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(54) **MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM FOR READING FROM A DATA BUS AND ASSOCIATED METHODS**

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(51) Int. Cl.⁷ **B60R 25/10**

(52) U.S. Cl. **340/426.1**; 340/426.13; 340/426.14; 340/426.17; 307/10.3; 307/10.6; 180/287

(58) **Field of Search** 340/426.1, 425.5, 340/439, 825.36, 825.37, 825.69, 426.13, 426.14, 426.16, 426.17; 307/10.2, 10.3, 10.4, 10.5, 10.6; 180/167, 287

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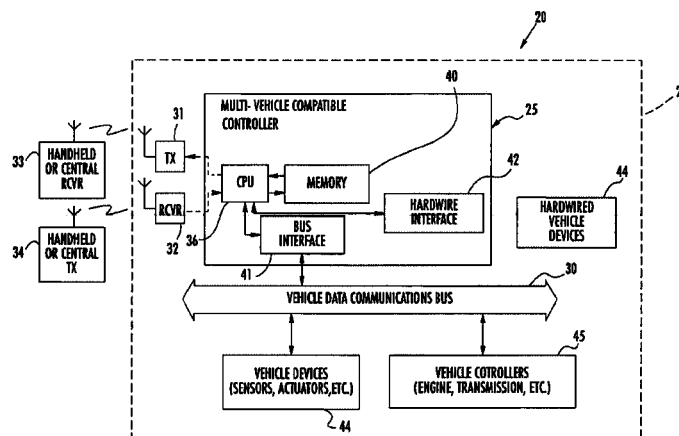
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(57) **ABSTRACT**

A control system includes a transmitter, a receiver for receiving signals from the transmitter, and a multi-vehicle compatible controller cooperating with the transmitter and receiver. The multi-vehicle compatible controller is for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from a data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus. The multi-vehicle compatible controller may include a memory for the stored device codes, and a processor cooperating with the memory for determining the match between the read device code and the stored device codes. The approach is useful for a number of vehicle remote control functions including vehicle security, remote keyless entry and remote starting. The multi-vehicle compatibility concept is also extended to an adaptor device which can be used in combination with a conventional remote function controller.

44 Claims, 8 Drawing Sheets



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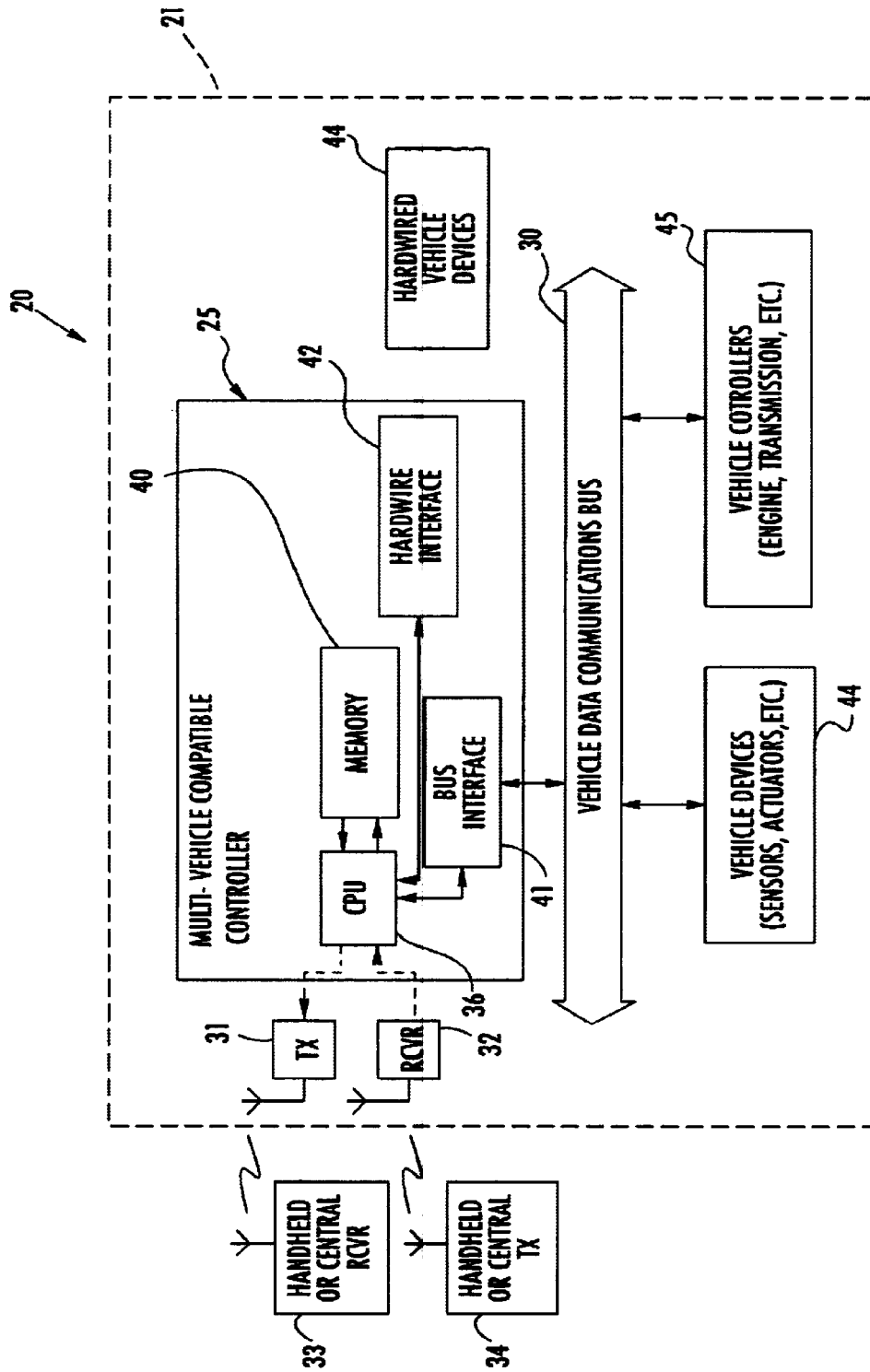


