multiplexed television programs so that video displays can be generated using the program control information signal and so that the downstream displays of the television programs can be selected and controlled by the viewers.

59. An operations center for use by a program packager in a television program delivery system, said operations center comprising:

a reception port, wherein television programs are received;

a local video storage database, operably connected to the reception port, wherein television programs are stored;

a converter, operably connected to the reception port, wherein television programs that are in not in digital format are converted to digital format;

a computer assisted packaging system, operably connected to the local storage, wherein program control information is created and digital format television programs are packaged using the program control information, said packaging system comprising:

a central processing unit;

an interface, operably connected to the central processing unit, wherein a program packager may enter program line-up information;

a database, operably connected to the central processing unit, wherein the entered program line-up information is stored; and

wherein the central processing unit arranges the stored program line-up information and creates the program control information and generates a program control information signal from the program control information;

a combiner, connected to the computer assisted packaging system, wherein a combined signal is created, the combined signal comprising the packaged digital format programs and the program control information signal; and

a transmitter, operably connected to the combiner, for transmitting said combined signal.

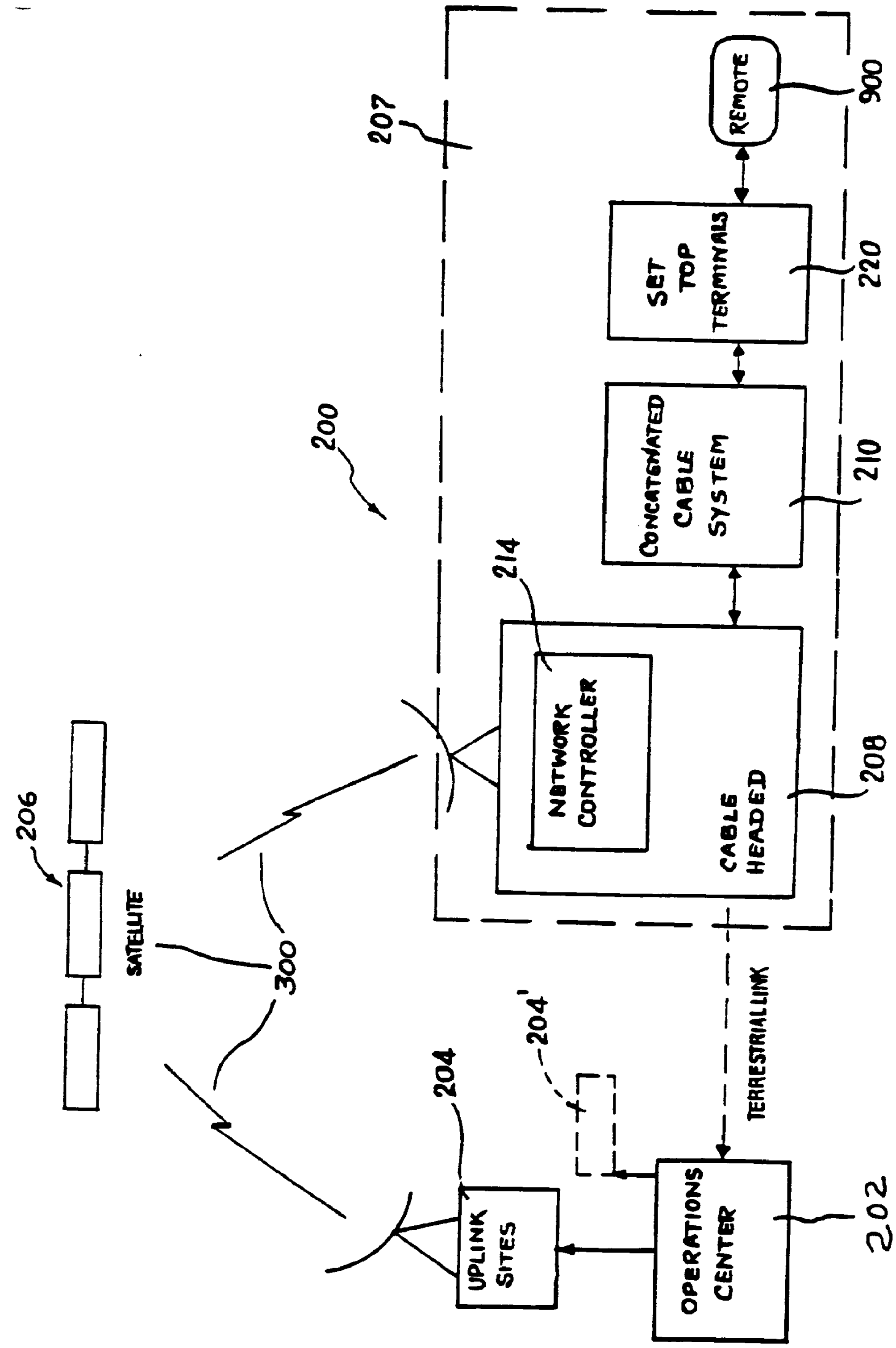

200
207
REMOTE
900
SET TOP TERMINALS
220
CONCATENATED CABLE SYSTEM
210
214
NETWORK CONTROLLER
CABLE HEADED
208
206
SATELLITE
300
TERRESTRIAL LINK
204'
204
UPLINK SITES
OPERATIONS CENTER
202

Fig. 1

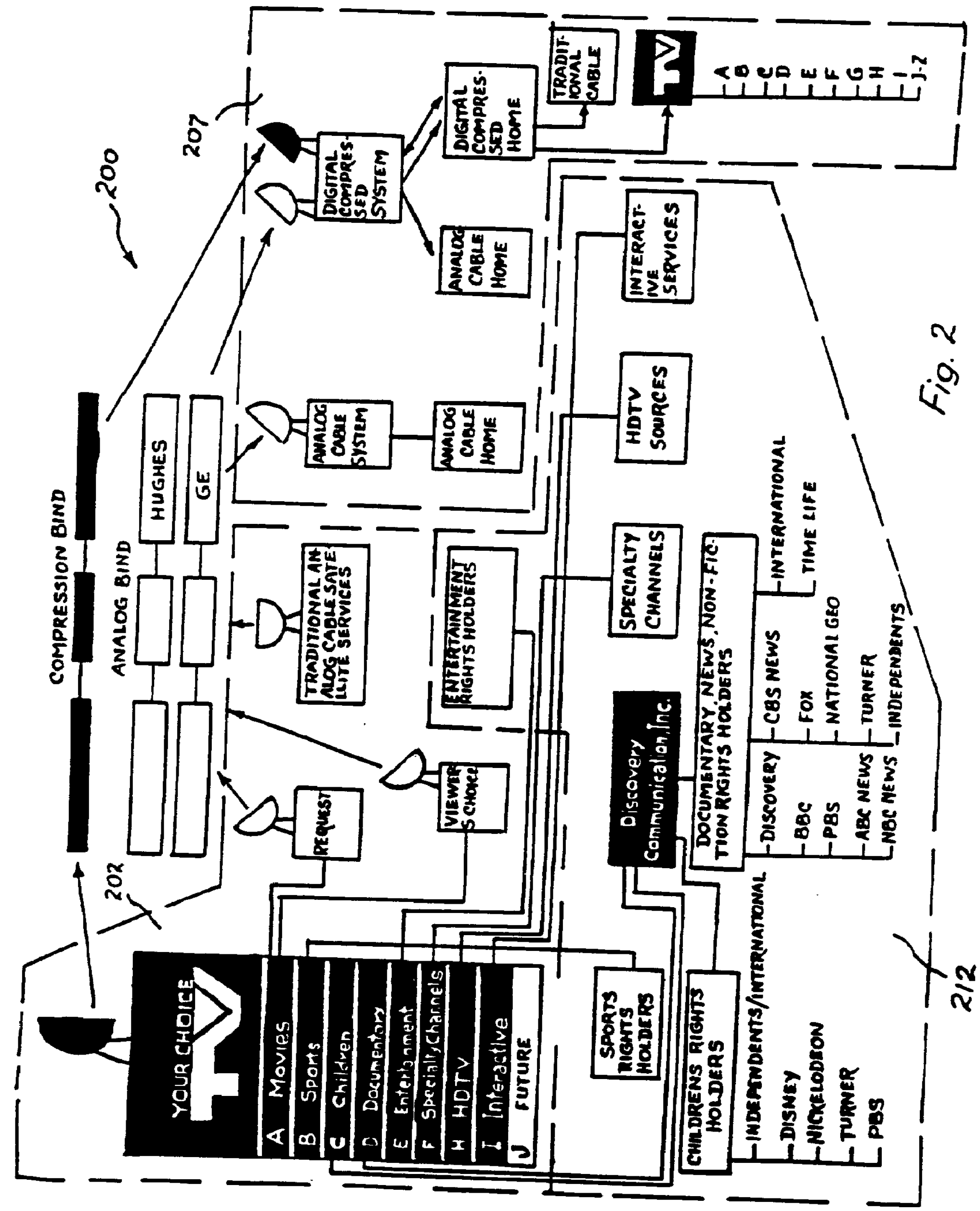


Fig. 2

SUBSTITUTE SHEET (RULE 26)

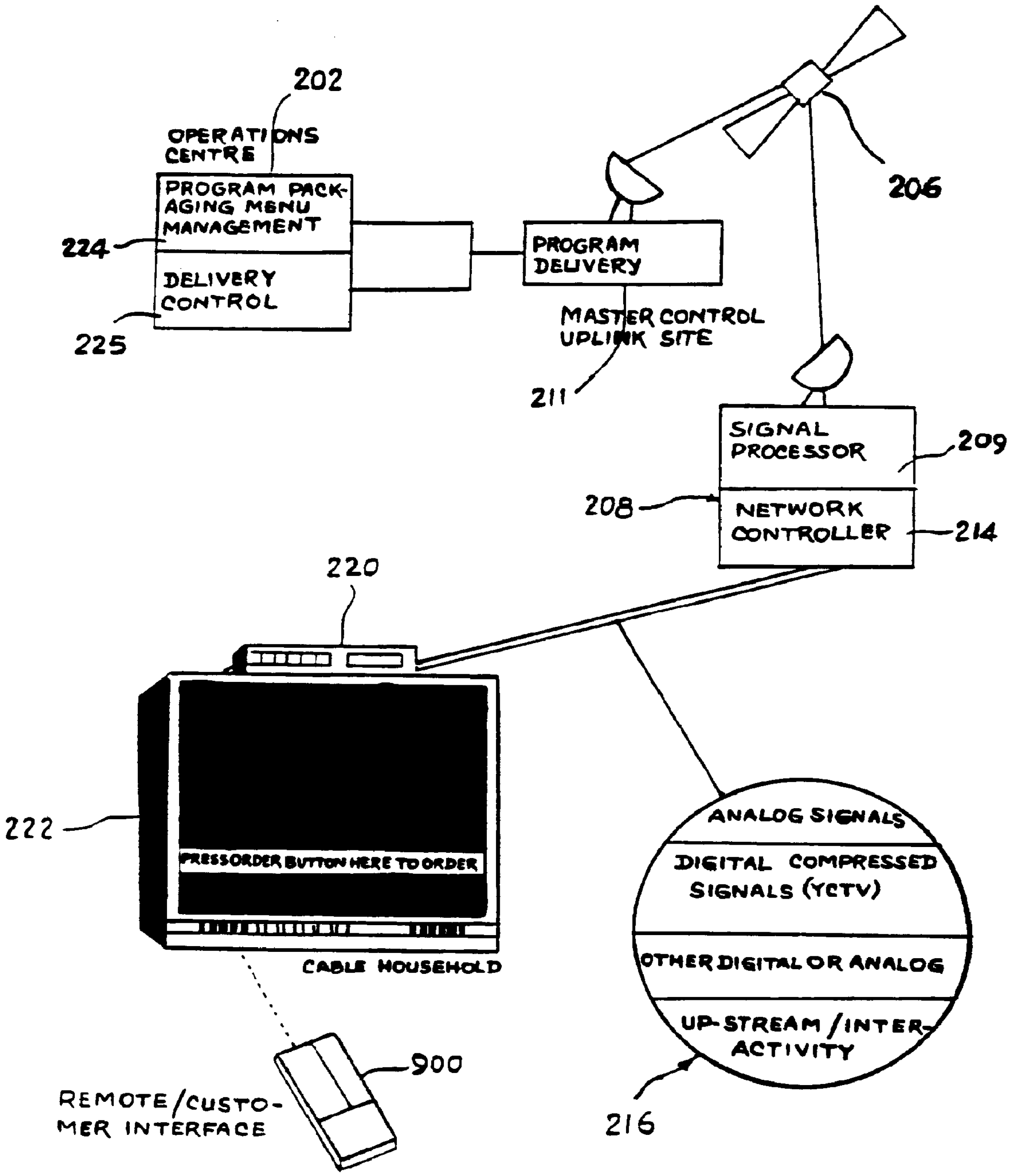

202
OPERATIONS CENTRE
PROGRAM PACKAGING MENU MANAGEMENT
224
DELIVERY CONTROL
225
PROGRAM DELIVERY
MASTER CONTROL UPLINK SITE
211
206
SIGNAL PROCESSOR
209
208
NETWORK CONTROLLER
214
220
222
PRESS ORDER BUTTON HERE TO ORDER
CABLE HOUSEHOLD
ANALOG SIGNALS
DIGITAL COMPRESSED SIGNALS (YCTV)
OTHER DIGITAL OR ANALOG
UP-STREAM / INTER-ACTIVITY
216
900
REMOTE/CUSTOMER INTERFACE

Fig. 3

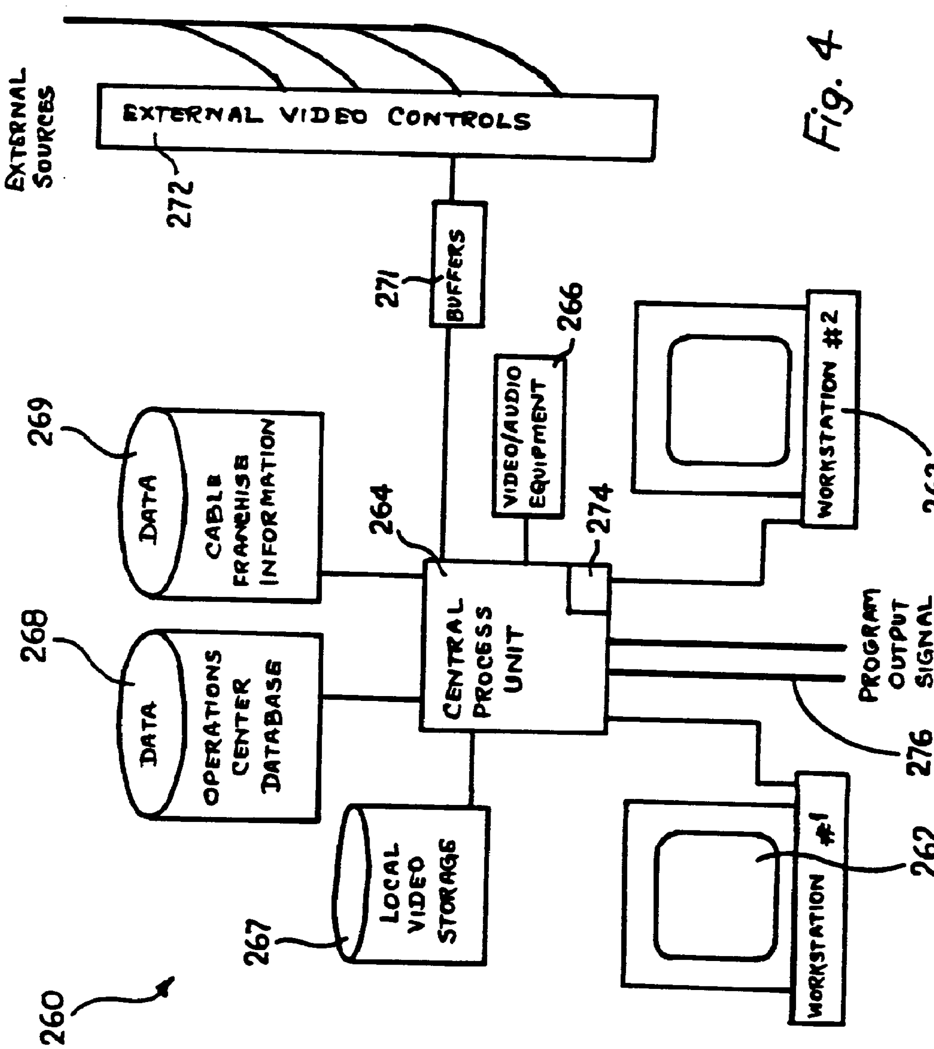

EXTERNAL SOURCES
EXTERNAL VIDEO CONTROLS
272
BUFFERS
271
VIDEO/AUDIO EQUIPMENT
266
DATA
CABLE FRANCHISE INFORMATION
269
DATA
OPERATIONS CENTER DATABASE
268
CENTRAL PROCESS UNIT
264
274
LOCAL VIDEO STORAGE
267
WORKSTATION #2
262
WORKSTATION #1
262
PROGRAM OUTPUT SIGNAL
276
260

Fig. 4

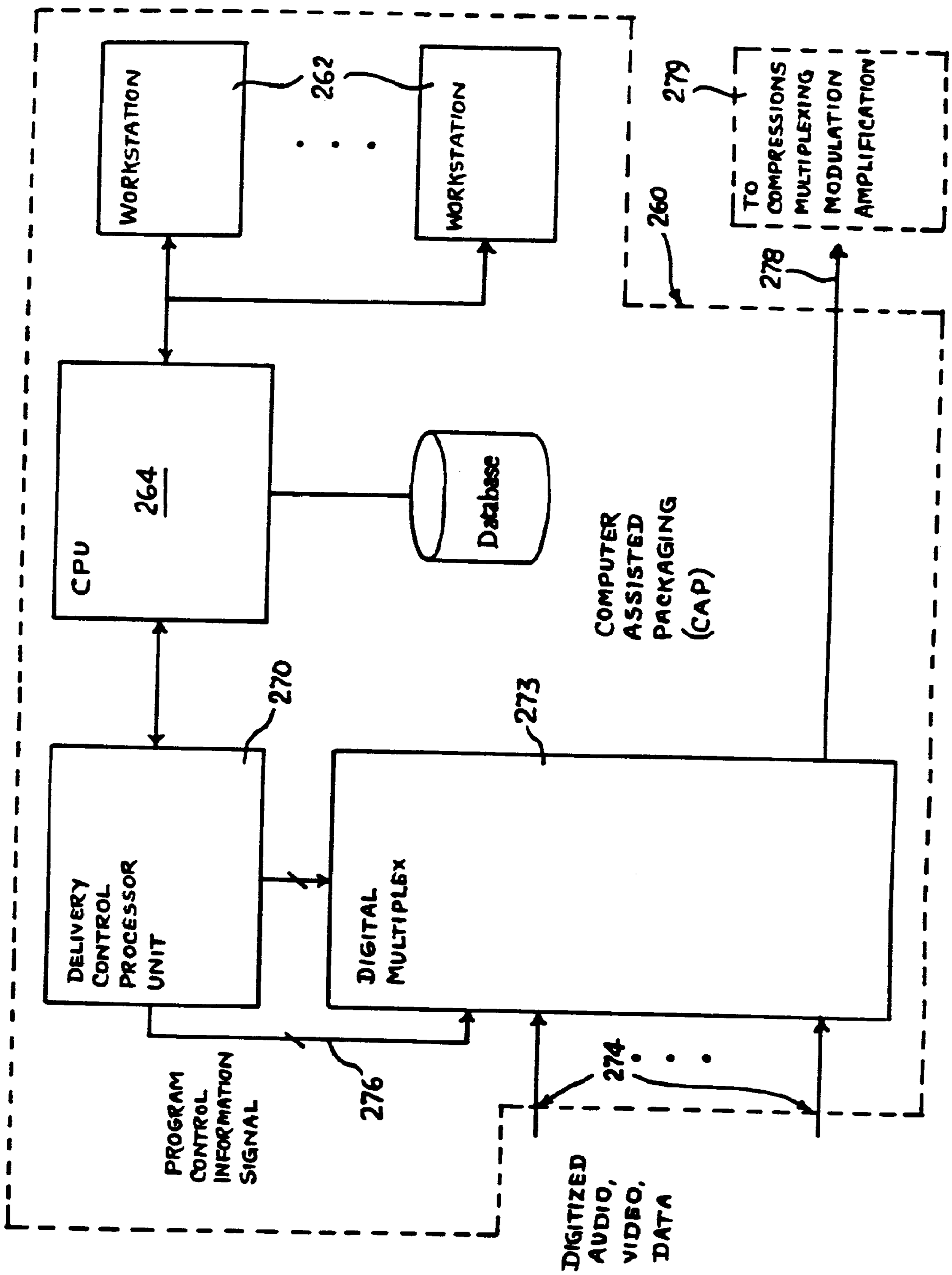
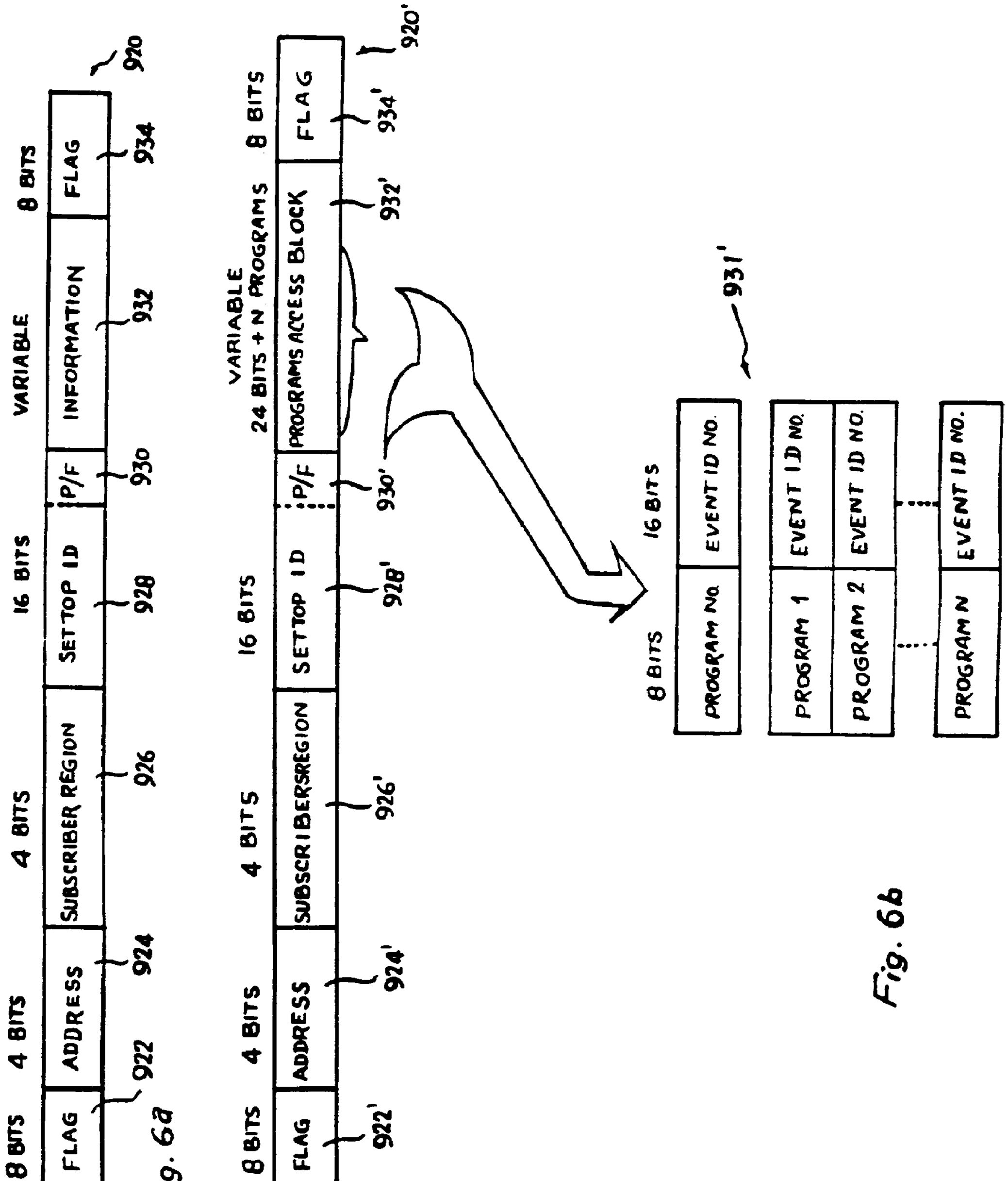

WORKSTATION
262
WORKSTATION
279
TO
COMPRESSIONS
MULTIPLEXING
MODULATION
AMPLIFICATION
260
278
CPU
264
Database
COMPUTER
ASSISTED
PACKAGING
(CAP)
270
273
DELIVERY
CONTROL
PROCESSOR
UNIT
DIGITAL
MULTIPLEX
PROGRAM
CONTROL
INFORMATION
SIGNAL
276
274
DIGITIZED
AUDIO,
VIDEO,
DATA

Fig. 5



8 BITS
4 BITS
4 BITS
16 BITS
VARIABLE
8 BITS
FLAG
ADDRESS
SUBSCRIBER REGION
SET TOP ID
P/F
INFORMATION
FLAG
920
922
924
926
928
930
932
934
VARIABLE
24 BITS + N PROGRAMS
PROGRAMS ACCESS BLOCK
SUBSCRIBERSREGION
920'
922'
924'
926'
928'
930'
932'
934'
931'
8 BITS
16 BITS
PROGRAM NO.
EVENT ID NO.
PROGRAM 1
PROGRAM 2
PROGRAM N

Fig. 6a

Fig. 6b

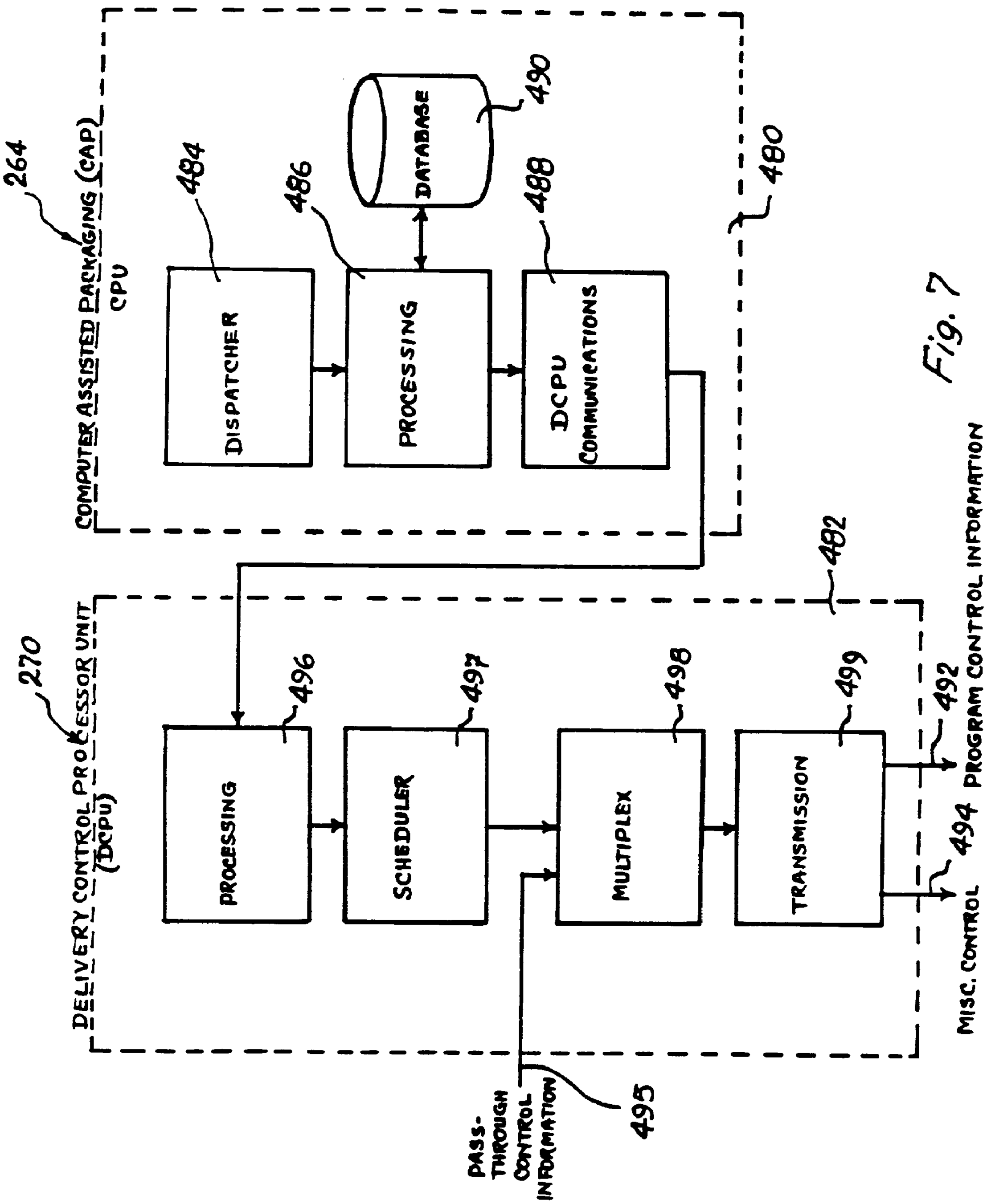


Fig. 7

SUBSTITUTE SHEET (RULE 26)

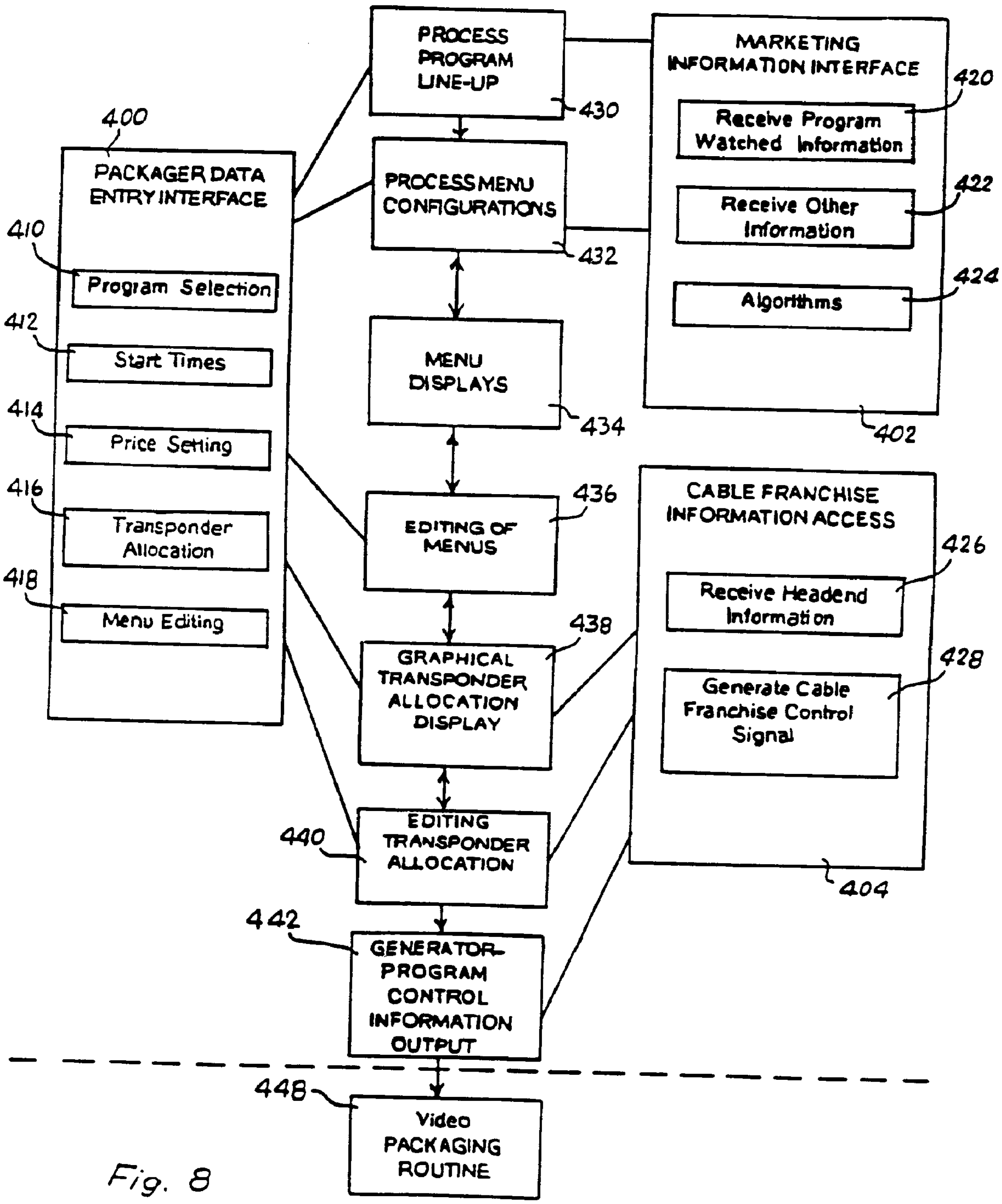
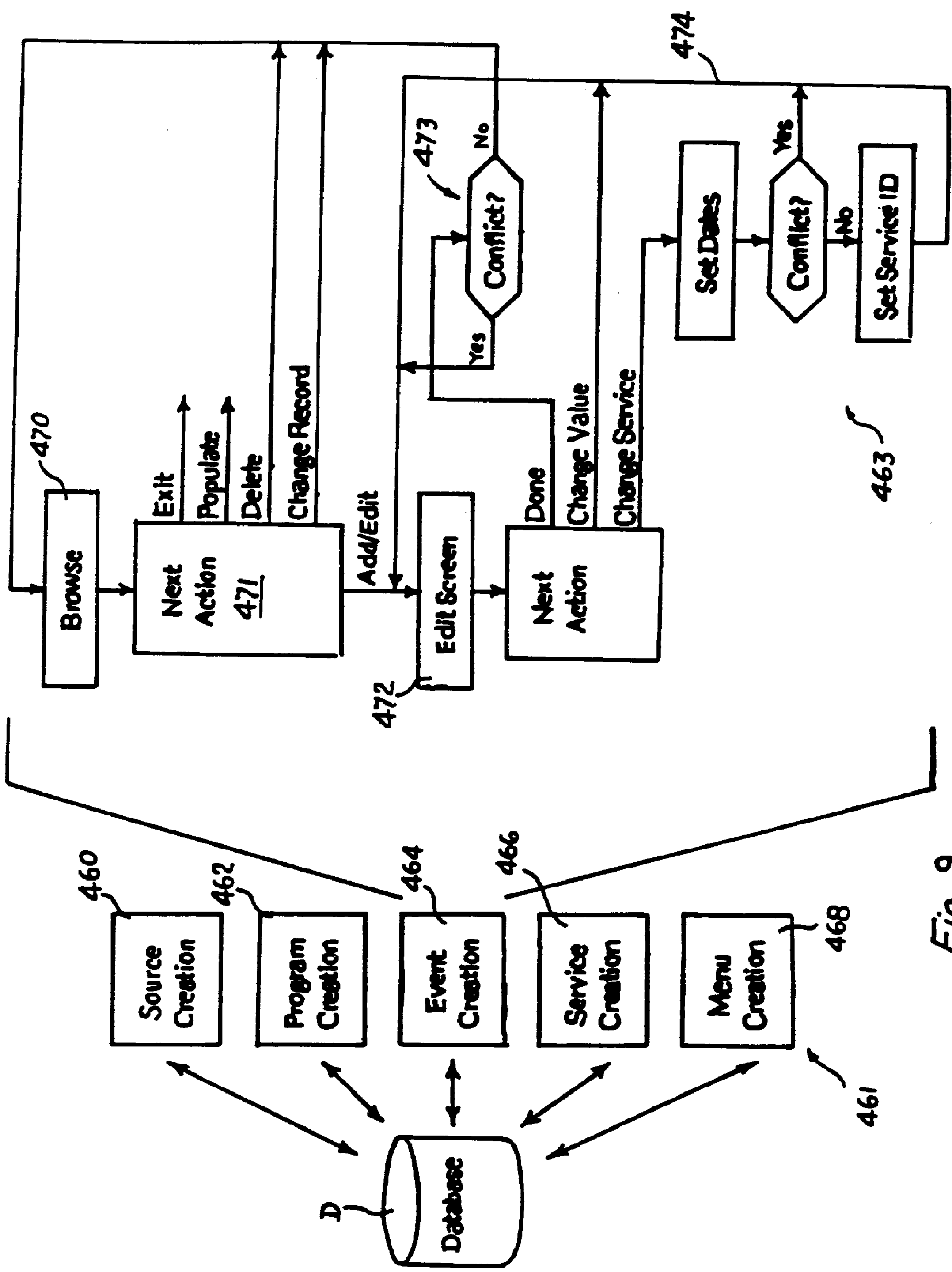

PROCESS PROGRAM LINE-UP
430
PROCESS MENU CONFIGURATIONS
432
MENU DISPLAYS
434
EDITING OF MENUS
436
GRAPHICAL TRANSPONDER ALLOCATION DISPLAY
438
EDITING TRANSPONDER ALLOCATION
440
GENERATOR PROGRAM CONTROL INFORMATION OUTPUT
442
Video PACKAGING ROUTINE
448
400
PACKAGER DATA ENTRY INTERFACE
410
Program Selection
412
Start Times
414
Price Setting
416
Transponder Allocation
418
Menu Editing
MARKETING INFORMATION INTERFACE
420
Receive Program Watched Information
422
Receive Other Information
424
Algorithms
402
CABLE FRANCHISE INFORMATION ACCESS
426
Receive Headend Information
428
Generate Cable Franchise Control Signal
404

Fig. 8



470
Browse
Next Action 471
Exit
Populate
Delete
Change Record
Add/Edit
472
Edit Screen
Next Action
Done
Change Value
Change Service
473
Conflict?
Yes
No
474
Set Dates
Conflict?
Yes
No
Set Service ID
463
460
Source Creation
462
Program Creation
464
Event Creation
466
Service Creation
Menu Creation
468
461
D
Database

Fig. 9

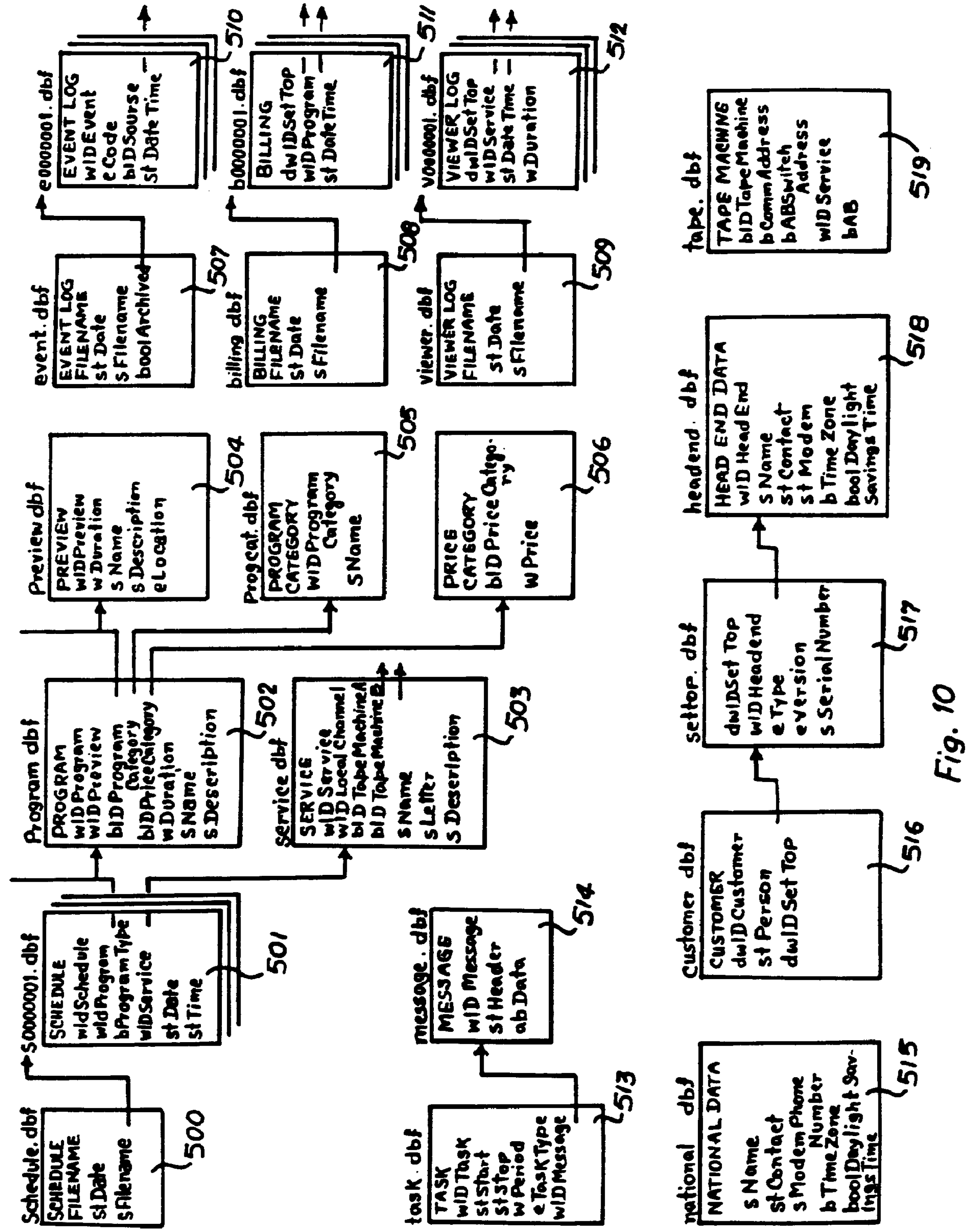

Schedule.dbf
SCHEDULE FILENAME
st Date
sFilename
500
S0000001.dbf
SCHEDULE
wIdSchedule
wIdProgram
bProgramType
wIDService
st Date
st Time
501
Program.dbf
PROGRAM
wIDProgram
wIDPreview
bIDProgram Category
bIDPriceCategory
wDuration
sName
sDescription
502
service.dbf
SERVICE
wID Service
wID Local Channel
bID TapeMachineA
bID TapeMachineB
sName
sLetter
sDescription
503
Preview.dbf
PREVIEW
wIDPreview
wDuration
sName
sDescription
eLocation
504
Progcat.dbf
PROGRAM CATEGORY
wIDProgram Category
sName
505
PRICE CATEGORY
bID Price Category
wPrice
506
event.dbf
EVENT LOG FILENAME
st Date
sFilename
boolArchived
507
billing.dbf
BILLING FILENAME
st Date
sFilename
508
viewer.dbf
VIEWER LOG FILENAME
st Date
sFilename
509
e0000001.dbf
EVENT LOG
wIDEvent
eCode
bIDSourse
st Date Time
510
b0000001.dbf
BILLING
dwIDSetTop
wIDProgram
st DateTime
511
V0000001.dbf
VIEWER LOG
dwIDSetTop
wIDService
st DateTime
wDuration
512
task.dbf
TASK
wIDTask
stStart
stStop
wPeriod
eTaskType
wIDMessage
513
message.dbf
MESSAGE
wID Message
st Header
ab Data
514
national dbf
NATIONAL DATA
sName
stContact
sModemPhone Number
bTimeZone
boolDaylight Savings Time
515
Customer.dbf
CUSTOMER
dwIDCustomer
st Person
dwIDSetTop
516
settop.dbf
dwIDSetTop
wIDHeadend
eType
eVersion
sSerialNumber
517
headend.dbf
HEAD END DATA
wIDHeadEnd
sName
stContact
stModem
bTimeZone
boolDaylight Savings Time
518
tape.dbf
TAPE MACHINE
bIDTapeMachine
bCommAddress
bABSwitch Address
wIDService
bAB
519

Fig. 10

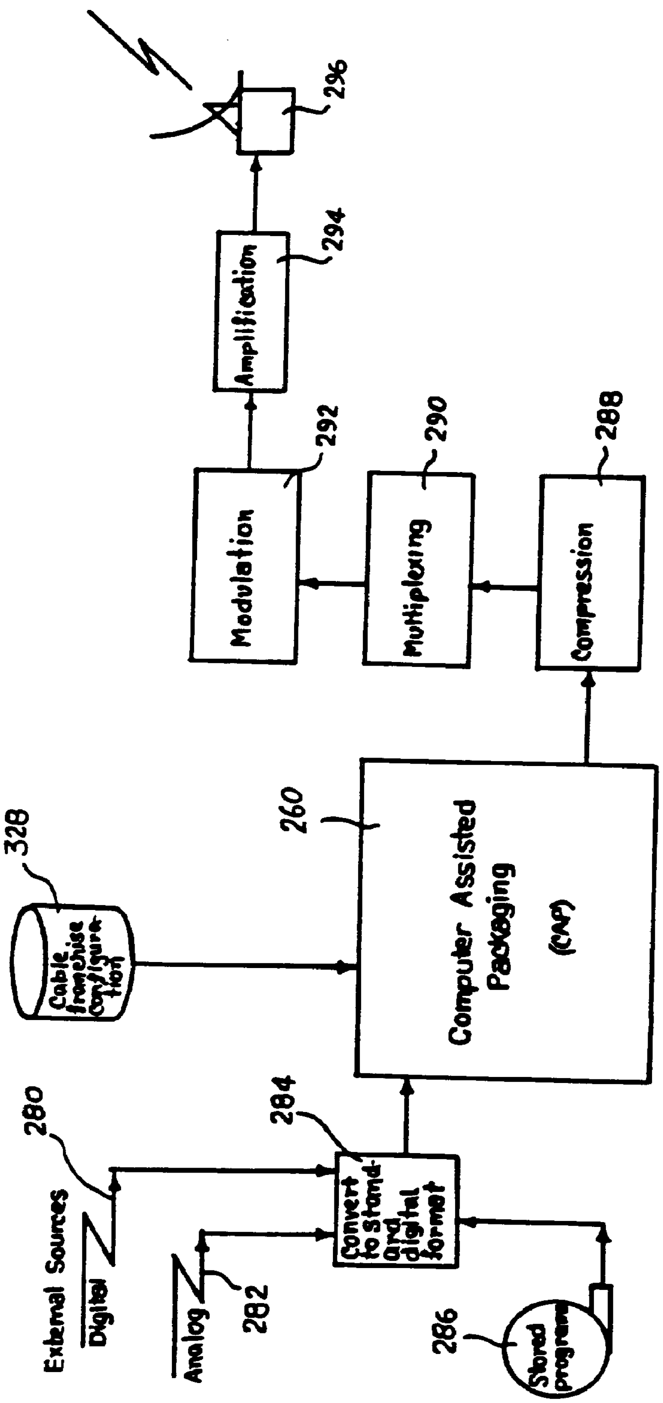
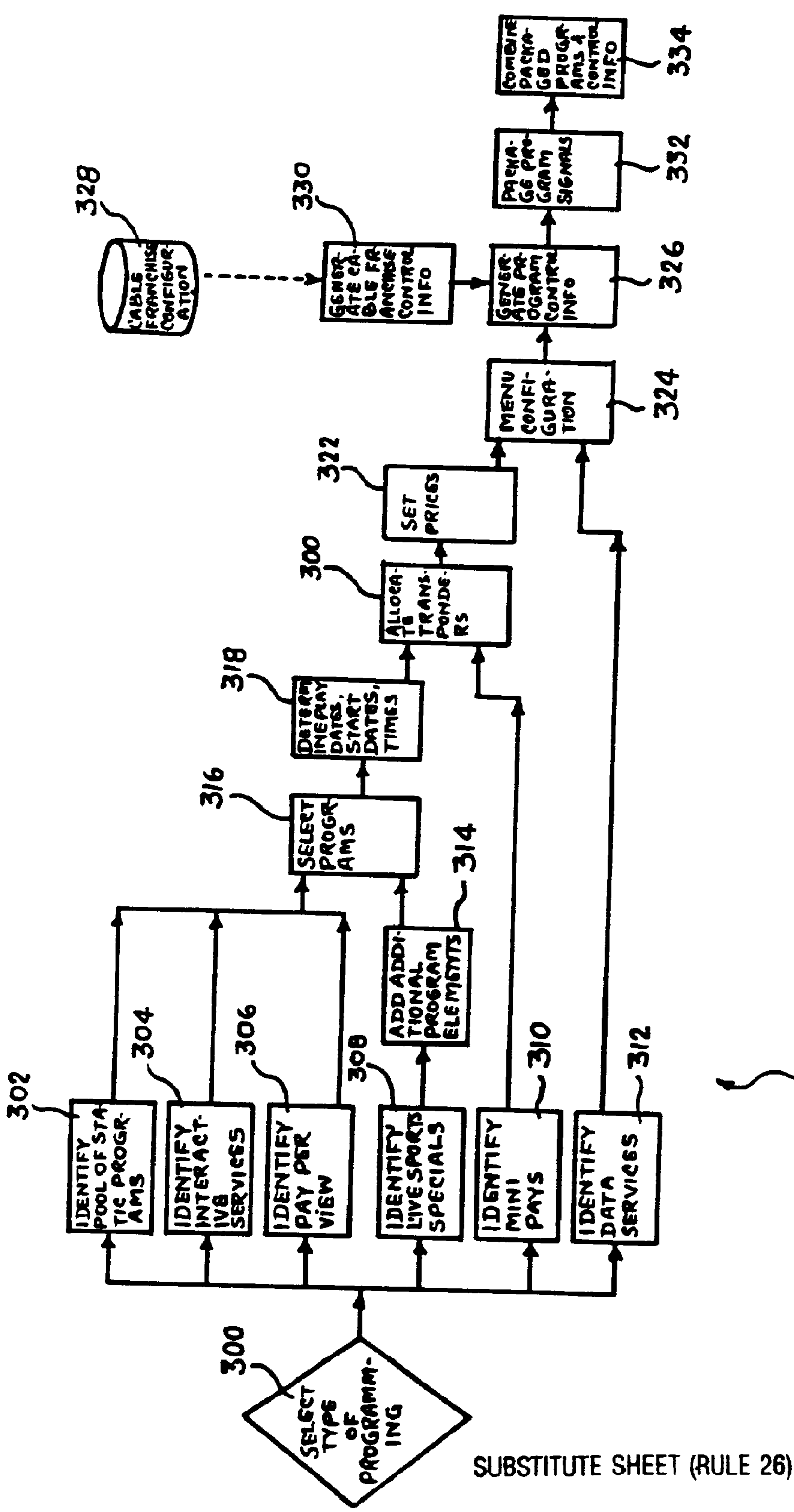


Fig. 11

SUBSTITUTE SHEET (RULE 26)


SELECT TYPE OF PROGRAMMING
300
IDENTIFY POOL OF STATIC PROGRAMS
302
IDENTIFY INTERACTIVE SERVICES
304
IDENTIFY PAY PER VIEW
306
IDENTIFY LIVE SPORTS SPECIALS
308
IDENTIFY MINI PAYS
310
IDENTIFY DATA SERVICES
312
ADD ADDITIONAL PROGRAM ELEMENTS
314
SELECT PROGRAMS
316
DETERMINE PLAY DATES, START DATES, TIMES
318
ALLOCATE TRANSPONDERS
300
SET PRICES
322
MENU CONFIGURATION
324
CABLE FRANCHISE CONFIGURATION
328
GENERATE CABLE FRANCHISE CONTROL INFO
330
GENERATE PROGRAM CONTROL INFO
326
PACKAGE PROGRAM SIGNALS
332
COMBINE PACKAGED PROGRAMS & CONTROL INFO
334

260

Fig. 12

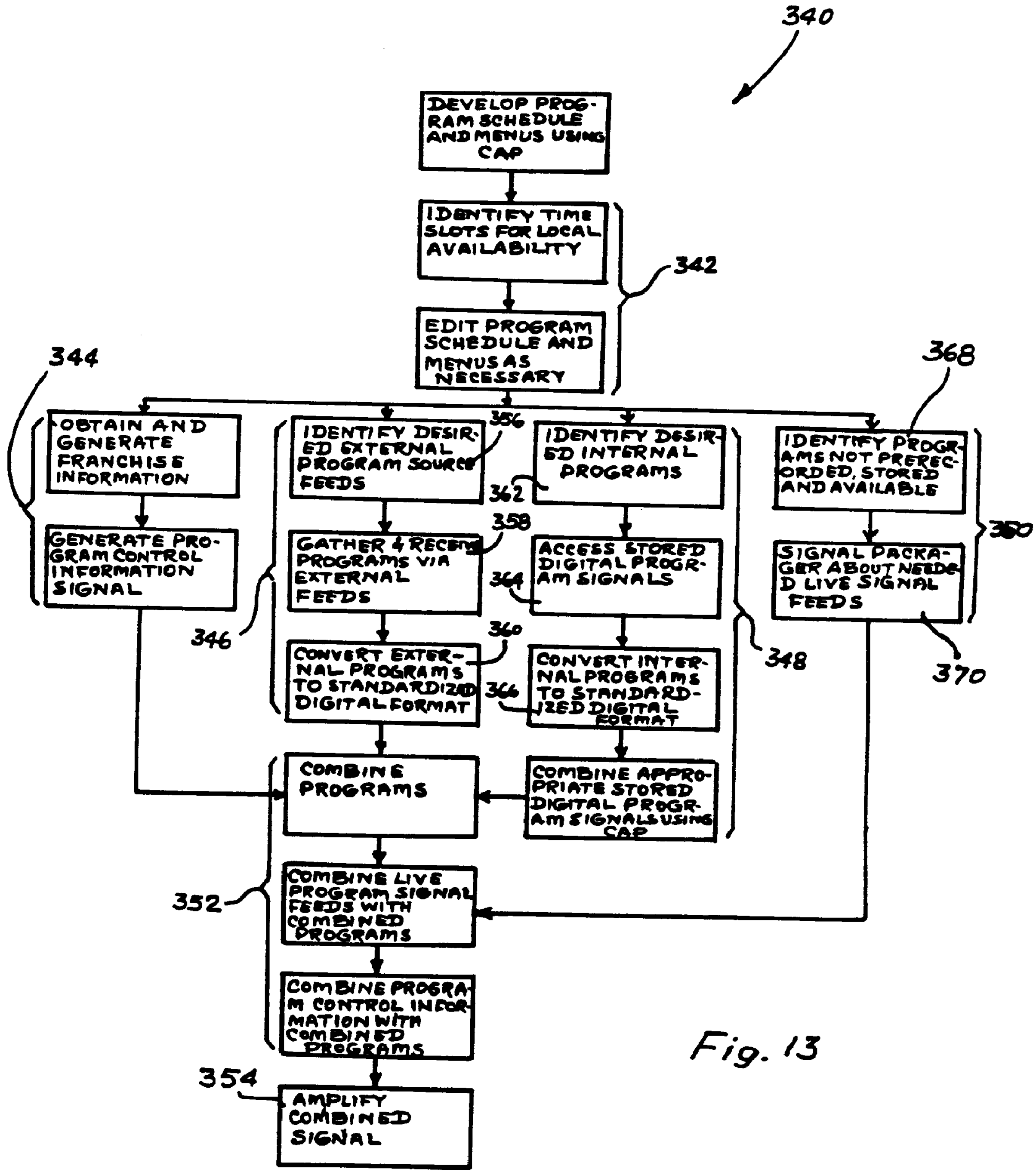

340
DEVELOP PROGRAM SCHEDULE AND MENUS USING CAP
IDENTIFY TIME SLOTS FOR LOCAL AVAILABILITY
342
EDIT PROGRAM SCHEDULE AND MENUS AS NECESSARY
344
OBTAIN AND GENERATE FRANCHISE INFORMATION
GENERATE PROGRAM CONTROL INFORMATION SIGNAL
356
IDENTIFY DESIRED EXTERNAL PROGRAM SOURCE FEEDS
358
GATHER & RECEIVE PROGRAMS VIA EXTERNAL FEEDS
346
360
CONVERT EXTERNAL PROGRAMS TO STANDARDIZED DIGITAL FORMAT
IDENTIFY DESIRED INTERNAL PROGRAMS
362
ACCESS STORED DIGITAL PROGRAM SIGNALS
364
CONVERT INTERNAL PROGRAMS TO STANDARDIZED DIGITAL FORMAT
366
348
368
IDENTIFY PROGRAMS NOT PRERECORDED, STORED AND AVAILABLE
350
SIGNAL PACKAGER ABOUT NEEDED LIVE SIGNAL FEEDS
370
COMBINE PROGRAMS
COMBINE APPROPRIATE STORED DIGITAL PROGRAM SIGNALS USING CAP
352
COMBINE LIVE PROGRAM SIGNAL FEEDS WITH COMBINED PROGRAMS
COMBINE PROGRAM CONTROL INFORMATION WITH COMBINED PROGRAMS
354
AMPLIFY COMBINED SIGNAL

Fig. 13

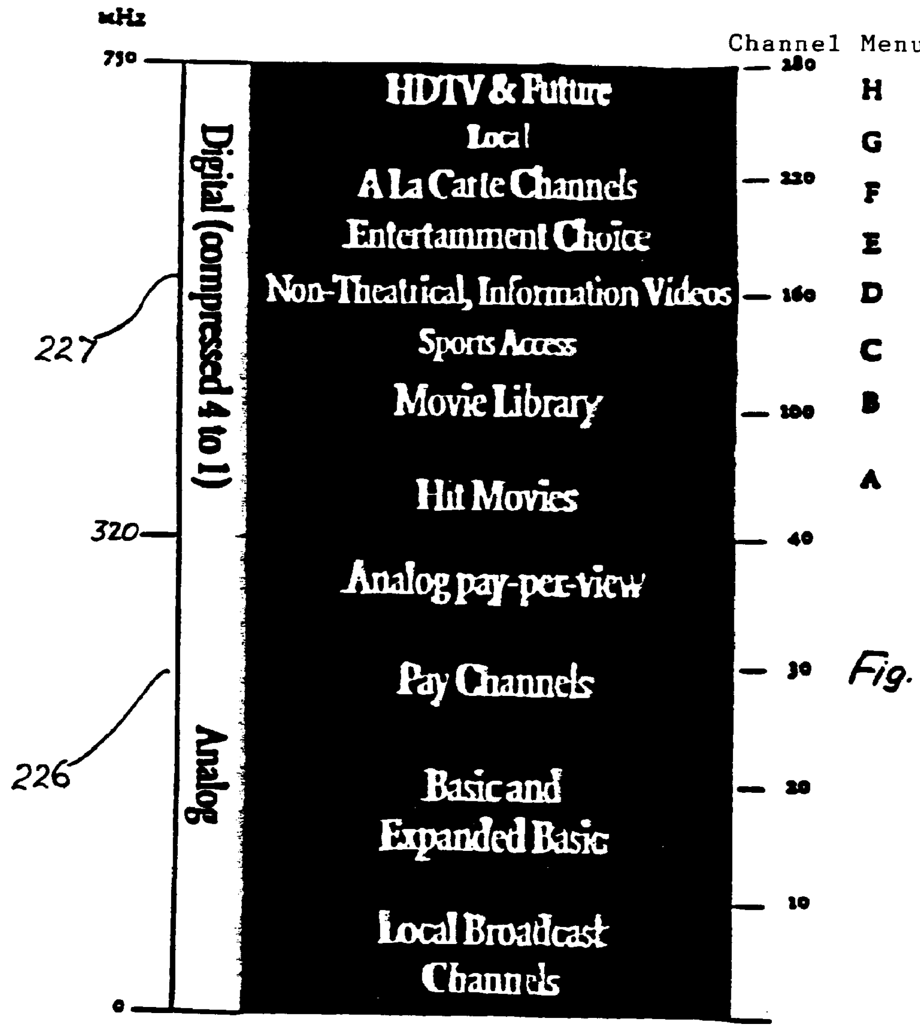


Fig. 14

230 229 228

CHANNEL MENU	PROGRAMMING CATEGORY	# CHANNELS ALLOCATED
A	Movies	50
B	Sports	2
C	Childrens	3
D	Documentary	14
E	Entertainment	10
F	Specialty Channels	15
G	Local	N/A
H	HDTV	4
I	Interactive	2
	COMBINED	100

Fig. 15

SUBSTITUTE SHEET (RULE 26)

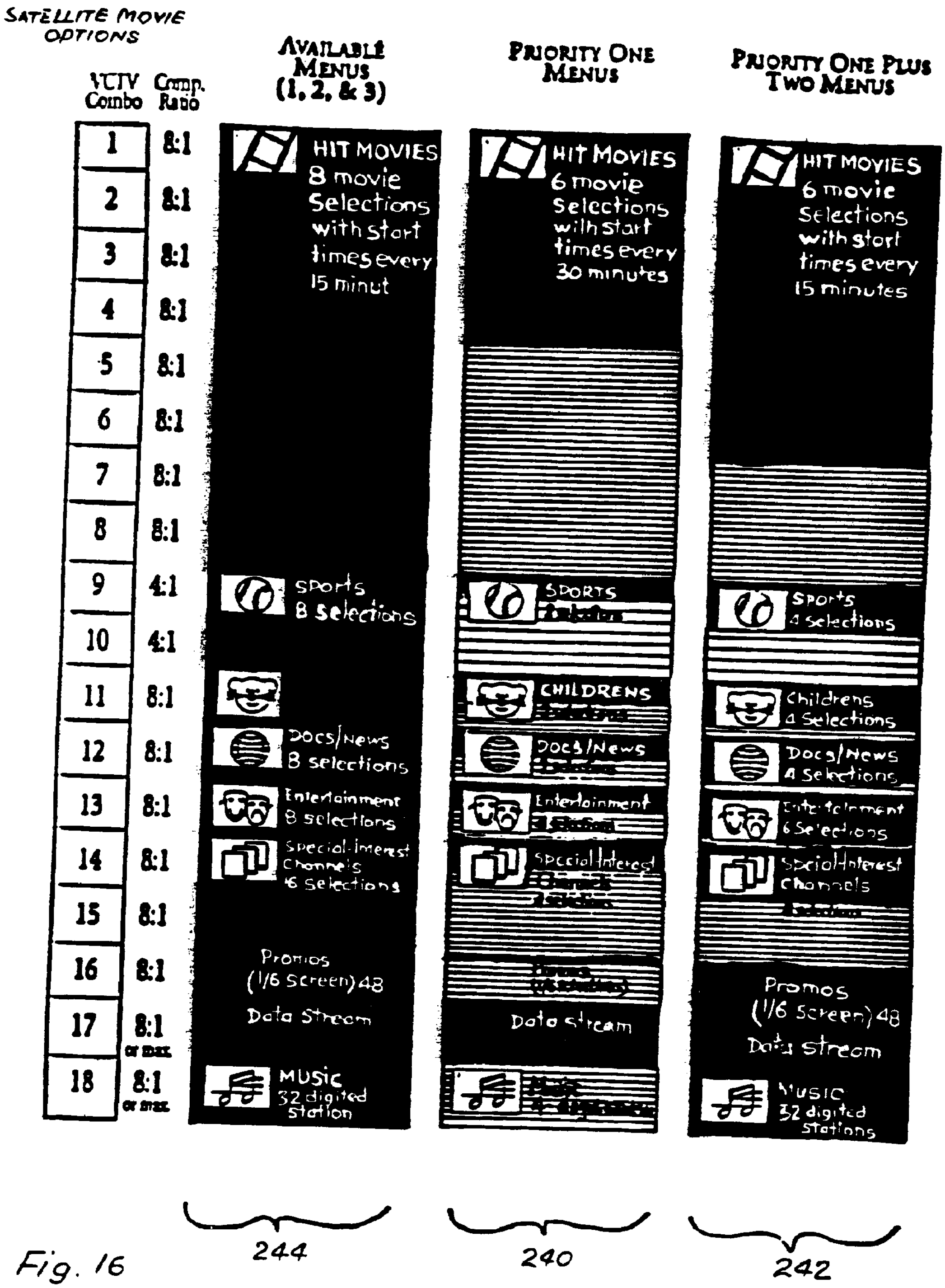

SATELLITE MOVIE OPTIONS
VCTV Combo
Comp. Ratio
AVAILABLE MENUS (1, 2, & 3)
PRIORITY ONE MENUS
PRIORITY ONE PLUS TWO MENUS
1 8:1
2 8:1
3 8:1
4 8:1
5 8:1
6 8:1
7 8:1
8 8:1
9 4:1
10 4:1
11 8:1
12 8:1
13 8:1
14 8:1
15 8:1
16 8:1
17 8:1 or max.
18 8:1 or max.
HIT MOVIES 8 movie Selections with start times every 15 minut
Sports 8 Selections
Docs/News 8 selections
Entertainment 8 selections
Special interest Channels 16 Selections
Promos (1/6 Screen) 48
Data Stream
MUSIC 32 digited station
HIT MOVIES 6 movie Selections with start times every 30 minutes
SPORTS
CHILDRENS
DOCS/NEWS
Entertainment
Special Interest
Data stream
HIT MOVIES 6 movie Selections with start times every 15 minutes
Sports 4 Selections
Childrens 4 Selections
Docs/News 4 Selections
Entertainment 6 Selections
Special Interest Channels
Promos (1/6 Screen) 48
Data stream
Music 32 digited stations
244
240
242

Fig. 16

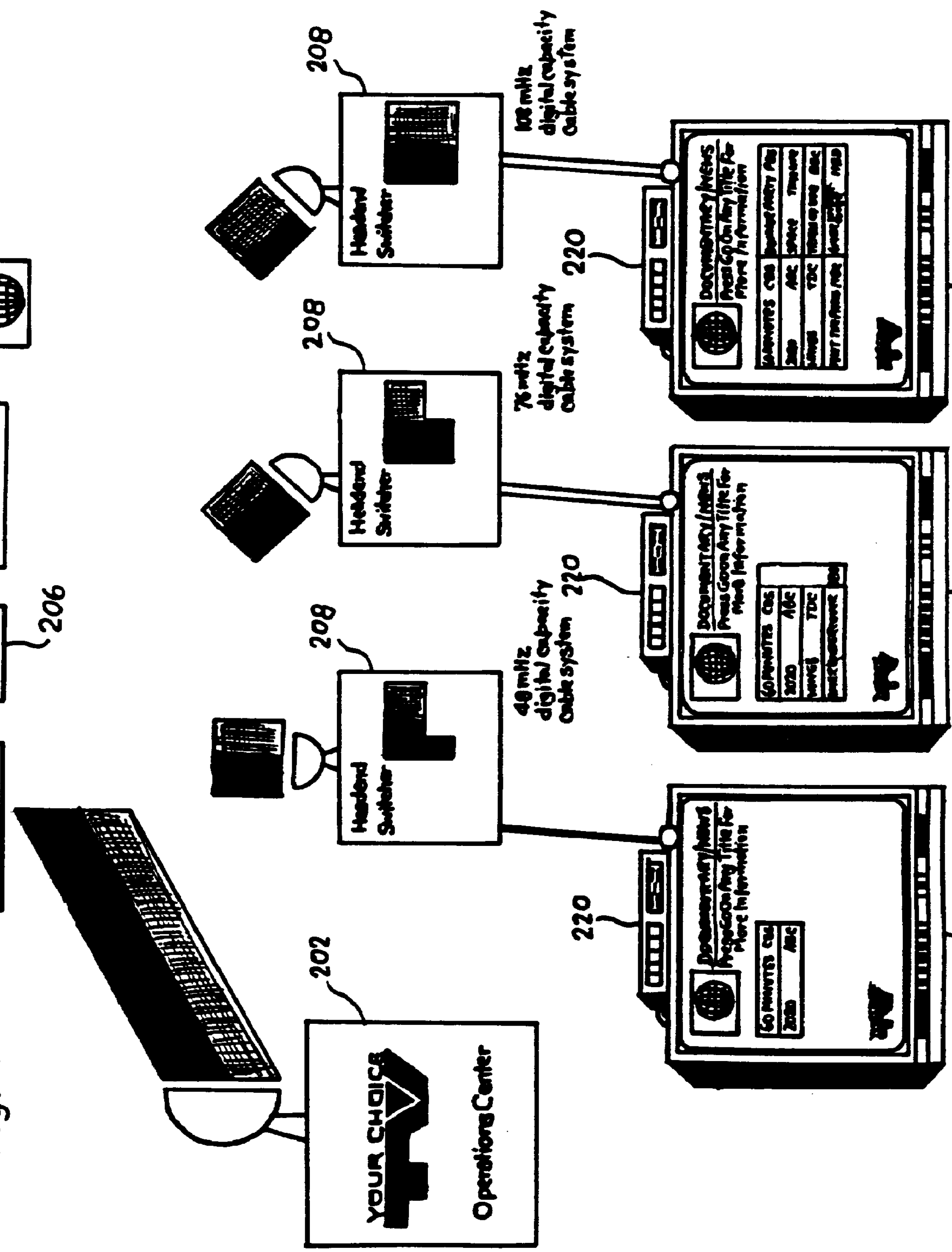

YOUR CHOICE TV
Operations Center
202
206
208
Headend Switcher
48 mHz digital capacity cable system
76 mHz digital capacity cable system
108 mHz digital capacity cable system
220
222
Documentary/News
Press GO On Any Title For More Information

Fig. 17

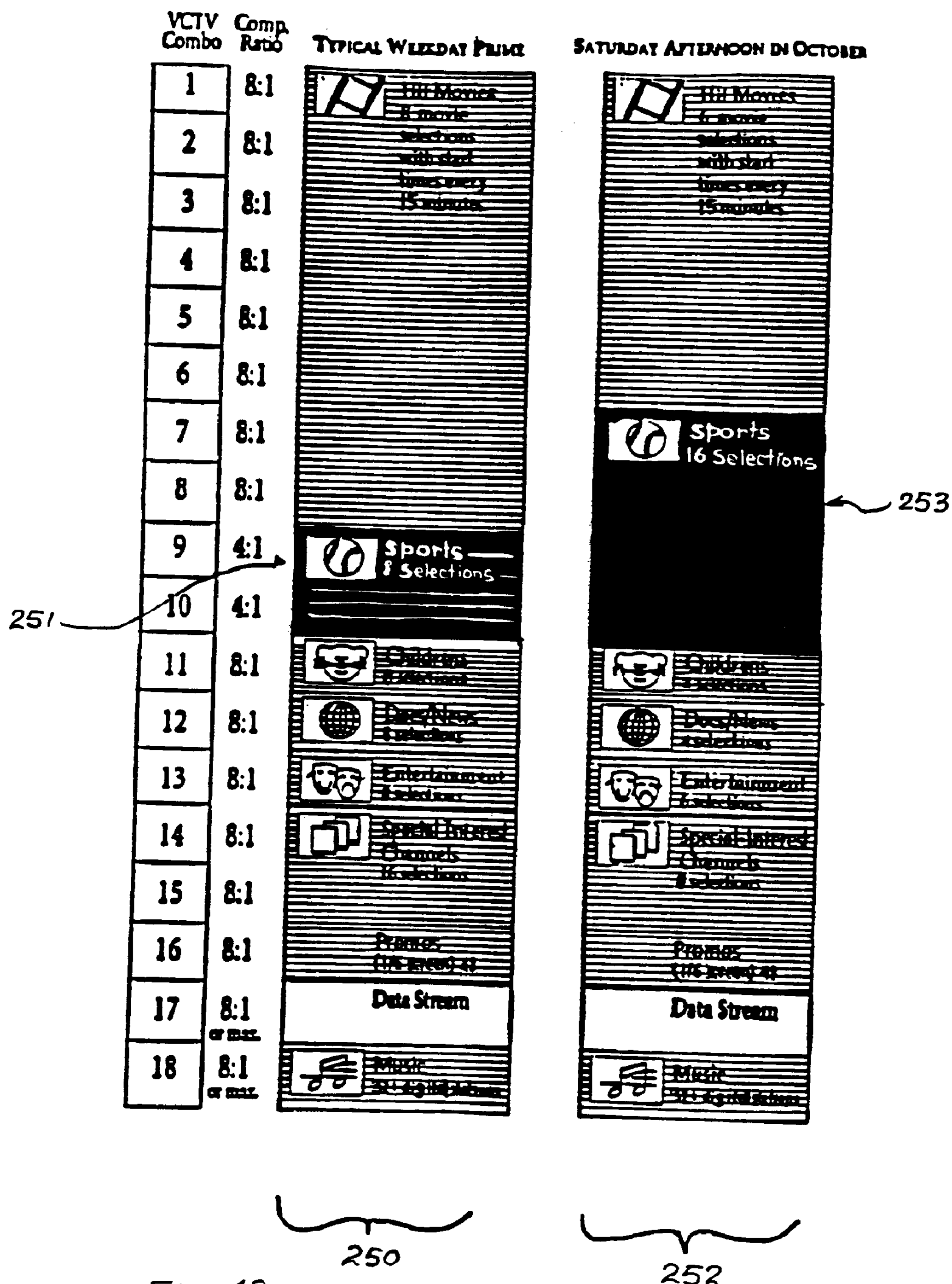
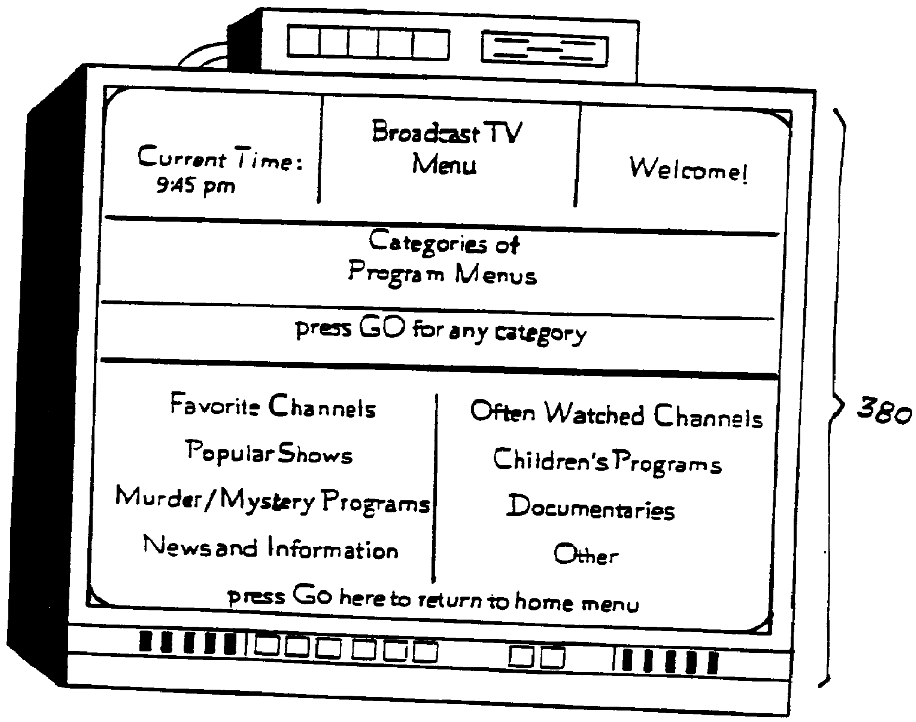


Fig 18

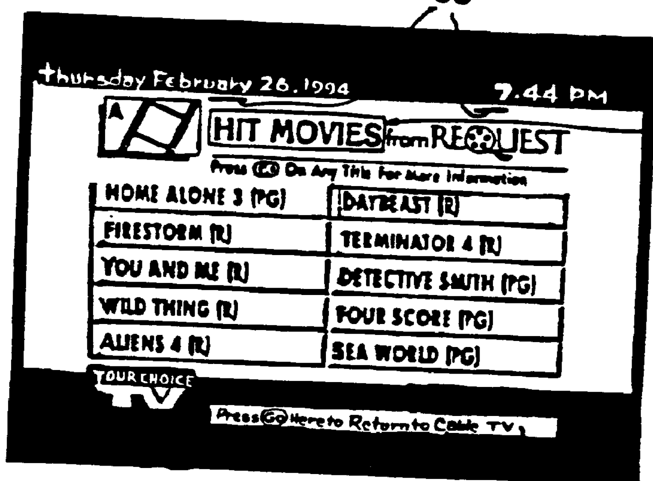
SUBSTITUTE SHEET (RULE 26)

Fig. 19


Current Time:
9:45 pm
Broadcast TV
Menu
Welcome!
Categories of
Program Menus
press GO for any category
Favorite Channels
Popular Shows
Murder/Mystery Programs
News and Information
Often Watched Channels
Children's Programs
Documentaries
Other
press Go here to return to home menu
380

386

382



1040

384

Fig. 20

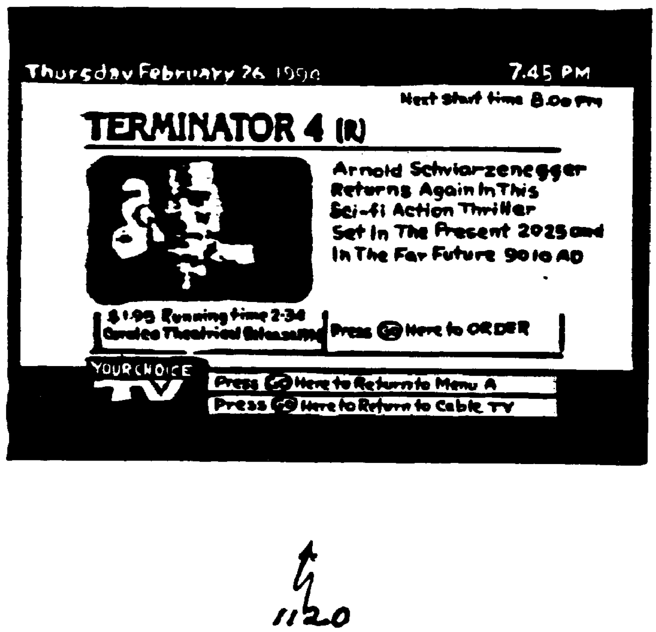

Thursday February 26 1996
7.45 PM
Next Start time 8.00 PM
TERMINATOR 4 (R)
Arnold Schwarzenegger Returns Again In This Sci-fi Action Thriller Set In The Present 2025 and In The Far Future 9010 AD
$1.95 Running time 2:34
Press Here to ORDER
YOUR CHOICE TV
Press Here to Return to Menu A
Press Here to Return to Cable TV
1120

Fig. 2J

OPIC
OFFICE DE LA PROPRIÉTÉ INTELLECTUELLE DU CANADA

CIPO
CANADIAN INTELLECTUAL PROPERTY OFFICE

Ottawa Hull K1A 0C9

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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Electronic Program Guide and Text Channel Data Controller

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Durden, Gregory Steven - U.S.A. ;
Christensen, Jan L. - U.S.A. ;
Paulick, Melvin - U.S.A. ;

(71) Scientific-Atlanta, Inc. - U.S.A. ;

(30) (US) 08/072,911 1993/06/07

(57) 34 Claims

Notice: This application is as filed and may therefore contain an incomplete specification.

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PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

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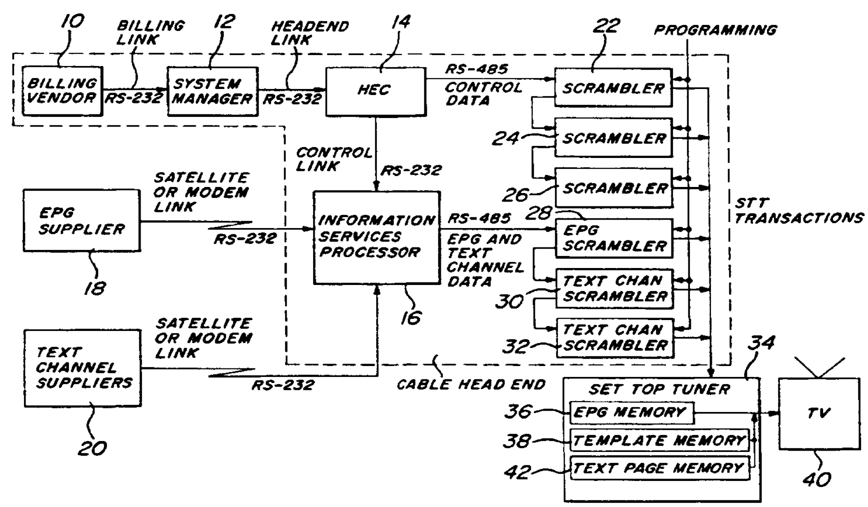
(74) Agents: ROCCI, Steven, J. et al.; Woodcock Washburn Kurtz Mackiewicz & Norris, 46th floor, One Liberty Place, Philadelphia, PA 19103 (US).

(81) Designated States: AU, BB, BG, BR, BY, CA, CN, CZ, FI, HU, JP, KP, KR, KZ, LK, LV, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SI, SK, TT, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: ELECTRONIC PROGRAM GUIDE AND TEXT CHANNEL DATA CONTROLLER



(57) Abstract

A data controller (16) which manages the flow of text and electronic program guide (EPG) information to a cable television viewer. The data controller (16) receives text and EPG information from one or a plurality of authorized data sources (20) via a communications link, processes the received data in its internal database manager to perform data compression and the like, and then transmits this text information to the viewer under control of the head end controller (34). In a preferred embodiment, the text data is formatted on a screen basis into transactions of a predetermined length and the EPG data is formatted on a program basis into transactions of the same length. The transactions are then inserted into the vertical blanking interval of a channel to which the corresponding text or electronic program data has been assigned.

ELECTRONIC PROGRAM GUIDE AND TEXT CHANNEL DATA CONTROLLER

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a data controller which manages the flow of text and electronic program guide data from the data supplier to the viewer's television tuner. In particular, the data controller of the invention accepts electronic program guide and text data from one or more local or remote sources, processes the data in its internal database manager, and formats the data for transmission to the viewer's television tuner preferably via the vertical blanking intervals of existing cable television channels.

Description of the Prior Art

Television text data services are readily available. Such services provide sports, weather, stock market, news, advertising and other information to the viewer's television for display to the viewer. Typically, the text data is provided to the cable head end by the text data service providers and then provided to the viewer via dedicated cable channels provided at the cable head end. At the cable head end, the text data from the different text data service providers is assigned to respective cable television channels available to the viewers, converted into a video signal, and then transmitted to the viewer's television via the assigned cable television channel in place of other programming. The viewer then tunes to the assigned cable television channel to receive the transmitted text data. Unfortunately, this technique wastes valuable video bandwidth for the transmission of the text data and is thus generally undesirable. Also, since the cable head end operator must create a video signal from the text data provided by the service providers prior to transmission of the text data to the viewer, the existing technique for providing text data to a viewer is quite tedious and expensive. A more efficient text data service is desired.

Other techniques for providing text data to viewers are known in the art. For example, closed captioned encoding techniques are used to transmit text data in synchronization with its associated video data by inserting the closed captioned text data into the vertical blanking interval of the video signal. In this manner, not only can synchronization be preserved, but also, additional bandwidth is not necessary for the transmission of the text data. However, the closed captioned text data must be inserted into the vertical blanking interval of the video signal by the producer of the video programming. As a result, the vertical blanking interval of the video signal cannot be used by the head end operator to insert other text data such as sports, weather, stock market, news, advertising and the like. An improved text data transmission technique is desired whereby such general text data may be inserted into the video signal at the cable head end for transmission to the viewer.

It is also known in the art to provide an electronic program guide (EPG) which provides the viewer with an on-screen listing of the upcoming television programs on the cable television channels available to the viewer. Typically, the EPG is provided by an EPG data service and the EPG data is converted into a video signal at the cable head end and transmitted to the viewer's television via a dedicated cable television channel. After tuning to the dedicated cable television channel, the viewer then must passively wait until the programming for the desired time period is displayed. In other words, this technique provides no mechanism for allowing the viewer to scroll through the EPG to the desired listing. Moreover, this technique also requires the cable head end operator to dedicate a separate cable television channel to the EPG data and to create video signals from the EPG data provided by the EPG service providers.

These problems with the transmission of EPG data have been addressed in the prior art by modulating the EPG data onto an FM carrier and transmitting that FM carrier with a video signal on one of the cable television channels. A dedicated peripheral device provided at the viewer's television tuner demodulates the EPG data from the FM carrier and stores the EPG data until the viewer requests presentation of the EPG data on the viewer's television. Upon selection of the EPG data, the EPG is displayed on the viewer's television in place of the other video programming. Since the EPG data is stored locally at the viewer's television, the viewer may scroll through the listings in the EPG until the desired listing is reached. While this technique does not require a separate dedicated cable television channel for the transmission of the EPG and allows the user to scroll through the EPG, an improved EPG transmission technique is desired which can be integrated with the viewer's normal cable television tuner so that a separate peripheral device dedicated to reception of the EPG is not necessary. Also, it is desired that the EPG data transmission be combined with the text data transmission to maximize efficiency.

In addition, it is also known to amplitude modulate the audio carrier or to frequency modulate an out-of-band carrier with control and authorization information from the head end controller for transmission to the viewers' cable television tuners. However, it is desired that the transmission of the control and authorization information also be integrated with the text data and EPG data transmission so that a single common data transmission/reception scheme may be used.

The present invention has been designed to meet these needs in the art.

SUMMARY OF THE INVENTION

The present invention relates to a data controller which manages the flow of text data and electronic program guide (EPG) data to a cable television viewer. The data controller of the invention receives text data and EPG data from one or a plurality of local or remote data sources via a communications link, processes the received data in its internal database manager to perform data compression and the like, and then provides this text data and EPG data to the viewer under control of the head end controller. In a preferred embodiment, the text data and EPG data are inserted into the vertical blanking intervals of cable television channels to which the corresponding text data or EPG data has been assigned, and upon receipt at the viewer's television tuner, the text data and EPG data are extracted from the vertical blanking interval and displayed on the viewer's television. Hence, text channels and one or more EPG channels may be provided as "virtual channels" which do not require extra video bandwidth.

Preferably, the viewer's cable television tuner includes an EPG memory for storing the EPG data at the viewer's television tuner to allow the viewer to scroll through the stored EPG data to the desired listings. Also, a template memory is preferably provided at the tuner to provide a framework in which to display the EPG data. Also, the EPG data is formatted into transactions including display commands and the like so that the EPG data may be transmitted directly to the viewer's television tuner as data rather than video, thereby saving a substantial amount of bandwidth.

In addition, the text data is also formatted into transactions including display commands and the like and transmitted to the viewer's television tuner on a screen by screen basis with an appropriate delay between the presentation of each page as designated by the system controller. Such auto-pagination makes it unnecessary for the user to request the pages to scroll; however, manual pagination may be provided by using memory at the set top tuner for storing successive pages of text data.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the invention will become more apparent and more readily appreciated from the following detailed description of the presently preferred exemplary embodiment of the invention taken in conjunction with the accompanying drawings, of which:

FIGURE 1 is a block diagram of a system for providing EPG data and text data to a viewer in accordance with the invention.

FIGURE 2 illustrates a data controller for receiving the EPG data and text data from the data providers, appropriately formatting that data for display, and inserting the data into the vertical blanking interval of a cable television channel to which the data is assigned for transmission to the viewer.

FIGURE 3 illustrates the information field of the EPG data read from the EPG database of Figure 2.

FIGURE 4 illustrates the data format of data read from the database for insertion into the assigned cable television channel.

FIGURE 5 is a flow chart illustrating the operation of the EPG transaction formatter of Figure 2.

FIGURE 6 is a flow chart illustrating the operation of the text transaction formatters of Figure 2.

FIGURE 7 illustrates a set top tuner for use in receiving text data and EPG data in accordance with the invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

An electronic program guide (EPG) and text channel data controller which affords the above-mentioned and other beneficial features in accordance with a presently preferred exemplary embodiment of the invention will be described below with reference to Figures 1-7. Those skilled in the art will readily appreciate that the description given herein with respect to those figures is for explanatory purposes only and is not intended in any way to limit the scope of the invention. For example, while a cable television system is shown and described, the present invention may also be used in a satellite, over-the-air broadcast, subscription television system or other television system known in the art. Also, while the present invention is described for use in the provision of sports and weather text channels, those skilled in the art will appreciate that these text channels are only examples of the limitless types of text channels which may be provided to a viewer in accordance with the invention. Accordingly, any questions regarding the scope of the invention should be resolved by referring to the appended claims.

Figure 1 illustrates an EPG and text information service in accordance with the invention. As shown, the local cable television company's billing vendor 10 communicates via a billing link to an RS-232 port of a system manager 12 located at the cable head end. Billing vendor 10 includes a subscriber database and generates a monthly bill for the subscribers in the system based on the level of service and any pay-per-view purchases. Billing vendor 10 may comprise a personal computer or other data processing device known in the art. Billing vendor 10 informs system manager 12 as to which cable television subscribers are authorized to receive the available cable television channels. System manager 12 is also a personal computer or other processing device which receives viewer authorization transactions from billing vendor 10 and generates transactions for delivery to the distribution apparatus or the subscribers. Such transactions include text channel definition transactions which instruct the subscriber's tuner which group of channels it is entitled to receive, which frequency to tune for a particular text data channel, whether to mute the audio for that text channel, the pagination delay between pages, and the like.

