



(11) **EP 1 077 433 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.02.2001 Bulletin 2001/08

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

(21) Application number: **00307044.8**

(22) Date of filing: **17.08.2000**

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

(30) Priority: **19.08.1999 US 149847 P**
14.08.2000 US 638845

(71) Applicant: **Sarnoff Corporation**
Princeton, NJ 08540-6449 (US)

(72) Inventors:
 • **Kalokitis, David**
Robbinsville, New Jersey 08691 (US)

• **Johnson, Henry C.**
East Windsor, New Jersey 08520 (US)
 • **Paglione, Robert Wayne**
Robbinsville, New Jersey 08691 (US)
 • **Schepps, Jonathan Lloyd**
Princeton, New Jersey 08550 (US)

(74) Representative: **Pratt, Richard Wilson et al**
D. Young & Co,
21 New Fetter Lane
London EC4A 1DA (GB)

(54) **Data aquisition and transfer**

(57) A data system includes a tag system (120) in a vehicle that transmits data to an interrogator (300). In the vehicle data relating to the vehicle systems is applied to the tag system (120) and data from an external device (600) is applied to the tag system (120). The data from the external device (600) is unrelated to the vehicle systems. External devices (600) include an electronic compass that provides data relating to the heading of the vehicle and a tone sensor (510) that provides data relating to a service facility (600) used by the vehicle (100). A service facility (600) includes a fuel dispenser (600) in which pump information is acoustically transmitted to the sensor (510) via the fuel being provided to the vehicle.

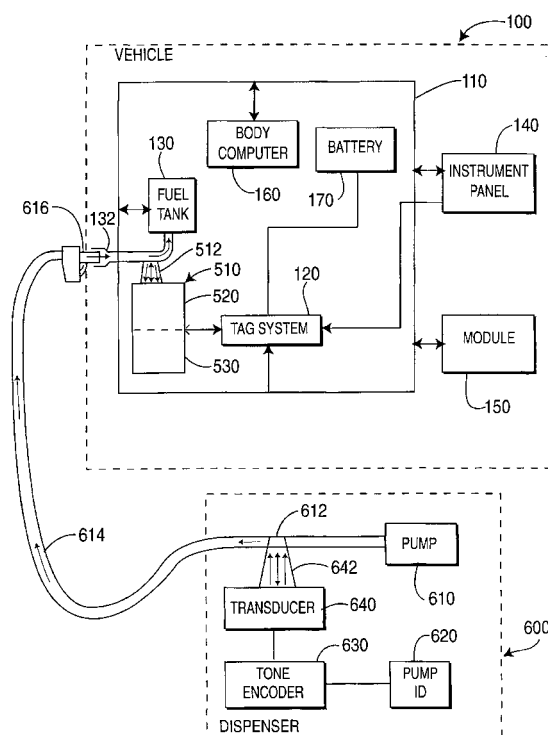


FIG. 5

Description

[0001] The present invention relates to a data system and to a dispenser system. An embodiment of the present invention relates to a vehicle information system. Another embodiment relates to a system for acquiring and transferring information from a vehicle.

Background of the Invention

[0002] Suggestions have been made in the past to employ available technology for the purpose of automating transactions concerning vehicles. For example, U. S. Patent No. 5,058,044 (the '044 patent) to Stewart et al. describes a system that includes a processing system on-board a vehicle for gathering data related to the operational history of the vehicle and transferring the data to a stationery processing system, such as for a mechanic regarding needed repairs and/or automated commercial transactions such as the billing of vehicle rentals or of repair work. The on-board system includes a processor for collecting data from sensors associated with selected operations systems of the vehicle (e.g., lights, drive train, tires, and fluid levels). Depending upon the system monitored, the processor may continually update its condition (e.g., mileage and gas level) in a storage area or it may only store information when service is required (e.g., lights and drive train). When the vehicle enters a service area, the on-board system is interrogated for its stored information. The interrogation is executed by an annunciator system which first detects the physical presence of the vehicle and then transmits an RF interrogation signal to a receiver on-board the vehicle that is coupled to the on-board processor. If the interrogation signal is recognized by the on-board processor, a vehicle identification code along with the stored information is conveyed to an RF signal and transmitted from the vehicle.

[0003] Because the system described in the '044 patent connects the on-board processor to each of the components in the vehicle, the vehicle may have to be substantially modified to accommodate the system of the '044 patent. Further, because the vehicle includes both a receiver and a transmitter, the complexity and cost of the '044 system is undesirably increased.

[0004] U.S. Patent No. 5,974,368 (the '368 patent) to Schepps et al describes a remote vehicle data interface system in which vehicle-related data is transmitted by a low-cost RF tag system in the vehicle to an RF interrogator without the need for each to have both an RF transmitter and an RF receiver. Moreover, the system of the '368 patent connects to a vehicle data bus to receive the vehicle-related data without need for substantial modification of the vehicle.

[0005] Neither of these prior art systems describe how data pertaining to conditions external to vehicle-related data or to the environment in which the vehicle is present might be acquired and utilized.

[0006] Accordingly, there is a need for a system for acquiring and providing data external to vehicle-related data, and for utilizing such external data.

[0007] A data system of one aspect of the present invention comprises at least one source of vehicle-related data, at least one source of external data not related to vehicle data, and a transmitter coupled to each of the sources for receiving the vehicle-related data and the external data therefrom, the transmitter transmitting the vehicle-related data and the external data. Examples of external data include a source of heading information, such as an electronic compass, and a service dispenser, such as a fuel dispenser. Examples of utilization systems include controls for traffic signals and service facilities.

[0008] According to a further aspect of the invention, a data system for a vehicle comprises, in addition to sources of vehicle-related data and of external data not related to vehicle data, and a transmitter on the vehicle, an interrogator receiving the vehicle-related data and the external data from the transmitter, and a utilization system coupled to said interrogator and responsive to at least the external data.

[0009] According to another aspect of the invention, a vehicle service dispenser system comprises a service dispenser external to a vehicle including a source of service dispenser information and a transducer for transmitting and/or receiving service information including the service dispenser information. Coupling means couples the vehicle to the service dispenser for receiving service and for coupling service information. A sensor on the vehicle is adapted to receive and/or transmit service information with the service dispenser external to the vehicle via the coupling means, and means is coupled to at least one of the sensor and the transducer for utilizing the service information.

BRIEF DESCRIPTION OF THE DRAWING

[0010] For a better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

FIGURE 1 is a schematic block diagram of a vehicle information system 10 according to an embodiment of the present invention;

FIGURE 2 is a schematic block diagram of a vehicle 100 including a tag system 120 and an electronic compass 500 according to an embodiment of the present invention;

FIGURE 3 is a schematic block diagram of a portion of system 10 illustrating the tag system 120 of FIGURE 2, interrogator 300 and electronic compass 500 according to an embodiment of the present invention;

FIGURE 4 is a schematic diagram illustrating the contents of an illustrative message packet 400 transmitted from the tag system 120 to the interro-

gator 300 according to an embodiment of the present invention;

FIGURE 5 is a schematic block diagram of a vehicle 100 including a tag system 120 and an external device 510 for identifying a dispenser according to an embodiment of the present invention ; and

FIGURE 6 is a schematic block diagram of a portion of system 10 illustrating tag system 120, interrogator 300 and external device 510 for identifying dispenser 600 according to an embodiment of the present invention.