FIG. 1

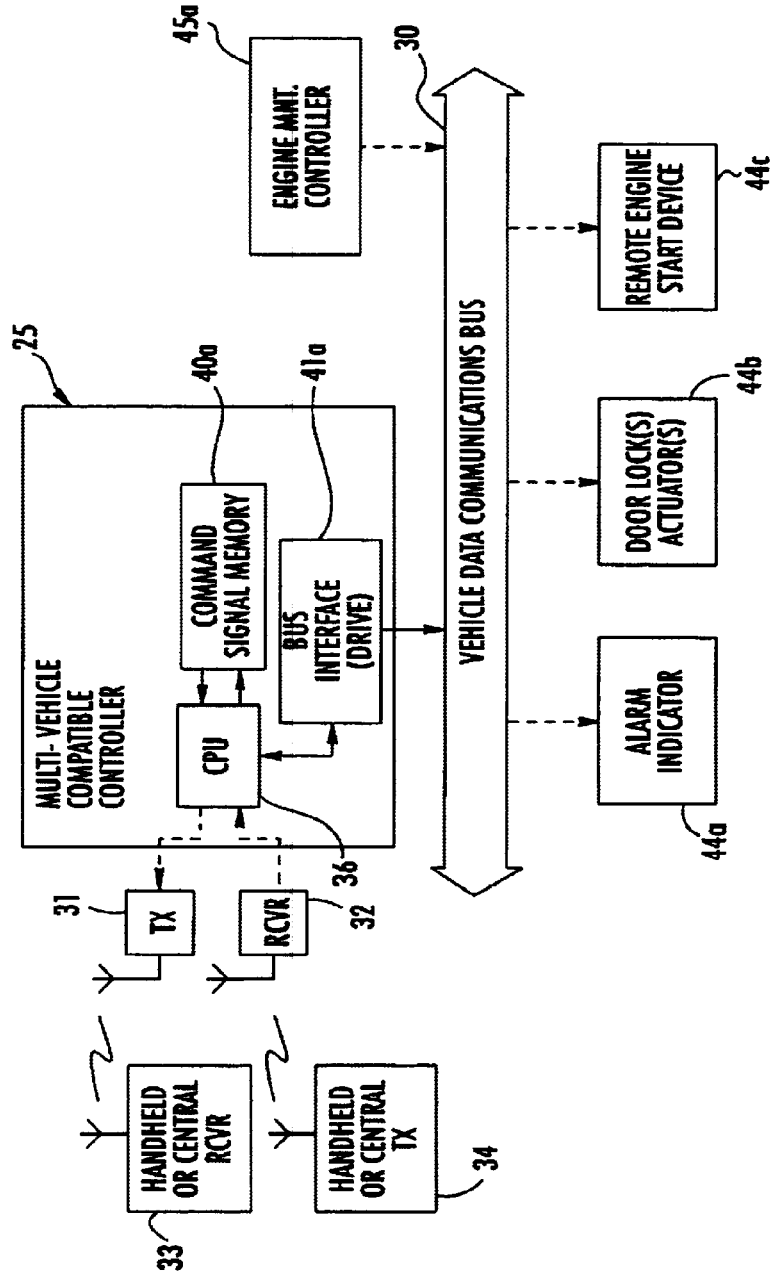
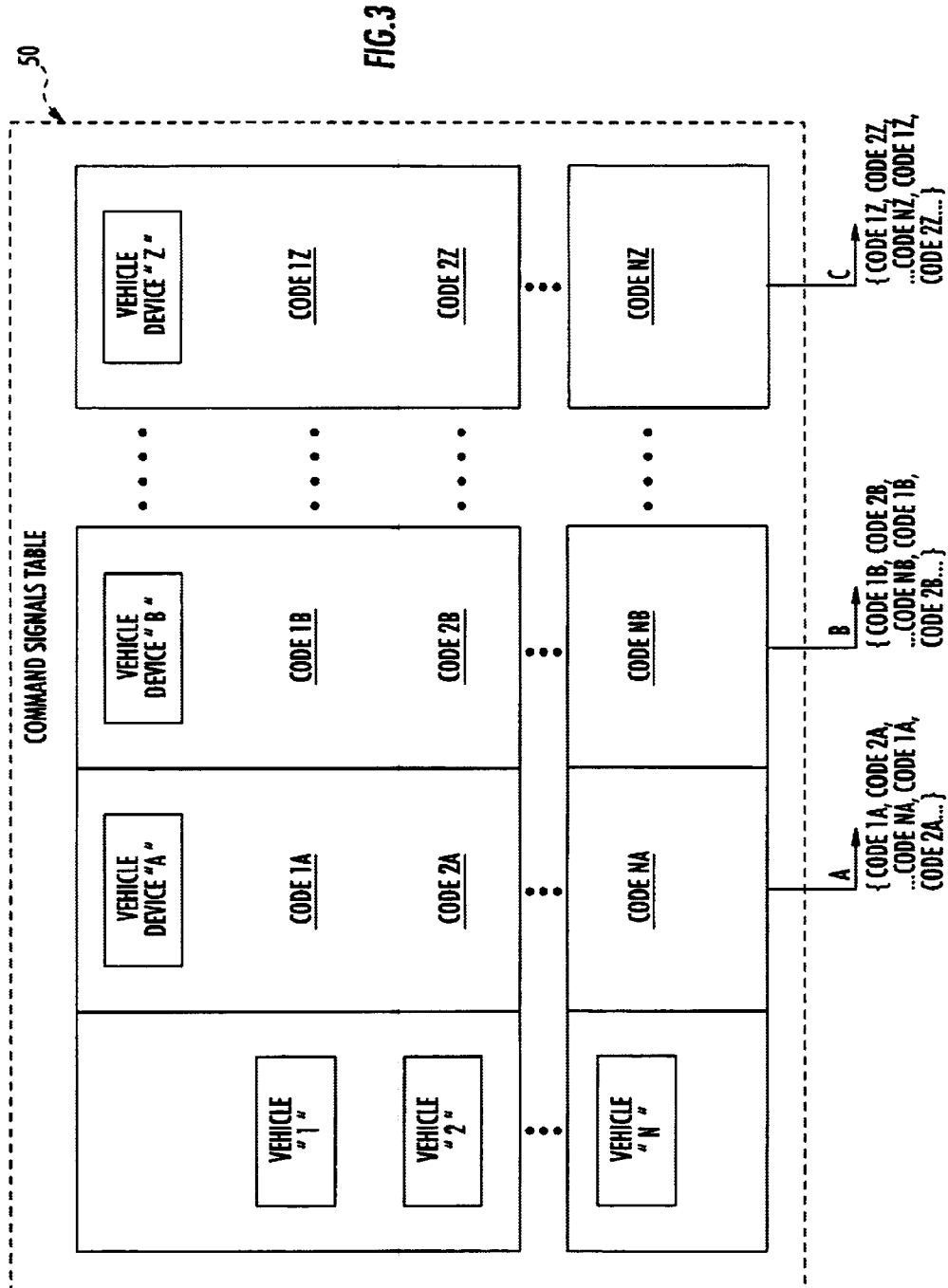