System manager 12 also communicates via a head end link to an RS-232 port of a head end controller (HEC) 14 which controls the transmission of television programming to the subscribers. As will be described in more detail with respect to Figure 2, HEC 14 communicates via a control link to an RS-232 port of an information services processor (or data controller) 16 which manages the flow of EPG and text data in accordance with the invention. As shown by dotted line in Figure 1, information services processor (ISP) 16 is preferably located at the cable head end with system manager 12, HEC 14 and the signal scramblers. However, those skilled in the art will appreciate that all of the head end equipment need not be located at one site.

As shown in Figure 1, EPG data is supplied from one or more local or remote EPG suppliers 18 via a satellite link, modem link or other communication link to an RS-232 port of ISP 16. Similarly, text data from one or more text channel suppliers 20 is provided via a satellite link, modem link, or other communication link to another RS-232 port of ISP 16. In preferred embodiments, ISP 16 has a plurality of identical RS-232 ports for accepting data from a plurality of EPG suppliers 18 and text channel suppliers 20. Also, as shown, one of these RS-232 ports is preferably used for a control link to HEC 14 as well. As will be described in more detail below with respect to Figure 2, ISP 16 manages EPG and text source databases in response to control signals from HEC 14 in order to provide EPG data and/or text channel data to selected viewers.

As shown in Figure 1, HEC 14 also provides control data directly to the viewer's television tuner via an RS-485 output port. Preferably, the control data from HEC 14 includes the aforementioned text channel definition transactions as well as EPG definition transactions for instructing the tuner at which frequency to tune for the EPG data and the like. The control data may also include software for downloading into the viewer's tuner for reprogramming the viewer's tuner as necessary. In a preferred embodiment, the control data from HEC 14 is inserted into the vertical blanking interval of the selected cable television signal by daisy-chained scramblers 22, 24 and 26 using known in-band techniques, although the control data from HEC 14 may also be modulated on an out-of-band carrier or an in-band audio carrier for transmission as described in related U.S. Patent Application Serial No. 07/983,766, filed December 1, 1992 and assigned to the present assignee, the contents of which are hereby incorporated by reference. Preferably, scramblers 22-26 are daisy-chained so that the scramblers may be addressed individually or globally. Similarly, EPG data and text channel data from ISP 16 are provided to the viewer's television tuner via an RS-485 output port of ISP 16. EPG data and text channel data are similarly inserted into the vertical blanking intervals of selected cable television signals by EPG scrambler 28 and text channel scramblers 30 and 32, respectively, using, for example, the in-band vertical blanking interval insertion techniques described in the aforementioned patent application serial no. 07/983,766 filed December 1, 1992. Of course, if desired, scramblers 22-32 may insert the control data, EPG data, and text channel data into other portions of the video signals such as the horizontal blanking intervals or else replace the video entirely. Those skilled in the art will also appreciate that a number of scramblers may be provided in accordance with the volume of data received from HEC 14 and ISP 16. Typically, however, the number of scramblers depends on the number of premium channels for which scrambling is used.

Preferably, EPG scrambler 28 and text channel scramblers 30 and 32 are identical to control data scramblers 22-26 and are similarly daisy-chained for individual or global addressing. As shown in Figure 1, scramblers 28-32 receive a single serial data channel which carries the combined EPG data and text data and display control transactions (to be described in more detail with respect to Figure 2) for all data streams in use. Each scrambler is also equipped with memory for storing a predetermined amount of this data in an internal memory so as to minimize the number of database accesses. Preferably, scramblers 28-32 have internal memory sufficient to store a significant number of transactions. For example, scrambler 30 may have enough internal memory to score a day's sports scores for display on a sports text channel. The data received and stored in scramblers 28-32 is preferably in RS-485 format, and the protocol in a preferred embodiment is SDLC. All data transactions to scramblers 28-32 are sent on individual data streams specifying the target scrambler (station addresses in SDLC protocol), and the control data is sent on a global data stream which is filtered in the scramblers 28-32 based on the address of the scrambler so that the data streams can be configured by a transaction from ISP 16. The individual EPG data and text data streams are preferably generic in the scramblers so that they can be allocated as desired. Preferably, scramblers 28-32 have baud rates of at least 9600.

Preferably, the subscriber's tuner is a set top tuner 34 which comprises an EPG memory 36 for storing the EPG data from ISP 16. For example, EPG memory 36 may store one or two weeks of EPG data for selective access by the viewer via a menu of the set top tuner 34. This menu preferably allows the viewer to scroll through the EPG data stored in EPG memory 36 using the key pads of the viewer's television remote control device. Set top tuner 34 may also comprise a nonvolatile template memory 38 for storing the template in which the EPG data is to be inserted for display to the viewer on the viewer's television 40. In this manner, a video signal containing the template display data need not be continuously retransmitted to the set top tuner 34, thereby saving more bandwidth. Instead, the EPG data only needs to be updated every 30 minutes or when there is a program change. Of course, different set top tuners 34 may have a varied amounts of memory and processing capabilities for such purposes in accordance with the acceptable memory costs during manufacture of the set top tuner 34.

As shown in Figure 1, set top tuner 34 may also comprise a text data memory 42 for storing a page of text data for presentation to the screen. Thus, while one page of text data is displayed to the subscriber, the next page of text data may be loaded into the text data memory 42.

As noted above, ISP 16 of the invention manages the flow of text data and EPG data from the data service provider to the viewer's set top tuner 34. ISP 16 manages this data by accepting data only from one or more authorized text data and/or EPG data sources, processing the text data and EPG data in its internal database manager, and formatting the processed data into a common data transaction format for output to the scramblers for transmission to the set top tuner 34. Provision of EPG data and text data to the subscribers is controlled by the head end controller 14 via the control link as will be described in more detail below.

In a preferred embodiment, ISP 16 comprises an IBM PS2 model 7546 personal computer having a plurality of RS-232 serial input ports for EPG data and/or text data inputs and at least one RS-485 HDLC serial link at its output of the type used by HEC 14. As shown in Figure 1, the control link will be a single RS-232 serial port. The hardware and software components of ISP 16 are then configured as illustrated in Figure 2.

As shown in Figure 2, ISP 16 preferably comprises a plurality of RS-232 ports which provide a common interface for the EPG data and text channel data asynchronously provided by the EPG supplier(s) 18 and text channel suppliers 20. The EPG data and text channel data is transmitted to ISP 16 via a satellite link (when the interface is operated in simplex mode) or by modem (when the interface is operated in half duplex mode). Preferably, the data is transmitted at a baud rate of at least 1200.

ISP 16 functions as a "gate keeper" which only allows access by authorized data sources. Accordingly, when

ISP 16 receives a message from an EPG supplier 18 or a text channel supplier 20, it first checks the data for authorization. If that supplier is not authorized, the data is ignored. On the other hand, if the supplier is authorized to access ISP 16, ISP 16 performs the requested action and returns a command response message. If the communications link is simplex, the response is ignored. Hence, access to ISP 16 is limited by authorization codes, but as will be described below, access is also limited by whether the data provider provides the EPG data or text data in the transmission protocol expected by ISP 16.

In particular, messages sent between an EPG supplier 18 or a text channel supplier 20 and ISP 16 are preferably formatted to include a start of text byte, a data block of ASCII characters, checksum bytes and an ASCII carriage return. This format is used in commands sent to ISP 16 from the data suppliers as well as in responses sent to the data suppliers. As known by those skilled in the art, the checksum verifies proper message transmission by comparing the checksum in the message with an internally computed checksum. Preferably, the checksum is a two byte CRC of all bytes in the message field beginning with the first character following the start of text character up to but not including the checksum field. The checksum is transmitted in the message as the hexadecimal ASCII representation (four bytes) of the CRC computation. The data blocks, on the other hand, are configured differently depending upon whether the input data is EPG data or text data.

EPG data from the EPG supplier 18 is formatted in accordance with an EPG command set including, for example, a Define Program Command which is used to identify all data relating to a single program, a Define Category Command which is used to establish a category for identifying different types of programs, and a Delete Category Command which is used to delete an unused category to make room in the database of ISP 16 for new programming categories. The EPG data is formatted on a "per program" basis by these commands.

An example of a presently preferred format for a Define Program Command is as follows:

Define Program Command

Byte	Description
1-2	Command Code
3-4	Service Provider 02 - EPG Supplier No. 1 03 - EPG Supplier No. 2 04 - EPG Supplier No. 3 10 - System Manager 20 - Local Origination
5-7	Type of Service 001 - EPG (001-099 National Services) (100-199 System Manager Services) (200-299 Local Origination Services) (300-399 Other Services)
8-13	Authorization Code From Supplier
14-19	Starting Date (e.g., 112292 = 11/22/92)
20-25	Starting Time (e.g., 123045 = 12:30:45)
26-29	Program Identifier (e.g. WTBS)
30-32	Duration (e.g., 135 = 1 hour and 35 minutes)
33	MPAA Rating (0=No Rating, 1=G, 2=NR, 3=PG, 4=PG13, 5=R, 6=X, 7=NC17)
34	Critique Number of * given by movie critic)
35-36	Category Identification
37-38	Attribute Bit Map 0-1 = Stereo 1-1 = Black and White 2-1 = Closed Captioned 3-1 = Bilingual 4-1 = Spanish
39-40	Traits Bit Map 0-1 = Profanity 1-1 = Nudity 2-1 = Violence 3-1 = Adult Situations

4-1 = Adult Theme
5-1 = Adult Language

41- Title and Program Description blocks

Delimiter characters are used for variable length fields such as the title and program description blocks to identify the length of the field. For example, a NUL (0 hexadecimal) means the field is null, SOH (1 hexadecimal) means the field is valid, and ETX (3 hexadecimal) means the end of the current record.

In a preferred embodiment, each program's record includes two lines of characters with up to 9 characters per line for a half hour program title block (the EPG display area is 9 characters by 2 lines for a half hour program), two lines of characters with up to 19 characters per line for a one or more hour title block (the EPG display area is 19 characters by 2 lines for a 1 hour program), and three lines of characters with up to 40 characters per line for a program description describing the program corresponding to the current record. Those skilled in the art will appreciate that half hour shows need not have a one hour program title block but that shows having a duration of one hour or more should have a short and long title block since the EPG data is scrolled on the screen and does not always permit the display of an entire long title for a program at the edge of the time frame of the EPG on the display. Of course, these blocks may have different sizes and may be filled by the appropriate delimiter if no text is available.

Once data transmitted with a Define Program Command is stored in an EPG database of ISP 16, the EPG data is formatted into transactions for transmission to the set top tuner 34 as will be described in more detail below. This command may also be used to update a program definition since it will overwrite a corresponding entry in the EPG database of ISP 16. As noted above, the EPG data is preferably updated at least every 30 minutes on the half hour and also when changes are made to the data.

The Define Category Command also is formatted to have a command code, service provider, and type of service in bytes 1-7. However, the Define Category Command preferably has category identification data in bytes 8-9 and a category name having up to 21 bytes starting at byte 10. Once again, a delimiter is preferably used to mark the end of the field. In a preferred embodiment, up to 99 different categories may be defined using this command. Any categories beyond 99 will be ignored. Categories should thus be deleted to make room for new ones. The Delete Category Command is similarly formatted except that it is not necessary to specify the category name - the category ID is sufficient to specify a category to be deleted.

ISP 16 may respond to such commands from the EPG supplier 18 by sending an appropriate response such as: no error (normal response), service provider not found (not authorized), type of service not found (not authorized), category ID not found, unrecognized command, checksum error, insufficient disk space, and the like. Of course, other EPG commands and command responses may be provided as desired. The above commands were merely described by way of example. However, it is important that any commands have a format known only to the authorized service providers in order to maintain system security.

The text channel data, on the other hand, may originate from many different text channel suppliers 20 and may arrive at the ISP 16 via many different communications links such as satellite, dial up modem, direct connect modem or via direct connect to the system manager 12. Preferably, the text data is also supplied to the ISP 16 via an RS-232 port identical to that used for receiving the EPG data and messages between the text channel supplier 20 and ISP 16 have the same general format and transmission characteristics as described above with respect to the EPG data except that the data blocks are formatted differently.

In particular, in a preferred embodiment each text channel consists of one or more text screens, where each text screen is comprised of 16 lines by either 24 or 45 characters per line depending upon the size of each character. Unlike the EPG data, the text data is not provided on a program basis. Rather, the text data is provided for each line of text on a text screen basis where one line of text is transmitted in each text data block. Preferably, the text channel suppliers 20 provide the text data by defining text screens using a command formatted as follows:

Define Text Screen

Byte	Description
1-2	Command Code
3-4	Service Provider
	02 - Text Supplier No. 1
	03 - Text Supplier No. 2
	04 - Text Supplier No. 3
	10 - System Manager
	20 - Local Origination
5-7	Type of Service
	001 - EPG
	002 - Sports
	003 - Weather
	004-099 Other Text Service
	(001-099 National Services)
	(100-199 System Manager Services)
	(200-299 Local Origination Services)
	(300-399 Other Services)
8-13	Authorization Code From Supplier
14-15	Page #
16-17	Line # (1-16)
18	Justification
	0 - Centered
	1 - Right
	2 - Left
19-20	Color
21	Character Size
	0 - Normal (45 Characters per line)
	1 - Large (24 Characters per line)

22-??	Text 45 or 24 Bytes Max depending on Character Size
??	SOH (01 Hex) End of Line Delimiter

All bytes after byte 16 are repeated for each line of text until a complete page has been sent. The page number is then updated in bytes 14-15 and the next page sent to ISP 16 for storage in the appropriate text database. As with the EPG data, the above-mentioned response codes may also be provided to the text channel supplier 20 which transmitted the text data to ISP 16. The structure of ISP 16 will now be described with respect to Figure 2.

ISP 16 primarily comprises a plurality of databases and database managers. As shown in Figure 2, there are essentially two types of databases maintained in ISP 16 - one type for EPG data and one type for text channel data. The EPG database is designed to collect data from each EPG supplier and to sort each EPG program record by channel and time of day. A separate database is created for each text channel for collecting text data from the associated text channel supplier 20 and formatting that the received text data for transmission on individual text channels using the techniques to be described below. Each database that is created is identified by the service provider and type of service codes listed in the Define Program Command for use in the control link commands provided to ISP 16 from HEC 14.

As shown in Figure 2, a received command is checked for its command code, the service provider, type of service and authorization code, as appropriate, by router and formatter 43. If the command is from an unauthorized data source, the subsequent data is ignored. However, if the received data is from an authorized supplier, router and formatter 43 routes the data to the appropriate database within ISP 16. For example, if EPG data is received, it is routed via EPG database manager 44 to EPG database 46. On the other hand, if the received data is text data from a weather service, the weather data is routed via weather database manager 48 to weather database 50. Similarly, if the received data is text data from a sports service, the sports data is routed via sports database manager 52 to sports database 54. Those skilled in the art will appreciate that a single database manager may perform the function of the separate database managers as indicated by dotted line in Figure 2. Also, those skilled in the art will appreciate that the separate databases may be implemented on the hard disk of the storage means of ISP 16 as also indicated by dotted line in Figure 2.

In a preferred embodiment, EPG database manager 44 sorts the received EPG data by channel and time of day and stores the received EPG data in the appropriate location in EPG database 46 for later recall. EPG database manager 44 may also perform garbage collection on the EPG database 46 as records are deleted. EPG database manager 44 may also call a data compression software routine such as the Huffman Compression Algorithm which, as known to those skilled in the art, maps more frequently used characters to fewer bits than the usual eight bits used in normal ASCII, while giving the less frequently used characters more bits. The number of bits used for a character is based on its probability of appearing in the data stream. Huffman encoding is described in detail in an article entitled "Lossless Data Compression", Byte, March, 1991, pp. 309-314. Such a routine is desired to maximize storage efficiency at EPG database 46. Similarly, each text database manager stores the text information in the associated text database and performs data compression.

Router and formatter 43 and database managers 44, 48 and 52 are all controlled by configurator 56, which is, in turn, responsive to control data from HEC 14. Configurator 56 responds to control commands from HEC 14 to provide updated authorization information to router and formatter 43 for comparison with the incoming data and for adding/subtracting database managers and databases and the like as EPG suppliers 18 and text channel suppliers 20 are added and subtracted from the system.

As noted above, access to ISP 16 is carefully controlled through the use of authorization codes. In addition, ISP 16 maintains control over the information services provided to the viewer by storing the EPG data and text data in a particular format in the appropriate database within ISP 16. For example, the EPG database may store the data in a particular binary tree format. Since the speed of the EPG database is not an issue in accordance with the invention (because the EPG database only needs to be able to read and write a number of records equal to the total number of channels in the cable system once every half an hour), a simple binary tree database has been used in a preferred embodiment. Such an EPG database will be stored on a hard disk drive of ISP 16. Preferably, the first 4 bytes stored on the hard disk drive will contain the file offset of the root node and the database records will follow. Each database record will contain, in addition to the required data, a left branch file offset and a right branch file offset. The left branch file offset points to the records with keys less than the current record, while the right branch file offset points to the records with keys greater than the current record. The database will use the program data and time and channel number as their key. For fastest access, those skilled in the art will appreciate that it is important to keep the database tree balanced.

In a preferred embodiment, the EPG database records are formatted such that the left branch appears first, then the right branch, the record key data and then the non-key record data. As shown in Figure 3, the EPG database key is a combination of the date and time field and the channel number from the EPG data. Following these fields are the duration field, the repeat field, the program rating field, the program category field, the critique field, the attributes flag field, the program traits flag field, the text data compressed flag and lastly the text data. Preferably, the text data field further consists of several optional subfields with a delimiter between each field. As noted above, the subfields preferably include the short program title line 1, the short program title line 2, the long program title line 1, the long program title line 2, and three lines of program description.

EPG database manager 44 accesses the EPG database 46 through shared library routines such as add a record, delete a record, read a record, and the like. In other words, an application program does not access the EPG database 46 directly. In a preferred embodiment, the EPG database 46 also uses a semaphore to disallow more than one process thread (EPG database manager 44 and EPG transaction formatter 58) from changing at any given time. As the EPG database 46 is used, it is fragmented as records are added and deleted, and as a result, EPG database manager 44 preferably further includes garbage collection routines for periodically performing the garbage collection function on the EPG database 46. The text databases are similarly configured except that garbage collection is not necessary.

EPG transaction formatter 58 reads the database records of EPG database 46 and formats them into program-based transactions having a predetermined number of bytes which are transmitted to the EPG scrambler 28 for insertion into the vertical blanking interval of a video signal and transmission to the set top tuner 34. These transactions are then sent via a transaction arbitrator 64 to the EPG scrambler 28 shown in Figure 1 for insertion into the appropriate video channel. Similarly, weather transaction formatter 60 and sports transaction formatter 62 read the database records of weather database 50 and sports database 54, respectively, and formats the text data into text screen-based transactions which may inserted into the vertical blanking interval of a video signal. Preferably, at least one transaction is inserted into a vertical blanking interval of each field of a video signal. It has been found that 22 bytes per transaction is a convenient transaction size to allow a transaction to fit into a vertical blanking interval of a field in this manner. In addition, the current time and date may be obtained from ISP system clock 63 to assure that the appropriate EPG programs are sent in the appropriate time slots.

The transactions from transaction arbitrator 64 are output to a single RS-485 output port of ISP 16 which is connected to multiple scramblers of the type used to scramble premium cable channels. The transactions are segmented into EPG data and text data streams for transmission to the EPG scrambler 28 (if the transaction includes EPG data) or to the text channel scramblers 30 and 32 (if the transaction includes text data). In a preferred embodiment, EPG transaction formatter 58 also tags the EPG transactions as Long Term or Short Term as they are transmitted to the EPG scrambler 28. EPG Short Term and Long Term data differ only in the timeliness of the information they provide to the set top tuner 34. Short Term data can be specified by HEC 14 via the control link to be anywhere from 1 to 255 hours of EPG data. The function of this Short Term data stream is to provide a quick refresh of the most immediate portion of the EPG data stored in EPG memory 36 of the set top tuner 34. Long Term data, on the other hand, consists of the remaining EPG data. The maximum time for the Long Term EPG data may also be specified by HEC 14 via the control link to be anywhere from 1 to 4096 hours, for example.

The EPG transactions generated by EPG transaction formatter 58 are formatted into SDLC frames as noted above. A sample SDLC format for the EPG transaction data is shown in Figure 4. In Figure 4, the beginning flag delineates the beginning of the SDLC frame, the station address delineates the scrambler to be addressed, the control byte is a command code that defines what is to be processed, the information field contains the EPG data formatted as in Figure 3, the frame check contains the CRC for all data between the beginning and ending flags, and the ending flag delineates the end of the SDLC frame. A transmission from EPG transaction formatter 58 will address a specific data stream and a response from the EPG scrambler 28 will identify its data stream in the station address location. As noted above, such transmissions may or may not require a response from the EPG scrambler 28.

The EPG transactions typically include an Add EPG Block command including a byte specifying that the following data is from the EPG data stream, a control code byte specifying, for example, whether a reply from the scrambler is expected, two bytes setting forth the EPG data block number, a flag setting forth whether the EPG data is Short Term or Long Term data, the number of transactions which make up the EPG data block, and the actual transactions. EPG transaction formatter 58 may also generate a Delete EPG Block command which specifies that the data is to be deleted from the EPG data stream, the control code byte, and the EPG block number to be deleted. These two transaction type for Long Term and Short Term EPG data may be used together to form a block of EPG data for insertion into the vertical blanking interval of a video signal. As noted above, the EPG data block preferably defines all of the information for a single program at a specific time, such as short and long titles and three lines of program description.

Figure 5 illustrates a flow chart for the software embodied in EPG transaction formatter 58. As shown, the software starts at step 500 and gets the system time and date from the ISP system clock 63 at step 502. An expired EPG data block is then deleted from the memory of the EPG scrambler 28 at step 504. An expired EPG data block is defined as a data block representing a program which has been completely aired prior to the current system time or a program which was aired before the time window used for the EPG. At step 506, current EPG data blocks having a time and date within the EPG time window are read from the EPG database 46. The current EPG data blocks are then formatted into Add EPG Block commands and associated transactions at step 508. A block/time map of EPG transaction formatter 58 is then updated at step 510. The block/time map preferably stores the time that each EPG data block was sent to EPG scrambler 28. The transactions representing the EPG data are then transmitted to the EPG scrambler 28 at step 512. EPG transaction formatter 58 then waits at step 514 for the next EPG update (which should occur when the system time enters a new half hour) or the next EPG change (which may occur at any time). Upon receipt of such an update or change, control returns to step 502.

Text transaction formatters 60 and 62 similarly generate text transactions for the text data, which as noted above, is defined on a per screen (rather than per program) basis. Hence, an Add Text Screen command is similar to an Add EPG Block command except that the text channel number and screen number are provided in place of the EPG block number and Short Term/Long Term data bytes. The text transaction formatters 60 and 62 may also request the time from the scrambler so that proper pagination may be maintained.

Figure 6 illustrates a flow chart for the software embodied in text channel transaction formatters 60, 62. As shown, the software starts at step 600 and reads a text screen record from the text database 50 or 54 at step 602. At step 604, the text screen is formatted into Add Text Screen transactions for transmission to the text channel scramblers 30, 32 at step 606. Preferably, such transactions are formatted such that the display characters are sent as display commands rather than as separate characters for every display coordinate of the text display screen. Then, at step 608, text transaction formatter 60, 62 waits a period of time specified by system manager 12 (if auto-pagination is used) before the next text page is formatted and transmitted to the text channel scramblers 30, 32. At the end of this period of time, control returns to step 604 and the next text screen record in the text database 50, 54 is formatted for transmission to text scramblers 30, 32 for insertion in the vertical blanking interval of a particular video signal.

Typically, text data is passed to the screen by sending a separate character for each display location of a page. In other words, if a text screen comprises 16 lines and 24 characters per line, a text screen is represented by sending 384 (24x16) characters, one for each display location for that display screen. A blank space character is sent to indicate that no character is present in a particular text screen location. Hence, even if a single word is displayed for a text screen, 384 characters are transmitted for display. This results in a great waste of bandwidth and transmission time, and accordingly, the present inventors send the text data to the screen as display transactions including display commands which generate the text data at the set top tuners 34. In this manner, it is unnecessary to send a byte for every address of the text screen of the display.

In particular, the text data is transmitted to the screen along with appropriate commands for controlling the display of the text data. For example, a first display command in a sequence identifies the following data as text data and instructs the set top tuner 34 to fill the television screen with a blue background or some other background or template over which the text will be displayed. The text data is then converted into a series of commands which together identify the separate screens of text. As noted above, the text data is grouped on a per screen basis, which allows the appropriate delay mechanism to be incorporated into the display commands to provide the necessary delay between the presentation of respective text screens.

For this purpose, transaction formatters 60 and 62 preferably include software for scanning the text data for actual characters, skipping extra spaces in the text data, and grouping the actual text for transmission in transactions of a designated size which will fit in the vertical blanking interval of a field of a video signal. Since spaces are eliminated, the display commands include a coordinate specifying the row and column address of the first display character on the screen and a number of contiguous characters follow that character in the same transaction until the transaction is filled or a number of successive spaces are encountered. Attribute information such as underline, blinking, or luminance inversion associated with the characters may also be transmitted using these display commands. These display commands are used to read the text data for a text screen from the appropriate database, and at the end of the text data for a text screen, a display command is transmitted to indicate that all data for that text screen has been transmitted. The transaction formatter 60, 62 also includes a wait loop or "timeout" command at the end of the transmission which builds in a delay (on the order of 7 seconds) which gives the viewer sufficient time to view text screen before the text data for the next text screen is displayed, thereby providing auto-pagination of the text screen.

Auto-pagination permits the viewer to automatically advance from one text screen to the next without any intervention by the viewer. In accordance with the auto-pagination scheme of the invention, the cable operator can specify the time duration between screens and forward this information to the transaction formatters 60, 62. Then, during operation, when the viewer selects a text channel, the current page of text data is displayed by extracting the selected text channel data from the vertical blanking interval of the video signal in which it is inserted and mapping that text data to a channel of the viewer's television which is designated for display of that text channel. The next screen of text data will be displayed after a predetermined delay which gives the viewer sufficient time to read the displayed text data for the current screen (approximately 7 seconds). This technique could replace the commonly used "barker" channel which uses a computer to generate text data which is then transmitted as a complete video channel over the cable television system.

As noted above, configurator 56 responds to control commands from HEC 14 to provide updated authorization information to router and formatter 43 for comparison with the incoming data and to add/subtract database managers and databases and the like as EPG suppliers 18 and text channel suppliers 20 are added and subtracted from the system. The control link between HEC 14 and configurator 56 is also used to report the status of the ISP 16 to system manager 12. Also, if desired, the control link may accept text data from system manager 12 for displaying system messages and the like.

The interface between the configurator 56 and HEC 14 is an RS-232 port with a data format fixed at, for example, 9600 baud. All control data is preferably transmitted as ASCII characters. Upon receipt of a message from HEC 14, configurator 56 checks the data, performs the requested action, and returns a command response message in a message format of the type described above for communications between router and formatter 43 and the EPG and text channel suppliers. Sample commands sent from HEC 14 to configurator 56 over the control link include a Set Date and Time command (for synchronization purposes), Request Configuration commands, Request Status commands, Get Category Record commands, Scrambler Control commands, and Database Control commands.

During operation, ISP 16 monitors all input ports for data from the EPG and text data service providers and builds a list of all available EPG and text data services. This list is sent to the system manager 12 using a Request Configuration command. This command specifies the available service providers, the type of service (EPG or text data) from each provider, the communications port associated with each service, the scrambler address or data stream (EPG or text data) for each service, the authorization code from the supplier for each service, the time and date of the last update from the service provider, the time and date of the last update to the scramblers, the time and date of the latest EPG data in the EPG database, and the like. Such information is provided to the system manager 12 for each service provider when this command is given.

The Request Status command contains flags indicating whether there are errors present in the error log and if the category list has changed since the last Request Status command was received. Get Error Record and Get Category Record commands may then be used to extract the error and category information.

The configuration commands are separated into EPG and text service configuration commands. A Configure EPG Service command specifies the service provider, the type of service, whether the service is to be enabled or disabled, the authorization code from the EPG supplier 18, the scrambler data stream for Short Term data, the scrambler data stream for Long Term data, the length of the Short Term data in hours (1-255), and the length of the Long Term data in hours (1-4096). The Configure Text Service command, on the other hand, specifies the service provider, the type of service (weather, sports, etc.), whether this service is to be enabled or disabled, the authorization code from the text channel supplier 20, the scrambler address or data stream for the text data, the channel number, and the pagination delay time (in seconds) before the next page of text data is to replace the current page of text data on the screen for auto-pagination.

The scrambler control commands include, for example, a Rebuild Scrambler Memory command which is used when a scrambler is replaced and needs data to be reloaded in its memory and a Scrambler Configuration command for specifying the amount of scrambler memory in kbytes. As noted above, a scrambler preferably contains enough memory to store a day's worth of sports scores or a complete weather forecast and the like so that repeated accesses to weather database 50 and sports database 54 are not necessary.

The database control commands include, for example, a Clear Database command which is used to clear the database associated with a particular service and a Delete Database command which is used to delete the database associated with a particular service. Other database control commands such as a Download Category Map command may also be provided for establishing a list of the specified categories of program data in the EPG data.

Figure 7 illustrates a preferred embodiment of a set top tuner 34. As shown, set top tuner 34 comprises EPG memory 36, template memory 38, text page memory 42, a tuner 700, and a set top processor 702 which reads commands from the vertical blanking interval of the incoming video signal and performs the appropriate action. For example, if the incoming command is a text channel definition or EPG definition command from HEC 14, the appropriate update of bit map 704 is performed. Similarly, if the incoming command is a display command including EPG data, that data is stored in EPG memory 36 and is displayed with the template stored in template memory 38 when the user makes a menu selection via television remote control unit 706 and remote receiver 708 requesting display of the EPG data. Of course, the template data may be sent as part of EPG display commands if no template memory is provided. On the other hand, if the incoming command is a display command including text data, a page of that data is stored in text page memory 42 for presentation to the display a page at a time. The text page memory is either automatically updated every few seconds by virtue of the delay built into the display commands from the text formatters 60, 62 (if auto-pagination is enabled), or else the user is allowed to manually access the text data in the memory. If manual access is provided, it is preferred that the text page memory hold at least the currently displayed text page, the previous text page and the subsequent text page in order to give the user the ability to scroll through the text data. In either case, set top processor 702 preferably has the ability to request the next text page while the current page is being displayed so that the next text page is already loaded for display at the end of the screen delay time. The selected text, EPG or video signal is then modulated at modulator 710 for display on television screen 40 at the channel specified in bit map 704.

Bit map 704 of set top processor 702 of the set top tuner 34 maps the received text information to the designated cable channel for display by designating the frequency that must be tuned by tuner 700 to receive the desired text data. This information is received in the aforementioned text channel definition transactions from HEC 14. For example, the viewer may specify via television remote 706 that she wishes to view a sports text data channel which her program guide indicates to be available by tuning the set top tuner 34 to channel 181. Set top processor 702 then checks bit map 704 for channel 181 to determine that it must tune the frequency for channel 29 in order to extract the sports text data for the viewer's channel 181 from the vertical blanking interval of channel 29. Set top processor 702 then sets tuner 700 to tune channel 29 but the video signal for channel 29 is not displayed. Instead, the video screen is blanked by set top processor 702 and the text data extracted from the vertical blanking interval by set top processor 702 is displayed. Any necessary descrambling of the received video is performed by set top processor 702. The viewer thus perceives that many more "virtual" channels are available even though a separate video channel was not used to transmit the text data.

Applications for the text channels of the invention include the provision of a help or user's guide channel, a channel for alerting subscribers on cable system status, a stock market ticker, and the like using text provided by the system manager 12 or another text channel supplier. This text data is preferably displayed on a designated channel of the viewer's set top tuner 34. User's guide data, help data and the like is preferably scrolled through by the user using the keys on the television remote control device (auto-pagination is not particularly desirable for a text channel of this type). In addition, text channels can be grouped for display whereby related subjects are displayed on adjacent channels of the set top tuner 34. For example, channel 181 could be used for football scores, 182 for hockey scores, 183 for baseball scores, 184 for basketball scores, and the like.

Although the present invention has been described with respect to particular embodiments, those skilled in the art will appreciate that the present invention may be modified without departing from the scope of the invention. For example, certain text channel data provided in accordance with the invention may be placed in premium or pay-per-view channels so that access to such text data may be restricted. Restricted text data could include personals and other adult oriented text data which parents may wish to restrict from their children or certain text data for which the cable operator may wish to charge an access fee. In addition, the EPG data and text data may also be transmitted in the horizontal blanking intervals of the video signals, on the audio carriers for each video channel, or even in place of some of the active video, if such is desired. Moreover, an interactive EPG may be designed whereby the user selects a program ID from the EPG and the processor of the set top tuner automatically tunes the frequency for the channel corresponding to that program ID. Accordingly, all such modifications are intended to be included within the scope of the invention as defined by the following claims.

WE CLAIM:

1. A data controller for controlling the presentation of text data to a television display, comprising:

a database for storing text data from a plurality of sources of text data;

means for formatting text data stored in said database and display commands into transactions having a predetermined number of bytes, and for assigning each of said sources of text data to a unique video program channel;

means for inserting said transactions into predetermined intervals of the unique video program channel to which text data in said transactions is assigned; and

a tuner which extracts said transactions from their unique video program channel and presents text data in said transactions to said television display in accordance with a display command in said transactions for display to a viewer.

2. A data controller as in claim 1, wherein at least one of said sources of text data provides electronic program guide (EPG) data representing the video programs available for display on said television display.

3. A data controller as in claim 1, wherein said sources of text data communicate with said database via a communications link.

4. A data controller as in claim 3, wherein said communications link comprises at least one of a satellite link and a modem link to said database.

5. A data controller as in claim 4, further comprising a data interface for providing common input ports for each of said sources of text data and for routing text data from each of said sources to said database.

6. A data controller as in claim 5, wherein said data interface operates in a simplex mode for transmissions

from said satellite link and in a duplex mode for transmissions from said modem link.

7. A data controller as in claim 5, wherein said database is divided into a plurality of source databases, one source database for each source of text data.

8. A data controller as in claim 1, further comprising means for compressing data from said sources prior to storage in said database.

9. A data controller as in claim 2, further comprising a database manager for authorizing access to said database, sorting received EPG data by assigned video program channel and time of day, and performing garbage collection on said database.

10. A data controller as in claim 7, wherein said formatting and assigning means assigns a source database to each new source of text data, controls said data interface to route text data from said new source to its source database, and updates access authorization to said source database for said new source of text data.

11. A data controller as in claim 1, wherein said predetermined intervals are vertical blanking intervals of the unique video program channel to which that text data is assigned and said inserting means inserts said transactions into said vertical blanking intervals of said unique video program channel.

12. A data controller as in claim 11, wherein said inserting means stores a number of transactions for creating a screen of text data on said television display and inserts said transactions into said vertical blanking intervals of said unique video program channel to which the source which

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produced the text data in said number of transactions is assigned.

13. A data controller as in claim 2, wherein said tuner comprises an EPG memory for storing EPG data representing the video programs available for display on said television display over a predetermined interval of time.

14. A data controller as in claim 13, wherein said tuner further comprises a template memory for storing a video display template into which said EPG data is inserted for display on said television display, said video display template representing a time grid for each authorized video programming channel in said EPG data which may be tuned by said tuner.

15. A data controller as in claim 14, wherein said tuner selectively accesses said EPG data in said EPG memory so as to allow a viewer to scan through said EPG data.

16. A data controller as in claim 1, wherein said tuner comprises a text memory for storing at least a page of text data for presentation to said television display.

17. A data controller as in claim 1, wherein said tuner comprises a bit map for correlating a designated channel on the television display to a frequency which must be tuned to get the text data for the designated channel from a vertical blanking interval of the video program channel containing the text data for the designated channel.

18. A method of controlling presentation of text data to a television display, comprising the steps of:

authorizing one of a plurality of sources of text data to access a source database for storage of text data from said one source;

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transmitting said text data from said one source to said source database for storage;

assigning said text data from said one source to a unique video program channel;

reading said text data from said one source from said source database and formatting display commands and said text data stored in said source database into transactions having a predetermined number of bytes;

inserting each transaction into a predetermined interval of the unique video program channel to which the text data in that transaction is assigned;

at a viewer's television tuner, extracting said transactions from their unique video program channel;

processing said transactions at said viewer's television tuner to extract said text data and said display commands; and

presenting said text data in said transactions to said television display in accordance with a display command in said transactions for display to said viewer.

19. A method as in claim 18, wherein said one source of text data authorized in said authorizing step for access to said source database provides electronic program guide (EPG) data representing the video programs available for display on said television display.

20. A method as in claim 18, wherein said transmitting step includes the step of transmitting said text data to said source database via a communications link comprising at least one of a satellite link and a modem link to said source database.

21. A method as in claim 20, wherein said transmitting step includes the steps of receiving said text data at an interface device of said source database which comprises common input ports for each of said sources of text

data and routing the received text data to said source database.

22. A method as in claim 21, wherein said transmitting step includes the further step of sending a command response message to said one source upon receipt of a command from said one source including said text data.

23. A method as in claim 18, comprising the further step of compressing said text data prior to storage in said source database.

24. A method as in claim 19, comprising the further steps of sorting received EPG data by video program channel and time of day.

25. A method as in claim 18, wherein said assigning step includes the steps of assigning said source database to said one source of text data, routing text data from said one source to said source database, and updating access authorization to said source database for said one source of text data.

26. A method as in claim 18, wherein said reading and formatting step comprises the steps of forming said transactions as display commands for a predetermined number of characters of said text data and of instructing said viewer's television tuner regarding where and how to display said text data in said transactions on said television display.

27. A method as in claim 26, wherein said predetermined interval is a vertical blanking interval of the unique video program channel to which that text data is assigned and said inserting step includes the step of inserting said transactions into said vertical blanking interval of said unique video program channel.

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28. A method as in claim 27, wherein said inserting step includes the further step of storing a number of transactions for creating a screen of text data on said television display and inserting said transactions into said vertical blanking interval of said unique video program channel to which the source which produced the text data in said number of transactions is assigned.

29. A method as in claim 19, comprising the further step of storing EPG data in said viewer's television tuner representing the video programs available for display on said television display over a predetermined interval of time.

30. A method as in claim 29, comprising the further step of storing a video display template in said viewer's television tuner for insertion of said EPG data for display, said template representing a time grid for each authorized video programming channel in said EPG data which may be tuned by said viewer's television tuner.

31. A method as in claim 30, comprising the further step of scrolling through said EPG data stored in said EPG memory of said viewer's television tuner.

32. A method as in claim 18, comprising the further step of storing at least a page of text data in a text memory of said viewer's television tuner for presentation to said television display.

33. A method as in claim 18, wherein said presenting step includes the steps of tuning said viewer's television tuner to a frequency of a video program channel containing in its vertical blanking interval the text data for a text channel designated by the viewer and presenting said text data to said television display when said viewer selects said designated text channel.

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34. A method as in claim 18, comprising the further step of delaying a predetermined amount of time after a page of text data has been presented to said television display before presenting a next page of text data to said television display.

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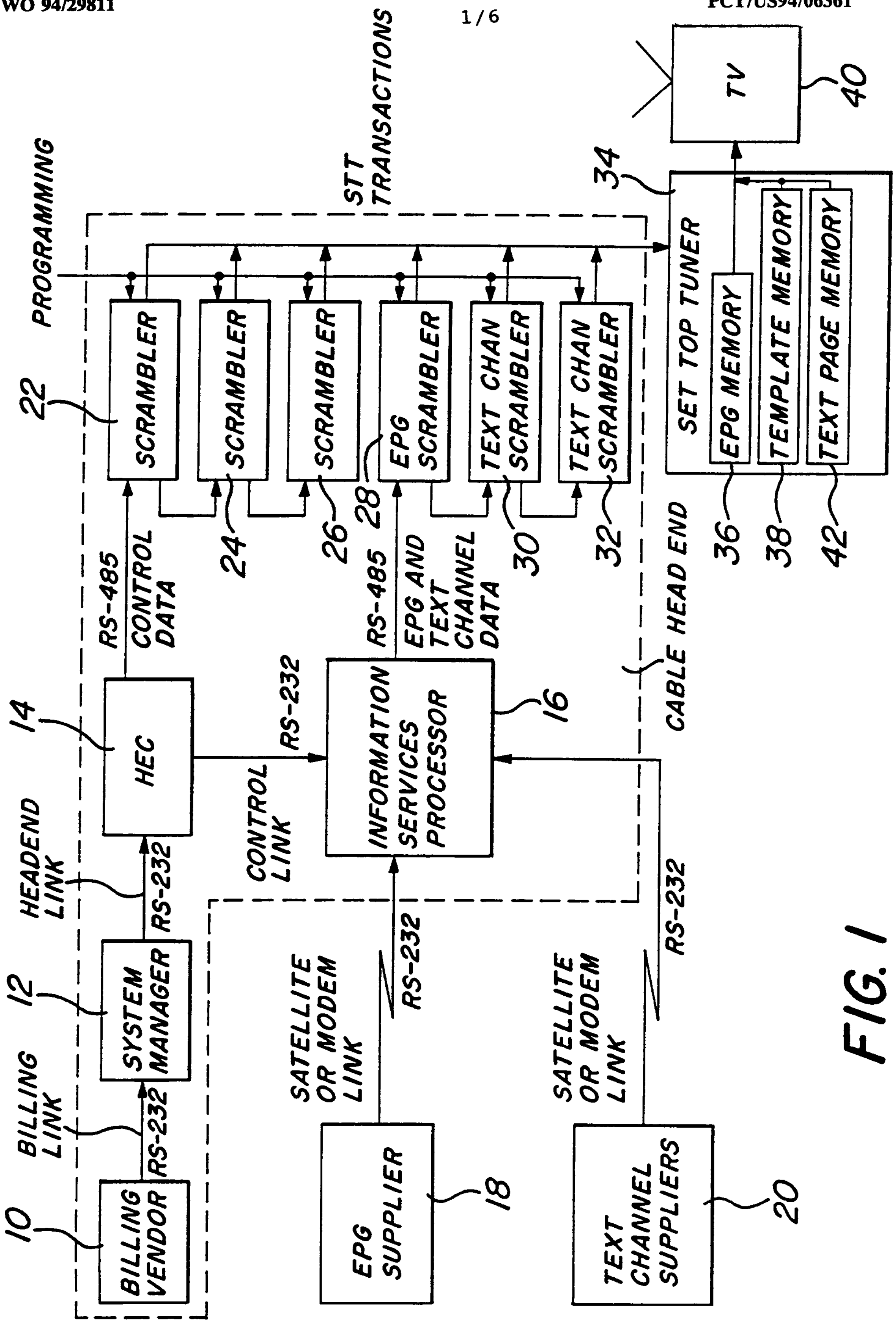

PROGRAMMING
STT
TRANSACTIONS
TV
40
34
SET TOP TUNER
EPG MEMORY
TEMPLATE MEMORY
TEXT PAGE MEMORY
36
38
42
22
SCRAMBLER
SCRAMBLER
SCRAMBLER
EPG
SCRAMBLER
TEXT CHAN
SCRAMBLER
TEXT CHAN
SCRAMBLER
24
26
28
30
32
RS-485
CONTROL
DATA
RS-485
EPG AND
TEXT
CHANNEL
DATA
CABLE HEAD END
14
HEC
RS-232
CONTROL
LINK
INFORMATION
SERVICES
PROCESSOR
16
HEADEND
LINK
RS-232
12
SYSTEM
MANAGER
BILLING
LINK
RS-232
10
BILLING
VENDOR
SATELLITE
OR MODEM
LINK
RS-232
EPG
SUPPLIER
18
SATELLITE
OR MODEM
LINK
RS-232
TEXT
CHANNEL
SUPPLIERS
20

FIG. 1

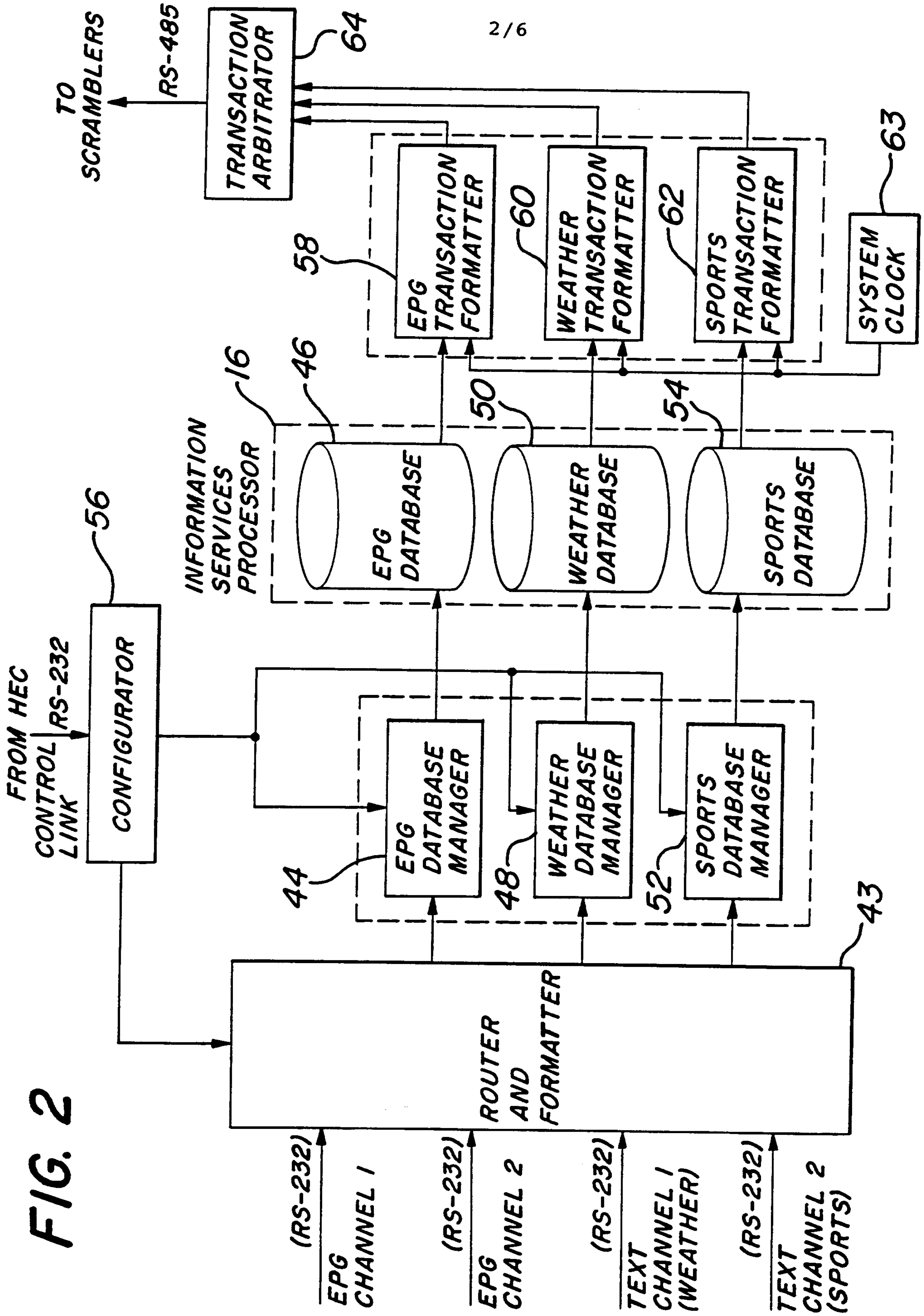

TO SCRAMBLERS
RS-485
TRANSACTION ARBITRATOR
64
EPG TRANSACTION FORMATTER
58
WEATHER TRANSACTION FORMATTER
60
SPORTS TRANSACTION FORMATTER
62
SYSTEM CLOCK
63
INFORMATION SERVICES PROCESSOR
16
EPG DATABASE
46
WEATHER DATABASE
50
SPORTS DATABASE
54
FROM HEC CONTROL LINK
RS-232
CONFIGURATOR
56
EPG DATABASE MANAGER
44
WEATHER DATABASE MANAGER
48
SPORTS DATABASE MANAGER
52
ROUTER AND FORMATTER
43
(RS-232)
EPG CHANNEL 1
(RS-232)
EPG CHANNEL 2
(RS-232)
TEXT CHANNEL 1 (WEATHER)
(RS-232)
TEXT CHANNEL 2 (SPORTS)

FIG. 2

FIG. 3 (INFORMATION FIELD)

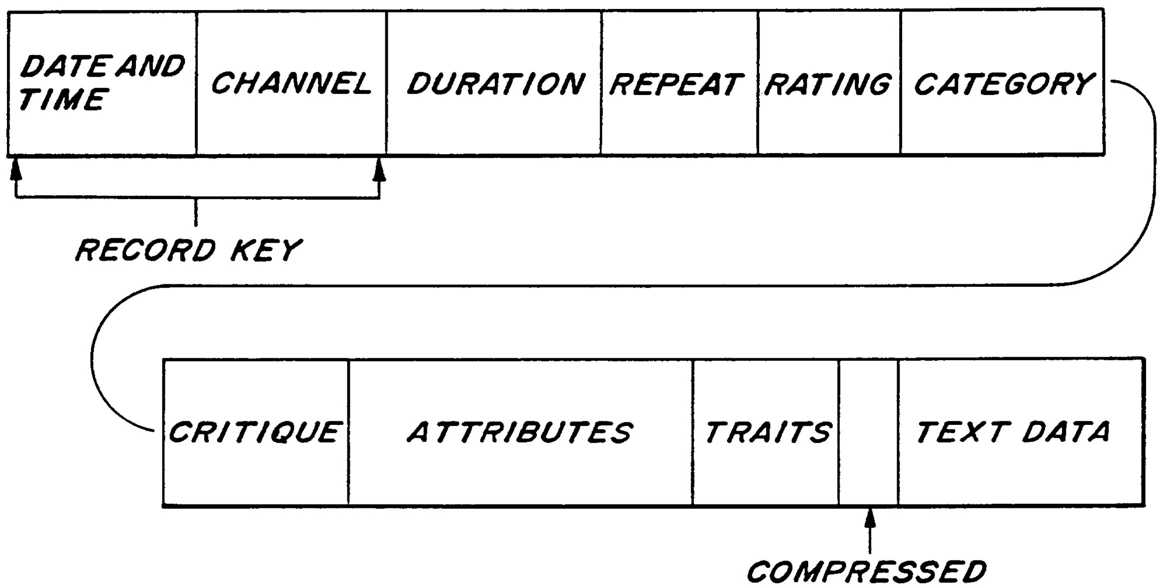


FIG. 4 (TO SCRAMBLERS)

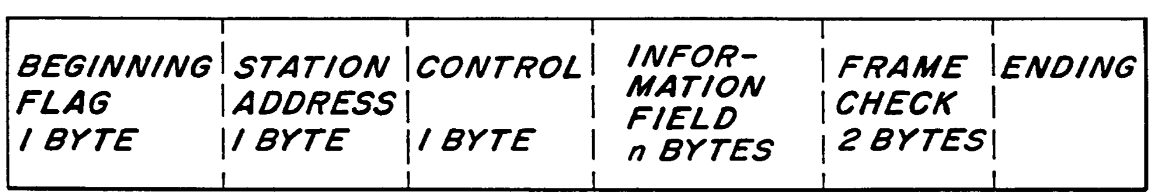


FIG. 5

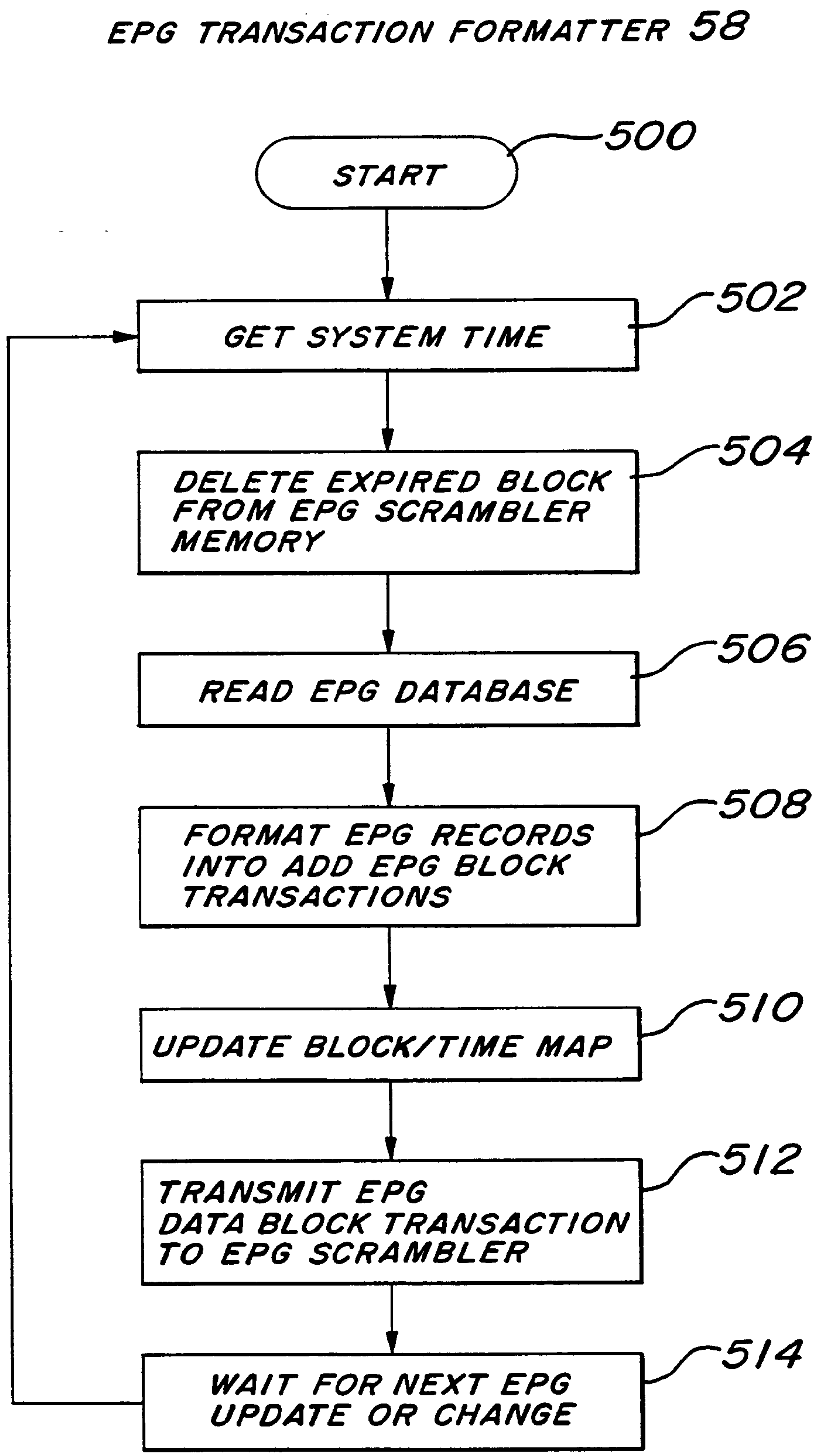
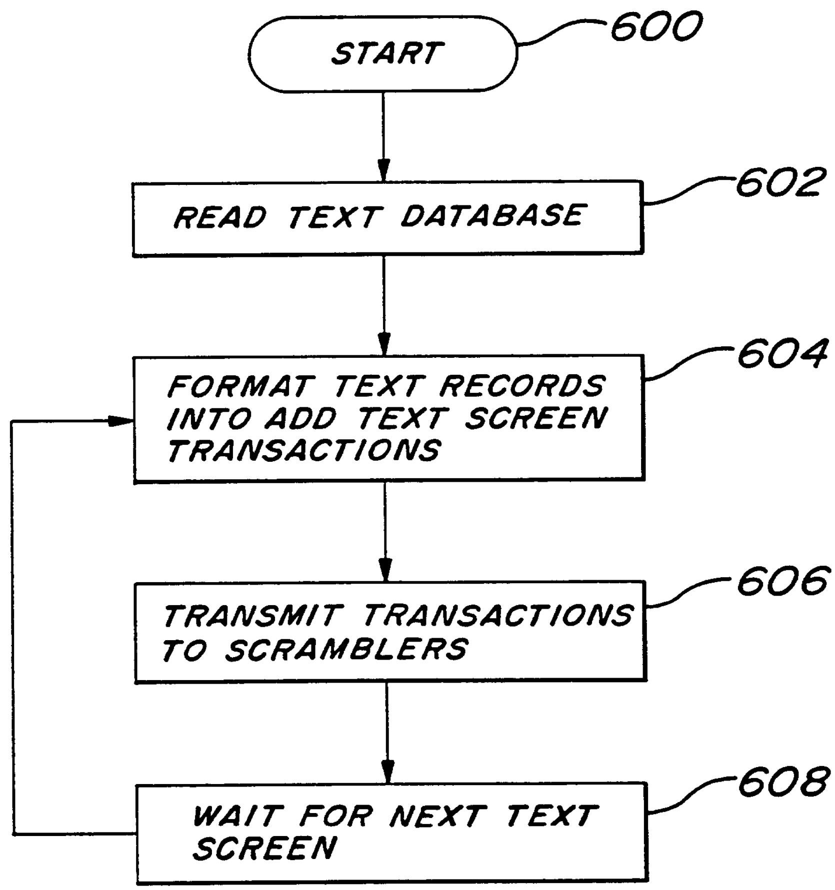

EPG TRANSACTION FORMATTER 58
START
500
GET SYSTEM TIME
502
DELETE EXPIRED BLOCK FROM EPG SCRAMBLER MEMORY
504
READ EPG DATABASE
506
FORMAT EPG RECORDS INTO ADD EPG BLOCK TRANSACTIONS
508
UPDATE BLOCK/TIME MAP
510
TRANSMIT EPG DATA BLOCK TRANSACTION TO EPG SCRAMBLER
512
WAIT FOR NEXT EPG UPDATE OR CHANGE
514

FIG. 6

TEXT CHANNEL TRANSACTION FORMATTER 60,62



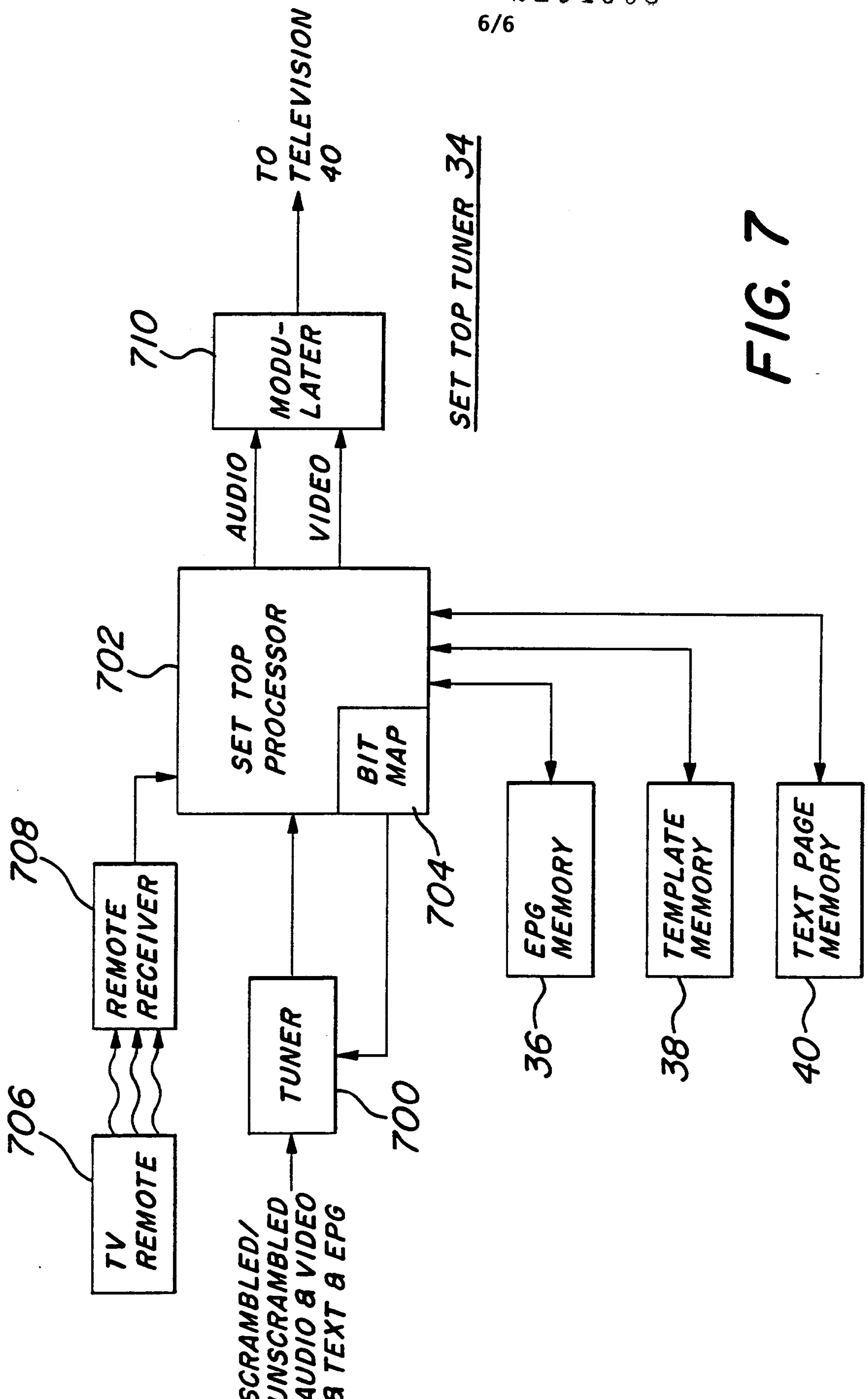


FIG. 7

SUBSTITUTE SHEET (RULE 26)

(19) Canadian Intellectual Property Office
An Agency of Industry Canada

Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

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(43) 11.08.1999

(12)

(21) 2 229 238

(51) Int. Cl.[6]: **G06F 017/60**, G06F 017/40

(22) 11.02.1998

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(54) SYSTEME DE CONTROLE DE VEHICULES AUTOMOBILES SERVANT A DETERMINER LES FRAIS D'ASSURANCE

(54) MOTOR VEHICLE MONITORING SYSTEM FOR DETERMINING A COST OF INSURANCE

(57)

A method and system of determining a cost of automobile insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics. The cost is adjustable retrospectively and can be prospectively set by relating the driving characteristics to predetermined safety standards. The method comprises steps of monitoring a plurality of raw data elements representative of an operating state of the vehicle or an action of the operator. Selected ones of the raw data elements are recorded when the ones are determined to have an identified relationship to safety standards. The selected ones are consolidated for processing against an insurer profile and for identifying a surcharge or discount to be applied to a base cost of automobile insurance. A final cost is produced from the base costs and the surcharges or discounts.

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CIPO
Canadian Intellectual Property Office

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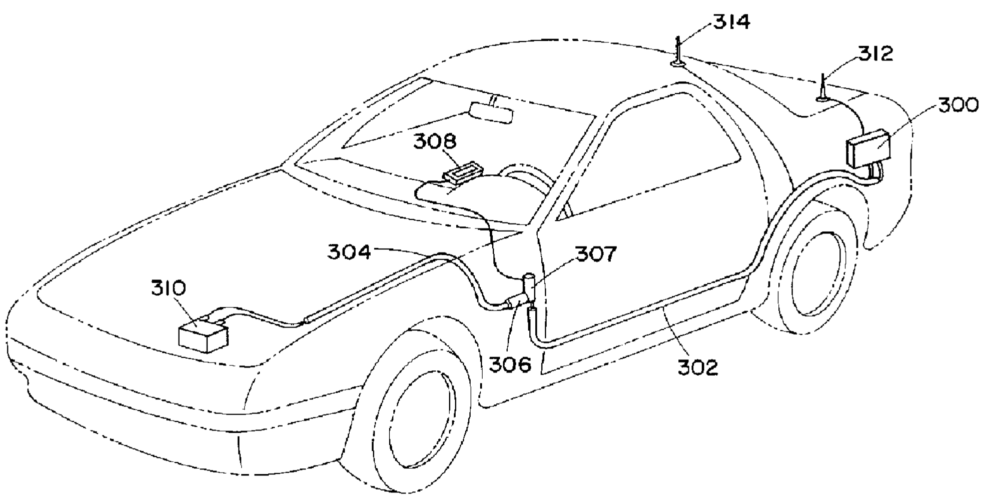
(51) Int.Cl.^{6} G06F 17/60, G06F 17/40

(54) **SYSTEME DE CONTROLE DE VEHICULES AUTOMOBILES SERVANT A DETERMINER LES FRAIS D'ASSURANCE**

(54) **MOTOR VEHICLE MONITORING SYSTEM FOR DETERMINING A COST OF INSURANCE**



(57) A method and system of determining a cost of automobile insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics. The cost is adjustable retrospectively and can be prospectively set by relating the driving characteristics to predetermined safety standards. The method comprises steps of monitoring a plurality of raw data elements representative of an operating state of the vehicle or an action of the operator. Selected ones of the raw data elements are recorded when the ones are determined to have an identified relationship to safety standards. The selected ones are consolidated for processing against an insurer profile and for identifying a surcharge or discount to be applied to a base cost of automobile insurance. A final cost is produced from the base costs and the surcharges or discounts.

Industrie Canada Industry Canada

MOTOR VEHICLE MONITORING SYSTEM FOR DETERMINING A COST OF INSURANCE

Abstract of the Disclosure

A method and system of determining a cost of automobile insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics. The cost is adjustable retrospectively and can be prospectively set by relating the driving characteristics to predetermined safety standards. The method comprises steps of monitoring a plurality of raw data elements representative of an operating state of the vehicle or an action of the operator. Selected ones of the raw data elements are recorded when the ones are determined to have an identified relationship to safety standards. The selected ones are consolidated for processing against an insurer profile and for identifying a surcharge or discount to be applied to a base cost of automobile insurance. A final cost is produced from the base costs and the surcharges or discounts.

MOTOR VEHICLE MONITORING SYSTEM FOR DETERMINING A COST OF INSURANCE

Background of the Invention

The present invention relates to data acquisition and processing systems, and particularly to a system for monitoring motor vehicle operational characteristics and driver behavior to obtain increased amounts of data relating to the safety of use for purposes of providing a more accurate determination of a cost of insurance for the vehicle.

Conventional methods for determining costs of motor vehicle insurance involve gathering relevant historical data from a personal interview with the applicant for the insurance and by referencing the applicant's public motor vehicle driving record that is maintained by a governmental agency, such as a Bureau of Motor Vehicles. Such data results in a classification of the applicant to a broad actuarial class for which insurance rates are assigned based upon the empirical experience of the insurer. Many factors are relevant to such classification in a particular actuarial class, such as age, sex, marital status, location of residence and driving record.

The current system of insurance creates groupings of vehicles and drivers (actuarial classes) based on the following types of classifications.

Vehicle:

Age;
manufacturer, model; and
value.

Driver:

Age;
sex;
marital status;
driving record (based on government reports),
violations (citations);

at fault accidents; and
place of residence.

Coverage:

Types of losses covered,
- liability,
- uninsured motorist,
- comprehensive, and
- collision;

liability limits; and
deductibles.

The classifications, such as age, are further broken into actuarial classes, such as 21 to 24, to develop a unique vehicle insurance cost based on the specific combination of actuarial classes for a particular risk. For example, the following information would produce a unique vehicle insurance cost.

Vehicle:

Age	1993 (three years old)
manufacturer, model	Ford, Explorer XLT
value	$ 18,000.

Driver:

Age	38 years old
sex	male
marital status	single
driving record (based on government reports)	
violations	1 point (speeding)
at fault accidents	3 points (one at fault accident)
place of residence	33619 (zip code)

Coverage:

Types of losses covered

liability	yes
uninsured motorist	no
comprehensive	yes
collision	yes
liability limits	$100,000./$300,000./$50,000.
deductibles	$500./$500.

A change to any of this information would result in a different premium being charged, if the change resulted in a different actuarial class for that variable. For instance, a change in the drivers' age from 38 to 39 may not result in a different actuarial class, because 38 and 39 year old people may be in the same actuarial class. However, a change in driver age from 38 to 45 may result in a different premium because of the change in actuarial class.

Current insurance rating systems also provide discounts and surcharges for some types of use of the vehicle, equipment on the vehicle and type of driver. Common surcharges and discounts include:

Surcharges:

Business use.

Discounts:

Safety equipment on the vehicle
- airbags, and
- antilock brakes;

theft control devices
- passive systems (e.g. "The Club"), and
- alarm system; and

driver type
- good student, and
- safe driver (accident free).

A principal problem with such conventional insurance determination systems is that much of the data gathered from the applicant in the interview is not verifiable, and even existing public records contain only minimal information, much of which has little relevance towards an assessment of the likelihood of a claim subsequently occurring. In other words, current rating systems are primarily based on past realized losses. None of the data obtained through conventional systems necessarily reliably predicts the manner or safety of future operation of the vehicle. Accordingly, the limited amount of accumulated relevant data and its minimal evidential value towards computation of a fair cost of insurance has generated a long-felt need for an improved system for more reliably and accurately accumulating data having a highly relevant evidential value towards predicting the actual manner of a vehicle's future operation.

Many types of vehicle operating data recording systems have heretofore been suggested for purposes of maintaining an accurate record of certain elements of vehicle operation. Some are suggested for identifying the cause for an accident, others are for more accurately assessing the efficiency of operation. Such systems disclose a variety of conventional techniques for recording vehicle operation data elements in a variety of data recording systems. In addition, it has also been suggested to provide a radio communication link for such information via systems such as a cellular telephone to provide immediate communication of certain types of data elements or to allow a more immediate response in cases such as theft, accident, break-down or emergency. It has even been suggested to detect and record seatbelt usage to assist in determination of the vehicle insurance costs (U.S. Patent No. 4,667,336).

The various forms and types of vehicle operating data acquisition and recordal systems that have heretofore been suggested and employed have met with varying degrees of success for their express limited purposes. All possess substantial defects such that they have only limited economical and practical value for a system intended to provide an enhanced acquisition, recordal and communication system of data which would be both comprehensive and reliable in predicting an accurate and adequate cost of insurance for the vehicle. Since the type of operating information acquired and recorded in prior art systems was generally never intended to be used for determining the cost of vehicle insurance, the data elements that were monitored and recorded therein were not directly related to predetermined safety standards or the determining of an actuarial class for the vehicle operator. For example, recording data characteristics relevant to the vehicle's operating efficiency may be completely unrelated to the safety of operation of the vehicle. Further, there is the problem of recording and subsequently compiling the relevant data for an accurate determination of an actuarial profile and an appropriate insurance cost therefor.

Current motor vehicle control and operating systems comprise electronic systems readily adaptable for modification to obtain the desired types of information relevant to determination of the cost of insurance. Vehicle tracking systems have been suggested which use communication links with satellite navigation systems for providing information describing a vehicle's location based upon navigation signals. When such positioning information is combined with roadmaps in an expert system, vehicle location is ascertainable. Mere vehicle location, though, will not provide data particularly relevant to safety of operation unless the data is combined with other relevant data in an expert system which is capable of assessing whether the roads being driven are high-risk or low-risk with regard to vehicle safety.

The present invention contemplates a new and improved motor vehicle monitoring, recording and communication system, which primarily overcomes the problem of determining cost of vehicle insurance based upon data which does not take into consideration how a specific vehicle is operated. The subject invention will base insurance charges with regard to current material data representative of actual driving characteristics of the vehicle and driver operation to provide a classification rating of the operator and the vehicle in an actuarial class which has a vastly reduced rating error over conventional insurance cost systems. Additionally, the present invention allows for frequent (monthly) adjustment to the cost of coverage because of the changes in operator behavior and driving patterns. This can result in automobile insurance charges that are readily controllable by individual operators. The system is adaptable to current electronic operating systems, tracking systems and communication systems for the improved extraction of selected insurance related data.

Brief Summary of the Invention

In accordance with the present invention, there is disclosed a method of determining a cost of automobile insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics, whereby the cost is adjustable by relating the driving characteristics to predetermined safety standards. The method is comprised of steps of monitoring a plurality of raw data elements representative of an operating state of a vehicle or an action of the operator. Selected ones of the plurality of raw data elements are recorded when they are determined to have an identified relationship to the safety standards. The recorded elements are consolidated for processing against an insured profile and for identifying a surcharge or discount to be applied to a base cost of automobile insurance. The total cost of insurance obtained from combining the base cost and surcharges or discounts is produced as a final cost to the operator.

In accordance with another aspect of the present invention, the recording comprises identifying a trigger event associated with the raw data elements which has an identified relationship to the safety standards so that trigger information representative of the event is recorded.

In accordance with a more limited aspect of the present invention, the method comprises a step of immediately communicating to a central control station via an uplink, information representative of the trigger event and recording response information generated by the control station.

In accordance with yet another aspect of the present invention, the method comprises steps of generating calculated data elements and derived data elements from the raw data elements, and accumulating the calculated and derived data elements in a recording device.

The present invention will use information acquired from the vehicle to more accurately assess vehicle usage and thereby derive insurance costs more precisely and fairly. Examples of possible actuarial classes developed from vehicle provided data include:

Driver:

Total driving time in minutes by each driver of the insured vehicle;

number of minutes driving in high/low risk locations (high/low accident areas);

number of minutes of driving at high/low risk times (rush hour or Sunday afternoon);

safe driving behavior,

using seat belts,

use of turn signals,

observance of speed limits, and

observance of traffic control devices;

number of sudden braking situations; and

number of sudden acceleration situations.

Vehicle:

Location vehicle is parked at night (in garage, in driveway, on street); and

location vehicle is parked at work (high theft locations, etc.).

These new and more precise actuarial classes are considered to be better predictors of loss because they are based on actual use of the vehicle and the behaviors demonstrated by the driver. This will allow the consumers unprecedented control over the ultimate cost of their vehicle insurance.

In accordance with the present invention, additional discounts and surcharges based on data provided by the insured vehicle will be available. Examples of surcharges and discounts based on vehicle provided data include:

Surcharges:

Excessive hard braking situations occurring in high risk locations; and intermittent use of a safety device, such as seat belts.

Discounts:

Regular selection of low/high risk routes of travel;
regular travel at low/high risk times;
significant changes in driving behavior that results in a lower risk;
vacation discount when the vehicle is not used;
regular use of safety devices; and
unfailing observance of speed limits.

There is some overlap between the use of actuarial classes and discounts and surcharges. Until data has been gathered and analyzed it is not possible to determine which vehicle provided data will be used to determine actuarial classes and which will be used for surcharges or discounts.

One benefit obtained by use of the present invention is a system that will provide precise and timely information about the current operation of an insured motor vehicle that will enable an accurate determination of operating characteristics, including such features as miles driven, time of use and speed of the vehicle. This information can be used to establish actual usage based insurance charges, eliminating rating errors that are prevalent in traditional systems and will result in vehicle insurance charges that can be directly controlled by individual operators.

It is another benefit of the subject invention that conventional motor vehicle electronics are easily supplemented by system components comprising a data recording, a navigation system and a communications device to extract selected insurance relevant data from the motor vehicle.

It is yet another object of the present invention to generate actuarial classes and operator profiles relative thereto based upon actual driving characteristics of the vehicle and driver, as represented by the monitored and recorded data elements for providing a more knowledgeable, enhanced insurance rating precision.

The subject new insurance rating system retrospectively adjusts and prospectively sets premiums based on data derived from motor vehicle operational characteristics and driver behavior through the generation of new actuarial classes determined from such characteristics and behavior, which classes heretofore have been unknown in the insurance industry. The invention comprises an integrated system to extract via multiple sensors, screen, aggregate and apply for insurance rating purposes, data generated by the actual operation of the specific vehicle and the insured user/driver.

Other benefits and advantages of the subject new vehicle insurance cost determination process will become apparent to those skilled in the art upon a reading and understanding of the specification.

Brief Description of the Drawings

The invention may take physical form in certain parts and steps and arrangements of parts and steps, the preferred embodiments of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof and wherein:

FIGURE 1 is a flowchart generally describing a data gathering process from a vehicle;

FIGURE 2 is a flowchart detailing the gathering and consolidating of appropriate information for determining a cost of insurance and the resulting insurance billing process;

FIGURE 3 is a suggestive perspective drawing of a vehicle including certain data element monitoring, recording and communicating devices;

FIGURE 4 is a block diagram of a vehicle on-board computer and recording system implementing the subject invention for selective communication with a central control center and a global positioning navigation system;

FIGURE 5 is a flowchart generally illustrating a method for acquiring and recording vehicle insurance related data; and

FIGURE 6 is a tabular illustration of various sources of insurance-related data, a necessary interface for acquiring the data and an exemplary sample rate therefor.

Detailed Description of the Invention

Referring now to the drawings, wherein the showings are for purposes of illustrating the preferred embodiments of the invention only and not for purposes of limiting same, the FIGURES show an apparatus and method for monitoring, recording and communicating insurance related data for determination of an accurate cost of insurance based upon evidence relevant to the actual operation and in particular the relative safety of that operation. Generally, a vehicle user is charged for insurance based upon statistical averages related to the safety of operation based upon the insurer's experience with other users who drive similar vehicles in a similar geographic area. The invention allows for the measure of the actual data while the motor vehicle is being driven. Such data measurement will allow the vehicle user to directly control his/her insurance costs by operating the vehicle in a manner which he/she will know will evidence superior safety of operation and a minimal risk of generation of an insurance claim. Examples of data which can be monitored and recorded include:

1. Actual miles driven;
2. Types of roads driven on (high risk vs. low risk); and,
3. Safe operation of the vehicle by the vehicle user through:
   - A. speeds driven,
   - B. safety equipment used, such as seat belt and turn signals,
   - C. time of day driven (high congestion vs. low congestion),
   - D. rate of acceleration,
   - E. rate of braking,
   - F. observation of traffic signs.

With reference to FIGURE 3, an exemplary motor vehicle is shown in which the necessary apparatus for implementing the subject invention is included. An on-board computer **300** monitors and records various sensors and operator actions to acquire the desired data for determining a fair cost of insurance. Although not shown therein, a plurality of operating sensors are associated with the motor vehicle to monitor a wide variety of raw data elements. Such data elements are communicated to the computer through a connections cable which is operatively connected to the vehicle data bus **304** through an SAE-J1978 connector, or OBD-II connector or other vehicle sensors **306**. A driver input device **308** is also operatively connected to the computer **300** through connector **307** and cable **302**. The computer is powered through the car battery **310** or a conventional generator system (not shown). Tracking of the vehicle for location identification can be implemented by the computer **300** through navigation signals obtained from a GPS (global positioning system) antenna or other locating system **312**. The communications link to a central control station is accomplished through the cellular telephone, radio, satellite or other wireless communication system **314**.

FIGURE 4 provides the block diagram of the in-vehicle computer system. The computer **300** is comprised of four principal components, an on-board data storage device **402**, an input/output subsystem **404** for communicating to a variety of external devices, a central processing unit and memory device **406** and a real time operating kernel **408** for controlling the various processing steps of the computer **300**. The computer **300** essentially communicates with three on-board vehicle devices for acquisition of information representative of various actual vehicle operating characteristics. A driver input console **410** allows the driver to input data representative of a need for assistance or for satisfaction of various threshold factors which need to be satisfied before the vehicle can be operated. The physical operation of the vehicle is monitored through various sensors **412** in operative connection with the vehicle data bus, while additional sensors **414** not normally connected to the data bus can be in direct communication with the computer **300** as will hereinafter be more fully explained.

The vehicle is linked to an operation control center **416** by a communications link **418**, preferably comprising a conventional cellular telephone interconnection. A navigation sub-system **420** receives radio navigation signals from a GPS **422**.

The type of elements monitored and recorded by the subject invention comprise raw data elements, calculated data elements and derived data elements. These can be broken down as follows:

Raw Data Elements:

Power train sensors

RPM,

transmission setting (Park, Drive, Gear, Neutral),

throttle position,

engine coolant temperature,

intake air temperature,

barometric pressure;

Electrical sensors

brake light on,

turn signal indicator,

headlamps on,

hazard lights on,

back-up lights on,

parking lights on,

wipers on,

doors locked,

key in ignition,

key in door lock,

horn applied;

Body sensors

airbag deployment,

ABS application,

level of fuel in tank,

brakes applied,

radio station tuned in,

seat belt on,

door open,

tail gate open,

odometer reading,
cruise control engaged,
anti-theft disable;

Other sensors

vehicle speed,
vehicle location,
date,
time,
vehicle direction,
IVHS data sources.

Calculated Data Elements:

rapid deceleration;
rapid acceleration;
vehicle in skid;
wheels in spin;
closing speed on vehicle in front;
closing speed of vehicle in rear;
closing speed of vehicle to side (right or left);
space to side of vehicle occupied;
space to rear of vehicle occupied;
space to front of vehicle occupied;
lateral acceleration;
sudden rotation of vehicle;
sudden loss of tire pressure;
driver identification (through voice recognition or code or fingerprint recognition);
distance travelled; and
environmental hazard conditions (e.g. icing, etc.).

Derived Data Elements:

vehicle speed in excess of speed limit;
observation of traffic signals and signs;
road conditions;
traffic conditions; and
vehicle position.

This list includes many, but not all, potential data elements.

With particular reference to **FIGURE 1**, a flowchart generally illustrating the data gathering process of the subject invention is illustrated. Such a process can be implemented with conventional computer programming in the real time operating kernel **408** of the computer **300**. The process is identified with initially a begin step **100** (key in ignition?) and a check of whether the vehicle is operating at step **102**. If the vehicle is not operating a reverification occurs every two (2) minutes as shown at step **104**. It should be noted that the computer is continually powered by at least the vehicle battery **310** (FIGURE 3), but it can be appreciated that during operation the generator (not shown) will supply the energy. If the vehicle is operating, then there is a step of recording sensor information **106**. The recording comprises monitoring a plurality of raw data elements, calculated data elements and derived data elements as identified above. Each of these is representative of an operating state of the vehicle or an action of the operator. Select ones of the plurality of data elements are recorded when the ones are determined to have an identified relationship to the safety standards. For example, vehicle speed in excess of a predetermined speed limit will need to be recorded but speeds below the limit need only be monitored and stored on a periodic basis. The recording may be made in combination with date, time and location. Other examples of data needed to be recorded are excessive rates of acceleration or frequent hard braking.

The recording process would be practically implemented by monitoring and storing the data in a buffer for a selected period of time, e.g., thirty seconds. Periodically, such as every two minutes, the status of all monitored sensors for the data elements is written to a file which is stored in the vehicle data storage **402**. The raw, calculated and derived data elements listed above comprise some of the data elements to be so stored.

Certain of the recorded sensor information may comprise a trigger event of which inquiry is identified at step **108**. "Trigger events" are defined as a combination of sensor data requiring additional action or which may result in a surcharge or discount during the insurance billing process. Certain trigger events may require immediate upload **110** to a central control which will then be required to take appropriate action. For example, a trigger event would be rapid deceleration in combination with airbag deployment indicating a collision, in which case the system could notify the central control of the vehicle location. Alternatively, if the operator were to trigger on an emergency light, similarly the system could notify the central control of the vehicle location indicating that an emergency is occurring. The trigger information is recorded, as at step **116**, and whatever response is taken by the central control is also recorded at step **118**. The trigger information recording step **116** and the recording sensor information step **106** may impart recording of information in the on-board data storage device **402** or memory **406**. The event response information recording at step **118** will usually occur in the central control station. Such response information could be the dispatch of an emergency vehicle, or the telephoning of police or an EMS unit.

Trigger events are divided into two groups: those requiring immediate action and those not requiring immediate action, but necessary for proper billing of insurance. Those required for proper billing of insurance will be recorded in the same file with all the other recorded vehicle sensor information. Those trigger events requiring action will be uploaded to a central control center which can take action depending on the trigger event. Some trigger events will require dispatch of emergency services, such as police or EMS, and others will require the dispatch of claims representatives from the insurance company.

The following comprises an exemplary of some, but not all, trigger events:

Need for Assistance:

These events would require immediate notification of the central control center.

1. Accident Occurrence. An accident could be determined through the use of a single sensor, such as the deployment of an airbag. It could also be determined through the combination of sensors, such as a sudden deceleration of the vehicle without the application of the brakes.
2. Roadside assistance needed. This could be through the pressing of a "panic button" in the vehicle or through the reading of a sensor, such as the level of fuel in the tank. Another example would be loss of tire pressure, signifying a flat tire.
3. Lock-out assistance needed. The reading of a combination of sensors would indicate that the doors are locked but the keys are in the ignition and the driver has exited the vehicle.
4. Driving restrictions. The insured can identify circumstances in which he/she wants to be notified of driving within restricted areas, and warned when he/she is entering a dangerous area. This could be applied to youthful drivers where the parent wants to restrict time or place of driving, and have a record thereof.

Unsafe Operation of the Vehicle

These events would be recorded in the in-vehicle recording device for future upload. Constant trigger events would result in notification of the driver of the exceptions.

1. Excessive speed. The reading of the vehicle speed sensors would indicate the vehicle is exceeding the speed limit. Time would also be measured to determine if the behavior is prolonged.
2. Presence of alcohol. Using an air content analyzer or breath analyzer, the level of alcohol and its use by the driver could be determined.
3. Non-use of seatbelt. Percent of sample of this sensor could result in additional discount for high use or surcharge for low or no use.
4. Non-use of turn signals. Low use could result in surcharge.
5. ABS application without an accident. High use could indicate unsafe driving and be subject to a surcharge.

With particular reference to FIGURE 2, a general flowchart describing the steps of the gathering of appropriate information for billing insurance on a periodic basis is illustrated.

At the initiation of the vehicle insurance billing process, the central billing system of the insurer will acquire **202** the vehicle sensor record file from the sensor record file **204** from each vehicle to be billed. This process of data acquisition will involve a periodic uploading of the vehicle file **204**. This file will be uploaded to the central system when the storage device **402** in the vehicle approaches capacity, on command, or when the billing process starts. All the information from the combination of files stored in the vehicle will be used to determine the bill for the insurance on the vehicle for the prior insurance period. Data acquisition is also made from the trigger event response file **206** in the acquisition step **208**. This data is stored in the central control center, and includes information for response activities listed above which require additional billing for services rendered to the insured.

At step **210**, the vehicle sensor record file and the trigger event response file are consolidated. Such files will include all the activity for which the insured is to be billed for the prior period. At step **212**, all the information comprising the insured profile, which is already maintained and stored in other insurance files, is applied to the consolidated activity files for the immediately prior period. This insured profile includes the information about coverages including limits and deductibles, which are necessary for establishing the appropriate cost of insurance for the subject insured. At step **214**, the acquired consolidated file information from step **210** and the overall insured profile acquired at step **212** are combined and processed against a surcharge or discount algorithm file, which include the specific factors for the various usage patterns and trigger events. The surcharges and discounts are continuously adjusted based on the loss results associated with driving behaviors demonstrated. Finally at step **216**, the appropriate billing is produced showing the charges for insurance and other services for the prior period. The billing can be sent electronically or in printed form to the insured for payment.

With particular reference to FIGURE 5, a general diagram of the process for acquiring and recording vehicle insurance related data is illustrated. At step **502**, the raw data elements are collected from the vehicle sensors that provide the raw data elements identified above. Calculated data elements are generated in step **504** and derived data elements are generated at step **508**. As noted, it is necessary to collect certain database information elements at step **506** prior to generating the derived data elements. A sample of all the data elements is stored in the vehicle at step **510**. The sample rate or the recording of the information is controlled based upon the particular insurance billing recording needs predetermined by an algorithm developed by the insurance company. The algorithm will change depending on the particular type of insurance related requirements for the information. At step **512**, if a certain incident, for example collision, occurs then a snapshot is generated of all the relevant data elements at the time of the incident, **514**.

With reference to FIGURE 6, various examples of sources of insurance related data, the interface required to acquire the data and an example of the sample rate are illustrated for a preferred embodiment of the subject invention. Accordingly, it can be seen that for a certain information database comprised of maps, speed limits, traffic signs, and highway conditions is stored in the data storage device of the computer and can be obtained on demand therefrom. Acquiring data from vehicle sources such as engine data, body data and electrical data is obtained through a conventional SAEJ 1978 connector with an exemplary sample rate of 10-15 Hz. The other sources of relevant data, such as IVHs, GPS, security system or any additional systems are obtained through various I/O ports and the sample rate can be varied in accordance with the desired goals of the insurer.

One of the useful consequences of the subject invention is that other products could be marketed to a particular vehicle operator based on information provided from the subject invention from the operator's motor vehicle. Since the invention includes processes for gathering, extracting and analyzing information provided by the vehicle, a more informed judgment can be made about a determination of when and which products could be marketed to that motor vehicle operator. For example, by knowing that a vehicle operator travels on vacation in that vehicle to a certain resort location may give rise to a marketing of a package of products particular to the type of travel or the location. Another example would relate to the knowledge that the vehicle operator attends particular types of sporting events which may give rise to certain types of products catered to fans of that sporting event.