[0011] In the Drawing, where an element or feature is shown in more than one drawing figure, the same alphanumeric designation may be used to designate such element or feature in each figure, and where a closely related or modified element is shown in a figure, the same alphanumeric designation primed may be used to designate the modified element or feature. Similarly, similar elements or features may be designated by like alphanumeric designations in different figures of the Drawing and with similar nomenclature in the specification, but in the Drawing are preceded by digits unique to the embodiment described. For example, a particular element may be designated as "xx" in one figure, by "1xx" in another figure, by "2xx" in another figure, and so on. It is noted that, according to common practice, the various features of the drawing are not to scale, and the dimensions of the various features are arbitrarily expanded or reduced for clarity.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Overview

[0012] FIGURE 1 shows a vehicle information system 10 including a tag system 120 mounted in a vehicle 100. The tag system 120 transmits vehicle-related data acquired from vehicle 100 and from external devices (shown in FIGURES 2, 3, 5 and 6) to interrogator 300. Vehicle information system 10 utilizes a data bus 110 (shown in FIGURES 2 and 5) in vehicle 100, which data bus 110 is typically part of vehicle 100 for control and monitoring of the operation thereof, with low-cost RF communications between tag system 120 and interrogator 300 to remotely access the vehicle-related data and data from the external device when the vehicle 100 is in a designated area 20. Interrogator 300 provides the data from vehicle 100 acquired through tag system 120 to host computer 320.

[0013] The vehicle-related data includes, for example, temperature, fluid levels, oil pressure, odometer, and other data related to the vehicle 100. Data from an external device includes, for example, heading data from an electronic compass, pump data from a fueling pump and other data as may be acquired or generated by a device external to tag system 120 of vehicle 100. Tag system 120 may also be used to read the status of

emissions-related and safety-related parameters without having to directly connect any equipment to the vehicle.

[0014] The tag system 120 includes an RF transmitter 210 (shown in FIGURES 3 and 6) for transmitting the vehicle-related data and the data from an external device 500 and the interrogator 300 includes an RF receiver 305 (shown in FIGURES 3 and 6) for receiving the vehicle-related data and the data from an external device 500. The complexity and cost of the tag system 120 and the interrogator 300 are reduced because neither includes circuitry and software to both transmit and receive data. In an alternative embodiment, tag system 120 and interrogator 300 may each include both a transmitter and a receiver for each both transmitting and receiving data.

[0015] Tag system 120 only monitors data transmitted on vehicle data bus 110 and, as a result, the control and operation of data bus 110 does not have to be modified to accommodate the tag system 120. In this way, the tag system 120 may be integrated into the vehicle 100 with minimal modification to the vehicle 100. Thus, the vehicle information system 10 is more likely to be accepted and incorporated into vehicles 100 by vehicle manufacturers. In an alternative embodiment, the tag system 120 may both receive data from data bus 110 and transmit data on data bus 110.

[0016] Vehicle information system 10 may be utilized in a variety of environments to remotely monitor vehicles. For example, the vehicle information system 10 may be used to determine the speed and/or direction of travel of a vehicle. In this case, the tag system 120 repeatedly transmits the speed and/or direction of travel along with the vehicle identification data of vehicle 100 as it travels along a road. An interrogator 300 positioned adjacent to the road or at an intersection receives the transmitted data for subsequent processing.

[0017] Alternatively, vehicle information system 10 may be used to monitor cars and/or trucks as they leave and/or arrive at a vehicle rental facility, vehicle service facility, central terminal or other facility. In this case, interrogator 300 may be located at access points, e.g., entrance/ingress and exit/egress points, to the facility to acquire data transmitted from tag systems 120 coupled to the car and/or truck. The host computer 320 or host system 320 utilizes the data acquired from the interrogator 300 to determine which cars and/or trucks have entered and exited the facility or are located at particular locations or stations within the facility.

[0018] FIGURE 1 shows a vehicle information system 10 including a tag system 120 mounted in an area of vehicle 100 not visible to the casual observer and not completely enclosed by metallic surfaces, for example, behind the dashboard in the passenger compartment, behind bumpers, or behind non-metallic body parts, or on the vehicle underside. Tag system 120 located in vehicle 100 intermittently transmits data, preferably in the form of message data packets 400 (shown in FIGURE

4). Interrogator 300 receives transmitted data message packets 400 when vehicle 100 is in the designated area 20 of interrogator 300. The size of designated area 20 may be adjusted by increasing or decreasing either the strength of the signal transmitted from tag system 120 or the sensitivity of the RF receiver 305 (shown in FIGURES 3 and 6) in interrogator 300, or by installing repeaters. Interrogator 300 has an antenna (not shown) that is oriented to define the orientation of area 20 with respect to interrogator 300 so that one or more message packets 400 transmitted from tag system 120 may be received by interrogator 300 when the vehicle 100 is in designated area 20. Interrogator 300 may be a hand held device or be permanently mounted. Interrogator 300 communicates with host computer 320 via a communication link, such as an RF link, electrical wires or cables, an optical fiber, or other convenient communication apparatus.

[0019] Host computer 320 utilizes the data transmitted by tag system 120 to signal and/or control a utilization device or system 30. The utilizations of system 10 include controlling traffic signals to give preference to emergency vehicles, tracking the fueling or other service device which a particular vehicle is using, monitoring and/or controlling vehicles in a truck depot or auto rental facility, and the like.

[0020] Host computer 320 determines whether the vehicle 100 "matches" predetermined criteria, for example, for purposes of setting traffic signals or authorizing vehicle fueling, based on the data transmitted from tag system 120 and information stored in host computer 320. Vehicle 100 matches if the stored data and the vehicle identification data are the same, such as by comparison to a stored look-up table. If there is a match, host computer 320 provides a signal to utilization system 30 to set the traffic signals or to allow vehicle 100 to receive fuel, as the case may be. If there is not a match, no action is taken or an attendant or supervisor may be alerted to investigate or otherwise take appropriate action.

[0021] In the embodiment wherein system 10 is utilized for controlling traffic signals to facilitate the preferential passage of fire trucks (shown in FIGURES 2 and 3), ambulances and other emergency vehicles, utilization system 30 is the traffic signal and controller which turns the signal "green" for the emergency vehicle and "red" for all other roads at the intersection. Interrogators 300 for such systems typically include antennas facing in particular directions, e.g., north, east, south and west, as indicated by compass indicia 22. In FIGURE 1, for example, area 20 might represent the reception pattern of a receiver connected to a south-facing antenna.

[0022] One problem with microwave frequency and other RF communications is that the signals bounce off, i.e. are reflected by, buildings and other fixed and/or mobile objects, and so may appear to come from a direction other than the true direction. This can occur, for example, due to multiple reflected signals arriving out of

phase at an intended receiver and in-phase at an unintended receiver. As a result, the RF signal from a vehicle approaching the intersection from a particular direction, e.g., south, may be received by an antenna/receiver of interrogator 300 and interpreted as if coming from another direction, e.g., east, due to one or more reflections of the RF signal, thereby to block the path of the emergency vehicle rather than give it priority.