FIG. 2



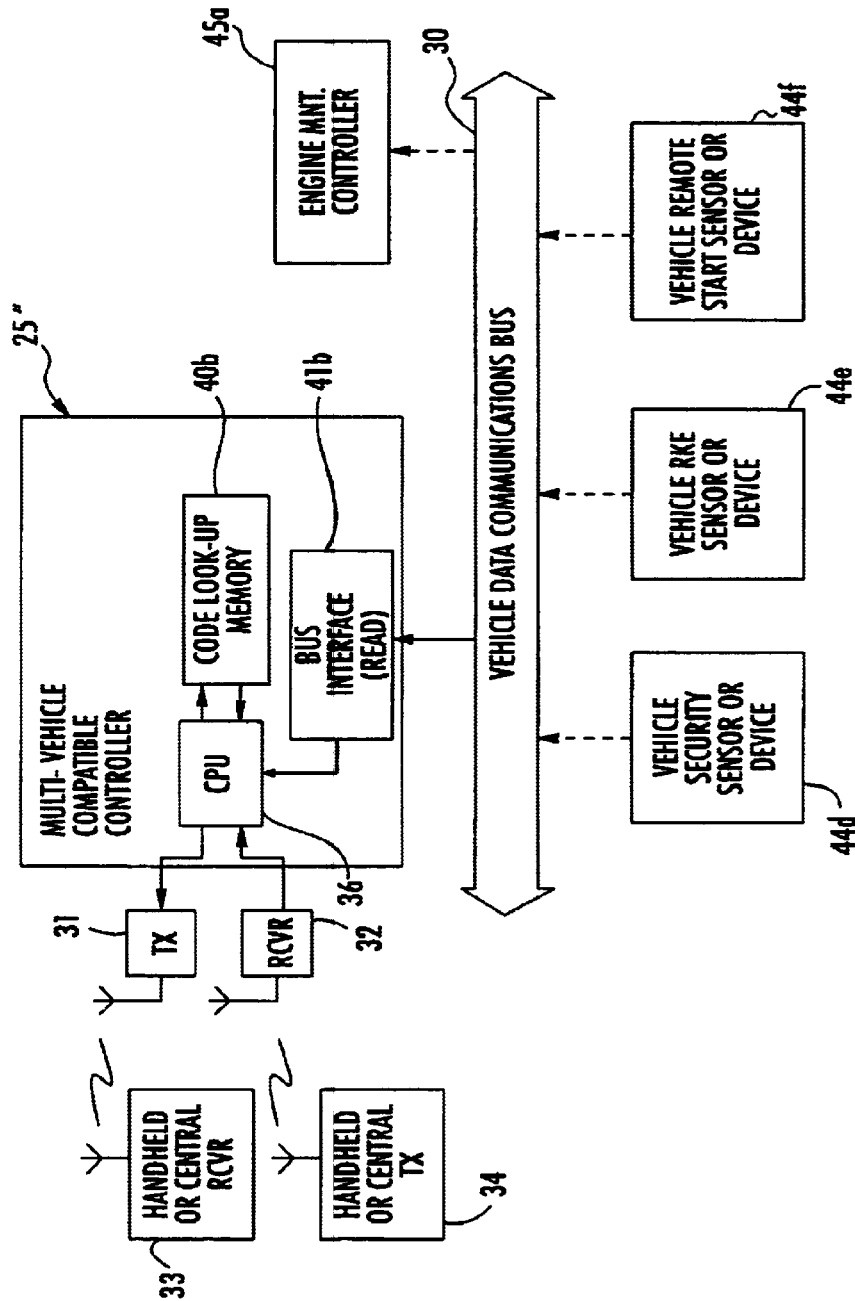


FIG. 4

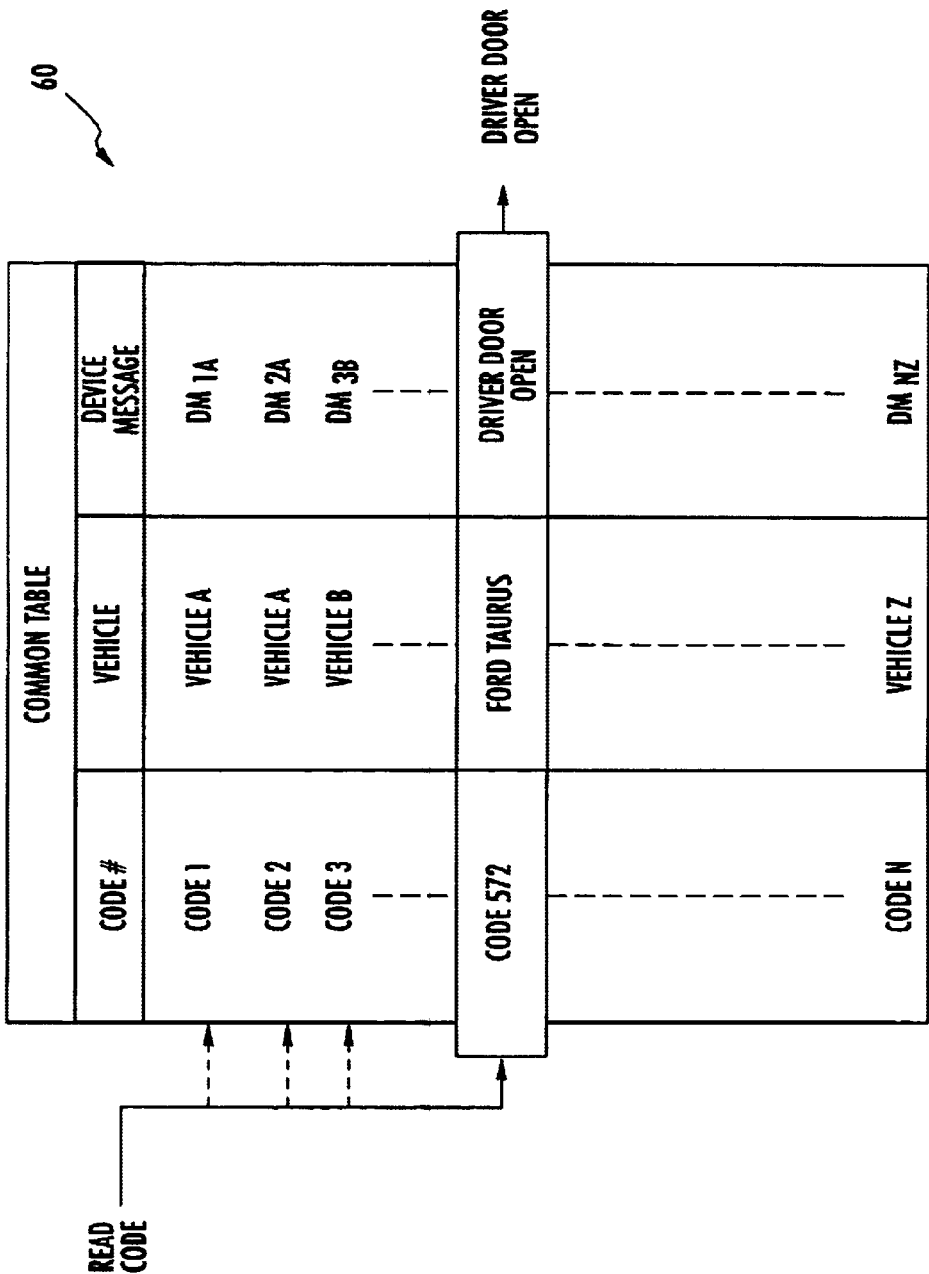