The invention has been described with reference to preferred embodiments. Obviously, modifications and alterations will occur to others upon a reading and understanding of the specification. It is our intention to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

Having thus described our invention, we claim:

1. A method of determining a cost of automobile insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics, whereby the cost is adjustable by relating the driving characteristics to predetermined safety standards, the method comprising:

monitoring a plurality of raw data elements representative of an operating state of a vehicle or an action of the operator;

recording selected ones of the plurality of raw data elements when said ones are determined to have a preselected relationship to the safety standards;

consolidating said selected ones for processing against an insured profile and for identifying a surcharge or discount to be applied to a base cost of automobile insurance; and,

producing a final cost from the base cost and the surcharge or discount.

2. The method as described in claim 1 wherein said recording comprises identifying a trigger event associated with a one of the raw data elements having the preselected relationship and recording both the one raw data element and trigger information representative of the trigger event.

3. The method as described in claim 1 further including immediately communicating to a central control station via an uplink information representative of a trigger event associated with a one of the raw data elements.

4. The method as described in claim 3 further including recording trigger event response information generated by said control station.

5. The method as described in claim 1 further including generating calculated data elements from said raw data elements.

6. The method as described in claim 5 further including generating derived data elements from said raw data elements.

7. The method as described in claim 6 wherein said consolidating comprises accumulating said calculated and derived data elements.

8. The method as described in claim 1 wherein at least a portion of the plurality of raw data elements are within an awareness and selected control of the operator and wherein the method further comprises adjusting by the operator of operator driving behavior thereby causing a change in the portion of raw data elements to obtain the surcharge or discount in the final cost.

9. The method as described in claim 8 wherein the base cost is for a predetermined period of time and wherein the adjusting by the operator is set to occur at predetermined intervals within the predetermined period.

10. The method as described in claim 9 wherein the predetermined period of time comprises two years and the predetermined intervals comprise monthly intervals.

11. A process for acquiring and recording vehicle insurance related data via an on-board computer and recording system comprising steps of:

monitoring a plurality of raw data elements representative of vehicle operating states and driver actions;

recording selected ones of the raw data elements in a vehicle record file of an on-board data storage device when said ones are identified as having a relationship material to determination of a cost of insurance;

identifying whether said selected ones comprise a trigger event, and if so identified, communicating information representative of the trigger event to a central control station for storage in a trigger event file; and,

consolidating said vehicle record file and said trigger event file in a form for determining a vehicle cost of insurance.

12. The process as defined in claim 11 further including communicating from the central control station an order for dispatch of an emergency or assist vehicle in response to the identifying of a special trigger event determined to require driver assistance.

13. A system of determining a cost of automobile insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics, whereby the cost is adjustable by relating the driving characteristics to predetermined safety standards, the system comprising:

means for monitoring a plurality of raw data elements representative of an operating state of a vehicle or an action of the operator;

means for recording selected ones of the plurality of raw data elements when said ones are determined to have a preselected relationship to the safety standards;

means for consolidating said selected ones for processing against an insured profile and for identifying a surcharge or discount to be applied to a base cost of automobile insurance; and,

means for producing a final cost from the base cost and the surcharge or discount.

14. The system as described in claim 13 further including means for immediately communicating to the central control station via an uplink information representative of a trigger event associated with the run of the raw data elements.

15. The system as described in claim 13 further including means for generating calculated data elements from said raw data elements.

16. The system as described in claim 15 further including generating derived data elements from said raw data elements.

17. A method of generating an actuarial class system for determining vehicle insurance costs for retrospectively adjusting and prospectively setting premiums based on data derived from motor vehicle operational characteristics and driver behavior, comprising:

monitoring a plurality of raw data elements representing vehicle operating states and driver actions;

recording selected ones of the raw data elements in a vehicle record files when said ones are identified as having a relationship material to determination of a cost of insurance;

setting a plurality of actuarial classes associated with corresponding degrees of safety of operation of the vehicle wherein said actuarial classes are derived from aggregating selected ones of the raw data elements; and,

consolidating said vehicle record files with selected actuarial classes for determining a corresponding cost of insurance for the vehicle in correspondence with a one of the actuarial classes.

18. The process for determining a cost of insurance as defined in claim 17 wherein said monitoring and recording steps occur concurrently with actual vehicle operation for acquiring the raw data elements during actual vehicle use.

19. The process for determining a cost of insurance as defined in claim 18 wherein at least a portion of the plurality of raw data elements are within an awareness and selective control of a driver, the process further comprising adjusting by the driver of driving behavior to changesaid portion of raw data elements for consolidating said vehicle record with an other one of the actuarial classes.

20. An integrated system for extracting from multiple sensors, screening, aggregating and applying for insurance rating purposes, data generated by an actual operation of a specific motor vehicle comprising:

means for extracting a plurality of raw data elements from the multiple sensors wherein the elements are representative of vehicle operating states and driver actions;

means for screening the raw data elements and aggregating selected ones of the raw data elements in a vehicle record file of an on-board storage device when said selected ones are identified as having a relationship material to determination of a cost of insurance for the vehicle;

means for associating the aggregated selected raw data elements with predetermined actuarial classes indicative of a degree of safety of operation of the vehicle; and

means producing a cost of insurance for the vehicle associated with selected ones of the actuarial classes.

data elements, said calculated and derived data elements being further aggregated for association with the selected one of the actuarial classes.

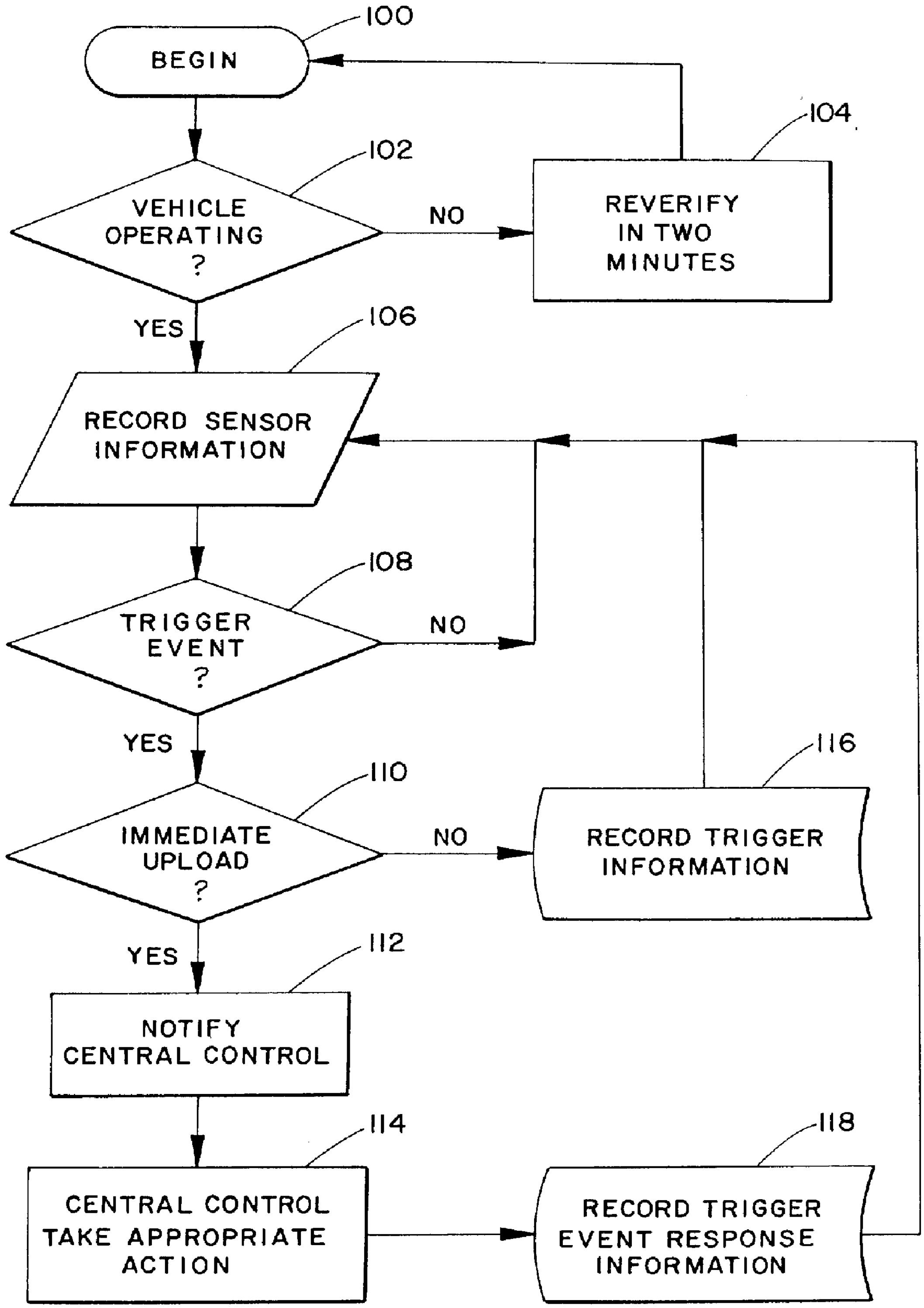
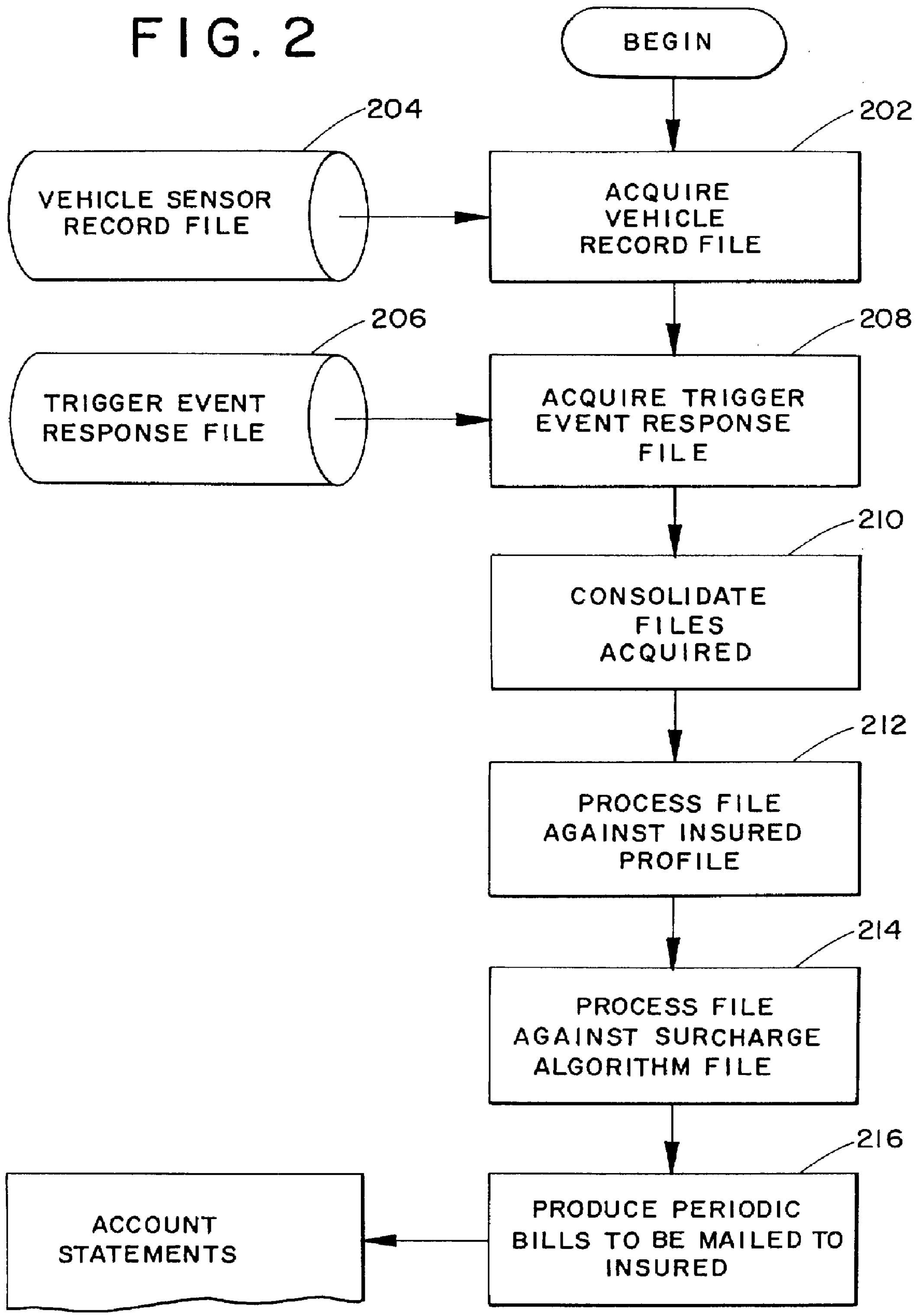

100
BEGIN
102
VEHICLE OPERATING ?
NO
104
REVERIFY IN TWO MINUTES
YES
106
RECORD SENSOR INFORMATION
108
TRIGGER EVENT ?
NO
YES
110
IMMEDIATE UPLOAD ?
NO
116
RECORD TRIGGER INFORMATION
YES
112
NOTIFY CENTRAL CONTROL
114
CENTRAL CONTROL TAKE APPROPRIATE ACTION
118
RECORD TRIGGER EVENT RESPONSE INFORMATION

FIG. 1

FIG. 2


BEGIN
204
VEHICLE SENSOR RECORD FILE
202
ACQUIRE VEHICLE RECORD FILE
206
TRIGGER EVENT RESPONSE FILE
208
ACQUIRE TRIGGER EVENT RESPONSE FILE
210
CONSOLIDATE FILES ACQUIRED
212
PROCESS FILE AGAINST INSURED PROFILE
214
PROCESS FILE AGAINST SURCHARGE ALGORITHM FILE
216
PRODUCE PERIODIC BILLS TO BE MAILED TO INSURED
ACCOUNT STATEMENTS

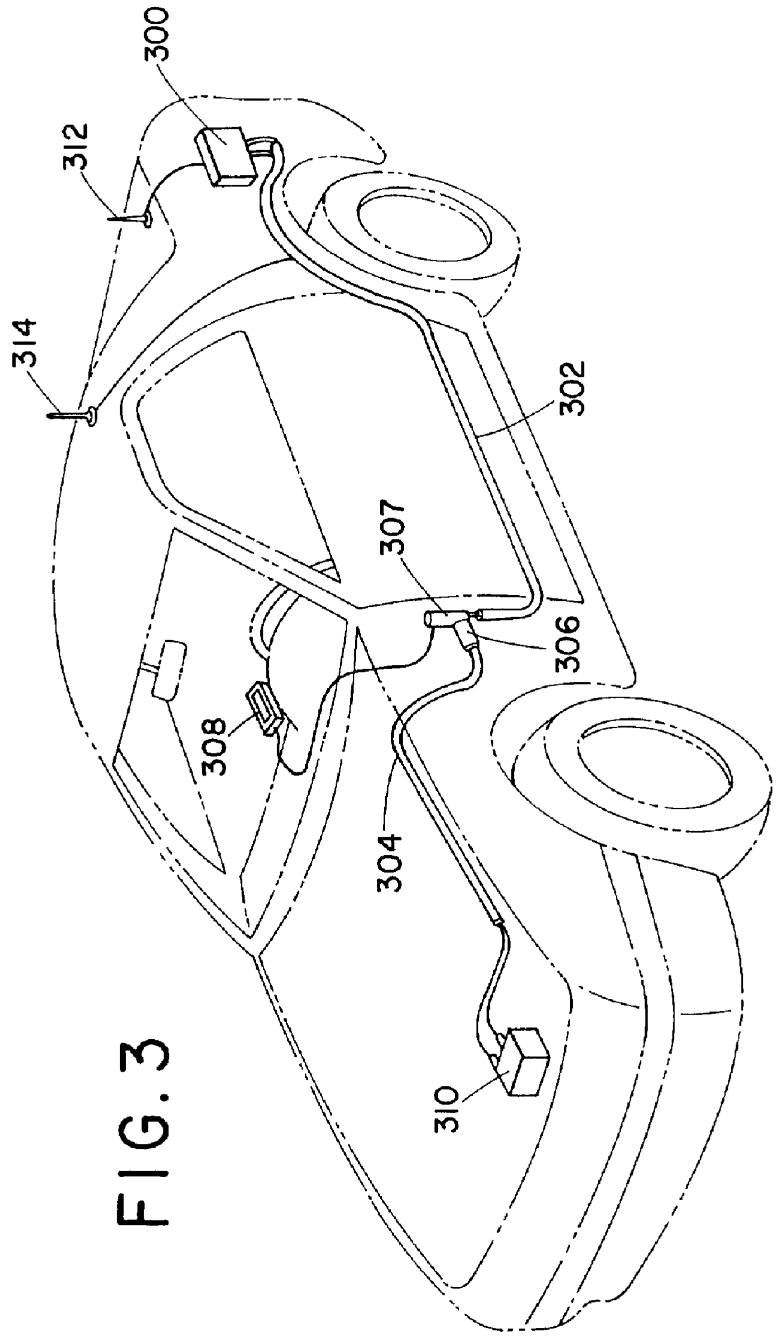


FIG. 3

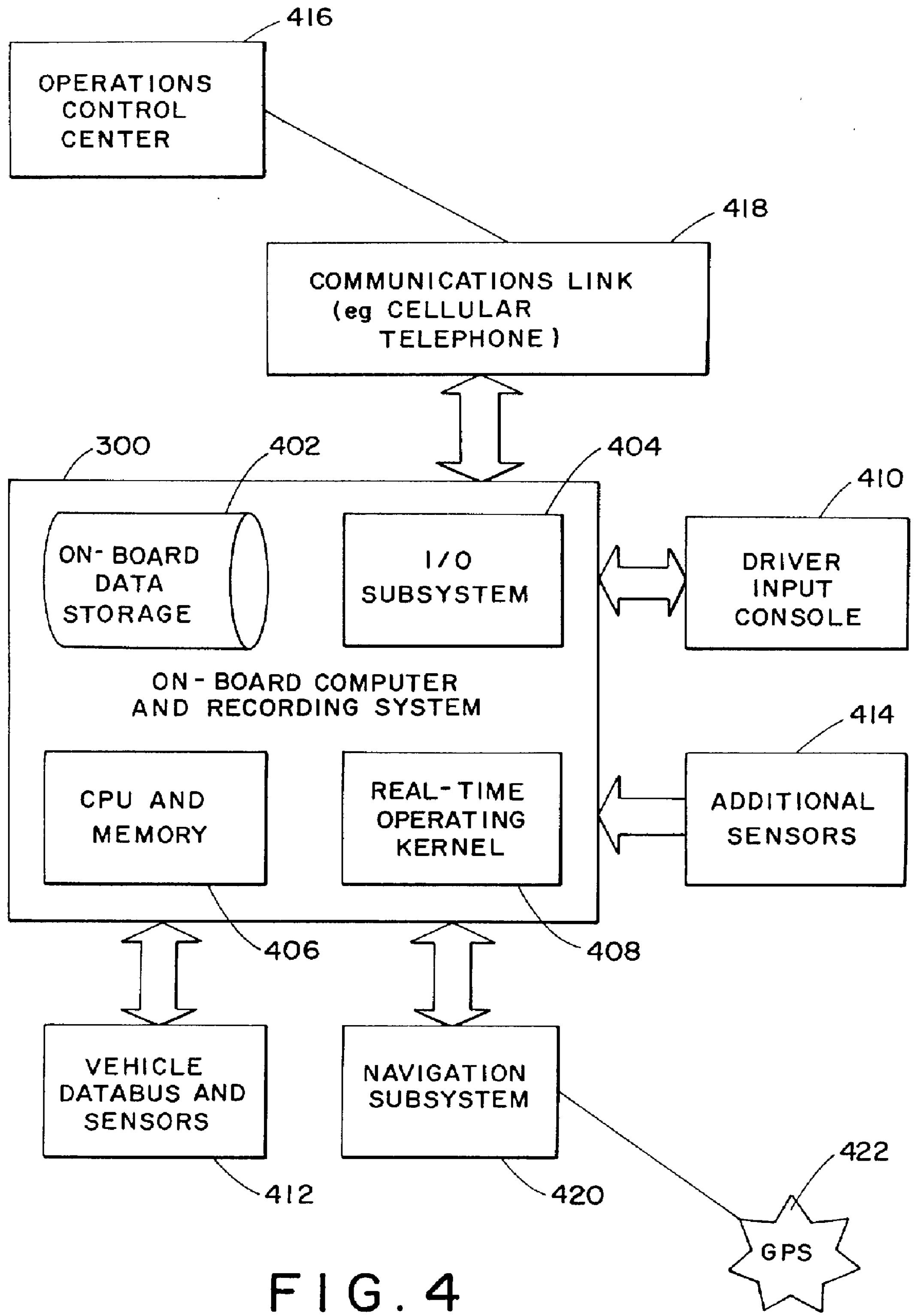

416
OPERATIONS CONTROL CENTER
418
COMMUNICATIONS LINK (eg CELLULAR TELEPHONE)
300
402
404
410
ON-BOARD DATA STORAGE
I/O SUBSYSTEM
DRIVER INPUT CONSOLE
ON-BOARD COMPUTER AND RECORDING SYSTEM
414
CPU AND MEMORY
REAL-TIME OPERATING KERNEL
ADDITIONAL SENSORS
406
408
VEHICLE DATABUS AND SENSORS
NAVIGATION SUBSYSTEM
422
412
420
GPS

FIG. 4

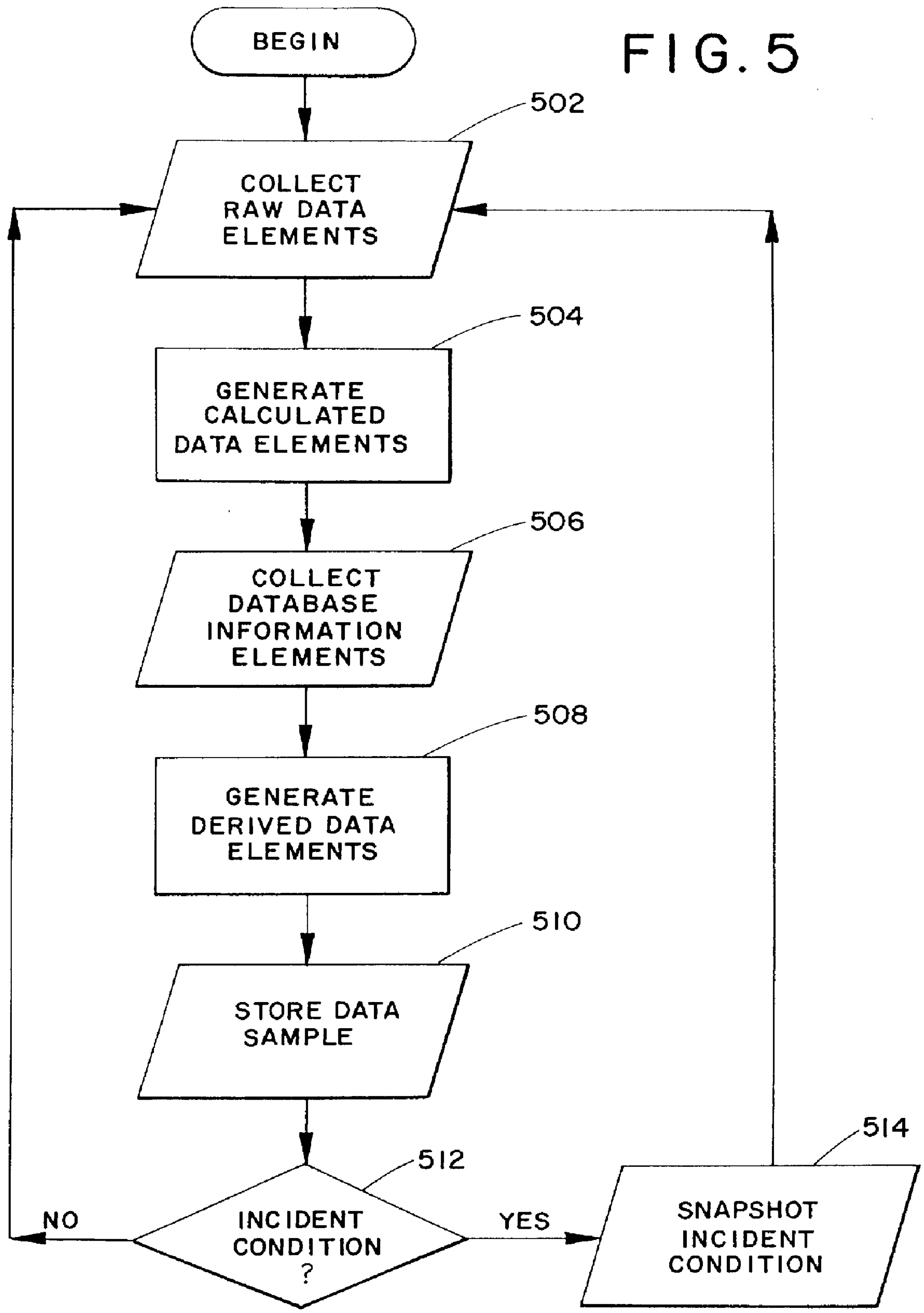

BEGIN
502
COLLECT RAW DATA ELEMENTS
504
GENERATE CALCULATED DATA ELEMENTS
506
COLLECT DATABASE INFORMATION ELEMENTS
508
GENERATE DERIVED DATA ELEMENTS
510
STORE DATA SAMPLE
512
INCIDENT CONDITION ?
NO
YES
514
SNAPSHOT INCIDENT CONDITION

FIG. 5

INFORMATION DATABASE - MAPS - SPEED LIMITS - TRAFFIC SIGNS - HIGHWAY CONDITIONS - (FUTURE TBD)	INTERFACE -COMPUTER STORAGE	SAMPLE RATE - ON DEMAND
VEHICLE SOURCES - ENGINE DATA - BODY DATA - ELECTRICAL DATA	INTERFACE -SAE J1978 CONNECTOR	SAMPLE RATE - 10 - 15 HZ
OTHER SOURCES - IVHS DATA - GPS DATA - SECURITY SYSTEM - ADDITIONAL SYSTEM(S)	INTERFACE - VARIOUS I/O PORTS (eg, RS-232/422, ETC.)	SAMPLE RATE -VARIES

FIG. 6

MOTOR VEHICLE INSURANCE PROCESS
VEHICLE DATA ACQUISITION PROCESS FLOW

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(54) **System and method of load sharing control for automobile.**

(57) A system and method for load sharing processing operations between a vehicle mounted station (105) and a stationary base station (25) having a large capacity host computer is described. The vehicle mounted station has detectors for determining operating conditions of a vehicle and controllers (3, 4, 501) for varying the operating conditions. The controllers are connected to a transmitter-receiver (5) which is arranged to communicate over a path (10) with a transmitter-receiver (11) of the base station. The base station has a host computer (18) having a large memory capacity. At predetermined intervals, for example, distance of travel or at engine stop, the vehicle transmitter (5) transmits operating conditions to the base receiver (11) for data processing and the base transmitter (11) then transmits processed data back to the receiver vehicle (5), whereupon the controllers (3, 4, 501) modify the vehicle operating conditons. The vehicle operating conditions may be an indication of life expectancy of fuel injectors or sensors, updating data processing maps. The presence of abnormal operating conditions may be detected by the vehicle mounted station, evaluated by the base station and an emergency warning indication provided back to the vehicle mounted station, or if the abnormal condition is not of an emergency nature then counter measures are transmitted from the base station to the vehicle mounted station.

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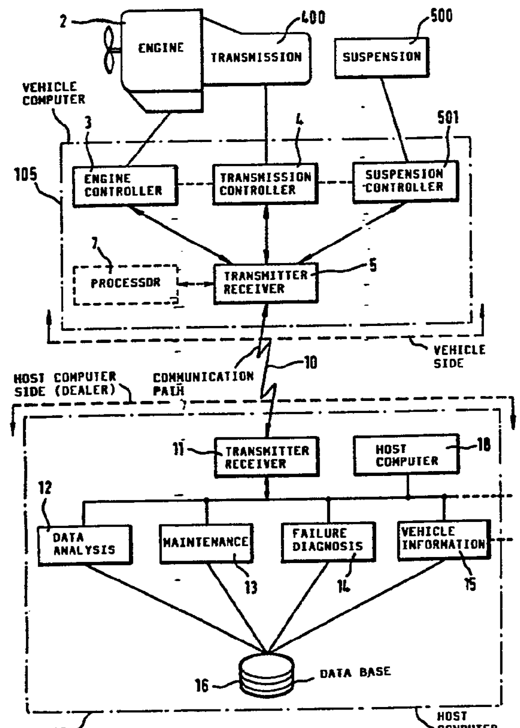
2
ENGINE
400
TRANSMISSION
500
SUSPENSION
VEHICLE COMPUTER
3
4
501
105
ENGINE CONTROLLER
TRANSMISSION CONTROLLER
SUSPENSION CONTROLLER
7
PROCESSOR
TRANSMITTER RECEIVER
5
VEHICLE SIDE
HOST COMPUTER SIDE (DEALER)
COMMUNICATION PATH
10
11
TRANSMITTER RECEIVER
HOST COMPUTER
18
12
DATA ANALYSIS
MAINTENANCE
FAILURE DIAGNOSIS
VEHICLE INFORMATION
13
14
15
16
DATA BASE
25
HOST COMPUTER STATION

Fig.1

SYSTEM AND METHOD OF LOAD SHARING CONTROL FOR AUTOMOBILE

BACKGROUND OF INVENTION

1) Field of Invention

This invention relates to a system and method for load sharing processing operations between a vehicle mounted station and a stationary base station and in particular for controlling various items of equipment mounted on an automobile using a large-capacity host computer installed at a stationary base station, e.g. on the ground.

2) Description of Related Art

The number of electrically controlled items used in an automobile, particularly an internal combustion engine, are increasing and control systems therefor are becoming ever more complicated. Several different systems have been attempted to collectively control the various items by time sharing interruptable arithmetic processing using a processor mounted on the automobile.

Such examples include Japanese Patent Publication No. 63-15469 (1988), "Electronic Engine Controller" and Japanese Patent Publication No. 62-18921 (1987), "Computer for Vehicle Control", and controls using a computer are now common.

A central control method using an LSI microprocessor responds to many requirements, such as responding to hazardous components located in the exhaust gas of the internal combustion engine and for reducing fuel consumption. In addition, microprocessors have been utilized in areas extending to attitude control, i.e. levelling control, steering performance and driving stability with regard to a vehicle body suspension control.

Regarding transmission of programs between a base station and the vehicle, for example, there is Japanese Patent Application Laid-Open No. 62-38624 (1987), "Radiocommunication Unit". However, this publication relates to revision of an operational control program for a vehicle mounted processor, and does not teach load sharing under predetermined driving conditions. In addition, regarding mutual communications, there is Japanese Patent Application Laid-Open No. 62-245341 (1987), "Engine Controller", but this describes only installation of a means to load failure diagnosis programs and does not mention any relationship with the driving conditions of the vehicle.

A full dependence upon a vehicle-mounted processor to process all that is included in the above mentioned conventional technologies and control systems to be newly installed will not only make the system complex but also necessitate a large-capacity processor. Computer control has been used to exploit such advantages as high processing speed and accuracy, easy modification of control characteristics and low cost. However, there are numerous control items, including fuel supply control and ignition control, for which real-time processing is required and implementing all of these together is difficult.

That is, processing all control parameters including the initial setting correction of set values cause by ageing (wear) changes of various characteristics, for example, an engine, transmission, steering, suspension, within a control system having only a vehicle-mounted computer makes the processing program increasingly large.

However, the conventional technologies are neither concerned with this difficulty nor even indicate that there is such a problem.

An object of this invention is to provide a new computer control method for vehicles which at least partially mitigates the above mentioned problems.

SUMMARY OF THE INVENTION

According to one aspect of this invention there is provided a method of load sharing processing operations between a vehicle mounted station and a stationary base station including the steps of said vehicle mounted station detecting operating conditions of the vehicle, transmitting data representative of the detected operating conditions to the base station, said base station receiving data from the vehicle mounted station, processing said data in accordance with data stored by said base station, said base station transmitting processed data to a receiver at said vehicle mounted station and control means at said vehicle mounted station connected to the vehicle mounted receiver and being arranged to perform at least one of revising or displaying the vehicle operating conditions in dependence upon the processed data.

Advantageously the vehicle mounted station detected operating conditions are performed by a detecting means adapted to detect at least one of water temperature, air/fuel ratio air fuel quantity, battery voltage, throttle valve angle opening, engine speed, transmission gear position and suspension setting. In a feature of this invention the vehicle mounted station includes a control means adapted to control at least one of a fuel injector, a transmission gear change means, and a suspension setting actuator.

Conveniently the data transmitted from the vehicle mounted station to the base station is performed at times of occurrence of predetermined conditions including at least one of the vehicle covering a predetermined distance, detection of the engine ceasing rotation and low fuel tank condition, and advantageously data transmitted between the vehicle mounted station and the base station includes header bits, vehicle identification bits, control data bits, data array bits, check symbol bits and end of transmission bits.

Preferably the vehicle mounted station transmits a request to transmit to the base station, said base station transmits a permission to transmit for the vehicle mounted station, said vehicle transmits data including header bits, vehicle identification bits, control data bits, data array bits and check symbol bits, said base station transmits a receipt acknowledgement and said stationary base station transmits end of transmission bits. In one preferred embodiment the vehicle mounted station contains at least one map indicative of vehicle operating conditions including an indication of ageing in at least one of vehicle injectors and sensors, said map being transmitted by said vehicle mounted station to said base station, said base station comparing transmitted map values with previously transmitted map values and estimating the amount of deterioration in said injectors and sensors, said base station being arranged to estimate the life expectancy of said injectors and sensors and to transmit data indicative thereof to said vehicle mounted station whereby said vehicle mounted station stores said updated information and indicates the life expectancy by visual or aural means. In such an embodiment corrected map values are transmitted from the base station to the vehicle mounted station when engine rotation has ceased for subsequent real time processing and conveniently the vehicle mounted station updates corrected map values in a series of steps during vehicle running and uses said corrected map values for real time control.

Advantageously a life predicting diagnosis of the vehicle is carried out by the base station by using current operating condition signals received from the vehicle mounted station, said predicting diagnosis being carried out at predetermined intervals of time or distance travelled. In a feature of the invention the vehicle mounted station is arranged to detect an abnormality and to transmit data indicative thereof to said base station, said base station evaluates said abnormality and determines whether an emergency retransmission to said vehicle mounted station is necessary to provide an indicative warning by one of a display means or an aural means, and in such feature if the abnormality is not of an emergency nature the data is stored in a failure chart prior to transmitting counter measures from the base station to said vehicle mounted station.

The vehicle-mounted station may transmit an abnormal condition signal to the base station, the base station transmits a request for data to be analysed, the vehicle mounted base station transmits data for analysis, the base station diagnoses a failure and if an emergency is determined by said base station then said base station immediately transmits a warning for indication by said vehicle mounted station but if said base station determines there to be no emergency then said base station stores data indicative of the abnormality and subsequently transmits counter measures to said vehicle mounted base station whereupon said vehicle mounted base station takes appropriate action in dependence thereof.

According to another aspect of this invention there is provided a system for load sharing processing operations between a vehicle mounted station and a stationary base station, said vehicle mounted station including
detecting means for detecting operating conditions of the vehicle,
first transmitting means for transmitting data representative of the detected operating conditions to the base station,
first receiving means for receiving data from the base station,
and control means for controlling vehicle operating conditions, said control means being connected to said first receiving means,
and said base station comprising second receiver means for receiving data from the vehicle mounted station,
processing means and storage means for processing the data received from the vehicle mounted station based upon information held in said storage means,
and second transmitting means for transmitting the processed data to the first receiving means whereupon the control means is arranged to perform at least one of revise or display the vehicle operating conditions in dependence upon the processed data.

Advantageously the detecting means isadapted to detect at least one of a temperature water sensor, air/fuel ratio, air flow quantity, battery voltage, throttle valve angle opening, engine speed, transmission gear position and suspension setting. Preferably the control means is arranged to control at least one of a fuel injector, a transmission gear change means, and a suspension setting actuator.

Conveniently the first transmitting means is adapted to transmit data comprising a header, a vehicle identification, data control bits, a data array, a check symbol and an end of transmission indicator.

In a feature of this invention a vehicle-mounted station includes detecting means for detecting operating conditions of a vehicle, transmitting/receiving means for transmitting data representative of the detected operating conditions to a base station capable of evaluating said data, said transmitting/receiving means being adapted to receive evaluated signals from the base station and to apply signals representative of said evaluated signals to a control means adapted to perform at least one of vary or display said operating conditions in dependence upon said received evaluated signals.

In another feature of this invention there is provided a stationary base station adapted to receive data from a vehicle mounted station, said base station including processing means and storage means for processing the data received from the vehicle mounted station based upon information held in said storage means, the base station being adapted to perform at least one of updating/correcting maps carried by a vehicle located processor, vehicle located sensors and injectors, establish the expected life expectancy of said sensors and injectors and further including transmitting means for transmitting processed data to a vehicle.

Thus, the above mentioned object is principally realized by controlling load sharing between computers. A study of computer control for vehicles indicates that data processing is roughly divided into data requiring high-speed real-time processing and data which may be processed in a comparatively long period. For example, ignition timing control and fuel injection control are control subjects that require processing in synchronism with engine rotation so that high-speed processing is required in response to high speed engine rotation. On the other hand, modification of initial settings because of ageing changes such as those in an engine transmission and suspension, may be computed over a relatively long time cycle. Also, controls which haveto be computed with a high accuracy take time when processed by a vehicle-mounted computer and only increase the load on the computer.

Also, with regard to failure diagnosis or failure prediction processing when status data is obtained, arithmetic processing itself may be separated from the real-time processing without difficulty. Of course, there may be some diagnoses which require emergency processing and a feature of this invention is to discriminate and act upon abnormal conditions that require urgent actions and diagnoses.

In consideration of the increasing complexity of the control system and the necessity for higher speed processing accompanied by the increasing r.p.m. of modern engines, this invention carries out load sharing between a vehicle-mounted computer and a stationary host computer.

More specifically a feature of this invention resides in predetermining the processing sharing conditions when specific operating conditions of the engine or specific conditions of the vehicle-mounted computer are detected, transmitting information to and from the host computer and sharing the processing.

The load sharing between the vehicle-mounted computer and the stationary host computer is achieved through the following operations. When the operating conditions for the engine are detected, the subsequent processing thereon is shifted to the host computer to be shared thereby. Thus, increases in load on the vehicle-mounted computer are prevented.

The above operating conditions are detected, for example, at predetermined distance of travel, when cumulative driving time reaches a predetermined time and/or when a predetermined condition is met such as engine stopped or fuel tank low.

Brief Description of the Drawings

The invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is an overall block diagram of a system according to the present invention,

Figure 2 is a block diagram of the vehicle-mounted computer,

Figure 3 shows occasions when transmission/reception between the computers is performed,

Figures 4(A) and (B) respectively show a data signal and a data transmission/reception sequence,

Figure 5 is a diagram of checking revised items for map matching,

Figure 6 is a diagram of failure diagnosis,

Figure 7 is a diagram of long-term data sampling,

Figure 8 is a flow chart for preparing a revised map,

Figure 9 is a data transmission flow chart when the engine is stopped,

Figure 10 is a flow chart for revised values, and

Figure 11 is a series flow chart of transmissions and receptions.

In the Figures like reference numerals denote like parts.

Description of Preferred Embodiments

In the drawings, Figure 1 shows one embodiment of the overall system where information is transmitted between a vehicle and a host computer located, for example, at a stationary, ground based dealership location through a telecommunications network.

An engine 2 in the vehicle is connected with a vehicle mounted computer 105 including an engine controller 3, a transmission 400 controller 4 and suspension 500 controller 501. In the currently described embodiment only three controllers are shown, but usually a number of these types of controllers are mounted on the vehicle. A transmitter-receiver 5 for transmitting and/or receiving information to and from the host computer 18 is provided within processor 105.

A telecommunication path 10 which may be wired or wireless, e.g. a radio link interconnects the vehicle side located processor 105 with a stationary host computer station 25 including a transmitter-receiver 11 on the host computer station side of the path. There is provided I/O (input/output units) for data analysis 12, I/O for maintenance arithmetic processing 13, I/O for failure analysis computation 14 and I/O for vehicle information 15 over a 2-way bus to the transmitter-receiver 11 and to the host computer 18. The I/O's are also linked to a data base 16 such as a memory store. The host computer side apparatus may be installed at the vehicle dealership or at a vehicle information service center. Although in this exemplary embodiment only 4 I/O's are shown, other I/O's for many other controllers may exist. The host computer 18 may have a capacity of several mega bytes. Also, here a radio communications link connecting the vehicle side and the host side is shown; radio links are preferred as being more practical because the vehicle side is normally moving. Of course, when occasion demands, information can be transmitted or received by wire communication lines from the host computer to a beacon by the roadside for subsequent wireless transmission/reception to the vehicle-mounted computer.

Also, in some cases the engine controller 3 or the transmission controller 4 as shown in Figure 1 has its own built-in processor and carries out respective processings or a vehicle-mounted processor 7 is provided as indicated in broken lines. Hereinafter engine controls are described wherein a processor for engine control is built in.

Figure 2 shows the computer 105 on the vehicle side with the suspension controller 501 omitted. ROM 21, RAM 22 and CPU 7 are connected by a bus line 30 for I/O processing. The bus line consists of a data bus, a control bus, and an address bus.

Other sequences (of which only two are shown) sense the engine operating conditions, inter alia, the engine cooling water temperature (TWS) 32 and the air/fuel ratio (O_2S) 34. Battery voltage and throttle valve opening and rotation speed also correspond to operating condition signals, but here they are omitted. A multiplexer 36 inputs the operating condition signals into an A/D conversion circuit 38. A register 40 sets A/D converted values.

An inlet pipe air flow sensor (AFS) 51 has its value set in a register 54 after conversion in an A/D converter 52. An engine angle sensor (AS) 56 provides reference signals REF and angle position signals POS to an angle signal processing circuit 58. The processed signals are used to control synchronizing signals and timing signals.

Engine operating condition ON/OFF switches (SWI-SWi) 59-61 indicate parameters such as start engine and engine idle. These signals are input into an ON-OFF switch-condition signal-processing circuit 60 and are used independently or in combination with other signals forming logic signals to determine controls or controlling methods known per se.

The CPU 7 carries out computations based on the above mentioned operating condition signals in accordance with multiple programs stored in ROM 21 and outputs its computation results into respective control circuits through the bus lines 30. Here the engine control circuit 3 and the transmission control circuit 4 have been shown, but numerous other control circuits such as an idle speed control circuit and exhaust gas recirculation (EGR) control circuit are possible.

The engine control circuit 3 has a fuel controller for controlling air/fuel ratios and increases or decreases the amount of fuel supplied by controlling an injector 44. 42 is a logic circuit for these controls. The transmission controller 4 carries out a transmission shift 48 in the transmission 400 through a logic circuit 46 based on the computation results of the driving conditions. A control mode register 62 presents timing signals for various control outputs.

Timing circuit 64-70 control transmitting and receiving operations. For example, circuit 64 outputs a trigger signal into the transmitter-receiver whenever a predetermined distance is travelled and transmits a corresponding engine operating condition signal through the transmitter-receiver to the stationary host computer. A display 90 is used to display instructions to the driver.

Circuit 66 is used to detect an engine stopped and to trigger an output signal thereupon. Circuit 68 is used to detect a low fuel tank condition and trigger an output signal thereupon. Circuit 70 is used to check whether predetermined conditions are met and when satisfactory, generate a trigger output signal. Figure 3 shows symbol illustrations of these circuits.

To sum up, circuits 66 to 70 produce signals which decide timing to transmit operating condition data to the stationary host computer. For example, from the circuit 64 which generates a signal whenever a predetermined distance has been travelled, it is possible to diagnose the operating condition per the predetermined travel distance. When only condition signals are transmitted, the host side computer makes a diagnosis based on deviations from the previous values or past condition signal data and conveys instructions based on its results to the vehicle-mounted computer. The vehicle-mounted computer gives driver instructions through a display or alarm in dependence upon the severity or grade of those instructions or modifies processing programs or sets parameter values.

Figure 4(A) shows an example of a data array and Figure 4(B) shows a data transmitting and receiving sequence during data communications between the vehicle-mounted computer and the stationary, e.g. ground, host computer (here a dealer located computer). A subject vehicle is specified by a header and a vehicle number (a number that is unique to the vehicle such as the engine number or the car body number).

Figure 5 shows a processing example when correction items in the map matching are checked (data analysis), the transmitter-receiver 11 at the dealer side being omitted for clarity. When controlling an engine via a microcomputer, control data is computed based on output conditions of each sensor. In addition, a system is used for subsequent engine control by responding to various engine conditions and by storing control data computed as a learning map. Figure 5 shows an example of using other control data values after corrections by analysing such control data stored in the so-called learning map or data to be changed together with other engine controls.

The program processing on the vehicle side is assumed in this example to be to check a map (step 5a). This satisfies conditions by the circuits 64 to 70 as described previously and the checking program of the map starts. Although this is simply called map matching, there is a learning map for ignition timing based on the output of a knock sensor or a learning map for defining an injection pulse width of the fuel injector in the fuel/air (O_2 feedback) from an exhaust to an inlet fuel injector, i.e. an O_2 detector detects if exhaust gas mixture is lean or rich and sends a pulse in dependence thereon to the fuel injector. Map revision is described later in detail with reference to Figure 8. Now, the flow of the transmission processing at the time of map matching is generally explained.

In step 5a, the vehicle-mounted computer checks data in the map by using various methods. For example, when data values contained in the learning map for defining the injection pulse width of the injector using parameters of number of revolutions of the engine N and engine load Qa/N (where Qa is quantity of air) during O_2 feedback are analysed, the corresponding map of the output of the inlet pipe air flow sensor and the air flow quantity is revised by comparing actual data values with previous data values and if the comparison result exceeds a predetermined value then the actual value is used to reset the map, thus effecting a "learning" process. The injector factor is also revised when the injector pulse width of the injector is determined in relation to the engine load Qa/N. Based on checking of the map, engine control data revisions are determined. In step 5b, the vehicle-mounted computer selects necessary data values in the map under check to be used to newly correct engine control data or computes data to be transmitted to the host computer by processing data values stored in the map and stores them in RAM as a map. When data to be transmitted is determined such is rendered as a trigger signal, the map arithmetically processed in the vehicle-mounted computer and contained in RAM is transmitted through the transmitter-receiver 5. The dealer side (host computer), having received this, executes its program based on received signals. In step 5c, data signal reception from the vehicle-mounted computer is started. However, in step 5d, if the dealer-side is already receiving data from another vehicle, a wait instruction is issued in step 5e. When not receiving data from another vehicle, the received data is stored in the memory of the host computer in step 5f. In step 5g, present memory values are compared with past values previously transmitted to the host computer. In step 5h, the amount of deterioration in actuators, such as injectors, and sensors such as inlet air quantity (Qa) sensors, is estimated based on the compared results. Next, in step 5i, the remaining life is estimated from the deterioration amount. In step 5j, data transmitted from the vehicle-mounted computer is computed in accordance with a predetermined program to determine data to be corrected at the vehicle computer. In step 5k, this data is transmitted through the transmitter-receivers 11 and 5. When it receives a transmission signal from the host computer, the vehicle-mounted computer starts the arithmetic processing. When in step 51 receiving the corrected map transmitted from the host computer commences, it is stored in RAM in step 5m. In step 5n, the corrected map is re-written when the engine restarts after stoppage. In step 5p, notification is made to the driver visually, through the display or audibly that the map has been re-written. This is an example of notifying the driver for caution's sake, because correction items of the map may influence whether the vehicle should be driven. However, for cases that do not specifically require this, notification can be omitted. Also, in step 5p, it is possible to display the deterioration amount and remaining life of the injector or sensor. Alternatively, re-writing the map at the time of re-starting the engine for example and/or shifting to the corrected map during travel can be made. However, at this time a method to enable a smooth transition is preferred. For example, methods as follows may be carried out, in that, when the deviation before correction is smaller than a predetermined value, a sequential transition is made and when the deviation is larger than the predetermined value, its intermediate value (in some cases, plural intermediate values) is established and shifted step by step to a corrected map. In addition, re-writing the map may also be carried out in a predetermined period after the power key switch is turned off, i.e. power is supplied for a predetermined period after the power key switch is turned off to enable the map to be re-written or memorised.

Figure 6 shows an example of a failure diagnosis, the transmitter-receiver 11 again being omitted for clarity. The vehicle-mounted computer carries out time-sharing computations of the injection pulse width and ignition timing by the injector in real time. For this, computations for a failure diagnosis are made in the intervals of these computations and only a basic diagnosis are made. This embodiment is based on the concept of having the vehicle-mounted computer make a basic abnormal diagnosis and transmit the data to the host computer. The host computer then makes more advanced, comprehensive and appropriate diagnosis using data indicative of the condition of other control subjects.

In step 6a, the diagnostic mode starts. This is carried out in parallel with the general program and for example, is repetitive at predetermined intervals of about 60 ms. In step 6b, a decision on whether any abnormality exists is made based on the diagnosis results. When no abnormality exists, the process ends. When an abnormality exists, the abnormal code is transmitted to the host computer on the dealer side through the transmitter-receivers 5 and 11. The host computer is triggered by the transmitted signal and executes a more detailed failure diagnosis program. Having received the abnormal code in step 6c, in step 6d, the host computer selects comprehensive control data necessary for failure diagnosis based on the abonormal code and asks the vehicle-mounted computer to transmit data for decision. Upon receipt of the request for transmission, the vehicle-mounted computer transmits the data for decision in step 6e. In step 6f, the host computer diagnoses comprehensively the failure using the data for decision transmitted from the vehicle-mounted computer. In this case, because the host computer is not carrying out the real-time arithmetic processing such as computation of the injector's injection pulse width, if the results of the failure diagnosis in step 6f in which an overall diagnosis is possible based on the data transmitted from the vehicle-mounted computer indicate an emergency, the host computer immediately transmits emergency measures to the vehicle-mounted computer. If an emergency treatment is not specifically diagnosed, the host computer stores the received data in a failure chart in step 6i and subsequently transmits countermeasures to the vehicle-mounted computer in step 6j and completes the diagnostic flow in step 61. In step 6k, the vehicle-mounted computer takes actions based on the countermeasure signals from the host computer and ends the diagnostic mode process at step 6m.

Figure 7 shows an example regarding life prediction or failure prediction in accordance with data collected through sampling over a long period of time in which the transmitter/receiver 11 is again omitted for clarity. In step 7a, the vehicle-mounted computer carries out data sampling at every predetermined interval to detect abnormalities. Detection of abnormalities in this case is a very simple detection of abnormalities and a high-level failure diagnosis is carried out by the host computer. In step 7b, an existence of abnormalities is confirmed and in step 7c, the vehicle-mounted computer transmits the necessary data including sampling values to the host computer through the transmitter-receivers 5, 11 and completes the flow process. If there is no abnormality, the flow process is completed. In addition, in view of the long-term data sampling, high-level failure diagnoses by the host computer may be made at every predetermined distance of travel as shown in Figure 3 or by the circuit 64 in Figure 2. Upon receipt of the data transmission signal from the vehicle-mounted computer, the host computer starts the failure diagnosis program in step 7d. In step 7e, control data accumulated in the memory of the host computer is analyzed to predict lift expectancy. In step 7f, defective parts are specified from data analysis results. In step 7g, the degree of emergency is determined. If there is an emergency, the host computer transmits a signal to that effect to the vehicle-mounted computer through the transmitter-receivers 11, 5 in step 71. The host computer makes life expectancy predictions based on the analysis results and stores the predictions in the failure chart at step 7i. At step 7j, countermeasure signals are transmitted to the vehicle-mounted computer to complete the flow process in step 71.

The vehicle mounted computer, in step 7k, takes action in accordance with the signal transmitted from the host computer and completes the process.

Thus, this invention has shared processing where items are divided into those requiring processing by a vehicle-mounted processor and those requiring long-term or highly accurate computations by a stationary larger computer. Having a vehicle-mounted processor execute all processings, as has been performed in the prior art, only makes a vehicle-mounted processor larger in capacity and physical size.

With regard to checking of the matching map as well as checking of revision items in the map, as performed in steps 5a and 5b of Figure 5, a detailed explanation will now be made by taking map revisions based on the O_2 feedback map as an example. Although there is a prior application (Japanese Patent Application No. 63-283886 (1988)) by the same applicant as this invention regarding O_2 feedback and learning based thereon, its basic methods and concepts are described as follows. The injection time of the injector is determined by the equations (1) and (2) below.

$$Ti = \cdot Tp \cdot (Ke + Kt - Ks) \cdot (1 + \bar{\ } Ki) + Ts \qquad (1)$$

$$Tp = K\,const \cdot Qa/N \qquad (2)$$

where

Kconst : injector factor

Tp : basic injection time

: correction factor for air/fuel ratio

Ts : delayed injection time of injector due to mechanical and electrical propogation lag

Ke : steady-state learning factor

Kt : transient learning factor

Ki : a correction factor

Ks : shift factor

Qa : sucked air flow amount

N : number of engine revolutions

That is, a basic fuel injection time Tp is determined through a sucked air flow amount of Qa of the engine and the rotational speed N from equation (2) and the correction factor is changed and corrected so that a stoichiometric air/fuel ratio is obtained based on the output of the air/fuel (O_2) sensor. Here, the correction factor largely deviates from 1.0 because of "ageing" changes in actuators such as the injectors and of sensors. Therefore, supplementary corrections are performed by means of the steady-state learning factor Ke and the transient learning factor Kt to make the correction factor be nearer to 1.0 and determine the fuel injection Time Ti.

Figure 8 shows a flow chart for preparing correction maps. In step 8a, the O_2 feedback learning map is checked to decide whether there are maps requiring corrections. Based on the check results, a decision is made in step 8b whether there are maps requiring re-matching. If not, the process ends. In this embodiment, a Ts map, a Kconst map and a Qs table are illustrated as maps requiring re-matching. Maps requiring re-matching are specified in steps 8c, 8e and 8h and in each of steps 8d, 8f and 8i, control data to be transmitted to the host computer is selected or computed if necessary and is stored in the RAM address of the vehicle-mounted computer to prepare the maps. In step 8j, header data of revision items corresponding to the map to be corrected is prepared, the corrected map is read out from RAM to write in the transmission area in preparation for transmission to the host computer in step 8k and the flow is completed.

Criteria to decide whether a revision is required and specific revision procedures are made in accordance with, for example, prior Japanese Patent Application No. 63-181794 (1988) of the present applicants.

Figure 9 shows an example of data transmission and reception when an engine stops. The engine is controlled by a microcomputer by computing control values to control actuators such as the injector based on outputs of each sensor, including the inlet air flow and crank angle sensors. Each datum may be required for failure diagnosis and matching by the host computer. Necessary data is taken in and stored in the host computer at every ignition key turn OFF.

In step 9a, a decision is made whether the ignition key is turned ON or OFF. When turned ON, the engine is running and the flow terminates. In step 9b, a decision is made whether the engine is rotating or not. When rotating, the flow ends. In steps 9c and 9d, a decision is made whether data transmission to the host computer is required or not. In other words, when the previous revision request is issued in step 9c and when there are revision items of the map to be corrected in step 9d, a decision is made that data transmission is required and operation proceeds to step 9e. Otherwise, operation proceeds to step 9i. In step 9e, a mask setting for transmission/reception is made to prevent interruption, the transmission/reception program is executed in step 9f and the mask is cleared in step 9h. In step 9h, transmission/reception is carried out through the transmitter-receiver 5 if transmission/reception is possible. If transmission/reception is not possible, the flow ends. When transmission/reception is made, the flow proceeds to step 9i, self-shut off and automatically stops the computer after the elapse of a predetermined time.

Next, the execution of data matching in step 5j of Figure 5 by the host computer will be explained by taking Figure 10 as an example.

Figure 10 is an example of obtaining deviations from the previous revision data and for evaluating correction values. In step 10a, a decision is made whether the revision is the first or not. If it is the first revision, basic data is stored in step 10c. If not, the previous data is retrieved. In step 10d, a correction value is calculated from the map data transmitted from the vehicle-mounted computer, revised (corrected) values in each map are calculated in step 10e, the calculated values are stored in the memory in step 10f and the process completes.

Figure 11 is an exemplary flow diagram of data transmission/reception. The vehicle-mounted computer starts a flow process at every predetermined interval. In step 11a, a decision is made whether the revision request has been completed or not. When completed, the flow proceeds to 11g and moves to the data return transmission program. If there is a transmission return request in step 11b, necessary data is transmitted to the host computer. Next, the vehicle-mounted computer awaits until the host computer transmits a signal permitting transmission. In step 111, the host computer receives the transmission signal from the vehicle-mounted computer and at step 11m determines if it is ready to receive the transmission from the vehicle-mounted computer. If it is ready a signal permitting transmission is derived in step 11n and if it is not ready then a wait instruction is issued in step 11o. The vehicle-mounted computer transmits data in step 11d if it has received a transmission permit in step 11c, lights up the display lamp in step 11e and applies a revision request flag ON in step 11f. If there is no transmission permit, the flow process ends. The host computer, which has received data, processes the data in step 11p and then, if the vehicle-mounted computer requires data return transmission in step 11g, decides whether return transmission is possible or not in step 11q. If return transmission is possible, it transmits back the processed data in step 11r. If it is not possible to transmit data back, the host computer issues a wait instruction in step 11s and transmits back the data in step 11t. The vehicle-mounted computer releases the wait condition when a signal permitting data return transmission is transmitted in step 11h, re-writes the data in step 11i based on the data transmission from the host computer in step 11t, turns OFF the display lamp in step 11j, puts OFF the revision request flag in step 11k and completes the process.

Having now fully described the present invention it will be realised that processing by a vehicle-mounted computer can be transferred to a stationary host computer as the occasion demands and real-time vehicle controls are implemented effectively without increasing the workload of the vehicle-mounted computer.

Claims

1. A method of load sharing processing operations between a vehicle mounted station (105, 2, 400, 500) and a stationary base station (25) including the steps of said vehicle mounted station detecting operating conditions of the vehicle, transmitting data representative of the detected operating conditions to the base station, said base station receiving data from the vehicle mounted station, processing said data in accordance with data stored by said base station, said base station transmitting processed data to a receiver at said vehicle mounted station and control means at said vehicle mounted station connected to the vehicle mounted receiver and being arranged to perform at least one of revising or displaying the vehicle operating conditions in dependence upon the processed data.

2. A method as claimed in claim 1 wherein the vehicle mounted station detected operating conditions are performed by a detecting means adapted to detect at least one of water temperature (32), air/fuel ratio (34) air fuel quantity (Q_a), battery voltage, throttle valve angle opening (56), engine speed (N), transmission gear position (4) and suspension setting (501).

3. A method as claimed in claim 1 or 2 wherein the vehicle mounted station includes a control means adapted to control at least one of a fuel injector (44), a transmission gear change means (400), and a suspension setting actuator (500).

4. A method as claimed in any preceding claim wherein the data transmitted from the vehicle mounted station to the base station is performed at times of occurrence of predetermined conditions including at least one of the vehicle covering a predetermined distance, detection of the engine ceasing rotation and low fuel tank condition.

5. A method as claimed in any preceding claim wherein data transmitted between the vehicle mounted station and the base station includes header bits, vehicle identification bits, control data bits, data array bits, check symbol bits and end of transmission bits.

6. A method as claimed in any preceding claim wherein the vehicle mounted station transmits a request to transmit to the base station, said base station transmits a permission to transmit for the vehicle mounted station, said vehicle transmits data including header bits, vehicle identification bits, control data bits, data array bits and check symbol bits, said base station transmits a receipt acknowledgement and said stationary base station transmits end of transmission bits.

7. A method as claimed in any preceding claim wherein the vehicle mounted station contains at least one map indicative of vehicle operating conditions including an indication of ageing in at least

one of vehicle injectors and sensors, said map being transmitted by said vehicle mounted station to said base station, said base station comparing transmitted map values with previously transmitted map values and estimating the amount of deterioration in said injectors and sensors, said base station being arranged to estimate the life expectancy of said injectors and sensors and to transmit data indicative thereof to said vehicle mounted station whereby said vehicle mounted station stores said updated information and indicates the life expectancy by visual or aural means.

8. A method as claimed in claim 7 wherein corrected map values are transmitted from the base station to the vehicle mounted station when engine rotation has ceased for subsequent real time processing.

9. A method as claimed in claim 7 wherein the vehicle mounted station updates corrected map values in a series of steps during vehicle running and uses said corrected map values for real time control.

10. A method as claimed in any preceding claim wherein a life predicting diagnosis of the vehicle is carried out by the base station by using current operating condition signals received from the vehicle mounted station, said predicting diagnosis being carried out at predetermined intervals of time or distance travelled.

11. A method as claimed in any preceding claim wherein the vehicle mounted station is arranged to detect an abnormality and to transmit data indicative thereof to said base station, said base station evaluates said abnormality and determines whether an emergency retransmission to said vehicle mounted station is necessary to provide an indicative warning by one of a display means or an aural means.

12. A method as claimed in claim 11 wherein if the abnormality is not of an emergency nature the data is stored in a failure chart prior to transmitting counter measures from the base station to said vehicle mounted station.

13. A method as claimed in any of claims 1 to 10 wherein the vehicle mounted station transmits an abnormal condition signal to the base station, the base station transmits a request for data to be analysed, the vehicle mounted base station transmits data for analysis, the base station diagnoses a failure and if an emergency is determined by said base station then said base station immediately transmits a warning for indication by said vehicle mounted station but if said base station determines there to be no emergency then said base station stores data indicative of the abnormality and subsequently transmits counter measures to said vehicle mounted base station whereupon said vehicle mounted base station takes appropriate action in dependence thereof.

14. A system for load sharing processing operations between a vehicle mounted station (105, 2, 400, 500) and a stationary base station (25), said vehicle mounted station including

detecting means (3, 4, 501) for detecting operating conditions of the vehicle,

first transmitting means (5) for transmitting data representative of the detected operating conditions to the base station,

first receiving means (5) for receiving data from the base station,

and control means (3, 4, 501) for controlling vehicle operating conditions, said control means being connected to said first receiving means,

and said base station comprising second receiver means (11) for receiving data from the vehicle mounted station,

processing means (18, 12-15) and storage means (16) for processing the data received from the vehicle mounted station based upon information held in said storage means (16),

and second transmitting means (11) for transmitting the processed data to the first receiving means (5) whereupon the control means (3, 4, 501) is arranged to perform at least one of revise or display the vehicle operating conditions in dependence upon the processed data.

15. A system as claimed in claim 14 wherein the detecting means is adapted to detect at least one of a temperature water sensor (32), air/fuel ratio (34), air flow quantity (Q_a), battery voltage, throttle valve angle opening (56), engine speed (N), transmission gear position (4) and suspension setting (501).

16. A system as claimed in claim 14 or 15 wherein the control means is arranged to control at least one of a fuel injector (44), a transmission gear change means (400), and a suspension setting actuator (500).

17. A system as claimed in any of claims 14 to 16 wherein the first transmitting means (5) is adapted to transmit data comprising a header, a vehicle identification, data control bits, a data array, a check symbol and an end of transmission indicator.

18. A vehicle mounted station including detecting means (3, 4, 501) for detecting operating conditions of a vehicle, transmitting/receiving means (5) for transmitting data representative of the detected operating conditions to a base station capable of evaluating said data, said transmitting/receiving means being adapted to receive evaluated signals from the base station and to apply signals representative of said evaluated signals to a control means (3, 4, 501) adapted to perform at least one of vary or display said operating conditions in dependence upon said received evaluated signals.

19. A stationary base station (25) adapted to receive data from a vehicle mounted station, said base station including processing means (18, 12-15) and storage means (16) for processing the data received from the vehicle mounted station based upon information held in said storage means (16), the base station being adapted to perform at least one of updating/correcting maps carried by a vehicle located processor, vehicle located sensors and injectors, establish the expected life expectancy of said sensors and injectors and further including transmitting means (11) for transmitting processed data to a vehicle.

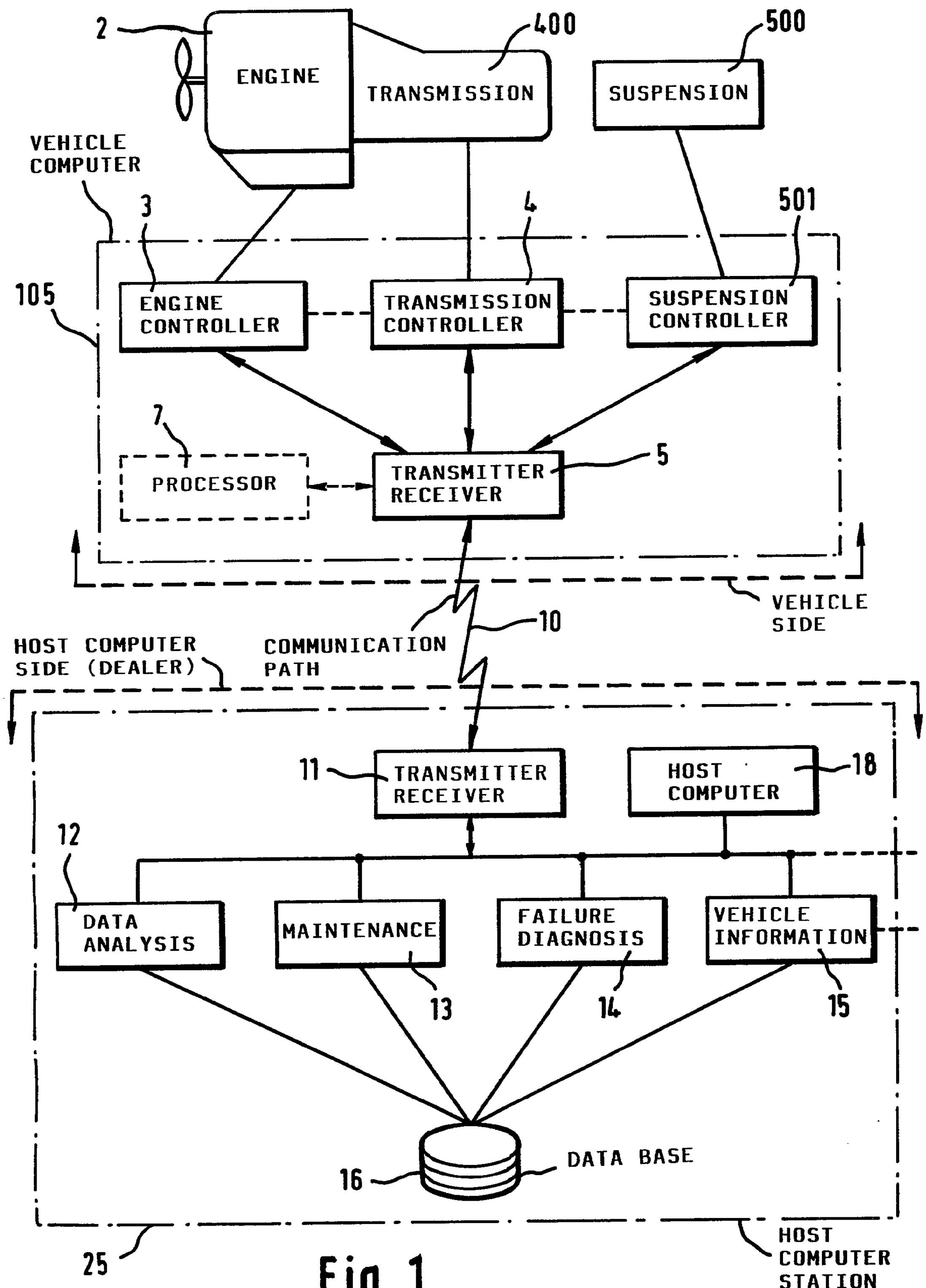
2
ENGINE
400
TRANSMISSION
500
SUSPENSION
VEHICLE
COMPUTER
3
4
501
105
ENGINE
CONTROLLER
TRANSMISSION
CONTROLLER
SUSPENSION
CONTROLLER
7
PROCESSOR
TRANSMITTER
RECEIVER
5
VEHICLE
SIDE
10
HOST COMPUTER
SIDE (DEALER)
COMMUNICATION
PATH
11
TRANSMITTER
RECEIVER
HOST
COMPUTER
18
12
DATA
ANALYSIS
MAINTENANCE
FAILURE
DIAGNOSIS
VEHICLE
INFORMATION
13
14
15
16
DATA BASE
25
HOST
COMPUTER
STATION

Fig. 1

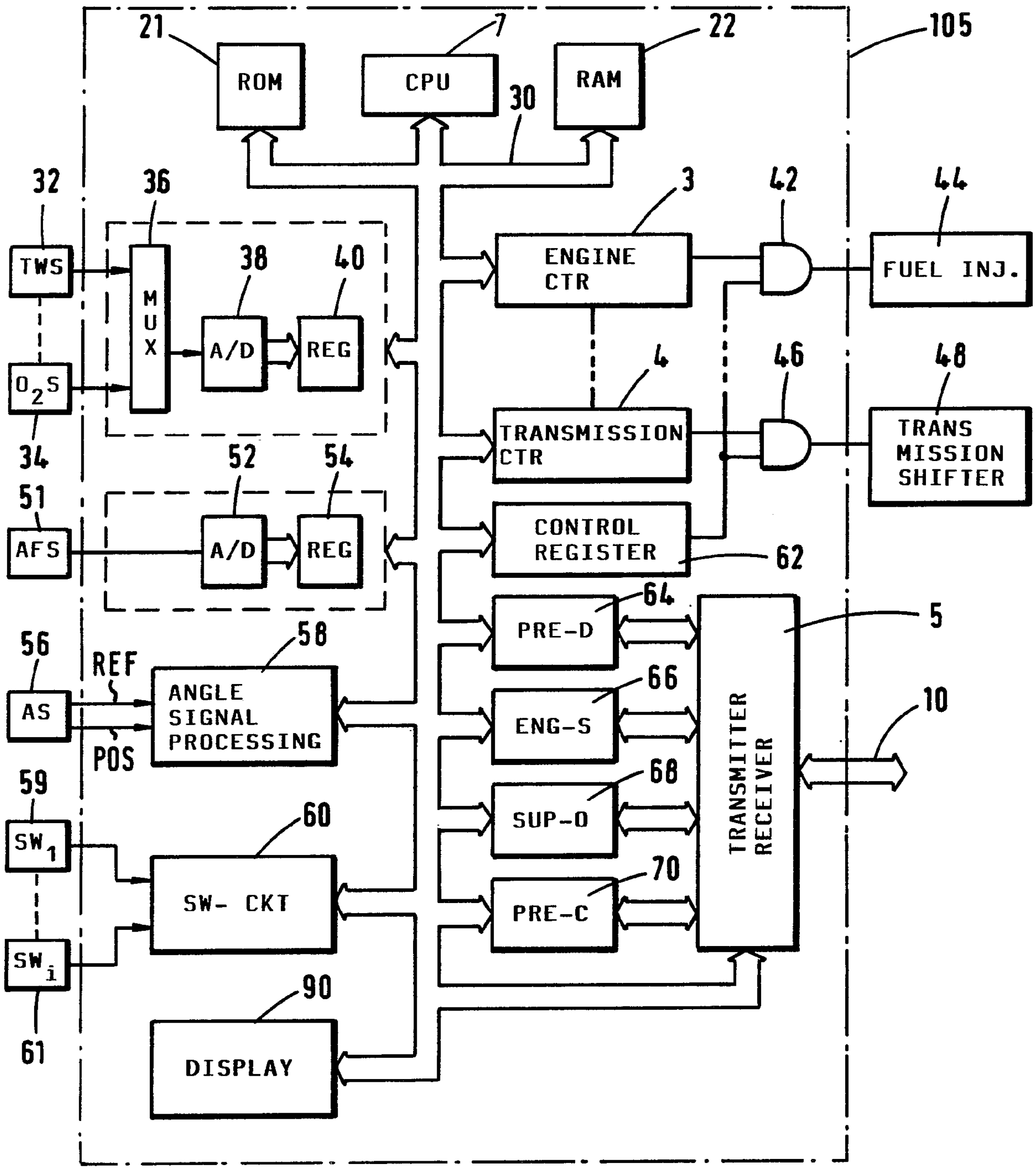
21
7
22
105
ROM
CPU
RAM
30
32
36
3
42
44
TWS
M U X
38
40
ENGINE CTR
FUEL INJ.
A/D
REG
4
46
48
O_2S
TRANSMISSION CTR
TRANS MISSION SHIFTER
34
52
54
51
AFS
A/D
REG
CONTROL REGISTER
62
64
5
56
REF
58
PRE-D
AS
ANGLE SIGNAL PROCESSING
66
10
POS
ENG-S
TRANSMITTER RECEIVER
59
68
SUP-O
60
SW_1
70
SW- CKT
PRE-C
SW_i
90
61
DISPLAY

Fig.2

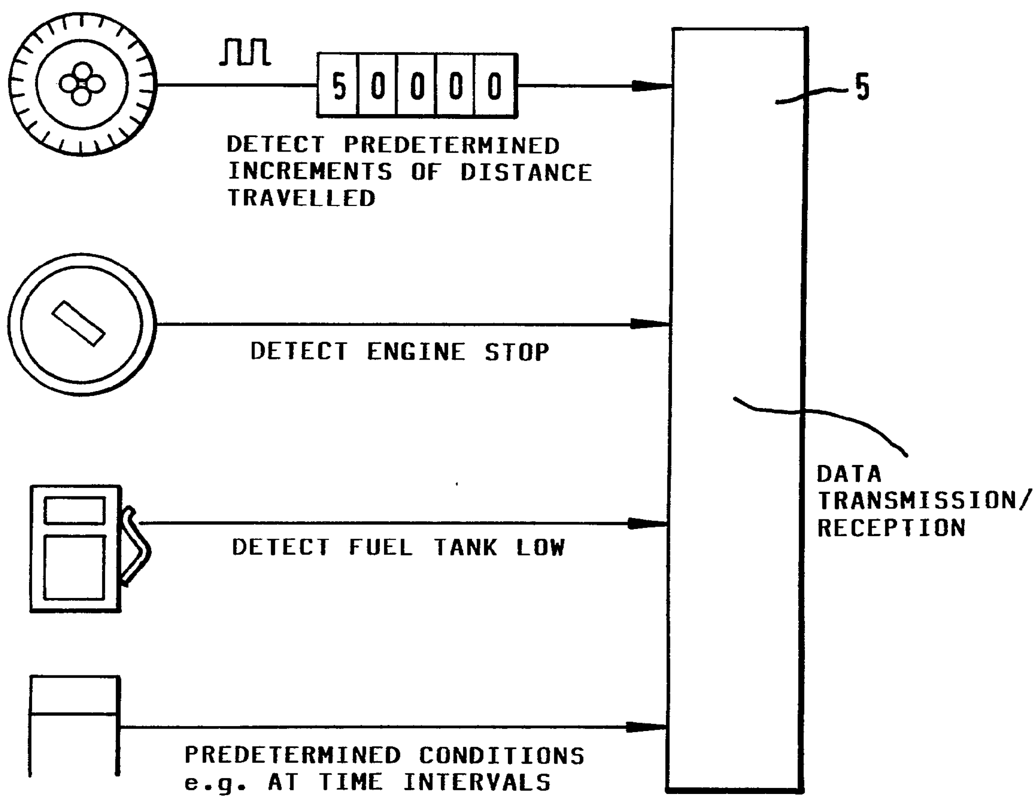
50000
5
DETECT PREDETERMINED
INCREMENTS OF DISTANCE
TRAVELLED
DETECT ENGINE STOP
DATA
TRANSMISSION/
RECEPTION
DETECT FUEL TANK LOW
PREDETERMINED CONDITIONS
e.g. AT TIME INTERVALS

Fig.3

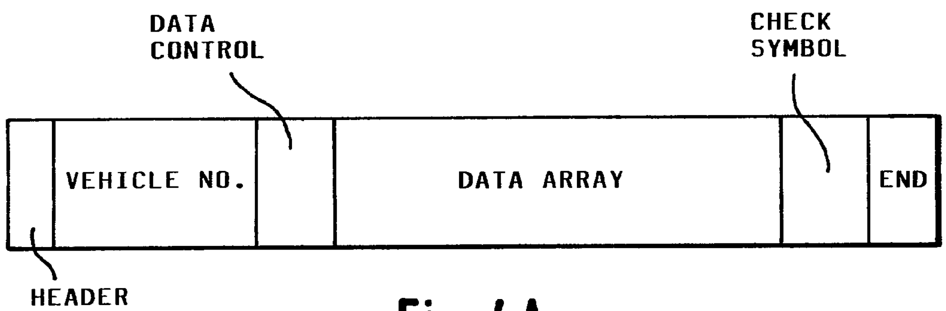
DATA
CONTROL
CHECK
SYMBOL
VEHICLE NO.
DATA ARRAY
END
HEADER

Fig.4A

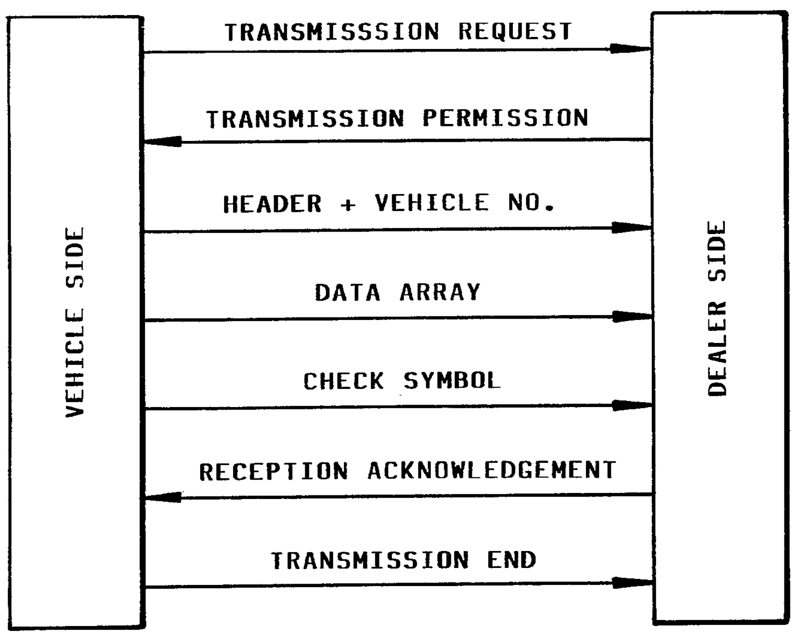
VEHICLE SIDE
DEALER SIDE
TRANSMISSSION REQUEST
TRANSMISSION PERMISSION
HEADER + VEHICLE NO.
DATA ARRAY
CHECK SYMBOL
RECEPTION ACKNOWLEDGEMENT
TRANSMISSION END

Fig.4B

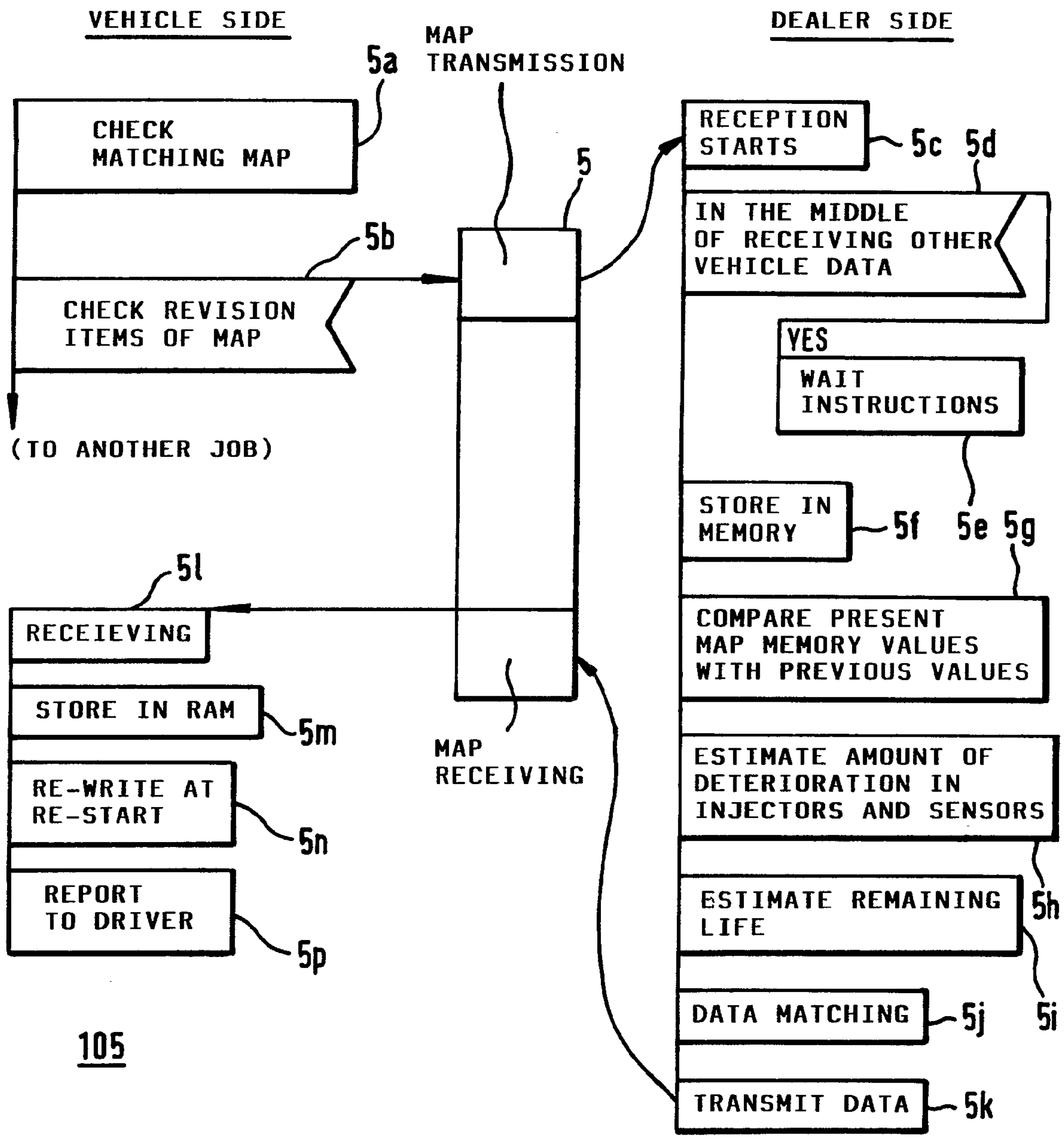
VEHICLE SIDE
MAP TRANSMISSION
DEALER SIDE
5a
CHECK MATCHING MAP
5
5b
CHECK REVISION ITEMS OF MAP
(TO ANOTHER JOB)
RECEPTION STARTS
5c
5d
IN THE MIDDLE OF RECEIVING OTHER VEHICLE DATA
YES
WAIT INSTRUCTIONS
STORE IN MEMORY
5f
5e
5g
COMPARE PRESENT MAP MEMORY VALUES WITH PREVIOUS VALUES
ESTIMATE AMOUNT OF DETERIORATION IN INJECTORS AND SENSORS
5h
ESTIMATE REMAINING LIFE
5i
DATA MATCHING
5j
TRANSMIT DATA
5k
5l
RECEIEVING
STORE IN RAM
5m
RE-WRITE AT RE-START
5n
REPORT TO DRIVER
5p
MAP RECEIVING
105
25

Fig.5

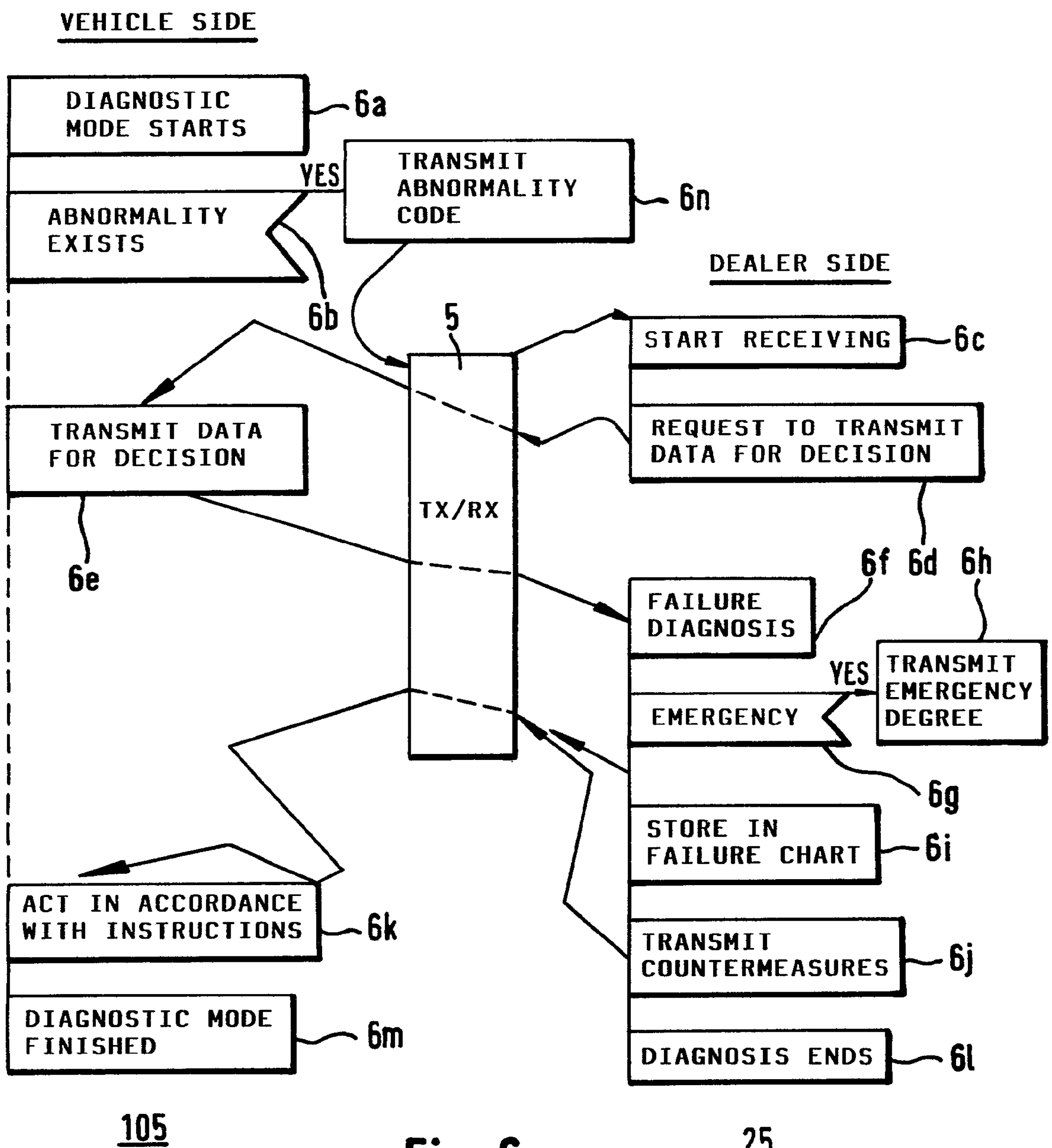
VEHICLE SIDE
DIAGNOSTIC MODE STARTS
6a
YES
TRANSMIT ABNORMALITY CODE
6n
ABNORMALITY EXISTS
6b
DEALER SIDE
5
START RECEIVING
6c
TRANSMIT DATA FOR DECISION
REQUEST TO TRANSMIT DATA FOR DECISION
TX/RX
6e
6f 6d 6h
FAILURE DIAGNOSIS
YES
TRANSMIT EMERGENCY DEGREE
EMERGENCY
6g
STORE IN FAILURE CHART
6i
ACT IN ACCORDANCE WITH INSTRUCTIONS
6k
TRANSMIT COUNTERMEASURES
6j
DIAGNOSTIC MODE FINISHED
6m
DIAGNOSIS ENDS
6l
105
25