[0023] This problem is overcome where external heading data is provided to tag system 120 to avoid any ambiguity regarding the direction in which the emergency vehicle is traveling. As described below, an external device 500 is an electronic compass that determines the direction of travel (or heading, as in compass heading) of the emergency vehicle and provides that information to tag system 120 which transmits the heading information. Interrogator 300 receives the signal from tag system 300 including the heading information and communicates same to host computer 320 which utilizes the heading information to determine which state the traffic signal 30 should be put into to give priority to the direction from which the emergency vehicle is approaching.

[0024] In the embodiment wherein system 10 is utilized for tracking the fueling or other service device to which a particular vehicle is using (shown in FIGURES 5 and 6), utilization device 30 might be a computer utilized for authorizing service, such as fueling, or for billing, inventory control or other function. Such arrangement might be utilized with commercial as well as privately-owned vehicles, for example, in a car rental facility, a truck depot, or a gas station. When a vehicle 100 having an RF tag system 120 is within the area 20 that is the facility, interrogator 300 detects its presence from its transmitted signal and signals same to host computer 320 which authorizes the dispensing of fuel or other service based on an appropriate approval protocol.

[0025] Problems of theft, unauthorized fueling, inaccurate billing and the like that might arise in facilities can be lessened, if not eliminated, by definitively and accurately associating a particular service dispenser with a particular vehicle 100, especially where the facility includes multiple service dispensers. An RF link between the vehicle and service dispenser, such as a fuel dispenser, could be implemented relatively simply, for example, in like manner to the identification between tag system 120 and interrogator 300. However, in an environment where there is likely to be multiple RF transmitters (e.g., multiple RF tag systems), the likelihood of signal interference and transmission collision increases rapidly as the number of vehicles increases. In a trucking facility or car rental facility, especially one located near an airport or other installation that in itself produces many RF emanations such as from radars, tower communications, and ground communications, the RF problems could be serious.

[0026] This problem is at least mitigated, if not overcome, where external data from the service dispenser is coupled to an external data sensor 510 on the vehicle

by other than RF communication. For example, where the service dispenser is a fuel dispenser (e.g., fueling pump 600 in FIGURES 5 and 6), dispenser identification information is coupled to vehicle 100 through the fueling hose of the pump being placed in a fuel filler opening in the vehicle. While such information coupling could be by electrical signals transmitted through wires in the fueling hose to contacts in the vehicle filler pipe, the danger of fire or explosion renders such approaches undesirable. Couplings in the vehicle other than contacts could include a pair of induction coils, one in nozzle 616 and the other in filler pipe 132 surrounding nozzle 616 when nozzle 616 is inserted in filler pipe 132, but that still requires electrical wires in fuel hose 614.

[0027] Accordingly, a transmitting acoustic transducer in the fueling pump transmits the pump identification information acoustically through the fueling hose and/or the fuel therein to a sensor in the vehicle that includes a receiving acoustic transducer. It is noted that such acoustic transmission system is inherently safe because the acoustic transducers and signal pose no danger of fuel ignition, either at the transmitter in the fuel dispenser or at the receiver in the vehicle, and there are no electrical wires in the fuel hose or in other fuel passages. Such acoustic system also avoids the reliability issues where electrical wires are embedded in a flexible hose and must pass through or around swivels, couplings and other plumbing components.

[0028] An embodiment that inserts heading information as external data into the RF tag system 120 of an emergency vehicle 100, as for giving priority to such vehicle, is described in relation to FIGURES 2, 3 and 4. It is noted that while a wide variety of different RF tag systems and interrogators could be employed in embodiments of the present invention, the tag system and interrogator described in U.S. Patent No. 5,974,386, are thought to be well suited and the descriptions herein are based upon such system.

[0029] In FIGURE 2, vehicle 100 includes vehicle data bus 110 that is used to transmit data between various vehicle components, such as fuel tank system 130, instrument panel 140, and other vehicle modules 150, and vehicle computer 160. Module 150 is, for example, an interface with other vehicle components of vehicle 100, such as the engine (not shown). Vehicle computer 160 may be, for example, the body or engine computer in the vehicle 100.

[0030] Data is provided to and retrieved from data bus 110 (as indicated by double-ended arrows) in accordance with a data standard, for example, a vehicle data bus standard such as the Society of Automotive Engineers (SAE) J1850 standard or the Controller Area Network (CAN) standard. SAE J1850 standard defines an electrical and data protocol for transmitting and receiving data via data bus 110 between and/or among the components coupled to data bus 110, such as fuel tank system 130, instrument panel 140, module 150, and vehicle computer 160.

[0031] Data bus 110 and the vehicle components coupled thereto are designed to ensure the reliable transmission of vehicle data, and the addition of other components that transmit data on data bus 110 may require modification of the operation of the vehicle components or substantial modification of data bus 110, or both, to ensure reliable data transmission. Thus it may not be advantageous to provide additional components that transmit data via data bus 110.

[0032] Tag system 120 avoids these problems because it only monitors the data (as indicated by a single-ended arrow from data bus 110) that is transmitted by the vehicle components on data bus 110, and may be coupled to data bus 110 by, for example, crimping a connector on the wire or wires forming data bus 110. Data bus 110 may be, for example, as simple as a single wire loop. Because neither the vehicle components nor data bus 110 need be modified, tag system 120 may be integrated with minimal modification of the vehicle 100, and so vehicle manufacturers may be more willing to incorporate tag system 120 into vehicle 100. As a result, the installation costs of tag system 120 are minimized. Alternatively, tag system 120 may transmit data via data bus 110.

[0033] In an embodiment of the invention, an external data source provides external data unrelated to vehicle data to tag system 120. An external data source is typically an external device, such as electronic compass 500. Electronic compass 500 is preferably a low-cost device that is mounted to vehicle 100 in a predetermined orientation so as to determine the vehicle's heading. One suitable such electronic compass is the model Vector 2X available from Precision Navigation, located in Santa Rosa, California. Electronic compass 500 preferably generates a serial data stream that contains calibrated heading information for vehicle 100. While an electronic compass is preferred because of its small size, low operating power and low cost, other external devices, such as a gyroscope, a magnetic compass, a GPS receiver and the like, could also be utilized to provide the same or similar heading information.

[0034] Circuitry and interfaces utilized for providing vehicle-related data to tag system 120 are known, for example, as described in U.S. Patent No. 5,974,368 regarding fuel system 130, instrument panel 140, module 150, computer 160, and data relating to the odometer reading or from a wheel sensor. Tag system 120 is powered by vehicle battery 170 and may also transmit battery voltage information.

[0035] In FIGURE 3, tag system 120 includes processor 205 that is coupled to receive data from interface 200, to control and receive data from A/D converter 215, and provide data to RF transmitter 210 for transmission. Interface 200 is coupled to receive external data from external device, such as heading data from electronic compass 500 and to couple such data to processor 205. In addition, interface 200 is, for example, compliant with the SAE J1850 standard to provide an interface be-

tween tag system 120 and vehicle data bus 110 to only retrieve data from bus 110. Data that is transmitted on data bus 110 by the vehicle components coupled thereto typically includes component identification data and parametric data related to the vehicle component and/or its operation, which data is often contained in one or more data packets. Alternatively, interface 200 may also provide data to data bus 110.