FIG. 5

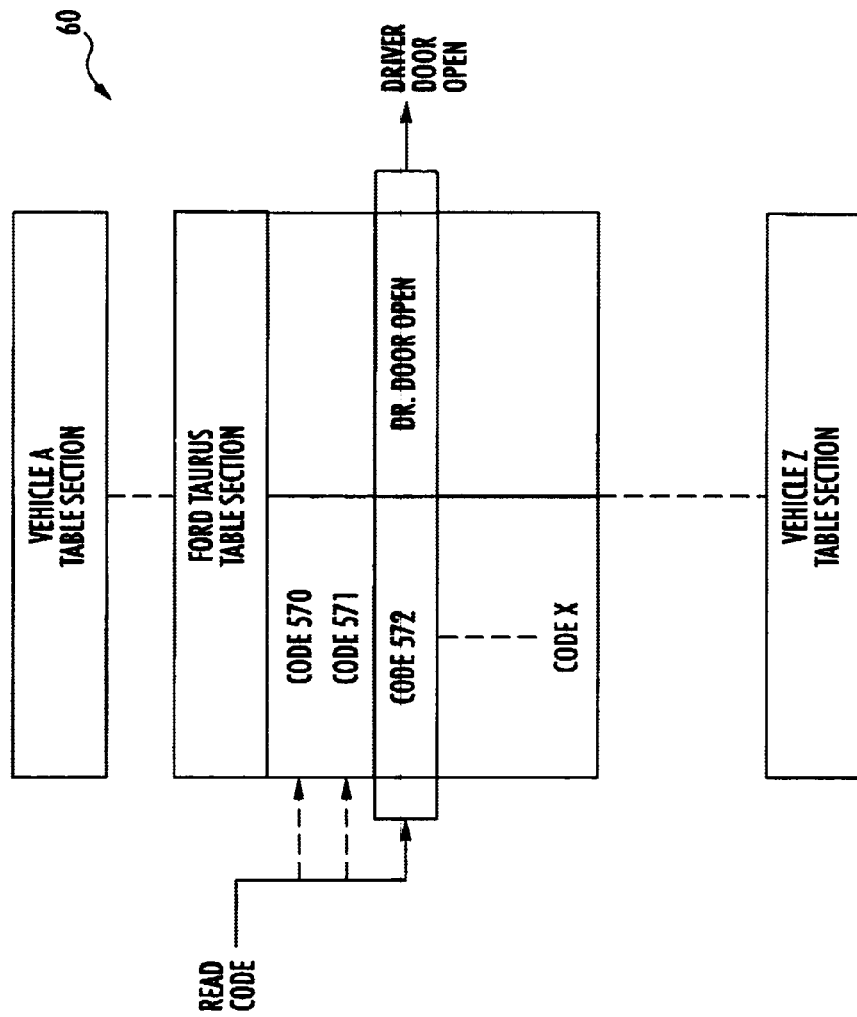
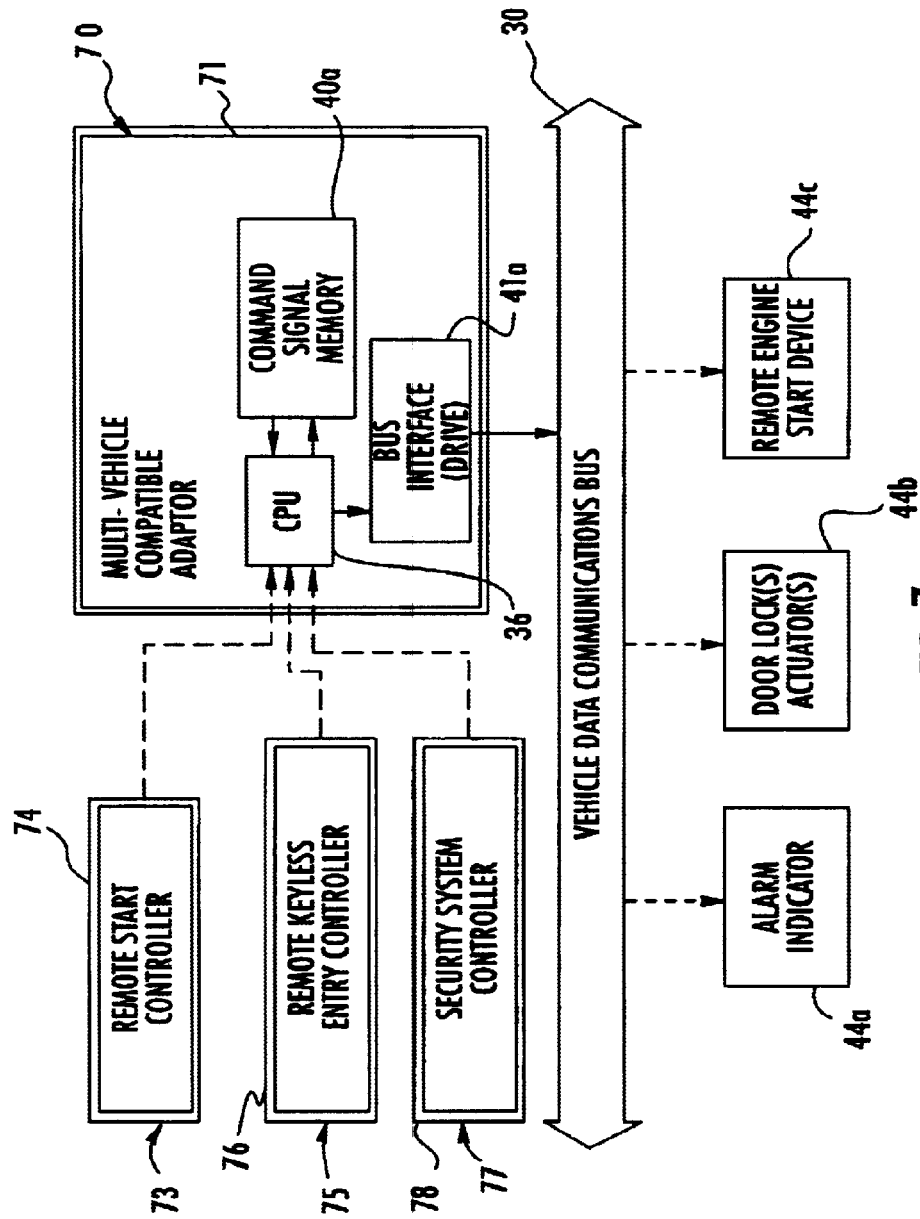