Fig. 6

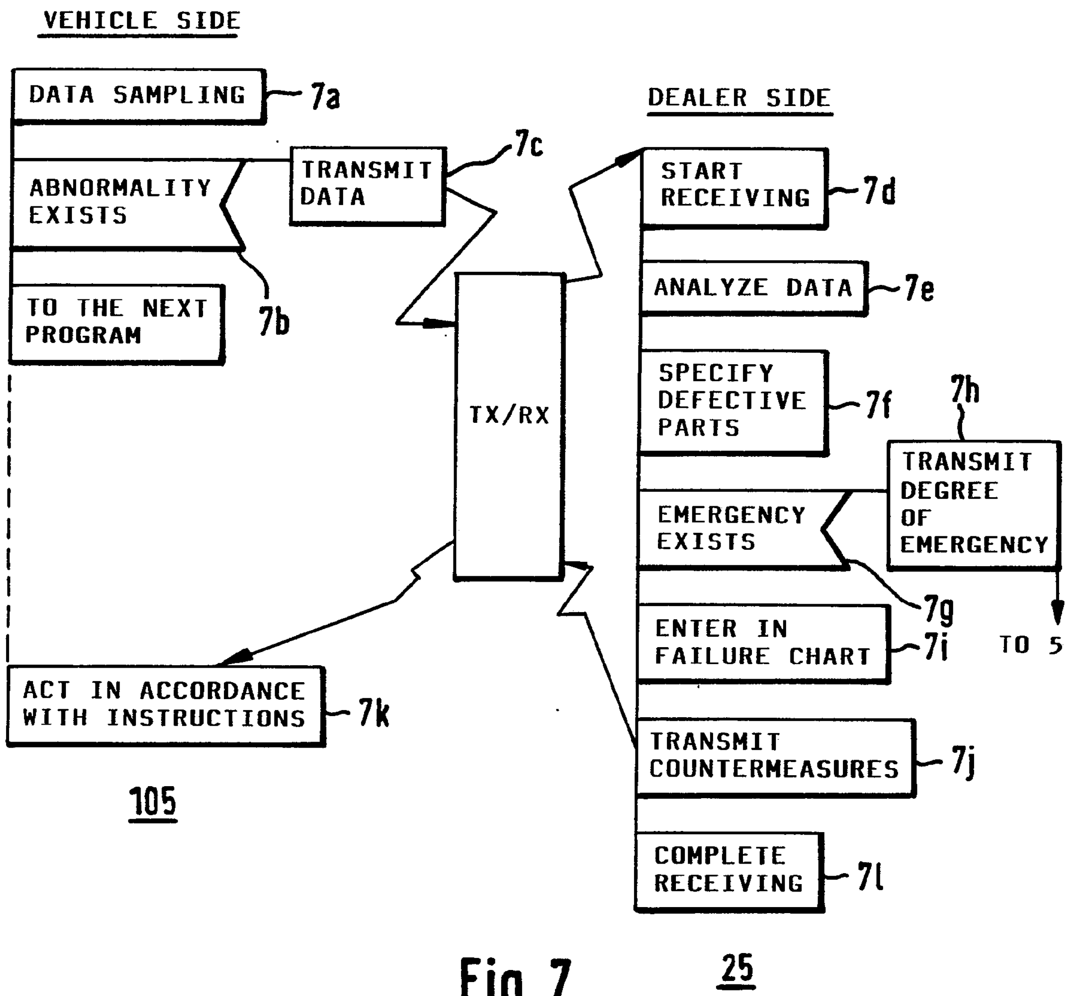
VEHICLE SIDE
DATA SAMPLING
7a
ABNORMALITY EXISTS
7b
TRANSMIT DATA
7c
TO THE NEXT PROGRAM
TX/RX
ACT IN ACCORDANCE WITH INSTRUCTIONS
7k
105
DEALER SIDE
START RECEIVING
7d
ANALYZE DATA
7e
SPECIFY DEFECTIVE PARTS
7f
7h
TRANSMIT DEGREE OF EMERGENCY
EMERGENCY EXISTS
7g
ENTER IN FAILURE CHART
7i
TO 5
TRANSMIT COUNTERMEASURES
7j
COMPLETE RECEIVING
7l
25

Fig.7

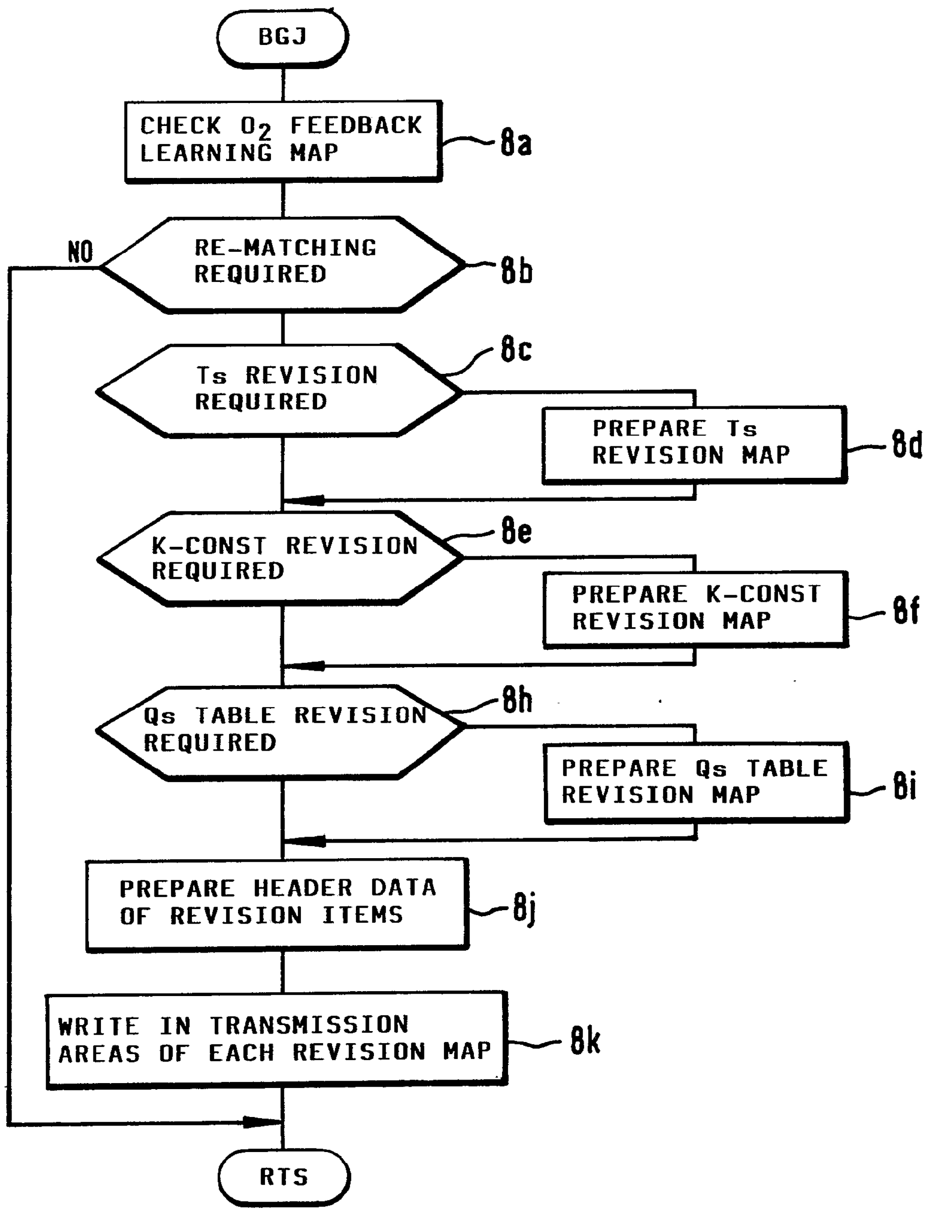
BGJ
CHECK O_2 FEEDBACK LEARNING MAP
8a
NO
RE-MATCHING REQUIRED
8b
Ts REVISION REQUIRED
8c
PREPARE Ts REVISION MAP
8d
K-CONST REVISION REQUIRED
8e
PREPARE K-CONST REVISION MAP
8f
Qs TABLE REVISION REQUIRED
8h
PREPARE Qs TABLE REVISION MAP
8i
PREPARE HEADER DATA OF REVISION ITEMS
8j
WRITE IN TRANSMISSION AREAS OF EACH REVISION MAP
8k
RTS

Fig.8

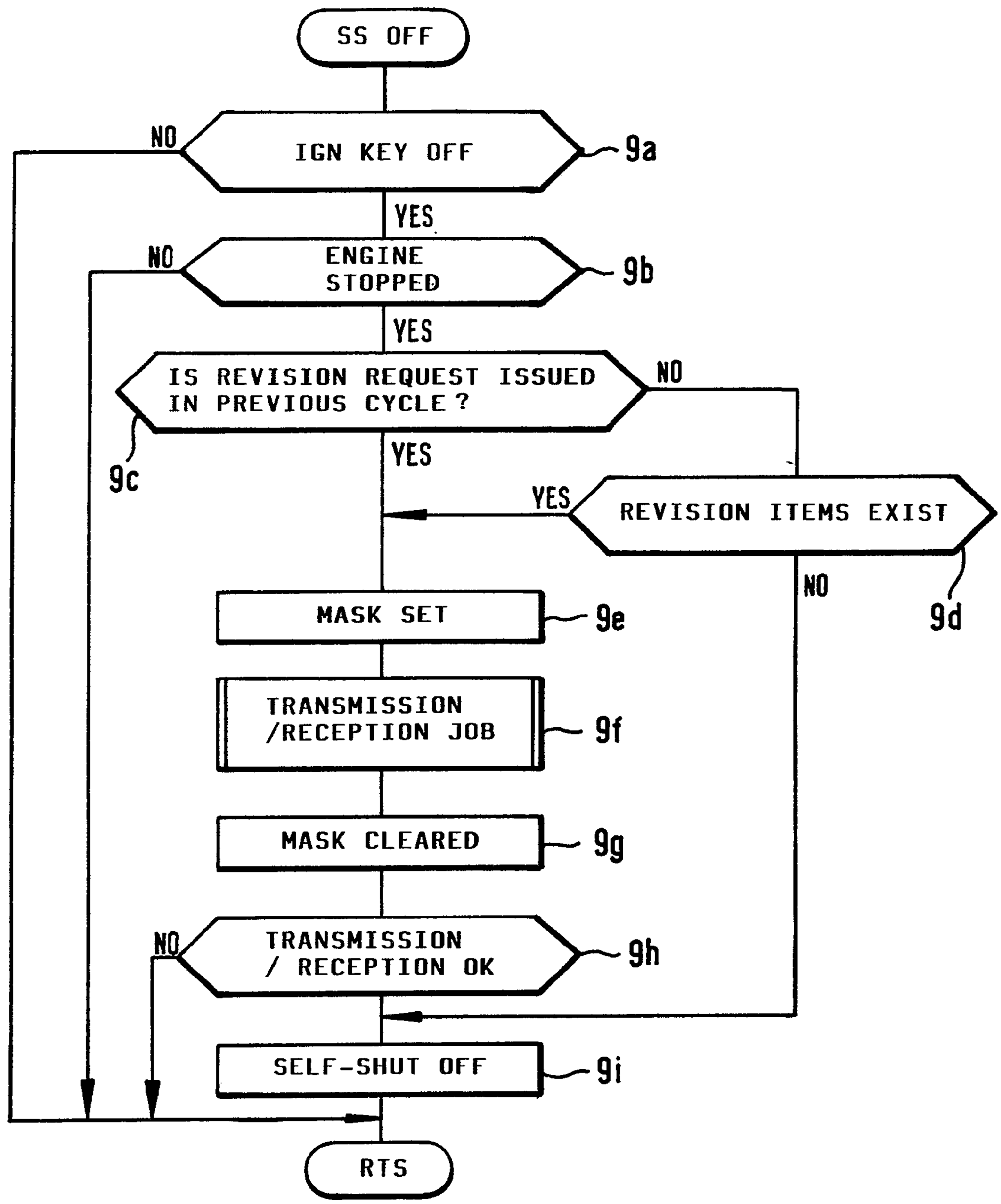
SS OFF
IGN KEY OFF
NO
YES
9a
ENGINE STOPPED
NO
YES
9b
IS REVISION REQUEST ISSUED IN PREVIOUS CYCLE ?
NO
YES
9c
REVISION ITEMS EXIST
YES
NO
9d
MASK SET
9e
TRANSMISSION /RECEPTION JOB
9f
MASK CLEARED
9g
TRANSMISSION / RECEPTION OK
NO
9h
SELF-SHUT OFF
9i
RTS

Fig.9

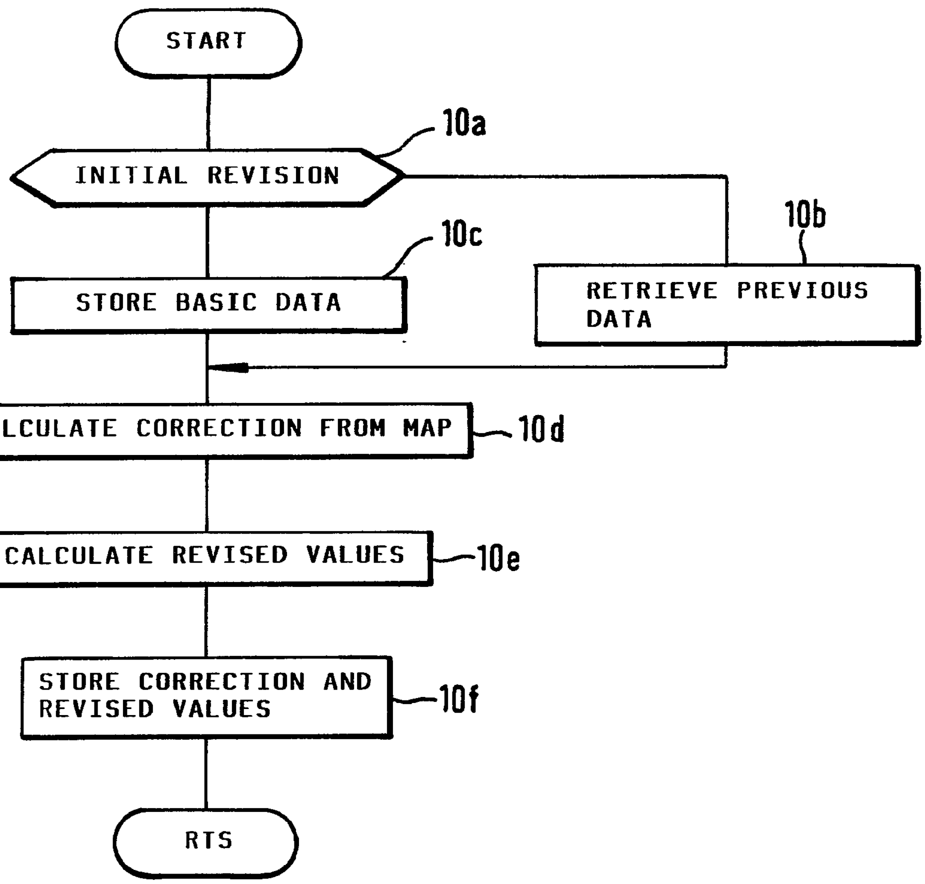
START
INITIAL REVISION
10a
10b
10c
STORE BASIC DATA
RETRIEVE PREVIOUS DATA
CALCULATE CORRECTION FROM MAP
10d
CALCULATE REVISED VALUES
10e
STORE CORRECTION AND REVISED VALUES
10f
RTS

Fig.10

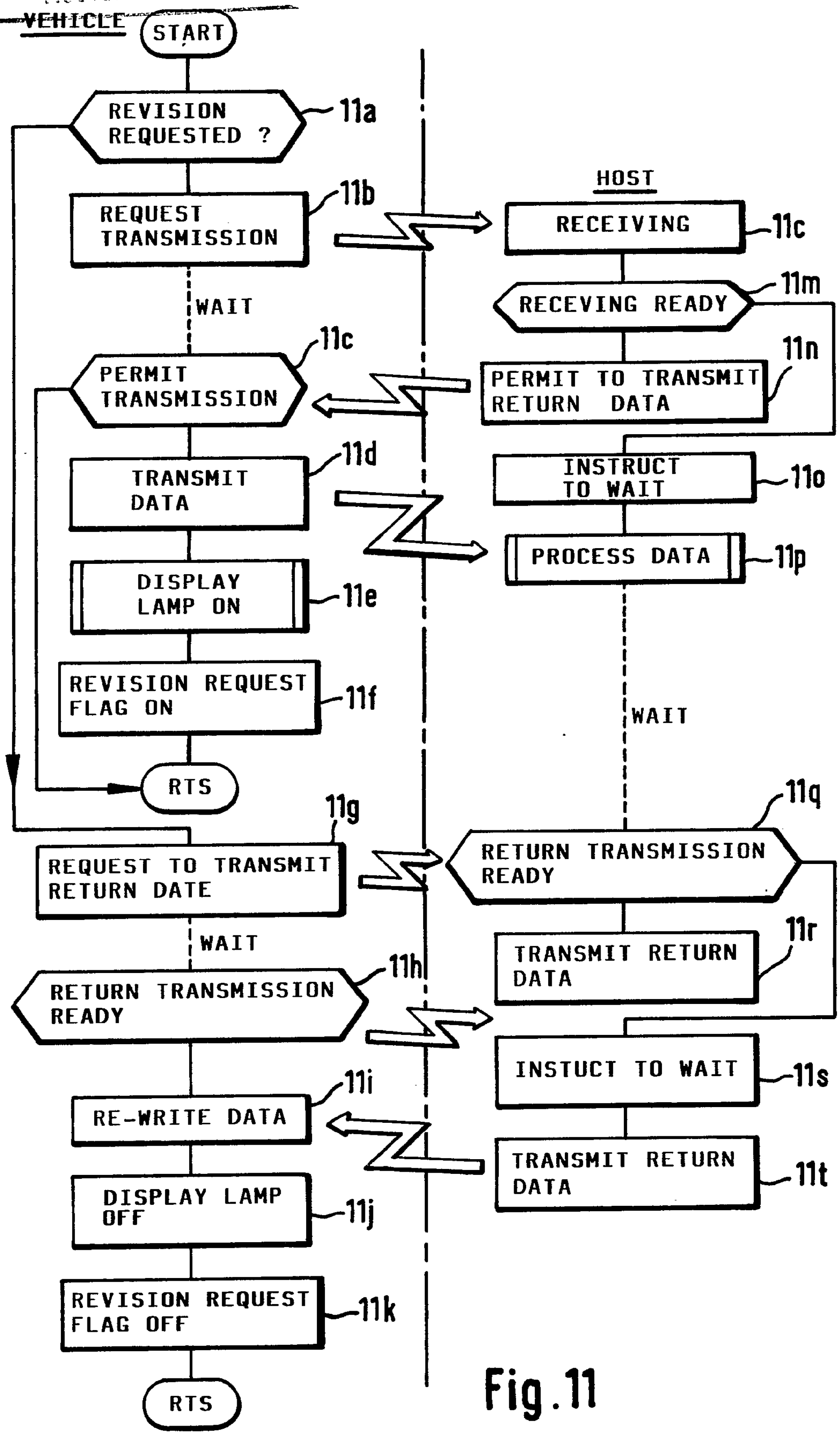
VEHICLE
START
REVISION REQUESTED ?
11a
REQUEST TRANSMISSION
11b
WAIT
PERMIT TRANSMISSION
11c
TRANSMIT DATA
11d
DISPLAY LAMP ON
11e
REVISION REQUEST FLAG ON
11f
RTS
11g
REQUEST TO TRANSMIT RETURN DATE
WAIT
RETURN TRANSMISSION READY
11h
RE-WRITE DATA
11i
DISPLAY LAMP OFF
11j
REVISION REQUEST FLAG OFF
11k
RTS
HOST
RECEIVING
11c
RECEVING READY
11m
PERMIT TO TRANSMIT RETURN DATA
11n
INSTRUCT TO WAIT
11o
PROCESS DATA
11p
WAIT
RETURN TRANSMISSION READY
11q
TRANSMIT RETURN DATA
11r
INSTUCT TO WAIT
11s
TRANSMIT RETURN DATA
11t

Fig.11

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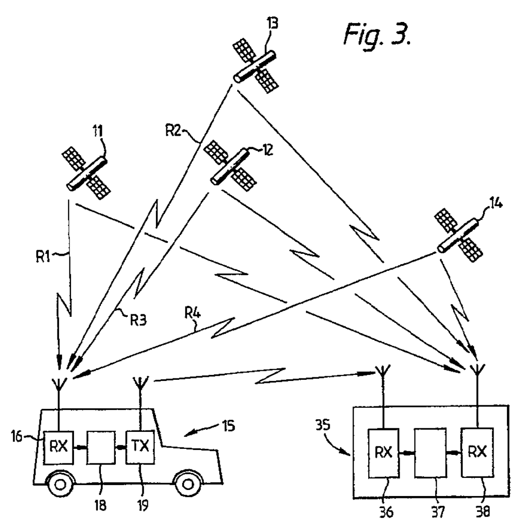
(54) **Vehicle location system.**

(57) Signals from a number of NAVSTAR global positioning system (GPS) satellites (11,12,13,14) are received by a receiver (16) in a vehicle (15) and a segment of the signals is stored in a memory (18) prior to retransmission by a transmitter (19). A base station (35) receives these transmissions from the mobile unit using a first receiver (36) as well as receiving signals directly from the NAVSTAR GPS satellites (11,12,13,14) using a second receiver (38). A control and calculating means (37) within the base station (35) can determine the ephemeris (course) information for the satellites and measure the transmission times or propagation delays of signals between the satellites and the vehicle and with this information the control and calculating means (37) can calculate the position of the vehicle unit.

Fig. 3.



EP 0 444 738 A2

This invention relates to a vehicle location system which makes use of a satellite-based global positioning service (GPS) of the NAVSTAR type and which has particular but not exclusive application to an automatic vehicle location (AVL) system for use with a fleet of vehicles, each of which is in radio contact with a base station.

Fleets of vehicles such as messengers and taxis have traditionally kept a base station informed of their location by using speech messages from the vehicle over a radio link to an operator or controller at the base station. This technique has significant disadvantages which include errors due to mis-heard messages, distraction of the vehicle driver and the large amount of time that the operator has to spend in simply updating a map or schedule. One solution to this problem involves using an automated vehicle locating system based on the NAVSTAR satellite-based global position system (GPS).

The NAVSTAR GPS is described in "Global Positioning by Satellite" by Philip G. Mattos, Electronics and Wireless World, February 1989 but the salient points of the system are repeated here. The NAVSTAR GPS consists of a number of satellites in approximately 12 hour, inclined orbits of the earth, each satellite transmitting continuous positional information. Two positioning services are provided by NAVSTAR, the precise positioning service (PPS) which is reserved for military use and the standard positioning service (SPS) which is available for general use. The following description is confined to the SPS although some features are common to both systems. By measuring the propagation time of these transmissions and hence the distance from three satellites to himself, a user can make an accurate calculation of his position in three dimensions. To make a valid positional fix, the user needs to measure the propagation times to an accuracy of better than 100ns and to facilitate this the satellite signals each have timing marks at approximately 1μs intervals. However, each satellite's signals are synchronised to an atomic clock and the normal user of the system will not maintain such an accurate clock. As a result the user's clock is said to be in error (in other words, different from satellite time) by a clock bias C_B. By measuring the apparent satellite signal propagation times from four satellites rather than three, the redundancy can be used to solve for C_B and the three accurate propagation times required can be calculated. The signal propagation times correspond to ranges of the user from the satellites related by the speed of light c. Prior to correction for the user's clock bias C_B, the apparent ranges of the satellites are all in error by a fixed amount and are called pseudoranges.

Figure 1 of the accompanying drawings shows a radio receiver 16 in a user's vehicle 15 receiving signals from four GPS satellites 11, 12, 13 and 14. The four pseudoranges of the satellite signals are denoted R1, R2, R3 and R4. The positions of the satellites and the vehicle are shown as three-dimensional coordinates whose origin is the centre of the earth. Figure 2 of the accompanying drawings shows the equations used by a GPS receiver to calculate the dimensional coordinates and the clock bias from a knowledge of four satellite positions and their respective pseudoranges. While it is not essential, these equations are usually solved using numerical techniques to hasten the calculations. It is important to note that the clock bias C_B has the dimension metres in order to agree with the remainder of the equation. C_B can be converted to a time by division by the speed of light c.

The data transmitted by each satellite consists broadly of three sets of information, the ephemeris, the almanac and the clock correction parameters. The ephemeris consists of detailed information about the satellite's own course over the next two hours, the almanac consists of less detailed information about the complete satellite constellation for a longer period and the clock correction parameters allow the user to correct for the GPS satellite's own clock errors. The satellite transmissions consist of a direct sequence spread spectrum (DSSS) signal containing the ephemeris, almanac, and the clock correction information at a rate of 50 bits per second (bps). In the case of the SPS a pseudo random noise (PRN) signal which has a chip rate of 1.023MHz and which is unique to each satellite is used to spread the spectrum of the information, which is then transmitted on a centre frequency of 1575.42MHz. The PRN signal is known as a coarse/acquisition (C/A) code since it provides the timing marks required for fast acquisition of GPS signals and coarse navigation. The signals received at a user's receiver have a bandwidth of approximately 2MHz and a signal to noise ratio (S/N) of approximately -20dB. In addition, since the satellites are each moving at a speed in excess of 3km/s, the GPS signals are received with a Doppler frequency offset from the GPS centre frequency. As a result, a stationary GPS receiver has to be capable of receiving signals with frequencies of up to ±4KHz from the GPS centre frequency, and a mobile receiver (as is usually the case) has to be able to receive signals over an even greater frequency range. To recover the data and measure the propagation time of the satellite signals, the GPS receiver must cancel or allow for the Doppler frequency offset and generate the C/A code relevant to each satellite. Initially, at least, this can be very time consuming since to despread the DSSS signals, the incoming and locally generated PRN codes must be exactly at synchronism. To find the PRN code delay the receiver must compare the locally generated code and the incoming code at a number of different positions until the point of synchronism or correlation is found. With a code length of 1023 chips this comparison can be a lengthy procedure. However, once the frequency offset and the PRN code delay for each satellite are known, tracking them is relatively easy.

Some considerable effort has been directed towards making more accurate location systems using the GPS. One technique for obtaining improved accuracy is to use a differential system which makes propagation time measurements for a mobile receiver and for a fixed receiver at a known location. Patent specification WO 87/06713 describes such a differential system which additionally smooths the values of propagation time over a number of measurements to obtain improved accuracy. There are numerous applications of the GPS, however, which do not require pinpoint accuracy; the operator of a fleet of vehicles, for example, will probably be satisfied with locations having an accuracy of only several hundred metres.

As can be appreciated, a receiver for use with the GPS is rather complex and hence expensive and it is the aim of the present invention to provide a considerably simplified system, based on the GPS, for locating a distant vehicle or vehicles from a fixed point.

According to a first aspect of the present invention there is provided a vehicle location system for use in a global positioning system (GPS), comprising at least one vehicle mounted equipment including means for receiving signals directly from the GPS, a fixedly sited base station including first means for receiving signals directly from the GPS, characterised in that the or each vehicle mounted equipment includes means for recording the received GPS signals and means for retransmitting the recorded GPS signals to the base station, and in that the fixedly sited base station includes second means for receiving the recorded GPS signals retransmitted by the vehicle mounted equipment, and position determining means coupled to the first and second means, for determining the position of the or each vehicle at the time when the vehicle mounted equipment received the GPS signals.

The maximum rate at which the retransmission of the GPS signals takes place will be determined by the capacity of the radio channel between the mobile unit(s) and the base station(s). This retransmission rate will generally be somewhat lower than the original rate of the GPS signals and at a different carrier frequency.

It is envisaged that a vehicle location system in accordance with the present invention will make use of a vehicle mounted communications transmitter that is already a part of the vehicle's equipment and also serves one or more other purposes although this is by no means essential.

The vehicle mounted equipment can make the necessary recordings of GPS data on receipt of a request signal from a base station, at predetermined intervals, or continuously, using a first in, first out (FIFO) type of storage means. The data can be retransmitted on receipt of a request signal from a base station, upon the lapse of a given amount of time from the beginning of the recording of the data or at predetermined time intervals. To make a position fix the transition time of the satellite signals has to be known accurately and the redundancy available due to reception of four satellite signals will only resolve errors of up to a few milliseconds. A coarser measure of the signal arrival time, that is nonetheless accurate to within a few milliseconds will thus be required by the base station. One solution to this problem would be for the vehicle mounted equipment to transmit a time of arrival (TOA) signal with the recording of the satellite data. Another solution would be for the vehicle mounted equipment to record the satellite data at certain, known intervals and to retransmit the data before the commencement of the next interval. In most cases the vehicle mounted equipment will also transmit an identifying signal with the recorded satellite signals so that the base station has a knowledge of the origin of any particular signal. Where a specific mobile unit has been requested to retransmit its recorded data, this identification signal may be superfluous, but its inclusion does provide a degree of extra protection in the event of receipt of corrupted request signals from the base station.

According to a second aspect of the present invention there is provided a vehicle mounted equipment for use with a vehicle location system in accordance with to the first aspect of the present invention, including means for receiving GPS signals, characterised in that the equipment also includes means for recording the received GPS signals and means for retransmitting the recorded GPS signals.

According to a third aspect of the present invention there is provided a fixedly sited base station for use with the system in accordance with the first aspect of the present invention, including first means for receiving GPS signals directly from the GPS, characterised in that the base station also includes second means for receiving a retransmission of GPS signals from a vehicle mounted equipment and means coupled to said first and second means for determining the position of the vehicle mounted equipment at the time that the GPS signals were received.

The present invention will now be described, by way of example, with reference to Figures 3, 4 and 5 of the accompanying drawings, wherein:

Figure 3 shows signals from four NAVSTAR satellites being received by a mobile unit and retransmitted to a base station,

Figure 4 is a block schematic diagram of a receiver, data store and transmitter for a mobile unit, and

Figure 5 is a block schematic diagram of a GPS receiver, a transceiver and a data store in a base station.

In the drawings corresponding features have been identified using the same reference numerals.

Figure 3 shows the vehicle location system operating with just one vehicle 15 and one base station 35. Transmissions from NAVSTAR GPS satellites 11,12,13 and 14 are received by both a vehicle mounted receiver 16 and a base station receiver 38. The GPS signals received by mobile receiver 16 are fed to a storing and control means 18 which records a short section of the satellite signals. The control means 18 might record GPS signals at preset intervals, upon receipt of a request signal (not shown) from the base station, or continuously where the stored signals at any instant will be those most recently received. The recorded signals are then retransmitted, at a lower data rate and on a different carrier frequency to that used by the satellites, by a transmipl 19 to a receiver 36 in the base station. The signals could be retransmitted at a predetermined interval after the commencement of the recording or upon receipt of a request signal from the base station. In the former case it may be necessary for the retransmitted signal to include some kind of identifier so that the base station knows from which vehicle the signals have originated. The rate at which the signals are retransmitted will depend upon the capacity of the radio channel between the mobile unit and the base station but will be approximately 1,000 times less than the rate at which they were received and sampled if a voice channel is used. The received and recorded satellite signals have a S/N ratio of approximately -20dB and retransmission will probably not cause significant further deterioration of the S/N. As a result, it is not usually necessary to include any error detection or correction codes with the retransmitted data. The base station also includes means for receiving the GPS signals directly from the satellites using receiver 38. Signals from receiver 38 are passed to a processing means 37 which maintains a copy of the GPS ephemeris and clock correction data for those satellites currently in use by the system. The processing means 37 can, with the data received by receivers 36 and 38, calculate the position of the vehicle 15 by removing the Doppler offset frequency successively from each of the recorded satellite signals, correlating the relevant C/A code with each of the signals and calculating the satellite pseudoranges. The processing means 37 may also maintain a copy of the GPS almanac so that the vehicle location system can use the signals from the most favourable satellites and find newly visible satellites more quickly.

Two main problems can arise from this offline, remote processing of the satellite signals. Firstly, if the mobile unit is at a great distance from the base station it is possible that the base station will not be able to receive signals from a satellite that is visible to the vehicle and which is essential to the positional fix. The base station will thus be deprived of up-to-date ephmeris information for that satellite. To reduce the likelihood of this problem, the antenna for the base station GPS receiver should be omnidirectional and mounted in an area clear of obstructions. Where a very large area is to be covered, the use of a number of physically separated base stations with means for intercommunication might be the best solution. For the base station to obtain the ephemeris data from the retransmission by the mobile unit is not a practical proposition since the recording and retransmission of sufficient spread spectrum data to provide a complete satellite ephemeris would take several hours. Secondly, there is a range ambiguity problem that, while present in a conventional vehicle mounted GPS receiver system, may be more difficult to solve in this case. The PRN codes used by the satellites repeat every millisecond and as a result the circular correlation of the received and locally generated PRN codes only allows a GPS receiver to calculate the sub-millisecond part of the satellite signal transit time. The integer number of milliseconds in the signal transit times can usually be calculated from the approximate position of the vehicle. Since a 1 millisecond difference in transit time corresponds to a difference in the satellite pseudorange of 300km, a knowledge of the vehicle position to within approximately 100km will allow the calculation of the integer number of milliseconds in the signal transit times. This degree of accuracy of the vehicle position may be available from a knowledge of which cell of a cellular radio system is being used to retransmit the signals to the base station. If the vehicle position is not known to this degree of accuracy (100km may be less than one hour's motoring) the data bit edges on the satellite signals can act as timing marks with a spacing of 20ms. Since the modulation of the satellite signal by the data is synchronised to an atomic clock, the position of the data bit edges in the received, despread signals gives a coarse measure of transit time which is nonetheless accurate to within one millisecond. To use this measurement technique, at least 20ms of satellite signals will need to be recorded to ensure that the recording contains a data bit edge from each satellite. A third alternative is to use the Doppler shift on the received GPS signals to calculate an approximate user position. However, this method still requires at least 20ms of satellite data and is mathematically more complex, especially if the user's vehicle is in motion.

Figure 4 is a block schematic diagram of a mobile receiver and transmitter suitable for use in a vehicle locating system in accordance with the present invention. Satellite signals are received at an antenna 20 which feeds an rf amplifier 22. The input stage of the rf amplifier 22 will usually include a bandpass filter. The output of the amplifier 22 is mixed with the output of local oscillator 24 in a mixer 23 and the output of the mixer is filtered by a bandpass filter 26. Although only one down-conversion stage is shown, the front end of the receiver could include two or more such stages. The nominal intermediate frequency to which the satellite signals are mixed down could be anything from zero to several MHz. In the case of a zero IF receiver, the filter 26 would be a low pass type. The output of filter 26 is digitised in an analogue to digital converter 27 whose sampling rate is determined by the Nyquist sampling criterion.

The output of the analogue to digital converter 27 is stored in a random access memory (RAM) 28 which is addressed by a counter 31, the counter itself being under the control of a receiver controller 30. The size of this RAM will be determined by the rate of sampling and the length of time that the incoming satellite signals are to be recorded for. For example, sampling at 2.046MHz (to satisfy the Nyquist criterion) for 8ms will require just under 16kbits of memory. The contents of the RAM 28 are transmitted serially by transmitter 32 via antenna 33. In a practical system the transmitter 32 may be part of an existing transceiver within the mobile unit.

These signals are received and processed by the base station, an embodiment of which is shown in block schematic form in Figure 5. The retransmitted signals from the mobile unit are received by antenna 43 and fed to a transceiver 44. Again, the transceiver 44 could be part of an existing communications link. A base station controller 42 is connected to the transceiver and in addition to receiving the signals from the mobiles and calculating their positions it maintains an up to date copy of the ephemeris data for all the satellites currently in view. GPS signals are received by a GPS receiver 38 via an antenna 40. The purpose of this receiver is to decode satellite ephemeris and clock correction data and it will probably also decode almanac data to facilitate satellite signal acquisition. Since positional information is not required for the base station it does not need to determine the propagation delays of the GPS signals. It is thus possible to use a signal despreading technique based on non-coherent demodulation which does not use any locally generated C/A codes. In all other respects the satellite data is received as described previously for a conventional system and stored in a RAM 41 for use by the base station controller 42 in calculating the satellite pseudoranges in respect of the or each vehicle. One advantage of using a complete GPS receiver at the base station rather than one employing a non-coherent demodulation technique is that it permits location fixes to be made by a differential technique. The base station uses the GPS to determine its own position and, since this is already known accurately, can calculate an up to date error term for the GPS. When the mobile unit(s) position is calculated, this error can be removed from the mobile unit's pseudoranges which gives an improvement in the accuracy of the positional fix. The transceiver 44 enables request signals to be passed from the base station to the mobile units for commencement of data logging and/or data transmission. It can also, if required, relay vehicle position or directions back to the driver of the vehicle.

From reading the present disclosure other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the design, manufacture and use of GPS systems and component parts thereof and which may be used instead of or in addition to features already described herein. Although claims have been formulated in this application to particular combinations of features, it should be understood that the scope of the disclosure of the present application also includes any novel feature or any novel combination of features disclosed herein either explicitly or implicitly or any generalisation thereof, whether or not it relates to the same invention as presently claimed in any claim and whether or not it mitigates any or all of the same technical problems as does the present invention. The applicants hereby give notice that new claims may be formulated to such features and/or combinations of such features during the prosecution of the present application or of any further application derived therefrom.

Claims

1. A vehicle location system for use in a global positioning system (GPS), comprising at least one vehicle mounted equipment including means for receiving signals directly from the GPS, a fixedly sited base station including first means for receiving signals directly from the GPS, characterised in that the or each vehicle mounted equipment includes means for re-

cording the received GPS signals and means for retransmitting the recorded GPS signals to the base station, and in that the fixedly sited base station includes second means for receiving the recorded GPS signals retransmitted by the vehicle mounted equipment, and position determining means coupled to the first and second means, for determining the position of the or each vehicle at the time when the vehicle mounted equipment received the GPS signals.

2. A vehicle location system as claimed in Claim 1, characterised in that the vehicle mounted equipment transmits a time of arrival (TOA) signal in addition to retransmitting the recorded GPS signals.

3. A vehicle location system as claimed in Claim 1 or Claim 2, characterised in that the rate at which the vehicle mounted equipment retransmits the GPS signals is lower than that at which the signals were recorded.

4. A vehicle location system as claimed in Claim 1, Claim 2 or Claim 3, characterised in that the vehicle mounted equipment further comprises control means coupled to the recording means, and in that signals from the control means cause the recording means to record GPS signals at preset intervals.

5. A vehicle location system as claimed in any one of the Claims 1 to 4, characterised in that the GPS is the satellite-based NAVSTAR GPS, and in that the or each base station has means for obtaining the GPS ephemeris for the satellites in use.

6. A vehicle location system as claimed in Claim 5, characterised in that the means for obtaining the GPS ephemeris in the or each base station has means for despreading the NAVSTAR GPS signals without using any locally generated pseudo random noise codes.

7. A vehicle mounted equipment for use with the system as claimed in any one of the Claims 1 to 6, including means for receiving GPS signals, characterised in that the equipment also includes means for recording the received GPS signals and means for retransmitting the recorded GPS signals.

8. A vehicle mounted equipment for use with the system as claimed in Claim 2 or any Claim dependent thereon, including means for receiving GPS signals, characterised in that the equipment includes means for recording the received GPS signals and means for retransmitting the recorded GPS signals and a time of arrival (TOA) signal.

9. A fixedly sited base station for use with the system as claimed in any one of the Claims 1 to 6, including first means for receiving GPS signals directly from the GPS, characterised in that the base station also includes second means for receiving a retransmission of GPS signals from a vehicle mounted equipment and means coupled to said first and second means for determining the position of the vehicle mounted equipment at the time that the GPS signals were received.

10. A fixedly sited base station as claimed in Claim 9, characterised in that the means for determining the position of the vehicle mounted equipment calculates the position of the base station using the GPS and then calculates the position of the vehicle mounted equipment using a differential technique.

Fig. 1.

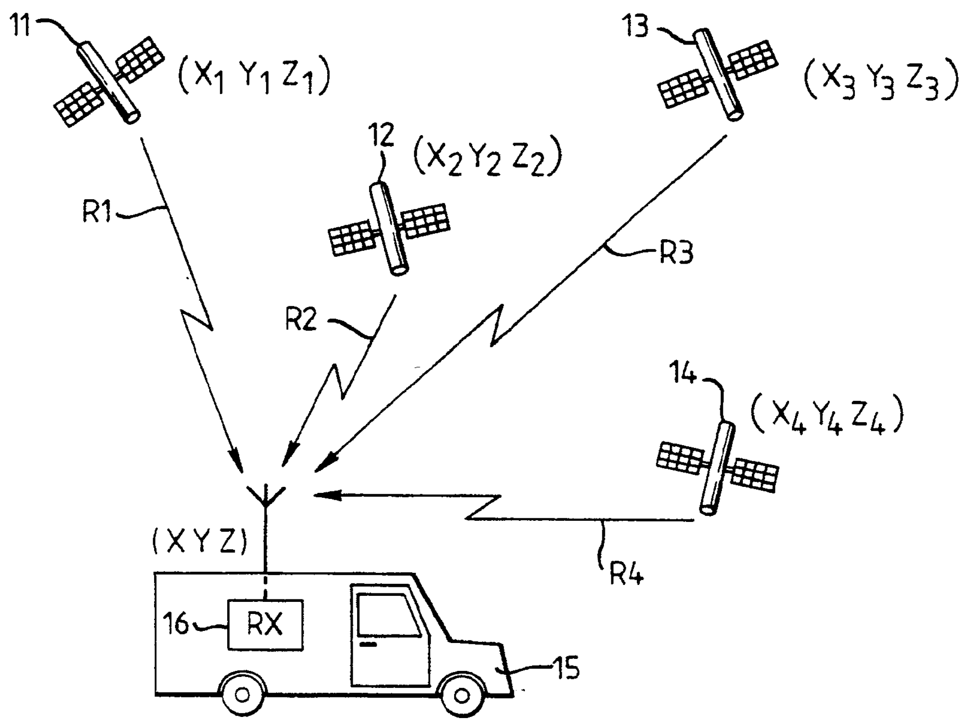


Fig. 2.

$$(X_1-X)^2+(Y_1-Y)^2+(Z_1-Z)^2=(R_1-C_B)^2$$
$$(X_2-X)^2+(Y_2-Y)^2+(Z_2-Z)^2=(R_2-C_B)^2$$
$$(X_3-X)^2+(Y_3-Y)^2+(Z_3-Z)^2=(R_3-C_B)^2$$
$$(X_4-X)^2+(Y_4-Y)^2+(Z_4-Z)^2=(R_4-C_B)^2$$

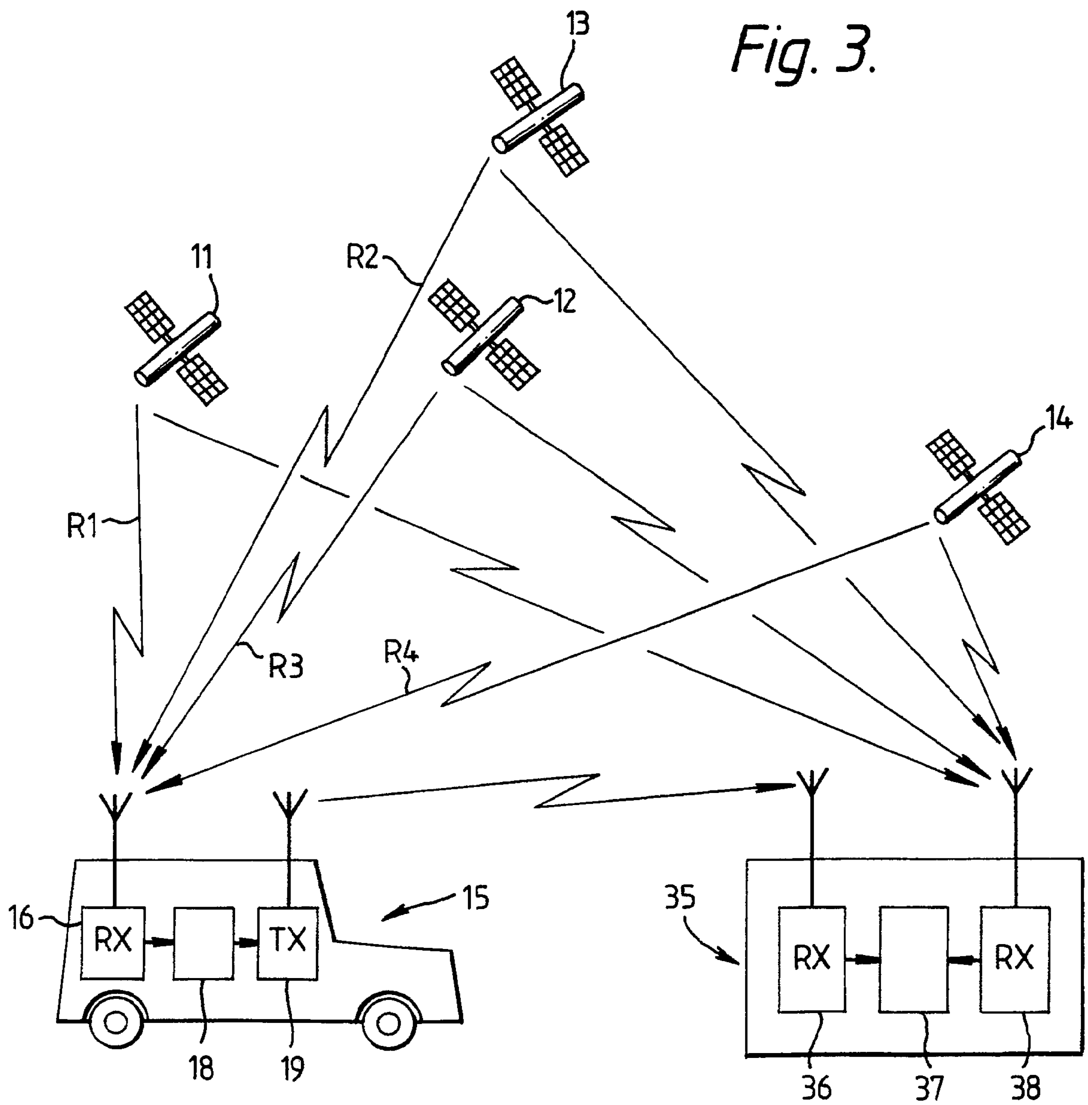
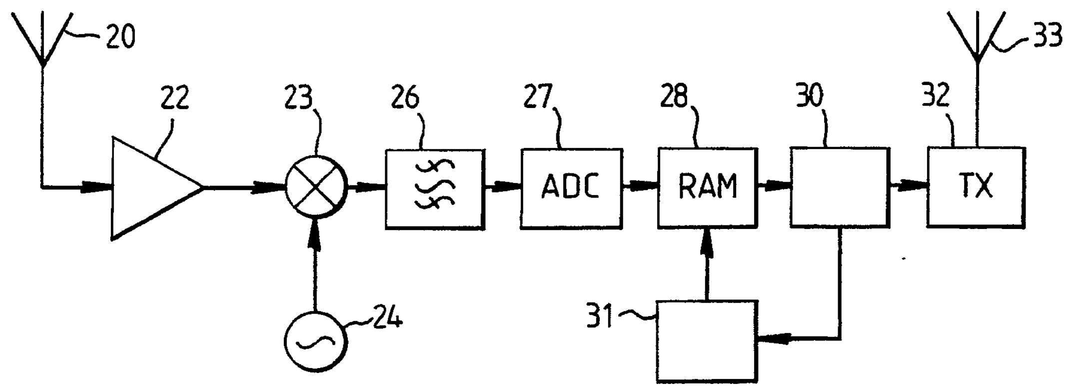


Fig. 3.

Fig. 4.


20
22
23
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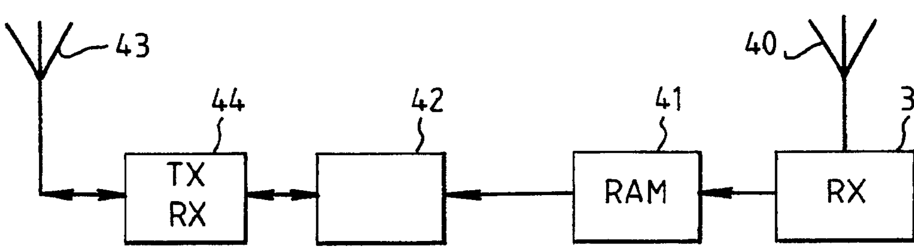
27
28
30
32
33
ADC
RAM
TX
24
31

Fig. 5.


43
44
42
41
40
38
TX
RX
RAM
RX

Individual evaluation system for motorcar risk

AB
(EP-700009)
The vehicle carries an electronic data processor linked to a speedometer, accelerometer, internal clock and calendar for checking and recording types of traffic hazard, duration of journey and other data related to safety. It can receive electromagnetic signal from the roadside related e.g. to speed limits, icing conditions and traffic jams, and can exchange data by wireless communication with a service station.

IN MINGUIJON PEREZ SALVADOR

PA MINGUIJON PEREZ SALVADOR

PA0 Minguijon Perez, Salvador; C/ Marcial no. 4, Pral B. Izqda; E-50005 Zaragoza (ES)

Published As

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EP0700009	19971112			A3 - Search report
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ES2108613	19980801			B1 - Patent published with search report
EP0700009	20010321			B1 - Patent specification
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G07C-005/08
G07C-005/10

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G06Q-099/00 [2006-01 A - I R M EP]

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G06Q-099/00 [2006 C - I R M EP]

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(EP-700009)
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European Patent Office
Office européen des brevets

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(54) **Individuelle-Bewertungssystem für das Risiko an selbstangetrieben Fahrzeuge**

(57) Unter die Indivieduelle-Bewertungssystem für das Risiko an selbsangetrieben-Fahrzeuge stellt sich ein Handlungsweise und elektronisches-Einrichtung vor, die die persönliches Versicherungsprämie in Funktion des ubernehmendes wirkliches Risiko-Schätzung erlaubt, in Basis nach die bestehende Wechselbeziehungen berechnet zwischen dieses und messbar Parameter im eigenen Fahrzeug.

Man stell ein strategisches-Betriebs Einfürhrung-Profil vor.

EP 0 700 009 A3

Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung
EP 95 50 0123

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Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	9.September 1997	Pottiez, M

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X : von besonderer Bedeutung allein betrachtet
Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie
A : technologischer Hintergrund
O : nichtschriftliche Offenbarung
P : Zwischenliteratur

T : der Erfindung zugrunde liegende Theorien oder Grundsätze
E : älteres Patentdokument, das jedoch erst am oder nach dem Anmeldedatum veröffentlicht worden ist
D : in der Anmeldung angeführtes Dokument
L : aus andern Gründen angeführtes Dokument

& : Mitglied der gleichen Patentfamilie, übereinstimmendes Dokument

EPO FORM 1503 03.82 (P04C03)

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(11) EP 0 895 173 A3

(12) # EUROPEAN PATENT APPLICATION

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(54) **Computer system for delivery of financial services**

(57) A computer system is provided for delivery of financial services, such as banking, general insurance, life assurance, pensions and investments, loans and mortgages, and financial planning and advisory services. The system comprises a number of user computers connected to a plurality of server computers by way of a network, such as the Internet. The system creates at least one mobile agent which obtains details of a user's requirements, obtains financial information from the server computers on behalf of the user in the light of the user's requirements, and then transports itself to the user's computer to deliver the financial information to the user.

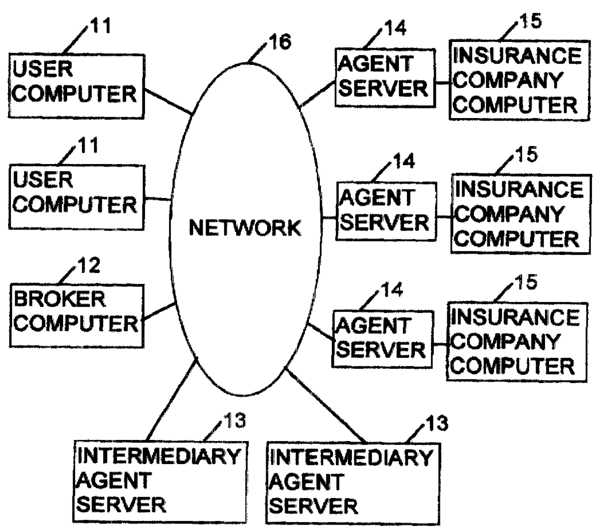

FIG.1

EP 0 895 173 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 4989

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 4989

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	12 December 2002	May, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 30 4989

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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12-12-2002

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

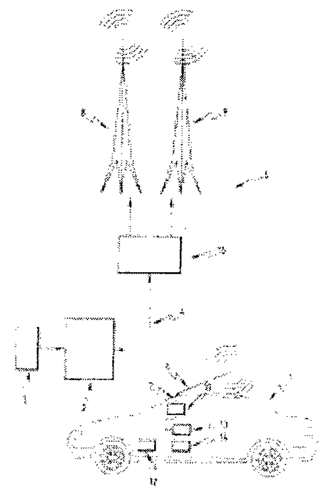

FIG.1

Remote reprogramming system of at least a computer of an informatics system on board of an automobile

AB
(EP1128265)
The remote reprogramming system has a central server (2), where reprogramming information is stored, connected to a data communication network (4) which is in turn connected to a broadcast network (5,9). Each vehicle (1) is fitted with a receiver (6,7,11) of broadcast signals, and devices (12,13,14) to extract the reprogramming information and to use the information to reprogram its on-board computer(s).

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	FR2805365	20010824	2000FR-0002195	20000222	A1 - Application for patent of invention, (first publ.)
	EP1128265	20010829	2001EP-0400351	20010209	A1 - Application published with search report
	FR2805365	20021129			B1 - Patent of invention (second publication)

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H04L-029/06 [2006-01 A - I R M EP];
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(11) EP 1 128 265 A1

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(54) Système de reprogrammation à distance d'au moins un calculateur d'un système informatique embarqué à bord d'un véhicule automobile

(57) Ce système de reprogrammation à distance d'au moins un calculateur d'un système informatique embarqué à bord d'un véhicule automobile (1), est caractérisé en ce qu'il comporte des moyens (2) formant centre-serveur dans lequel sont stockées des informations de reprogrammation du calculateur, raccordés par un réseau (4) de communication d'informations à une infrastructure de télécommunication (5) adaptée pour entrer en contact et échanger des informations avec des moyens de télécommunication complémentaires (6) embarqués à bord du véhicule (1) et raccordés à un réseau de transmission d'informations (7) interne au véhicule auquel est raccordé le calculateur pour permettre la reprogrammation à distance de celui-ci.

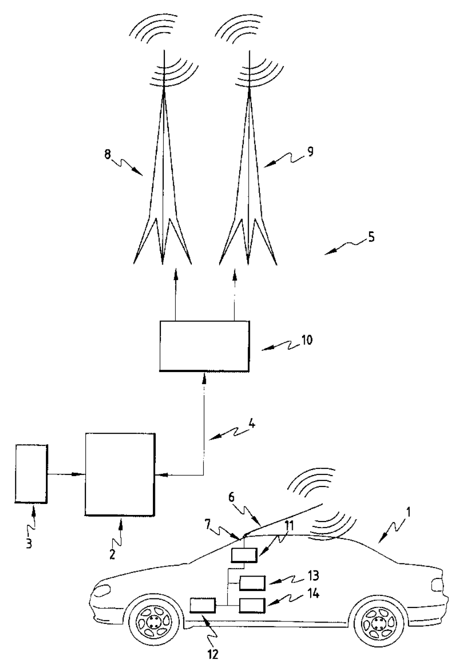

FIG.1

EP 1 128 265 A1

Description

[0001] La présente invention concerne un système de reprogrammation à distance d'au moins un calculateur d'un système informatique embarqué à bord d'un véhicule automobile.

[0002] On assiste depuis plusieurs années à une intégration croissante de calculateurs à bord des véhicules automobiles.

[0003] Il peut arriver que pour diverses raisons, il soit nécessaire de reprogrammer tout ou partie d'un ou de plusieurs de ces calculateurs.

[0004] Cette reprogrammation peut par exemple concerner la correction d'un programme, la correction d'une stratégie de contrôle et de commande d'un organe fonctionnel ou une modification de paramètres d'une fonction.

[0005] Cette reprogrammation nécessite alors la reprise du parc de véhicules par une campagne de rappel qui coûte souvent cher aux constructeurs aussi bien en terme d'image de marque qu'en terme financier.

[0006] Le but de l'invention est donc de résoudre ces problèmes.

[0007] A cet effet, l'invention a pour objet un système de reprogrammation à distance d'au moins un calculateur d'un système informatique embarqué à bord d'un véhicule automobile, caractérisé en ce qu'il comporte des moyens formant centre-serveur dans lequel sont stockées des informations de reprogrammation du calculateur, raccordés par un réseau de communication d'informations à une infrastructure de télécommunication adaptée pour entrer en contact et échanger des informations avec des moyens de télécommunication complémentaires embarqués à bord du véhicule et raccordés à un réseau de transmission d'informations interne au véhicule auquel est raccordé le calculateur pour permettre la reprogrammation à distance de celui-ci.

[0008] L'invention sera mieux comprise à la lecture de la description qui va suivre, donnée uniquement à titre d'exemple et faite en se référant aux dessins annexés, sur lesquels :

- la Fig.1 représente un schéma synoptique illustrant la structure d'un tel système de reprogrammation ; et
- la Fig.2 représente un organigramme illustrant le fonctionnement de celui-ci.

[0009] On a en effet représenté sur cette figure 1, un système de reprogrammation à distance d'au moins un calculateur d'un système informatique embarqué à bord d'un véhicule automobile.

[0010] Le véhicule automobile est désigné par la référence générale 1 sur cette figure.

[0011] Ce système comporte des moyens formant centre-serveur désignés par la référence générale 2, munis de moyens désignés par la référence générale 3 de stockage d'informations de reprogrammation de ce calculateur.

[0012] Ces moyens formant centre-serveur sont raccordés par un réseau de communication d'informations désigné par la référence générale 4, à une infrastructure de télécommunication désignée par la référence générale 5, adaptée pour entrer en contact et échanger des informations avec des moyens de télécommunication complémentaires désignés par la référence générale 6, embarqués à bord du véhicule 1 et raccordés à un réseau de transmission d'informations interne au véhicule, désigné par la référence générale 7, auquel est raccordé le calculateur pour permettre la reprogrammation à distance de celui-ci.

[0013] L'infrastructure de télécommunication peut comporter par exemple différents pylônes d'émission/réception d'informations tels que les pylônes désignés par les références 8 et 9 sur cette figure, répartis sur un territoire donné pour couvrir celui-ci, ces différents pylônes étant reliés à une base de télécommunication désignée par la référence générale 10.

[0014] De nombreux opérateurs mettent en oeuvre ce type d'infrastructures de télécommunication, celles-ci pouvant être utilisées pour entrer en contact et échanger des informations avec un véhicule.

[0015] Comme cela a été indiqué précédemment, le véhicule comporte des moyens de télécommunication complémentaires 6 comportant par exemple une antenne adaptée pour échanger des informations avec l'infrastructure de télécommunication, cette antenne étant reliée à un réseau de transmission d'informations interne au véhicule désigné par la référence générale 7.

[0016] Ce réseau est alors géré par exemple par un calculateur central 11 du véhicule et est raccordé à différents calculateurs embarqués à bord du véhicule, tels que par exemple les calculateurs désignés par les références 12,13 et 14 sur cette figure.

[0017] Ces calculateurs peuvent par exemple comporter le calculateur de contrôle du fonctionnement du moteur du véhicule, le calculateur de contrôle du fonctionnement de la boîte de vitesses, le calculateur de contrôle du fonctionnement des suspensions, le calculateur de contrôle des moyens de freinage, etc...

[0018] Le système tel que décrit peut alors être utilisé pour assurer la reprogrammation d'au moins l'un de ces calculateurs.

[0019] A cet effet, lors du déclenchement d'une opération de reprogrammation d'un calculateur, le centre-serveur 2 déclenche l'émission d'une requête de mise en contact avec un véhicule déterminé, à destination de l'infrastructure de télécommunication qui recherche alors dans une base de données correspondantes, les coordonnées téléphoniques de ce véhicule afin de permettre l'établissement de la communication avec ce véhicule.

[0020] Cette étape est désignée par la référence générale 15 sur la figure 2 et permet d'établir une connexion entre le centre-serveur et le véhicule, en 16.

[0021] Au début de cette communication, le calculateur central 11 du véhicule émet à destination du centre-serveur, des informations d'identification du véhicule, telles que par exemple un numéro d'identification de celui-ci et des informations d'identification de sa composition et en particulier de sa composition électronique et informatique.

[0022] Cette étape est illustrée en 17 sur la figure 2.

[0023] En 18, le centre-serveur émet à destination du véhicule, des informations de déverrouillage du système informatique embarqué à bord du véhicule et en particulier du calculateur central 11 de celui-ci.

[0024] Ces informations de déverrouillage sont alors comparées par exemple à des informations prédéterminées stockées dans le calculateur central 11 pour valider ou non le déverrouillage du système.

[0025] Si les informations de déverrouillage sont incorrectes, le système reste verrouillé et la procédure de reprogrammation est rejetée, comme cela est illustré en 19 sur cette figure 2.

[0026] Par contre, si le déverrouillage est accepté, le calculateur central 11 vérifie si des conditions de sécurité de fonctionnement du véhicule sont remplies comme cela est illustré en 20 sur la figure 2.

[0027] Ces conditions peuvent par exemple concerner le fait que le véhicule est à l'arrêt ou non, etc...

[0028] Si ces conditions de sécurité sont remplies, le calculateur central 11 assure le blocage des autres calculateurs du véhicule comme cela est illustré en 21 pour inhiber toute intervention possible d'un utilisateur du véhicule afin de ne pas perturber la reprogrammation de ces calculateurs.

[0029] Cette étape peut par exemple être associée à la génération d'un signal d'avertissement de l'utilisateur du véhicule lui indiquant qu'une opération de reprogrammation est en cours afin de bien lui faire comprendre ce qui se passe.

[0030] Une fois le système informatique embarqué à bord du véhicule bloqué, le calculateur central 11 assure la reprogrammation du ou des calculateurs correspondants lors de l'étape 22 à partir des informations reçues du centre-serveur par l'intermédiaire de l'infrastructure de télécommunication.

[0031] Le calculateur central 11 détermine alors le ou les calculateurs à reprogrammer et assure la reprogrammation de ceux-ci à travers le réseau de transmission d'informations interne au véhicule.

[0032] Une fois cette reprogrammation effectuée, le calculateur central 11 déclenche en 23 une vérification de la procédure de reprogrammation sur chaque calculateur modifié afin que ces derniers vérifient leur bon chargement.

[0033] Enfin, lors de l'étape 24, le calculateur central 11 mémorise un historique des opérations de reprogrammation et émet à destination du centre-serveur un compte rendu de l'opération de reprogrammation afin qu'une trace de cette opération soit conservée au niveau de ce centre-serveur.

[0034] Cette émission est illustrée en 25 sur cette figure 2.

[0035] La procédure est alors terminée en 26.

[0036] Un tel système peut mettre en oeuvre des messages de type Internet émanant par exemple d'un centre-serveur d'une station d'un garage central d'un constructeur correspondant qui émet alors un code de recherche pour identifier un véhicule concerné.

[0037] Ce code qui correspond par exemple au numéro d'identification d'un véhicule permet d'identifier la composition électronique de celui-ci, le nombre de calculateurs, le type de systèmes de contrôle présents, l'état des versions, etc..

[0038] Si le calculateur central du véhicule reconnaît ce numéro, il accepte la communication et permet ainsi la procédure de reprogrammation.

[0039] Deux cas peuvent alors être prévus, selon que le véhicule est activé ou non.

[0040] Si le véhicule n'est pas activé, il n'y a aucune modification possible des calculateurs du véhicule, car le système informatique est considéré comme non opérationnel.

[0041] Ceci permet d'éviter de remettre à jour des véhicules non utilisés régulièrement.

[0042] Par contre, si le véhicule est activé, c'est-à-dire que l'ensemble des calculateurs est sous tension, que ce véhicule soit roulant ou à l'arrêt, le calculateur central de celui-ci peut admettre la requête de modification d'un ou des calculateurs.

[0043] A cet effet, le calculateur central doit attendre que le conducteur du véhicule arrête celui-ci et coupe le contact.

[0044] Le calculateur central peut alors maintenir l'alimentation du système informatique afin de pouvoir effectuer toutes les modifications nécessaires tout en gardant un maximum de sécurité.

[0045] C'est ainsi que ces modifications sont effectuées lorsque le conducteur n'utilise pas le véhicule.

[0046] Comme cela a été indiqué précédemment, l'ensemble des calculateurs du véhicule est relié par l'intermédiaire d'un réseau interne au véhicule, ce qui permet d'assurer la transmission des informations.

[0047] L'opération de reprogrammation n'est bien entendu autorisée qu'à partir du moment où le système informatique a été déverrouillé par l'utilisation d'un mot de passe correct.

[0048] Dans le cas où l'ensemble des modifications n'est pas terminé alors que le conducteur rentre à nouveau dans son véhicule, il peut être nécessaire de faire apparaître au niveau du tableau de bord, un avertissement indiquant que le véhicule est momentanément indisponible et en inhibant toute action par exemple sur la clé de contact du véhicule.

[0049] Le conducteur comprend alors qu'une mise à jour automatique des calculateurs de son véhicule est en train d'être effectuée.

[0050] Une fois les modifications effectuées, le calculateur central lance un contrôle automatique de ces calculateurs afin de s'assurer du bon fonctionnement de cette opération de reprogrammation.

[0051] Le calculateur central stocke également, par exemple par écriture en Flash EPROM, l'ensemble des opérations de reprogrammation avec leur date, le type de modification, etc..., puis coupe automatiquement l'alimentation des calculateurs.

[0052] Lorsque le conducteur du véhicule reprend son véhicule, il voit par exemple par une indication au tableau de bord qu'une mise à jour a été effectuée.

[0053] Il peut alors soit passer chez un garagiste pour connaître l'ensemble des problèmes résolus, soit interroger directement le centre-serveur et voir afficher sur un site Internet par exemple, l'ensemble des modifications.

[0054] Le réseau du constructeur conserve également en mémoire toutes les opérations effectuées sur le véhicule.

[0055] L'utilisation de numéros d'identification des véhicules permet également à un constructeur de connaître l'ensemble du parc de véhicules concernés.

[0056] En cas de panne ou d'accident, un réparateur quelconque peut également interroger le véhicule pour connaître son identification et donc sa composition et adapter les interventions de dépannage en fonction de celui-ci.

[0057] Le calculateur central peut d'ailleurs détecter une anomalie ou un dysfonctionnement du véhicule et émettre à destination du centre-serveur du constructeur, un message correspondant afin que celui-ci ait un historique des pannes et puisse intervenir plus efficacement dans la recherche d'un problème ou l'explication d'un dysfonctionnement.

[0058] Bien entendu, les opérations de reprogrammation des calculateurs peuvent se faire soit systématiquement, soit à la requête d'un client, par exemple dans le cadre d'un contrat de maintenance préventive.

[0059] Un tel système permet également une communication entre par exemple un garagiste et un véhicule pour permettre un diagnostic de l'ensemble du fonctionnement du système informatique du véhicule sans intervention humaine sur le véhicule.

[0060] Le calculateur central transmet alors les requêtes de diagnostic à l'ensemble des calculateurs du véhicule et émet des informations de diagnostic pour analyse par le garagiste.

[0061] Toutes les opérations classiques de diagnostic faites aujourd'hui par les systèmes de test en garage, peuvent alors être faites sur ce même principe, ce qui permet d'éviter non seulement le développement de nouveaux moyens de diagnostic, mais également des interventions humaines sur les véhicules.

[0062] Une telle opération peut par exemple être réalisée par un spécialiste de tel ou tel calculateur qui peut alors l'interroger à distance, afin d'aider à la recherche d'une panne.

[0063] On notera également que les moyens formant centre-serveur dans lesquels sont stockées des informations de reprogrammation peuvent être raccordés à l'infrastructure de télécommunication par un réseau de communication à liaison filaire, à satellite, etc...

[0064] Bien entendu, d'autres modes de réalisation encore d'un tel système peuvent être envisagés.

Revendications

1. Système de reprogrammation à distance d'au moins un calculateur d'un système informatique embarqué à bord d'un véhicule automobile (1), caractérisé en ce qu'il comporte des moyens (2) formant centre-serveur dans lequel sont stockées des informations de reprogrammation du calculateur, raccordés par un réseau (4) de communication d'informations à une infrastructure de télécommunication (5) adaptée pour entrer en contact et échanger des informations avec des moyens de télécommunication complémentaires (6) embarqués à bord du véhicule (1) et raccordés à un réseau de transmission d'informations (7) interne au véhicule auquel est raccordé le calculateur pour permettre la reprogrammation à distance de celui-ci.

2. Système selon la revendication 1, caractérisé en ce que le système informatique du véhicule comporte un calculateur central (11) de gestion du fonctionnement de celui-ci.

3. Système selon la revendication 1 ou 2, caractérisé en ce que lors du lancement d'une opération de reprogrammation par le centre-serveur, l'infrastructure de télécommunication (5) est adaptée pour rechercher les coordonnées téléphoniques du véhicule dans une base de données afin d'entrer en communication avec celui-ci (en 15 et 16) de manière à permettre un échange d'informations d'identification entre le centre-serveur et le véhicule (en 17) pour déverrouiller ou non (en 18) le système informatique et en ce qu'en cas de déverrouillage du système, le calculateur central (11) est adapté pour vérifier (en 20) des conditions de sécurité liées au fonctionnement du véhicule, bloquer (en 21) les calculateurs du système, assurer (en 22) la reprogrammation du ou des calculateurs correspondants, déclencher (en 23) une opération de vérification de la procédure de reprogrammation et assurer (en 24), une mémorisation de cette opération et l'émission à destination du centre-serveur d'un compte rendu de cette opération de reprogrammation avant d'autoriser à nouveau l'utilisation du véhicule.

4. Système selon la revendication 3, caractérisé en ce que le calculateur central (11) et le centre-serveur (2) comprennent des moyens de diagnostic du fonctionnement du système informatique du véhicule.

5. Système selon l'une quelconque des revendications précédentes, caractérisé en ce que les moyens (2) formant centre-serveur sont raccordés à l'infrastructure de télécommunication (5) par un réseau de communication filaire.

6. Système selon l'une quelconque des revendications précédentes, caractérisé en ce que les moyens (2) formant centre-serveur sont raccordés à l'infrastructure de télécommunication (5) par un réseau de communication à satellite.

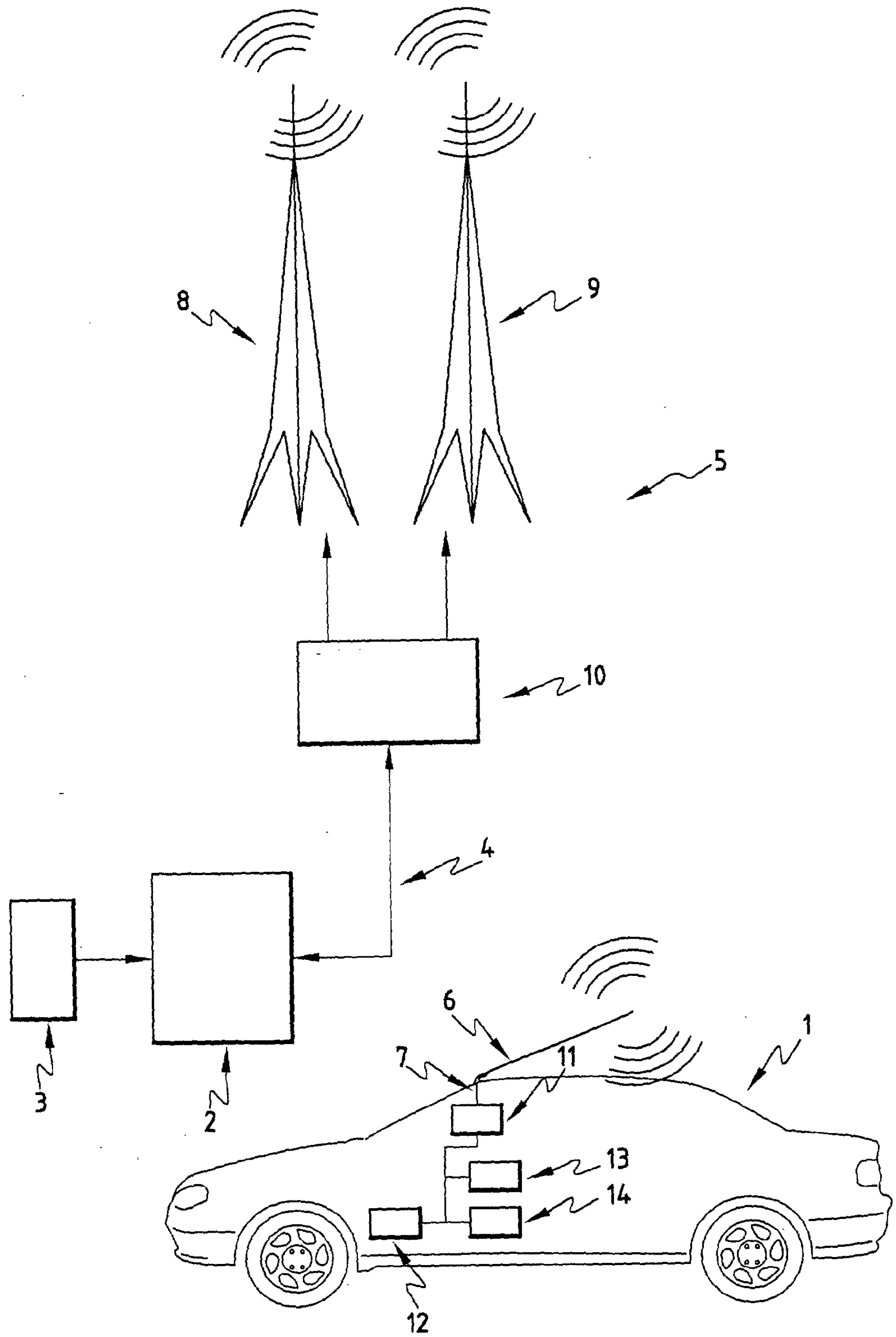

FIG.1

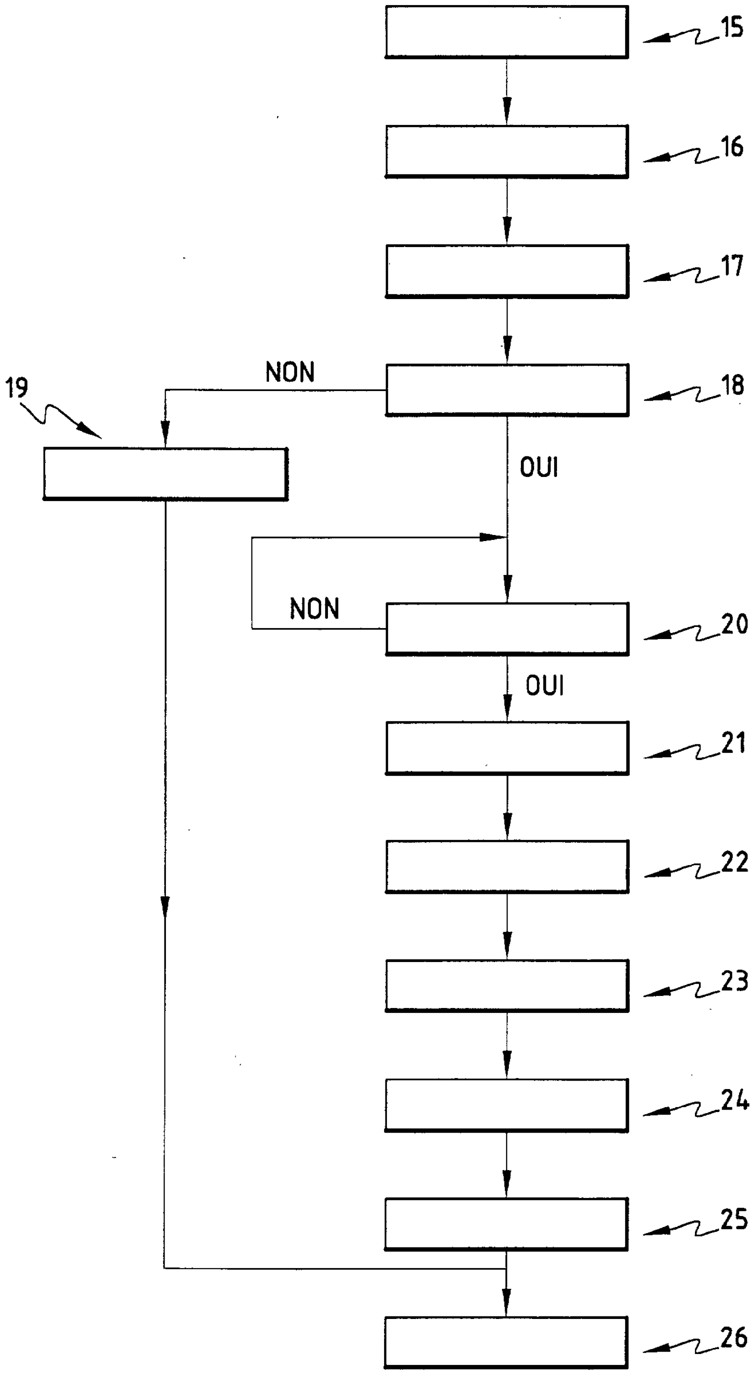

FIG.2

Office européen des brevets

RAPPORT DE RECHERCHE EUROPEENNE

Numéro de la demande
EP 01 40 0351

DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	Revendication concernée	CLASSEMENT DE LA DEMANDE (Int.Cl.7)
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G06F
H04L
B60R

Le présent rapport a été établi pour toutes les revendications

Lieu de la recherche	Date d'achèvement de la recherche	Examinateur
LA HAYE	11 juin 2001	Kingma, Y

CATEGORIE DES DOCUMENTS CITES

X : particulièrement pertinent à lui seul
Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie
A : arrière-plan technologique
O : divulgation non-écrite
P : document intercalaire

T : théorie ou principe à la base de l'invention
E : document de brevet antérieur, mais publié à la date de dépôt ou après cette date
D : cité dans la demande
L : cité pour d'autres raisons

& : membre de la même famille, document correspondant

EPO FORM 1503 03.82 (P04C02)

ANNEXE AU RAPPORT DE RECHERCHE EUROPEENNE RELATIF A LA DEMANDE DE BREVET EUROPEEN NO. EP 01 40 0351

La présente annexe indique les membres de la famille de brevets relatifs aux documents brevets cités dans le rapport de recherche européenne visé ci-dessus.
Lesdits members sont contenus au fichier informatique de l'Office européen des brevets à la date du
Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsabilité de l'Office européen des brevets.

11-06-2001

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EPO FORM P0460

Pour tout renseignement concernant cette annexe : voir Journal Officiel de l'Office européen des brevets, No.12/82

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

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(54) Monitoring system for determining and communicating a cost of insurance

(57) A method and system for communicating insurance related services between an insured and an insurer through an Internet communication scheme includes a processing system for processing acquired event and sensored data to compute the cost of insurance for the same period as the data is acquired. An enhanced Internet communication scheme provides an insured access to the acquired data and its processing through enhanced presentation systems (e.g., maps with usage, service or special event processing or even automobile service diagnostics.) In addition, communication packages can provide estimates based upon user-supplied information identifying projected usages.

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Description

Field of the Invention

[0001] The present invention relates to data acquisition, processing and communicating systems, and particularly to a system for acquiring and handling relevant data for an insured unit of risk for purposes of providing a more accurate determination of cost of insurance for the unit of risk and for communicating or quoting the so determined cost to an owner of the unit of risk. Although the invention has its principal applicability to motor vehicles such as automobiles, the invention is equally applicable to other units of risk such as, without limitation, motorcycles, motor homes, trucks, tractors, vans, buses, boats and other water craft and aircraft. The invention especially relates to a system for monitoring and communicating units of risk operational characteristics and operator actions for implementing the operational characteristics, to obtain increased amounts of data relating to the safety or risk of use for a subject unit, for purposes of providing a more accurate determination of the cost of insurance corresponding to a real time usage of the risk unit, and for making such data and computed costs accessible to a customer or insured or others on hardcopy, over the Internet or by other electronic means for convenient communication. The invention relates to electronic commerce, particularly where insurance and related information is marketed, sold or communicated via the Internet or other interactive network.

Background of the Invention

[0002] Conventional methods for determining costs of motor vehicle insurance involve gathering relevant historical data from a personal interview with the applicant for the insurance and by referencing the applicant's public motor vehicle driving record that is maintained by a governmental agency, such as a Bureau of Motor Vehicles. Such data results in a classification of the applicant to a broad actuarial class for which insurance rates are assigned based upon the empirical experience of the insurer. Many factors are relevant to such classification in a particular actuarial class, such as age, sex, marital status, location of residence and driving record.

[0003] The current system of insurance creates groupings of vehicles and drivers (actuarial classes) based on the following types of classifications.

Vehicle		
	Age;	
	manufacturer, model; and	
	value.	
Driver		
	Age;	
	sex;	
	marital status;	
	driving record (based on government reports),	violations (citations);
	at fault accidents; and	
	place of residence.	
Coverage		
	Types of losses covered,	
	liability,	
	uninsured motorist,	
	comprehensive, and	
	collision;	
	liability limits; and deductibles.	

[0004] The classifications, such as age, are further broken into actuarial classes, such as 21 to 24, to develop a unique vehicle insurance cost based on the specific combination of actuarial classes for a particular risk. For example, the following information would produce a unique vehicle insurance cost.

Vehicle		
	Age	1997 (three years old)
	manufacturer, model	Ford, Explorer XLT

(continued)

	value	$ 18,000.
Driver		
	Age	38 years old
	sex	male
	marital status	single
	driving record (based on government reports)	
	violations	1 point (speeding)
	at fault accidents	3 points (one at fault accident)
	place of residence	33619 (zip code)
Coverage		
	Types of losses covered	
	liability	yes
	uninsured motorist	no
	comprehensive	yes
	collision	yes
	liability limits	$100,000./$300,000./$50,000.
	deductibles	$500./$500.

[0005] A change to any of this information would result in a different premium being charged, if the change resulted in a different actuarial class for that variable. For instance, a change in the drivers' age from 38 to 39 may not result in a different actuarial class, because 38 and 39 year old people may be in the same actuarial class. However, a change in driver age from 38 to 45 may result in a different premium because of the change in actuarial class.

[0006] Current insurance rating systems also provide discounts and surcharges for some types of use of the vehicle, equipment on the vehicle and type of driver. Common surcharges and discounts include:

Surcharges	
	Business use.
Discounts	
	Safety equipment on the vehicle
	airbags, and
	antilock brakes;
	theft control devices
	passive systems (e.g. "The Club"), and
	alarm system; and
	driver type
	good student, and
	safe driver (accident free).
	group
	senior drivers
	fleet drivers

[0007] A principal problem with such conventional insurance determination systems is that much of the data gathered from the applicant in the interview is not verifiable, and even existing public records contain only minimal information, much of which has little relevance towards an assessment of the likelihood of a claim subsequently occurring. In other words, current rating systems are primarily based on past realized losses. None of the data obtained through conventional systems necessarily reliably predicts the manner or safety of future operation of the vehicle. Accordingly, the limited amount of accumulated relevant data and its minimal evidential value towards computation of a fair cost of insurance has generated a long-felt need for an improved system for more reliably and accurately accumulating data having a highly relevant evidential value towards predicting the actual manner of a vehicle's future operation.

[0008] Many types of vehicle operating data recording systems have heretofore been suggested for purposes of maintaining an accurate record of certain elements of vehicle operation. Some are suggested for identifying the cause for an accident, others are for more accurately assessing the efficiency of operation. Such systems disclose a variety of conventional techniques for recording vehicle operation data elements in a variety of data recording systems. In addition, it has also been suggested to provide a radio communication link for such information via systems such as a cellular telephone to provide immediate communication of certain types of data elements or to allow a more immediate response in cases such as theft, accident, break-down or emergency. It has even been suggested to detect and record seatbelt usage to assist in determination of the vehicle insurance costs (U.S. Patent No. 4,667,336).

[0009] The various forms and types of vehicle operating data acquisition and recordal systems that have heretofore been suggested and employed have met with varying degrees of success for their express limited purposes. All possess substantial defects such that they have only limited economical and practical value for a system intended to provide an enhanced acquisition, recordal and communication system of data which would be both comprehensive and reliable in predicting an accurate and adequate cost of insurance for the vehicle. Since the type of operating information acquired and recorded in prior art systems was generally never intended to be used for determining the cost of vehicle insurance, the data elements that were monitored and recorded therein were not directly related to predetermined safety standards or the determining of an actuarial class for the vehicle operator. For example, recording data characteristics relevant to the vehicle's operating efficiency may be completely unrelated to the safety of operation of the vehicle. Further, there is the problem of recording and subsequently compiling the relevant data for an accurate determination of an actuarial profile and an appropriate insurance cost therefor.

[0010] Current motor vehicle control and operating systems comprise electronic systems readily adaptable for modification to obtain the desired types of information relevant to determination of the cost of insurance. Vehicle tracking systems have been suggested which use communication links with satellite navigation systems for providing information describing a vehicle's location based upon navigation signals. When such positioning information is combined with roadmaps in an expert system, vehicle location is ascertainable. Mere vehicle location, though, will not provide data particularly relevant to safety of operation unless the data is combined with other relevant data in an expert system which is capable of assessing whether the roads being driven are high-risk or low-risk with regard to vehicle safety.

[0011] On-line Web sites for marketing and selling goods have become common place. Many insurers offer communication services to customers via Web sites relevant to an insured profile and account status. Commonly assigned pending application U.S. Serial No. 09/135,034, filed August 17, 1998, now U.S. Patent No. 6,064,970 discloses one such system. Customer comfort with such Web site communication has generated the need for systems which can provide even more useful information to customers relative to a customer's contract with the insurer. Such enhanced communications can be particularly useful to an insured when the subject of the communications relates to real time cost determination, or when the subject relates to prospective reoccurring insurable events wherein the system can relate in the existing insured's profile with some insurer provided estimates of a future event for deciding an estimated cost of insuring the event.

[0012] The present invention contemplates a new and improved monitoring, recording and communicating system for an insured unit of risk, which primarily overcomes the problem of determining cost of vehicle insurance based upon data which does not take into consideration how a specific unit of risk is operated. The subject invention will base insurance charges with regard to current material data representative of actual operating characteristics to provide a classification rating of an operator or the unit in an actuarial class which has a vastly reduced rating error over conventional insurance cost systems. Additionally, the present invention allows for frequent (monthly) adjustment to the cost of coverage because of the changes in operating behavior patterns. This can result in insurance charges that are readily controllable by individual operators. The system is adaptable to current electronic operating systems, tracking systems and communicating systems for the improved extraction of selected insurance related data. In addition, the system provides for enhanced and improved communication of the relevant acquired data, cost estimates of insuring events and customer insured profiles through an Internet/Web site.

Brief Summary of the Invention

[0013] In accordance with the present invention, there is disclosed a method of determining a cost of automobile insurance based upon monitoring, recording and communicating data representative of operator and vehicle driving characteristics, whereby the cost is adjustable by relating the driving characteristics to predetermined safety standards. The method is comprised of steps of monitoring a plurality of raw data elements representative of an operating state of a vehicle or an action of the operator. Selected ones of the plurality of raw data elements are recorded when they are determined to have an identified relationship to the safety standards. The recorded elements are consolidated for processing against an insured profile and for identifying a surcharge or discount to be applied to a base cost of automobile insurance. The total cost of insurance obtained from combining the base cost and surcharges or discounts is produced as a final cost to the operator.

[0014] In accordance with another aspect of the present invention, the recording comprises identifying a trigger event associated with the raw data elements which has an identified relationship to the safety standards so that trigger information representative of the event is recorded.

[0015] In accordance with a more limited aspect of the present invention, the method comprises a step of immediately communicating to a central control station via an uplink, information representative of the trigger event and recording response information generated by the control station.

[0016] In accordance with yet another aspect of the present invention, the method comprises steps of generating calculated data elements and derived data elements from the raw data elements, and accumulating the calculated and derived data elements in a recording device.

[0017] In accordance with the present invention, there is provided a method and system for Internet on-line communicating, between an insurer and an insured, of detected operating characteristics of a unit of risk, (e.g., a vehicle) for a selected period, and the cost of insuring the unit for the selected period, as decided by the insurer in consideration of the detected operating characteristics. A Web site system is provided for selectively communicating the operating characteristics and the cost between the insurer and the insured. A monitoring system monitors the operating characteristics. A storage system stores the operating characteristics and is accessible to the Web site system. A processing system decides the cost of insuring the unit for a period based upon the operating characteristics monitored during that period. The processing system is also accessible to the Web site system.

[0018] One benefit obtained by use of the present invention is a system that will provide precise and timely information about the current operation of an insured motor vehicle that will enable an accurate determination of operating characteristics, including such features as miles driven, time of use and speed of the vehicle. This information can be used to establish actual usage based insurance charges, eliminating rating errors that are prevalent in traditional systems and will result in vehicle insurance charges that can be directly controlled by individual operators.