[0036] The data acquired from electronic compass 500 and from data bus 110 is provided to processor 205 which is, for example, a microprocessor or microcontroller. Interface 200 and processor 205 may be separate components or may be combined as a single component. One such combined component is integrated circuit part number MC68HC05V7 available from Motorola, Inc. located in Scottsdale, Arizona, which circuit is compatible, for example, with General Motors automobiles compliant with the SAE J1850 standard. Operation of processor 205 is known, for example, as described in U.S. Patent No. 5,974,368, and includes providing data to RF transmitter 210 for modulation and transmission.

[0037] Processor 205 may also receive data from analog-to-digital (A/D) converter 215 which is coupled directly to a component that produces analog data, such as an analog data output 502 of electronic compass 500 (data path indicated by dashed arrow), or to an analog component of vehicle 100 such as a fuel-level sensing potentiometer or a temperature-sensing resistance. Alternatively, processor 205 may receive digital data directly from digital components, such as a digital data output 504 of electronic compass 500 (data path indicated by dashed arrow), or from a digital component in vehicle 100, i.e. data not requiring conversion by A/D converter 215. Thus, processor 205 may receive digital data at a data bus input 206 from data bus 110 via interface 200, at an "analog" input 207 from an analog source converted to digital format by A/D converter 215, and at a digital input 208 from a source of digital data in suitable format.

[0038] Processor 205 produces a message data packet 400, such as that shown in FIGURE 4, and controls and modulates RF transmitter 210 to transmit message packet 400, such as by turning transmitter 210 on and off, as is known. RF transmitter 210 is, for example, an AM surface acoustic wave (SAW) transmitter.

[0039] The message packet 400 transmitted by tag system 120 via RF link 225 is received by interrogator 300 which includes an RF receiver 305 that receives transmitted message packet 400. The received message packet 400 from receiver 305 is provided to demodulator 310 which demodulates received message packet 400 and couples the demodulated data to processor 315. Processor 315 processes and converts the received message packet data to a form suitable for host computer 320.

[0040] RF link 225 between tag system 120 and interrogator 300 may be implemented using either "active"

or "semi-active" transmission technology. In active transmission systems, battery 170 powers all of tag system 120 continually to produce continuous, or at least periodic, transmissions. In a semi-active transmission system, battery 170 powers all of tag system 120 except for transmitter 210, and message packets 400 are transmitted between transmitter 210 and interrogator 300 via "passive backscatter." In passive backscatter, a continuous wave is transmitted by interrogator 300, which is passively modulated and reflected back to interrogator 300 by tag system 120, as is known.

[0041] A format for a message packet or data packet 400 containing several different types of data is shown in FIGURE 4. Message packet 400 includes a data type field 405 that indicates what type of data is contained in the packet and a sequence data field 410 that indicates whether the message packet 400 is a single message packet or one of a sequence of related message packets. In the latter case, sequence data field 410 indicates the position of each message packet 400 in the sequence of related message packets. Related message packets 400 may be utilized to reduce the size of each message packet, thereby to reduce the likelihood of data packet transmission collisions and interference among transmissions from a number of different tag systems 120. Data packet 400 includes, for example, vehicle identification data (VID) field 415, such as a vehicle identification number (VIN), that uniquely identifies vehicle 100 so that interrogator 300 and/or host computer 320 can associate each message packet with other message packets from the same vehicle. The message packet 400 may also include vehicle-related data fields such as fuel data field 420 indicating the fuel level in the fuel tank and odometer data field 425 indicating the odometer reading.

[0042] Extra data field 430 is contained in message packet 400 for providing data from the external data source, such as from electronic compass 500, to interrogator 300 and host computer 320 via tag system 120. Message packet 400 also includes an error correction code 435, which is, for example, a cyclic redundancy code (CRC).

[0043] FIGURE 5 is a schematic block diagram of a vehicle 100 including a tag system 120 and an external device 510 for identifying a dispenser according to an embodiment of the present invention. Vehicle 100 includes vehicle data bus 110 that is used to transmit data between various vehicle components, such as fuel tank system 130, instrument panel 140, other vehicle modules 150, and vehicle computer 160, and data is provided to and retrieved from data bus 110 (as indicated by double-ended arrows) in accordance with a data standard, all as described above in relation to FIGURE 2.

[0044] Vehicle 100 is moved near to fuel dispenser 600 to be fueled. Dispenser 600 includes a fuel pump 610 that pumps fuel through outlet pipe 612 and hose 614 to fuel nozzle 616, as is conventional. Actuating a valve in nozzle 616 causes fuel to flow from nozzle 616

into fuel filler pipe 132 of vehicle 100 and thence into fuel tank 130, as is conventional. During fueling, fuel is present in outlet pipe 612, hose 614 and filler pipe 132. Thus, in general, fuel dispenser 600 represents a service dispenser and filler pipe 132 represents a service receiver on vehicle 100.

[0045] According to an embodiment of the invention, external data 510 provides external data unrelated to vehicle data, such as identification data or other data relating to fuel dispenser 600 or other service facility, to tag system 120. External data source 510 is, for example, a source of signals relating to such service facility or service device, such as the fuel dispenser 600 that is used to fuel vehicle 100. Dispenser 600 includes a source 620 of pump identification information, for example, a uniquely coded digital word contained in an electronic memory such as a read-only-memory or a set of switches. Tone encoder 630 receives the pump-identifying digital word and encodes the pump identification as a sequence of tones, for example, as a sequence of audio frequency tones. In addition, encoder 630 may modulate the sequence of tones on a carrier signal, thereby producing a uniquely-coded audio-frequency electrical signal containing the pump identifying information.

[0046] The coded electrical signal is provided to transmitting acoustic transducer 640 which is coupled 642 to outlet pipe 612 or to another fuel passage of dispenser 600 to transmit into the fuel therein an audio-frequency acoustic signal containing the pump information. The acoustic signal propagates through the fuel, i.e. through the column of fuel in outlet pipe 612, hose 614 and nozzle 616, to fuel filler pipe 132 of vehicle 100. External device 510 includes receiving acoustic transducer 520 that is coupled 512 to vehicle fuel filler pipe 132 to receive the acoustic signal, i.e. the coded audio tones, from the fuel therein. Device 510 includes a sensor 520 that converts the sequence of audio tones to an electrical tone signal and a tone decoder 630 that decodes the sequence of electrical tones to a digital electronic signal, such as a serial digital word, that is applied to tag system 120. Tag system 120 transmits the serial digital word representing the pump identification information to interrogator 300.

[0047] FIGURE 6 is a schematic block diagram of a portion of system 10 illustrating tag system 120, interrogator 300 and external device 510 for identifying dispenser 600 according to an embodiment of the present invention. Tag system 120 includes processor 205 that is coupled to receive data from interface 200, to control and receive data from A/D converter 215, and provide data to RF transmitter 210 for transmission, all as described above in relation to FIGURE 3. Interface 200 is coupled to receive external data from external device 510, such as pump identification data from dispenser 600 in the form of a digital word produced by sensor/tone decoder 510, and to couple such data to processor 205. Alternatively, sensor/tone decoder 510 may pro-

duce at an output 514 a digital word representative of dispenser 600 identification in a form compatible with a digital input to processor 205 and apply such digital word directly thereto.