FIG. 6



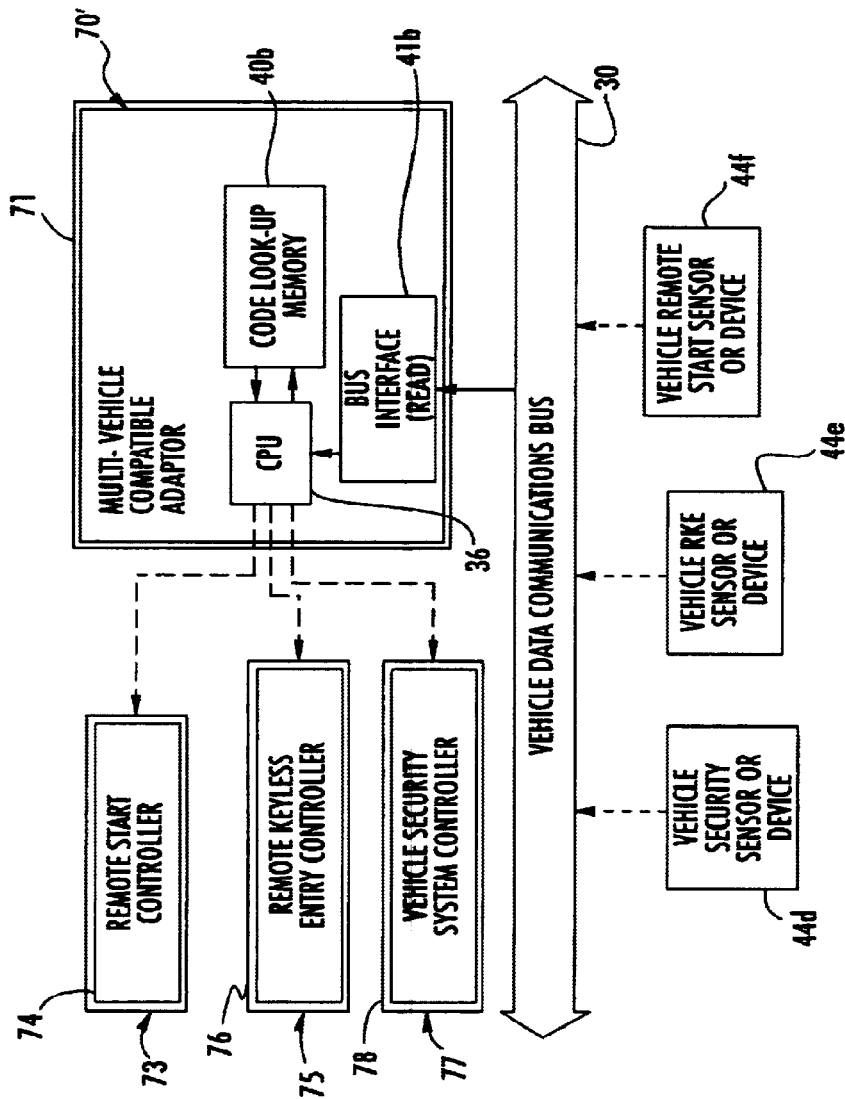


FIG. 8

MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM FOR READING FROM A DATA BUS AND ASSOCIATED METHODS

RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. patent application Ser. No. 09/382,245 filed Aug. 25, 1999 now U.S. Pat. No. 6,275,147, which in turn, is a continuation of Ser. No. 09/023,838 filed on Feb. 13, 1998 now U.S. Pat. No. 6,011,460, which in turn, is a continuation-in-part of Ser. No. 08,701,356 filed on Aug. 22, 1996, now U.S. Pat. No. 5,719,551.

FIELD OF THE INVENTION

This application is related to the field of control systems and, more particularly, to a remote control system and related methods for vehicles.

BACKGROUND OF THE INVENTION

Vehicle security systems are widely used to deter vehicle theft, prevent theft of valuables from a vehicle, deter vandalism, and to protect vehicle owners and occupants. A typical automobile security system, for example, includes a central processor or controller connected to a plurality of vehicle sensors. The sensors, for example, may detect opening of the trunk, hood, doors, windows, and also movement of the vehicle or within the vehicle. Ultrasonic and microwave motion detectors, vibration sensors, sound discriminators, differential pressure sensors, and switches may be used as sensors. In addition, radar sensors may be used to monitor the area proximate the vehicle.

The controller typically operates to give an alarm indication in the event of triggering of a vehicle sensor. The alarm indication may typically be a flashing of the lights and/or the sounding of the vehicle horn or a siren. In addition, the vehicle fuel supply and/or ignition power may be selectively disabled based upon an alarm condition.

A typical security system also includes a receiver associated with the controller that cooperates with one or more remote transmitters typically carried by the user as disclosed, for example, in U.S. Pat. No. 4,383,242 to Sassover et al. and U.S. Pat. No. 5,146,215 to Drori. The remote transmitter may be used to arm and disarm the vehicle security system or provide other remote control features from a predetermined range away from the vehicle. Also related to remote control of a vehicle function U.S. Pat. No. 5,252,966 to Lambropoulos et al. discloses a remote keyless entry system for a vehicle. The keyless entry system permits the user to remotely open the vehicle doors or open the vehicle trunk using a small handheld transmitter.

Unfortunately, the majority of vehicle security systems need to be directly connected by wires to individual vehicle devices, such as the vehicle horn or door switches of the vehicle. In other words, a conventional vehicle security system is hardwired to various vehicle components, typically by splicing into vehicle wiring harnesses or via interposing T-harnesses and connectors. The number of electrical devices in a vehicle has increased so that the size and complexity of wiring harnesses has also increased. For example, the steering wheel may include horn switches, an airbag, turn-signal and headlight switches, wiper controls, cruise control switches, ignition wiring, an emergency flasher switch, and/or radio controls. Likewise, a door of a vehicle, for example, may include window controls, locks, outside mirror switches, and/or door-panel light switches.

In response to the increased wiring complexity and costs, vehicle manufacturers have begun attempts to reduce the amount of wiring within vehicles to reduce weight, reduce wire routing problems, decrease costs, and reduce complications which may arise when troubleshooting the electrical system. For example, some manufacturers have adopted multiplexing schemes to reduce cables to three or four wires and to simplify the exchange of data among the various onboard electronic systems as disclosed, for example, in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42-45.