[0019] It is another benefit of the subject invention that conventional motor vehicle electronics are easily supplemented by system components comprising a data recording process, a navigation system and a communications device to extract selected insurance relevant data from the motor vehicle.

[0020] It is another object of the present invention to generate actuarial classes and operator profiles relative thereto based upon actual driving characteristics of the vehicle and driver, as represented by the monitored and recorded data elements for providing a more knowledgeable, enhanced insurance rating precision.

[0021] It is another aspect of the present invention that an on-line Web site is provided for communicating data, services, and estimates to customers via an Internet Web Site, including estimated costs for expected operating usage for a particular unit of risk. Accordingly, the real time cost determination and communication through the Web site provides the type of enhanced communications between a customer and an insurer that can be particularly useful in limiting costs, and enhancing safety.

[0022] It is another benefit of the invention that a user of a unit of risk may be authenticated as a proper user of the unit, and a more accurate rating for the authenticated user may be implemented for the computation of insurance costs.

[0023] The subject new insurance rating system retrospectively adjusts and prospectively sets premiums based on data derived from motor vehicle operational characteristics and driver behavior through the generation of new actuarial classes determined from such characteristics and behavior, which classes heretofore have been unknown in the insurance industry. The invention comprises an integrated system to extract via multiple sensors, screen, aggregate and apply for insurance rating purposes, data generated by the actual operation of the specific vehicle and the insured user/driver.

Brief Description of the Drawings

[0024] The invention may take physical form in certain parts and steps and arrangements of parts and steps, the preferred embodiments of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof and wherein:

FIGURE 1 is a block diagram/flowchart generally describing data capture methods within a unit of risk for insurance in claims processing;

FIGURE 2 is a block diagram generally illustrated in the communication network design the unit of risk including a response center of the insurer and a data handling center;

FIGURE 3 is a suggestive perspective drawing of a vehicle including certain data elements monitoring, recording and communication devices;

FIGURE 4 is a block diagram of a vehicle onboard computer and recording system implementing the subject invention for selective communication with a central operations control center and a global positioning navigation system;

FIGURE 5 is a block diagram illustrating use of acquired data including communication through Internet access; and,

FIGURE 6 is a block diagram/flowchart illustrating an underwriting and rating method for determining a cost of insurance in conjunction with the system of FIG. 4.

Detailed Description of the Preferred Embodiments

[0025] The following terms and acronyms are used throughout the detailed description:

[0026] Internet. A collection of interconnected (public and/or private) networks that are linked together by a set of standard protocols (such as TCP/IP and HTTP) to form a global, distributed network. While this term is intended to refer to what is now commonly known as the Internet, it is also intended to encompass variations which may be made in the future, including changes and additions to existing standard protocols.

[0027] World Wide Web ("Web"). Used herein to refer generally to both (i) a distributed collection of interlined, user-viewable hypertext documents (commonly referred to as Web documents or Web pages) that are accessible via the Internet, and (ii) the client and server software components which provide user access to such documents using standardized Internet protocols. Currently, the primary standard protocol for allowing applications to locate and acquire Web documents is HTTP, and the Web pages are encoded using HTML. However, the terms "Web" and "World Wide Web" are intended to encompass future markup languages and transport protocols which may be used in place of (or in addition to) HTML and HTTP.

[0028] Web Site. A computer system that serves informational content over a network using the standard protocols of the World Wide Web. Typically, a Web site corresponds to a particular Internet domain name, such as "progressive. com," and includes the content associated with a particular organization. As used herein, the term is generally intended to encompass both (i) the hardware/software server components that serve the informational content over the network, and (ii) the "back end" hardware/software components including any non-standard or specialized components, that interact with the server components to perform services for Web site users.

[0029] Referring now to the drawings, wherein the showings are for purposes of illustrating the preferred embodiments of the invention only and not for purposes of limiting same, the FIGURES show an apparatus and method for monitoring, recording and communicating insurance related data for determination of an accurate cost of insurance based upon evidence relevant to the actual operation and in particular the relative safety of that operation. Generally, a unit of risk, e.g., vehicle, user is charged for insurance based upon statistical averages related to the safety of operation based upon the insurer's experience with other users who drive similar vehicles in a similar geographic area. The invention allows for the measure of the actual data while the motor vehicle is being driven. Such data measurement will allow the vehicle user to directly control his/her insurance costs by operating the vehicle in a manner which he/she will know will evidence superior safety of operation and a minimal risk of generation of an insurance claim. Examples of data which can be monitored and recorded include:

1. Actual miles driven;
2. Types of roads driven on (high risk vs. low risk); and,
3. Safe operation of the vehicle by the vehicle user through:

    A. speeds driven,
    B. safety equipment used, such as seat belt and turn signals,
    C. time of day driven (high congestion vs. low congestion),
    D. rate of acceleration,
    E. rate of braking,
    F. observation of traffic signs.

4. Driver identification

[0030] With reference to FIGURE 3, an exemplary motor vehicle is shown in which the necessary apparatus for implementing the subject invention is included. An on-board computer **300** monitors and records various sensors and operator actions to acquire the desired data for determining a fair cost of insurance. Although not shown therein, a plurality of operating sensors are associated with the motor vehicle to monitor a wide variety of raw data elements. Such data elements are communicated to the computer through a connections cable which is operatively connected to the vehicle data bus **304** through an SAE-J1978 connector, or OBD-II connector or other vehicle sensors **306**. A driver input device 308 is also operatively connected to the computer **300** through connector **307** and cable 302. The computer is powered through the car battery **310**, a conventional generator system, a battery or a solar based system (not shown). Tracking of the vehicle for location identification can be implemented by the computer **300** through navigation signals obtained from a GPS (global positioning system) antenna, a differential GPS or other locating system **312**. The communications link to a central control station is accomplished through the cellular telephone, radio, satellite or other wireless communication system **314**.

[0031] FIGURE 4 provides the block diagram of the in-vehicle computer system. The computer **300** is comprised of several principal components, an on-board data storage device, an input/output subsystem for communicating to a variety of external devices, a central processing unit and memory device and a real time operating kernel for controlling the various processing steps of the computer **300.** It is known that all of these functions can be included in a single dedicated microprocessor circuit **300.** The computer **300** essentially communicates with a number of on-board vehicle devices for acquisition of information representative of various actual vehicle operating characteristics. A driver input console **410** allows the driver to input data representative of a need for assistance or for satisfaction of various threshold factors which need to be satisfied before the vehicle can be operated.

[0032] For example, a driver authentication system is intended, such as where several individual drivers (same family, etc.) may properly use the vehicle but each may have different ratings for insurance computations.

[0033] The physical operation of the vehicle is monitored through various sensors **412** in operative connection with the vehicle data bus, while additional sensors **414** not normally connected to the data bus can be in direct communication with the computer **300** as will hereinafter be more fully explained.

[0034] The vehicle is linked to an operation control center **416** by a communications link **418**, preferably comprising a conventional cellular telephone interconnection, but also comprising satellite transmission, magnetic or optical media, radio frequency or other known communication technology. A navigation sub-system **420** receives radio navigation signals from a positioning device **422** which may include, but is not limited to GPS, radio frequency tags, or other known locating technology.

[0035] The type of elements monitored and recorded by the subject invention comprise raw data elements, calculated data elements and derived data elements. These can be broken down as follows:

Raw Data Elements:

[0036]

Power train sensors

RPM,
transmission setting (Park, Drive, Gear, Neutral),
throttle position,
engine coolant temperature,
intake air temperature,
barometric pressure;

Electrical sensors

brake light on,
turn signal indicator,
headlamps on,
hazard lights on,
back-up lights on,
parking lights on,
wipers on,
doors locked,
key in ignition,
key in door lock,
horn applied;

Body sensors

airbag deployment,
ABS application,
level of fuel in tank,
brakes applied,
radio station tuned in,
seat belt on,
door open,
tail gate open,
odometer reading,
cruise control engaged,

anti-theft disable,
occupant in seat,
occupant weight;

Other sensors

vehicle speed,
vehicle location,
date,
time,
vehicle direction,
IVHS data sources
pitch and roll,
relative distance to other objects.

Calculated Data Elements:

[0037]

rapid deceleration;
rapid acceleration;
vehicle in skid;
wheels in spin;
closing speed of vehicle in front;
closing speed of vehicle in rear;
closing speed of vehicle to side (right or left);
space to side of vehicle occupied;
space to rear of vehicle occupied;
space to front of vehicle occupied;
lateral acceleration;
sudden rotation of vehicle;
sudden loss of tire pressure;
driver identification (through voice recognition or code or fingerprint recognition);
distance traveled; and
environmental hazard conditions (e.g. icing, etc.).

Derived Data Elements:

[0038]

vehicle speed in excess of speed limit;
observation of traffic signals and signs;
road conditions;
traffic conditions; and
vehicle position.

[0039] This list includes many, but not all, potential data elements.

[0040] With particular reference to FIG. 1, a flowchart generally illustrating the data capture process of the subject invention within the vehicle for insurance and claims processing, is illustrated. Such a process can be implemented with conventional computer programming in the real time operating kernel of the computer **300**. Although it is within the scope of the invention that each consumer could employ a unique logic associated with that consumer's unit of risk, based on the underwriting and rating determination (FIG. 6), as will be more fully explained later, FIG. 1 illustrates how the data capture within a particular consumer logic is accomplished. After the system is started **100**, data capture is initiated by a trigger event **102** which can include, but is not limited to:

Ignition On/Off
Airbag Deployment
Acceleration Threshold

Velocity Threshold
Elapsed Time
Battery Voltage Level
System Health
User Activation/Panic Button
Traction
Location/Geofencing
Driver Identification
Remote Activation

[0041] Trigger event processing **104** essentially comprises three elements, a flow process for contacting a central control **106,** contacting a claims dispatch, and/or recording trigger event data **110.** Trigger event processing can include, but is not limited to:

Contact External Entities
EMT (Emergency Medical Transport), Claims Dispatch, Other External Entity Takes Appropriate Action
Record Sensor Information
Transmission of Data
Recalibration
Load Software

[0042] If trigger event processing comprises contact central control, the inquiry is made, and if affirmative, the central control is contacted **112**, the central control can take appropriate action **114,** and a record is made of the action taken by the central control **116.**

[0043] For the process of claims dispatch **108**, the system first contacts **120** the claims dispatch service department of the insurer, the claims dispatch takes appropriate action **122** and a recording **124** of the claims dispatch action information is made.

[0044] The recording of trigger event data can include, but is not limited to:

The Trigger
Latitude
Longitude
Greenwich Mean Time
Velocity
Acceleration
Direction
Vehicle Orientation
Seatbelt Status

Data capture processing concludes with end step **130**.

[0045] The recording thus comprises monitoring a plurality of raw data elements, calculated data elements and derived data elements as identified above. Each of these is representative of an operating state of the vehicle or an action of the operator. Select ones of the plurality of data elements are recorded when the ones are determined to have an identified relationship to the safety standards. For example, vehicle speed in excess of a predetermined speed limit will need to be recorded but speeds below the limit need only be monitored and stored on a periodic basis. The recording may be made in combination with date, time and location. Other examples of data needed to be recorded are excessive rates of acceleration or frequent hard braking.

[0046] The recording process would be practically implemented by monitoring and storing the data in a buffer for a selected period of time, e.g., thirty seconds. Periodically, such as every two minutes, the status of all monitored sensors for the data elements is written to a file which is stored in the vehicle data storage within the computer **300**. The raw, calculated and derived data elements listed above comprise some of the data elements to be so stored.

[0047] "Trigger events" should be appreciated as a combination of sensor data possibly requiring additional action or which may result in a surcharge or discount during the insurance billing process. Certain trigger events may require immediate upload **106** to a central control which will then be required to take appropriate action **114.** For example, a trigger event would be rapid deceleration in combination with airbag deployment indicating a collision, in which case the system could notify the central control of the vehicle location. Alternatively, if the operator were to trigger on ap emergency light, similarly the system could notify the central control of the vehicle location indicating that an emergency is occurring.

[0048] Trigger events are divided into two groups: those requiring immediate action and those not requiring immediate action, but necessary for proper billing of insurance. Those required for proper billing of insurance will be recorded in the same file with all the other recorded vehicle sensor information. Those trigger events requiring action will be uploaded to a central control center which can take action depending on the trigger event. Some trigger events will require dispatch of emergency services, such as police or EMS, and others will require the dispatch of claims representatives from the insurance company.
[0049] The following comprises an exemplary of some, but not all, trigger events:

Need for Assistance:

[0050] These events would require immediate notification of the central control center.

1. Accident Occurrence. An accident could be determined through the use of a single sensor, such as the deployment of an airbag. It could also be determined through the combination of sensors, such as a sudden deceleration of the vehicle without the application of the brakes.
2. Roadside assistance needed. This could be through the pressing of a "panic button" in the vehicle or through the reading of a sensor, such as the level of fuel in the tank. Another example would be loss of tire pressure, signifying a flat tire.
3. Lock-out assistance needed. The reading of a combination of sensors would indicate that the doors are locked but the keys are in the ignition and the driver has exited the vehicle.
4. Driving restrictions. The insured can identify circumstances in which he/she wants to be notified of driving within restricted areas, and warned when he/she is entering a dangerous area. This could be applied to youthful drivers where the parent wants to restrict time or place of driving, and have a record thereof.

Unsafe Operation of the Vehicle

[0051] These events would be recorded in the in-vehicle recording device for future upload.
[0052] Constant trigger events would result in notification of the driver of the exceptions.

1. Excessive speed. The reading of the vehicle speed sensors would indicate the vehicle is exceeding the speed limit. Time would also be measured to determine if the behavior is prolonged.
2. Presence of alcohol. Using an air content analyzer or breath analyzer, the level of alcohol and its use by the driver could be determined.
3. Non-use of seatbelt. Percent of sample of this sensor could result in additional discount for high use or surcharge for low or no use.
4. Non-use of turn signals. Low use could result in surcharge.
5. ABS application without an accident. High use could indicate unsafe driving and be subject to a surcharge.

[0053] With particular reference to FIG. 2, a general block diagram/flowchart of the network design for gathering appropriate information for insurance billing on a periodic basis is illustrated. Each unit of risk **200**, which as noted above, can just as easily be an airplane or boat, as well as a automobile, includes the data storage **202** and data process logic **204** as described more in detail in FIG. 4. The insured **206** responsible for each unit of risk communicates within the insuring entity **208** or its designee (by "designee" is meant someone acting for the insurer, such as a dedicated data collection agent, data handler or equipment vendor **210** and/or a value added service provider **212.)** The data handler can be a third party entity verifying that the operating equipment of the system is in proper working order, and as such, will usually be a subcontractor to the insurer. A value added service provider is another third party entity, such as a directional assistance service, or telephone service provider, also apart from the insurer, whose communications with the units of risk may be important or useable to the insurance computation algorithms.
[0054] Another important feature of FIG. 2 is that the insured **206** may not only communicate with the insurer **208** through the communications link **418** (FIG. 4), but also through an Internet **218** communications path. Such communication will occur through a Webserver **220** and the insurer's Web site so that an insured **206** may get on-line with the insurer **208** to observe and verify recorded data, claims processing, rating and billing **222**, as well as acquire improved insurance cost estimations, as will hereinafter be more fully explained.
[0055] With particular reference to FIG. 5, a more detailed description of system use of data acquired from the unit of risk is explained with particular attention to advantageous Internet communications. The unit of risk **200** is primarily concerned with transferring three classes of data between it and the insurer. The event data **500** and stored sensor data **502** have been discussed with reference to FIG. 1. Data process logic **504** is particular processing logic that can be transferred from the insurer to the unit of risk that is adapted for acquiring data especially important for assessing

the particular unit's insurance costs. For example, if a particular unit has a special need for providing information about brake pedal application, special data process logic will be provided to that unit to store data related to this activity. On the other hand, for many other units such data may not be necessary and so the unit may operate with standard data process logic **204**. The important feature of special data process logic **504** is that the data process logic **204** for a unit of risk can be regularly updated as either the insured, the insurer or events warrant. One easily foreseeable special data process logic would be related to breathalyser analysis.

[0056] The process flowchart starting at Begin **506** more generally describes the communication activity between the insurer and the unit of risk. The insurer will acquire event data **508**, sensor data **510**, may update **512** the data process logic and then process **514** the raw data elements to generate either the calculated or derived data elements. All relevant data is stored **516** in a conventional data storage device **518**. If the stored item is an event **524**, then the insurer needs to cause some sort of response to the event. For example, if there is an airbag deployment, the insurer may actually try to communicate with the vehicle, and upon failure of communication, may initiate deployment of emergency medical or police service. If this specific event processing and/or alerts **526** occurs, the system may have to initiate a charge per use event. For instance, charges can also include immediate response claims, EMS contact charges or police dispatch charges. The data or events which are stored in stored device **518** are accessed by a billing algorithm **530** to generate a cost for the unit of risk in consideration of all the relevant data and events occurring in that period. It is a special feature of the subject invention that the cost of insurance is based upon the real time data occurring contemporaneously with the billing so that the system provides an insurance use cost, as opposed to an estimation based upon historical data. After a relevant cost is computed, periodic bills are produced and typically mailed to a customer as an account statement **534.**

[0057] Another important feature of the subject invention illustrated in FIG. 5 is that the insurer provides a Webserver **220** to allow a customer to access via Internet **218** communication, the relevant sensor data and event data associated with the customer.

[0058] Two different types of on-line services interfaces are illustrated; a prospective on-line services interface **550**, or an interface **552** for reporting acquired data. The data reports through the acquired service interface may comprise all of the stored event and sensor data, along with enhanced processing maps showing travel routes during the billing period, or even a map showing current location of the unit of risk. By Geofencing is meant to identify when the unit travels outside of a certain geographical area. It is even possible to determine whether automobile maintenance service is appropriate by diagnostic analysis of the sensor and event data.

[0059] The prospective interface relates to "what if" gaming where a customer can project certain usages of the unit of risk, and the system can, in combination with similar occurring usage in the past or, based upon the overall customer profile or matrix, project a estimated cost for such usage. In effect, a user can determine in advance what particular usage of the unit will incur as insurance cost with a very reliable associated insurance estimate.

[0060] Lastly, enhanced on-line account statements **554** can also be communicated on-line wherein maps with usage, or service usage details can be provided as a more detailed explanation of the resulting costs of an account statement.

[0061] With particular reference to FIG. 6, the subject invention is particularly useful for generating improved rating algorithms due to the improved acquisition and amount of relative data for assessing insurance costs for a unit of risk. In the manner as discussed above, the database **518** has the benefit of the data from a plurality of customers **206**. An insurer can over time use the accumulated underwriting and rating information from individual customers **520** to develop improved rating algorithms **522**. Such improved algorithms can be regularly communicated to the units of risk **200** for improved insurance cost computation accuracies. The improved rating algorithms can be communicated **524** to the units of risk on-board computer **300** (FIG. 4).

[0062] The subject invention is also applicable as a process for collecting data to be used for the following non-insurance related purposes: advertising and marketing, site selection, transportation services, land use planning, determining road design, surface or composition, traffic planning and design, and road conditions.

[0063] The invention has been described with reference to the preferred embodiments. Obviously modifications and alterations will occur to others upon a reading and understanding of this specification. The present invention is intended to include all such modifications and alterations in so far as they come within the scope of the appended claims or equivalents thereof.

Claims

1. A method of communicating a cost of insuring a unit of risk and corresponding operating characteristics for the unit monitored for a selected period, comprising steps of:

    providing a Web site system for communicating data between an insurer and an insured relative to the unit of risk;

monitoring the operating characteristics during the selected period;
deciding the cost of insuring for the period based upon the operating characteristics monitored in that period; and
selectively communicating the monitored operating characteristics and decided cost to the insured through the Web site system.

2. The method as defined in claim 1 wherein the selected period comprises a real time period for operating the unit of risk.

3. The method as defined in claim 1 wherein the selected period comprises a prospective period for operating the unit of risk, the operating characteristics comprise estimated operating characteristics suggested by the insured, and the decided cost of insuring comprises an estimated cost for the estimated operating characteristics.

4. The method as defined in claim 3 wherein the estimated operating characteristics selectively comprise a destination, a travel route, a time of travel or an operator identity for the unit of risk.

5. The method as defined in claim 1 further including generating an operating profile for the unit of risk from the monitored operating characteristics.

6. The method as defined in claim 5 further including identifying an operator as the unit of risk.

7. The method as defined in claim 5 further including identifying an equipment item as the unit of risk.

8. The method as defined in claim 1 further including providing selectively available value added services including telephone services, positioning services and diagnostic services to the unit of risk or operator.

9. The method as defined in claim 8 further including considering the value added services for the deciding of the cost of insurance.

10. A system for Internet on-line communicating between an insurer and insured, of detected operating characteristics of a unit of risk for a selected period, and a cost of insuring the unit for the selected period, as decided by the insurer in consideration of the detected operating characteristics, the system comprising:

a Web site system for selectively communicating the operating characteristics and the cost from the insurer to the insured;
a monitoring system for monitoring the operating characteristics;
a storage system for storing the operating characteristics, the storage system being accessible to the Web site system; and,
a processing system for deciding the cost of insuring the unit for the period based upon the monitored operating characteristics, the processing system being accessible to the Web site system.

11. The system as defined in claim 10 wherein the selected period comprises a real time period for operating the unit of risk.

12. The system as defined in claim 10 wherein the selected period comprises a prospective period for operating the unit of risk, the operating characteristics comprise estimated operating characteristics suggested by the insured, and the decided cost of insuring comprises an estimated cost for the estimated operating characteristics.

13. The system as defined in claim 10 wherein the unit of risk comprises an operator.

14. The system as defined in claim 10 wherein the unit of risk comprises an equipment item.

15. The system as defined in claim 10 including an on-line service interface providing an item from a group comprising usage projection estimates, maps, geofencing and automobile service diagnostics.

16. The system as defined in claim 10 including an on-line account statement interface providing cost information for the unit of risk and further selectively providing maps indicating unit usage, and service usage detail of the unit of risk.

17. The system as defined in claim 10 including a user identification system for authenticating an operator of the unit of risk and wherein the identification of the user corresponds to an associated insurance rating for the user.

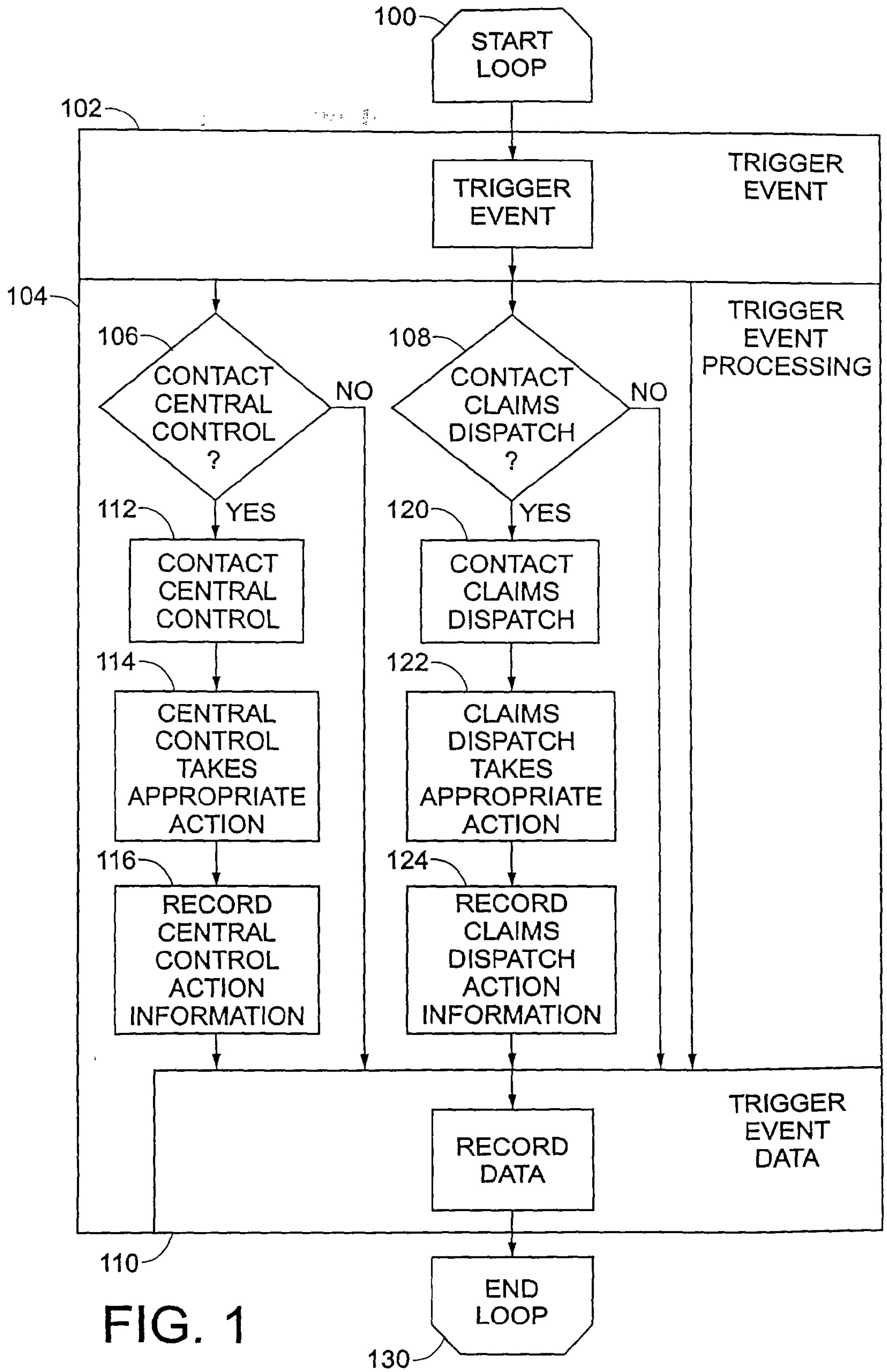
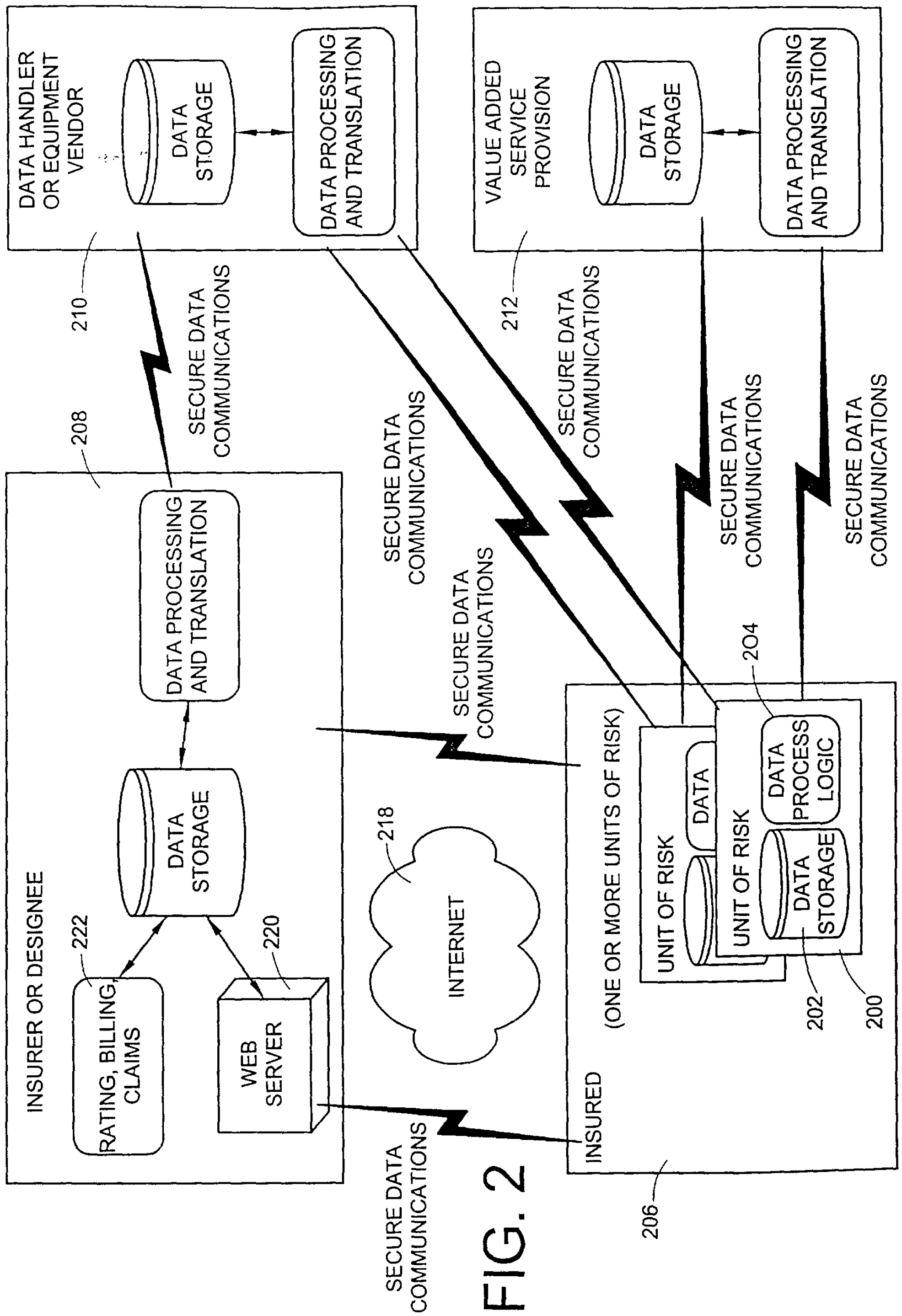

100
START LOOP
102
TRIGGER EVENT
TRIGGER EVENT
104
TRIGGER EVENT PROCESSING
106
CONTACT CENTRAL CONTROL ?
NO
YES
108
CONTACT CLAIMS DISPATCH ?
NO
YES
112
CONTACT CENTRAL CONTROL
120
CONTACT CLAIMS DISPATCH
114
CENTRAL CONTROL TAKES APPROPRIATE ACTION
122
CLAIMS DISPATCH TAKES APPROPRIATE ACTION
116
RECORD CENTRAL CONTROL ACTION INFORMATION
124
RECORD CLAIMS DISPATCH ACTION INFORMATION
TRIGGER EVENT DATA
RECORD DATA
110
END LOOP
130

FIG. 1



INSURER OR DESIGNEE
208
RATING, BILLING, CLAIMS
222
DATA STORAGE
DATA PROCESSING AND TRANSLATION
WEB SERVER
220
INTERNET
218
SECURE DATA COMMUNICATIONS
SECURE DATA COMMUNICATIONS
SECURE DATA COMMUNICATIONS
SECURE DATA COMMUNICATIONS
INSURED
(ONE OR MORE UNITS OF RISK)
UNIT OF RISK
DATA
UNIT OF RISK
DATA STORAGE
DATA PROCESS LOGIC
204
202
200
206
DATA HANDLER OR EQUIPMENT VENDOR
DATA STORAGE
DATA PROCESSING AND TRANSLATION
210
SECURE DATA COMMUNICATIONS
VALUE ADDED SERVICE PROVISION
DATA STORAGE
DATA PROCESSING AND TRANSLATION
212
SECURE DATA COMMUNICATIONS
SECURE DATA COMMUNICATIONS
SECURE DATA COMMUNICATIONS

FIG. 2

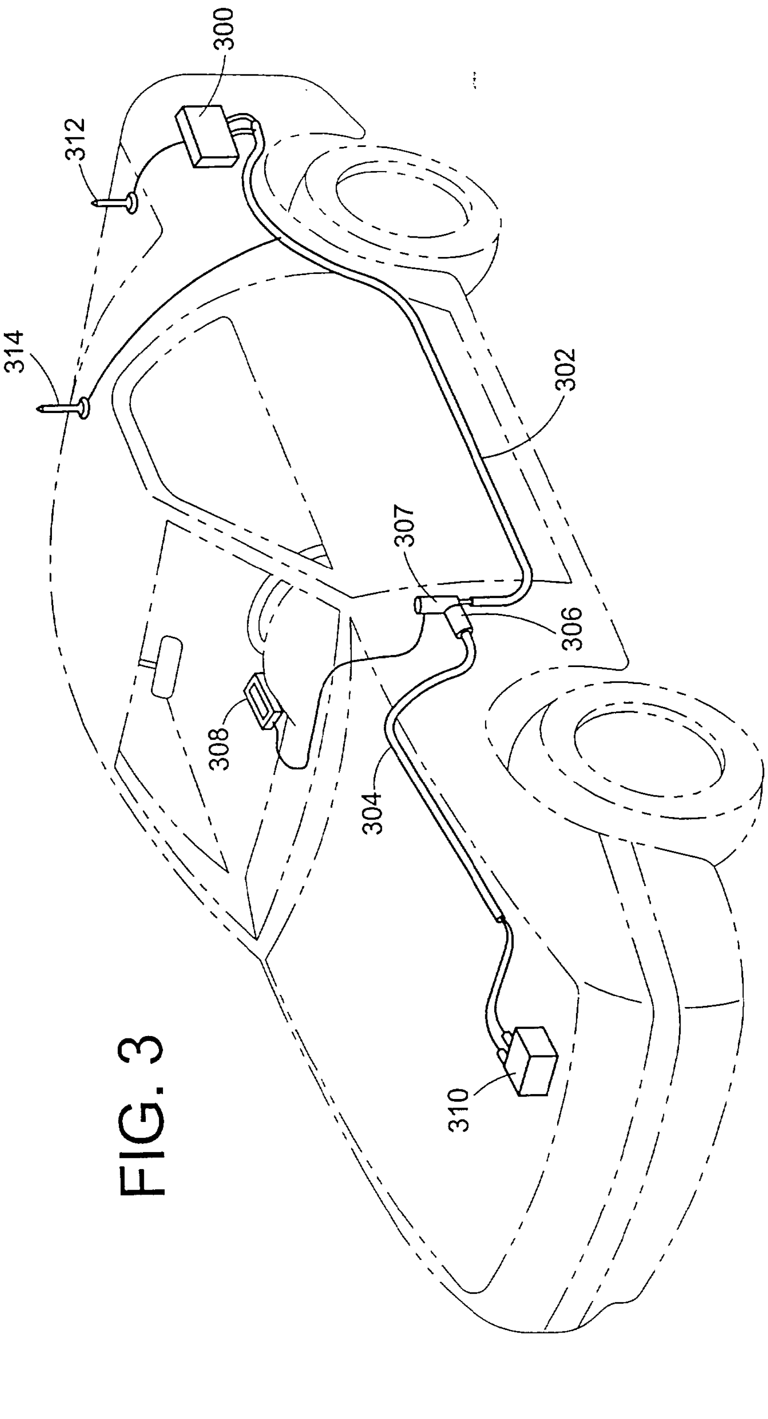


FIG. 3

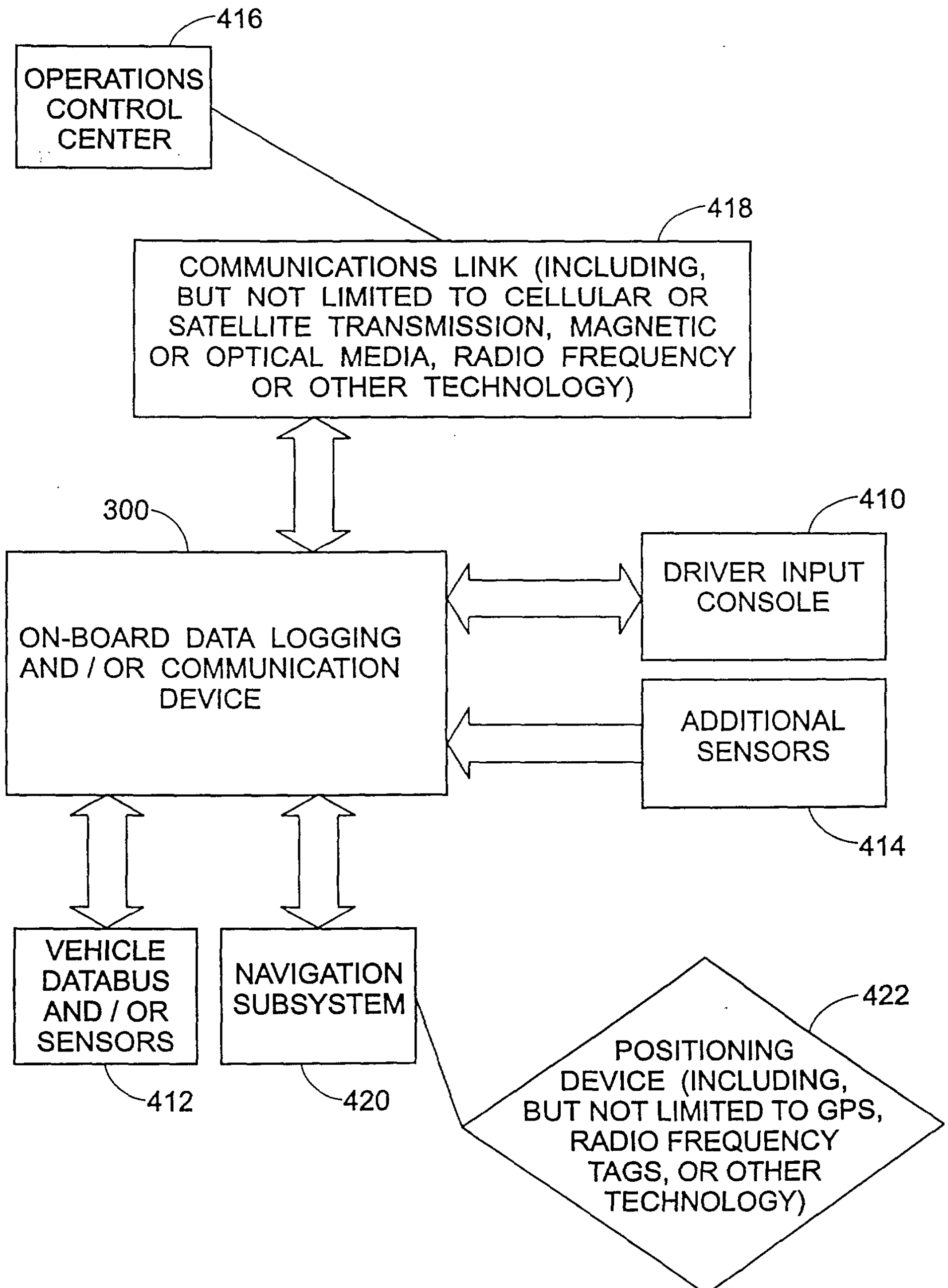

416
OPERATIONS CONTROL CENTER
418
COMMUNICATIONS LINK (INCLUDING, BUT NOT LIMITED TO CELLULAR OR SATELLITE TRANSMISSION, MAGNETIC OR OPTICAL MEDIA, RADIO FREQUENCY OR OTHER TECHNOLOGY)
300
ON-BOARD DATA LOGGING AND / OR COMMUNICATION DEVICE
410
DRIVER INPUT CONSOLE
ADDITIONAL SENSORS
414
VEHICLE DATABUS AND / OR SENSORS
412
NAVIGATION SUBSYSTEM
420
422
POSITIONING DEVICE (INCLUDING, BUT NOT LIMITED TO GPS, RADIO FREQUENCY TAGS, OR OTHER TECHNOLOGY)

FIG. 4

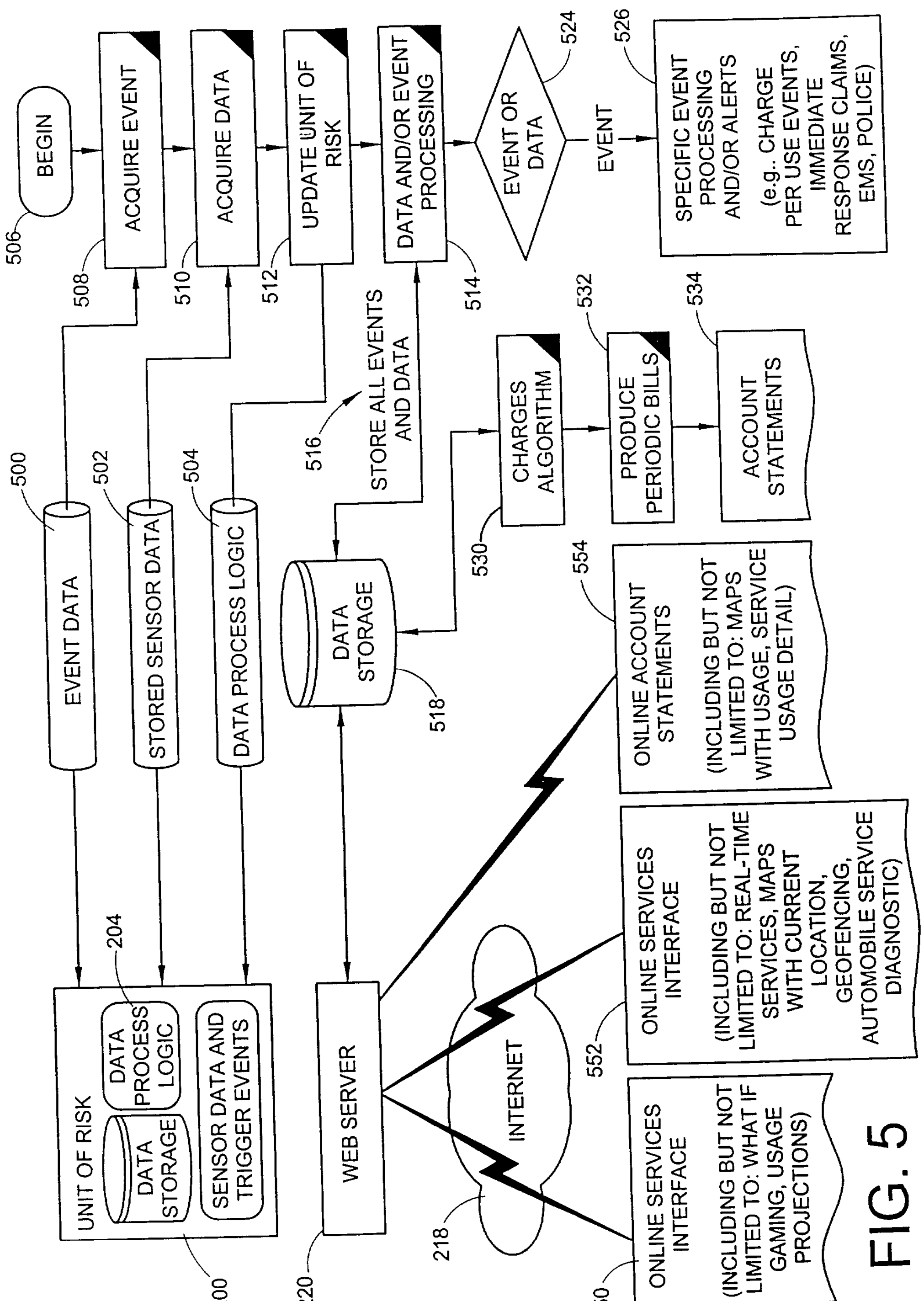

BEGIN
506
ACQUIRE EVENT
508
ACQUIRE DATA
510
UPDATE UNIT OF RISK
512
DATA AND/OR EVENT PROCESSING
514
EVENT OR DATA
524
EVENT
SPECIFIC EVENT PROCESSING AND/OR ALERTS (e.g., CHARGE PER USE EVENTS, IMMEDIATE RESPONSE CLAIMS, EMS, POLICE)
526
EVENT DATA
500
STORED SENSOR DATA
502
DATA PROCESS LOGIC
504
516
STORE ALL EVENTS AND DATA
DATA STORAGE
518
CHARGES ALGORITHM
530
PRODUCE PERIODIC BILLS
532
ACCOUNT STATEMENTS
534
ONLINE ACCOUNT STATEMENTS (INCLUDING BUT NOT LIMITED TO: MAPS WITH USAGE, SERVICE USAGE DETAIL)
554
UNIT OF RISK
DATA STORAGE
DATA PROCESS LOGIC
204
SENSOR DATA AND TRIGGER EVENTS
200
WEB SERVER
220
INTERNET
218
ONLINE SERVICES INTERFACE (INCLUDING BUT NOT LIMITED TO: REAL-TIME SERVICES, MAPS WITH CURRENT LOCATION, GEOFENCING, AUTOMOBILE SERVICE DIAGNOSTIC)
552
ONLINE SERVICES INTERFACE (INCLUDING BUT NOT LIMITED TO: WHAT IF GAMING, USAGE PROJECTIONS)
550

FIG. 5

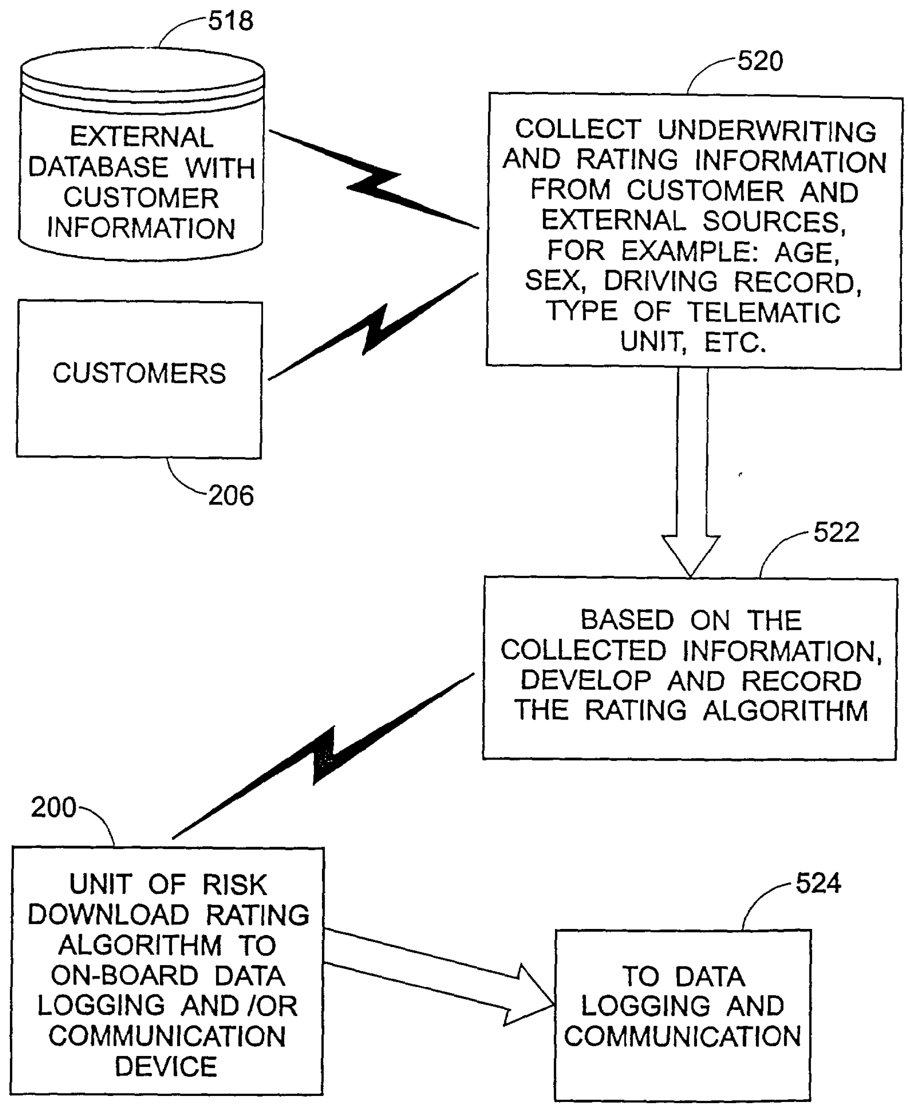

518
EXTERNAL DATABASE WITH CUSTOMER INFORMATION
520
COLLECT UNDERWRITING AND RATING INFORMATION FROM CUSTOMER AND EXTERNAL SOURCES, FOR EXAMPLE: AGE, SEX, DRIVING RECORD, TYPE OF TELEMATIC UNIT, ETC.
CUSTOMERS
206
522
BASED ON THE COLLECTED INFORMATION, DEVELOP AND RECORD THE RATING ALGORITHM
200
UNIT OF RISK DOWNLOAD RATING ALGORITHM TO ON-BOARD DATA LOGGING AND /OR COMMUNICATION DEVICE
524
TO DATA LOGGING AND COMMUNICATION

FIG. 6

European Patent Office

DECLARATION

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 01 30 3501

The Search Division considers that the present application, does not comply with the provisions of the EPC to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of all claims	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Reason:	G06F17/60

The claims relate to subject matter excluded from patentability under Art. 52(2) and (3) EPC. Given that the claims are formulated in terms of such subject matter or merely specify commonplace features relating to its technological implementation, the search examiner could not establish any technical problem which might potentially have required an inventive step to overcome. Hence it was not possible to carry out a meaningful search into the state of the art (Rule 45 EPC). See also Guidelines Part B Chapter VIII, 1-6.

The applicant's attention is drawn to the fact that a search may be carried out during examination following a declaration of no search under Rule 45 EPC, should the problems which led to the declaration being issued be overcome (see EPC Guideline C-VI, 8.5).

Place of search	Date	Examiner
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Office européen des brevets

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(51) Int Cl.^{7}: **G06F 17/60**

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(54) **An apparatus for monitoring a plurality of real-time insurance contracts**

(57) The present invention provides an apparatus for monitoring a real-time insurance contract whereby said real-time insurance contract has at least two active statuses. The apparatus comprises

- a data processing member
- a data storage member
- an information receiving member for receiving information relating to a change of risk covered by said insurance contract
- an insurance contract status assessment member capable of reassessing the status of said insurance contracts based on information comprising information received by said information receiving member and information stored in said data storage member.

EP 1 241 599 A1

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Description

Field of the invention

[0001] The present invention relates to apparatus for monitoring insurance contracts.

Background

[0002] Insurance contracts have become an integral part of daily lives and are one of the basic foundations of our social security system. They allow individual risks such as the risk of a car accident to be carried collectively by the group insurance holders. The financial loss in case of e.g. a car damage can therefore be paid by regular small monthly payments instead of one large sum at the time of damage.

[0003] Conventional insurance contracts generally have two statuses, they are either on or off. In other words, it is the underlying assumption of such a contract that the transferred risk is an averaged risk . Accordingly, the respective insurance fee also has to be an averaged insurance fee.

[0004] In real life, the situation is of course much more complex. The risk, when for example driving a car, is constantly changing. The weather can be either good or bad. Driving in a crowded city is much riskier than driving on a highway in rural countryside. When the car is parked, the risk drops to almost zero.

[0005] Hence, there is a desire to provide insurance contracts that dynamically adjust to the risk that currently needs to be covered, to provide a so-called real-time insurance contract. Such insurance contracts inherently have the advantage that the insurance fees are adjusted simultaneously so that the insurance holders only have to cover the insurance fees for the actually transferred risks. The insurance agreements could also be tailored much more to the holders' needs.

[0006] From a logistics point of view, real-time insurance contracts are much more difficult to administrate and to monitor. Not only all the changes of the status have to be recorded, it is also desirable that the insurance holder receives almost immediate notice a change in the transferred risk and the associated fee rate.

[0007] Currently, standard computer based apparatuses are used to administrate and monitor insurance contracts. These apparatuses are only capable of handling conventional two status insurance contracts. They can only store the information entered by the insurance administrator and are limited to storing the day of change of off to on and from on to off.

[0008] It is therefore an object of the present invention to provide an apparatus for monitoring real-time insurance contracts which overcomes the disadvantages of the prior apparatuses for monitoring insurance contracts.

Summary of the invention

[0009] The present invention provides an apparatus for monitoring a real-time insurance contract whereby said real-time insurance contract has at least two active statuses. The apparatus comprises

- a data processing member
- a data storage member for storing
  - insurance contract data, said insurance contract data comprising insurance contract status data for each of the statuses of said insurance contract
  - the currently transferred risk covered by said insurance contract,
  - the current insurance fee rate due in respect of said insurance contract
  - the times of the change of the status of said insurance contract
  - the amount of fees due in respect of said insurance contract
- an information receiving member for receiving information relating to a change of risk covered by said insurance contract
- an insurance contract status assessment member capable of reassessing the status of said insurance contracts based on information comprising information received by said information receiving member and information stored in said data storage member

Detailed Description

[0010] The present invention provides an apparatus for monitoring real-time insurance contract.

[0011] The term "insurance contract" as used herein encompasses all agreements between two parties whereby the first party is taking over a risk encountered by the second party and whereby the second party is paying an insurance fee in consideration of the transfer of risk to the first party. In most cases, an object causes the risk covered by the insurance contract. The object can be material (for example a car) or can be immaterial (for example health of a human being).

[0012] The term "status" of an insurance contract as used herein refers to each set of transferred risk and associated insurance fee rate. The two simplest statuses of an insurance contract are active and passive whereby active means a risk is transferred and the respective insurance fee is due and whereby passive means no risk in transferred and only nominal or administrative fees are due if any.

[0013] The term "real-time insurance contract" as used herein refers to insurance contracts having at least two active statuses. These active statuses differ in the risk transferred and generally also in the associated insurance fee rate.

[0014] The apparatus for monitoring real-time insurance contracts of the present invention is typically based on a computer system such as those well known in the art. This computer system provides the data processing member and the data storage member of the apparatus of the present invention. The data storage member can be a temporary storage means such as a memory chip of the computer, but preferably is a permanent storage means such as a CD-ROM, and yet more preferably is a re-writeable storage means such as a hard drive, a floppy drive, a re-writeable CD-ROM, an optical storage means, a magneto-optical storage means, and the like. The computer system of the apparatus of the present invention further provides data input such as a keyboard, a voice recognition system, a scanner, and the like. It further provides data output means such as displays, printers, and the like. Finally, the functionality of the computer system may be relied on for the functionality of the other members of the apparatus of the present invention such as the information receiving system, insurance contract status assessment member.

[0015] The apparatus of the present invention and in particular the computer system is capable of storing data necessary to administrate and monitor an insurance contract and preferably a plurality of insurance contracts. These data for example comprise insurance contract data such as contract status data for each of the statuses of the insurance contract, the currently transferred risk covered by the insurance contract, the current insurance fee rate due, the times of the change of the status of the insurance contract, the sum of fees due in respect of said insurance contract, personal information about the insurance holder, and the like.

[0016] The apparatus of the present invention further comprises an information receiving member for receiving information relating to a change of risk covered by said insurance contract. The information can be received from the insurance administrator, from the insurance holder, or from one or more external information gathering devices or any combination thereof.

[0017] Where the information is received from the insurance administrator or the insurance holder, the information receiving member may be designed so that the transfer of information to the apparatus of the present invention is triggered by the insurance administrator or by the insurance holder respectively. Such an apparatus offers the possibility for the insurance holder to instantaneously change the status of the insurance contract.

[0018] Where information is received from an external information gathering device, this device may gather environmental information relating to the object of the insurance contract such as time of the day, time of the year, weather information, street conditions, and the like. This device may also measure internal information relating to the object of the insurance contract such as the current mode of usage, the position of object, speed and acceleration of the object, and the like. The device may measure any combination of environmental information data and internal information data. Such an apparatus offers the possibility to adjust the status of the insurance contract in dependence of additional, current information about the object of the insurance contract. Sensors for detecting such data are well known in the art and generally are considered suitable for the present invention. The apparatus of the present invention may be designed such that the apparatus requests gathering of information for example on a regular time basis, such that the external information gathering device independently initiates the transfer of information for example triggered by a change of condition picked up by the sensor, or such that the external device independently gathers information (e.g. continuously or in regular time intervals), stores it, and later transmits the information to the information receiving means of the apparatus of the present invention.

[0019] In most cases, namely when the source of information is not co-located with the information receiving member, the information receiving member would be connected to the insurance administrator, to the insurance holder, or to the external information gathering device respectively by an information transfer system such as those well known in the art. Preferably, the information transfer system is capable of quickly transmitting information yet more preferably substantially immediately transmitting information. Suitable information transfer systems include but are not limited to phones, wireless phones, computer networks such as the Internet, satellite communication systems, and the like. Such an apparatus allows the status of the insurance contract to be adjusted virtually without any restrictions as to the current position of the insurance holder or the object of the insurance respectively.

[0020] The information receiving member may rely for its functionality on at least a part of the computer system of the apparatus of the present invention. A set of instructions to be carried out by the data processing member and stored on the data storage member may be the basis to provide the functionality of the information receiving member of the present invention. Alternatively, the information receiving member may be separate from the computer system of the apparatus of the present invention.

[0021] The apparatus of the present invention further comprises a insurance contract status assessment member. This member is capable of determining a change in the insurance contract status based on its input, namely the information received by the information receiving member. The member is capable of interpreting the input information received by the information receiving member and in particular so where the information is received from a external information gathering device. As used herein, the term "interpreting" means the received information is put in relation with the various possible statuses of the insurance contract such as by comparing received numerical data with ranges provided by the insurance contract status assessment member. The latter numerical ranges may be part of the insurance contract data stored on the data storage member. The output of the insurance contract status assessment member of the present invention is the current status of the insurance contract after taking into consideration the received information. Preferably, this output is subsequently stored in that data storage member.

[0022] The insurance contract status assessment member may rely for its functionality on at least a part of the computer system of the apparatus of the present invention. A set of instructions to be carried out by the data processing member and stored on the data storage member may be the basis to provide the functionality of the insurance contract status assessment member of the present invention. Alternatively, the insurance contract status assessment member may be separate from the computer system of the apparatus of the present invention.

[0023] The apparatus of the present invention may further comprise an insurance parameter determination member capable of determining insurance parameters for the insurance contract. Preferably, the insurance parameters determined by the insurance parameter determination member include the insurance rate. The output of the insurance parameter determination member is the current set of insurance parameters after consideration of the status input. Preferably, this output is subsequently stored in that data storage member. The determination process may be based on an arithmetic formula whereby the status of the insurance contract (the output parameter of the insurance contract status assessment member) is an input parameter of said arithmetic formula. The most simple suitable formula is based on a predefined array of sets of insurance parameters where the array is indexed by the possible statuses of the insurance contracts. In particular where the status of the insurance contract is defined by a numerical parameter, more complex, arithmetic formulas based on this numeric status parameter are also suitable.

[0024] Optionally, the determination process may have further input parameters such as external information (e.g. time of the day, time of the year, weather conditions, and the like), holder related information (e.g. insurance history of the holder, behavior pattern of the holder, health information of the holder, and the like), and the like.

[0025] The insurance parameter determination member may rely for its functionality on at least a part of the computer system of the apparatus of the present invention. A set of instructions to be carried out by the data processing member and stored on the data storage member may be the basis to provide the functionality of the insurance parameter determination member of the present invention. Alternatively, the insurance parameter determination member may be separate from the computer system of the apparatus of the present invention or may involve interaction with the insurance administrator.

[0026] The apparatus of the present invention may further comprise an information transmission member capable of transmitting information to either party of said insurance contract. Such information may for example comprise the fact of a change of status, the new status, the new fee rate, any combination thereof, and the like. If the information receiving party is not co-located with the apparatus of the present invention, the information may be transmitted via a suitable information transfer system. Suitable information transfer systems include but are not limited to phones, wireless phones, computer networks such as the Internet, satellite communication systems, and the like.

[0027] The information transmission member may rely for its functionality on at least a part of the computer system of the apparatus of the present invention. A set of instructions to be carried out by the data processing member and stored on the data storage member may be the basis to provide the functionality of the information transmission member of the present invention. Alternatively, the information transmission member may be separate from the computer system of the apparatus of the present invention.

Claims

1. An apparatus for monitoring a real-time insurance contract said real-time insurance contract having at least two active statuses, said apparatus comprising

   - a data processing member
   - a data storage member for storing

     - insurance contract data, said insurance contract data comprising insurance contract status data for each of the statuses of said insurance contract
     - the currently transferred risk covered by said insurance contract,
     - the current insurance fee rate due in respect of said insurance contract
     - the times of the change of the status of said insurance contract
     - the amount of fees due in respect of said insurance contract

   - an information receiving member for receiving information relating to a change of risk covered by said insurance contract
   - an insurance contract status assessment member capable of reassessing the status of said insurance contracts based on information comprising information received by said information receiving member and information stored in said data storage member

2. An apparatus for monitoring a real-time insurance contract according to Claim 1
wherein
said apparatus further comprises an insurance parameter determination member capable of determining insurance parameters for said insurance contract based on an arithmetic formula, said status of said insurance contract being an input parameter of said arithmetic formula.

3. An apparatus for monitoring a real-time insurance contract according to Claim 2
whereby
said insurance parameters determined by said insurance parameter determination member comprise the current fee rate.

4. An apparatus for monitoring a real-time insurance according to Claim 2 whereby
said arithmetic formula has a second input parameter, said second input parameter being independent of the object causing the risk covered by said insurance contract.

5. An apparatus for monitoring a real-time insurance contract according to Claim 4
wherein
said second parameter is selected from the group of

- time of the day
- time of the year
- weather conditions

6. An apparatus for monitoring a real-time insurance contract according to Claim 1
whereby
a change of risk covered by said insurance contract is triggered by the user of said object into the said information receiving member.

7. An apparatus for monitoring a real-time insurance contract according to Claim 1,
an object causing the risk covered by said insurance contract
wherein
said information receiving member receives information from an external data gathering device capable of detecting a change of the internal or environmental condition of said object.

8. An apparatus for monitoring a real-time insurance contract according to Claim 7
wherein
said change of the physical condition is selected from the group of

- change mode of usage
- change of position
- change of speed
- change of environmental conditions

9. An apparatus for monitoring a real-time insurance contract according to Claim 7
wherein
said information receiving member is capable of automatically detecting a change of the physical condition of said object.

10. An apparatus for monitoring a real-time insurance contract according to Claim 1
wherein
the information used by said insurance contract status assessment member further comprises an array of insurance parameters comprising a fee rate, said array being indexed by parameters comprising the possible statuses of said insurance contract.

11. An apparatus for monitoring a real-time insurance contract according to Claim 1
wherein
said apparatus further comprises an information transmission member capable of transmitting information to either party of said insurance contract.

European Patent Office

DECLARATION

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 01 10 6090

The Search Division considers that the present application, does not comply with the provisions of the EPC to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of all claims	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Reason:	G06F17/60

Claims 1-11 relate to a conventional apparatus for performing a business method. Although these claims do not literally belong to the method category, they essentially claim protection for a commercial effect. The Search Division considers that searching this subject-matter would serve no useful purpose. It is not at present apparent how the subject-matter of the present claims may be considered defensible in any subsequent examination phase in front of the EPO with regard to the provisions of Articles 54 and 56 EPC (novelty, inventive step; see also Guidelines B-VII, 1-6.

The applicant's attention is drawn to the fact that a search may be carried out during examination following a declaration of no search under Rule 45 EPC, should the problems which led to the declaration being issued be overcome (see EPC Guideline C-VI, 8.5).

Place of search	Date	Examiner
THE HAGUE	11 July 2001	Suendermann, R

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(54) **Monitoring system for determining and communicating a cost of insurance**

(57) Means are provided for recording, storing, calculating, communicating and reviewing one or more operational aspects of a machine. Insurance costs are based, in part, on activities of the machine operator. A discount may be provided in exchange for recording the operational aspects and providing the recorded information to the insurer. The party may review information and decide whether to provide it to the insurer. The means for reviewing may present comparative information. Information that causes insurance costs to vary may be highlighted. Provided data may be used to verify insurance application information, generate actuarial information or determine insurance rates. Operating data may be reviewed on a computer, a Web site or other display medium so a party can observe how his operating behavior compares to that of other operators of similar machines and may be manipulated so a party can understand how changes in operating behavior can affect his insurance rates.

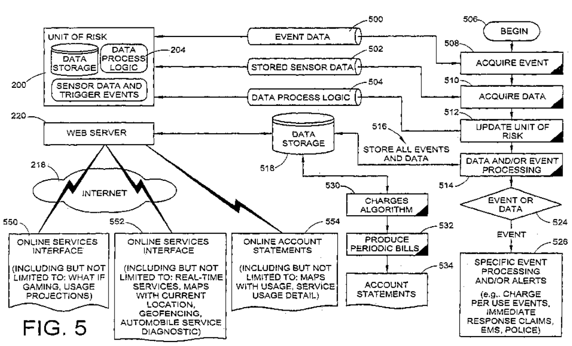

FIG. 5

EP 1 746 537 A3

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 07 6910

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 160 707 A (PROGRESSIVE DIRECTRAC SERVICE CORP) 5 December 2001 (2001-12-05) * abstract * * page 4, paragraph 13 - page 5, paragraph 23 * -----	1-10	INV. G06Q40/00
X	EP 1 241 599 A (NETFORMFIVE INFORMATIONSTECHNOLOGIE GMBH) 18 September 2002 (2002-09-18) * column 3, paragraph 16 - column 4, paragraph 20 * * column 5, paragraph 23 - paragraph 24 * -----	1-10	
X	US 2002/095249 A1 (LANG BROOK W) 18 July 2002 (2002-07-18) * abstract * * column 1, line 41 - column 2, line 59 * -----	1-10	
X	US 2003/009347 A1 (IWAI YASUSHI ET AL) 9 January 2003 (2003-01-09) * page 2, paragraph 20 - page 3, paragraph 33 * -----	1-10	TECHNICAL FIELDS SEARCHED (IPC)
X	WO 02/41119 A (GOUX, TIMOTHY, GAYLE) 23 May 2002 (2002-05-23) * abstract * -----	1-10	G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 January 2007	Marcu, Antoniu

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

8

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 07 6910

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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17-01-2007

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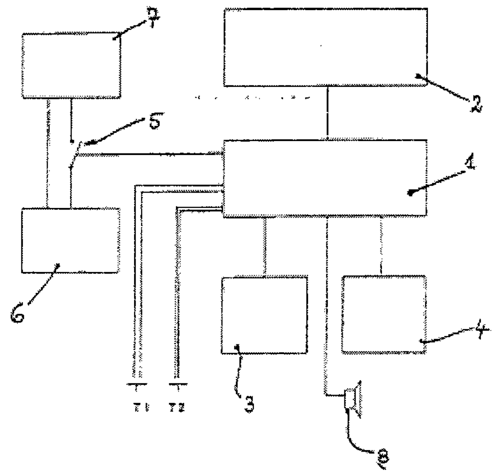
For more details about this annex : see Official Journal of the European Patent Office, No. 12/82



Speech recognition system as means of controlling access

AB
(DE19522940)
The voice controlled access system has a memory 2, a processor 1, a recorder 4, a loudspeaker 8, several batteries 3,6, two input keys T1,T2 and a main switch 5 controlling the activation of the vehicle electronic system 7. A spoken command is recorded, and the analogue signal is converted into a digital format for entering into the memory. The processor compares the command with the digitised reference speech patterns.

IN WAGNER THOMAS BAUER NORBERT

PA FRAUNHOFER

PA0 Fraunhofer-Gesellschaft zur Fœrderung der angewandten Forschung e.V., 80636 München, DE

Published As

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DE19522940	19970102	1995DE-1022940	19950623	A1 - Doc. laid open (First publication)

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IC
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B60R-025/04
G07C-009/00
G10L-007/08
G10L-017/00

ICAA
B60R-025/00 [2006-01 A - I R M EP];
G07C-009/00 [2006-01 A - I R M EP];
G10L-017/00 [2006-01 A - I R M EP]

ICCA
B60R-025/00 [2006 C - I R M EP];
G07C-009/00 [2006 C - I R M EP];
G10L-017/00 [2006 C - I R M EP]

EC
B60R-025/00
G07C-009/00C2D
G10L-017/00U

CT
(DE19522940)
Search Report [Examiner]
DE4027491(A1) [DE4027491]
DE9419006(U1) [DE9419006U]
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WO9215090(A1) [WO9215090]

(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

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B 60 R 25/04

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Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., 80636 München, DE

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Wagner, Thomas, 91052 Erlangen, DE; Bauer, Norbert, 91058 Erlangen, DE

(56) Entgegenhaltungen:

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DE	94 19 006 U1
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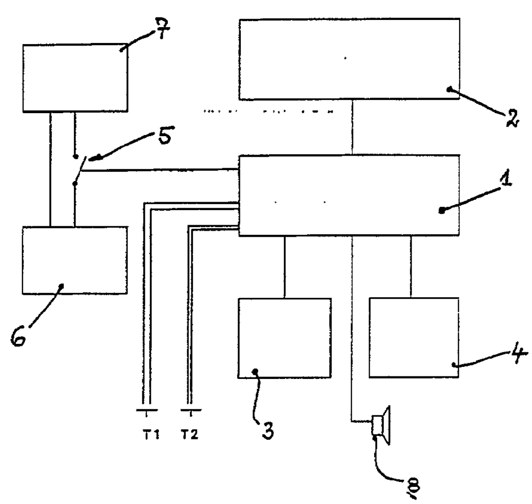
Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Verfahren zum Identifizieren einer menschlichen Stimme

(57) Die Erfindung stellt ein zuverlässig arbeitendes Verfahren und eine solche Vorrichtung zum Identifizieren einer menschlichen Stimme bereit, insbesondere zum Sichern von Gegenständen gegen Diebstahl, umfassend
(a) das Aufnehmen der Stimme mit Hilfe einer Aufnahmeeinheit,
(b) das Umwandeln der aufgenommenen akustischen Signale in elektrische Signale,
(c) das Digitalisieren und Abspeichern der Signale in einer Auswerteeinheit mit Speicher,
wobei ggf. die obigen Schritte (a) bis (c) mit weiteren Stimmen wiederholt werden und
(d) das Vergleichen der digitalisierten Signale der Stimme mit solchen, die sich bereits im Speicher der Auswerteeinheit befinden, und ggf. das Identifizieren der Stimme als im wesentlichen identisch mit einer der Stimmen, die im Speicher der Auswerteeinheit gespeichert sind.



DE 195 22 940 A 1

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Beschreibung

Die vorliegende Erfindung betrifft das Gebiet der akustischen Personenidentifikation. Das erfindungsgemäße Verfahren eignet sich beispielsweise zum Sichern von Gegenständen gegen Diebstahl, wobei die Identifikation einer Stimme als Schlüssel fungiert. Diese Identifikation muß zuverlässig arbeiten, sollte aber gleichwohl im Rahmen eines vertretbaren Hard- und Softwareaufwandes liegen.

Erfindungsgemäß wird diese Aufgabe dadurch gelöst, daß ein Verfahren zum Identifizieren einer menschlichen Stimme bereitgestellt wird, welches das Aufnehmen der Stimme mit Hilfe einer Aufnahmeeinheit, das Umwandeln der aufgenommenen akustischen Signale in elektrische Signale sowie das Digitalisieren und Abspeichern der Signale in einer Auswerteeinheit mit Speicher umfaßt. Erfindungsgemäß ist es möglich, daß mehrere Stimmen und/oder mehrere Laut folgen ein und derselben Stimme mittels der genannten Schritte im Speicher abgelegt, d. h. "eingelernt" werden. Zum Identifizieren einer bestimmten Stimme werden dann die wie oben erhaltenen digitalisierten Signale dieser Stimme mit solchen anderer Stimmen, die sich bereits im Speicher der Auswerteeinheit befinden, verglichen. Dabei kann die Stimme vom System als im wesentlichen identisch mit einer der Stimmen, die bereits gespeichert sind, identifiziert oder als unbekannt erkannt werden (Anspruch 1, Anspruch 10).

Das erfindungsgemäße Verfahren läßt sich besonders vorteilhaft beim Sichern von Gegenständen einsetzen, wobei die Identifikation der Stimme als "Schlüssel fungiert (Anspruch 11). Dieser "Schlüssel" kann beispielsweise das Unterbrechen oder Schließen eines Stromkreises sein. Auch andere Arten von Schließfunktionen sind denkbar (Computer-Zugangsberechtigung, Personen-Identifikation beim Online-Banking oder Einsatz in Geldautomaten). Um einen solchen Freigabe- oder Schließmechanismus zu konstruieren, wird eine Stimme oder werden mehrere Stimmen, bevorzugt in Form einer charakteristischen Laut- bzw. Tonabfolge, in digitalisierter Form im Speicher abgelegt. Die digitalisierten Charakteristika dieser Stimme oder Stimmen dienen als "Schloß". Nur solche Personen, deren Stimmen abgespeichert sind, verfügen über den zu diesem Schloß gehörigen "Schlüssel". Zum "Aufschließen" muß diese Person die genannten Laut- oder Tonfolgen, beispielsweise ein bestimmtes Codewort, von sich geben. In einer bevorzugten Ausführungsform der Erfindung läßt sich diese "Schließfunktion" aktivieren und deaktivieren, beispielsweise indem zwei Schalter den Ablauf der einzelnen Verfahrensschritte so steuern, daß der eine Schalter das Aufnehmen, Umwandeln und Speichern der Signale ermöglicht, während der andere Schalter das Vergleichen und ggf. Identifizieren ermöglicht (Anspruch 2).

In einer bevorzugten Ausführungsform läßt sich das Verfahren zum Sichern von Kraftfahrzeugen gegen Diebstähle einsetzen (Anspruch 4, Anspruch 5). Bekanntlich nimmt die Zahl von Kfz-Diebstählen, insbesondere bei teueren Modelle, drastisch zu, so daß erhöhte und zusätzliche Schutzmaßnahmen erforderlich sind. Gleichzeitig setzen Versicherungen für eine Kostenerstattung im Schadensfall wirksame Sicherungsmaßnahmen gegen unbefugte Benutzung voraus. Besonders vorteilhaft ist das vorliegende Verfahren, weil es mit einem unverlierbaren Schlüsselsystem arbeitet. Sicherungssysteme im Stand der Technik basieren im wesentlichen auf mechanischen oder elektronischen Schlüsseln, ohne die zwar eine unbefugte Benutzung oft wirkungsvoll verhindert wird, bei deren Verlust oder Diebstahl das Kfz jedoch sofort entwendet werden kann.

In einer bevorzugten Ausführungsform wird bei der Verwendung des erfindungsgemäßen Verfahrens zum Sichern von Kraftfahrzeugen deren Elektrik unterbrochen und erst dann wieder freigegeben, wenn sich ein Benutzer durch Sprechen eines Codewortes, beispielsweise seinen Namen, oder aber auch durch ein anderes eingespeichertes akustisches Signal zu erkennen gibt.

Ausschlaggebend für die Identifikation ist dabei die Kombination vieler Merkmale der Stimme der jeweiligen Person, beispielsweise Stimmfarbe, Tonhöhe, usw. die sich von anderen nicht imitieren lassen; ähnlich der Eigenschaft von Fingerabdrücken.

Die Verwendung des erfindungsgemäßen Verfahrens ist auch deshalb besonders vorteilhaft, da Speicher- und Logikbausteine ständig billiger werden und die meist bereits vorhandene Elektronik im Kfz, insbesondere bei teureren Modellen, beispielsweise das Vorhandensein eines Bordcomputers mit Speicher und Recheneinheit, die Installierung des entsprechenden Systems kostengünstig ermöglicht, bei schon vorhandenen Hardware-Konzept und Ergänzung eines vertretbaren Aufwandes an Software.

Um den Gegenstand zu sichern, ist die Auswerte- und Steuereinheit, mit der das Aufnehmen und Vergleichen der Stimmen ermöglicht wird, so mit dem zu sichernden Gegenstand verbunden, daß die Benutzung des Gegenstandes bei Feststellen der Identität der Stimme mit einer solchen, deren Signale bereits in der Auswerteeinheit des Speichers abgelegt sind, möglich ist; bei Feststellen mangelnder Identität aber unmöglich ist. Dies kann beispielsweise durch einen Schalter in einem Stromkreis des Gegenstandes erfolgen, ohne dessen Geschlossensein der Gegenstand nicht in Benutzung oder in Betrieb genommen werden kann. Im Falle der Sicherung eines Kraftfahrzeugs kann es sich dabei um einen Schalter handeln, der beim Erkennen einer abgespeicherten Stimme die vorher gesperrte Bordelektrik oder -elektronik freigibt.

Das erfindungsgemäße Verfahren wird mit Hilfe einer Auswerte- und Steuereinheit durchgeführt, die z. B. aus einem ASIC bestehen kann. Diese Einheit steuert sowohl das Einlernen als auch das Vergleichen und Identifizieren der Stimme: in einer Aufnahmeeinheit, beispielsweise mit Mikrofon, wird die Stimme des Benutzers zuerst in elektrische Signale umgewandelt, evtl. bandgefiltert und dann digitalisiert. Das digitalisierte Signal wird an die Auswerteeinheit weitergegeben und dort verglichen. Bevorzugt wird dabei ein Vergleichsalgorithmus eingesetzt, der in der Auswerteeinheit abgespeichert sein kann. Dieser Vergleichsalgorithmus hat zum Ziel, die digitalisierten Daten einer sich identifizierenden Person mit den im System gespeicherten Daten anderer, beispielsweise zum Benutzen des Gegenstandes befugter Personen zu vergleichen und so zu entscheiden, ob es sich bei der sich identifizierenden Person um eine befugte Person handelt.

Der Vergleichsalgorithmus berechnet eine Short-Time-Fouriertransformation der eingehenden digitalisierten Daten. Der dabei entstehende neue Datenvektor (auch Merkmalsvektor genannt) wird mit Hilfe eines Klassifikationsverfahrens mit den abgespeicherten Daten verglichen. Als Klassifikatoren können statistische Klassifikationsverfahren, neuronale Netze oder synergetische Computer verwendet werden. Der Klassifikator entscheidet, ob der Merkmalsvektor mit dem Merkmalsvektor einer gespeicherten Stimme so gut übereinstimmt, daß er diese Person als "im wesentlichen identisch" mit einer Person klassifiziert, deren Stimme gespeichert ist (Anspruch 7, Anspruch 8, Anspruch 9).

Wird das Verfahren zur Diebstahlsicherung eingesetzt, dann wird bei dieser — positiven — Klassifizierung die Diebstahlsicherung ausgeschaltet bzw. das "Schloß" mit der als "Schlüssel" erkannten Stimme aufgeschlossen. Im Falle eines Kfz wird dann beispielsweise die Bordelektronik freigegeben oder der Stromkreis zwischen Batterie und Zündung geschlossen.

Wird die Stimme als "fremd" klassifiziert, wird die Sperre nicht aufgehoben. Optional können optische oder akustische Warnsignale ausgegeben werden, beispielsweise mit Hilfe der Hupe oder Lichthupe (Anspruch 6).

Vorzugsweise wird die Spannungsversorgung des Sicherungssystems, über einen Akku gepuffert, von der Batterie des Kfz sichergestellt.

Ebenfalls optional kann ein Ausgang der Auswerteeinheit an vorhandene Bordlautsprecher (Radioanlage) abgeschlossen werden. Dies ermöglichst zusätzlich, daß ein Benutzer vom System durch einen akustischen Hinweis (z. B. den Satz "bitte identifizieren sie sich" oder einen Piepston) zum Versuch der Identifikation aufgefordert wird.

Es ist bevorzugt daß das "Einlernen" neuer befugter Benutzer nur bei ausgeschalteter Diebstahlsicherung erfolgen kann. Bevorzugt sind hierfür zwei Tasten im Fahrerraum vorgesehen, deren eine den "Einlernmodus" aktiviert. Ist dieser Modus aktiviert, kann der "neue Benutzer" mehrmals hintereinander charakteristische Laut- oder Tonfolgen von sich geben, beispielsweise seinen Namen oder ein frei wählbares Kennwort sprechen. Dieses Wort oder diese Laut folge wird vom System aufgenommen und vom Klassifikator der Auswertungseinheit in einer geeigneten Form im Systemspeicher angelegt. Anhand genau dieses Wortes wird der Benutzer nachher wieder identifiziert.

Bevorzugt erfolgt das Einschalten der Diebstahlsicherung von Kfz bei ausgeschalteter Zündung über eine weitere Taste im Fahrerraum. Ganz besonders bevorzugt ist es, daß die einmal eingeschaltete Sicherung nur durch das gesprochene Kennwort eines befugten Benutzers wieder deaktiviert wird.

Ein Beispiel soll das Verständnis der Erfindung vertiefen.

Fig. 1 zeigt das Beispiel einer Anordnung, mit der das erfindungsgemäße Verfahren durchgeführt werden kann, wenn ein Gegenstand wie ein Kfz gegen Diebstahl gesichert werden soll.

Im Bordcomputer befindet sich ein Chip **1** für die Datenauswertung (z. B. ein ASIC), der die Abspeicherung von Stimmen befugter Benutzer in einem Speicher **2** (z. B. einem EPROM oder EEPROM) steuert. Der Chip ist an die Stromversorgung der Batterie **6** angeschlossen. Die Versorgung kann über Akkus 3 gepuffert sein.

Ein Ausgang des Chips **1** ist mit einer Aufnahmeeinheit 4 mit einem Mikrofon verbunden. Ein weiterer Ausgang ist über einen Schalter **5** mit dem Stromkreis verbunden, der die Batterie **6** mit der Zündung oder Bordelektronik **7** verbindet.

Fakultativ sind Schalter oder Taster zum Scharfstellen der Diebstahlsicherung (T1) bzw. zum Starten des Einlernmodus für neue Benutzer (T2) vorgesehen. Ebenfalls fakultativ ist ein Ausgang des Chips mit einem Lautsprecher **8**, beispielsweise dem Radio, verbunden, durch welchen eine akustische Aufforderung zur Benutzeridentifikation aktiviert werden kann.

Die Klassifizierung des gesprochenen Wortes entscheidet, ob der über eine FFT gewonnene Merkmalsvektor der Sprache der Person, die das KfZ öffnen oder anlassen möchte, mit dem im Speicher **2** Vorgegebenen hinreichend übereinstimmt. Bejahendenfalls wird die Fahrzeugtür geöffnet oder das Anlassen erlaubt.

Mit einer Direktanlassung kann ebenfalls gearbeitet werden, so daß Schlüssel entbehrlich sind. Das Abschalten des Motors dagegen kann durch einen weiteren optionellen Taster erfolgen, hierfür ist die Benutzung des Wortes (dessen Merkmalsvektor) nicht zwingend, vorteilhaft sogar entbehrlich.

Patentansprüche

1. Verfahren zum Identifizieren einer menschlichen Stimme, insbesondere zum Sichern von Gegenständen gegen Diebstahl, umfassend
   (a) das Aufnehmen einer Stimme mit Hilfe einer Aufnahmeeinheit **(4)**,
   (b) das Umwandeln der aufgenommenen akustischen Signale in elektrische Signale **(4)**,
   (c) das Digitalisieren und Abspeichern der Signale in einer Auswerteeinheit mit Speicher **(1, 2)**,

   wobei ggf. die Schritte (a) bis (c) mit weiteren Stimmen wiederholt werden, und
   (d) das Vergleichen digitalisierter Signale einer Vergleichs-Stimme mit einer oder mehreren solchen, die sich bereits im Speicher **(2)** der Auswerteeinheit **(1)** befinden, und Identifizieren der Stimme als im wesentlichen identisch mit der oder einer der Stimmen, die im Speicher **(2)** der Auswerteeinheit **(1)** gespeichert sind.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Auswerteeinheit **(1)** über einen ersten Schalter (T2) so gesteuert wird, daß nur die Schritte (a) bis (c) ausgeführt werden können, und/oder über einen zweiten Schalter (T1) so gesteuert wird, daß nur Schritt (d) ausgeführt werden kann.
3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Auswerteeinheit **(1)** so mit dem zu sichernden Gegenstand verbunden ist, daß die uneingeschränkte Benutzung des Gegenstandes bei Feststellen der Identität der Vergleichs-Stimme mit einer solchen, deren Signale bereits im Speicher **(2)** abgelegt sind, möglich ist, bei Feststellen mangelnder Identität unmöglich ist.
4. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß es sich bei dem zu sichernden Gegenstand um ein Kraftfahrzeug handelt, daß die Verbindung einen Schalter **(5)** umfaßt, der den zum Starten des Kraftfahrzeugs erforderlichen Stromkreis unterbrechen kann und daß die uneingeschränkte Benutzung das Starten und Wegfahren ist.
5. Verfahren nach Anspruch 2 und 4, dadurch gekennzeichnet, daß sich der erste und/oder der zweite Schalter (T1, T2) zur Steuerung der ausführbaren Schritte des Identifizierens im Innenraum des Kraftfahrzeugs befinden.
6. Verfahren nach einem der Ansprüche 3 bis 5, dadurch gekennzeichnet, daß beim Feststellen mangelnder Identität akustische oder optische Warnsignale abgegeben werden.

7. Verfahren nach einem der voranstehenden Ansprüche, dadurch gekennzeichnet, daß in Schritt (d) die Stimmen mit Hilfe eines Vergleichsalgorithmus verglichen werden, der eine Short-Time-Fouriertransformation (FFT) der eingehenden digitalisierten Daten berechnet, wobei der neu entstehende Datenvektor mit Hilfe eines Klassifikationsverfahrens mit Datenvektoren der abgespeicherten Signale verglichen wird.

8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß für das Klassifikationsverfahren neuronale Netze oder synergetische Computer verwendet werden.

9. Verfahren nach einem der Ansprüche 3 bis 8, dadurch gekennzeichnet, daß der Klassifikator entscheidet, ob die verglichenen Merkmalsvektoren so gut übereinstimmen, daß im wesentlichen Identität festgestellt wird.

10. Vorrichtung zum Identifizieren einer menschlichen Stimme gemäß einem der erwähnten Verfahrensansprüche, umfassend

(a) eine Aufnahmeeinheit mit Mikrofon (**4**),
(b) eine Auswerte- und Steuereinheit (**1**),
(c) einen Speicher (**2**) für digitalisierte Stimmsignale, sowie
(d) eine Verbindung zu dem zu sichernden Gegenstand, die die Inbetriebnahme des Gegenstandes steuern kann (**5**), und/oder
(e) einen oder mehrere Akkumulatoren (**3, 6**) für eine gepufferte Spannungsversorgung der Vorrichtung, und/oder
(f) einen oder mehrere Lautsprecher (**8**), und/oder
(g) Schalter (**T1, T2**) zum Steuern der Bedienungsfunktionen der Vorrichtung.

11. Verwendung mindestens eines gesprochenen Wortes als Schlüssel für das Öffnen einer Autotür oder als Schlüssel für das Freigeben des Motorstartens oder selbiges selbst.

Hierzu 1 Seite(n) Zeichnungen

– Leerseite –

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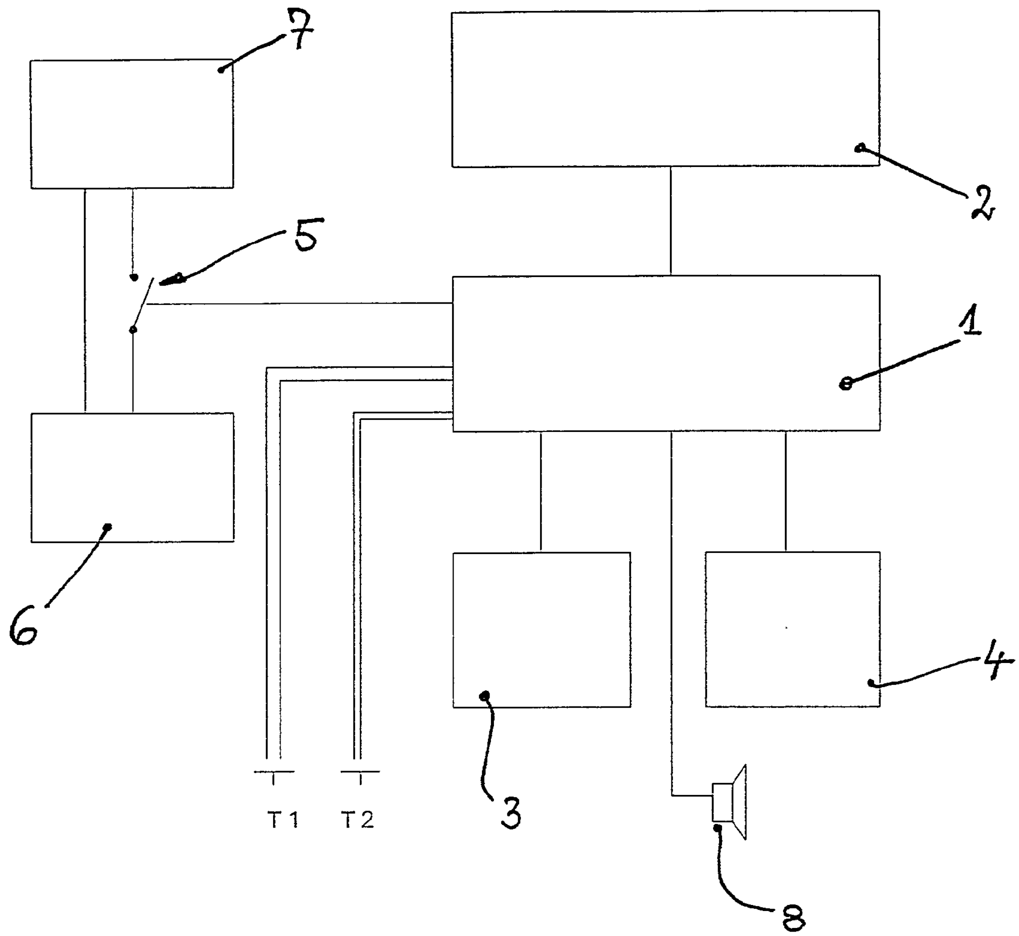

Figur 1

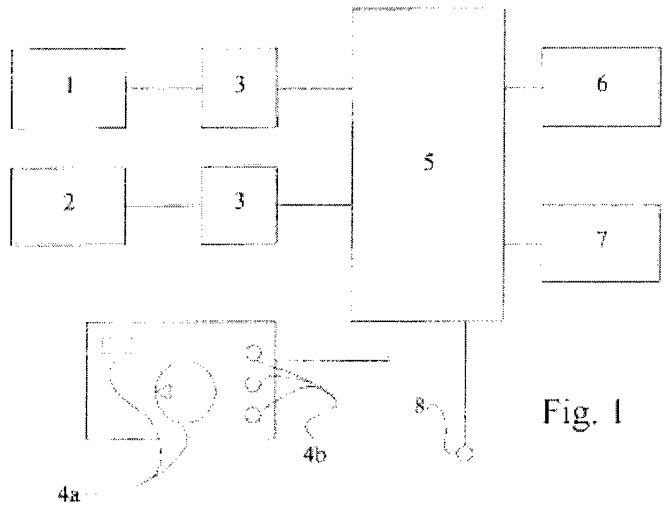

Fig. 1

Recording driving style of driver of motor vehicle

AB
(DE19728872)
The method records acceleration values along vehicle longitudinal and transverse axes using acceleration sensors (1,2) with amplifier and filter (3). One acceleration value is stored in memory (6), if recorded value exceeds a certain limit. The memory size is determined by the duration and size of the infringement by recorded value. The memory stores size and duration of infringement. The storage size is proportional to the integral of the amount of the value over the limit and the time. In addition to each stored value, or at certain distances, time information, particularly the signal of the real time on the clock (7), is stored, memory (7) being non-volatile (ROM). The amount and the size of the values stored are indicated to the driver. Microcontroller (5) connects to diodes (4b) for display and controller (4a) esp. for inputting time. The driver has a value indicated, which depends on the sum of the values stored in the memory. Formerly stored values of the developing sum are more weakly weighted than later stored values.