[0048] The message packet 400 transmitted by tag system 120 to interrogator 300, which may be at any convenient location within the fueling or service facility, is processed by host computer 320 to relate the vehicle identification data and pump identification data from tag system 120, such as for confirming authorization of the sale, billing the correct customer, maintaining fueling and/or inventory records, and the like. It is noted that if nozzle 616 is removed from filler pipe 132 of vehicle 100, the pump identification information in the data packets 400 transmitted by tag system 120 will be interrupted, such interruption can be utilized to interrupt or stop the pumping of fuel by dispenser 600, thereby preventing fueling to be resumed in another vehicle (unauthorized fueling or theft) and/or limiting spillage and the fire hazard and potential environmental damage that could result.

[0049] Acoustic transducers for transmitting acoustic signals into a liquid and for sensing acoustic signals from a liquid are widely available and are utilized in many commercial devices, such as "sonar" fish finders and depth gauges for baits, and for ultra-sound medical devices and the like. Such devices are attached to fuel outlet pipe 612 and fuel filler pipe 132 in convenient locations in accordance with standard attachment and/or mounting practices. While the coded signals are described as audio-frequency tones, coded signals in other frequency ranges, such as ultrasonic frequencies, and coding other than tone coding, may be employed.

[0050] The system as described may be utilized for signaling and/or communication between the service dispensing station 600 and the vehicle 100. A vehicle service dispenser system may comprise, for example, a service dispenser 600 external to a vehicle 100 that includes a source 620 of service dispenser information and a transducer 640 for transmitting the service dispenser information, such as by an acoustic transducer 640 coupled to a fueling hose 614. The fueling hose 614 couples the vehicle 100 to the service dispenser 600 for receiving service therefrom. On the vehicle 100, a sensor 510 such as an acoustic transducer 520 is adapted to receive the service dispenser information from the service dispenser 600 external to the vehicle 100 via a coupling means, e.g., the fuel hose 614. Also on the vehicle 100, means coupled to the sensor 510 is responsive to at least the service dispenser information for utilizing the service dispenser information. The sensor 510 includes a first transducer of a given kind and the service dispenser 600 includes a second transducer of the same kind, for example, an acoustic transducer 520 in the sensor 510 coupled to a fluid system 130, 132 of the vehicle 100 and an acoustic transducer 640 in the service dispenser 600 coupled to a fluid passage 612 of the service dispenser 600. The service dispenser informa-

tion may include identification information, and means in the vehicle 120, 140, 150, 160 may utilize the service dispenser information, for example, for at least one of authentication, billing, theft prevention, spill limiting, verifying proper service, and inventorying (i.e. making an inventory). In like manner, the acoustic transducer 520 in the vehicle 100 may signal or communicate information to the acoustic transducer 640 in the service dispenser 600 and means in the service dispenser may utilize the received information, for example, for at least one of authentication, billing, theft prevention, spill limiting, verifying proper service, and inventorying. For example, such information exchanged between a vehicle and a fuel dispenser may relate to fuel type, octane rating, credit/billing data, vehicle fleet or ownership, various alarms or alerts, applicable discounts, and the like.

[0051] Various techniques for apportioning the bytes of data in a message packet and for reducing message packet collisions and transmission interference are known, e.g., as disclosed in U.S. Patent No. 5,974,368. While the description herein has generally referred to a "tag" system 120, it is noted that the function of system 120 may be embodied in a tag that is connected to vehicle 100, or be embodied in a part of vehicle 100, either as a separate vehicle component or as part of another vehicle component.

[0052] While the present invention has been described in terms of the foregoing illustrative embodiments, variations of the present invention will be apparent to those skilled in the art. For example, in a tag system transmitting a sequence of related data packets or message packets, additional data from one or more external data sources, for example, heading data, GPS data or pump identification data, may be inserted on a rotating basis into any data field including data field 430. In addition, additional data regarding vehicle 100, for example, engine status data or air-bag activation of other collision data, may be transmitted on a rotating basis in fields 420, 425.

[0053] In addition, RF link 225 may provide either one-way (only from tag system 120 to interrogator 300) or two-way communication. A one-way link 225 provides a monitoring function where the tag system 120 transmits current external data, e.g., heading or fueling station information, and current condition of all monitored parameters of vehicle 100, as described above. A two-way link 225 allows interrogator 300 to send messages to tag system 120 to either command or control tag system 120 to monitor certain parameters, or to pass parameters to external data source 500 or to systems in vehicle 100. In the latter case, link 225 may provide the means to remotely perform certain functions, such as to control the sensitivity of electronic compass 500 or to control fueling station 600, as well as to control vehicle 100 systems, such as to lock/unlock doors and monitor/adjust emission control sensors and other systems.

[0054] Similarly, the acoustic coupling link 510, 614, 640 may provide either one-way (only from dispenser

600 to tag system 120) or two-way communication. A one-way link provides a monitoring function where the tag system 120 receives current external data, e.g., pump identification or other fueling station information, and current condition of all monitored parameters of vehicle 100, as described above. A two-way link allows dispenser 600 to send messages to tag system 120 to either command or control tag system 120 to monitor certain parameters, or to pass parameters to vehicle 100 and/or to interrogator 300 and/or utilization system 30 or to systems in vehicle 100. In the latter case, a two-way link provides the means for tag system 120 to send vehicle information to dispenser 600, such as fuel type and octane requirements, credit card or billing information or other control or monitoring information.

[0055] Vehicles as used herein may include not only cars and trucks, but also trains, boats, airplanes and any other movable object for which heading information or service facility information is desired. Similarly, a service facility may be a fuel dispensing facility, such as a gas station, or any other facility or station that provides one or more fluids for a vehicle. Embodiments of the invention are thus useful with any service dispenser and a corresponding service receiver on a vehicle.

Claims

1. A data system for a vehicle comprising:
 - at least one source of vehicle-related data;
 - at least one source of external data not related to vehicle data; and
 - a transmitter coupled to each of said sources for receiving the vehicle-related data and the external data therefrom, said transmitter transmitting the vehicle-related data and the external data.
2. The data system of claim 1 wherein said at least one source of external data includes at least one of an electronic compass and an acoustic transducer.
3. The data system of claim 1, wherein source of external data includes an acoustic transducer coupled to the fuel system of the vehicle.
4. The data system of claim 1, 2 or 3, wherein said transmitter is coupled to each of said sources by a processor, said processor including at least one of an analog input, a data bus input and a digital input for receiving at least one of the vehicle-related data and the external data.
5. The data system of claim 1, 2, 3 or 4, in combination with a service facility including a source of identification information, wherein said at least one source of external data receives identification information

from said source of identification information.

6. A data system for a vehicle comprising:

on the vehicle, at least one source of vehicle-
related data; 5
on the vehicle, at least one source of external
data not related to vehicle data;
a transmitter on the vehicle coupled to each of
said sources for receiving the vehicle-related 10
data and the external data therefrom, said
transmitter transmitting the vehicle-related da-
ta and the external data;
an interrogator receiving the vehicle-related 15
data and the external data from said transmit-
ter;
a utilization system coupled to said interrogator
and responsive to at least the external data.

7. The data system of claim 6 wherein said at least 20
one source of external data includes a source of
heading information, and wherein said utilization
system is responsive to the heading information.

8. The data system of claim 6 or 7, wherein said at 25
least one source of external data is adapted to re-
ceive information from a service dispenser and
wherein said utilization system is responsive to the
service dispenser information.