Implementing multiplexing concepts in vehicles in a cost-effective and reliable manner may not be easy. Successful implementation, for example, may require the development of low or error-free communications in what can be harsh vehicle environments. With multiplexing technology, the various electronic modules or devices may be linked by a single signal wire in a bus also containing a power wire, and one or more ground wires. Digital messages are communicated to all modules over the data communications bus. Each message may have one or more addresses associated with it so that the devices can recognize which messages to ignore and which messages to respond to or read.

The Thompson article describes a number of multiplexed networks for vehicles. In particular, the Grand Cherokee made by Chrysler is described as having five multiplex nodes or controllers: the engine controller, the temperature controller, the airbag controller, the theft alarm, and the overhead console. Other nodes for different vehicles may include a transmission controller, a trip computer, an instrument cluster controller, an antilock braking controller, an active suspension controller, and a body controller for devices in the passenger compartment.

A number of patent references are also directed to digital or multiplex communications networks or circuits, such as may be used in a vehicle. For example, U.S. Pat. No. 4,538,262 Sinniger et al. discloses a multiplex bus system including a master control unit and a plurality of receiver-transmitter units connected thereto. Similarly, U.S. Pat. No. 4,055,772 to Leung discloses a power bus in a vehicle controlled by a low current digitally coded communications system. Other references disclosing various vehicle multiplex control systems include, for example, U.S. Pat. No. 4,760,275 to Sato et al.; U.S. Pat. No. 4,697,092 to Roggen-dorf et al.; and U.S. Pat. No. 4,792,783 to Burgess et al.

Several standards have been proposed for vehicle multiplex networks including, for example, the Society of Automotive Engineers "Surface Vehicle Standard, Class B Data Communications Network Interface", SAE J1850, July 1995. Another report by the SAE is the "Surface Vehicle Information Report, Chrysler Sensor and Control (CSC) Bus Multiplexing Network for Class 'A' Applications", SAE J2058, July 1990. Many other networks are also being implemented or proposed for communications between vehicle devices and nodes or controllers.

Unfortunately, conventional vehicle control systems, such as aftermarket vehicle security systems, are for hardwired connection to vehicle devices and are not readily adaptable to a vehicle including a data communications bus. Moreover, a vehicle security system if adapted for a communications bus and devices for one particular model, model year, and manufacturer, may not be compatible with any other models, model years, or manufacturers. Other systems for the control of vehicle functions may also suffer from such shortcomings.

SUMMARY OF THE INVENTION

In view of the foregoing background it is therefore an object of the invention to provide a remote control system

and related method for a vehicle comprising a data communications bus and at least one vehicle device connected to the data communications bus, and wherein the system is adapted to operate with different vehicles.

This and other objects, features and advantages in accordance with the present invention are provided by a control system including a transmitter and a receiver for receiving signals from the transmitter, and a multi-vehicle compatible controller cooperating with the transmitter and receiver. Moreover, the multi-vehicle compatible controller is also for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus.

The multi-vehicle compatible controller may comprise a memory for the stored device codes, and a processor cooperating with the memory for determining the match between the read device code and the stored device codes. The at least one vehicle device may include a plurality of vehicle devices, and, accordingly, the multi-vehicle compatible controller stores a respective set of device codes for each of the vehicle devices.

The invention is useful for a number of vehicle remote control functions. For example, the stored device codes may relate to vehicle security. In other words, the multi-vehicle compatible controller may be an alarm or security system controller. The stored vehicle codes may also relate to keyless entry for the vehicle. By way of further example, the stored device codes may relate to remote starting a vehicle engine.

The multi-vehicle compatibility concept may be extended to an adaptor device for after-market installation, and be especially advantageous when used in combination with a conventional remote function controller. In other words, the multi-vehicle compatible controller may comprise a multi-vehicle compatible adaptor connected to the data communications bus for determining the match between the read device code and the stored device codes and generating an output signal responsive thereto, and a controller connected to the multi-vehicle compatible adaptor and being responsive to output signals therefrom. Of course, the controller and adaptor may be positioned in respective different housings.

The control system can be operated directly by the user, or via an intervening communications network. In other words, in some embodiments, the transmitter may be a remote handheld transmitter to be carried by a user when away from the vehicle, and the receiver is at the vehicle. In other embodiments, the transmitter may include at least a central station transmitter, and the receiver is at the vehicle. The central station transmitter may be part of a satellite or cellular telephone network.

In yet other embodiments, the receiver may be a handheld unit carried by the user or a central station receiver, such as to notify the user or others of a vehicle security breach, for example. In these embodiments, the transmitter is then located at the vehicle.

Another aspect of the invention relates to a control method for a vehicle comprising a data communications bus and at least one vehicle device connected thereto. The method preferably comprises storing a set of device codes for a given vehicle device for a plurality of different

vehicles, reading a device code from the data communications bus, and determining a match between a read device code and the stored device codes and performing a function based thereon to thereby provide compatibility with a plurality of different vehicles. The method may further include receiving a signal from a transmitter, and wherein performing the function is also based upon receiving the signal from the transmitter.

Another method aspect of the invention is for adapting a control system for a vehicle to be compatible with a plurality of different vehicles, with each vehicle comprising a data communications bus and at least one vehicle device connected thereto. The control system preferably comprises a transmitter, a receiver for receiving signals from the transmitter, and a controller cooperating with the transmitter and the receiver. More particularly, the method for adapting preferably comprises storing a set of device codes for a given vehicle device for a plurality of different vehicles, reading a device code from the data communications bus, and determining a match between a read device code and the stored device codes for performing at least one vehicle function and to thereby provide compatibility with a plurality of different vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic block diagram of a vehicle control system including the multi-vehicle compatible controller connected to a data communications bus and other hard-wired devices in accordance with the invention.

FIG. 2 is a more detailed schematic block diagram of an embodiment of the multi-vehicle compatible controller illustrating the command signal generation in accordance with the invention.

FIG. 3 is a schematic diagram illustrating processing of command signals by the multi-vehicle compatible controller of FIG. 2.

FIG. 4 is a more detailed schematic block diagram of an embodiment of the multi-vehicle compatible controller illustrating the code signal look-up in accordance with the invention.

FIG. 5 is a schematic diagram illustrating processing of a code read from the data communications bus in accordance with a first embodiment of the multi-vehicle compatible controller of FIG. 4.

FIG. 6 is a schematic diagram illustrating processing of a code read from the data communications bus in accordance with a second embodiment of the multi-vehicle compatible controller of FIG. 4.