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PA0 Savignano, Manuel Aldo, Monte Carlo, MC

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	DE19728872	19990114	1997DE-1028872	19970707	A1 - Doc. laid open (First publication)

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1997DE-1028872 19970707

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B60R-016/02
G07C-005/00
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EC
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DE4215406(A1) [DE4215406]
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Erfinder wird später genannt werden

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DE	32 24 966 A1
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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Verfahren und Vorrichtung zum Erfassen des Fahrstils eines Fahrers

DE 197 28 872 A 1

Beschreibung

Die Erfindung betrifft ein Verfahren und eine Vorrichtung zum Erfassen des Fahrstils eines KFZ-Fahrers.

Der individuelle Fahrstil eines Autofahrers ist geprägt durch ein typisches Beschleunigungs- bzw. Abbremsverhalten in verschiedenen Verkehrssituationen. Während z. B. ein besonnener Fahrer abrupte Geschwindigkeitsänderungen nach Möglichkeit vorausschauend vermeidet, ist der Stil des "Rasers" gekennzeichnet durch häufige Tempowechsel, ständige starke Beschleunigungs- und Bremsvorgänge, hohes Tempo in engen Kurven etc. Bekanntermaßen stellt ein solcher Fahrstil auch ein sehr hohes Gefährdungspotential für den Fahrer und für andere Verkehrsteilnehmer dar.

Aus der Analyse des Beschleunigungsverhaltens über die Zeit lassen sich folglich Rückschlüsse über den Fahrstil ziehen. Eine Anzeige des Fahrstils könnte damit einerseits der Selbstkontrolle des Fahrers dienen, z. B. für Fahranfänger. Andererseits wären Angaben zum Fahrstil für alle Branchen interessant, in denen aus der potentiellen Gefährdung durch einen schlechten Fahrstil finanzielle Folgen erwachsen, z. B. für Kfz-Versicherer, Autovermieter u. a. Letztlich kann die Ermittlung des Fahrstils auch den Fahrer selbst vor akuten Gefahren warnen, wenn z. B. eine Kurve mit überhöhter Geschwindigkeit durchfahren wird.

Es ist Aufgabe der vorliegenden Erfindung, ein Verfahren und eine Vorrichtung zum Erfassen des Fahrstils eines Fahrers vorzustellen, das die nachträgliche Analyse des Fahrstils ermöglicht. Es soll zum einen dem Autofahrer direkt Hinweise auf unausgeglichenen, gefährlichen Fahrstil geben und andererseits daran interessierten Kreisen, wie beispielsweise Versicherungen, Autovermietungen etc. die Möglichkeit einer nachträglichen Kontrolle bieten.

Erfindungsgemäß wird ein Verfahren zum Erfassen des Fahrstils eines KFZ-Fahrers mit den Merkmalen des Patentanspruches 1 vorgeschlagen.

Im Fahrzeug ist mindestens ein Beschleunigungssensor angeordnet, der die Beschleunigungswerte in Fahrtrichtung oder in der Querachse des Fahrzeuges erfaßt. Besser ist die Verwendung von mindestens zwei Sensoren, damit das Verhalten in der Kurve gleichzeitig mit dem Brems- und Beschleunigungsverhalten in Fahrtrichtung erfaßt werden kann. Die von den Sensoren gemessenen Werte werden schaltungstechnisch aufbereitet und die Werte einer den Beschleunigungswerten zugeordneten Größe in einem Speicher gespeichert. Dabei erfolgt eine Abspeicherung aber nur dann, wenn der erfaßte Beschleunigungswert einen vorgegebenen Grenzwert betragsmäßig übersteigt. Dies hat zur Folge, daß der Speicher nicht mit denjenigen Werten gefüllt wird, die unterhalb bestimmter Grenzen liegen, also im Regelfall unproblematisches und ausgeglichenes Fahrverhalten charakterisieren. Gespeichert werden nur die Werte, bei denen ein Grenzwert überschritten wird.

Eine solche Datenkompression ist erforderlich, um die Größe des Speichers möglichst klein zu halten. Das Verfahren ist damit kostengünstig durchführbar. Die Grenzwerte für die Beschleunigungswerte können in den verschiedenen erfaßten Richtungen unterschiedlich gewählt werden. Damit wird es möglich, daß beispielsweise starkes Beschleunigen solange nicht negativ gewertet wird, als daraus keine starken Bremsmanöver oder überhöhte Querbeschleunigungen durch Ausweichen oder schnelle Kurvenfahrt resultieren.

Während der Fahrt erfolgt eine ständige Überwachung der Beschleunigungswerte auf Überschreitung der festgelegten Grenzwerte. Erfolgt eine Grenzwertüberschreitung, so wird die Höhe dieser Überschreitung solange registriert, bis der Grenzwert wieder unterschritten wird.

Vorzugsweise wird zur weiteren Datenkompression für jede Grenzwertüberschreitung nur ein Wert gespeichert. Der Wert der Speichergröße hängt von der Höhe und der Dauer der Grenzwertüberschreitung ab. Eine nur geringe Grenzwertüberschreitung, die aber lange andauert, würde dann mit dem gleichen Speicherwert abgespeichert wie eine kurzzeitige, aber sehr krasse Grenzwertüberschreitung.

Vorzugsweise ist die Speichergröße proportional zum Integral der Grenzwertüberschreitung nach der Zeit.

Um eine spätere zeitliche Rekonstruktion des Ereignisses vornehmen zu können, kann zusammen mit jedem Speicherwert oder in regelmäßigen Abständen eine Zeitinformation, z. B. von einer Echtzeituhr, abgespeichert werden.

In einer bevorzugten Weiterbildung des erfindungsgemäßen Verfahrens werden die abgespeicherten Werte dem Fahrer angezeigt. Es können die gespeicherten Werte entweder direkt nach Anzahl und Größe angezeigt werden, oder zur Vereinfachung und besseren Übersichtlichkeit während der Fahrt auch nur ein fiktiver, errechneter Wert, der beispielsweise von der Summe der im Speicher abgelegten Werte abhängt.

In einer bevorzugten Form des erfindungsgemäßen Verfahrens bestimmt sich der an gezeigte Wert aus der Summe der Speicherwerte, wobei jeder Speicherwert mit einem Wichtungsfaktor in die Summe eingeht, der um so niedriger ist, je länger der Speicherzeitpunkt des jeweiligen Wertes vergangen ist. Auf diese Art kann eine Änderung des Fahrstils schneller vom Anzeigewert abgelesen werden.

Für die Summenbildung können entweder alle im Speicher verfügbaren Werte herangezogen werden, oder nur die Werte, die innerhalb eines bestimmten Zeitintervalls vor dem Anzeigezeitpunkt oder ab einem bestimmten Zeitpunkt abgespeichert worden sind. Dieses Zeitintervall kann beispielsweise ein Tag, eine Woche oder ein Monat sein. Dadurch wird es möglich, daß beispielsweise bei einem Fahrerwechsel sofort die vom neuen Fahrer erzielten Werte angezeigt werden. Um vergleichbare Werte zu erhalten, müssen entsprechende Ausgleichsfaktoren in das Ergebnis eingehen.

Die Anzeige der gespeicherten Werte kann entweder direkt, beispielsweise durch Anzeige eines Zahlenwertes, erfolgen oder lediglich in groben Bereichen, beispielsweise durch verschiedenfarbige Leuchtdioden, die durch ihre Farben den Bereich des Meßwertes anzeigen.

Da länger zurückliegende Speicherwerte an Interesse verlieren, wird der Speicherinhalt vorzugsweise periodisch überschrieben, wobei die ältesten Werte durch die aktuellen Speicherwerte ersetzt werden.

Durch das erfindungsgemäße Verfahren ist es möglich, das Fahrverhalten eines Fahrers im Nachhinein zu analysieren. Die Anzeige kann beispielsweise per Computer über der Zeitachse ausgedruckt werden, damit die jeweils erzielten Werte visuell darstellbar sind. Der Fahrer kann aber auch bereits während der Fahrt entweder durch die Anzeigewerte oder durch das Aufleuchten verschiedenfarbiger Leuchtdioden unmittelbar feststellen, ob die Beschleunigungswerte kritische Grenzen überschreiten.

Erfindungsgemäß wird außerdem eine Vorrichtung zum Erfassen des Fahrverhaltens eines Fahrers gemäß Patentanspruch 12 vorgeschlagen. Die erfindungsgemäße Vorrichtung umfaßt mindestens einen Beschleunigungssensor und einen Datenspeicher. Im Speicher ist für alle einen vorgegebenen Grenzwert betragsmäßig übersteigenden Beschleunigungswerte der Wert einer dem Beschleunigungswert zugeordneten Größe abspeicherbar.

Vorzugsweise sind in der Vorrichtung zwei Beschleunigungssensoren angeordnet, von denen einer die Beschleunigung in Fahrtrichtung und der andere die Beschleunigung in Querrichtung des Fahrzeuges erfaßt.

Gemäß einer Weiterbildung der Erfindung verfügt die Vorrichtung über eine Zeitmeßeinrichtung, so daß neben dem Beschleunigungswert auch die Dauer der Grenzwertüberschreitung ermittelt und gespeichert werden kann. Bei der Zeitmeßeinrichtung kann es sich vorzugsweise um eine Echtzeituhr handeln, die aber auch zusätzlich installiert sein kann. Dann kann der Speicherwert zur späteren zeitlichen Rekonstruktion zusammen mit einer Echtzeitinformation abgespeichert werden.

Um die Daten, die von den Beschleunigungssensoren, der Zeitmeßeinrichtung und der Echtzeituhr geliefert werden, verarbeiten zu können, kann die Vorrichtung über eine Datenverarbeitungseinheit verfügen, mit der die Daten vor und/oder nach der Speicherung bearbeitet werden können.

Als Speicher wird vorzugsweise ein sogenannter Ringspeicher eingesetzt, der nach einer bestimmten Zeit oder sobald kein Speicherplatz mehr verfügbar ist, die zuerst gespeicherten Daten kontinuierlich mit den neu aufgenommenen Daten überschreibt.

Die Vorrichtung kann mit einer PC-Schnittstelle ausgerüstet sein, die die Ausgabe der gespeicherten Daten zur weiteren Bearbeitung erlaubt.

Die Vorrichtung kann auch über eine Anzeigevorrichtung verfügen, die die gespeicherten Werte oder daraus abgeleitete Werte anzeigen kann. Eine solche Anzeigevorrichtung kann beispielsweise aus einer Skala bestehen, die einen Zahlenwert anzeigt, oder auch aus Leuchtdioden, die durch verschiedene Farben oder durch die Anzahl der beleuchteten Dioden bestimmte Bereiche anzeigt. Dem Fahrer kann damit sein Fahrstil angezeigt werden. Die Anzeige kann auch so ausgestaltet werden, daß ein über einen bestimmten Zeitraum gemittelter Wert angezeigt wird, gleichzeitig aber Spitzenwerte, wie sie beispielsweise in sehr schnell durchfahrenen Kurven auftreten, sofort sichtbar gemacht werden, beispielsweise durch eine separate Leuchtdiode.

An einem Wählschalter kann der Zeitraum, der den angezeigten Werten zugrunde liegt, eingestellt oder der Anfang des Meßzeitraumes bestimmt werden.

Die Erfindung wird im folgenden anhand der beigefügten Abbildung näher erläutert:

Fig. 1 zeigt eine schematische Darstellung einer erfindungsgemäßen Vorrichtung.

Die Vorrichtung besteht aus zwei Beschleunigungssensoren **1**, **2** mit einem Meßbereich von je ± 1 g. Ein Beschleunigungssensor erfaßt die Beschleunigungswerte in Fahrtrichtung, der andere in Richtung der Fahrzeugquerachse. Über eine Signalverstärkung und analoge Filterung **3** gelangen Signale in einen Microcontroller **5**, der die Registrierungen und Auswertungen der eingehenden Signale sowie die Steuerung der Meßwerterfassung durchführt.

Die Berechnung werden in einem flüchtigen Speicherbereich des Microcontrollers **5** vorgenommen. Zur permanenten Datenspeicherung ist ein ausreichend großer nicht flüchtiger Speicher **6** angeschlossen, z. B. ein Flash-Eprom oder ein Zero-Power-RAM.

An den Mikrocontroller **5** ist außerdem eine Echtzeituhr **7** angeschlossen, die Zeitsignale liefert, die zusammen mit den von den Beschleunigungssensoren **1**, **2** gelieferten Signalen verarbeitet und gespeichert werden können.

Die Speicherung einer Grenzwertüberschreitung zusammen mit einer Zeitmarke, die von der am Microcontroller **5** angeschlossenen Echtzeituhr **7** gewonnen wird, benötigt 4 Byte. Bei einer Verwendung eines 128 kByte großen nicht flüchtigen Speichers **6** können ca. 32.000 Grenzwertüberschreitungen gespeichert werden. Legt man bei einem extrem schlechten Fahrstil durchschnittlich zwei Grenzwertüberschreitungen pro Minute zugrunde und geht von einer mittleren täglichen Fahrzeit von vier Stunden aus, so erlaubt das Gerät die Speicherung über einen Zeitraum von mehr als zwei Monaten; danach werden die ältesten Daten überschrieben. Bei einem durchschnittlichen Fahrstil ist die Aufzeichnungsdauer entsprechend länger.

An den Mikrocontroller **5** sind darüber hinaus Bedien- **4**a und Anzeigeelemente **4**b angeschlossen, die dem Fahrer die ermittelten und gespeicherten Werte oder daraus abgeleitete Werte anzeigen. Die Anzeigeelemente **4**b bestehen aus einer grünen, einer gelben und einer roten Leuchtdiode entsprechend normalem, bedenklichem und schlechtem Fahrstil.

Am Bedienelement **4**a kann der Fahrer den Zeitraum wählen, für den der Fahrstil ermittelt werden soll. Es kann beispielsweise der letzte Tag, die letzte Woche oder der letzte Monat eingestellt werden. An einer Rückstelltaste kann der Fahrer außerdem den Anfangszeitpunkt bestimmen, ab dem der Fahrstil bewertet werden soll, z. B. nach einem Fahrerwechsel.

Das Gerät wird beispielsweise mittels eines Gummisaugers am unteren Rand der Frontscheibe genau in der Mittelachse des Fahrzeuges angebracht. Damit ist die korrekte Ausrichtung in der Fahrebene gewährleistet. Eine waagerechte Einstellung erfolgt über ein arretierbares Drehgelenk.

Die Stromversorgung erfolgt über einen Anschluß am Zigarettenanzünder. Damit ist das Gerät sehr einfach ein- und auszubauen.

Weiterhin ist ein Anschluß **8** zum Auslesen der Daten über einen PC vorgesehen.

Patentansprüche

1. Verfahren zum Erfassen des Fahrstils eines KFZ-Fahrers, wobei die Beschleunigungswerte entlang der Fahrzeuglängsachse und/oder entlang der Fahrzeugquerachse durch Beschleunigungssensoren erfaßt und die Werte einer den Beschleunigungswerten zugeordneten Größe in einem Speicher (**6**) gespeichert werden, **dadurch gekennzeichnet**, daß nur dann eine Speicherung erfolgt, wenn der erfaßte Beschleunigungswert einen vorgegebenen Grenzwert betragsmäßig übersteigt.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß für jede Grenzwertüberschreitung nur ein Wert gespeichert wird.
3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Speichergröße von der Dauer und der Größe der Grenzwertüberschreitung des erfaßten Beschleunigungswertes bestimmt wird.
4. Verfahren nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß die Speichergröße proportional zum Integral der Grenzwertüberschreitung nach der Zeit ist.
5. Verfahren nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß zusätzlich zu jedem Speicherwert oder in bestimmten Abständen eine Zeitinformation, insbesondere das Signal einer Echtzeituhr (**7**), gespeichert wird.
6. Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Anzahl und/oder die Größe der im Speicher (**6**) gespeicherten Werte dem Fahrer angezeigt werden.
7. Verfahren nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß dem Fahrer ein Wert angezeigt wird, der von der Summe der im Speicher gespeicherten Werte abhängt.
8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß früher abgespeicherte Werte bei der Summenbildung schwächer gewichtet werden als später abgespeicherte Werte.
9. Verfahren nach einem der Ansprüche 6 bis 8, dadurch gekennzeichnet, daß die Anzeige mittels Leucht-

dioden (**4**b) erfolgt.

10. Verfahren nach einem der Ansprüche 6 bis 9, dadurch gekennzeichnet, daß der angezeigte Wert aus den Speicherdaten eines vorgegebenen Zeitintervalls vor dem Anzeigezeitpunkt, insbesondere des letzten Tages, der letzten Woche oder des letzten Monats, oder den seit einem vorgegebenen Zeitpunkt gespeicherten Werten, gebildet wird.

11. Verfahren nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß die gespeicherten Werte kontinuierlich mit den neu zu speichernden Werten überschrieben werden.

12. Vorrichtung zum Erfassen des Fahrstils eines KFZ-Fahrers, bestehend aus mindestens einem in Fahrtrichtung oder in Querrichtung des Fahrzeuges angeordneten Beschleunigungssensor (**1**, **2**) und einem Datenspeicher (**6**), dadurch gekennzeichnet, daß für alle einen vorgegebenen Grenzwert betragsmäßig übersteigenden Beschleunigungswerte der Wert einer dem Beschleunigungswert zugeordneten Größe im Datenspeicher (**6**) abspeicherbar ist.

13. Vorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß zwei Beschleunigungssensoren (**1**, **2**) vorgesehen sind, von denen einer die Beschleunigung in Fahrtrichtung und der andere in Querrichtung des Fahrzeuges erfaßt.

14. Vorrichtung nach Anspruch 12 oder 13, dadurch gekennzeichnet, daß sie über eine Zeitmeßeinrichtung (**7**) verfügt und die Dauer einer Grenzwertüberschreitung mit der Speichergröße abspeicherbar ist.

15. Vorrichtung nach einem der Ansprüche 12 bis 14, dadurch gekennzeichnet, daß sie über eine Echtzeituhr (**7**) verfügt und das von der Echtzeituhr (**7**) abgegebene Zeitsignal mit der Speichergröße abspeicherbar ist.

16. Vorrichtung nach einem der Ansprüche 12 bis 15, dadurch gekennzeichnet, daß sie über eine Datenverarbeitungseinheit (**5**) verfügt, mit der die Signale des oder der Beschleunigungssensoren (**1**, **2**) und/oder der Zeitmeßeinrichtung (**7**) und/oder der Echtzeituhr vor und/oder nach der Speicherung bearbeitet werden können.

17. Vorrichtung nach einem der Ansprüche 12 bis 16, dadurch gekennzeichnet, daß der Speicher (**6**) ein kontinuierlich überschreibbarer Ringspeicher ist.

18. Vorrichtung nach einem der Ansprüche 12 bis 17, dadurch gekennzeichnet, daß die gespeicherten Daten über eine PC-Schnittstelle (**8**) auslesbar sind.

19. Vorrichtung nach einem der Ansprüche 12 bis 18, dadurch gekennzeichnet, daß die im Speicher (**6**) gespeicherten Daten oder daraus abgeleitete Werte anzeigbar sind.

20. Vorrichtung nach Anspruch 19, dadurch gekennzeichnet, daß die Anzeige mittels einer Skala oder mehrerer Leuchtdioden (**4**b) erfolgt.

21. Vorrichtung nach einem der Ansprüche 12 bis 20, dadurch gekennzeichnet, daß die Vorrichtung über einen Wählschalter (**4**a) verfügt, an dem das Meßintervall und/oder der Beginn des Meßzeitraumes wählbar ist.

Hierzu 1 Seite(n) Zeichnungen

- Leerseite -

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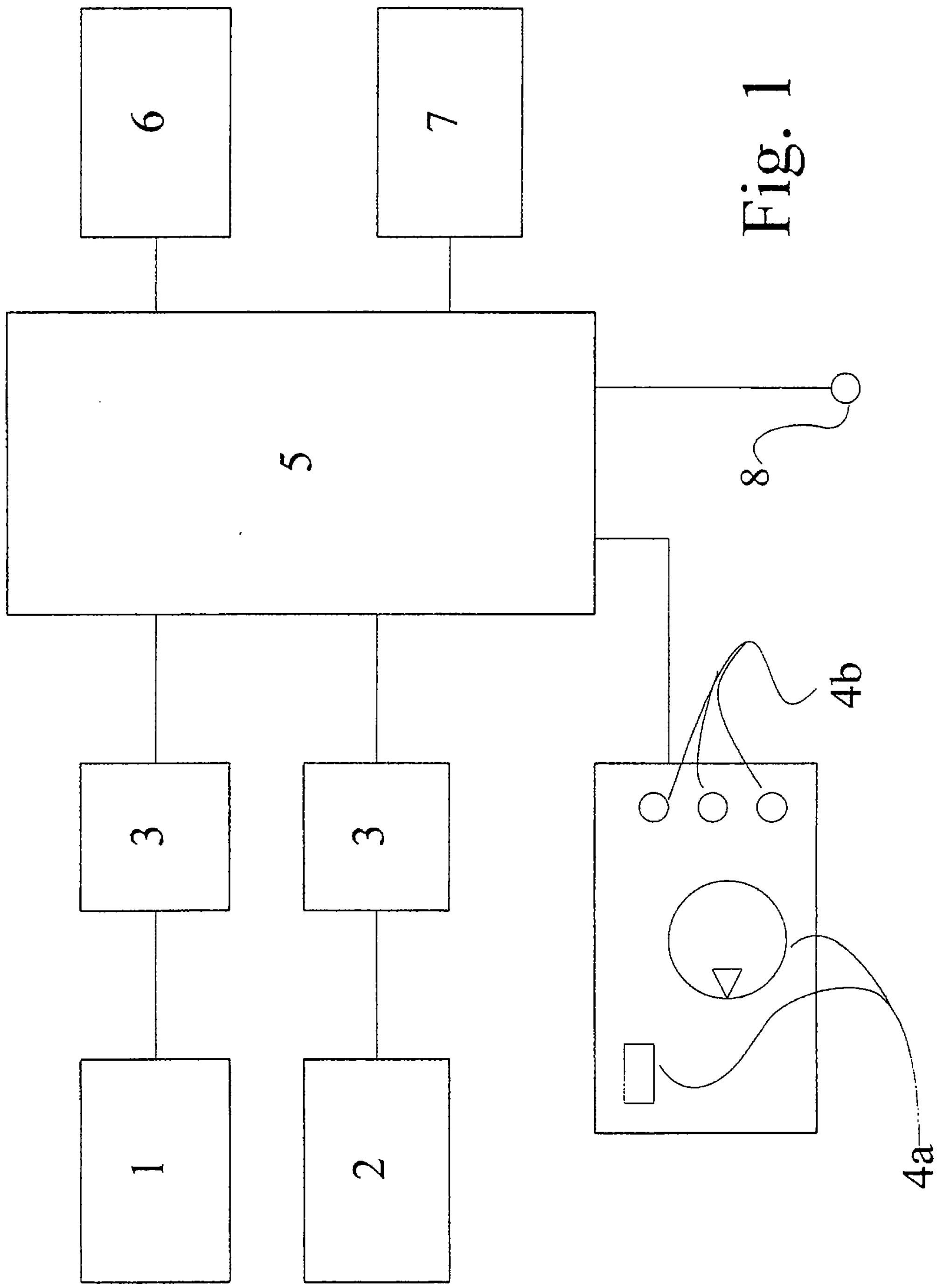
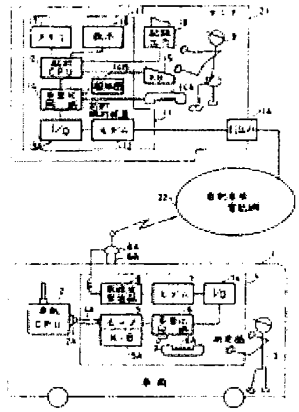


Fig. 1



Diagnostic device for on-vehicle computer

AB

(JP03004660)
PURPOSE: To diagnose a vehicle at site moved at a remote location by constituting the diagnostic device with a means monitoring an on-vehicle computer to fetch diagnostic information and a radio transmitter sending the fetched diagnostic information to a diagnostic analyzer fixed at the outside of a vehicle by radio communication.
CONSTITUTION: A diagnostic device of an on-vehicle computer 2 consists of a connection means and a diagnostic analyzer, and the connection means includes a measuring instrument 4 carried easily in a car body 1 being a car body to be diagnosed with the operator 3, and having a connector 4A connecting to a socket 2A of the on-vehicle computer 2 to fetch the diagnostic information. A diagnostic analyzer 11 receives the diagnostic information sent from the car body 1 and sends it to an analysis computer 12. Since the diagnostic analyzer 11 is arranged fixedly to the center 21, the shape and the size are optional. Thus, an input operation keyboard 15, a display section 16, a memory section 17 and a recording output section 18 operated by the operator 9 are optional.

IN UCHIDA HIDEKI

PA HINO MOTORS

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審査請求　未請求　請求項の数　2　（全5頁）

㊹発明の名称　車載用コンピュータの診断装置

㉑特　願　平1－138764

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明　細　書

1. 発明の名称

車載用コンピュータの診断装置

2. 特許請求の範囲

1. 車両に搭載されたコンピュータの診断情報を取り込むためにそのコンピュータに接続される接続手段と、

この接続手段を介して取り込まれた診断情報を解析する診断解析装置と

を備えた車載用コンピュータの診断装置において、

前記診断解析装置は、前記車両の外に固定的に配置され、

前記接続手段は、前記車両に搭載された無線送信装置と、前記診断解析装置に接続された無線受信装置とを含む

ことを特徴とする車載用コンピュータの診断装置。

2. 無線送信装置および無線受信装置は、自動車用電話装置が利用されたことを特徴とする請求項1記載の車載用コンピュータの診断装置。

3. 発明の詳細な説明

〔産業上の利用分野〕

本発明は、コンピュータを搭載する車両に利用する。

本発明は、車両に搭載されたコンピュータの診断に利用される。

〔概要〕

本発明は、車両に搭載されたコンピュータに接続してその診断情報を取り込む接続手段と、この取り込んだ診断情報を解析する診断解析装置とを備えた車両用コンピュータの診断装置において、

車外に固定された診断解析装置に、接続手段より無線通信で診断情報を送信することにより、

経験の乏しい作業者が接続手段を操作しても、完全な診断が行われるとともに、車両の診断情報の記録およびその解析が容易に行われるようにし

たものである。

〔従来の技術〕

最近、車両、ことに自動車の各部の制御装置にプログラム制御回路が用いられている。これらを制御する車載コンピュータには、万一故障が生じても、これに対処する安全装置を備えている。したがってこの安全装置を含む車載コンピュータは、適宜その作動状態の診断を行う必要がある。

このため車載コンピュータには、あらかじめ診断装置の接続手段を受け入れるソケットが設けられ、このソケットに受け入れられた接続手段を介して取り込まれた診断情報を診断解析装置で診断する。この診断解析装置は操作入力端、表示部、メモリなどを含む解析コンピュータから構成される。

診断を行うときには作業者は、これら接続手段と診断解析装置とを備えた診断装置を被診断車両に接近させ、車載コンピュータのソケットに接続し、入力操作部と表示部とにより一般診断を行い、問題点が検出されると、この問題点に対する特殊の診断を行って、これに対する処置をして、車両を完全なものに整備していた。

〔発明が解決しようとする問題点〕

しかし、経験が少い作業員ではこの診断が十分に行えない。

また、診断装置を被診断車両に搭載して使用するには診断装置を可搬型にしなければならない。そのため型状に制限があり、十分な能力のある装置とすることができない。

さらに、多数の診断装置が各基地などに分散配備されることになるので、車両全体の診断記録作成や統計処理に不向きである。

本発明は、このような問題点を解決して、経験の少ない作業員が行っても十分な診断を行うことができ、さらに遠隔地に移動した車両を現地で診断することができ、かつ診断記録作業が簡単に行うことができる車載用コンピュータの診断装置を提供することを目的とする。

〔問題点を解決するための手段〕

本発明は、車両に搭載されたコンピュータの診断情報を取り込むためにそのコンピュータに接続される接続手段と、この接続手段を介して取り込まれた診断情報を解析する診断解析装置とを備えた車載用コンピュータの診断装置において、

診断解析装置は、車両の外に固定的に配置され、接続手段は、車両に搭載された無線送信装置と、前記診断解析装置に接続された無線受信装置とを含むことを特徴とする。

無線送信装置および無線受信装置は、自動車用電話装置を利用することができる。

〔作用〕

被診断車両の車載コンピュータに携帯して持ち込む接続手段は、車載コンピュータにモニタして診断情報を取り込む手段と、この取り込んだ診断情報を車外の固定された診断解析装置に無線通信により送信する無線送信装置とで構成されるから小型のものとすることができ、したがって作業者を迅速かつ容易に被診断車両が存在する遠隔の地まで派遣することが可能である。

さらに接続手段は、固定された診断解析装置に接続された無線受信装置を含むもので、被診断車両から送信された診断情報を受信して解析し診断できる。この診断装置は固定されており、その形状や寸法に制限がないので、十分に解析できる能力のあるものとすることができる。

車両に携帯する複数の接続手段を無線通信により、１つの診断解析装置で処理できるので、多数の診断情報を記録し、統計し、分析することにより多数の車載コンピュータを効率よく管理できるとともに、新たな開発情報を得ることができる。

派遣される作業者は診断処理を行わないので経験の少い者でも十分に対応できる。

万一、被診断車両の車載コンピュータに異常が発生した場合は、迅速にその処理を行うことができる。

無線の送信装置および受信装置を自動車用電話装置を利用する場合は、伝送されるデータの品質が向上するとともに通信地域が全国的に拡大できる。さらに車両側にハンドセットを付加することにより、車両側と固定局側との各作業者は音声に

より、打合せを行うことができる。

〔実施例〕

次に本発明の実施例を図面を参照して説明する。

第1図は本発明一実施例の全体構成説明図であり、第2図は同実施例のブロック構成図である。

図において、車両1はバス用自動車で、その運転席に車載コンピュータ2が搭載される。作業者3はセンタ21より派遣されて、前記車両1の車載コンピュータ2を診断する。診断は定期的に行われる一般診断と、特に異常が発生したときに行う臨時診断とがある。

車載コンピュータ2の診断装置は、接続手段と診断解析装置とから構成され、接続手段には作業者3が被診断車両である車両1に容易に携帯して持ち込め、車載コンピュータ2のソケット2Aに接続して診断情報を取り込むコネクタ4Aを備えた測定器4を含む。この測定器4には作業者3が手動により診断操作を行う入力操作端5Aを備えたモニタ部5を含む。診断解析装置11は測定器4が取り込む診断情報を解析する解析コンピュータ12を含む。

ここに本発明の特徴とするところは、診断解析装置11は車両1の外のセンタ21に固定的に配置され、接続手段は前記測定器4とともに車両1に搭載される無線送信装置として、前記モニタ部5が取り込んだ診断情報にハンドセット6Aにより作業者3の音声を多重化する多重化回路6と、この多重化回路6の出力をインタフェース7Aを介して受け取り無線信号用の信号波形に変調するモデム7およびこのモデム7の出力を仮設アンテナ8Aを介して自動車用電話網22に無線信号として送出する無線送受信部8を含み、前記診断解析装置11は車両1より送出された診断情報を受信する無線受信装置として、前記自動車用電話網22から引込み端11Aを介して入力する診断情報を復調するモデム13と、このモデム13の出力をインタフェース13Aを介して受け取り前記解析コンピュータ12に送出するとともに必要によりこの診断解析装置11を操作する作業者9が前記作業者3に前記ハンドセット6Aを介して音声による通話を行うハンドセット14Aを備えた多重化回路14とを含むことにある。

すなわち、診断解析装置11はンセタ21に固定的に配置されているので、その形状や寸法は任意のものとすることができる。したがって作業者9が操作する入力操作端15、表示部16、メモリ部17および記録出力部18は適当なものが選択できる。また仮設アンテナ8Aは吸着部8Bにより被診断車両である車両1のルーフ部に容易に設置できる。

つぎに本実施例の操作を説明する。作業者3は車両1のルーフ部に仮設アンテナ8Aを設置し、測定器4のコネクタ4Aを車載コンピュータ2のソケット2Aに接続し、入力操作端5Aを操作してモニタ部5を始動する。これにより無線送受信部8は自動車用電話網22を介してセンタ21と交信準備がなされる。診断操作に先立ち、作業者3はハンドセット6Aによりセンタ21の作業者9を報知器14Bにより呼び出し、作業者9はハンドセット14Aにより作業者3と音声により打合わせを行う。

診断が一般診断である場合、作業者3は定められた手順に従い、入力操作端5Aを操作して車載コンピュータ2の診断情報をセンタ21に送出する。センタ21の作業者9は解析コンピュータ12の解析結果を表示部16の表示により検討して異常の有無を検出する。異常があった場合、作業者9は入力操作端15を操作して車載コンピュータ2に直接接触するか、またはハンドセットによる音声交信により作業者3がその入力端末端5Aの操作により異常の発生原因を追究して、これに対する処置を行う。このようにして診断が終了すると、作業者9は診断結果をメモリ部17のファイルに格納して車両1の車載コンピュータ2の履歴として保存し、必要により記録出力部18で出力する。

診断が臨時診断である場合は、車載コンピュータ2において発生した異常状態を再現するように作業者3が入力操作端5Aの操作を行う。センタ21の作業者9はこの診断情報による解析結果を判定して、作業者3に車載コンピュータ2の点検を行わせ、異常発生の原因の除去を行う。

このように診断情報の判定はセンタ21の作業者9が行うので、被診断車両に派遣される作業者3は経験の少いものでよい。測定器4には表示部16および記録出力部18は不要であり、入力操作端5Aも簡単なものでよい。したがって測定器4は小型ですみ、携帯に容易な形状にできる。また被診断車両が多数のとき複数の作業者を派遣する必要がある。診断結果を個々の測定器で記録するようなものでは、全車両の診断履歴は別の情報処理装置で処理しなければならぬが、本実施例ではこのような必要がない。

また無線送信装置および無線受信装置を本実施例のように自動車用電話装置の網を利用する場合は、被診断車両の所在位置が広い地域にわたっても1つのセンタで管理ができ、しかも診断情報や音声交信の伝送路上の通信品質が劣化しない。

この場合は、同一回線上で、データの伝送信号と音声の伝送信号とが重複しても、それぞれを明瞭に認識できる。

〔発明の効果〕

以上説明したように、本発明によれば、被診断車両の車載コンピュータの診断が経験の少い作業者が操作して十分に行われるとともに、その診断データの整理が容易に行われるので、車両の管理が徹底化され、異状の発生の未然防止がはかれる効果がある。また万一異状が発生しても、迅速に対処できる。

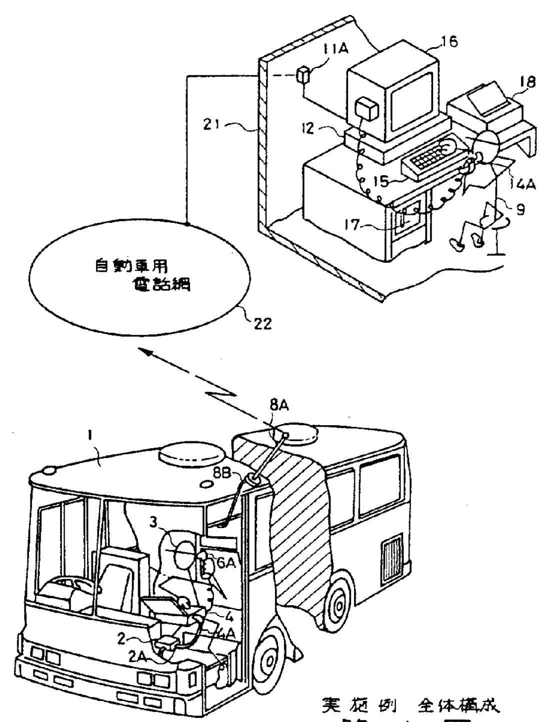
4. 図面の簡単な説明

第1図は、本発明一実施例の全体構成説明図。

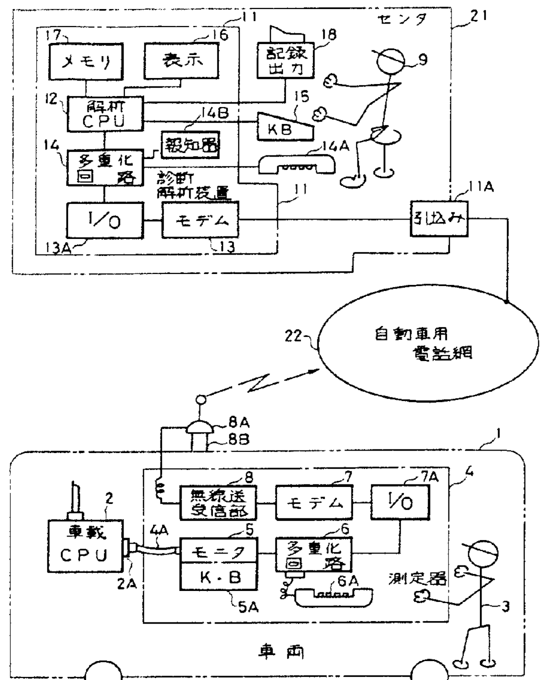
第2図は、同実施例のブロック構成図。

1…車両、2…車載コンピュータ、2A…ソケット、3、9…作業者、4…測定器、4A…コネクタ、5…モニタ部、5A、15…入力操作端、6、14…多重化回路、6A、14A…ハンドセット、7、13…モデム、7A、13A…インタフェース、8…無線送受信部、8A…仮設アンテナ、8B…吸着部、11…診断解析装置、11A…引込み端、12…解析コンピュータ、14B…報知器、16…表示部、17…メモリ部、18…記録出力部、21…センタ、22…自動車用電話網。

特許出願人　日野自動車工業株式会社
代理人　弁理士　井　出　直　孝



実施例 全体構成
第1図



実施例 ブロック構成図
第 2 図

ACCIDENT DATA RECORDER

Patent number:	WO8403359 (A1)
Publication date:	1984-08-30
Inventor(s):	ZOTTNIK EDMUND [DE] +
Applicant(s):	ZOTTNIK EDMUND +
Classification:	
- international:	***G01P1/12; G07C5/08;*** **G01P1/00; G07C5/00;** (IPC1-7): G01P1/12
- european:	G01P1/12C; G07C5/08P2; G07C5/08R2
Application number:	WO1984DE00041 19840224
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- US4638289 (A)
- EP0118818 (A1)
- EP0118818 (B1)
- DE3405757 (A1)

Cited documents:

- DE2322299 (A1)
- US3226981 (A)
- FR2424537 (A1)
- US4250487 (A)
- US2917300 (A)

Abstract of **WO 8403359 (A1)**

The accident data recorder is intended to short term recording and storage of data and events relating to a motor vehicle accident and comprises for example detectors of the number of revolutions of the wheels to determine the length of the travel and the vehicle speed. In addition to those detectors (25), acceleration sensors (26) are provided which are capacitively operated and of which the output signals are continuously recorded in a non-volatile store (22) together with the output signals of the wheel revolution number detectors as well as other data relating to the operation of the vehicle. To this effect, there is provided an addressing logic which operates according to a closed count loop by returning to the initial address when the final address is reached and which stores data on previously stored data. Such cyclic recording is interrupted upon the arrival of a triggering signal determined by an accident and causing the freezing of the last stored data including data recorded during a predetermined time interval after the signal.

PCT

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(33) Prioritätsland: DE

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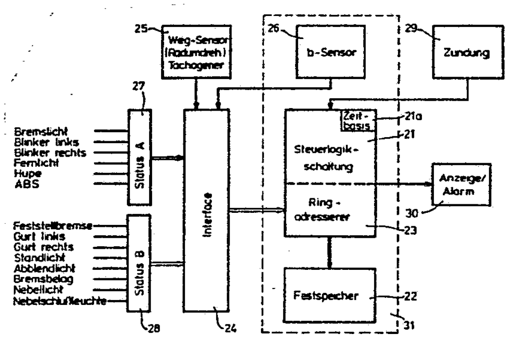
(81) Bestimmungsstaaten: JP, US.

Veröffentlicht

Mit internationalem Recherchenbericht.
Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist. Veröffentlichung wird wiederholt falls Änderungen eintreffen.

(54) Title: ACCIDENT DATA RECORDER

(54) Bezeichnung: UNFALLDATENSCHREIBER



(57) Abstract

The accident data recorder is intended to short term recording and storage of data and events relating to a motor vehicle accident and comprises for example detectors of the number of revolutions of the wheels to determine the length of the travel and the vehicle speed. In addition to those detectors (25), acceleration sensors (26) are provided which are capacitively operated and of which the output signals are continuously recorded in a non-volatile store (22) together with the output signals of the wheel revolution number detectors as well as other data relating to the operation of the vehicle. To this effect, there is provided an addressing logic which operates according to a closed count loop by returning to the initial address when the final address is reached and which stores data on previously stored data. Such cyclic recording is interrupted upon the arrival of a triggering signal determined by an accident and causing the freezing of the last stored data including data recorded during a predetermined time interval after the signal.

(57) Zusammenfassung

Unfalldatenschreiber zur kurzzeitigen Aufnahme und Speicherung von unfallbezogenen Daten und Ereignissen bei Kraftfahrzeugen, mit beispielsweise Radumdrehungen abtastenden Gebern zur Ermittlung von zurückgelegter Fahrstrecke und Fahrzeuggeschwindigkeit. Ergänzend zu diesen Radsensoren (25) sind Beschleunigungssensoren (26) vorgesehen, die auf kapazitiver Grundlage arbeiten und deren Ausgangssignale zusammen mit den Ausgangssignalen der Radsensoren sowie weiteren Statusdaten bezüglich des Betriebs des Fahrzeugs kontinuierlich auf Speicherplätze eines Festspeichers (22) eingeschrieben werden. Hierzu ist eine Adressierlogik (23) vorgesehen, die in einer geschlossenen Zählschleife arbeitet und nach Erreichen einer Endadresse auf die Anfangsadresse zurückspringt und die ursprünglich gespeicherten Daten wieder überschreibt. Unterbrochen wird diese zyklische Datenspeicherung durch den Eintritt eines einen Unfall definierenden Triggerereignisses, was ein Einfrieren der zuletzt geschriebenen Daten einschliesslich Daten einer vorgegebenen Nachlaufzeit bedeutet.

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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Unfalldatenschreiber

Stand der Technik

Die Erfindung geht aus von einem Unfalldatenschreiber nach der Gattung des Hauptanspruchs. Unfalldatenschreiber, die bei Einbau in einem Kraftfahrzeug überwiegend darauf gerichtet sind, für die Beurteilung des Unfalls relevante Daten oder Umstände, die in einem begrenzten Zeitraum vor dem Unfall aufgetreten oder eingetreten sind, aufzuzeichnen und über den Unfallzeitpunkt hinaus zu konservieren, sind in vielfältiger Form bekannt; im wesentlichen als auf mechanischer Grundlage arbeitende Kurzwegschreiber.

So verfügen Kurzwegschreiber (Fabrikat Kienzle) oder Farbscheiben-Tachographen (Firma Hasler AG) jeweils über einen Antrieb durch eine biegsame Welle vom Getriebe her zur Registrierung der Umdrehung der Antriebsräder bei graphisch/mechanischer Aufzeichnung. Aufgezeichnet werden kann lediglich die Geschwindigkeit vor dem Unfall ohne jede zusätzliche Daten, wobei sich als besonderes Problem bei solchen mechanischen Kurzwegschreibern, beispielsweise mit Aufzeichnung des zurückgelegten Weges oder der Geschwindigkeit durch Einkratzen einer Kurve in eine mit einer Farbschicht versehenen Scheibe, der Umstand herausgestellt hat, daß bei blockierten Rädern keinerlei Daten mehr zu gewinnen sind, also im Grunde dann, wenn eine besonders sorgfältige Datenaufzeichnung notwendig ist.

Ferner sind sogenannte Tachographen mit elektromechanischer Datenspeicherung bekannt, die Kunststoffolien in Kreisform benutzen und eine Vielzahl von Daten durch jeweils übereinander angeordnete Scheiben aufzeichnen können. Auch hier stehen bei blockierten Rädern keine aufzuzeichnenden Werte mehr zur Verfügung.

Als bekannt könnte sich auch die Speicherung der Daten bei einem Kurzzeitschreiber auf elektromagnetischer oder rein elektrischer Grundlage erweisen, indem man mittels eines vorzugsweise mehrspurigen Endlos-Magnetbandes entweder mit wegabhängigem Antrieb oder mit kontinuierlichem Bandantrieb konstante Impulse oder drehzahlabhängige Signale speichert, oder elektronisch die Impulse eines von einem Rad angetriebenen Gebers mit einem Zähler auswertet und die Impulszeiten speichert.

Problematisch ist dabei jedenfalls bei allen Kurzzeitschreibern, die irgendwie eine mechanische Bewegung durchführen müssen, der Umstand, daß ein störungsfreier Betrieb über eine angestrebte Mindestbetriebsdauer nicht sichergestellt werden kann, andererseits

Kurzzeit-Unfalldatenschreiber aber ihrer Natur nach so ausgelegt sein müssen, daß sie durchlaufend eine Vielzahl von Daten aufnehmen und, weil nach vorgegebenen Zeiträumen ohne Auftreten eines Unfalls dann überflüssig, praktisch überschreiten müssen. Ein Unfalldatenschreiber muß also ständig arbeiten und andererseits so ausgelegt sein, daß ab einem bestimmten Zeitpunkt, der unmöglich vorauszusagen ist und bei manchen Fahrzeugen niemals auftreten wird, Ereignisdaten eines vorhergehenden Zeitraums zur Auswertung mit besonderer Präzision zur Verfügung gestellt werden müssen.

Es ist schließlich eine Einrichtung zur Registrierung von Betriebsdaten eines Fahrzeugs bekannt (DE-PS 23 22 299), die als Unfalldatenschreiber die Betriebsdaten des Fahrzeugs letztlich digital mindestens einer Zwischenspeicherung unterwirft. Diese bekannte Einrichtung ist so aufgebaut, daß sie über einen nicht genauer bezeichneten Beschleunigungsmesser für die Erfassung von Längsbeschleunigungen und einen Beschleunigungsmesser für die Erfassung von Querbeschleunigungen aufweist, ferner läßt sich mittels eines induktiven Fühlers die Radumdrehung erfassen und nach Verstärkung in ein digitales Signal umwandeln. Den Beschleunigungsmessern sind Verstärker für hohe und niedrige Verstärkung nachgeschaltet, so daß sich insgesamt vier analoge Beschleunigungsmeßwerte ergeben, die über einen Analogmultiplexer und einer zwischengeschalteten Sample-and-Hold-Schaltung einem einzigen Analog/Digitalumsetzer zugeführt werden und von diesem unter der Steuerung eines entsprechend gemultiplexten Steuersignalgebers zwei Schieberegistern für Beschleunigungen derart zugeführt werden, daß in einem ersten Schieberegister die Daten für geringe Beschleunigung und in einem zwei-

ten die Daten für hohe Beschleunigung enthalten sind. Ein drittes Schieberegister nimmt die Impulse der Fahrzeuggeschwindigkeit auf. Durch die im Takt des Steuersignalgebers durchlaufende neue Datenzuführung zu den Schieberegistern gehen die jeweils ältesten Daten automatisch verloren. Die bekannte Einrichtung geht daher davon aus, daß bei einer hinreichend großen Anzahl von Schieberegisterstufen nach einem Aufprallsignal und Ausbleiben der Taktimpulse noch hinreichend viele digitale Daten vor dem Erscheinen des Aufprallsignals in den Registern enthalten sind; dies bedingt für ungünstige Unfallsituationen (hohe Geschwindigkeiten) allerdings einen außerordentlich hohen Speicherumfang.
Das Aufprallsignal wird im übrigen durch Vergleich der jeweils einer geringeren Verstärkung unterworfenen Längs- und Querbeschleunigungssignale an einem Beschleunigungsdetektor ermittelt.

In Weiterbildung kann bei der bekannten Einrichtung dann zur unverlierbaren Speicherung der in den Schieberegistern enthaltenden Daten diesen über Schalter ein Festspeicher nachgeschaltet sein, der aufgrund eines vom Beschleunigungsdetektor festgestellten Aufprallsignals dann zunächst den Inhalt eines ersten Schieberegisters durch Schließen des verbindenden Schalters übernimmt, und zwar über eine bestimmte Zeit nach dem Aufprall hinaus, so daß auch Nachunfalldaten noch gespeichert werden können. Problematisch ist bei dieser bekannten Einrichtung dann jedoch in diesem Zusammenhang, daß Nachunfalldaten, die den anderen vorhandenen Schieberegistern zugeführt werden, auf keinen Fall mehr in den Festspeicher übernommen werden können, weil der Steuersignalgeber das Einspeichern weiterer Daten in die Register, die nicht mit den Festspeichern verbunden sind, verhindern. Das Unfallgeschehen spielt sich aber in der Realzeit ab und muß aufgezeichnet werden, wenn die Daten eingehen. Daher gehen alle Nachunfalldaten, die nicht dem ersten Schieberegister zugeführt werden, verloren.

Problematisch ist bei der bekannten Einrichtung ferner noch, daß keine Angabe über den speziellen Aufbau der Beschleunigungssensoren gemacht wird, so daß davon ausgegangen werden muß, daß diese, auch wegen der notwendigen Analog/Digitalumsetzung, nicht hinreichend feinfühlig arbeiten, was auch durch die bei dieser Einrichtung für notwendig erachtete Zuordnung von jeweils zwei Analogverstärkern mit unterschiedlichem Verstärkungsgrad für jeden Beschleunigungsmesser unterstrichen wird.

Durch die Stückelung der Daten durch den Eingangs-Analogmultiplexer ergibt sich ein Zeitversatz, außerdem kann, auch wenn eine Integration erfolgen sollte, nur über jeweils 1/4 der verfügbaren Taktzeit integriert werden, so daß schon bei der Datenumsetzung, vier Dateneingänge wie angegeben dem Analogmultiplexer zugeordnet vorausgesetzt, 3/4 der Daten verloren gehen.

Obwohl nicht im einzelnen angegeben, kann die Erfassung eines Triggerereignisses (Aufprallsignal) durch den Beschleunigungsdetektor nur als Überschreiten von fest vorgegebenen Werten für die Längs- oder die Querbeschleunigung definiert werden. Dies führt dazu, daß wegen der unterlassenen, differenzierten Wertung der Beschleunigungsdaten, beispielsweise eine Berechnung resultierender Werte aus Längs- und Querbeschleunigung, die häufigsten Unfälle praktisch nicht zur Auslösung führen, beispielsweise dann, wenn unter Nichtbeachtung der Vorfahrt Aufprallunfälle nur minimale Querbeschleunigungen, keine Längsbeschleunigung, jedoch signifikante Winkelbeschleunigungen bewirken, insbesondere wenn der Reibungsbeiwert Rad/Straße herabgesetzt ist. Da aber eine Unterbrechung des Taktsignals nur bei Auftreten eines Aufprallsignals erfolgt, dürften in einer Vielzahl von Fällen, insbesondere bei Personenunfällen, die signifikanten Daten verloren gehen. Weitere Nachteile der bekannten Einrichtung sind beispielsweise folgende. Durch die lediglich Aufzeichnung von Längsbeschleunigung und Querbeschleunigung können Bewegungen eines Fahrzeugs in einer Ebene nicht festgelegt werden. Bei einem Schleudervorgang dreht sich ein Fahrzeug um seine Hochachse, und aus der Längsbeschleunigung wird eine Querbeschleunigung. Nur wenn man die Winkelbeschleunigung um die Hochachse in eine Berechnung einbezieht, läßt sich durch eine rechnerische Rekonstruktion ein falsches Ergebnis der ermittelten Ortskurve vermeiden.

Da für die Auswertung Momentanwerte im Abstand der gewählten Taktrate lediglich zur Verfügung stehen, können diese bei großen differentiellen Änderungen der Beschleunigungen (Bremsvorgang-Aufprall) nichts über die zur Berechnung erforderliche mittlere Beschleunigung aussagen. Es muß vielmehr davon ausgegangen werden, daß die gespeicherten Werte mit den wirklichen in lediglich zufälliger Weise verknüpft sind.

Problematisch ist ferner, daß zeitkritische Überlegungen, etwa eine Korrelierung mit der Absolutzeit nicht vorgenommen werden, daher sind beispielsweise im Falle einer Fahrerflucht zeitliche Zusammenhänge nicht nachzuweisen. Ferner sind Speicherung von Störungen im System nicht vorgesehen, Manipulationen an der Stromversorgung, Ausfall von Sensoren oder Signalleitungen können nicht erfaßt werden; ein sicherer Schutz gegen Sabotage ist nicht möglich. Das gleiche trifft auf komplexe Funktionen wie beispielsweise Eigentest, Selbsteichung u. dgl. zu.

Dabei beruht die vorliegende Erfindung auf der Erkenntnis, daß die zeitliche Auflösung eines komplexen Auffahrunfalls zur differenzierten Schuldzuweisung unerläßlich ist, und zwar einschließlich sich ergebender Beschleunigungswirkungen; eine Forderung, die mit einer wegabhängigen Aufzeichnung allein nicht gelöst werden kann, weil in diesem Fall die Aufzeichnungspausen, die beispielsweise dadurch entstehen können, daß die Räder blockieren, bedeutsamer als die Aufzeichnungen selbst sind. Von wesentlicher Bedeutung ist ferner, daß eine Realzeit-Aufzeichnung erfolgen muß, die sowohl eine direkte Verfügbarkeit der aufgezeichneten Daten untereinander und in ihrem Zeitbezug sicherstellt als auch bei mehreren Aufzeichnungen das einzig verbleibende schlüssige Indiz für eine eventuelle Tatbeteiligung bildet.

Vorteile der Erfindung

Der erfindungsgemäße Unfalldatenschreiber mit den kennzeichnenden Merkmalen des Hauptanspruchs hat demgegenüber den Vorteil, daß der gesamte Bewegungsablauf des Fahrzeugs für einen hinreichend langen Zeitraum vor Eintritt des Unfallereignisses präzise aufgezeichnet wird und im Moment des Unfalls unlöschbar gespeichert bleibt. Dabei wird nicht nur auf die durch die Messung von Radumdrehungen bestimmbare Fahrzeuggeschwindigkeit abgestellt, sondern es werden hochpräzise Beschleunigungsangaben ermittelt und gespeichert sowie gleichzeitig als Berechnungsgrundlage für die Ermittlung eines Unfallzeitpunktes ausgewertet.

Sämtliche gespeicherten Informationen und Daten sind auf eine Zeitbasis bezogen, die als eine von Straßen und Fahrbetrieb unabhängige Führungsgröße eingesetzt ist. Dabei liefert die Zeitbasis sowohl einen Zähltakt für einen Zeitzähler als auch die Taktfrequenz des Gesamtsystems für die Datenerfassung und Speicherung.

Der erfindungsgemäße Unfalldatenschreiber ist so ausgelegt, daß das gesamte Geschehen beginnend mit einem hinreichend großen Abstand vor einem jeweiligen Unfallzeitpunkt bis zu einem hinreichenden Zeitpunkt nach einem Unfall in allen seinen Einzelheiten hochgenau und in so enger Quantisierung aufgezeichnet wird, daß sich eine lückenlose Darstellung sämtlicher Ereignisse vor und nach dem Unfall vornehmen und entsprechend auswerten läßt.

Selbstverständlich ist die Entscheidung, ob normalerweise im stetigen Umlauf ständig wieder überschriebene Daten konserviert werden sollen, von irgendwelchen Entscheidungen des Fahrers selbst unabhängig; der Unfalldatenschreiber stellt aufgrund der ihm von externen Sensoren zugeführten Bedingungen die Möglichkeit, daß ein Unfall aufgetreten ist, fest und friert die zu diesem Unfall gehörenden Daten ein; gleichzeitig wird, nach Ablaufen einer ergänzenden Nachlaufzeit eine neue Sekundärschleife für die Speicherplatzbelegung in einem Festspeicher definiert und so eine Bereitschaftszeit zur Verfügung gestellt, um die kritische Zeit nach Auffahrunfällen mit zu überwachen.

Vorteilhaft ist ferner, daß eine bestimmte Abfolge von sogenannten Statusbedingungen A in engen zeitlichen Abständen, beispielsweise jeweils alle 100 ms überwacht und gespeichert werden, während bei äußeren Statusbedingungen B zur Einsparung von Speicherplätzen in größeren zeitlichen Abständen, beispielsweise alle 500 ms eine Registrierung ihres Betriebszustandes erfolgt.

Durch die in den Unteransprüchen aufgeführten Maßnahmen sind vorteilhafte Weiterbildungen und Verbesserungen des im Hauptanspruch angegebenen Unfalldatenschreibers möglich.

Zeichnung

Ein Ausführungsbeispiel der Erfindung ist in der Zeichnung dargestellt und wird in der nachfolgenden Beschreibung näher erläutert. Dabei zeigen:

Fig. 1 ein Blockschaltbild der wesentlichsten Bestandteile des erfindungsgemäßen Unfalldatenschreibers mit den den Datenfluß charakterisierenden jeweiligen Zuordnungen der einzelnen Bauelemente zueinander und

die Fig. 2 bis 5

in schematisierter Darstellung ein Ausführungsbeispiel des bei vorliegender Erfindung verwendeten Beschleunigungssensors.

Beschreibung der Ausführungsbeispiele

Es ist eine zentrale Steuerlogikschaltung 21 vorgesehen, die entsprechend der Darstellung der Fig. 1 die erforderlichen, aufzuzeichnenden Daten zugeführt erhält und die Speicherung der Daten in einem Festspeicher 22 veranlaßt, wozu sie sich einer Adressierlogik 23 bedient, die auch als Ringadressierer, Ringspeicher oder zyklisch umlaufender Adressenzähler bezeichnet werden kann, der mit der von ihm jeweils in vorgegebenen Zeitabständen erstellten neuen Adresse immer einen anderen Speicherplatz oder eine andere Speicherstelle im Festspeicher 22 anspricht und dieser sämtliche von einer Interface- oder Schnittstellenschaltung 24 gelieferten Daten zur Speicherung zuführt.

Die im folgenden lediglich noch als Ringadressierer bezeichnete Adressierlogik läuft dabei in einer geschlossenen Schleife um und adressiert nach einer vorgegebenen Schleifendauer oder Aufzeichnungszeit, die variabel ist, jeweils zu Beginn des Umlaufs adressierte und zur Speicherung der Daten freigegebene Speicherzellen des Festspeichers 22 erneut, wodurch dann die früheren Daten überschrieben werden. Die Daten werden über die Schnittstellenschaltungen 24 insgesamt geliefert von einem Tachogenerator oder Wegsensor, der vorzugsweise eine vorgegebene Anzahl von Impulsen pro Radumdrehung, falls gewünscht, für jedes Rad separat liefert und so unter Bezugnahme auf entsprechende Zeitbasisangaben eine Bestimmung des jeweils zurückgelegten Weges und der entsprechenden Geschwindigkeit ermöglicht. Dieser externe Sensor ist in Fig. 1 mit 25 bezeichnet; mit 26 ist ein Beschleunigungssensor dargestellt, der so ausgelegt ist, daß eine zur Messung der Radumdrehung vollständig unabhängige Größe eingeführt wird, die in allen kritischen Fällen verfügbar ist und in der Lage ist, beliebige, auf das Fahrzeug einwirkende Beschleunigungen zu erfassen. Bei diesem b-Sensor handelt es sich um ein kapazitives System, bei dem Kondensatorflächen als Biegebalken ausgeführt und so montiert sind, daß die Trägheitskräfte in der jeweils selektierten Achse direkt senkrecht zu beiden Achsen einwirken. Auf Aufbau und Wirkungsweise des Beschleunigungssensors 26 wird im folgenden noch eingegangen.

Zusätzlich zu den Weg-Geschwindigkeitsdaten und den Beschleunigungsdaten gelangen eine Vielzahl von im Grunde beliebigen, für die Auswertung eines Unfalls insoweit aber relevante Daten zur Bearbeitung und Speicherung, für die stellvertretend für alle sonst noch möglichen Informationen in der Darstellung der Fig. 1 sogenannte Statusbedingungen A und Statusbedingungen B definiert sind; wie in Fig. 1 angegeben, handelt es sich bei den Status-A-Daten beispielsweise um Bremslicht, Blinker links, Blinker rechts, Fernlicht, Hupe, Angaben über ABS (Antiblockiersystem)-Wirkungen. Die Status-A-Daten stehen stellvertretend für alle für das Fahrgeschehen relevanten Funktionen des Fahrzeugs, die in digitaler Form vorliegen oder in eine solche Form umgewandelt sind und die mit höchster Auflösung verfügbar sein müssen. Sie werden in engen Zeitabständen, beispielsweise 100 ms, wie vorteilhafterweise dann auch die anderen Funktionsdaten des Fahrzeugs, der Speicherung über die Ringadressierung zugeführt, während die Status-B-Daten alle für den Betrieb des Fahrzeugs wichtigen Funktionen umfassen, die nicht mit höchster Auflösung verfügbar sein müssen und daher in größeren Zeitabständen von beispielsweise 500 ms gespeichert werden.

Die Status-A- und Status-B-Blöcke 27 und 28 können für die Aufbereitung der von ihnen über die Schnittstellenschaltung 24 gelieferten Daten in entsprechender Weise ausgebildet sein, also beispielsweise auch als Wandler physikalischer Größen in elektrische Ausgangsgrößen, wobei die meisten der Status-A- und Status-B-Daten einfache Ja-Nein-Bedingungen sein können, beispielsweise also, ob die Hupe betätigt wurde oder nicht, so daß entsprechende Ausgänge entweder den Zustand log0 oder log1 aufweisen.

Es ist dann noch ein Zündungsblock 29 vorgesehen, der der Steuerlogikschaltung des Unfalldatenschreibers eine Information darüber zuführt, daß die Zündung eingeschaltet worden ist und schließlich verfügt die Steuerlogikschaltung selbst über einen Anzeige- oder Alarmblock 30, der so ausgebildet ist, daß dann, wenn eine Sequenz gespeicherter Daten festgeschrieben oder eingefroren worden ist, eine entsprechende Anzeige zur Veranlassung einer Überprüfung und/oder Auswertung bewirkt wird.

Wirkungsweise:

Der grundlegende Funktionsablauf bei dem erfindungsgemäßen Datenschreiber ist dann so, daß in dem Festspeicher 22 eine vorgegebene Anzahl von adressierbaren Speicherstellen oder Speicherplätzen vorhanden ist. Bei einem praktischen Ausführungsbeispiel können etwa so viele Speicherplätze im Festspeicher oder Hauptspeicher vorhanden sein, daß drei mal jeweils für eine Aufzeichnungszeit von 60 Sekunden Daten niedergelegt werden können, wobei sich für einen Vorgang eine Aufnahmezeit von 60 Sekunden sowohl als sinnvoll als auch ausreichend erweist. Einer solchen Zeitdauer ist im Stadtverkehr bei 50 km/h eine zurückgelegte Wegstrecke von 833 m, beim Verkehr auf Landstraßen bei 100 km/h eine Wegstrecke von 1667 m und auf der Autobahn bei angenommenen 200 km/h eine Wegstrecke von 3333 m zugeordnet, über die dann ein lückenloser Nachweis über sämtliche relevanten Fahrzeugfunktionen geführt werden kann.

Die Aufzeichnung, also die Niederlegung der Daten im Festspeicher erfolgt zeitabhängig im vorher bestimmten Umfang, wodurch, wie soeben schon dargelegt, die aufgezeichneten Wegstrecken proportional mit der Geschwindigkeit wachsen.

Als Zeitbasis 21a ist eine vom sonstigen System unabhängige Quarzzeitbasis vorgesehen, die einen minimalen Strombedarf aufweist und als der einzige Schaltungsteil, der nicht abgeschaltet werden darf, über einen Notbetrieb mit Pufferbatterie verfügt.

Diese Zeitbasis 21a liefert sowohl den Zähltakt für einen separaten Zeitzähler als auch die System-Taktfrequenz für den gesamten Steuerungsablauf und die Speichervorgänge, wobei es selbstverständlich innerhalb des erfindungsgemäßen Rahmens liegt, für die Wahrnehmung der Steuervorgänge und die allgemeine Verwaltung des Systems auch Mikroprozessoren, Einzweckrechner oder ähnliche Einrichtungen einzusetzen.

Der Festspeicher 22 ist dabei üblicherweise als RAM ausgeführt. Die Adressierlogik oder der Ringadressierer legt den begrenzten Speicherumfang einer Aufzeichnungsfrequenz (Dauer beispielsweise 1 Minute) als Zählschleife fest und definiert eine Anfangs- und eine Endadresse. Demnach zählt der Ringadressierer von der Anfangsadresse aufwärts bis zur Endadresse, veranlaßt dabei das Einschreiben sämtlicher fahrzeugrelevanter Daten in die einzelnen Speicherzellen und springt beim Erreichen der Endadresse wieder auf die Anfangsadresse zurück, so daß es bei normalem Fahrbetrieb dann zu einem Überschreiben der durch diese Zählschleife gespeicherten Daten im Festspeicher im endlosen Ablauf kommt.

Eine Unterbrechung im zyklischen Umlauf der Zählschleife ergibt sich nur dann, wenn ein Triggerereignis auftritt, welches von der logischen Steuerschaltung errechnet und als Unfall interpretiert wird. Dies kann beispielsweise dadurch geschehen, daß vom Beschleunigungssensor 26 gemeldete Beschleunigungen kontinuierlich mit vorgegebenen Maximalwerten verglichen und auf einen Unfall geschlossen wird, wenn entsprechende Überschreitungen festgestellt werden. Die Entscheidung, wann bzw. ob ein Unfall vorliegt, kann mit größtmöglicher Sicherheit getroffen werden, wobei die jeweiligen Bewertungskriterien so nahe wie möglich an den im normalen Fahrbetrieb auftretenden Beschleunigungen liegen. Es ist ferner möglich, zusätzlich zu der reinen Überwachung der Beschleunigungen auch andere Daten zur Definition eines Unfalls heranzuziehen, beispielsweise starke Verzögerung in Fahrtrichtung gleichzeitig ohne betätigte Betriebsbremse.

Die Detektion des Triggerereignisses führt dazu, daß die Vorlaufdaten, also die bisher im Festspeicher durch den Umlauf eingeschriebenen Daten eingefroren werden, mit anderen Worten, der Ringadressierer 23 adressiert die zu seiner bisherigen Zählschleife gehörenden Speicherplätze nicht mehr, es wird dann lediglich noch für eine begrenzte Zeit weitergeschrieben, maximal beispielsweise eine halbe Minute und minimal bis zum Fahrzeugstillstand.

Anschließend kann der Ringadressierer 23 aus dieser Zählschleife herausspringen und eine nächstfolgende Zählschleife, die ebenfalls eine Dauer von einer Minute haben kann, definieren mit entsprechend adressierten weiteren Speicherplätzen im Festspeicher 22, wodurch die Speicherplätze der ersten Zählschleife eingefroren und nicht mehr löschbar sind, und zwar durch keine Mittel, die beispielsweise dem Fahrer zur Verfügung stehen.

Im folgenden wird jetzt zunächst auf ein bevorzugtes Ausführungsbeispiel bezüglich Art, Aufbau und Funktion des verwendeten Beschleunigungssensors eingegangen.

Der Grundgedanke eines in Fig. 2 beispielhaft gezeigten Beschleunigungssensors besteht darin, jeweils eine Fläche eines Kondensators als Biegebalken auszuführen und so anzuordnen, daß einwirkende Trägheitskräfte in der jeweils selektierten Achse senkrecht zur Balkenachse einwirken, wobei der Kondensator als Teil eines elektronischen Oszillators - von im übrigen durchaus beliebigen Schaltungsaufbau - so in die Konzeption des Oszillators einbezogen ist, daß er mindestens mitbestimmend für dessen Schwingfrequenz ist. In Abhängigkeit zu den Biegekräften ergibt sich dann jeweils für unterschiedliche Durchbiegungen ein linearer Zusammenhang zur Kapazität und bei entsprechender Ausbildung des Oszillators ein linearer Zusammenhang der Kapazitätsänderung mit der Änderung der Schwingfrequenz.

Entsprechend dem vereinfachten Ausführungsbeispiel der Fig. 2 ist ein zentraler Einspannkörper 10 vorgesehen, der Biegebalken in Form von flachen Zungen 11, 12 und 13 einseitig eingespannt lagert und vorzugsweise gleichzeitig elektrisch mit den Zungen so verbunden ist, daß sich am Block des Einspannkörpers 10 das gemeinsame Nullpotential der Schaltung ergibt, in welche der Beschleunigungsaufnehmer eingeordnet ist.

Die Zungen sind bei dem in Fig. 2 gezeigten vereinfachten Ausführungsbeispiel eines Beschleunigungsaufnehmers, wie er insbesondere zur Anwendung bei Kraftfahrzeugen im Bereich von in diese eingebaute Kurzzeit-Unfalldatenschreiber vorgesehen ist, um jeweils 90° zueinander versetzt in einer Ebene, wobei ein in Fahrtrichtung weisender kapazitiver Sensor entbehrlich ist. Es ergeben sich so drei kapazitive Sensoren F1, F2, F3, jeweils gebildet aus den Zungen 11, 12, 13, die stationären Gegenplatten 11', 12' und 13' gegenüberstehen, in vorgegebenem Abstand, so daß sich im Ruhezustand Kondensatoren mit vorgegebenen Kapazitätswerten ergeben.

Sobald auf einen solchen, aus einzelnen kapazitiven Sensoren bestehenden Beschleunigungsaufnehmer Beschleunigungskräfte einwirken, kommt es zu einer Verbiegung der einzelnen Zungen aufgrund der Trägheitskräfte der Zungen und zu einer entsprechenden Annäherung an die stationären Gegenplatten oder Entfernung von diesen, was zu entsprechenden Kapazitätsänderungen an den einzelnen Beschleunigungssensoren aufgrund der sich ändernden Plattenabstände führt. Dabei wird bei negativen Beschleunigungsänderungen, die als eine Annäherung der Platten jedes gebildeten Kondensators definiert sei, eine Kapazitätserhöhung und bei positiver Beschleunigungseinwirkung eine Kapazitätserniedrigung erfolgen.

Entsprechend einem praktischen Ausführungsbeispiel können die Zungen, die von durchgehend gleichförmigem Querschnitt vorzugsweise sind, eine Breite von 1,4 cm bei einer Länge von 2 cm und einer Dicke von 0,03 cm aufweisen und aus einem geeigneten Werkstoff wie beispielsweise Berylliumbronze oder auch zur Erzielung einer noch geringeren Temperaturabhängigkeit aus einem Werkstoff bestehen, der allgemein unter der Bezeichnung Nivarox bekannt ist. Beträgt bei einem solchen Ausführungsbeispiel der Normalabstand zwischen den Platten jedes Kapazitäts-Sensors F1, F2, F3 0,01 cm bei einer überdeckten Länge von 0,8 cm, dann ergeben sich die, aus der folgenden Tabelle entnehmbaren Werte bei vorausgesetzten, einwirkenden Beschleunigungen zwischen -20 g bis +20 g:

b g	A außen mm	A mittl. mm	C pF	f Hz
-20.0	0.0600	0.0838	11.84	422084
-10.0	0.0800	0.0919	10.79	463005
-1.0	0.0980	0.0992	10.00	499834
-0.5	0.0990	0.0996	9.96	501880
-0.2	0.0996	0.0998	9.93	503108
-0.1	0.0998	0.0999	9.93	503517
+0.0	0.1000	0.1000	9.92	503926
+0.1	0.1002	0.1001	9.91	504335
+0.2	0.1004	0.1002	9.90	504745
+0.5	0.1010	0.1004	9.88	505972
+1.0	0.1020	0.1008	9.84	508018
+10.0	0.1200	0.1081	9.17	544847
+20.0	0.1400	0.1162	8.53	585768

Aus der Tabelle läßt sich entnehmen, daß eine Grundfrequenz des Oszillators beim Normalabstand (einwirkende Beschleunigung = 0) von ca. 503,926 KHz zugrundegelegt werden kann, mit entsprechend linearer und gut auswertbarer Frequenzänderung zwischen 422,084 KHz bei g = -20 bis 585,768 KHz bei g = +20; die Kapazitätsänderung in pF schwankt dann zwischen 11,84 und 8,53 pF.

Eine Torsionseinwirkung auf die einzelnen Zungen oder Biegebalken durch Winkelbeschleunigung, im Falle des Beschleunigungsaufnehmers der Fig. 1 also eine Drehbewegung um eine etwa von oben nach unten in der Zeichenebene liegende Achse wirkt sich auf den mittleren Abstand der Kondensatorflächen nicht aus, da eine Verdrehung der Zungen 11 und 12 in diesem Fall eine symmetrische Abstandsänderung um die neutrale Achse bewirkt, die sich selbst kompensiert.

Schwingungen oder Vibrationen wirken sich auf die mittlere Kapazität ebenfalls nicht aus, da zwar überlagerte Kapazitätsänderungen mit der jeweiligen Schwing- oder Vibrationsfrequenz entstehen können, die sich aber über eine vorgesehene Integrationszeit bei der Auswertung der Schwingfrequenz von mindestens 50 ms nicht auswirken können. Mögliche Resonanzfrequenzen der Zungen selbst liegen wegen ihrer Abmessungen in einem erheblich höheren Frequenzbereich und kommen bei dem dargestellten Ausführungsbeispiel nicht zur Auswirkung.

Die schematische Darstellung der Fig. 3 dient zur Beurteilung von einwirkenden Drehbeschleunigungen, wie sie sich auf den in Fig. 2 dargestellten Beschleunigungssensor im Sinne des dort gezeigten Doppelpfeils A durchaus ergeben können. Unter der Voraussetzung einer in Fahrtrichtung einwirkenden, vorhandenen Längsbeschleunigung b_L führt eine Drehbeschleunigung in einer gegebenen Richtung dazu, daß sich bei dem einen Kapazitätssensor, beim Ausführungsbeispiel F1, die einwirkende Drehbeschleunigung b_D vom Wert der Längsbeschleunigung b_L substrahiert, im anderen Fall des Sensors F3 hinzuaddiert. Die beiden Sensoren F1 und F3 liefern daher Angaben über umgesetzte resultierende Beschleunigungswerte von b1 für F1 und b2 für F3. Hieraus läßt sich die Drehbeschleunigung nach folgender Formel ermitteln:

$$b_D = (b2 - b1)/2.$$

Die gleichfalls vorliegende Längsbeschleunigung ergibt sich aus der folgenden Formel

$$b2 = (b2 + b1)/2.$$

Ferner lassen sich aufgrund der resultierenden Beschleunigungen bezüglich der Richtung der einwirkenden Beschleunigungen die folgende Feststellung treffen: Ist das Ergebnis der ersten, die Drehbeschleunigung betreffenden Formel positiv, dann war die Drehbeschleunigungseinwirkung linksdrehend, im anderen Falle rechtsdrehend. Aus der zweiten Formel für die Längsbeschleunigung ergibt sich bei positivem Ergebnis eine Angabe der Beschleunigung in Fahrtrichtung, bei negativem Ergebnis eine Bremsbeschleunigung gegen die Fahrtrichtung.

Bei dem in Fig. 2 gezeigten Ausführungsbeispiel ist der Kapazitätssensor F2 in Fahrtrichtung liegend angeordnet; daher führen an ihm gemessene Kapazitätsänderungen zu der Feststellung, daß beispielsweise bei einer Beschleunigungseinwirkung in Fahrtrichtung gesehen nach rechts, also in der Zeichenebene nach unten die Beschleunigungsanzeige des Kapazitätssensors F2 positiv, im anderen Falle negativ ist. Natürlich reagiert der Sensor F2 auch auf Drehbeschleunigungen des Fahrzeugs, dann aber gemeinsam mit den Sensoren F1 und F3 in der weiter vorn schon beschriebenen Weise, so daß dann, wenn die Sensoren F1 und F3 keine Drehbeschleunigung anzeigen, eine am Sensor F2 festgestellte Beschleunigung in Fahrtrichtung gesehen nach rechts oder links erfolgt ist.

Die mechanische Fertigung der durch diese Trägheitskräfte die Kapazitätsänderungen an F1, F2 und F3 hervorrufenden Zungen kann mit so hoher Genauigkeit erfolgen, daß ein Abgleich lediglich wegen möglicher Montagefehler vorgesehen werden sollte, dabei ist die Materialkonstante E im geforderten Bereich temperaturunabhängig und einer Alterung nicht unterworfen. Die Dielektrizitätskonstante ist ebenfalls temperaturunabhängig, da die gesamte Aufnehmeranordnung vorzugsweise innerhalb eines auf Vakuumbedingungen gebrachten Gehäuses angeordnet ist.

Es empfiehlt sich im übrigen, den jedem Kapazitätssensor zugeordneten Schwingkreis eines Oszillators mit Schmitt-Triggern auf der Basis der Verwendung von C-MOS-Halbleiterelementen aufzubauen, wodurch sich eine noch geringere Temperaturabhängigkeit ergibt; außerdem ist es empfehlenswert, mit der Betriebsspannung, die an den Kondensatoren anliegt, nicht zu hoch zu gehen, beispielsweise eine Gleichspannung von 5 V zu verwenden, wodurch der durch die

Kräfte des elektrischen Feldes zwischen den Platten verursachte Fehler in einer Größenordnung von 0, 1 % gehalten werden kann und daher insgesamt nicht störend ist.

Ein praktisches Ausführungsbeispiel für den Aufbau eines erfindungsgemäßen Beschleunigungsaufnehmers in einem Gehäuse ist in Fig. 4 dargestellt; der blockförmige Einspannkörper 10 lagert die Zungen 11, 12 und 13, denen gegenüberliegend die stationären Gegenplatten 11', 12' und 13' angeordnet sind. Die die Gegenelektroden bildenden stationären Platten können an über Langlöcher 14 an der Bodenplatte 15 des Gehäuses 16 befestigte Führungen gehalten sein, so daß eine Verschiebung in Richtung auf die beweglichen Zungen möglich ist, zur anfänglichen Kapazitätseinstellung. Die Gegenplatten 11', 12', 13' sind dabei jeweils isoliert befestigt und ihre Anschlüsse sind über kapazitätsarme Vollkabel 17 zu stationären Anschlußpunkten I, II und III der Platte geführt, wobei der gemeinsame Anschlußpunkt IV von dem Einspannkörper 10 gebildet ist.

Bei dem Ausführungsbeispiel der Fig. 5 ist ein auf Beschleunigungen in allen Richtungen und in allen Drehrichtungen empfindlicher Beschleunigungsaufnehmer bei 20 dargestellt, mit einem zentralen, die einzelnen Zungen langernden Einspannkörper 21 und insgesamt sechs, jeweils um 90^{O} zueinander um den würfelförmigen Einspannkörper herum angeordneten und in diesen eingespannten Zungen, die mit entsprechenden Gegenplatten Kapazitätssensoren X1, X2; Y1, Y2 und Z1, Z2 bilden. Jeder dieser Kapazitätssensoren ist Teil eines

Schwingkreises und daher in der Lage, die auf ihn einwirkende, aus Drehung (Torsion) oder linearer Beschleunigung in positiver und negativer Richtung sich ergebenden Einwirkungen festzustellen, zunächst die Kapazitätsänderungen umzuwandeln und dann in Form einer Frequenzänderung auswertbar zu machen. Durch entsprechende Differenzbildungen lassen sich dann, wie weiter vorn anhand der Darstellung der Fig. 2 gezeigt, die einzelnen Werte der einwirkenden Beschleunigungen ermitteln.

Die folgende Schemadarstellung zeigt die zu speichernden Datensequenzen im zeitlichen Ablauf, wenn man berücksichtigt, daß die aufzuzeichnenden Daten jeder Funktion einer unterschiedlichen zeitlichen Auflösung bedürfen. Legt man für die Beschleunigungsdaten eine Auflösung von 100 ms mindestens zugrunde, dann kann für die Geschwindigkeitsdaten die gleiche Auflösung oder eine solche von 500 ms verwendet werden. Die Statusdaten können ebenfalls in diese beiden Kategorien aufgeteilt werden. Es ergeben sich dann im Zeitabstand von 100 ms die folgenden Datensequenzen:

0	100	200	300	400	500	600	700	ms
SZ			TZ				EZ	
vl	vl	vl	vl	vl	vl	vl	vl	
bl	bl	bl	bl	bl	bl	bl	bl	
bq	bq	bq	bq	bq	bq	bq	bq	
bw	bw	bw	bw	bw	bw	bw	bw	
S. A+B	S. A	S. A	S. A+B	S. A	S. A+B	S. A	S. A	

Darin bedeuten:

SZ	Startzeit	TZ	Triggerzeit
EZ	Stillstandzeit	vl	Längsgeschwindigkeit
bl	Längsbeschleunigung	bq	Querbeschleunigung
bw	Winkelbeschleunigung	S.A.	Status A
S.B	Status B		

Die Statusdaten insgesamt belaufen sich bei den hier in Betracht gezogenen, zu speichernden Betriebszuständen und -funktionen auf insgesamt 13 Bit, nämlich 6 Bit für Status A und 7 Bit für Status B.

Unter Bezugnahme auf Fig. 1 wird noch erwähnt, daß der erfindungsgemäße Unfalldatenschreiber mechanisch aus zwei Baugruppen besteht, nämlich dem Basisgerät, welches als Gehäuse fest im Kraftfahrzeug eingebaut ist und Anpassung, Befestigung und Schutz im Kraftfahrzeug übernimmt und gleichzeitig, soweit erforderlich, Bauelemente des Status-A- und des Status-B-Blocks 27, 28 sowie die Schnittstellenschaltungen 24 und des Tachogenerators enthält, während ein Einschub, der auch als Speicherkassette bezeichnet wird, in Fig. 1 umrandet dargestellt und mit dem Bezugszeichen 31 versehen ist. Bei dem Speicherkasetteneinschub handelt es sich um ein kompatibles Teil, welches einen unkomplizierten Austausch einzelner Speicherkassetten ermöglicht bei in allen Basisgeräten genormter Einschuböffnung und welches die Speicher, also Festspeicher 22 und Ringadressierer 23 sowie die Verwaltung (Steuerlogikschaltung mit Zeitbasis) und den Beschleunigungssensor enthält. Die Anordnung des Beschleunigungssensors ebenfalls im Bereich der Speicherkassette hat den Vorzug, daß bei der Entnahme und späteren Auswertung durch die Möglichkeit gezielter Meßeinwirkungen auf den Sensorbereich dessen Eichung bzw. Abweichungen vom Standard in die Auswertung der Daten entsprechend einbezogen werden kann.

Die folgenden, jeweils mit kennzeichnenden Überschriften versehenen Erläuterungen erklären genauer die einzelnen Vorgänge und Beziehungen und ergänzen die Gesamtkonzeption in der Darstellung der Fig. 1.

Inbetriebnahmezeit

Als erste Werte im Festspeicherbereich des RAM werden die Zeit der Inbetriebnahme, die Seriennummer des Entnahmegerätes und die Fahrzeugdaten eingetragen. Gleichzeitig wird der Zeitzähler auf 0 gesetzt und der Zähltakt freigegeben.

Fahrtbeginn

Jeder Aufzeichnungszyklus beginnt mit dem Eintrag der aktuellen Systemzeit. Als Beginn einer Fahrt (Start) wird definiert:

a) die Zündung ist eingeschaltet - Signal vom Zündungsblock 29 .
b) der Impulsgeber des Tachogenerators (Weg- oder Radumdrehungssensor 25) liefert Impulse in einem vorgegebenen Maximalabstand. Mit der ersten folgenden Datensequenz wird die Startzeit SZ eingetragen.
c) Es wird eine Längsbeschleunigung festgestellt.

Fahrtende

Das Ende einer Fahrt wird als Fahrzeugstillstand definiert durch

a) das Ausbleiben der Impulse des Tachogenerators in einem vorgegebenen Zeitintervall und

b) der gleichzeitig rechnerisch aus den b-tFunktionen ermittelten Fahrzeugstillstand, beispielsweise fortlaufende Integration der Beschleunigung über der Zeit;

c) 0-Werte der Beschleunigungen.

Sind alle Bedingungen erfüllt, dann wird mit der letzten Datensequenz die Stillstandszeit als aktuelle Systemzeit eingetragen.

Nachlaufzeit

Ist die Fahrtendezeit eingetragen worden, wird durch den Ringadressierer die nächste Aufzeichnungsschleife durch Hochzählen der Adressen definiert. In dieser Sekundärschleife werden dann im Normalfall 0-Daten aufgezeichnet. Diese Methode ermöglicht bei einem Folgeaufprall den sofortigen Abschluß einer neuen Aufzeichnung und sichert die Daten der primären Schleife vor dem Überschreiben mit 0-Daten. Diese Nachlaufzeit beträgt ca. 3 Minuten bei stehendem Fahrzeug.

Tritt während dieser Sicherheits- oder Nachlaufzeit also kein neues Triggerereignis auf, dann werden die Daten im Bereich des Ringzählers später überschrieben. Tritt während der Sicherheitszeit ein neues Triggerereignis auf, so wird der Adressoffset vorgezogen und eine neue Sequenz mit Eintragung der Triggerzeit gestartet.

Triggerzeit

Die Triggerzeit ist diejenige Systemzeit, zu der ein definiertes Triggerereignis als stattgefundener Unfall definiert und die Zuordnung des Primärspeichers zum Hauptspeicherbereich ausgelöst und damit die Daten in der Speicherschleife gesichert werden.

Diese Systemzeit kann beispielsweise als 3-Byte-Wort zusätzlich in der dem Triggerereignis folgenden Sequenz eingetragen werden und bildet innerhalb einer Aufzeichnung die Bezugsreferenz zu anderen Speichern. Bei der Beurteilung des Verhaltens des Fahrers ist mit dieser Zeit der Ausgangspunkt für eine detaillierte Auflösung des Geschehens festgelegt. Alle sekundärdefinierten Fixpunkte werden von dieser Zeitmarke an berechnet, relative Bezüge zweier korrespondierender Speichersysteme können hergestellt werden, wenn entsprechende Korrelationspunkte innerhalb des Speicherumfangs festgelegt werden.