30

9. A vehicle service dispenser system comprising:

a service dispenser external to a vehicle, said
service dispenser including a source of service
dispenser information and a transducer for 35
transmitting and/or receiving service informa-
tion including the service dispenser informa-
tion;
coupling means coupling the vehicle to the
service dispenser for receiving service and for 40
coupling service information;
on the vehicle, a sensor adapted to receive and/
or transmit service information with said service
dispenser external to the vehicle via the cou-
pling means; and 45
means coupled to at least one of said sensor
and said transducer for utilizing the service in-
formation.

10. The system of claim 9 wherein said sensor includes 50
an acoustic transducer coupled to a fluid system of
the vehicle and wherein the service dispenser in-
cludes an acoustic device coupled to a fluid pas-
sage of the service dispenser.

55

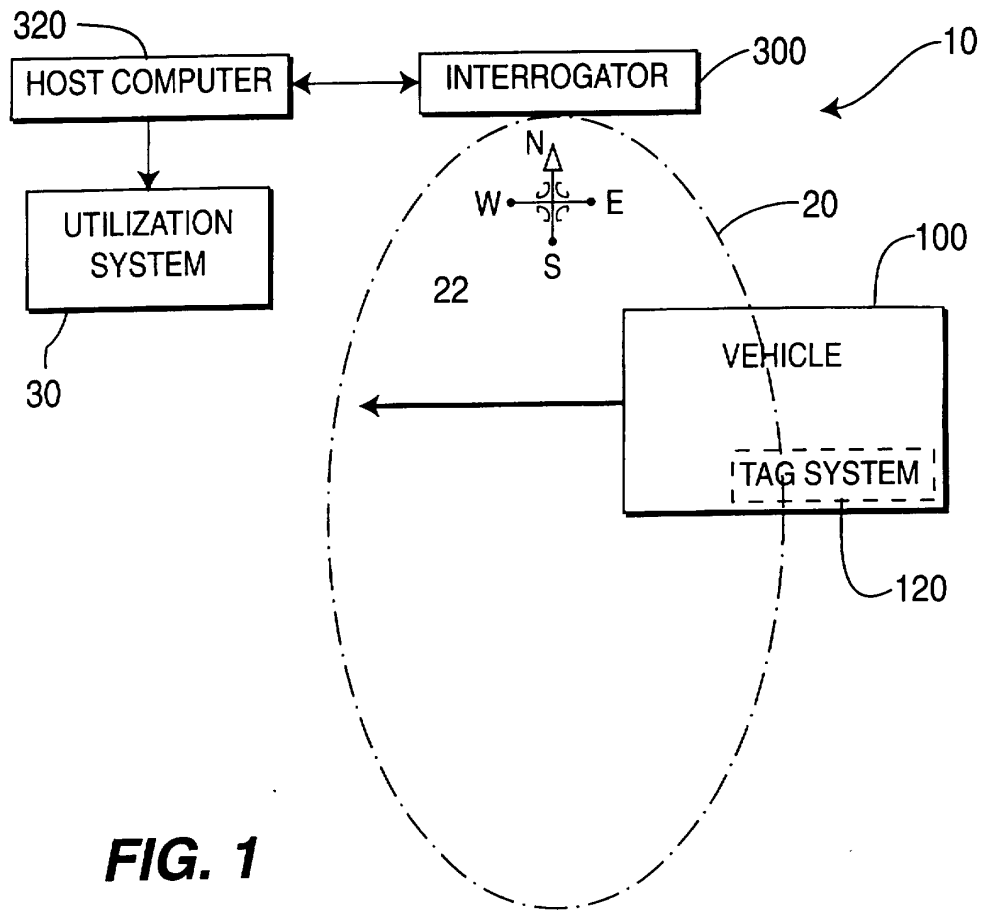


FIG. 1

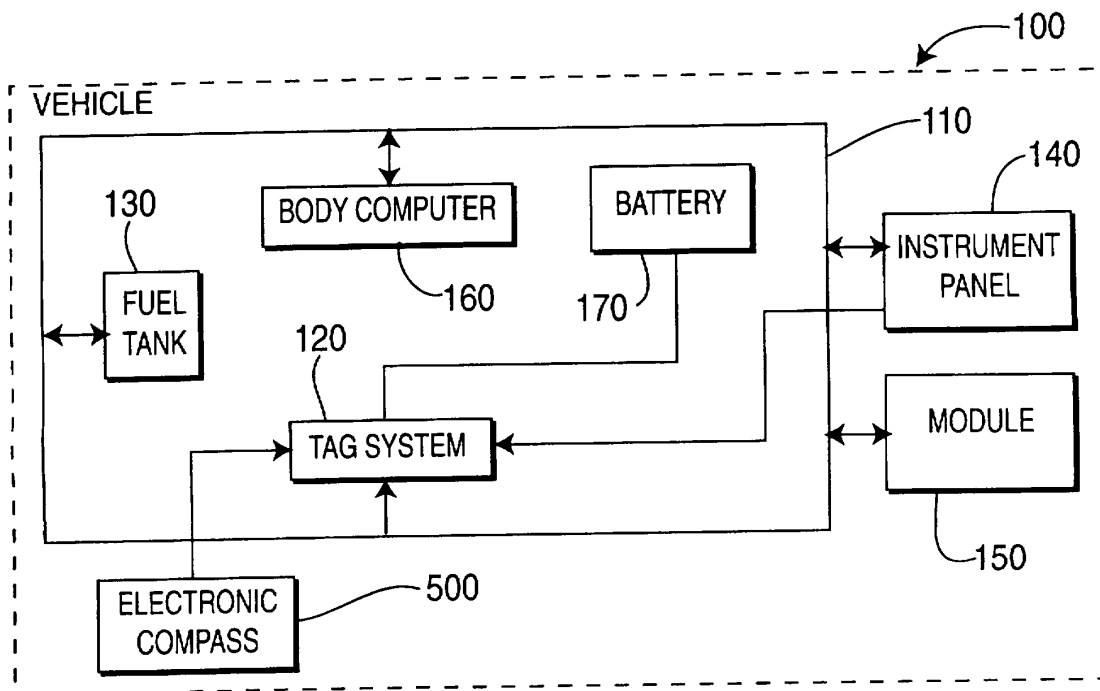


FIG. 2

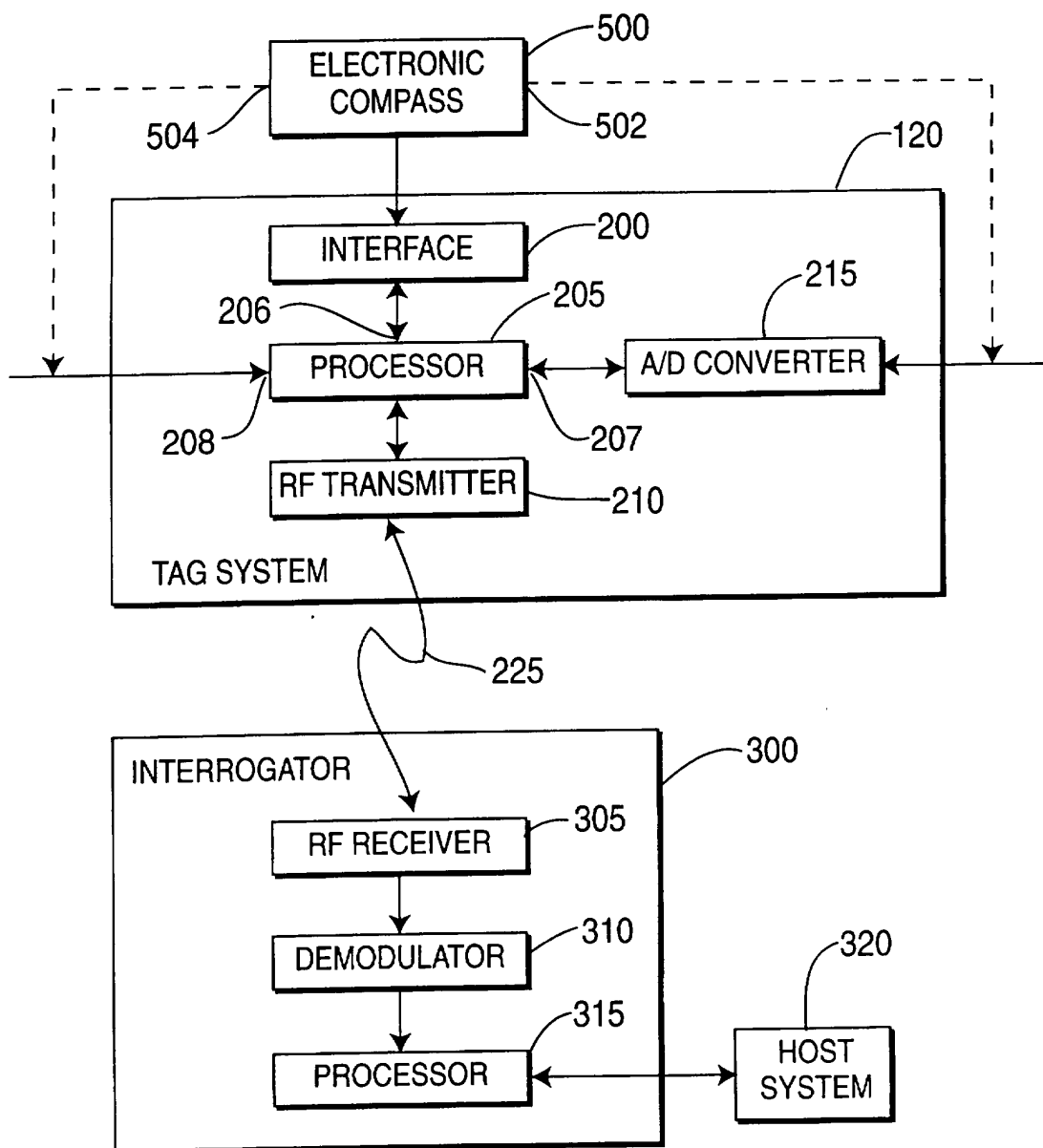


FIG. 3

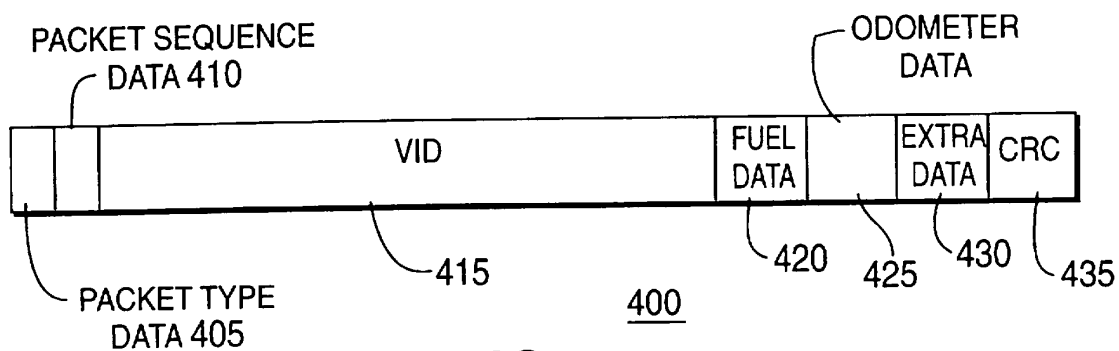