FIG. 7 is a schematic block diagram of a multi-vehicle compatible adaptor in accordance with the present invention and illustrating the command signal processing portion.

FIG. 8 is a schematic block diagram of a multi-vehicle compatible adaptor in accordance with the present invention and illustrating the read code processing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described more fully hereinafter with reference to the accompanying drawings in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the illustrated embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the

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invention to those skilled in the art. Like numbers refer to like elements throughout. Prime and multiple prime notation are used in alternate embodiments to indicate similar elements.

Referring initially to FIG. 1, a control system **20** for a vehicle **21** is now described. The control system **20** includes a multi-vehicle compatible controller **25** connected to a data communications bus **30** in the vehicle **21**. The data communications bus **30** may be any of several types, such as compatible with the J1850 or CAN standards, or other type of bus as will be appreciated by those skilled in the art. The multi-vehicle compatible controller **25**, as its name suggests, provides compatibility with different codes used on the data bus and which may vary by vehicle as described in greater detail below.

The control system **20** preferably includes a transmitter, and a receiver for receiving signals from the transmitter. As shown in the illustrated embodiment, both a transmitter **31** and a receiver **32** are provided at the vehicle **21**. In addition, both a receiver **33** and a transmitter **34** are provided remotely or away from the vehicle. The first transmitter/receiver pair **31, 33** may be used, for example, to provide a remote alert or page to a user when away from the vehicle of a security breach at the vehicle, for example. The second transmitter/receiver pair **32, 34** may be used to cause a desired function to be performed at the vehicle, such as remote starting the engine, remotely unlocking the vehicle doors, or changing the mode of a security system between armed and disarmed modes, for example. Many other similar applications are contemplated by the present invention as will be appreciated by those skilled in the art. As will also be appreciated by those skilled in the art, in other embodiments, only one of these pairs of transmitters and receivers may be provided in the control system.

The remote transmitter **34** may be a small portable unit including a housing, function control switches carried by the housing, a battery within the housing, and the associated transmitter circuitry. This type of remote handheld transmitter is commonly used in conventional vehicle security systems, remote start systems, and remote keyless entry systems. The communications from the remote transmitter **34** to the receiver **32** at the vehicle is typically a direct radio frequency link, that is, there is no intervening communications links. However, in other embodiments, the remote transmitter **34** may indirectly communicate with the receiver **32** via other communications infrastructure, such as via satellite, or cellular communications, via the public switched telephone network (PSTN) and/or over the world wide web or Internet, as will be appreciated by those skilled in the art.

The remote transmitter **34** may also be a passive transponder type device, that takes power from an associated transponder reader as will be appreciated by those skilled in the art, and automatically transmits a signal to the reader. For example, the transponder may be of the type carried in conjunction with the vehicle keys, or may be embedded in the key as will be readily appreciated by those skilled in the art.

The remote transmitter **34** may also include one or more central station transmitters, such as may be provided by a satellite transmitter or cellular telephone transmitter, for example. Such a central station transmitter may also be connected to other communications infrastructure.

The remote receiver **33** may also be a small portable unit including a housing, one or more indicators carried by the housing, a battery within the housing, and the associated receiver circuitry. This type of remote receiver may also

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directly communicate with the vehicle transmitter **31**, or there may be intervening communications links as will be appreciated by those skilled in the art. In some embodiments, the remote transmitter **34** and remote receiver **33** may be packaged together in a common handheld housing. Of course the remote receiver **33** may also include one or more central stations along the lines as described above for the central station remote transmitter.

The multi-vehicle compatible controller **25** may also include a central processing unit (CPU) **36** and one or more memories **40** connected thereto. Although the memory **40** is illustrated as a separate device, those of skill in the art will recognize that the memory may alternately be embedded on the same integrated circuit as the processing circuitry of the CPU.

The multi-vehicle compatible controller **25** also may optionally include a hardwire interface **42** which may be directly connected to one or more vehicle devices **44**. For example, in some embodiments for a security system, direct connections may be made to one or more vehicle sensors, an indicator LED, a siren, or the headlight relay. For a remote start system, hardwire connections may be made to a starter motor relay, for example. Those of skill in the art will recognize other devices **44** that may be directly connected to the multi-vehicle compatible controller **25** via the hardwire interface **42**. The hardwire interface **42** may include circuitry for sending signals to or reading signals from the vehicle devices **44** as will be appreciated by those skilled in the art. In some embodiments, the hardwire interface **42** may not be needed or incorporated in the multi-vehicle compatible controller **25**.

The multi-vehicle compatible controller **25** also illustratively includes a bus interface **41** cooperating with the CPU **36** to perform at least one of reading signals from the data communications bus **30**, or generating signals on the data bus. The bus interface **41** includes circuitry for interfacing to the proper signal levels and formats on the data communications bus **30** as will be appreciated by those skilled in the art without further discussion herein.

As will also be readily appreciated by those skilled in the art, the vehicle **21** includes a number of electrical/electronic devices that can be controlled and/or the status thereof read via the data communications bus **30**. For simplicity of explanation, these devices are schematically illustrated by the two blocks **44, 45**, respectively labeled "vehicle devices (sensors, actuators, etc.)," and "vehicle controllers (engine controller, transmission controller, etc.)." In other words, the vehicle devices connected to the data bus **30** may be considered to be relatively simple devices, such as sensors, or more complicated devices with some internal processing, such as may generally be considered as controllers.

The multi-vehicle compatibility controller **25** may provide its multi-vehicle compatibility in one or both directions of communications via the data communications bus **30**. Referring now additionally to FIGS. 2 and 3, the drive or generation of signals on the data bus portion of communication is now further described. In this embodiment, the multi-vehicle compatible controller **25** illustratively includes a command signal memory **40a**, and a bus interface **41a** only for the drive direction for simplicity of explanation.

The devices connected to the data communications bus **30** illustratively include an alarm indicator **44a**, such as can be provided by a separate siren or the vehicle horn, for example. The alarm indicator **44a** would likely be included for a security system. The vehicle devices may also include one or more door lock actuators **44b** as would be likely used

by a security system or remote keyless entry system, for example, as would be readily appreciated by those skilled in the art.

For a remote start system, one or more remote starting device **44c** may be connected to the data communications bus **30** as shown in the illustrated embodiment. Such a remote starting device **44c** may be a starter relay, for example, controlled by signals from the data communications bus. The remote starting device **44c** could also be a device or circuit to bypass an engine immobilizer circuit as will be appreciated by those skilled in the art.

The vehicle device to which signals are to be sent by the multi-vehicle controller **25'** may also include another controller, such as the schematically illustrated engine management controller **45a**. The engine management controller **45a** could be sent signals such as to prevent or enable starting for security or remote start applications as will be appreciated by those skilled in the art.