Man kann dem Triggerbetrieb das folgende Schema zugrundelegen:

T				E				
1	2	3	4	5	6	7	8	9
20		R i n g a d r e s s i e r e r b e r e i c h						10
19	18	17	16	15	14	13	12	11

Die Datensequenz startet mit der Triggerzeit, die in die normalen Datenfolgen zusätzlich eingereiht wird. Das Triggerbit wird in Adresse 1 aufgezeichnet, in den Speicherstellen 2 bis 20 befinden sich die Vorlaufdaten von insgesamt 60 Sekunden nach Vereinbarung. Je nach dem weiteren Fahrtverlauf wird das Hochzählen der Ringadressiereradressen vorgenommen und damit eine Sicherung der

Daten erreicht. Als Beispiel sei angenommen, daß in der Speicherstelle 5 Stillstand registriert wird. Es wird mit dem Bereich 21 bis 41 sofort ein neuer Schleifenumlauf des Ringadressierers definiert.

Es wird davon ausgegangen, daß im Normalfall ein Fahrzeug spätestens 30 Sekunden nach dem Triggerereignis zum Stillstand gekommen ist. Die rechnerische Auswertung der Geschwindigkeit und die Meßdaten der Impulsgeber stellen übereinstimmend den Stillstand fest; jetzt werden die Ringzähleradressen um eine Sequenzbreite hochgezählt. In den gesicherten Daten befinden sich dann im Normalfall ca. 40 Sekunden Vortriggerdaten und 20 Sekunden Posttriggerdaten.

Folgeunfall

Wird nach jedem Triggerereignis eine volle Aufzeichnungssequenz gesichert, dann kann im ungünstigsten Fall ein Folgeaufprall nach einem Auffahrunfall und erfolgten Stillstand die zweite Speichersequenz beanspruchen und damit bis zu 50 Sekunden 0-Daten sichern. Die Erfindung vermeidet dies durch eine dynamische Ermittlung der Verschiebungskonstante für den Ringspeicher (Ringadressierer) sicher, indem leere Speicherstellen nicht berücksichtigt werden und Vor-Triggerdaten nur bis zurStartzeit übernommen werden. Daher wird ein Stadtunfall in der Regel weniger als 60 Sekunden und ein Folgeunfall nicht mehr als 10 bis 20 Sekunden Aufzeichnung erfordern, so daß der vorhandene Speicherumfang optimal genutzt wird.

Realzeit

Die Realzeit ist die auf die Synchronzeitmarke umgerechnete absolute Systemzeit, wobei bei der Gewinnung relativer Daten aus mehreren Systemen, wenn an dem Unfall mehr als ein Kraftfahrzeug beteiligt ist, durch eine Umrechnung auf die Zeit des Entnahmesystems eine Elimination der relativen Zeitfehler der verschiedenen Systeme möglich ist. Eine verbleibende Zeitunsicherheit ist auf einen möglichen Gangfehler der Zeitbasis während der Entnahmezeitdifferenz zweier Systeme zurückzuführen, da es sich hier um relativ kurze Zeitintervalle handelt, ist der Restfehler vernachlässigbar.

Messung der Fahrzeuggeschwindigkeit und Wegstrecke

Eine Gewinnung von geschwindigkeitssynchronen Impulsen kann von einer Endstufe des Getriebes über eine Antriebsübersetzung für den Tachometer abgeleitet werden. Es ist sinnvoll, einen Impulsgeber so auszulegen, daß je Meter Radumfang immer eine gleiche Anzahl von Impulsen erzeugt wird, so daß die Aufzeichnungen in allen Systemen ohne Korrektur miteinander vergleichbar sind. Wird die Anzahl der in einem vorgegebenen Intervall erzeugten Impulse gespeichert, dann steht unabhängig vom Fahrzeugtyp der während des Intervalls zurückgelegte Weg im Speicher.

Es ist auch eine Messung unmittelbar an den Fahrzeugrädern möglich bzw. der Auswertung von drehsynchronen Impulsen dann, wenn ein ABS-System ohnehin vorhanden ist.

Beschleunigungsmessung

Die zur Beurteilung eines Unfalls relevanten Fakten beziehen sich hauptsächlich auf Fahrzeugbewegungen, die wiederum aus auf das Fahrzeug einwirkenden Beschleunigungen resultieren. Auf Art und Aufbau eines Beschleunigungsmessers für alle denkbaren Arten einwirkender Beschleunigungen ist weiter vorn schon eingegangen worden; daher steht ergänzend zur Standardbestimmung der Fahrgeschwindigkeit durch die Aufzeichnung der Längsbeschleunigung noch ein Mittel zur Verfügung, den momentanen Wert einer Fahrgeschwindigkeit durch Integration der b-tFunktion im gewünschten Zeitintervall zu ermitteln. Beide Meßverfahren ergänzen sich nahtlos, weil immer dann, wenn das eine Verfahren keine zuverlässigen Meßwerte mehr liefert, das andere im optimalen Bereich arbeitet.

Als erstes Beispiel sei angenommen, daß das Fahrzeug mit blockierten Rädern bremst. Die von der Drehung der Räder abgeleiteten Werte für die Fahrgeschwindigkeit sind 0. Jetzt hat jedoch die Beschleunigung einen gut erfaßbaren Wert, nämlich im normalen Fahrbetrieb nahe dem Maximum.

Als zweites Beispiel sei angenommen, daß sich das Fahrzeug mit konstanter Geschwindigkeit bewegt. Die jetzt aus der Drehzahl der Räder ermittelten Werte für die Fahrgeschwindigkeit stimmen optimal mit der tatsächlichen Fahrgeschwindigkeit überein, weil die Räder ohne Schlupf abrollen. Die Werte für die Beschleunigung sind 0. Der erfindungsgemäße Beschleunigungssensor ermöglicht daher auch in kritischen Bereichen die Korrektur von konventionell ermittelten Werten für die Geschwindigkeit und springt dann ein, wenn wegen blockierender Räder keine Geschwindigkeitswerte mehr erfaßt werden können oder quereinwirkende Stöße wegen in dieser Richtung nicht wirksamer Radbewegungen ohnehin nicht erfaßt werden können.

Datenkompression

Ein Notbetrieb bei vollem Speicher kann ermöglicht werden, wenn die Daten des jeweils ältesten aufgezeichneten Ereignisses in ihrem Umfang auf wesentliche Daten reduziert werden. Diese Auswahl kann nach festgelegten Kriterien erfolgen, beispielsweise eine Reduzierung der Daten auf die Zeit zwischen Stillstand und 10 Sekunden vor Triggerereignis. In diesem Fall würde der maximale Speicherbedarf je Ereignis nur noch ca. 20 Sekunden oder 33 % betragen.

Stromausfall durch Sabotage

Grundsätzlich kann das Abklemmen des Unfalldatenschreibers von der Stromversorgung nur dann verhindert werden, wenn hierdurch auch mindestens eine zum Betrieb des Kraftfahrzeugs notwendige Funktion ausfällt. Da einfache Unterbrechungen durch den Unfalldatenschreiber überbrückbar sind, empfiehlt es sich, daß z.B. eine Motor elektronik ständig den Betriebszustand des Unfalldatenschreibers abfragt und bei ausbleibender Meldung des Unfalldatenschreibers ihre Funktion einstellt. Als Sabotage kann man den Zustand definieren, daß die Zündung eingeschaltet, der Unfalldatenschreiber jedoch mindestens eine Minute stromlos bleibt. Ein solcher Zustand kann durch ein passives akustisches oder optisches Signal angezeigt werden und wird als Ausfallzeit im Speicherbereich eingetragen und gesichert.

Bevorzugtes Ausführungsbeispiel

Die folgenden Ausführungen betrachten ein bevorzugtes Ausführungsbeispiel in seinem speziellen Aufbau und seiner Wirkungsweise sowie weitere, vorteilhafte Ausgestaltungen der Erfindung.

Ersetzt man den mit Bezug auf Fig. 1 bisher verwendeten Begriff der Steuerlogikschaltung sowie des Ringaddressierers durch einen Mikroprozessor 21/23, dann ist der Ringaddressierer in seiner Hardware-Bezeichnung das Abbild eines Grundfunktionsablaufs im Mikroprozessor. Unter der Steuerung eines zentralen Takts, der den Systemtakt des Mikroprozessors repräsentiert und abgeleitet ist aus der Quarzzeitbasis 21a, ergibt sich die Arbeitsweise eines solchen Mikroprozessors 21/23 mit zugeordnetem Festspeicher 22 dann wie folgt, wobei hier auch gleich vorteilhafte Ausgestaltungen mit erwähnt werden. Der Mikroprozessor 21/23 des Unfalldatenschreibers läuft ständig, also auch bei stehendem oder geparktem Fahrzeug, wobei ein gegebenenfalls geringfügig höherer Stromverbrauch durch entsprechend ausgebildete Mikroprozessoren auf C-Mos-Basis beispielsweise aufgefangen werden können.

Auch werden die Messungen bezüglich Geschwindigkeit und Beschleunigungen sowie der Status-Werte des Fahrzeugs durchlaufend durchgeführt, eine Aufzeichnung dieser gemessenen erfolgt jedoch nur bei Bewegung des Fahrzeugs. Ebenfalls laufen bei stehendem Fahrzeug die Berechnungen im Mikroprozessor weiter, die dieser beispielsweise durch entsprechende Verknüpfungen der Ausgangswerte der b-Sensoren 26 durchführen muß, um zur Erfassung eines unfallbedingten Triggerereignisses aus den gemessenen Beschleunigungswerten Drehbeschleunigungen oder Winkelbeschleunigungen feststellen zu können. Eine besonders vorteilhafte Ausgestaltung vorliegender Erfindung wird dabei in der Maßnahme gesehen, daß nach jedem erfolgten Halt des Fahrzeugs ein Zählvorgang eingeleitet wird, der die jeweilige reine Haltezeit erfaßt - es wird also, beispielsweise mit dem quarzzeitgesteuerten Systemtakt - ein Zähler gestartet. Sobald sich das Fahrzeug dann wieder bewegt, beginnt die neue Aufzeichnungssequenz der Daten mit dem Eintrag dieses erreichten Zählerstands, der insofern lediglich einen einzigen Wert darstellt und die Startmarke für das jetzt beginnende Einschreiben nachfolgender Daten im beispielsweise 100 ms-Abstand auf eine Ringschleife im Speicher 22 definiert. Mit anderen Worten, der Mikroprozessor zählt bzw. definiert durch einfache Inkrement- bzw. Dekrementbildung Speicherbereiche (Adressierung), die als zyklisch umlaufende einfache Zählschleife eine Speicherschleife definieren, in welche die gemessenen Daten - die errechneten Daten brauchen nicht eingetragen zu werden, da sich diese aus den gemessenen Daten zu jedem späteren Zeitpunkt wieder berechnen lassen - eingeschrieben werden. Erreicht diese (primäre) Zählschleife einen vorgegebenen Wert, dann springt diese wieder auf die Startaddresse und die zuerst eingetragenen Daten in diese Speicherschleife werden überschrieben. Eine solche einfache primäre Zählschleife kann Daten beispielsweise für die Dauer von 1 Minute aufnehmen, wenn das Fahrzeug durchlaufend in Bewegung ist. Ergeben sich aber durch Zwischenhalte Leerzeiten, die zu entsprechenden Leerdaten führen, dann werden die reinen Haltezeiten durch den weiter vorn schon erwähnten Zählvorgang erfaßt, so daß durch eine solche Betriebsart erreicht wird, daß z. B. bei einem oder mehreren Ampelhalten die im Speicher vorhandenen Fahrdaten nicht durch die sich hierbei ergebenden nachfolgenden Leerdaten überschrieben werden. In einem solchen Fall läßt sich, wie einzusehen ist, auf eine für den Fahrbetrieb eine Dauer von 1 Minute Daten aufnehmende Speicherschleife unter Umständen wesentlich mehr Datenmaterial einschreiben und insofern komprimieren.

Die Interfaceschaltung für die Beschleunigungs- oder Wegsensoren kann beispielsweise vier gepufferte Zähler enthalten, d.h. Zähler, deren Ausgänge gepuffert auf eine Busleitung gegeben werden. Der Mikroprozessor fragt entsprechend seiner Programmierung diese Zählerstände ab, wobei er vorher selbst einen Zählerstop einleitet. Sofort nach Abfrage werden die entsprechenden Zähler für die Beschleunigung und Wegsensoren wieder rückgesetzt und beginnen ihren Zählvorgang erneut - in der Zwischenzeit, nämlich bei den hier angenommenen 100 ms Abständen bezüglich der jeweiligen Dateneintragungen hat der Mikroprozessor hinreichend Zeit, um durch geeignete Verknüpfungen der gemessenen und von ihm abgefragten Daten ein unfallbedingtes Triggerereignis zu errechnen. Ein solches Triggerereignis ist selbstverständlich immer dann gegeben, wenn eine der erfaßten Beschleunigungswerte von sich aus schon einen vorgegebenenSchwellwert überschreitet - ergänzend hierzu berechnet der Mikroprozessor selbstverständlich resultierende Werte aus den Längs- und Querbeschleunigungsmessungen und kann daher auch dann ein unfallbedingtes Triggerereignis feststellen, wenn die Beschleunigungswerte einzeln den jeweiligen Sollwert nicht überschreiten. Die Ermittlung der Drehbeschleunigung ist dabei eine einfache Subtraktion, wie weiter vorn schon erwähnt, eine Winkelbeschleunigung läßt mittels eines Algorithmus sich entsprechend errechnen. Zu der Erfassung eines Triggerereignisses, dessen Feststellung grundsätzlich eine weitere, im folgenden erläuterte Funktion des Mikroprozessors einleitet, noch folgendes. Die Erfindung ermöglicht mit hoher Sicherheit auch die Erfassung reiner Personenunfälle, da die ermittelten Daten einer Gewichtung unterworfen werden können. So kann der Mikroprozessor durch Berechnungen ein Triggerereignis beispielsweise dann feststellen, wenn die Längsbeschleunigung einen bestimmten Wert erreicht, der gegebenenfalls weit unter einem angenommenen Schwellwert liegt, andererseits aber bei diesem erreichten Wert die Bremse nicht betätigt worden ist. Dies läßt auf einen Personenunfall schließen - desgleichen können durch entsprechende Gewichtung auch bei Vollbremsungen auftretende zusätzliche Beschleunigungsänderungen, die sich als Stöße am Kraftfahrzeug definieren lassen, wenn dieser bei einer Vollbremsung auf ein Hindernis trifft, im Sinne der Feststellung eines Triggerereignisses ausgewertet werden.

Immer dann, wenn ein solches Triggerereignis aufgetreten ist, können zwei Fälle unterschieden werden.

Erfolgt keine Verminderung der Geschwindigkeit bis zum schließlichen Halt, dann kann daraus geschlossen werden, daß es sich um einen Fahrerfluchtfall handelt, und der Mikroprozessor verläßt dann von selbst, also auch ohne daß das Fahrzeug hält, die primäre Zählschleife für die Dateneintragung, er veranlaßt also eine Erhöhung der Startadresse für die Aufzeichnung um den kompletten Offset der (primären) Speicherschleife, und zwar, und dies gilt für alle Fälle des Auftretens eines Triggerereignisses, entweder zurückgerechnet bis zum letzten Halt des Fahrzeugs (Datenumfang zwischen zwei Startmarken - wodurch immer nur die für den jeweiligen Unfall relevanten Daten gesichert und der verfügbare Speicherraum optimal genutzt werden kann) oder, falls seit dem letzten Halt ein längerer Zeitraum als für die primäre Zählschleife (1 Minute) vergangen ist, eben das Einfrieren dieser einminütigen Speicherzählschleife dadurch, daß der Mikroprozessor jetzt mit der um den kompletten Offset erhöhten neuen Startadresse arbeitet.

Auf diese Weise brauchen im übrigen sog. Vorlauf- bzw. Nachlaufzeiten nicht mehr festgelegt, also berücksichtigt zu werden, und es sind Mehraufzeichnungen (Folgeunfälle) möglich.

Kommt andererseits nach Feststellung eines Triggerereignisses das Fahrzeug, wie es üblich ist, zu einem Halt, dann stoppt die Eintragung mit dem Fahrzeugstillstand, die neue Startadresse wird definiert, gegebenenfalls werden mit dem Offset die Nullfrequenzen der Beschleunigungsgeber eingetragen, und der Zählvorgang wird gestartet, um zu jedem späteren Zeitpunkt, wie gleich noch erläutert wird, einen Bezug zur Absolutzeit herstellen zu können.

Eine dritte Möglichkeit, Unfalldaten auch ohne Errechnung bzw. Feststellung eines Triggerereignisses durch Mikroprozessor bis zur Auswertung zu speichern, ergibt sich aufgrund der vorteilhaften Grundkonzeption vorliegender Erfindung dadurch, daß bei einem Unfall, wenn dieser beispielsweise personenbezogen ist und/ oder die Kollision mit einem evtl. nur sehr kleinen Hindernis in ihren Auswirkungen so gering ist, daß der Rechner ein Triggerereignis nicht ausmachen kann, die eingeschriebenen Daten dennoch deshalb gespeichert bleiben, weil, wie weiter vorn schon erwähnt, bei jedem Halt - und ein solcher ergibt sich, normales Verhalten vorausgesetzt, bei jedem Unfall durch die Reaktion des Fahrers - die ferner ermittelten (gemessenen) Daten nicht mehr in den Speicher übernommen werden, sondern diese reine Haltezeit durch das Starten eines Zählers erfaßt wird.

Veranlaßt daher der von dem Unfall betroffene Verkehrsteilnehmer die Entnahme der Speicherkassette nach einem solchen, von ihm selbst festgestellten Unfall, dann sind die möglicherweise seine Unschuld beweisenden Daten nicht verloren, sondern in der (primären) Speicherschleife aufgezeichnet, zusammen mit der seit dem Halt des Fahrzeugs vergangenen Zeit, so daß so auch ein lückenloser Bezug zur Absolutzeit hergestellt werden kann.

Der weitere Vorgang ist dann so, daß zur Auswertung die Speicherkassette, die in bevorzugter Ausführungsform auch die Zeitbasis, den von ihr in seinem Systemtakt abhängenden Mikroprozessor, sowie mindestens die Beschleunigungssensoren umfaßt, entnommen wird. Bei dieser Entnahme läuft der zur Erfassung der Haltezeit gestartete Zähler weiter. Wird die Speicherkassette dann in einer Auswertestation, was vorgezogen wird, ausgelesen, dann stoppt der Rechner der Auswertestation den Zeitzähler, und es werden die Absolutzeit, über welche die Auswertestation ja verfügt, sowie der Zählerstand des Zeitzählers den ausgelesenen Daten angefügt. Durch diese nach rückwärts gerichtete Errechnungsmöglichkeit unter Einschluß der Zählerposition des Haltezeit-Zählers ist es natürlich möglich, einen lückenlosen Bezug zur Absolutzeit herzustellen, wobei alle Zeitzähler auf den (sehr geringfügigen) Gangfehler der Quarzzeitbasis des Unfalldatenschreibers während der Zählerzeit reduziert werden. Auf diese Weise ist es möglich, beliebig viele, unabhängige Unfalldatenschreiber-Speicher direkt miteinander in Bezug zu setzen, da alle Speicherinhalte eine gemeinsame Zeitmarke enthalten. Durch eine Bestimmung der Gangabweichung der Quarzzeitbasis jedes Unfalldatenschreibers beim Auslesen kann dann auch der geringfügige relative Gangfehler auf Null zurückgeführt werden. Es ist auf diese Weise möglich, unter Umständen auch noch mehrere Wochen zurückliegende Unfälle, die durch Fahrerflucht nicht zur unmittelbaren Auswertung der Speicherkassette geführt haben, festzustellen, denn bei einem solchen Unfall wird durch die Reaktion des Mikroprozessors auf das von ihm selbst festgestellte Triggerereignis sowohl, wie nach jedem Triggerereignis, die Zählschleife um den kompletten Offset neu definiert, d.h. die Startadresse entsprechend erhöht, so daß der Unfalldatenschreiber jetzt in einer sekundären Zählschleife läuft, als auch gleichzeitig eine Zeitzählung in Gang gesetzt, die nicht mehr gestoppt wird und die nur eine Speicherstelle im Festspeicher besetzt. Die Organisation von Mikroprozessor mit Festspeicher kann dann weiter so getroffen sein, daß auch bei zyklischem Zählschleifenumlauf in der sekundären (neuen) Speicherschleife Zwischenhalts wieder durch entsprechendes, paralleles Zählen (des gleichen Systemtaktes) erfaßt werden.

Durch das ständige Arbeiten des Mikroprozessors und die Messung sowie Verrechnung der eingehenden Daten sind natürlich auch Unfallgeschehen am stehenden oder geparkten Fahrzeug erfaßbar, denn sobald einer der b-Sensoren von seiner Nullfrequenz abweichende Werte liefert, wie sie bei einem Auffahrunfall auf ein stehendes Fahrzeug auftreten, wird dies vom Mikroprozessor natürlich als Bewegung des Fahrzeugs interpretiert und nach Eintragung des erreichten Zeitzählerstands (für die Haltezeit) startet eine neue Aufzeichnungsfrequenz. Kommt das kollidierte parkende Fahrzeug anschließend wieder zur Ruhe, dann wird dies als neuer Fahrzeughalt interpretiert und der Zählvorgang wieder eingeleitet, so daß jederzeit die zur Kollision führenden Daten erfaßt werden können, wenn ein solcher Unfall zu einem späteren Zeitpunkt bemerkt und die Speicherkassette zur Auswertung gegeben wird. Es läßt sich dann auch der Absolutzeitpunkt der Fahrzeugbeschädigung noch feststellen.

Patentansprüche

1. Verfahren zur kurzzeitigen Aufnahme bzw. Speicherung von unfallbezogenen Daten und Ereignissen bei Kraftfahrzeugen, wobei durch Erfassung von Radumdrehungen Daten bezüglich zurückgelegter Fahrtstrecke und Fahrzeuggeschwindigkeit,mittels Beschleunigungssensoren Daten für Längs- und Querbeschleunigung des Fahrzeugs und gegebenenfalls durch Erfassung sonstiger interessierender Betriebszustände diese angebende Daten gewonnen, einer Analog/Digitalwandlung unterworfen und mittels eines zentralen Taktes für die Datenbewegung kurzzeitig zwischengespeichert bzw. nach Auftreten eines Unfalls unlöschbar gespeichert werden, dadurch gekennzeichnet, daß sämtliche erfaßten Daten in digitaler Form zeitlich fortlaufend im durch den zentralen Takt gegebenen zeitlichen Abstand auf Speicherplätze eines Festspeichers (22) durch Definieren einer in einer Maximalschleife umlaufenden Adressierung eingeschrieben werden,

daß die Beschleunigungsdaten durch die direkte

Auswertung von Frequenzänderungen von Beschleunigungssensoren auf kapazitiver Grundlage enthaltenden Schwingschaltungen gewonnen werden,

und daß bei Auftreten eines durch ein Unfallgeschehen verursachten Triggerereignisses die Adressierung durch Startadressenerweiterung (Änderung der Startadresse) in mindestens eine weitere, die bisherigen Festspeicheradressen nicht mehr enthaltende Sekundäradressierschleife übergeht derart, daß sämtliche zeitlich vor dem Unfall liegenden Daten bis zur Auswertung unlöschbar gespeichert bleiben.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß nach einem Fahrzeughalt bzw. bei stehendem Fahrzeug die Belegung der Speicherplätze des Festspeichers durch das Aufzeichnen der Datensequenz unterbrochen und zur Erfassung der reinen Haltezeit ein Zählvorgang gestartet wird und daß bei erneuter Bewegung des Fahrzeugs die neue Aufzeichnungssequenz mit dem Eintrag des Zählerstandes als Startmarke beginnt.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der zentrale, die Datenbewegung und die Zählvorgänge bestimmende Systemtakt von einer Quarzzeitbasis vorgegeben ist.

4. Verfahren nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß durch Vergleich gemessener Beschleunigungsdaten (Längs- und Querbeschleunigung) bzw. errechneter Beschleunigungsdaten (Resultierende von Längs- und Querbeschleunigung, Winkelbeschleunigung) und Vergleich mit gegebenen-

falls auf andere Fahrzeug-Statusdaten (Bremsung) bezogenen Schwellwerten sowie gegebenenfalls unter Einbeziehung von Weg- und Geschwindigkeitsdaten ein unfallbezogenes Triggerereignis festgestellt und durch Speicherversatz (Definition einer neuen, um einen kompletten Offset für eine gegebene Speicherschleife erhöhter Startadresse) in einem anderen Speicherbereich sämtliche Fahrzeugdaten weiter aufgezeichnet werden (sekundäre Adressierzählschleife).

5. Verfahren nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß der Offset für die Startadressenerhöhung bei Auftreten eines Triggerereignisses entweder auf eine komplette Speicherschleife bezogen wird oder auf den gespeicherten Datenumfang einer zurückliegenden Aufzeichnungssequenz zwischen zwei Startmarken, die mit dem Eintrag des durch einen vorherigen Halt des Fahrzeugs veranlaßten Zählerstands beginnt.

6. Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß nach jedem Triggerereignis ohne bzw. mit nachfolgendem Fahrzeughalt der Zeitzählvorgang durch systemtaktbedingtes Hochzählen einer Speicherstelle im Festspeicher anläuft und solange durchgeführt wird, bis die Speicherkassette einschließlich Zeitbasis, Mikroprozessorschaltung, Festspeicher und den Beschleunigungssensoren zur Auswertung ausgelesen und der erreichte Zeitzählerstand mit der Absolutzeit der Auswertestation in Bezug gesetzt wird derart, daß im Moment des Auswertens eine lückenlose absolute Zeitbestimmung bezüglich des Eintritts des Triggerer-

eignisses erfolgt.

7. Verfahren nach einem oder mehreren der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß zur automatischen Eichung der Beschleunigungssensoren die jeweiligen aktuellen Nullfrequenzen bei jedem Fahrzeugstart (Beginn der Aufzeichnung) in den Speicher eingeschrieben werden.

8. Unfalldatenschreiber zur Durchführung des Verfahrens nach einem oder mehreren der Ansprüche 1 bis 7, mit Radumdrehungen abtastenden Gebern zur Ermittlung von zurückgelegter Fahrstrecke und Fahrzeuggeschwindigkeit, mit Beschleunigungssensoren für die Erfassung von Längs- und Querbeschleunigungen, gegebenenfalls mit weiteren Sensoren zur Erfassung sonstiger interessierender Betriebszustände, mit Mitteln zur Analog/Digitalwandlung der erfaßten Daten, mit einem zentralen Taktgeber für die Datenbewegung, ferner mit Speichermitteln zur kurzzeitigen Zwischenspeicherung bzw. nach Auftreten eines Unfalls (Triggerereignis) zur unlöschbaren Speicherung der nachfolgend auswertbaren erfaßten Daten, dadurch gekennzeichnet, daß lediglich ein Festspeicher (22) zur umlaufenden Speicherung der erfaßten Daten zunächst in einer ersten Speicherschleife mit einer vorgegebenen Anzahl von Speicherplätzen vorgesehen ist,

daß zur Erfassung der Beschleunigungsdaten Schwingschaltungen mit Beschleunigungssensoren auf kapazitiver Grundlage vorgesehen sind, wobei die von diesen abgegebenen Frequenzen unmittelbar der digitalen Zählung und nachfolgenden Speicherung im Festspeicher zuführbar sind und daß Verrechnungsmittel vorgesehen sind, die unter Auswertung von erfaßten bzw. berechneten Beschleunigungsdaten und gegebenenfalls weiterer Fahrzeugdaten den Zeitpunkt eines unfallbezogenen Triggerereignisses vorgeben derart, daß unter Erhöhung der Startadresse für die Datenspeicherung um den kompletten Offset der (primären), gegebenenfalls reduzierten Speicherschleife eine neue (sekundäre) Speicherschleife definiert wird zur nachfolgenden Datenspeicherung.

9. Unfalldatenschreiber nach Anspruch 8, dadurch gekennzeichnet, daß Zeitzählmittel vorgesehen sind, die bei jedem Fahrzeughalt gestartet durch den quarzzeitbezogenen Systemtakt ihren Speicherinhalt bis zur erneuten Fahrzeugbewegung verändern, wobei der jeweils erreichte Zählerstand als Startmarke mit der neuen Aufzeichnungssequenz gespeichert wird.

10. Unfalldatenschreiber nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß periphere, zusätzliche Betriebszustände des Kraftfahrzeugs als mit hoher Auflösung und mit normaler Auflösung zu speichernde Daten (Status-A-Daten; Status-B-Daten) definiert und in die Datensequenzen einbezogen sind.

11. Unfalldatenschreiber nach einem der Ansprüche 8 bis 10, dadurch gekennzeichnet, daß der Festspeicher (22) mit der Datenverwaltung und Organisation (Steuerlogikschaltung 21 und Ringadressierer 23 bzw. Mikroprozessor 21/23) zusammen mit den Beschleunigungssensoren (26) getrennt zu einem Basisgerätteil in Form eines Einschubs (Speicherkassette 31) ausgebildet sind, wobei das einen Einschub für die Speicherkassette aufweisende Basis-

gerät die Schnittstellen (24) für die Übermittlung der digitalen Statusdaten, Pufferspeicher und Stromversorgung enthält.

12. Unfalldatenschreiber nach einem der Ansprüche 8 bis 11, dadurch gekennzeichnet, daß der Beschleunigungssensor mindestens einen, einseitig eingespannten, an seinem anderen Ende mit einer stationären Gegenplatte (11', 12', 13') einen Kondensator bildenden Biegebalken (Zungen 11, 12, 13) umfaßt, sowie einen zugeordneten Oszillator, dessen Schwingfrequenz sich in Abhängigkeit zur Kapazitätsänderung am Kondensator bei einer Beschleunigungseinwirkung auswertbar ändert.

13. Unfalldatenschreiber nach Anspruch 12, dadurch gekennzeichnet, daß jeweils um 90° versetzt an einem gemeinsamen blockförmigen Einspannkörper (10) einseitig befestigte Zungen (11, 12, 13) vorgesehen sind, denen gegenüberliegend die Zungen über eine vorgegebene Länge überdeckend, die stationären Gegenplatten zur Bildung von Kapazitätssensoren (F1, F2, F3) angeordnet sind.

14. Unfalldatenschreiber nach Anspruch 12 oder 13, dadurch gekennzeichnet, daß der blockförmige Einspannkörper (10), den elektrischen Bezugspunkt bildend, in einem geschlossenen, unter Vakuum stehenden Gehäuse, welches auf der Speicherkassette befestigt oder Teil derselben ist, angeordnet ist, wobei an der Gehäusebodenplatte (15) Überführungskörper (19) befestigt die Gegenplatten (11', 12', 13') der jeweils gebildeten Kondensatoren in ihrem Abstand justierbar zu den Zungen (11, 12, 13) befestigt sind.

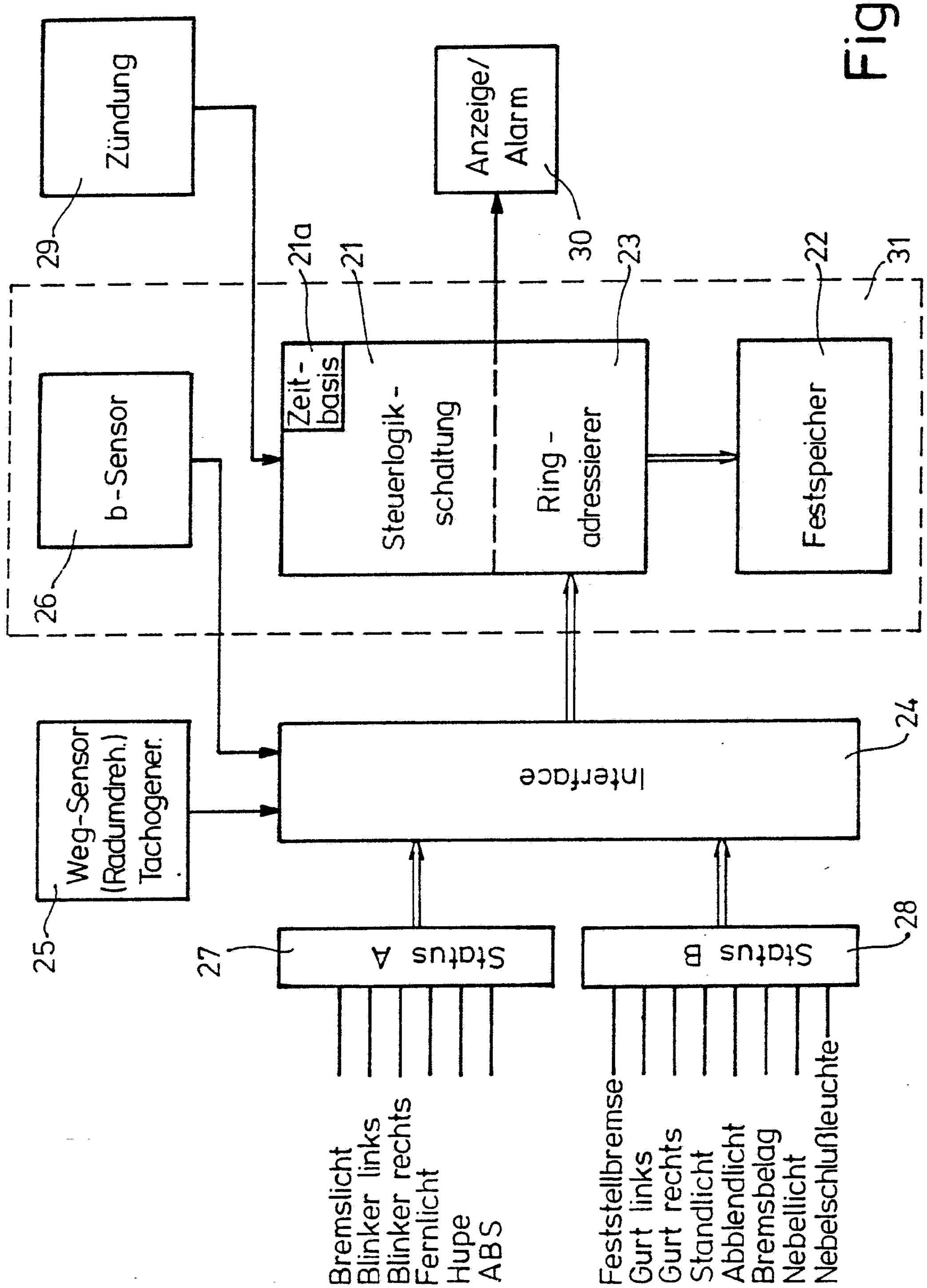

Zündung
29
Anzeige/
Alarm
30
21a
21
23
22
31
Zeit-
basis
Steuerlogik-
schaltung
Ring-
adressierer
Festspeicher
b-Sensor
26
Weg-Sensor
(Radumdreh.)
Tachogener.
25
Interface
24
Status A
27
Status B
28
Bremslicht
Blinker links
Blinker rechts
Fernlicht
Hupe
ABS
Feststellbremse
Gurt links
Gurt rechts
Standlicht
Abblendlicht
Bremsbelag
Nebellicht
Nebelschlußleuchte

Fig.1

Fig. 2

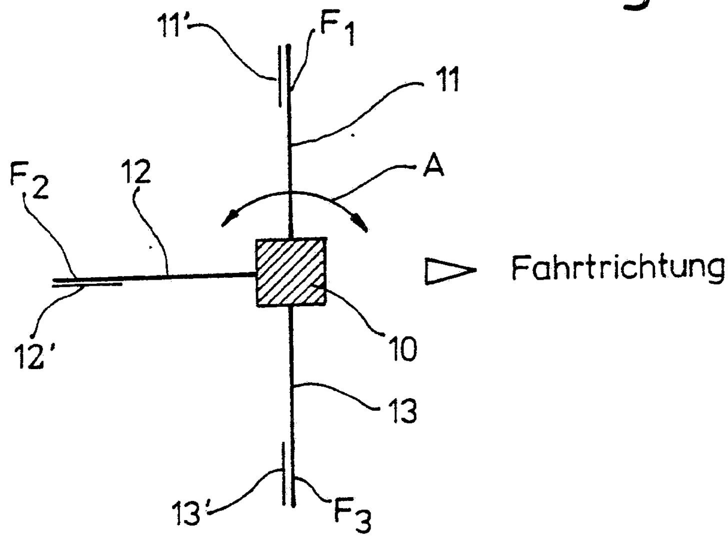

11'
F1
11
A
F2
12
Fahrtrichtung
12'
10
13
13'
F3

Fig. 3

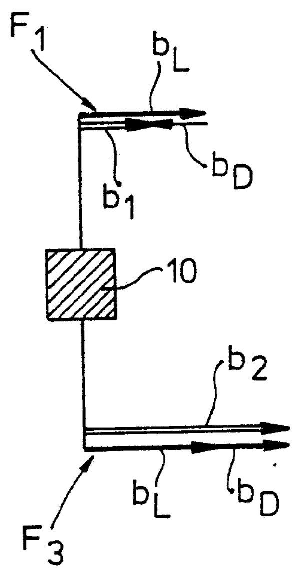

F1
bL
bD
b1
10
b2
bL
bD
F3

Fig. 4

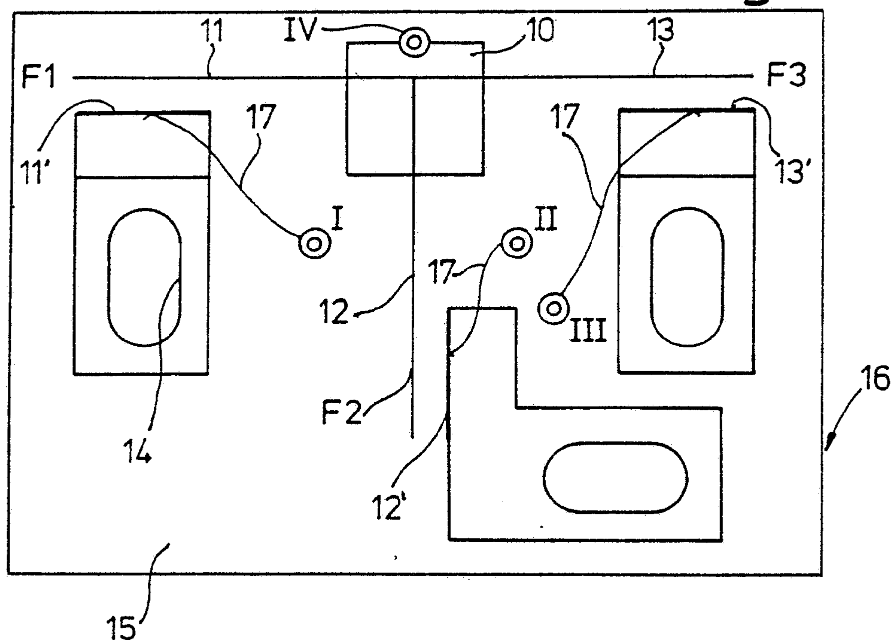
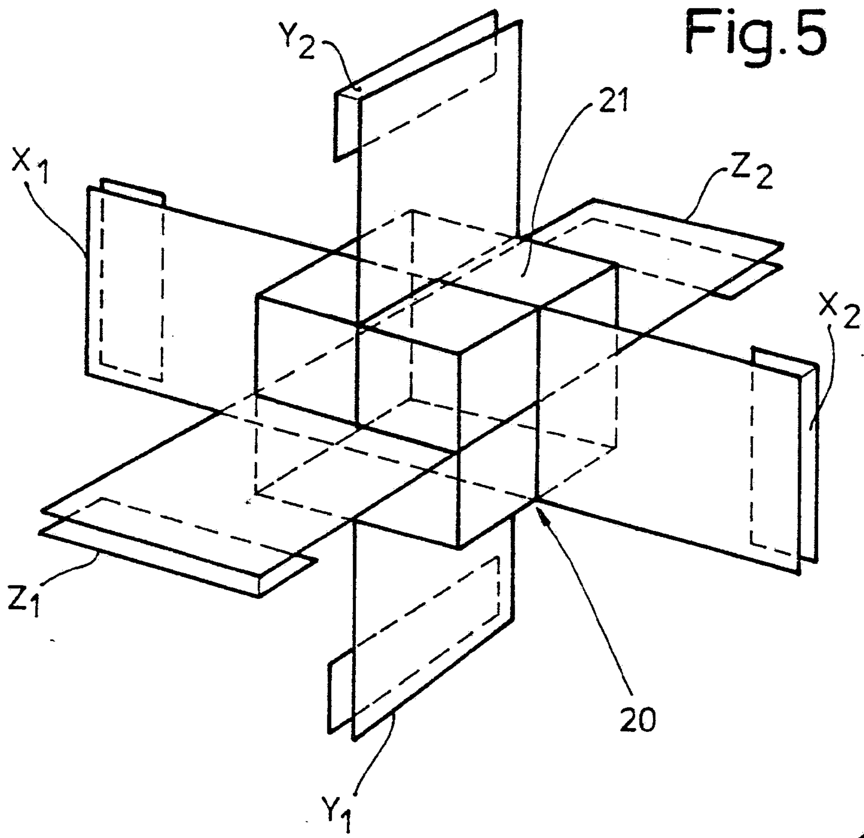

IV
11
10
13
F1
F3
17
17
11'
13'
I
II
17
12
III
16
F2
14
12'
15

Fig. 5


Y2
21
X1
Z2
X2
Z1
20
Y1

INTERNATIONAL SEARCH REPORT

International Application No PCT/DE84/00041

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

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

Int.Cl.^{3}: G01P 1/12

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC^3	G01P

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	DE, A, 2322299 (GENERAL MOTORS CORP.), 8 November 1973, see page 6, lines 20-32; page 8, lines 2-7; lines 14-19; lines 24-32; page 9, lines 8-18; figures ---	1,4,8
Y	US, A, 3226981 (MULLINS et al.), 4 January 1966, see column 3, lines 30-42; figures 1-4 ---	1,8,12
A	FR, A, 2424537 (SOCIETE MOTO METER AG), 23 November 1979, see page 1, line 25; page 2, line 31;figures ---	1,8,10
A	US, A, 4250487 (ARNOLD), 10 February 1981, see column 1, lines 40-64; figure 2 ---	1,8
A	US, A, 2917300 (SPIESS), 15 December 1959, see column 1, lines 33-45; figures 1,2a, 2b,3 ---	1,8
A	FR, A, 2511509 (O.N.E.R.A.), 18 February 1983, see page 5, line 17; page 6, line 5; figure 1 -------	13,14

* Special categories of cited documents: [15]

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

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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

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

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
24 May 1984 (24.04.84)	2 July 1984 (02.07.84)
International Searching Authority [1]	**Signature of Authorized Officer [20]**
European Patent Office	

Form PCT/ISA/210 (second sheet) (October 1981)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/DE 84/00041 (SA 6632)

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 18/06/84

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- 2322299	08/11/73	GB-A-	1371185	23/10/74
		AU-A-	5427373	10/10/74
		AU-B-	468500	15/01/76
		JP-A-	49061840	15/06/74
US-A- 3226981		None		
FR-A- 2424537	23/11/79	DE-A-	2818388	08/11/79
		GB-A,B	2020127	07/11/79
US-A- 4250487	10/02/81	US-A-	4291295	22/09/81
US-A- 2917300		None		
FR-A- 2511509	18/02/83	None		

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

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/DE 84/00041

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[3]

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

Int.Kl.³: G 01 P 1/12

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff[4]

Klassifikationssystem	Klassifikationssymbole
Int.Kl.³	G 01 P

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen[5]

III. EINSCHLÄGIGE VERÖFFENTLICHUNGEN[14]

Art*	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der Maßgeblichen Teile[17]	Betr. Anspruch Nr.[18]
Y	DE, A, 2322299 (GENERAL MOTORS CORP.) 8. November 1973, siehe Seite 6, Zeilen 20-32; Seite 8, Zeilen 2-7; Zeilen 14-19; Zeilen 24-32; Seite 9, Zeilen 8-18; Figuren --	1,4,8
Y	US, A, 3226981 (MULLINS et al.) 4. Januar 1966, siehe Spalte 3, Zeilen 30-42; Figuren 1-4 --	1,8,12
A	FR, A, 2424537 (SOCIETE MOTO METER AG) 23. November 1979, siehe Seite 1, Zeile 25 - Seite 2, Zeile 31; Figuren --	1,8,10
A	US, A, 4250487 (ARNOLD) 10. Februar 1981, siehe Spalte 1, Zeilen 40-64; Figur 2 --	1,8
A	US, A, 2917300 (SPIESS) 15. Dezember 1959, siehe Spalte 1, Zeilen 33-45; Figuren 1,2a,2b, 3 --	1,8

./.

* Besondere Kategorien von angegebenen Veröffentlichungen[15]:

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist

"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)

"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht

"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist

"T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist

"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden

"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist

"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche[2]	Absendedatum des internationalen Recherchenberichts[2]
24. Mai 1984	02 JUIL. 1984
Internationale Recherchenbehörde[1]	Unterschrift des bevollmächtigten Bediensteten[20]
Europäisches Patentamt	G.L.M. KRUYDENBERG

Formblatt PCT/ISA/210 (Blatt 2) (Oktober 1981)

III. EINSCHLÄGIGE VERÖFFENTL CHUNGEN (FORTSETZUNG VON BLATT 2)		
Art*	ennzeichnung der Verö fen l chung [6] soweit erf. rderlich nter Angabe der maßgeb hen Teile [17]	Bet Anspruch Nr [18]
A	FR, A, 2511509 (O.N.E.R.A.) 18. Februar 1983, siehe Seite 5, Zeile 17 - Seite 6, Zeile 5; Figur 1 ----------	13,14

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT UBER DIE

INTERNATIONALE PATENTANMELDUNG NR. PCT/DE 84/00041 (SA 6632)

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 18/06/84

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- 2322299	08/11/73	GB-A-	1371185	23/10/74
		AU-A-	5427373	10/10/74
		AU-B-	468500	15/01/76
		JP-A-	49061840	15/06/74
US-A- 3226981		Keine		
FR-A- 2424537	23/11/79	DE-A-	2818388	08/11/79
		GB-A,B	2020127	07/11/79
US-A- 4250487	10/02/81	US-A-	4291295	22/09/81
US-A- 2917300		Keine		
FR-A- 2511509	18/02/83	Keine		

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

ACCIDENT DATA RECORDER

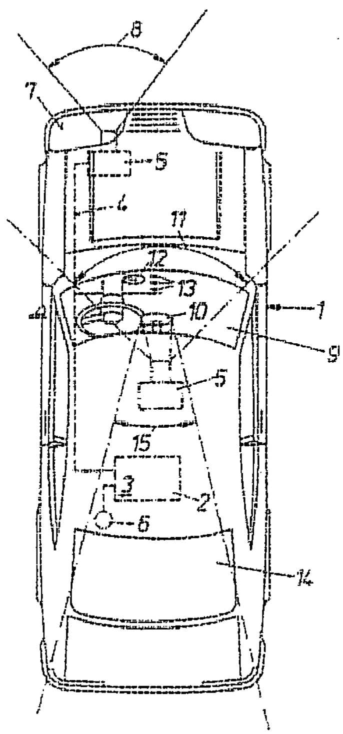
Patent number:	WO8809023 (A1)
Publication date:	1988-11-17
Inventor(s):	SZABO VIKTOR [AT] +
Applicant(s):	SZABO VIKTOR [AT] +
Classification:	
- international:	***B60R11/04; G07C5/08;*** **B60R11/00; G07C5/00;** (IPC1-7): B60R11/04; G07C5/08
- european:	B60R11/04; G07C5/08R4C
Application number:	WO1988AT00024 19880503
Priority number(s):	AT19870001168 19870508

Cited documents:

DE3015737 (A1)
EP0087398 (A2)
DE1630943 (A1)
DE3422764 (A1)
DE3342898 (A1)

Abstract of **WO 8809023 (A1)**

In order to obtain the fullest possible data concerning the antecedents and circumstances of an accident involving motor vehicles for the purpose of assessing responsibility, the accident data recorder is equipped with a video camera (5) arranged on or in the vehicle (1) and a video signal recording unit (2) to which are fed the signals from any other sensing devices (6) which may, if necessary, provide additional information concerning environmental conditions. The recording unit (2) can be designed as a video tape recorder with an endless tape or as a magnetic disk unit which are capable of recording data for 10 minutes and which on completion of such a cycle record over the last cycle which has not beeninterrupted by an accident.



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 4 : **G07C 5/08, B60R 11/04**	**A1**	**(11) Internationale Veröffentlichungsnummer:** **WO 88/ 09023** **(43) Internationales Veröffentlichungsdatum:** 17. November 1988 (17.11.88)

(21) Internationales Aktenzeichen: PCT/AT88/00024

(22) Internationales Anmeldedatum: 3. Mai 1988 (03.05.88)

(31) Prioritätsaktenzeichen: A 1168/87

(32) Prioritätsdatum: 8. Mai 1987 (08.05.87)

(33) Prioritätsland: AT

(71)(72) Anmelder und Erfinder: SZABO, Viktor [AT/AT]; Lindenweg 38, A-2380 Perchtoldsdorf (AT).

(74) Anwalt: PINTER, Rudolf; Elisabethstrasse 1/24, A-1010 Wien (AT).

(81) Bestimmungsstaaten: AT (europäisches Patent), BE (europäisches Patent), BR, CH (europäisches Patent), DE (europäisches Patent), FR (europäisches Patent), GB (europäisches Patent), HU, IT (europäisches Patent), JP, LU (europäisches Patent), NL (europäisches Patent), SE (europäisches Patent), SU, US.

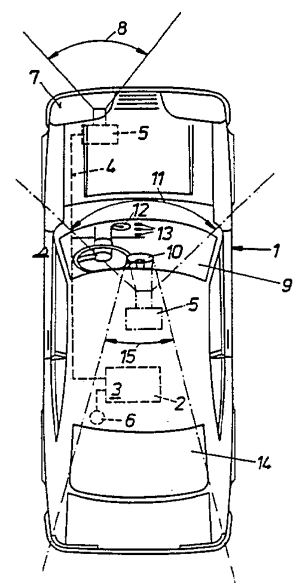
Veröffentlicht
Mit internationalem Recherchenbericht.

(54) Title: ACCIDENT DATA RECORDER

(54) Bezeichnung: UNFALLDATENSCHREIBER

(57) Abstract

In order to obtain the fullest possible data concerning the antecedents and circumstances of an accident involving motor vehicles for the purpose of assessing responsibility, the accident data recorder is equipped with a video camera (5) arranged on or in the vehicle (1) and a video signal recording unit (2) to which are fed the signals from any other sensing devices (6) which may, if necessary, provide additional information concerning environmental conditions. The recording unit (2) can be designed as a video tape recorder with an endless tape or as a magnetic disk unit which are capable of recording data for 10 minutes and which on completion of such a cycle record over the last cycle which has not beeninterrupted by an accident.



(57) Zusammenfassung

Um möglichst umfassende Informationen über die Vorgeschichte und den Hergang eines Unfalles mit Kraftfahrzeugen für die Beurteilung der Verschuldensfrage zur Verfügung zu haben, ist der Unfalldatenschreiber mit einer am bzw. im Fahrzeug (1) angeordneten Videokamera (5) sowie einer Videosignal-Aufzeichnungseinheit (2), der auch die Signale von allfälligen weiteren Sensoreinrichtungen (6), die gegebenenfalls zusätzliche Auskunft über Umgebungsbedingungen geben, zugeführt sind, ausgestattet. Die Aufzeichnungseinheit (2) kann dabei von einem Video-Bandrecorder mit Endlosband oder einer Magnetplatten-Station gebildet sein, die für eine 1- bis 10-minütige Datenaufzeichnung ausgelegt sind und nach Ablauf eines derartigen Zyklus den vorherigen, nicht durch einen Unfall unterbrochenen Zyklus überschreiben.

LEDIGLICH ZUR INFORMATION

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

AT	Österreich	**FR**	Frankreich	**MR**	Mauritanien
AU	Australien	**GA**	Gabun	**MW**	Malawi
BB	Barbados	**GB**	Vereinigtes Königreich	**NL**	Niederlande
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DK	Dänemark	**MG**	Madagaskar		
FI	Finnland	**ML**	Mali		

UNFALLDATENSCHREIBER

Technisches Gebiet

Die Erfindung betrifft einen Unfalldatenschreiber zur kurzzeitigen Aufnahme bzw. Speicherung von unfallbezogenen Daten bzw. Ereignissen bei Kraftfahrzeugen, mit zumindest einer am Fahrzeug angeordneten Sensoreinrichtung zur Erfassung von interessierenden Daten bzw. Ereignissen und Umwandlung derselben in elektrische Signale, sowie mit einer Speichereinrichtung, welche mit allen Sensoreinrichtungen zur Signalübertragung verbunden ist und zur zeitlich bestimmten, kurzzeitigen Zwischenspeicherung, bzw. - nach Auftreten eines über zumindest eine der Sensoreinrichtungen festgestellten Unfalles - unlöschbaren Speicherung, der Signale dient.

Stand der Technik

Unfalldatenschreiber, die bei der Verwendung in einem Kraftfahrzeug dazu dienen, für die Beurteilung eines Unfalles relevante Daten oder Umstände, die in einem bestimmten, begrenzten Zeitraum vor dem Unfall auf- bzw. eingetreten sind, aufzuzeichnen und über den Unfallzeitpunkt hinaus zu speichern und zur Verfügung zu halten, sind in vielfältiger Form bekannt - im wesentlichen arbeiten die meisten der in diesem Zusammenhang bekannten Geräte auf mechanischer Grundlage als sogenannte Kurzwegschreiber. Derartige Kurzwegschreiber oder Fahrscheiben-Tachographen verfügen jeweils über einen Antrieb durch eine biegsame Welle vom Getriebe bzw. von den Antriebsrädern des Fahrzeuges her zur Registrierung der Umdrehung der Antriebsräder, wobei aber lediglich die zeitbezogene Geschwindigkeit vor dem Auftreten eines Unfalles ohne jede zusätzliche Daten aufgezeichnet werden kann. Bei blockierten Rädern sind bei derartigen Anordnungen naturgemäß keinerlei Daten mehr aufzuzeichnen, was von besonderem Nachteil ist, da in dieser Phase eine besonders sorgfältige Datenaufzeichnung notwendig wäre.

Aus der DE-PS 23 22 299 ist eine Einrichtung zur Registrierung von Betriebsdaten eines Fahrzeugs bekannt, die als

Unfalldatenschreiber diese Betriebsdaten digital mindestens einer Zwischenspeicherung zuführt. Über je einen Beschleunigungsmesser für die Erfassung von Längsbeschleunigungen und Querbeschleunigungen sowie einen induktiven Fühler für die Radumdrehung werden elektrische Signale geliefert, die im Takt eines Steuersignalgebers Schieberegister durchlaufen. Das Aufprallsignal, also die eigentliche Feststellung des Unfalles, wird durch einen Vergleich der Längs- und Querbeschleunigungssignale ermittelt. Als wesentlicher Nachteil dieser Einrichtung ist wiederum die Tatsache zu nennen, daß damit nur sehr wenige, zur Beurteilung der Gesamtsituation bei einem Unfall zweckdienliche Daten gesammelt werden können bzw. nach einem Unfall auch tatsächlich zur Verfügung stehen.

Aus der EP-A1-0 118 818 ist schließlich ein Unfalldatenschreiber der eingangs genannten Art bekannt geworden, bei dem die zurückgelegte Fahrtstrecke und Fahrzeuggeschwindigkeit aus der Erfassung der Radumdrehungen, die Längs- und Querbeschleunigungen des Fahrzeuges über Beschleunigungssensoren und zusätzlich sonstige interessierende Betriebszustände bzw. Daten erfaßt, einer Analog/Digitalwandlung unterworfen und mittels eines zentralen Taktes für die Datenbewegung kurzzeitig zwischengespeichert bzw. - nach einem Unfall - unlöschbar gespeichert werden. Sämtliche Daten werden dabei zeitlich fortlaufend in einen Festspeicher eingeschrieben. Obwohl bei diesem bekannten Unfalldatenschreiber bereits eine Reihe sehr wesentlicher interner, kraftfahrzeugbezogener Daten - wie etwa der Status der Blinkanlage, der Hupe, der Bremse usw. - mitüberwacht und aufgezeichnet werden, ist doch auch in diesem Zusammenhang wiederum als wesentlicher Nachteil zu nennen, daß praktisch keine vom den Unfalldatenschreiber tragenden Fahrzeug unabhängige äußere Einflüsse aufgezeichnet und im Falle eines Unfalles gespeichert werden können.

Darstellung der Erfindung

Aufgabe der vorliegenden Erfindung ist es, die genannten Nachteile der bekannten Unfalldatenschreiber zu vermeiden und insbesonders einen Unfalldatenschreiber der eingangs genannten Art so zu verbessern, daß die nach dem Auftreten eines Unfalles oder eines anderen, vergleichbaren Ereignisses tatsächlich in der Speichereinrichtung zur Verfgügung stehenden Daten eine möglichst weitgehende Berücksichtigung aller im Zusammenhang mit dem Unfall bzw. mit der Klärung der Verschuldensfrage wesentlichen Daten erlauben.

Dies wird gemäß der vorliegenden Erfindung dadurch sichergestellt, daß zumindest eine der Sensoreinrichtungen eine optische Erfassungseinheit samt in der Speichereinrichtung zugehöriger Bildaufzeichnungseinheit aufweist, daß die optische Erfassungseinheit von einer Videokamera und die Bildaufzeichnungseinheit von einer Videosignal-Aufzeichnungseinheit gebildet ist, und daß der Videosignal-Aufzeichnungseinheit auch die Signale von allfälligen weiteren Sensoreinrichtungen, die gegebenenfalls zusätzliche Auskunft über Umgebungsbedingungen und dergleichen geben, zugeführt sind. Die Verwendung einer Videokamera, die heutzutage bereits extrem klein, handlich, robust, zuverlässig und preisgünstig auf den Markt erhältlich ist, gibt unmittelbar den enormen Vorteil einer objektiven Aufzeichnung aller für die Beurteilung eines Unfalles wesentlichen Daten und Umstände. Aus der bekannten Bildfolgefrequenz können beispielsweise unmittelbar und mit großer Genauigkeit Geschwindigkeiten, Beschleunigungen, oder Fahrtstrecken aller an einem Unfall beteiligten Fahrzeuge ermittelt werden, wozu im Normalfall zusätzlich nur noch eine Referenzentfernung an der Unfallstelle selbst sowie die Brennweite der auf der Videokamera verwendeten Optik bekannt sein muß. Aus der Videoaufzeichnung läßt sich weiters unmittelbar beispielsweise ersehen, ob Lichter oder Blinker an entgegenkommenden bzw. kreuzenden Fahrzeugen gesetzt waren, ob bzw. welche Warn- oder Hinweistafeln aufgestellt waren, ob Bahnschranken bereits halb geschlossen waren, und dergleichen mehr. Auch Informationen über den tatsächlichen Straßenzustand - Streusplitt, Schlaglöcher, Fahrbahnnässe - oder Umgebungsbedingungen - Regen, Nebel, Staubwolken - sind unmittelbar zu erhalten. Kombiniert mit Zustandsdaten betreffend das den erfindungsgemäßen Unfalldatenschreiber führende Fahrzeug - wie etwa zusätzliche Information über die Fahrgeschwindigkeit, Getriebestellung, Status der Lichter usw. - ergibt sich eine Möglichkeit zur lückenlosen Überwachung und bedarfsweisen Festhaltung aller wesentlichen Daten zur Beurteilung eines Unfalles, auch wenn die anderen der an einem Unfall beteiligten Fahrzeuge nicht mit einem erfindungsgemäßen Unfalldatenschreiber ausgerüstet sind.

Abgesehen von der primären Verwendung als Unfalldatenschreiber bietet die erfindungsgemäße Anordnung unmittelbar auch den Vorteil, daß unabhängig vom tatsächlichen Auftreten eines Unfalles bzw. eines ähnlichen Ereignisses stets eine große Menge von Daten über alle im Blickfeld der Videokamera passierenden Ereignisse zur Verfügung steht, was es beispielsweise ermöglicht, ein das eigene Fahrzeug nach dem Überholen rücksichtslos schneidendes Fremdfahrzeug auszuforschen und den Fahrer zur Anzeige zu bringen. In gleicher Weise stehen beispielsweise natürlich auch Daten über im Blickfeld der Videokamera passierende Unfälle zur Verfügung, an denen das mit dem erfindungsgemäßen Unfalldatenschreiber ausgerüstete Fahrzeug gar nicht beteiligt ist, sodaß auch diesbezüglich die Aufklärung des Unfallherganges bzw. die Klärung der Verschuldensfrage sehr vereinfacht wird.

Denkbar wäre natürlich auch eine etwa vom Gesetzgeber verordnete bzw. von den Fahrzeugherstellern gemeinsam beschlossene Einführung derartiger Unfalldatenschreiber für alle neu zugelassenen Fahrzeuge, oder aber auch nur für besondere Einzelgruppen von Fahrzeugen - wie etwa Taxis, Omnibusse, usw. - ; in diesem Falle könnten auch alle an einem Unfall beteiligten Fahrzeuge verpflichtet werden, ihre Videosignal-Aufzeichnungseinheit bzw. das tatsächlich verwendete Speichermedium unmittelbar am Unfallort an die Exekutive auszuhändigen, sodaß jegliche Manipulation an diesen Beweismitteln ausgeschlossen wäre. Auch könnten z.B. versiegelte bzw. plombierte Aufzeichnungseinheiten bzw. Speichermedien Verwendung finden, die nur von autorisierten Personenkreisen, wie etwa der Exekutive, geöffnet bzw. ausgetauscht werden könnten.

Für bestimmte Fahrzeuggruppen, wie etwa Omnibusse, Taxis, Einsatzfahrzeuge und dergleichen, könnte natürlich auch vorgesehen sein, daß eine zusätzliche Videokamera, auf den

Fahrer bzw. den Innenraum des Fahrzeuges gerichtet, mit an die Aufzeichnungseinheit angeschlossen wird, womit Unfälle bzw. Ereignisse, die auf ein Fehlverhalten bzw. Ablenkung oder dergleichen des Fahrers zurückzuführen sind, unmittelbar als solche erkennbar wären.

In der DE-OS 32 43 786 ist bereits eine "permanente Verkehrs-Aufzeichnung" geoffenbart bei der Umgebungsbilder direkt auf einer nach dem elektrostatischen Prinzip arbeitenden Bildtrommel nach Art eines Fotokopiergerätes festgehalten werden sollen. Nach diesem Verfahren ist allerdings die tatsächlich an der Trommel benötigte Lichtintensität so groß, daß nur intensive zusätzliche Beleuchtung eines nahegelegenen Objektes bei gleichzeitig größtmöglicher Blendenöffnung des verwendeten Objektives (was die Schärfentiefe praktisch auf eine einzelne Ebene reduziert) eine derartige Abbildung ermöglicht. Darüber hinaus sind in der genannten Schrift stets nur einzelne Bilder - also praktisch "Standbilder"- der Umgebung angesprochen. Wie derartige einzelne Bilder einer sich naturgemäß üblicherweise bewegenden Umgebung überhaupt zu auf einer Trommel fixierbaren "Momentaufnahmen" gemacht werden können ist ebenfalls nicht ersichtlich.

Aber auch wenn über all dies hinweggesehen würde, besteht immer noch zur vorliegenden Erfindung der grundlegende Unterschied, daß gemäß der genannten Schrift einzelne Standbilder (vergleichbar mit einzelnen Fotos geschossen von einer automatischen Kamera) aufgenommen werden, wogegen gemäß der vorliegenden Erfindung mit der Videokamera tatsächlich Bewegungsabläufe registriert und kurzzeitig bzw. bedarfsweise auch bleibend festgehalten werden. Daß aus einem "Standfoto" nur in den seltensten Fällen relevante Aussagen über den Hergang von Kollisionen zwischen bewegten Fahrzeugen oder dergleichen und damit über die Verschuldensfrage oder ähnliches zu erhalten sind, versteht sich von selbst.

Die Videokamera kann in weiterer Ausgestaltung der Erfindung im Bereich der Windschutzscheibe innen im Kraftfahrzeug angebracht sein, wobei vorzugsweise auch Rückspiegel und/oder Bedienelemente und/oder Fahrzustandsanzeigen mit im aufgenommenen Bildfeld sind. Damit ist insbesonders im Zusammenhang mit einen größeren Innenraum aufweisenden

Kraftfahrzeugen, wie etwa Lastkraftwagen oder Autobussen, eine sehr einfache Art der vor Schmutz, Eis, Witterungseinflüssen oder dergleichen geschützten Anbringung der Videokamera gegeben, welche den zusätzlichen Vorteil aufweist, daß das Blickfeld im wesentlichen dem des Fahrers entspricht, der ja auch einen möglichst umfassenden Überblick über die Umgebung haben muß. Bei Miteinbeziehung von zumindest Teilen des Rückspiegelfeldes, der Bedienelemente, bzw. der Fahrzustandsanzeigen des eigenen Kraftfahrzeuges ist auf sehr einfache Weise die Mitaufnahme der in diesem Zusammenhang zur Verfügung stehenden zusätzlichen Daten bzw. Informationen sichergestellt - so kann z.B. durch Miteinbeziehung des Rückspiegels ins aufgenommene Bildfeld ohne weiteres nachgewiesen werden, ob ein zum Überholen ausscherendes Fahrzeug tatsächlich rechtzeitig vorher den entsprechenden Blinker gesetzt hat. Gleiches kann aber natürlich auch durch Anbringung einer zweiten, beispielsweise durch die hintere Heckscheibe nach außen gerichteten Videokamera erreicht werden, was gegenüber der normalerweise relativ kleinen Abbildung im Rückspiegel auf alle Fälle Vorteile bezüglich der erzielbaren Detailgenauigkeit bietet.

Insbesonders bei der Verwendung in Kraftfahrzeugen mit eher kleinem Fahrzeuginnenraum ist eine andere Weiterbildung der Erfindung von Vorteil, gemäß welcher die Videokamera an der in Bewegungsrichtung vorderen Front des Kraftfahrzeuges, vorzugsweise hinter einer durchsichtigen Abdeckung, wie etwa einer Scheinwerferabdeckung, angeordnet ist. Auf diese Weise steht ein ungehinderter und möglichst umfassender Blick in die für die meisten Unfälle wesentlichste Fahrtrichtung des Kraftfahrzeuges zur Verfügung - zusätzliche Informationen über den Status des den Unfalldatenschreiber tragenden Fahrzeuges können hier beispielsweise über die heutzutage bereits weitverbreiteten Bordcomputer des Kraftfahrzeuges und entsprechende Interface-Schaltungen der Videosignal-Aufzeichnungseinheit zugeführt und zeitgleich mitaufgezeichnet werden. Falls auch bei einer derartigen Anbringung der Videokamera das Feld hinter dem Kraftfahrzeug mitüberwacht werden soll, kann entweder eine geeignete Umlenkspiegelanordnung zur Einblendung eines Blickes nach hinten oder aber überhaupt eine zweite, beispielsweise aus dem Kofferraum nach hinten gerichtete Videokamera vorgesehen werden.

In weiterer Ausgestaltung der Erfindung ist vorgesehen, daß die, bzw. eine der, Videokamera(s) infrarotempfindlich ist, was beispielsweise bei Fahrten in der Nacht oder bei schlechter Sicht große Vorteile bietet und einfach zu realisieren ist. Damit können auch unbeleuchtete Objekte bzw. Passanten oder Tiere mitaufgezeichnet werden, deren Verhalten oft das Verkehrsgeschehen und insbesonders auch Unfälle auf bisher kaum feststellbare Weise beeinflußt.

Die weiteren, mit der Videosignal-Aufzeichnungseinheit verbundenen Sensoreinrichtungen können gemäß einer vorteilhaften Weiterbildung der Erfindung eine Mikrowellen-Radareinrichtung und/oder eine Ultraschall-Entfernungsmesseinrichtung umfassen. Damit können - insbesonders auch bei schlechter Sicht - wiederum relevante Umgebungsdaten, wie etwa bezüglch Entfernungen und Relativgeschwindigkeiten, mitaufgezeichneten werden, die die Auswertung der Aufzeichnungen erleichtern und verbessern.

Nach einer bevorzugten weiteren Ausgestaltung der Erfindung ist vorgesehen, daß die weiteren Sensoreinrichtungen eine Code-Empfangseinheit umfassen, welche auf die charakteristische Kennung von mit einem Code-Sender ausgerüsteten anderen Fahrzeug anspricht. Damit kann - ähnlich zu den zumeist vierstelligen Kennziffern, die über Radar erfaßten Flugzeuge im Überwachungsraum einer Kontroll- und Leitstelle zugeordnet werden, welche dann das jeweilige Flugzeug bis zum Verlassen des Überwachungsraumes automatisch kennzeichnen- jedes Fahrzeug, bzw. jedes zu erfassende Fahrzeug einer bestimmten Gruppe, einfach und sicher identifiziert werden, auch wenn z.b. schlechte Sichtverhältnisse vorliegen oder der schuldbewußte Lenker eines Unfallfahrzeuges sich nach erfolgter Blendung und damit allfälliger Ausschaltung der Aufzeichnungseinheit unerkannt vom Unfallsort entfernen möchte. Ebenfalls ausgeschaltet können damit die bekannten Probleme mit verschmutzten bzw. unlesbaren Kennzeichentafeln werden.

Die Aufzeichnungseinheit kann nach einer weiteren Ausgestaltung der Erfindung von einem Video-Bandrecorder gebildet sein, der vorzugsweise mit einem Endlosband einer Laufdauer im Zeitbereich von 1 bis 10 Minuten ausgerüstet ist. Derartige Bandrecorder sind heutzutage Stand der Technik und in qualitativ hochstehender, robuster und kleiner Form auch bereits sehr kostengünstig im Handel erhältlich. Durch die Ausrüstung mit einem Endlosband bzw. einer Endlosbandkassette mit der genannten Laufdauer ist sichergestellt, daß einerseits alle für die Beurteilung eines allfälligen Unfalles relevanten Außenumstände - betreffend das Wetter, den Straßenzustand und dergleichen - im Falle eines Unfalles auch tatsächlich aufgezeichnet sind und daß andererseits auf sehr einfache Weise eine ständig fortlaufende Überschreibung der kurzzeitig zwischengespeicherten Daten bzw. Signale erfolgen kann. Nach dem tatsächlichen Auftreten eines Unfalles bzw. nach der Feststellung eines solchen über zumindest eine der Sensoreinrichtungen - beispielsweise einem sogenannten Trägheitsschalter - kann das Endlosband bzw. die Kassette dem Bandrecorder entnommen und durch ein neues ausgetauscht werden, womit, soferne das Fahrzeug weiter verkehrstüchtig ist, die unterbrochene Fahrt ohne weiteres wieder fortgesetzt werden kann; das Endlosband bzw. die Kassette kann zur Beurteilung der Verschuldensfrage aufgehoben und jederzeit beliebig oft abgespielt werden. Wenn - wie eingangs bereits erwähnt - mehrere an einem Unfall beteiligte Fahrzeuge mit dem erfindungsgemäßen Unfalldatenschreiber ausgerüstet sind, kann zur Vorführung bzw. sachverständigen Begutachtung auch eine zeitrichtig zusammenmontierte Version aller Aufzeichnungen gemeinsam - etwa auf einem Großbildschirm - abgespielt werden, was insbesonders mit der bei Videoabspielgeräten heutzutage zur Standardausrüstung gehörenden Standbild- bzw. Einzelbildschaltung sehr einfach und rasch schlüssige Aussagen über Unfallhergang und Verschuldensfrage erlaubt.

Nach einer anderen Weiterbildung der Erfindung kann die Aufzeichnungseinheit aber auch von einer Magnetplatten-Station gebildet sein, welche in ihrer Kapazität vorzugsweise für eine ein- bis zehn-minütige Datenaufzeichnung ausgelegt ist und nach Ablauf eines derartigen Aufzeichnungszyklus den vorherigen, nicht durch einen Unfall unterbrochenen Zyklus überschreibt. Derartige Magnetplatten-Stationen sind heutzutage als sogenannte "Disk-Drives" im Zusammenhang mit Kleincomputern ausgereifter Stand der Technik, und sind zufolge ihrer einfachen Handhab- und Archivierbarkeit für die Zwecke der vorliegenden Erfindung bestens geeignet.

Die Aufzeichnungseinheit kann nach einer anderen vorteilhaften Ausgestaltung der Erfindung aber auch einen Festspeicher aufweisen, der in seiner Kapazität vorzugsweise für eine ein- bis zehn-minütige Datenaufzeichnung ausgelegt ist und nach Ablauf eines derartigen Aufzeichnungszyklus den vorherigen, nicht durch einen Unfall unterbrochenen Zyklus überschreibt. Ein derartiger Festspeicher enthält in vorteilhafter Weise keine mechanisch beweglichen Teile und ist damit für die Verwendung in einem Erschütterungen und Vibrationen ausgesetzten Fahrzeug bestens geeignet. Wenn mit billigeren bzw. kleineren Festspeichern das Auslangen gefunden werden soll, kann natürlich die Auflösung der Videokamera auf entsprechend weniger Bildpunkte gegenüber beispielsweise dem normalen Fernsehbild herabgesetzt werden - die Grenzen dafür sind nur durch die in der Praxis noch ermittelbaren relevanten Umgebungsbedingungen bzw. Daten gegeben.

Zusätzlich zu der eingangs angesprochenen Möglichkeit der Ermittlung von Geschwindigkeiten, Beschleunigungen oder Fahrstrecken aus der Zuhilfenahme extern bestimmter Entfernungen und der bekannten Bildfolgefrequenz, kann in weiterer Ausgestaltung der Erfindung die Videokamera mit einer Meßoptik mit ins Bildfeld eingeblendetem Raster zur Entfernungs- und/oder Geschwindigkeitsmessung versehen sein. Derartige Raster bzw. Strichmarken sind beispielsweise von Jagdferngläsern oder militärischen Fernrohren her bekannt und ermöglichen auf einfache Weise zumindest eine Grobabschätzung von Entfernungen. Die im bzw. am Fahrzeug angebrachte Videokamera kann dabei beispielsweise so eingestellt werden, daß eine bestimmte Linie des ins Bildfeld eingeblendeten Rasters auf die vor dem Fahrzeug in einer Entfernung von 10 Metern oder 20 Metern liegende Straßenoberfläche einjustiert wird. In diesem Zusammenhang dann bei der Auswertung wesentliche Änderungen der Höhenlage bzw. der Neigung des Fahrzeuges können z.B. durch entsprechende Sensoren in die Speicherung einbezogen und berücksichtigt werden.

Die Aufzeichnungseinheit kann nach einer bevorzugten weiteren Ausgestaltung der Erfindung an einem hinsichtlich möglicher Unfallauswirkungen geschützten Ort, vorzugsweise zentral und/oder mit einer zusätzlichen Abdeckung versehen, im Kraftfahrzeug angebracht sein. Damit kann optimaler Schutz für die Aufzeichnungseinrichtung mit einem optimalen Blickfeld für die Videokamera kombiniert werden - allenfalls erforderliche längere Signalverbindungen stellen in diesem Zusammenhang kein Problem dar.

Der Vollständigkeit halber sei hier auch darauf hingewiesen, daß zufolge der extremen Lichtempfindlichkeit einerseits und Einbrennsicherheit andererseits bei heutzutage im Handel erhältlichen Videokameras, beispielsweise auf der Basis von CCD-Chips (Charge Coopled Device), auch Nachtfahrten an sich keine großen Probleme für den erfindungsgemäßen Unfalldatenschreiber darstellen - allenfalls ist aber natürlich mit einer verschlechterten Erkennbarkeit unbeleuchteter Umgebungsdetails bei Blendung durch ein entgegenkommendes Fahrzeug zu rechnen - auf alle Fälle sind aber die auf das eigene Fahrzeug bezogenen Daten sowie die Entfernung, Geschwindigkeit und Beschleunigung von entgegenkommenden oder kreuzenden Fahrzeugen zufolge der Beleuchtung derselben aus der Aufzeichnung ermittelbar. In diesem Zusammenhang sehr hilfreiche weitere Sensoreneinrichtungen sind obenstehend angesprochen.

Beschreibung der Zeichnung einer Ausführung der Erfindung

Die Erfindung wird im folgenden noch anhand der schematischen Zeichnung näher erläutert.

Fig. 1 zeigt ein mit einem erfindungsgemäßen Unfalldatenschreiber ausgerüstetes Kraftfahrzeug in Draufsicht und

Fig. 2 zeigt ein Beispiel des Bildfeldes einer Videokamera mit Meßoptik zur Verwendung in einem Ausführungsbeispiel. wobei der Horizontalmaßstab zur Verdeutlichung der Darstellung übertrieben groß und nicht zum Vertikalmaßstab passend ist.

Das in Fig. 1 in schematisch gezeichneter Draufsicht dargestellte Kraftfahrzeug 1 ist mit einem Unfalldatenschreiber zur kurzzeitigen Aufnahme bzw. Speicherung von unfallbezogenen Daten bzw. Ereignissen ausgestattet, der im wesentlichen aus einer eine nicht näher dargestellte Videosignal-Aufzeichnungseinheit 2 aufweisenden Speichereinrichtung 3 sowie einer über eine Leitung 4 verbundenen Videokamera 5 und weiteren, ebenso wie die Videokamera 5 am Kraftfahrzeug 1 selbst angeordneten Sensoreinrichtungen, die hier nur symbolisch angedeutet und mit 6 bezeichnet sind, besteht. Über die Sensoreinrichtungen 6, die beispielsweise auch unmittelbar mit dem nicht dargestellten Bord- bzw. Diagnosecomputer des Kraftfahrzeuges 1 verbunden sein können, sowie über die Videokamera 5, können im Zusammenhang mit der Auswertung eines Unfalles interessierende Daten bzw. Ereignisse erfaßt und in elektrische Signale umgewandelt werden, die in der Speichereinrichtung 3 bzw. in der Videosignal-Aufzeichnungseinheit 2 in zeitlich bestimmtem Zusammenhang entweder kurzzeitig zwischengespeichert oder aber nach Auftreten eines zumindest über eine der Sensoreinrichtungen festgestellten Unfalles unlöschbar gespeichert werden.

Die Videokamera 5 ist in dem in Fig. 1 dargestellten Ausführungsbeispiel an der in Bewegungsrichtung vorderen Front des Kraftfahrzeuges 1 hinter einer durchsichtigen Scheinwerferabdeckung 7 angebracht - der aufzeichenbare Bildwinkel ist mit 8 bezeichnet. Als Alternative dazu ist in Fig. 1 auch die Anordnung der Videokamera 5 (bzw. einer weiteren Videokamera 5) im Bereich der Windschutzscheibe 9 innen im Kraftfahrzeug 1 dargestellt, wobei auch der Rückspiegel 10 mit in dem hier größeren Bildfeld - Blickwinkel 11 - ist. Bei dieser Art der Anbringung der Videokamera 5 können auch hier nicht dargestellte Bedienelemente des Kraftfahrzeuges 1, wie etwa der Schalthebel, der Handbremshebel oder der Blinkerschalter mit im aufgenommenen Bildfeld sein; gleiches gilt auch beispielsweise für den Tachometer 12 oder Fahrzustandsanzeigen bzw. Anzeigelampen 13. Im dargestellten Falle ist für die alternative Anordnung der Videokamera 5 im Inneren des Kraftfahrzeuges 1 über den Rückspiegel 10 ein Blickwinkel für die Videokamera 5 nach hinten durch die Heckscheibe 14 des Kraftfahrzeuges 1 gegeben, der mit 15 bezeichnet ist. Möglich wäre in diesem Zusammenhang natürlich auch die Anordnung einer zweiten, hier nicht dargestellten, nach hinten gerichteten Videokamera 5, die einerseits eine bessere Detailauflösung und andererseits - bei Anordnung beispielsweise unmittelbar an der Heckscheibe - einen ungestörten Ausblick auch bei beladenem oder vollbesetztem Fahrzeuginnenraum sicherstellt.

Die Aufzeichnungseinheit 2 kann von einem Video-Bandrecorder, einer Magnetplatten-Station, oder von einem Festspeicher gebildet sein, wobei in allen Fällen eine Aufnahmedauer von etwa einer bis etwa zehn Minuten vorgesehen wird- kürzere oder längere Aufnahmedauer kann aber bedarfsweise natürlich ebenso verwendet werden - nach Ablauf dieser Dauer wird die Aufzeichnung vom Beginn her stetig überschrieben.

Sobald über die Sensoreinrichtungen 6 - beispielsweise über einen geeigneten Trägheitsschalter oder dergleichen- eine einen Unfall anzeigende Beschleunigung bzw. Verzögerung registriert wird, wird das stetige Überschreiben der Aufzeichnung in der Aufzeichnungseinheit 2 eingestellt, womit die unfallrelevanten Daten bzw. Ereignisse gespeichert bleiben. Falls gewünscht, kann in diesem Zusammenhang natürlich auch vorgesehen werden, daß nach der Anzeige eines Unfallereignisses über die Sensoreinrichtungen 6 noch eine kurze Zeit (beispielsweise 15 bis 30 Sekunden) weiter aktuelle Daten aufgezeichnet werden, damit Unfallfolgen bzw. Auswirkungen oder dergleichen ebenfalls noch zur Auswertung des Geschehens zur Verfügung stehen.

Als Alternative dazu, wäre auch möglich, in der Aufzeichnungseinheit 2 beispielsweise zwei separate Laufwerke für zwei Videokassetten oder allgemein zwei getrennte Speichereinrichtungen vorzusehen, wobei die eine davon beim Auftreten eines Unfalles stoppt - womit die gesamte Information eines Aufzeichnungszyklus vor dem Auftreten des Unfalles zur Verfügung steht - und die zweite zum gleichen Zeitpunkt zu laufen beginnt und damit das Geschehen nach dem Unfall festhält.

Über die Sensoreinrichtungen 6 können auch zusätzliche Daten über Umgebungsbedingungen, wie etwa Fahrbahnnässe, Außentemperatur, Glatteis oder dergleichen, der Aufzeichnungseinheit 2 zugeführt werden, womit sich der Hergang eines Unfalles ziemlich lückenlos belegen läßt.

Aus dem schematischen Bild in Fig. 2 ist ein Beispiel für ein aufgezeichnetes Einzelbild der Videokamera 5 gemäß Fig. 1 bzw. der Aufzeichnungseinheit 2 zu sehen. Im eigentlichen Bildfeld 16 ist eine Straße 17, auf der das die Videokamera mitführende Fahrzeug fährt, sowie eine Querstraße 18 mit einem von rechts kommenden Fahrzeug 19 zu sehen - sonstige Details der Umgebung sind der Einfachheit der Darstellung wegen weggelassen. Weiters ist ein ins Bildfeld eingeblendetes Raster 20 zu ersehen, welches mit einzelnen Strichmarken versehen ist, die hier jeweils 1 Meter auf der Fahrbahnoberfläche entsprechen. Die horizontale Linie ist hier in einer Entfernung von 10 Metern eingezeichnet; es könnten natürlich mehrere vertikale und Punkte gleicher vertikaler Entfernung verbindende quasi horizontale Linien in das Bildfeld eingeblendet werden, wobei sich dann eine Art Gitterraster mit nach oben hin ebenso wie die eingezeichnete Straße 17 konvergierenden Linien ergibt. Die tatsächliche Übereinstimmung der vertikal aufgetragenen Entfernungsskala mit den realen Gegebenheiten bedingt natürlich eine Einstellung der im bzw. am Kraftfahrzeug angebrachten Videokamera, die aber nur einmal in Form einer Justierung vorgenommen zu werden braucht. Änderungen in der relativen Lage des Fahrzeuges und damit der Videokamera zur Fahrbahnoberfläche, die sich natürlich auf die tatsächliche Entfernung bzw. die Zusammenhänge des ins Bildfeld eingeblendeten Rasters zur tatsächlichen Entfernung auswirken, können über Niveaumesser bzw. Neigungsmesser berücksichtigt werden, die entweder zur unmittelbaren Verstellung der Videokamera oder aber zur Beeinflussung der Einblendung des Rasters ins Bildfeld verwendet werden können. Ob dieses Raster 20 gemäß Fig. 2 elektronisch ins aufgezeichnete Bildfeld eingeblendet wird oder aber in einer Meßoptik für die Videokamera angeordnet ist, ist an sich belanglos.

Nochmals sei an dieser Stelle darauf hingewiesen, daß der horizontale Maßstab in Fig. 2 nicht mit dem vertikalen übereinstimmt.

Die Aufzeichnungseinheit 2 ist gemäß Fig. 1 an einem hinsichtlich möglicher Unfallauswirkungen geschützten Ort, vorzugsweise zentral am Boden des Kraftfahrzeuges 1 und/oder mit einer zusätzlichen Abdeckung versehen, angebracht, womit ähnlich wie bei einem Flugschreiber in Verkehrsflugzeugen auch nach größeren Unfällen keine Information über den Unfallhergang verloren geht.

Zusätzlich zu der in Fig. 1 vorne am Kraftfahrzeug 1 angebrachten Videokamera 5 könnte natürlich eine weitere derartige Kamera auch an der Rückseite des Fahrzeuges vorgesehen werden, um bei Auffahrunfällen, Überholunfällen oder dergleichen ebenfalls die erforderlichen Informationen möglichst lückenlos zur Verfügung zu haben.

In dem in Fig. 2 unterhalb des eigentlichen Bildfeldes 16 verbleibenden Streifen können beispielsweise verschiedene, auf das den Unfalldatenschreiber führende eigene Fahrzeug bezogene Daten eingeblendet sein - z.B. Fahrgeschwindigkeit, Status der Bremsen, Lichter, Blinker und dergleichen; auch könnte hier z.B. die Information vom Niveau- und Neigungsmesser einfach angezeigt und bei der Auwertung berücksichtigt werden.

Im Zusammenhang mit der Verwendung eines Video-Bandrecorders als Aufzeichnungseinheit können verschiedene zusätzliche Informationen - wie etwa Signale von weiteren Sensoreinrichtungen oder auch über Innen- und/oder Außenmikrophone aufgenommene Geräusche - beispielsweise auch einfach auf der bei derartigen Geräten üblicherweise am Bandrand vorgesehenen Tonspur aufgezeichnet werden.

Patentansprüche:

1. Unfalldatenschreiber zur kurzzeitigen Aufnahme bzw. Speicherung von unfallbezogenen Daten bzw. Ereignissen bei Kraftfahrzeugen, mit zumindest einer am Fahrzeug angeordneten Sensoreinrichtung zur Erfassung von interessierenden Daten bzw. Ereignissen und Umwandlung derselben in elektrische Signale, sowie mit einer Speichereinrichtung, welche mit allen Sensoreinrichtungen zur Signalübertragung verbunden ist und zur zeitlich bestimmten kurzzeitigen Zwischenspeicherung, bzw. - nach Auftreten eines über zumindest eine der Sensoreinrichtungen festgestellten Unfalles - unlöschbaren Speicherung, der Signale dient, dadurch gekennzeichnet, daß zumindest eine der Sensoreinrichtungen (6) eine optische Erfassungseinheit samt in der Speichereinrichtung (3) zugehöriger Bildaufzeichnungseinheit aufweist, daß die optische Erfassungseinheit von einer Videokamera (5) und die Bildaufzeichnungseinheit von einer Videosignal-Aufzeichnungseinheit (2) gebildet ist, und daß der Videosignal-Aufzeichnungseinheit (2) auch die Signale von allfälligen weiteren Sensoreinrichtungen (6), die gegebenenfalls zusätzliche Auskunft über Umgebungsbedingungen und dergleichen geben, zugeführt sind.
2. Unfalldatenschreiber nach Anspruch 1, dadurch gekennzeichnet, daß die Videokamera (5) im Bereich der Windschutzscheibe (9) innen im Kraftfahrzeug (1) angebracht ist, wobei vorzugsweise auch Rückspiegel (10) und/oder Bedienelemente und/oder Fahrzustandsanzeigen (13) mit im aufgenommenen Bildfeld sind.
3. Unfalldatenschreiber nach Anspruch 1, dadurch gekennzeichnet, die Videokamera (5) an der in Bewegungsrichtung vorderen Front des Kraftfahrzeuges (1), vorzugsweise hinter einer durchsichtigen Abdeckung, wie etwa einer Scheinwerferabdeckung (7), angeordnet ist.
4. Unfalldatenschreiber nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Videokamera (5) infrarotempfindlich ist.