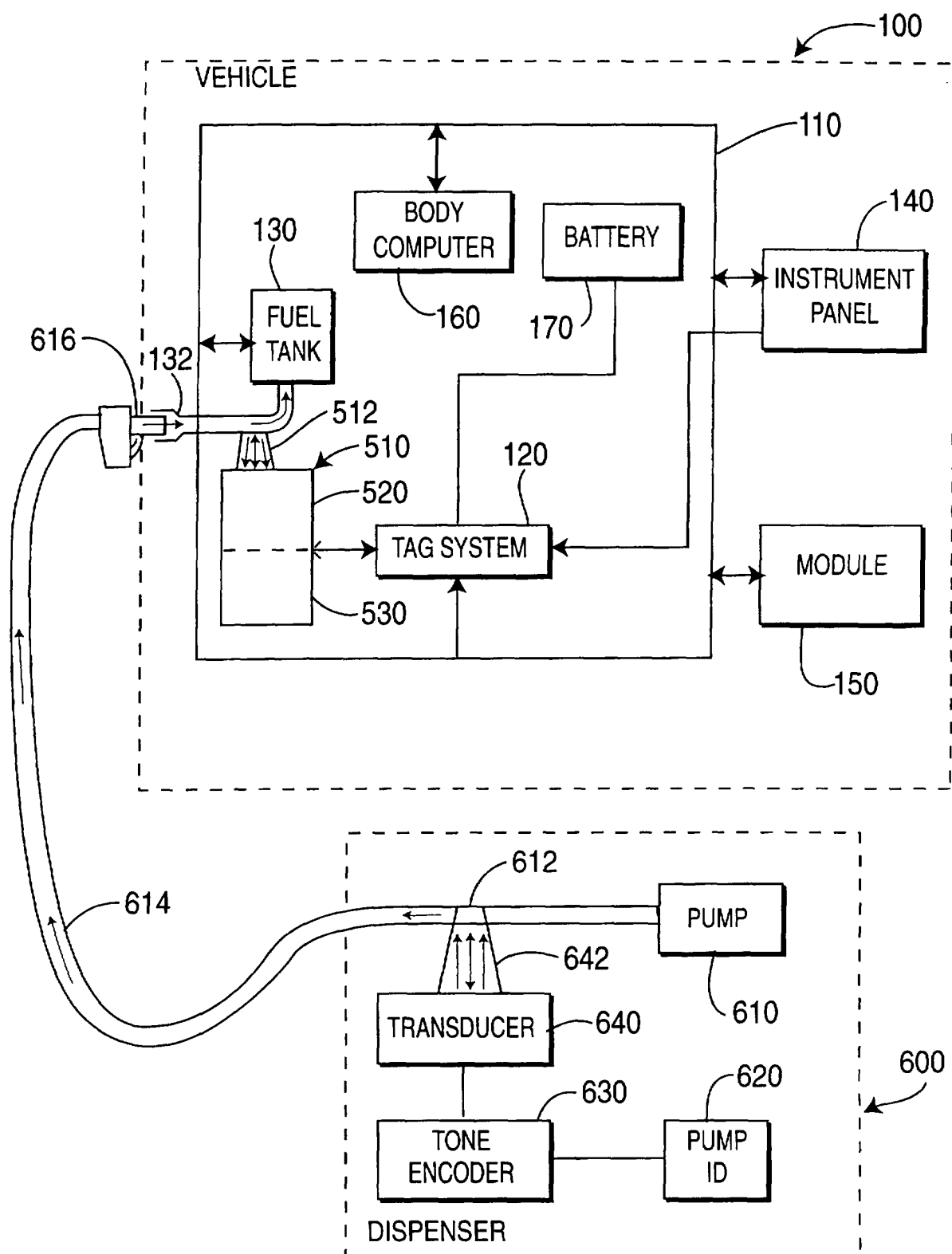
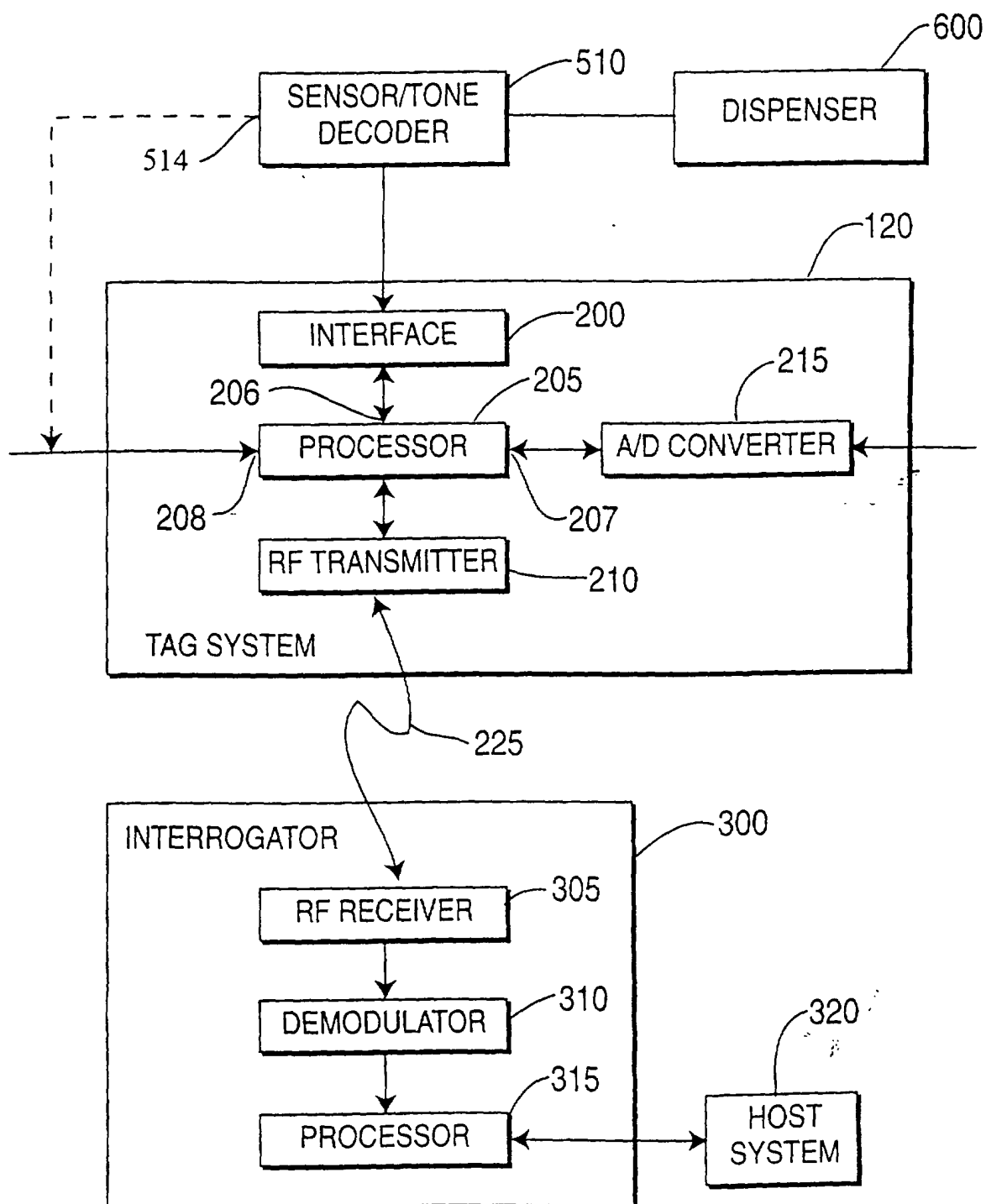


FIG. 4

**FIG. 5**

**FIG. 6**



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 7044

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 4 831 539 A (HAGENBUCH LEROY G) 16 May 1989 (1989-05-16) * abstract * * column 2, line 5 - line 58 * * column 15, line 56 - line 68 * * claim 6 * ---	1,2,6,7	G07C5/00
Y	WO 97 21626 A (GILBARCO LTD) 19 June 1997 (1997-06-19) * page 3, paragraph 4 - page 5, paragraph 1 * * page 8, paragraph 3 * ---	1-9	
Y	US 5 825 283 A (CAMHI ELIE) 20 October 1998 (1998-10-20) * abstract * * page 12, line 38 - page 13, line 3 * * page 16, line 33 - page 17, line 35 * ---	1-9	
A	DE 198 52 814 A (CONTINENTAL TEVES AG & CO OHG) 2 June 1999 (1999-06-02) * the whole document * -----	1-10	TECHNICAL FIELDS SEARCHED (Int.Cl.7) G07C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 November 2000	Examiner Teutloff, H
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			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 30 7044