5. Unfalldatenschreiber nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die weiteren Sensoreinrichtungen (6) eine Mikrowellen-Radareinrichtung umfassen.
6. Unfalldatenschreiber nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die weiteren Sensoreinrichtungen (6) eine Ultraschall-Entfernungsmesseinrichtung umfassen.
7. Unfalldatenschreiber nach Anspruch 1 bis 5, dadurch gekennzeichnet, daß die weiteren Sensoreinrichtungen (6) eine Code-Empfangseinheit umfassen, welche auf die charakteristische Kennung von mit einem Code-Sender ausgerüsteten anderen Fahrzeugen anspricht.
8. Unfalldatenschreiber nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß die Aufzeichnungseinheit (2) von einem Video-Bandrecorder gebildet ist, der vorzugsweise mit einem Endlosband einer Laufdauer im Zeitbereich von 1 bis 10 min ausgerüstet ist.
9. Unfalldatenschreiber nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß die Aufzeichnungseinheit (2) von einer Magnetplatten-Station gebildet ist, welche in ihrer Kapazität vorzugsweise für eine 1- bis 10-minütige Datenaufzeichnung ausgelegt ist und nach Ablauf eines derartigen Aufzeichnungszyklus den vorherigen, nicht durch einen Unfall unterbrochenen Zyklus überschreibt.
10. Unfalldatenschreiber nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß die Aufzeichnungseinheit (2) einen Festspeicher aufweist, der in seiner Kapazität vorzugsweise für eine 1- bis 10-minütige Datenaufzeichnung ausgelegt ist und nach Ablauf eines derartigen Aufzeichnungszyklus den vorherigen, nicht durch einen Unfall unterbrochenen Zyklus überschreibt.
11. Unfalldatenschreiber nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß die Videokamera (5) mit einer Meßoptik mit ins Bildfeld (16) eingeblendetem Raster (20) zur Entfernungs- und/oder Geschwindigkeitsmessung versehen ist.
12. Unfalldatenschreiber nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß die Aufzeichnungseinheit (2) an einem hinsichtlich möglicher Unfallauswirkungen

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

Fig. 1

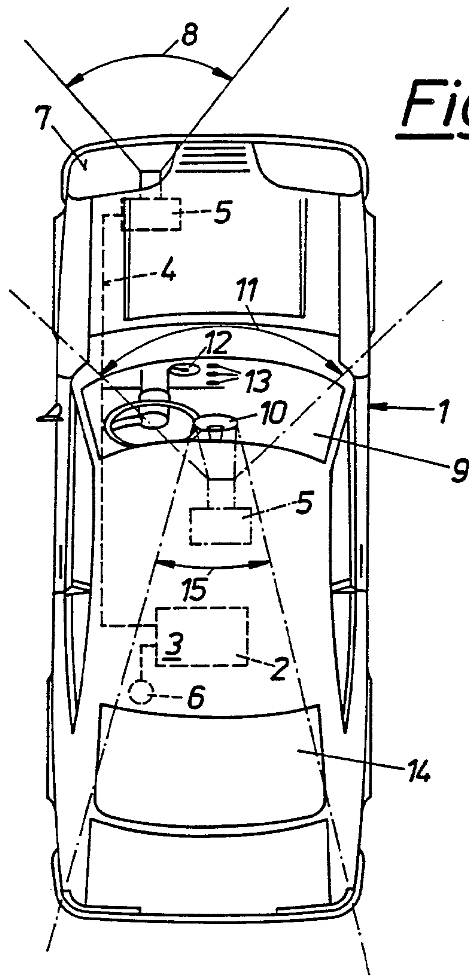
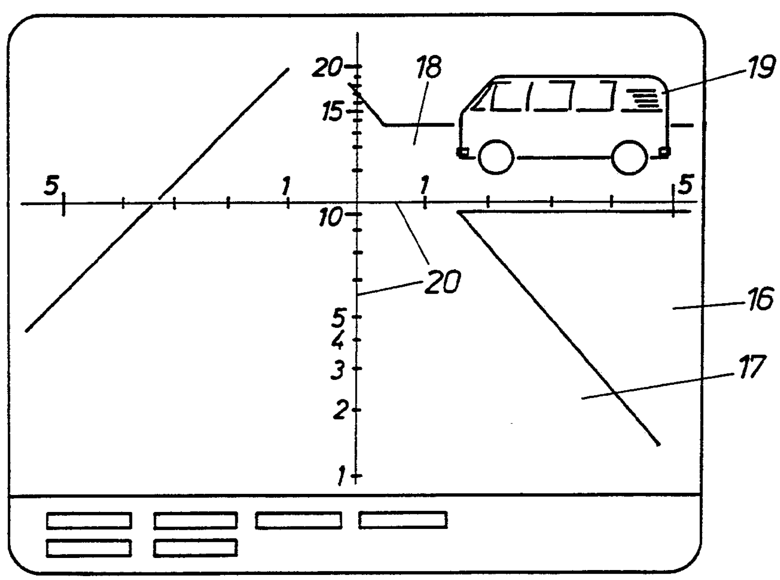


Fig. 2



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]

"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
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

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]:

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

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"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist

"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

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
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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	

EPO FORM P0473

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

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 >>

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GB2046914 (A)
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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

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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

(71) Anmelder *(für alle Bestimmungsstaaten ausser US):* MANNESMANN KIENZLE GMBH [DE/DE]; Heinrich-Hertz-Str. 45, D-7730 Villingen-Schwenningen (DE).

(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US)* : GRULER, Martin [DE/DE]; Brühlweg 3, D-7209 Aixheim (DE). BACIC, Helmut [DE/DE]; Burgstr. 18, D-7744 Königsfeld (DE). SCHULTZE, Hartmut [DE/DE]; Oskar-Joos-Str. 1, D-7730 Villingen-Schwenningen (DE).

(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).

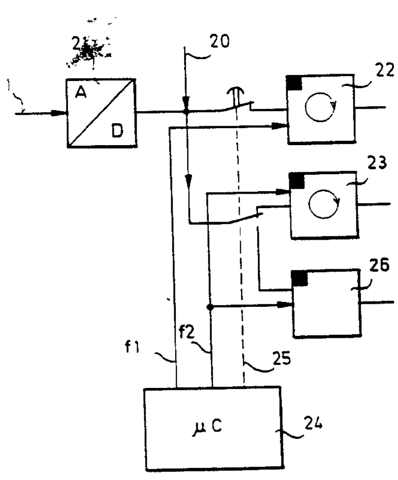
Veröffentlicht
Mit internationalem Recherchenbericht.

(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.

AT	Österreich	FR	Frankreich	MR	Mauritanien
AU	Australien	GA	Gabon	MW	Malawi
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FI	Finnland				

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

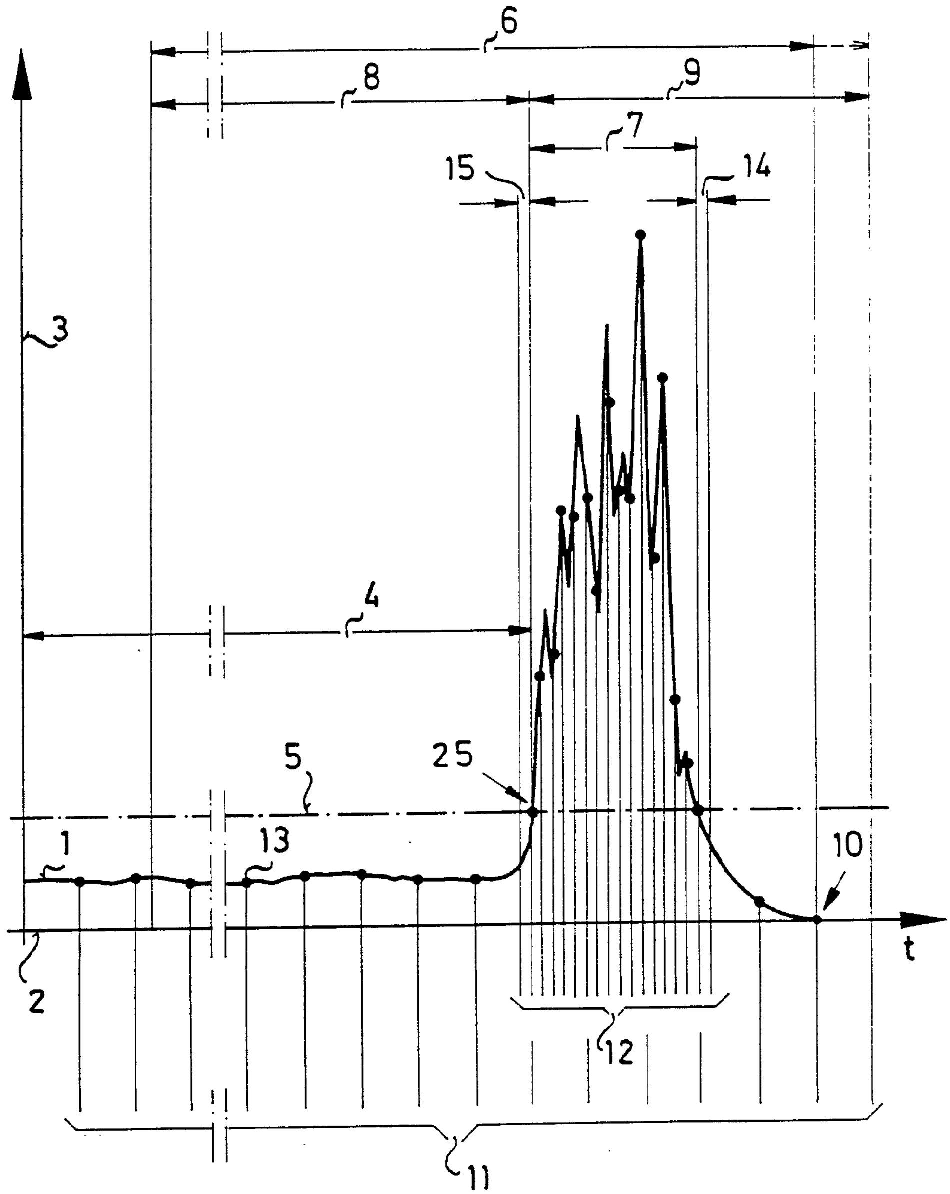
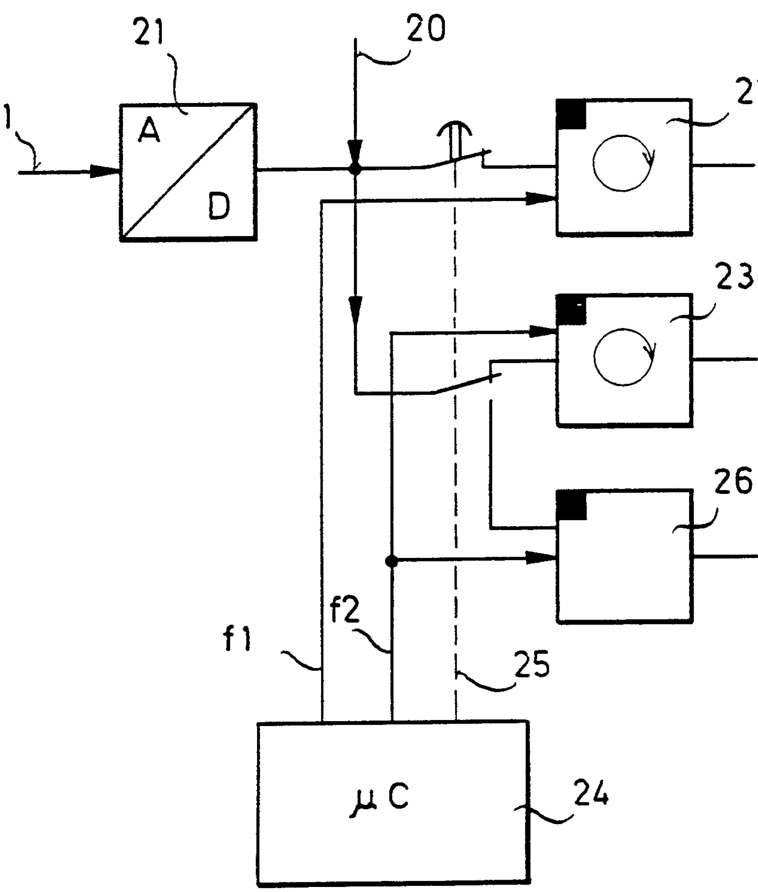


FIG. 2



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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"&" document member of the same patent family

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.

Form PCT/ISA/210 (second sheet) (July 1992)

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	

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.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		BE-A- 882548	16-07-80
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		FR-A,B 2454142	07-11-80
WO-A-8805196	14-07-88	AU-B- 613891	15-08-91
		AU-A- 1084588	27-07-88
		CA-A- 1301292	19-05-92
		EP-A- 0352260	31-01-90
		US-A- 4987541	22-01-91
GB-A-2055469	04-03-81	DE-A- 2929396	22-01-81
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		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	

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/EP 92/02529

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

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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
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

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
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WO-A-8805196	14-07-88	AU-B- 613891	15-08-91
		AU-A- 1084588	27-07-88
		CA-A- 1301292	19-05-92
		EP-A- 0352260	31-01-90
		US-A- 4987541	22-01-91
GB-A-2055469	04-03-81	DE-A- 2929396	22-01-81
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		WO-A- 8403359	30-08-84
		JP-T- 60500637	02-05-85
		US-A- 4638289	20-01-87
EP-A-0087398	31-08-83	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 5 : **G06F 13/00, 15/20**	**A1**	**(11) International Publication Number:** **WO 94/04975** **(43) International Publication Date:** 3 March 1994 (03.03.94)

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(71) Applicant: VORAD SAFETY SYSTEMS, INC. [US/US]; 10802 Willow Court, San Diego, CA 92127 (US).

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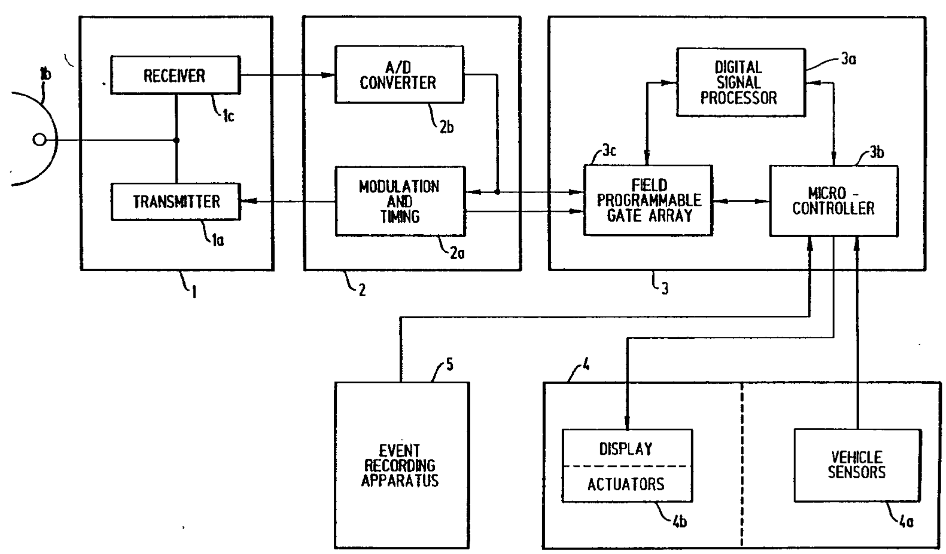
(74) Agents: LAND, John et al.; Spensley Horn Jubas & Lubitz, 1880 Century Park East, Suite 500, Los Angeles, CA 90067 (US).

(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 $\overline{\text{RST}}$ signal, the transition of the $\overline{\text{RST}}$ 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 $\overline{\text{RST}}$ 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.

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, 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.

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 operation 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, 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.

4. The event recording apparatus of claim 1, 2, or 3, 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.

5. The event recording apparatus of claim 1, 2 or 3, wherein the controller means further includes means for controlling functions of the automotive vehicle in response to data values read form the data storage card.

6. The event recording apparatus of claim 1, 2 or 3, 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.

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

8. 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.

9. 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.

10. The event recording apparatus of claim 9, 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; braking pressure; acceleration or deceleration in one or more dimensions; rate of turning; steering angle; cruise control status; brake temperature; brake line hydraulic pressure; average speed; miles-per-gallon; 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.

11. 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.

12. The event recording apparatus of claim 11, 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.

13. 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.

14. 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.

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

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

17. 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.

18. 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 parame-

ter 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; and

(f) reading a computer program from the data storage card.

19. The method for recording events of claim 18, 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) ding into a computer data stored in the data storage card.

20. The method for recording events of claim 18, wherein the data stored in the data storage card relates to events internal to the vehicle.

21. The method for recording events of claim 18, 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; braking pressure; acceleration or deceleration in one or more dimensions; rate of turning; steering angle; cruise control status; brake temperature; brake line hydraulic pressure; 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.

22. The method for recording events of claim 18, wherein the data stored in the data storage card relates to events external to the vehicle.

23. The method for recording events of claim 22, 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.

24. The method for recording events of claim 18, 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.

25. The method for recording events of claim 18, wherein data storage is commenced upon the occurrence of a selected event.

26. The method for recording events of claim 18, wherein data storage is terminated upon the occurrence of a selected event.

27. The method for recording events of claim 18, wherein the non-volatile memory means includes multiple logical data pages for storing independent sets of data.

28. 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, the controller means including means for reading data from the data storage unit;

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

29. The event recording apparatus of claim 1, 2, or 3, further including a system non-volatile memory means for storing data read from the data storage card.

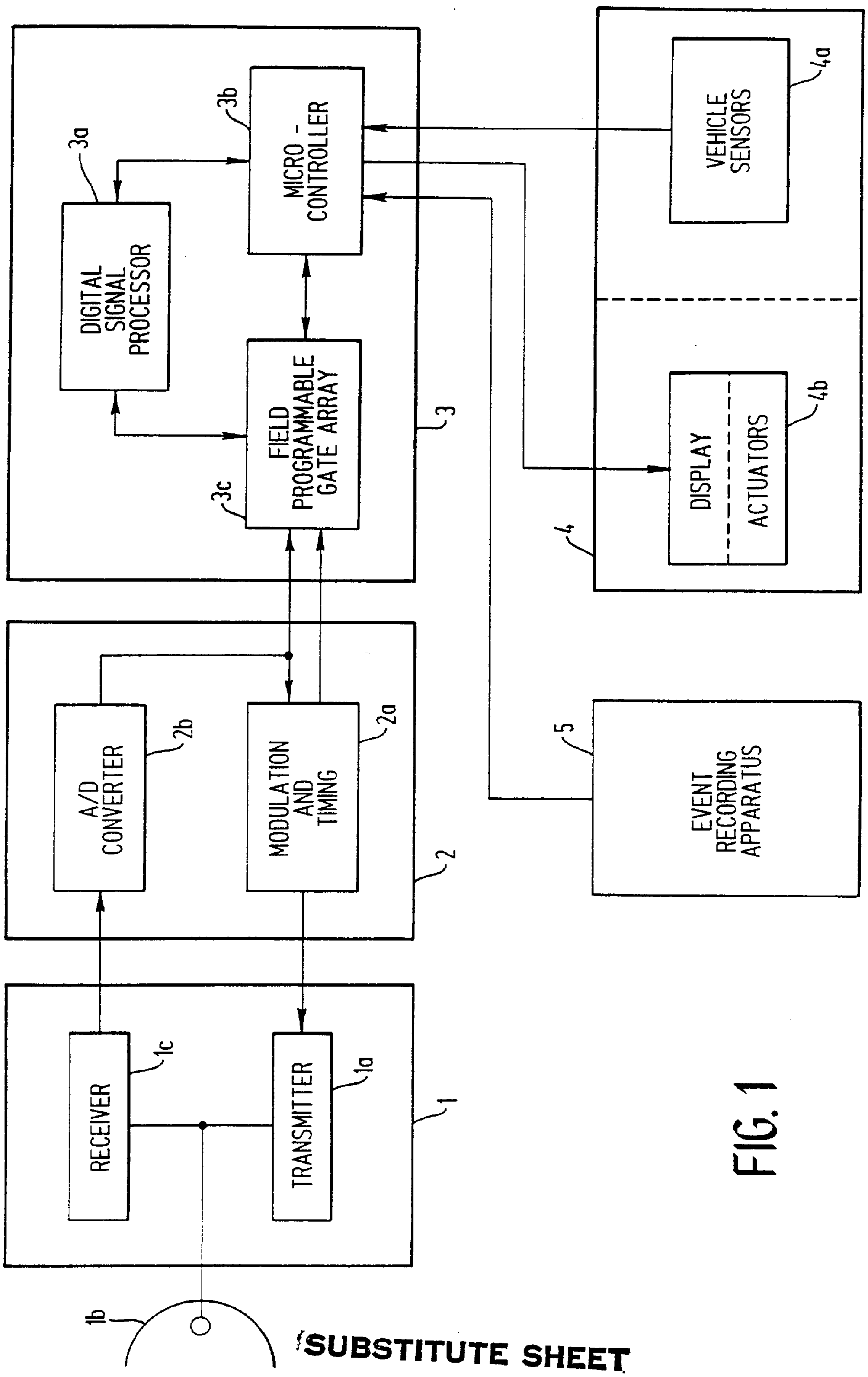

FIG. 1

SUBSTITUTE SHEET

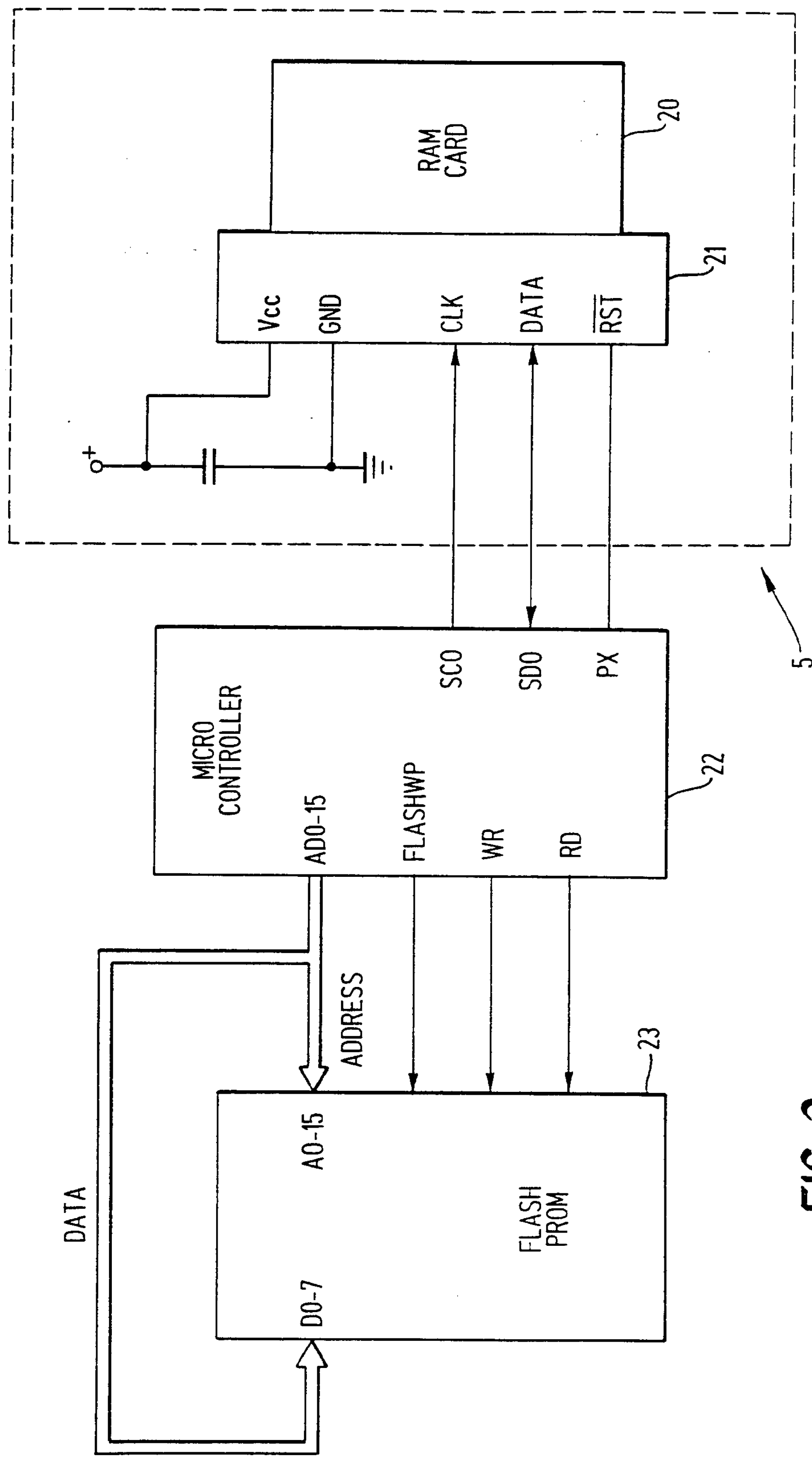
RAM
CARD
20
21
Vcc
GND
CLK
DATA
RST
MICRO
CONTROLLER
SCO
SDO
PX
22
AD0-15
FLASHWP
WR
RD
ADDRESS
23
A0-15
FLASH
PROM
D0-7
DATA
5

FIG. 2

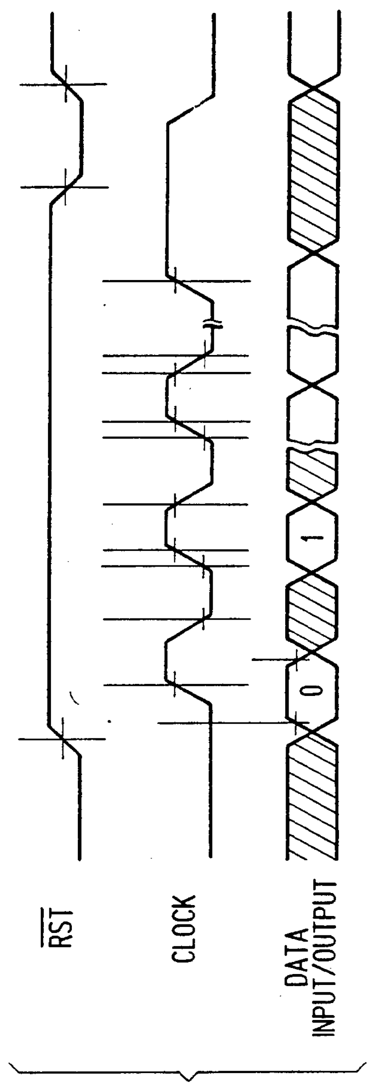

FIG. 3

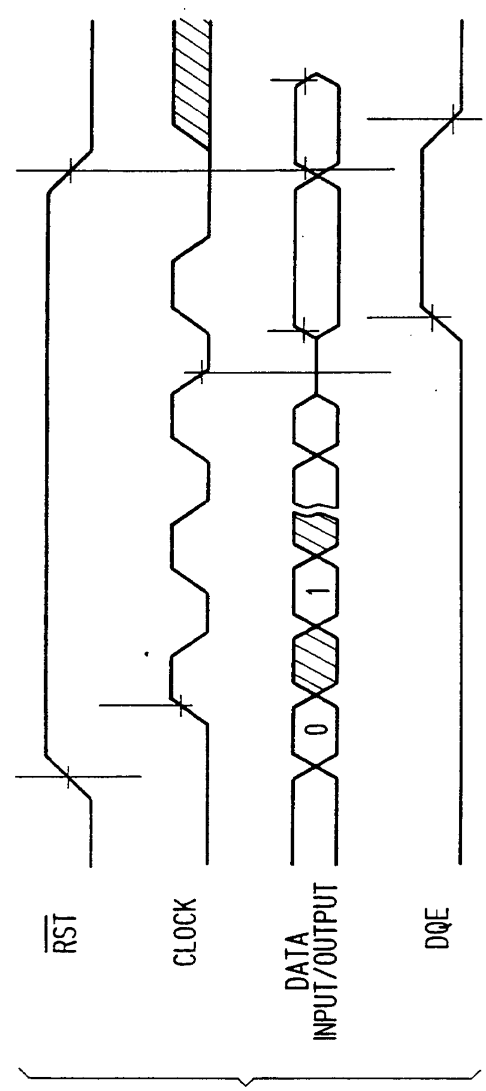

FIG. 4

SUBSTITUTE SHEET

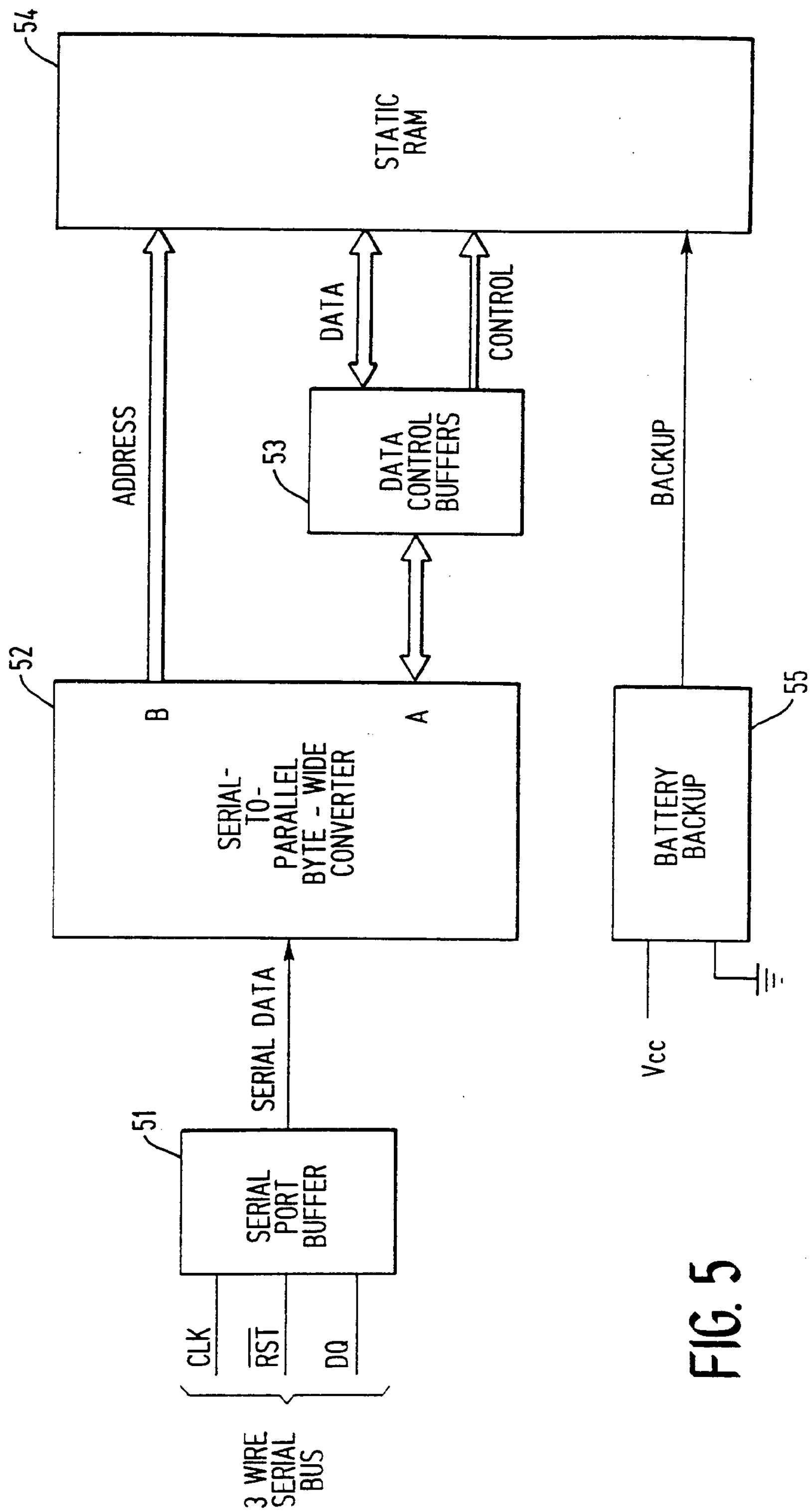

FIG. 5

SUBSTITUTE SHEET

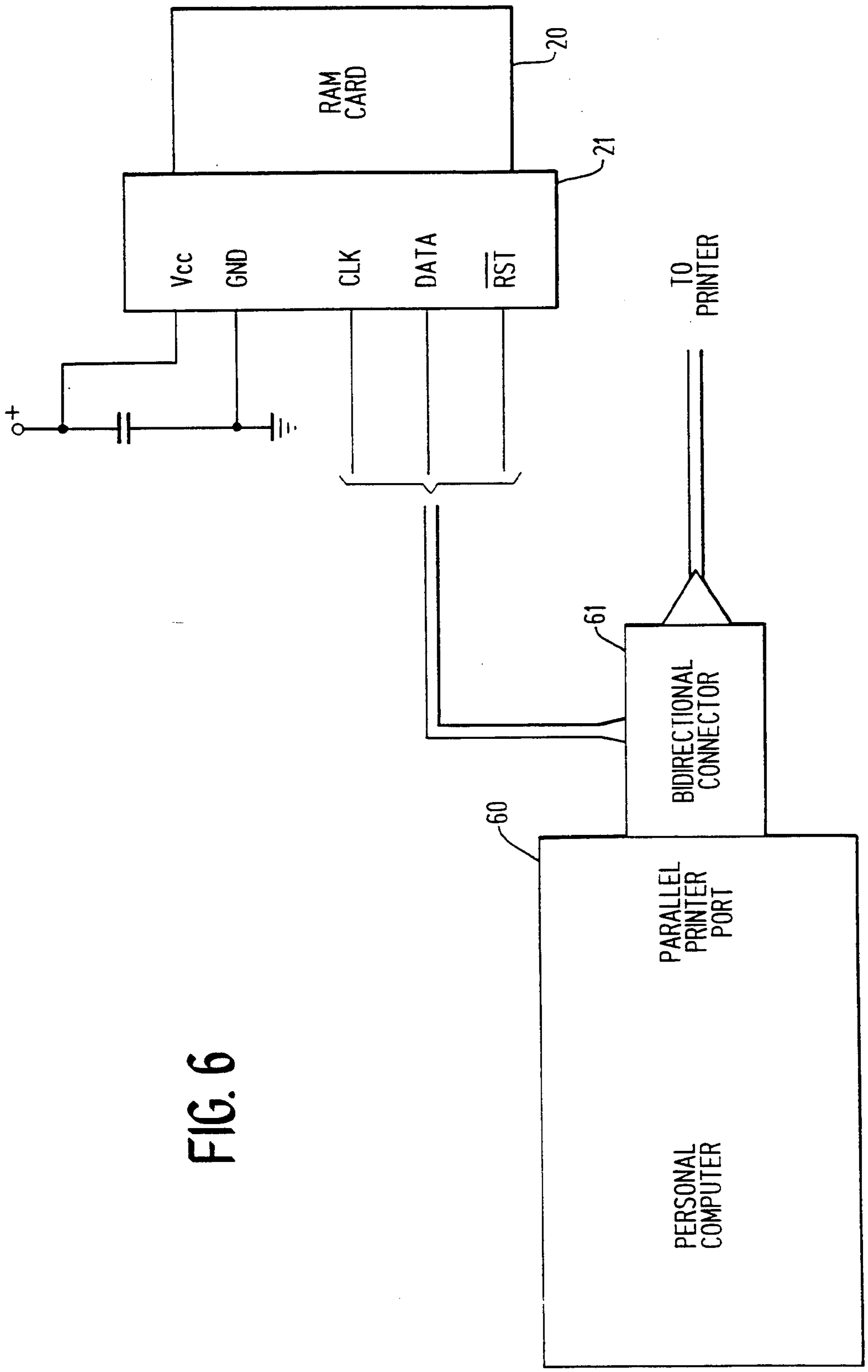
RAM CARD
20
21
Vcc
GND
CLK
DATA
$\overline{RST}$
TO PRINTER
61
BIDIRECTIONAL CONNECTOR
60
PARALLEL PRINTER PORT
PERSONAL COMPUTER

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/07500

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :G06F 13/00, 15/20
US CL :364/424.04; 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, 424.05, 426.04, 550, 551.01; 340/435, 436, 438, 441, 459, 825.31; 180/287

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 --- Y	US, A, 4,853,859 (Morita et al) 01 August 1989, Figures 2(a), 3(a), and 4; column 6, lines 44+; column 7, lines 21+.	1-5, 7-10, 12-34 ------------ 6, 11
Y	US, A, 4,926,331 (Windle et al) 15 May 1990, Figures 9,11 and 32; columns 2-3 and 10-13.	1-34
Y	US, A, 4,805,722 (Keating et al) 21 February 1989, Figures 1-3.	7-8
Y	US, A, 5,014,200 (Chundrlik et al) 07 May 1991, Figures 1-4.	15-16, 26-27, 34
A	US, A, 3,461,429 (Gray) 12 August 1969, see entire document.	1-34

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:

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

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

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

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Date of the actual completion of the international search 30 September 1993	Date of mailing of the international search report 12 NOV 1993
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer Collin W. Park Telephone No. (703) 305-9754

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/07500

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,067,061 (Juhasz) 03 January 1978, see entire document.	1-34
A	US, A, 4,072,850 (McGlynn), 07 February 1978, see entire document.	1-34
A	US, A, 4,258,421 (Juhasz et al) 24 March 1981, see entire document.	1-34
A	US, A, 4,271,402 (Kastura et al) 02 June 1981, see entire document.	1-34
A	US, A, 5,050,080 (Abe) 17 September 1991, see entire document.	1-34

Form PCT/ISA/210 (continuation of second sheet)(July 1992)★

ACCIDENT DATA MEMORY

Patent number:	WO9418645 (A1)
Publication date:	1994-08-18
Inventor(s):	GRULER MARTIN; BACIC HELMUT; SALOMONSSON OVE +
Applicant(s):	MANNESMANN KIENZLE GMBH [DE] +
Classification:	
- international:	***B62D41/00; G01P1/12; G07C5/00; G07C5/08;*** **B62D41/00; G01P1/00; G07C5/00;** (IPC1-7): G01P1/12; G07C5/08
- european:	G01P1/12C; G07C5/08R2
Application number:	WO1994EP00152 19940121
Priority number(s):	DE19934303470 19930206

Also published as:

- DE4303470 (C1)
- JP7502360 (T)
- IL108534 (A)
- HU73910 (A2)
- EP0635153 (A1)

more >>

Cited documents:

- WO9117447 (A1)
- EP0118818 (B1)
- FR2615624 (A1)
- DE3643203 (A1)
- DE4136968 (A)

Abstract of **WO 9418645 (A1)**

In order to record accidents caused to parked vehicles, for example by other cars, the invention provides that an accident data memory installed in the parked vehicle is extended by means which, preferably after a certain time-lag after switching off the engine, maintain the accident data memory of the vehicle operative for a limited time with a sensitivity which is greater than that prevailing when the vehicle engine is switched on, in constant readiness for the detection and recording of an accident situation.

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INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

(51) Internationale Patentklassifikation 5 : G07C 5/08, G01P 1/12	A1	(11) Internationale Veröffentlichungsnummer: **WO 94/18645** (43) Internationales Veröffentlichungsdatum: 18. August 1994 (18.08.94)

(21) Internationales Aktenzeichen: PCT/EP94/00152

(22) Internationales Anmeldedatum: 21. Januar 1994 (21.01.94)

(30) Prioritätsdaten:
P 43 03 470.5 6. Februar 1993 (06.02.93) DE

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(81) Bestimmungsstaaten: CZ, HU, JP, PL, europäisches Patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Veröffentlicht
Mit internationalem Recherchenbericht.

(54) Title: ACCIDENT DATA MEMORY

(54) Bezeichnung: UNFALLDATENSPEICHER

(57) Abstract

In order to record accidents caused to parked vehicles, for example by other cars, the invention provides that an accident data memory installed in the parked vehicle is extended by means which, preferably after a certain time-lag after switching off the engine, maintain the accident data memory of the vehicle operative for a limited time with a sensitivity which is greater than that prevailing when the vehicle engine is switched on, in constant readiness for the detection and recording of an accident situation.

(57) Zusammenfassung

Zur Registrierung von Unfallereignissen an geparkten Fahrzeugen z.B. durch Fremdfahrzeuge wird vorgeschlagen, einen in dem geparkten Fahrzeug installierten Unfalldatenspeicher mit Mitteln zu erweitern, die den Unfalldatenspeicher vorzugsweise zeitverzögert nach dem Ausschalten des Antriebsaggregats des Fahrzeugs für eine begrenzte Zeit mit einer gegenüber dem Zustand des eingeschalteten Antriebsaggregats erhöhten Empfindlichkeit in einer fortdauernden Bereitschaft für die Detektion und Registrierung einer Unfallsituation aktiv erhalten.

LEDIGLICH ZUR INFORMATION

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

AT	Österreich	GA	Gabon	MR	Mauretanien
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FR	Frankreich	MN	Mongolei	VN	Vietnam

Unfalldatenspeicher

Die Erfindung betrifft einen Unfalldatenspeicher gemäß dem Oberbegriff des Anspruchs 1. Unfalldatenspeicher sind in ihrem Aufbau als solche bekannt.

Der Zweck eines Unfalldatenspeichers besteht in der Erfassung und Registrierung von Daten, die für die objektive Klärung der Schuldfrage nach einem Unfallereignis sachdienlich sind. Es ist Stand der Technik, die Bewegungsdaten sowie die Zustandsdaten einiger Fahrzeugaggregate während des Fahrbetriebs des mit einem Unfalldatenspeicher ausgerüsteten Fahrzeugs zu registrieren. Im Unfalldatenspeicher gemäß der EP 0 118 818 B1 endet die Datenaufzeichnung mit dem Fahrzeugstillstand.

Die Detektion eines Unfallereignisses erfolgt üblicherweise zumindest durch eine Auswertung der vom Unfalldatenspeicher erfaßten Beschleunigungssignale. Da Straßenunebenheiten, die normale Fahrdynamik oder das Zuschlagen einer Fahrzeugtür nicht zur Auslösung der speziell für eine Unfallsituation vorgesehenen Speicherverfahren führen dürfen, weisen die bekannten Unfalldatenspeicher Auslösekriterien auf, die die Registrierung von kleineren "Rempeleien" nicht gestatten. Wird ein parkendes Fahrzeug zB bei dem Rangiermanöver eines Fremdfahrzeugs angefahren, kann ein derartiger Unfall von den bisher bekannten Unfalldatenspeichern nicht registriert werden.

Die Aufgabe der vorliegenden Erfindung ist es, diesen Nachteil zu beseitigen. Sie wird durch die kennzeichnenden Merkmale des ersten Anspruchs gelöst. Die weiteren Ansprüche zeigen vorteilhafte Weiterbildungen.

Erfindungsgemäß wird vorgeschlagen, zusätzlich zu den während des Fahrbetriebs erforderlichen höheren Ansprechschwellen für die Auslösung der speziell zur unlöschbaren Registrierung einer Unfallsituation vorgesehenen Speicherverfahren Mittel vorzusehen, die die Betriebsbereitschaft des Unfalldatenspeichers nach dem Ausschalten des Antriebsaggregats des Fahrzeugs für eine begrenzte Zeit mit einer erhöhten Empfindlichkeit für die Detektion und Registrierung von Unfallereignissen fortzusetzen.

Die Erhöhung der Empfindlichkeit kann dadurch erfolgen, daß der zur Auslösung der Unfallregistrierung festgesetzte Schwellwert der Amplitude der Beschleunigungssignale um etwa 90 % herabgesetzt wird bei gleichzeitiger Verlängerung des Betrachtungszeitraums der zur Auslösung führenden Einwirkungsdauer des Beschleunigungssignals. Dadurch, daß der Unfalldatenspeicher mit Mitteln zur Durchführung dieser Maßnahme erweitert wird, werden am geparkten Fahrzeug auch leichte Stöße detektierbar.

Um Fehlauslösungen zu vermeiden, ist eine Umschaltung des Unfalldatenspeichers auf diese erhöhte Empfindlichkeit nur bei stillstehendem Fahrzeug sinnvoll. Zur Steuerung der Umschaltung benötigt der Unfalldatenspeicher die Information darüber, in welchem Betriebszustand sich das Antriebsaggregat des Fahrzeugs befindet. Diese Abfrage erfolgt vorzugsweise über eine Erfassung der Schaltstellung des Zündstartschalters des Fahrzeugs.

Um Fehlauslösungen unmittelbar nach dem Ausschalten des Antriebsaggregats des Fahrzeugs zu vermeiden, die beispielsweise durch das Verlassen des Fahrzeugs durch die Fahrzeuginsassen oder das Entladen des Fahrzeugs hervorgerufen werden könnten, empfiehlt es sich, die Umschaltung auf die erhöhte Empfindlichkeit zeitverzögert durchzuführen. Eine Verzögerung von ca. 5 Minuten erscheint im allgemeinen praxisgerecht. Dadurch kann sichergestellt werden, daß sich das Fahrzeug in Ruhe befindet.

Um ermittlungsdienliche Aussagen zum Unfallereignis machen zu können, ist es vorteilhaft, den erfindungsgemäß erweiterten Unfalldatenspeicher mit Zeitzählmitteln auszustatten, so daß der Unfallzeitpunkt genau bestimmt werden kann. Die

Zeitzählmittel können in einer als vollständiges Kalendarium ausgebildeten Echtzeituhr oder nur aus einem Relativzeitmesser bestehen. In jedem Fall kann auf diese Weise zusätzlich zu den durch die Beschleunigungssignale erfaßten Stoßdaten eine Zeitmarke in dem registrierten Datensatz abgelegt werden.

Patentansprüche

1. Unfalldatenspeicher
   a) mit Mitteln zur Erfassung von Beschleunigungssignalen,
   b) mit Mitteln zur Analyse der erfaßten Beschleunigungssignale hinsichtlich ihrer Amplitude und ihrer Einwirkungsdauer für die Detektion einer Unfallsituation,
   c) mit Mitteln zur Abfrage des Betriebszustandes des Antriebsaggregats des Fahrzeugs, in welchem der Unfalldatenspeicher installiert ist, und
   d) mit Mitteln zur Speicherung der erfaßten Signale und/oder der daraus ermittelten Daten,

   gekennzeichnet durch Mittel, die den Unfalldatenspeicher nach dem Ausschalten des Antriebsaggregats des Fahrzeugs für eine begrenzte Zeit mit einer gegenüber dem Zustand des eingeschalteten Antriebsaggregats erhöhten Empfindlichkeit in einer fortdauernden Bereitschaft für die Detektion und Registrierung einer Unfallsituation aktiv erhalten.

2. Unfalldatenspeicher nach Anspruch 1,
   dadurch gekennzeichnet,
   daß die Erfassung des Betriebszustandes des Antriebsaggregats des Fahrzeugs durch eine Abfrage der Schaltstellung des Zündstartschalters erfolgt.

3. Unfalldatenspeicher nach Anspruch 1 oder 2,
   dadurch gekennzeichnet,
   daß die Umschaltung in die erhöhte Empfindlichkeit für die Detektion und Registrierung einer Unfallsituation zeitverzögert nach dem Ausschalten des Antriebsaggregats des Fahrzeugs erfolgt.

4. Unfalldatenspeicher nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß die nach dem Ausschalten des Antriebsaggregats des Fahrzeugs fortdauernd betriebsbereiten Mittel zur Detektion und Registrierung einer Unfallsituation zur Registrierung des Zeitpunktes eines Unfallereignisses mit Zeitzählmitteln ausgestattet sind.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 94/00152

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl.5 G07C5/08 G01P1/12

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	WO, A, 91 17447 (CORDIER) 14 November 1991 see page 6, line 3 - page 9, line 8; figures ---	1,4
A	EP, A, 0 118 818 (ZOTTNIK) 19 September 1984 cited in the application see abstract; claims; figures ---	1,4
A	FR, A, 2 615 624 (CURTI) 25 November 1988 see page 1, line 27 - page 3, line 13; figure ---	1
A	DE, A, 36 43 203 (GRUNDIG) 30 June 1988 see column 2, line 10 - line 50; figure ---	1,4
A	DE, A, 41 36 968 (MANNESMANN KIENZLE) 12 November 1992 see abstract; claims; figures ----	1

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 April 1994 (29.04.94)	24 May 1994 (24.05.94)
Name and mailing address of the ISA/ EUROPEAN PATENT OFFICE	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 94/00152

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4 992 943 (MCCRACKEN) 12 February 1991 see abstract; claims; figures ---	1
A	DE, A, 33 14 036 (KEHRBERG) 25 October 1984 see claim 1; figures ---	2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/EP 94/00152

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9117447	14-11-91	FR-A-	2661765	08-11-91
		AU-A-	7887991	27-11-91
		CA-C-	2064019	08-02-94
		EP-A-	0481062	22-04-92
		JP-T-	4507297	17-12-92
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
FR-A-2615624	25-11-88	NONE		
DE-A-3643203	30-06-88	NONE		
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		EP-A-	0566716	27-10-93
		JP-T-	6500182	06-01-94
US-A-4992943	12-02-91	NONE		
DE-A-3314036	25-10-84	NONE		

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 94/00152

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 5 G07C5/08 G01P1/12

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

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 5 G07C G01P

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	WO,A,91 17447 (CORDIER) 14. November 1991 siehe Seite 6, Zeile 3 - Seite 9, Zeile 8; Abbildungen ---	1,4
A	EP,A,0 118 818 (ZOTTNIK) 19. September 1984 in der Anmeldung erwähnt siehe Zusammenfassung; Ansprüche; Abbildungen ---	1,4
A	FR,A,2 615 624 (CURTI) 25. November 1988 siehe Seite 1, Zeile 27 - Seite 3, Zeile 13; Abbildung ---	1
A	DE,A,36 43 203 (GRUNDIG) 30. Juni 1988 siehe Spalte 2, Zeile 10 - Zeile 50; Abbildung --- -/--	1,4

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
29. April 1994	2 4 -05- 1994

Name und Postanschrift der Internationale Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Meyl, D

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 94/00152

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	DE,A,41 36 968 (MANNESMANN KIENZLE) 12. November 1992 siehe Zusammenfassung; Ansprüche; Abbildungen ---	1
A	US,A,4 992 943 (MCCRACKEN) 12. Februar 1991 siehe Zusammenfassung; Ansprüche; Abbildungen ---	1
A	DE,A,33 14 036 (KEHRBERG) 25. Oktober 1984 siehe Anspruch 1; Abbildungen -----	2

1

Formblatt PCT/ISA/210 (Fortsetzung von Blatt 2) (Juli 1992)

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/EP 94/00152

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
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		WO-A-	8403359	30-08-84
		JP-T-	60500637	02-05-85
		US-A-	4638289	20-01-87
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DE-A-3643203	30-06-88	KEINE		
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		EP-A-	0566716	27-10-93
		JP-T-	6500182	06-01-94
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(54) Title: RAPID SATELLITE SIGNAL ACQUISITION IN A SATELLITE POSITIONING SYSTEM

(57) Abstract

A method for fast acquisition of Satellite Positioning System (SATPS) signals that does not require permanent storage of satellite almanac information at a ground station. A nearby reference SATPS station (13), whose position is known, provides a new SATPS station (14) with differential positioning SATPS information and optionally with SATPS satellite ephemeride information on each visible satellite (15, 17, 19, 21). By limiting the search to the frequency range and code-phase attributes corresponding to the visible satellites, the ranges to be searched are decreased. When a first SATPS satellite signal is acquired and locked onto by the new station, the frequency range for searching is narrowed to a range corresponding to the Doppler shift frequency range for the visible satellites, and acquisition of additional SATPS satellite signals proceeds quickly. The system allows the use of less accurate timing sources for the new stations.

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RAPID SATELLITE SIGNAL ACQUISITION IN A SATELLITE POSITIONING SYSTEM

Background of the Invention

When a Satellite Positioning System (SATPS) receiver/processor powers up, or when the receiver/processor experiences SATPS signal interruption, if the receiver/processor has no almanac that indicates the present location of the visible SATPS satellites, the receiver/processor and associated SATPS antenna will perform a blind satellite search to find a sufficient number of SATPS satellites, usually three or more, to begin establishing the antenna's SATPS-determined location and/or proper time. The SATPS antenna and receiver/processor will usually select SATPS satellite numbers at random for the search. This procedure will often consume several minutes before "lock" on an adequate number of SATPS satellite signals is achieved. Several workers in electrical communications have disclosed methods and/or apparati for reducing the time or difficulty of acquiring signals communicated from satellites.

United States Patent No. 4,384,293, issued to Deem et al, discloses apparatus for providing pointing information, using one or more GPS satellites and two antennas spaced apart about ten carrier signal wavelengths. The difference in phase of GPS signals received by the two antennas determines the pointing direction determined by the line of sight between the two antennas. Phase differences of GPS signals received by arrays of three or more collinear or non-collinear antennas are used to determine the attitude of an object on which the antennas are mounted in U.S. Patent No. 5,021,792, issued to Hwang, and in U.S. Patent No. 5,101,356, issued to Timothy et al.

Sekine discloses GPS receiver/processor apparatus that quickly maximizes correlation between a received GPS pseudo-random noise (PRN) code and an internally stored GPS code, in U.S. Patent No. 4,968,981. This approach uses a separate channel for each of N PRN codes and shifts the phase of the internally stored code n/2 bits at a time (n

= 1, 2, ... , N), in a search for a position of increased code correlation value.

In U.S. Patent No. 5,036,329, Ando discloses a satellite reacquisition or initial acquisition method applicable to GPS satellites. Using an estimate of the average Doppler shifted frequency f_{avg} manifested by the GPS signals received from a visible GPS satellite, a narrow band search is first performed in the frequency range f_{avg} - 8600 Hz $\leq f \leq f_{avg}$ + 8600 Hz. If no GPS satellite signals are found in this range within 3.75 minutes, the search range is widened until at least one GPS satellite signal is found.

A simultaneous multi-channel search for reacquisition of GPS satellite signals after signal interruption occurs is disclosed by Sakaguchi and Ando in U.S. Patent No. 5,059,969. This method first searches for the GPS satellite with the highest elevation angle relative to the GPS antenna. Two or more sequences of signal frequency ranges are swept over in parallel until at least one GPS signal is reacquired.

United States Patent No. 5,061,936, issued to Suzuki, discloses attitude control for a rotationally mobile antenna. If the strength of the initial signal received by the antenna from a spacecraft (whose position is yet unknown) is below a first selected threshold and above a second selected threshold, the antenna attitude is scanned over a relatively small range, to increase the signal strength toward or above the first threshold value. If the signal strength is initially below the second threshold, the antenna attitude is scanned over a larger range, to increase the signal strength above the second threshold value so that a smaller range antenna scan can be implemented.

In U.S. Patent No. 5,119,504, Durboraw discloses a satellite-aided cellular communications system in which a subscriber unit self-determines its own (changing) location and transmits this information to the satellites for use in subsequent communications. This requires that each subscriber unit transmit and receive signals, and one subscriber unit does not communicate directly with, or provide satellite location information for, another subscriber unit.

An electronic direction finder that avoids reliance on sensing of terrestrial magnetic fields for establishing a preferred direction for satellite signal acquisition is disclosed by Ghaem et al in U.S. Patent No. 5,146,231. The apparatus uses a receiver/processor for GPS or similar navigation signals received from a satellite, and requires (stored) knowledge of the present location of at least one reference satellite from which signals are received. The orientation of the finder or its housing relative to a line of sight vector from the finder to this reference satellite is determined. This orientation is visually displayed as a projection on a horizontal plane. Any other direction in this horizontal plane can then be determined with reference to this projection from a knowledge of the reference satellite location.

Ando, in U.S. Patent No. 5,155,491, discloses a method for tracking radio signals from GPS satellites that follow a single orbit around the Earth. At most four GPS satellites follow one of the six GPS orbits, as the constellation is presently configured. The C/A-code and/or P-code is known for each of the at-most-four GPS satellites in a single orbit so that searching along a single orbit requires acquisition of only one of the four known codes associated with these satellites, and at least one of these four GPS satellites is not visible at a particular observation time. After acquisition of whatever GPS satellites on a particular GPS orbit can be tracked, the system moves sequentially from one GPS orbit to another orbit until all trackable GPS satellites are found. The system then selects the three or four GPS satellites that are most suitable for global positioning computations.

These methods either require storage of detailed knowledge of the satellite trajectories or of satellite signal indicia. This information for SATPS satellites can be voluminous and is not present in many SATPS signal receiver/processor systems. What is needed is a method that relies only upon information that is already available within the receiving system or from another nearby receiving system. Preferably, the method should provide reasonably accurate information on the present location of any visible SATPS satellite, should allow rapid acquisition of SATPS signals from one or a plurality of visible SATPS satellites, and should not require consumption of much additional power for operation.

Summary of the Invention

The invention focuses on initial acquisition and identification of visible SATPS satellites by an SATPS signal antenna and receiver/processor ("SATPS station") at the time of power-up. Receipt of differential SATPS signals from another already-operative SATPS station allows the SATPS station that is now powering up (the "new" SATPS station) to reduce the number of SATPS channels searched. The new SATPS Station need not store the SATPS almanac information and may use less expensive timing sources. This eliminates the need for a back-up battery and allows quicker acquisition of the visible SATPS satellites upon power-up.

In one embodiment, the method includes the steps of: (1) providing a reference SATPS station, whose location coordinates are known with high accuracy, with a transmitter to broadcast differential SATPS information to other nearby SATPS stations, including the new SATPS station; (2) providing differential SATPS information from the reference station to the new station, including the pseudorange corrections and satellite index of each SATPS satellite that is visible from the reference station (the SATPS "reference/visible" satellites); (3) establishing a selected number of channels at the new station to acquire SATPS signals from the reference/visible satellites; (4) stepping through the pseudorange and code-phase attributes for each of the visible SATPS satellites to acquire and lock onto the SATPS signals from one or more of the SATPS satellites; (5) once one SATPS satellite signal is acquired, narrowing the frequency tuning range of all the other tuning channels to a much smaller frequency range, based upon the calculated frequency error and Doppler shift frequency range; and (6) using this smaller frequency range to more quickly acquire and lock onto additional SATPS satellite signals, if needed.

Limiting the search for SATPS satellite signals at the new station to the visible SATPS satellites for which differential SATPS information is available provides the following benefits. First, a station that is not a reference station does not need battery backup for the random access memory in order to store the satellite almanac information. Second, as each SATPS satellite signal is acquired and identified, the frequency range that needs to be searched for that satellite can be narrowed substantially, using an estimate of the Doppler shift for signals emitted from that satellite. Third, an inexpensive time base source for an SATPS receiver/processor can be used without incurring a large penalty in satellite signal acquisition time. Once one satellite signal is locked onto, the SATPS receiver/processor can correct for the (relatively large) frequency error of the associated time base and can search over a smaller frequency range that covers the appropriate Doppler shifted frequencies received.

Brief Description of the Drawings

Figure 1 is a schematic view of a differential satellite positioning system in operation, showing a reference SATPS station and another SATPS station that receives differential SATPS information from the reference station.

Figure 2 is a flow chart illustrating acquisition of and lock-on for one or more SATPS satellites signals by a new SATPS station according to one embodiment of the invention.

Description of Best Mode of the Invention

Figure 1 illustrates operation of a differential satellite positioning system in simplified form. A reference SATPS station 13, including an SATPS receiver/processor and associated SATPS antenna 23, and a roving SATPS station 14, including an SATPS receiver/processor and associated SATPS antenna 25, are spaced apart on or adjacent to the Earth's surface, where it is assumed that the reference receiver's location is known very accurately at any time. Presently, an SATPS signal antenna is approximately omni-directional so that SATPS signals can be received from any area of the sky, except near the horizon, without "pointing" the antenna.

An SATPS antenna receives SATPS signals from a plurality (preferably four or more) of SATPS satellites and passes these signals to an SATPS signal receiver/processor, which (1) identifies the SATPS satellite source (satellite number or other indicia) for each SATPS signal, (2) determines the time at which each identified SATPS signal arrives at the antenna, and (3) determines the present location of the SATPS antenna from this information and from information on the ephemerides, stored in the receiver/processor, for each identified SATPS satellite. The SATPS signal antenna and signal receiver/processor are part of the user segment of a particular SATPS, the Global Positioning System, as discussed by Tom Logsdon in The NAVSTAR Global Positioning System, Van Nostrand Reinhold, 1992, pp. 33-90, incorporated by reference herein.

The reference station 13 may be stationary or may be moving with location coordinates known as a function of time t. Four or more SATPS satellites 15, 17, 19 and 21 transmit SATPS signals that are received by the reference and roving stations 13 and 14 and converted to present location, velocity and time for that station. The reference and roving stations 13 and 14 also include modems 27 and 29, respectively, or other communication means that provide a one-way link between the reference station 13 and the roving station 14 or a two-way link, as shown. Optionally, the system shown in Figure 1 may also include one or more signal repeaters 31, located between the two stations 13 and 14, to facilitate long distance or non-line-of-sight communication between these two stations. Optionally, the system may include two or more roving stations.

Assume that a roving station 14 has lost its lock on one or more (or all) visible SATPS satellites 15, 17, 19 and 21, or that the roving station is powering up after a period of no activity. This roving station 14 (referred to herein as a "new" station for convenience) will need to acquire or reacquire, and to lock onto, one or more of the SATPS satellites visible from the reference station 13 (referred to as a "reference/visible satellite" herein for convenience), in order to provide location and/or time information for this new station. The reference station 13 may be moving or may be stationary. It is assumed that the reference station 13 is located nearby (i.e., within 250 kilometers) and that its location coordinates are known with high accuracy at any time so that differential satellite positioning system ("DSATPS") information is available from the reference station.

According to one embodiment of the invention, this procedure for (re)acquisition and lock-on for one or more visible SATPS satellites is illustrated in Figure 2. In step 41, the new station either powers up or senses that it has lost lock on all SATPS satellites. In steps 43 and 45, the new station 14 receives DSATPS information from the reference station 13 and determines the reference/visible SATPS satellites. In step 47, the new station 14 sets up a sufficient number of SATPS signal channels to receive SATPS signals directly from the reference/visible SATPS satellites. In step 49, the frequency range and code-phase attributes (PRN codes, etc.) are stepped through for each of these reference/visible SATPS satellites to acquire and lock onto the SATPS signals from one or more of the SATPS satellites. This may be implemented by searching simultaneously over, say, six channels, each corresponding to a different reference/visible SATPS satellite. After a first SATPS satellite signal is acquired, the frequency tuning range for all the other SATPS satellites is narrowed, in step 51, to a small frequency range around the calculated frequency, based upon Doppler shift frequency ranges. In step 53, additional SATPS satellite signals are acquired and locked onto, if needed.

Once an SATPS satellite is tracked and its SATPS signals are acquired and locked onto, the frequency range for the search can be narrowed, because an estimate can be made of the error of the roving station frequency source. Two sources of significant error in SATPS signal acquisition are (1) Doppler frequency shift due to the non-zero velocity of a satellite relative to an SATPS receiver/processor and (2) SATPS receiver/processor time base error relative to the more accurate satellite time base. Where a relatively inexpensive clock is used to provide a time base for an SATPS receiver/processor, the second of these two errors can be about ten times as large as the first error. For example, the maximum Doppler shift frequency may be 5-8 kHz, and the time base error may correspond to a frequency error of 47 kHz (30 ppm for a frequency of 1.575 GHz). Use of a relatively expensive and more accurate clock to provide a time base for the SATPS receiver/processor will reduce the time base error. Once an SATPS signal is locked onto and that satellite is identified, the receiver/processor time base error, which is approximately the same for any SATPS satellite, can be determined and the frequency range for subsequent searches for other SATPS satellites can be reduced to the Doppler shift frequency range, which is much smaller than the original frequency range that must be searched.

The system disclosed here allows rapid acquisition of SATPS satellite lock-on for any number of visible satellites. Whereas, acquisition of a first SATPS satellite may require a time interval of several minutes, the system disclosed here allows acquisition of a first SATPS satellite in reduced time, depending on the number of satellite acquisition channels used.

Further, the clock used to provide a time base for the SATPS receiver/processor at the roving station may be much less precise using the disclosed system for satellite acquisition. For example, a receiver clock that is accurate to within 2.5 ppm or lower, with a representative cost of the order of $25, is often required for reasonably prompt SATPS satellite acquisition in a conventional setting. A receiver clock that is accurate to within 10 ppm, with a representative cost of about $5, will suffice for the system disclosed here; and it is possible that a clock that is merely accurate to within 20 ppm can be used with the disclosed system, which would reduce the cost of the clock further.

Finally, the new station need not store the SATPS satellite ephemeride information itself. The new station can call up and make use of this information from the reference station when the new station is operated, and thus use smaller permanent memory for general operations.

A Satellite Positioning System (SATPS) is a system of satellite signal transmitters, with receivers located on the Earth's surface or adjacent to the Earth's surface, that transmits information from which an observer's present location and/or the time of observation can be determined. Two operational systems, each of which qualifies as an SATPS, are the Global Positioning System and the Global Orbiting Navigational System.

The Global Positioning System (GPS) is part of a satellite-based navigation system developed by the United States Defense Department under its NAVSTAR satellite program. A fully operational GPS includes up to 24 satellites approximately uniformly dispersed around six circular orbits with four satellites each, the orbits being inclined at an angle of 55^{o} relative to the equator and being separated from each other by multiples of 60^{o} longitude. The orbits have radii of 26,560 kilometers and are approximately circular. The orbits are non-geosynchronous, with 0.5 sidereal day (11.967 hours) orbital time intervals, so that the satellites move with time relative to the Earth below. Theoretically, four or more GPS satellites will be visible from most points on the Earth's surface, and visual access to three or more such satellites can be used to determine an observer's position anywhere on the Earth's surface, 24 hours per day. Each satellite carries a cesium or rubidium atomic clock to provide timing information for the signals transmitted by the satellites. Internal clock correction is provided for each satellite clock.

Each GPS satellite transmits two spread spectrum, L-band carrier signals: an L1 signal having a frequency f1 = 1575.42 MHz and an L2 signal having a frequency f2 = 1227.6 MHz. These two frequencies are integral multiples f1 = 1540 f0 and f2 = 1200 f0 of a base frequency f0 = 1.023 MHz. The L1 signal from each satellite is binary phase shift key (BPSK) modulated by two pseudo-random noise (PRN) codes in phase quadrature, designated as the C/A-code and P-code. The L2 signal from each satellite is BPSK modulated by only the C/A-code. The nature of these PRN codes is described below.

One motivation for use of two carrier signals L1 and L2 is to allow partial compensation for propagation delay of such a signal through the ionosphere, which delay varies approximately as the inverse square of signal frequency f (delay$\propto f^{-2}$). This phenomenon is discussed by MacDoran in U.S. Patent No. 4,463,357, which discussion is incorporated by reference herein. When transit time delay through the ionosphere is determined, a phase delay associated with a given carrier signal can be determined.

Use of the PRN codes allows use of a plurality of GPS satellite signals for determining an observer's position and for providing navigation information. A signal transmitted by a particular GPS signal is selected by generating and matching, or correlating, the PRN code for that particular satellite. All PRN codes are known and are generated or stored in GPS satellite signal receivers carried by ground observers. A first PRN code for each GPS satellite, sometimes referred to as a precision code or P-code, is a relatively long, fine-grained code having an associated clock or chip rate of 10 f0 = 10.23 MHz. A second PRN code for each GPS satellite, sometimes referred to as a clear/acquisition code or C/A-code, is intended to facilitate rapid satellite signal acquisition and hand-over to the P-code and is a relatively short, coarser-grained code having a clock or chip rate of f0 = 1.023 MHz. The C/A-code for any GPS satellite has a length of 1023 chips or time increments before this code repeats. The full P-code has a length of 259 days, with each satellite transmitting a unique portion of the full P-code. The portion of P-code used for a given GPS satellite has a length of precisely one week (7.000 days) before this code portion repeats. Accepted methods for generating the C/A-code and P-code are set forth in the document GPS Interface Control Document ICD-GPS-200, published by Rockwell International Corporation, Satellite Systems Division, Revision A, 26 September 1984, which is incorporated by reference herein.

The GPS satellite bit stream includes navigational information on the ephemeris of the transmitting GPS satellite and an almanac for all GPS satellites, with parameters providing corrections for ionospheric signal propagation delays suitable for single frequency receivers and for an offset time between satellite clock time and true GPS time. The navigational information is transmitted at a rate of 50 Baud. A useful discussion of the GPS and techniques for obtaining position information from the satellite signals is found in Tom Logsdon, The NAVSTAR

Global Positioning System, Van Nostrand Reinhold, New York, 1992, incorporated by reference herein.

A second configuration for global positioning is the Global Orbiting Navigation Satellite System (GLONASS), placed in orbit by the former Soviet Union and now maintained by the Russian Republic. GLONASS also uses 24 satellites, distributed approximately uniformly in three orbital planes of eight satellites each. Each orbital plane has a nominal inclination of 64.8^{o} relative to the equator, and the three orbital planes are separated from each other by multiples of 120^{o} longitude. The GLONASS circular orbits have smaller radii, about 25,510 kilometers, and a satellite period of revolution of 8/17 of a sidereal day (11.26 hours). A GLONASS satellite and a GPS satellite will thus complete 17 and 16 revolutions, respectively, around the Earth every 8 days. The GLONASS system uses two carrier signals L1 and L2 with frequencies of f1 = (1.602 + 9k/16) GHz and f2 = (1.246 + 7k/16) GHz, where k (= 0, 1, 2, ..., 23) is the channel or satellite number. These frequencies lie in two bands at 1.597-1.617 GHz (L1) and 1,240-1,260 GHz (L2). The L1 code is modulated by a C/A-code (chip rate = 0.511 MHz) and by a P-code (chip rate = 5.11 MHz). The L2 code is presently modulated only by the P-code. The GLONASS satellites also transmit navigational data at at rate of 50 Baud. Because the channel frequencies are distinguishable from each other, the P-code is the same, and the C/A-code is the same, for each satellite. The methods for receiving and analyzing the GLONASS signals are similar to the methods used for the GPS signals.

Reference to a Satellite Positioning System or SATPS herein refers to a Global Positioning System , to a Global Orbiting Navigation System, and to any other compatible satellite-based system that provides information by which an observer's position and the time of observation can be determined, all of which meet the requirements of the present invention.

A Satellite Positioning System (SATPS), such as the Global Positioning System (GPS) or the Global Orbiting Navigation Satellite System (GLONASS), uses transmission of coded radio signals, with the structure described above, from a plurality of Earth-orbiting satellites. A single passive receiver of such signals is capable of determining receiver absolute position in an Earth-centered, Earth-fixed coordinate reference system utilized by the SATPS. A configuration of two or more receivers can be used to accurately determine the relative positions between the receivers or stations. This method, known as differential positioning, is far more accurate than absolute positioning, provided that the distances between these stations are substantially less than the distances from these stations to the satellites, which is the usual case. Differential positioning can be used for survey or construction work in the field, providing location coordinates and distances that are accurate to within a few centimeters in some circumstances.

In differential position determination, many of the errors in the SATPS that compromise the accuracy of absolute position determination are similar in magnitude for stations that are physically close. The effect of these errors on the accuracy of differential position determination is therefore substantially reduced by a process of partial error cancellation.

Claims

1. A method for rapid acquisition of one or more Satellite Positioning System (SATPS) satellite signals by an SATPS station, referred to as a new SATPS station, that seeks to acquire or to reacquire such SATPS signals, the method comprising the steps of:

(1) providing a reference SATPS station, whose location coordinates are known with high accuracy, with a transmitter to broadcast differential SATPS information to other nearby SATPS stations, including the new SATPS station;

(2) providing differential SATPS information from the reference station to the new station, including satellite number or equivalent satellite indicia, for each SATPS satellite that is visible from the reference station, referred to as an SATPS reference/visible satellite;

(3) establishing a selected number of channels to acquire SATPS signals from each of the SATPS reference/visible satellites;

(4) stepping through the frequency range and code-phase attributes for each of the SATPS reference/visible satellites to acquire and lock onto the SATPS signals;

(5) after one SATPS satellite signal is acquired and the satellite is identified, reducing the frequency tuning range to a smaller frequency range, based upon that satellite's expected Doppler shift frequency range; and

(6) using this smaller frequency range to search for and acquire an SATPS signal from at least one additional SATPS satellite.

2. The method of claim 1, further comprising the step of choosing said Satellite Positioning System to be a Global Positioning System or a Global Orbiting Navigation Satellite System.

3. A method for acquisition of one or more SATPS satellite signals by an SATPS station, referred to as a new SATPS station, that seeks to acquire or to reacquire such SATPS signals, without requiring storage of

SATPS satellite ephemeride information at the new station, the method comprising the steps of:

(1) providing a reference SATPS station, whose location coordinates are known with high accuracy, with a transmitter to broadcast differential SATPS information to other nearby SATPS stations, including the new SATPS station;

(2) providing differential SATPS information from the reference station to the new station, including satellite number or equivalent satellite indicia, for each SATPS satellite that is visible from the reference station, referred to as an SATPS reference/visible satellite, and information on the ephemeride for each SATPS reference/visible satellite;

(3) establishing a selected number of channels to acquire SATPS signals from each of the SATPS reference/visible satellites;

(4) stepping through the frequency range and code-phase attributes for each of the SATPS reference/visible satellites to acquire and lock onto the SATPS signals;

(5) after one SATPS satellite signal is acquired and the satellite is identified, reducing the frequency tuning range to a smaller frequency range, based upon that satellite's expected Doppler shift frequency range; and

(6) using this smaller frequency range to search for and acquire an SATPS signal from at least one additional SATPS satellite.

4. The method of claim 3, further comprising the step of choosing said Satellite Positioning System to be a Global Positioning System or a Global Orbiting Navigation Satellite System.

5. A method for rapid acquisition of one or more SATPS satellite signals by an SATPS station, referred to as a new SATPS station, that seeks to acquire or to reacquire such SATPS signals, the method comprising the steps of:

(1) providing a reference SATPS station, whose location coordinates are known with high accuracy, with a transmitter to broadcast differential

SATPS information to other nearby SATPS stations, including the new SATPS station;

(2) providing differential SATPS information from the reference station to the new station, including satellite identifying number or equivalent indicia, for each SATPS satellite that is visible from the reference station, referred to as an SATPS reference/visible satellite, where the reference station and the new station each have a timing source and the new station timing source has an associated inaccuracy of as high as 20 parts per million;

(3) establishing a selected number of channels to acquire SATPS signals from each of the SATPS reference/visible satellites;

(4) stepping through the frequency range and code-phase attributes for each of the SATPS reference/visible satellites to acquire and lock onto the SATPS signals;

(5) after one SATPS satellite signal is acquired and the satellite is identified, reducing the frequency tuning range to a smaller frequency range, based upon that satellite's expected Doppler shift frequency range; and

(6) using this smaller frequency range to search for and acquire an SATPS signal from at least one additional SATPS satellite.

6. The method of claim 5, further comprising the step of choosing said Satellite Positioning System to be a Global Positioning System or a Global Orbiting Navigation Satellite System.

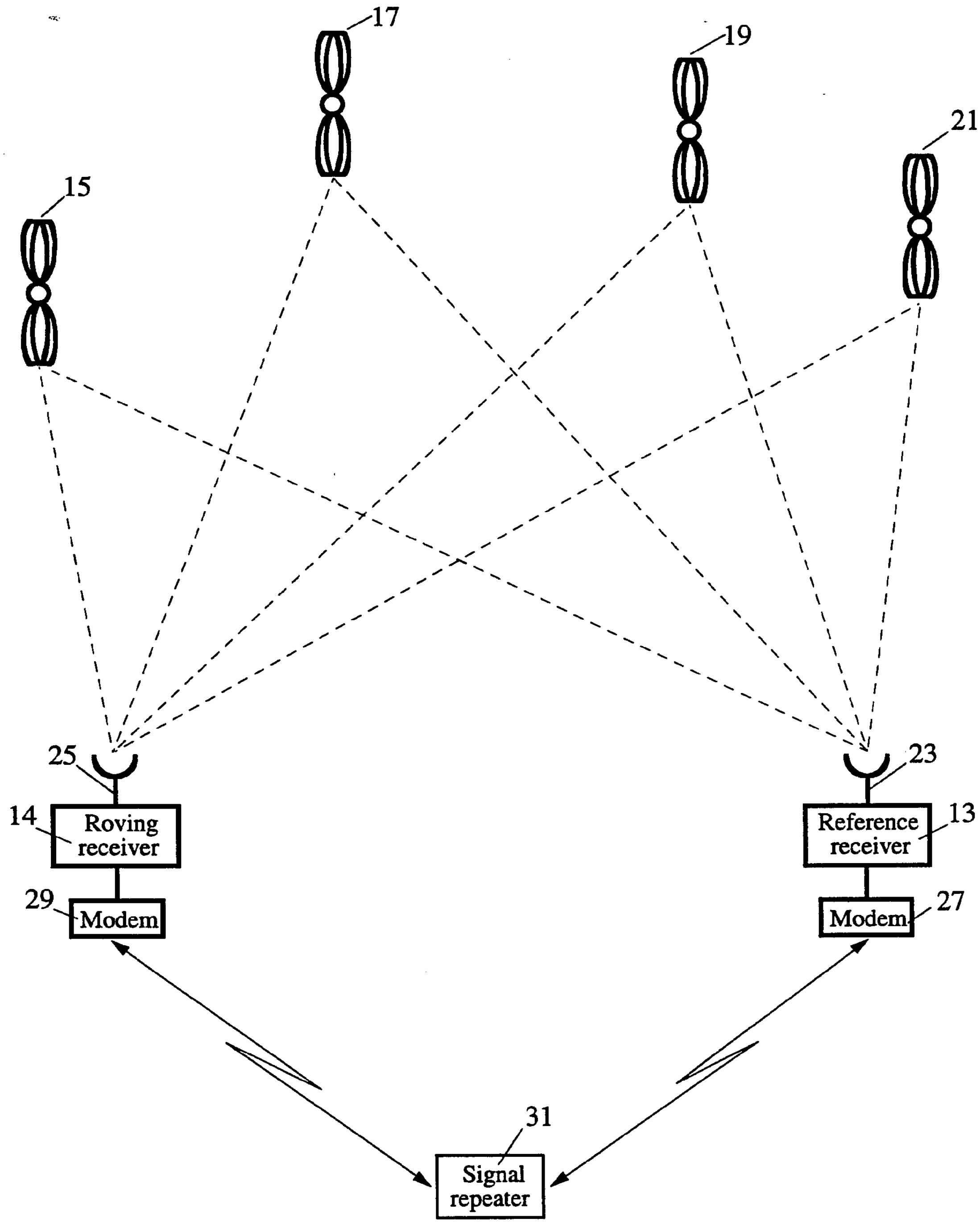
15
17
19
21
25
23
14
Roving receiver
Reference receiver
13
29
Modem
Modem
27
31
Signal repeater

FIG. 1

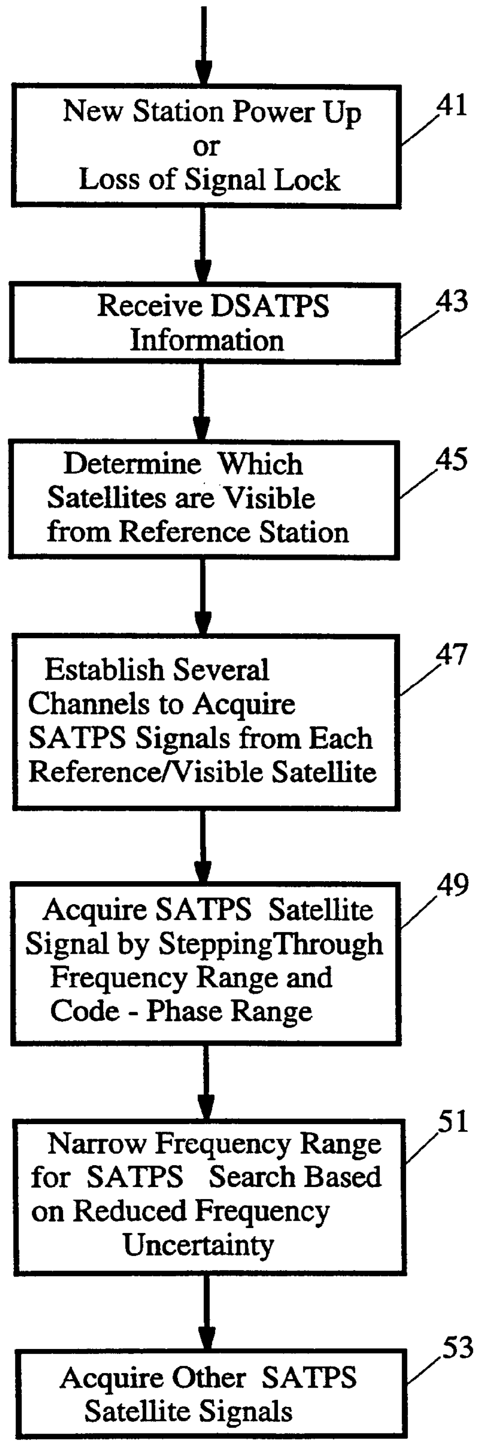
New Station Power Up
or
Loss of Signal Lock
41
Receive DSATPS
Information
43
Determine Which
Satellites are Visible
from Reference Station
45
Establish Several
Channels to Acquire
SATPS Signals from Each
Reference/Visible Satellite
47
Acquire SATPS Satellite
Signal by SteppingThrough
Frequency Range and
Code - Phase Range
49
Narrow Frequency Range
for SATPS Search Based
on Reduced Frequency
Uncertainty
51
Acquire Other SATPS
Satellite Signals
53

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/05603

A. CLASSIFICATION OF SUBJECT MATTER
IPC(5) :G01S 5/02
US CL :342/357
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. : 342/357,358; 375/1

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	US, A, 4,701,934 (JASPER) 20 OCTOBER 1987 SEE COLS. 19-20	1-6
A	US, A, 4,751,512 (LONGAKER) 14 JUNE 1988 SEE FIG. 1.	1-6
A	US, A, 5,119,102 (BARNARD) 02 JUNE 1992 SEE COL. 4 LINE 63-COL. 5, LINE 61.	1-6
A	US, A, 5,185,761 (KAWASAKI) 09 FEBRUARY 1993 SEE ENTIRE DOCUMENT.	1-6
A,P	US, A, 5,225,842 (BROWN ET AL) 06 JULY 1993 SEE ENTIRE DOCUMENT	1-6

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

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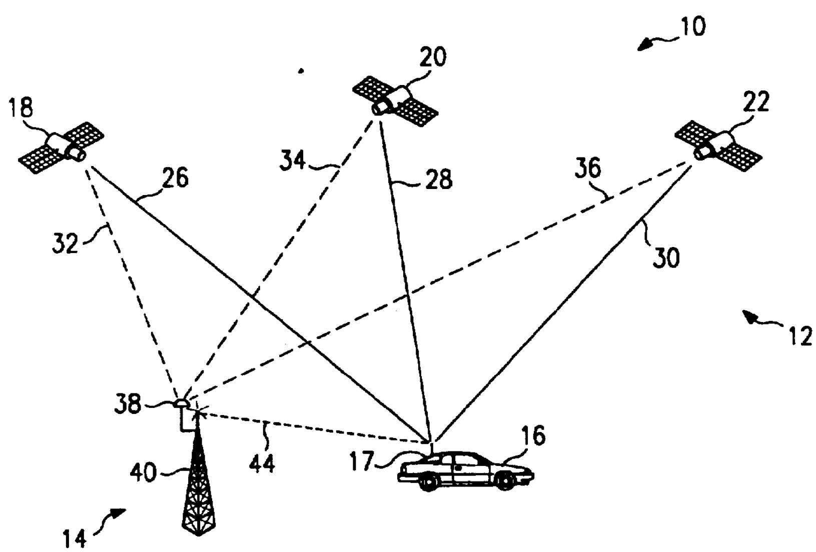
(54) Title: LOCATING SYSTEM AND METHOD USING A MOBILE COMMUNICATIONS NETWORK



(57) Abstract

A differential positioning system (10) includes components of a satellite-based or land-based positioning system (12) and components of a mobile communications network (14). The differential positioning system (10) provides accurate and immediate position information to a mobile unit (17). A transmitter site (40) of a mobile communications network (14) is associated with a reference positioning receiver (38). The reference positioning receiver (38) generates correction data for transmission to the mobile unit (17). The mobile unit (17) includes a mobile communications device (42) for receiving the correction data generated by the reference positioning receiver (38) and a mobile positioning receiver (24) for generating a position fix. The mobile unit (17) refines the position fix generated by the mobile positioning receiver (24) using correction data received by the mobile communications device (42).

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LOCATING SYSTEM AND METHOD USING A MOBILE COMMUNICATIONS NETWORK

TECHNICAL FIELD OF THE INVENTION

This invention relates to locating systems, and more particularly to a locating system and method using a mobile communications network.

BACKGROUND OF THE INVENTION

Mobile communications technology has enjoyed substantial growth over the past decade. Many cars, trucks, airplanes, boats, and other vehicles are equipped with devices that allow convenient and reliable mobile communication through a network of satellite-based or land-based transceivers. Advances in this technology have also led to widespread use of hand-held, portable mobile communications devices.

Many customers of mobile communications systems also require an accurate determination of their position, and perhaps reporting of this position to a remote location. For example, a cellular telephone in a vehicle or carried by a person offers a convenient communication link to report position information. The position information may be generated by traditional positioning systems, including a satellite-based positioning system such as the global positioning system (GPS), or a land-based positioning system, such as LORAN-C. These approaches, however, may not be suitable for particular applications that require great position accuracy.

SUMMARY OF THE INVENTION

In accordance with the present invention, the disadvantages and problems associated with previous techniques used to locate and report the position of a vehicle, person, or object equipped with a mobile communications device have been substantially reduced or eliminated. One aspect of the present invention provides a differential positioning system that integrates positioning technology with an existing mobile communications infrastructure.

According to an embodiment of the present invention, a locating system using a cellular telephone network and a positioning system includes a reference positioning receiver having known position coordinates. The reference positioning receiver receives first position signals from the positioning system and generates correction data in response to the first position signals and the known position coordinates. A transmitter site of the cellular telephone network is coupled to the reference positioning receiver and transmits the correction data generated by the reference positioning receiver. A mobile unit in communication with the cellular telephone network and the positioning system receives correction data transmitted by the transmitter site. The mobile unit also receives second position signals from the positioning system and determines the location of the mobile unit in response to the second position signals and the correction data.

According to another embodiment of the present invention, a system for locating a mobile unit within the service area of a mobile communications network includes a plurality of transmitter sites having known position coordinates, each transmitter site broadcasting time-of-arrival (TOA) data. A mobile communications device on the mobile unit receives the TOA data transmitted by at least three transmitter sites. A memory on the mobile unit stores known position coordinates of the transmitter sites. A processor receives the TOA data from the mobile communications device and determines the position of the mobile unit in response to the TOA data received from the transmitter sites and the known position coordinates of the transmitter sites stored in the memory.

Important technical advantages of the present invention include improving the accuracy of existing positioning systems using a mobile communications system. In particular, existing transmitter sites of a mobile communications network may be used as reference points to transmit position correction data to mobile units within the mobile communications network service area. Other important technical advantages include integration of communicating, locating, and reporting functions for an overall reduction in the cost and complexity of the system. For example, a differential GPS (DGPS) positioning system may use an existing communications link, such as the overhead message stream of a cellular telephone network, to send correction data from the transmitter site to the mobile unit. Important technical advantages may also include accurate and immediate position fixes without relying on calculations performed at a remote location. Other important technical advantages may also include implementation of a time-of-arrival (TOA) positioning system within the mobile communications network without land-based or satellite-based positioning technology. Other technical advantages are readily apparent to one skilled in the art from the following figures, description, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and for further features and advantages, reference is now made to the following description taken in conjunction with the accompanying drawings, wherein like reference numerals represent like parts, in which:

FIGURE 1 illustrates a differential positioning system;

FIGURE 2 illustrates an alternative embodiment of the differential positioning system of FIGURE 1;

FIGURE 3 is a schematic representation of a transmitter site associated with a reference positioning receiver;

FIGURE 4 is a schematic representation of a mobile unit;

FIGURE 5 is a schematic representation of a central host; and

FIGURE 6 illustrates an alternative positioning system.

DETAILED DESCRIPTION OF THE INVENTION

FIGURE 1 illustrates several components used in a differential positioning system 10. The system includes components of a satellite-based or land-based positioning system 12 and components of a mobile communications network 14. Differential positioning system 10 provides accurate and immediate position information to vehicle 16 equipped with a mobile unit 17.

Positioning system 12 is illustrated as a satellite-based radio navigation system, such as the NAVSTAR positioning system (GPS). The description uses the NAVSTAR GPS as a representative positioning system 12, but any land-based or satellite-based system may be used. For example, positioning system 12 may be a land-based LORAN-C, a space-based GLONASS, or any other appropriate positioning technology. In general, positioning system 12 comprises a plurality of space-based or land-based transmitters that emit position signals.

The NAVSTAR GPS consists of a number of satellites in approximately twelve hour, inclined orbits of the earth, each satellite transmitting position signals. The GPS concept of operation is based upon satellite ranging. With position signals from three satellites, a GPS receiver can make an accurate calculation of its position in three dimensions. To make a valid position fix, the GPS receiver measures the propagation times of position signals from the satellites to a very high accuracy. This is accomplished by synchronizing the transmission of position signals to an atomic clock. However, to reduce costs and complexity, the GPS receiver may not maintain such an accurate clock, which introduces a clock bias (C_B) between the satellite clock and the GPS receiver clock. By measuring the apparent satellite signal propagation times from four satellites rather than three, the redundancy can be used to solve C_B. The signal propagation times correspond to ranges of the GPS