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-11-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4831539 A	16-05-1989	US 4630227 A	16-12-1986
		AU 611636 B	20-06-1991
		AU 7414287 A	17-12-1987
		CA 1302567 A	02-06-1992
		DE 3789730 D	09-06-1994
		DE 3789730 T	08-09-1994
		EP 0249487 A	16-12-1987
		US 5995888 A	30-11-1999
		US 5327347 A	05-07-1994
		US 5416706 A	16-05-1995
		US 5528499 A	18-06-1996
		US 5650930 A	22-07-1997
		US 5650928 A	22-07-1997
		US 5742914 A	21-04-1998
		US 5631832 A	20-05-1997
		US 5644489 A	01-07-1997
		US 5631835 A	20-05-1997
		AT 37829 T	15-10-1988
		AU 599568 B	26-07-1990
		AU 4164485 A	31-10-1985
		CA 1255797 A	13-06-1989
		DE 3565498 D	17-11-1988
		EP 0162608 A	27-11-1985
		IN 164712 A	13-05-1989
		IN 167750 A	15-12-1990
		JP 61028826 A	08-02-1986
		US 4839835 A	13-06-1989
		US 4845648 A	04-07-1989
		ZA 8503133 A	30-12-1987
WO 9721626 A	19-06-1997	AU 1102897 A	03-07-1997
		EP 1038830 A	27-09-2000
		EP 0868393 A	07-10-1998
		US 5956259 A	21-09-1999
US 5825283 A	20-10-1998	NONE	
DE 19852814 A	02-06-1999	WO 9928159 A	10-06-1999

EPO FORM P0459

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