The multi-vehicle compatible controller **25'** may also include an optional hardwire interface and other components as mentioned above. For clarity and simplicity of explanation, these components need no further description.

In accordance with this aspect of the invention, the multi-vehicle compatible controller **25'** preferably generates at least one set of command signals on the data communications bus **30** for the at least one vehicle device. The at least one set of command signals preferably comprises at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide compatibility with the plurality of different vehicles. In other words, multiple signals or codes can be generated on the data communications bus **30**, and only that code for the given vehicle and device will cause an operation or response from the vehicle device. This provides for a relatively simple and straightforward approach to interface or cooperate with a vehicle having a data communications bus **30**, and wherein the controller is advantageously compatible with a number of different vehicles. Since typically it may be desired to interface to a plurality of vehicle devices, the multi-vehicle compatible controller **25'** may generate a respective set of command signals for each of the vehicle devices.

Such multi-vehicle compatibility provided by the controller **25'** is especially advantageous in after-market systems, such as for security, remote keyless entry, or remote starting for example. The ability to interface through the data communications bus **30** also significantly reduces the wiring complexity needed to interface to the associated vehicle devices.

The multi-vehicle compatible controller **25'** may sequentially generate the different command signals (working and non-working) for an intended vehicle device. To ensure effective communications even in the presence of noise, for example, the multi-vehicle compatible controller **25'** may generate the set of command signals a plurality of times, such as, for example, two to five times. The need to effectively communicate should be balanced against possible traffic congestion on the data bus **30** as will be appreciated by those skilled in the art.

Referring now more specifically to the diagram of FIG. 3, the operation of the multi-vehicle controller **25'** is further described. The controller **25'** may operate by arranging in the command signals memory **40a** a common table **50** as shown. The CPU **36** upon determining that an action needs to be performed, such as unlocking the driver's door, for example, would identify the appropriate column from the table **50** from among the columns labeled "vehicle device A" to

"vehicle device Z". For example, the appropriate column may be "vehicle device B", in which case the CPU would then read the memory locations in this column to generate on the bus **30** the appropriate set of codes to lock the driver's door for each of the N vehicles with which the multi-vehicle compatible controller **25'** is compatible. Of course, only one of the codes would be a working code, and the other codes would cause no vehicle function to be performed. For example, if vehicle **2** was the vehicle in which the multi-vehicle compatible controller **25'** were installed, only the code **2B** would cause the driver's door to unlock.

The actual coded signals would be compatible with the particular data communications bus **30** as will be appreciated by those skilled in the art. The codes may be binary codes, which for convenience can be represented more simply by corresponding hexadecimal codes as would also be appreciated by those skilled in the art. For example, for an unlock all vehicle doors to be commanded in a 1995 Jeep Grand Cherokee, the code may be 03868004, for a 2000 Jeep Grand Cherokee, the code may be 0422A00400. As will be readily appreciated by those skilled in the art, such codes can be obtained from the manufacturers directly, or may be read from the data bus **30** using any one of a number of commercially available diagnostic tools for reading the data bus **30**, for example.

The set of command signals may be repeated as mentioned above, and as schematically illustrated at the lower portion of the table **50**. Of course, the memory **40a** may store the actual codes, but may also store data enabling generation of the set of command signals by the CPU **36**. This may be particularly so where certain portions of the code, e.g. preamble, or some other portion, are common across either multiple vehicles, and/or over multiple vehicle devices.

The number of vehicles and number of devices to be controlled using the multi-vehicle compatible controller **25'** can both be relatively large to cover a substantial portion of the vehicle marketplace. Alternatively, the multiple command signal concept may also be advantageously used to provide compatibility for as few as two vehicles, and even a single vehicle device.

Turning now to FIGS. 4-6, the other direction of communication is now described. In particular, the reverse direction or reading of signals from the data communications bus **30** is now described. Many of the components are the same as those described above, and, hence, need no further description. In the illustrated embodiment, the CPU **36** is connected to a code look-up memory **40b**. In addition, only the read or receive side of the bus interface **41b** is schematically illustrated. The data bus **30** also illustratively connects one or more of vehicle security sensors or devices **44d**, vehicle remote keyless entry sensors or devices, and vehicle remote start sensors or devices **44f** to the multi-vehicle compatible controller **25'**. An engine management controller **45a** is also illustratively connected to the data communications bus **30** as may be used for vehicle security or remote starting as mentioned above. Considered in somewhat different terms, the multi-vehicle compatible controller **25'** may be for one or more of the conventional vehicle remote control functions broadly considered as vehicle security, remote keyless entry, or remote starting. Other similar control functions for a vehicle are also contemplated by the present invention.

The compatibility to read a code and determine the message or content thereof for a vehicle device from among a plurality of vehicles can be used alone or in combination with the compatibility for writing or generating signals on

the bus described above. More particularly, the multi-vehicle compatible controller 25" is for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus 30, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus 30.

As noted briefly above, the multi-vehicle compatible controller 25" may comprise the code look-up memory 40b for the stored device codes, and a processor or CPU 36 cooperating with the memory for determining the match between the read device code and the stored device codes. The at least one vehicle device may include a plurality of vehicle devices, and, accordingly, the memory 40b of the multi-vehicle compatible controller 25" preferably stores a respective set of device codes for each of the plurality of vehicle devices.

Referring now more specifically to FIG. 5, the look-up table feature of the multi-vehicle compatible controller 25" is now described. A common table 60 may be created which contains a column for the vehicle codes in some predefined sequence, such as in a numerical order beginning with a first code, Code 1, and ending with a last code, Code N, as illustrated. The central column in the illustrated embodiment includes the corresponding vehicle identification with the vehicles extending from a first vehicle, Vehicle A, to a last vehicle, Vehicle Z. The number of codes and vehicles may be selected so that a given multi-vehicle compatible controller 25" is useable across an economically large number of vehicles as will be appreciated by those skilled in the art.

The last or rightmost column in the illustrated table 60 is the device data or message corresponding to the associated vehicle and code. These device messages extend from a first message, DM_{1A}, to a last device message, DM_{NZ}. The messages may be of many different types, such as driver door open or closed, hood open or closed, shock sensor triggered, brake pressure indicated, gearshift selector in Park, etc. as will be appreciated by those skilled in the art.

By way of example, the common table 60 includes a blocked row schematically illustrating a match for a Code 572. This code is for a Ford Taurus and indicates that the driver's door is open. This type of data may be useful in any of the illustrated implementations including vehicle security, remote keyless entry, or remote starting. The CPU 36 would read the code on the data bus 30 and compare the code against the stored codes to determine a match. The CPU 36 is likely to buffer some or all of a code when received to subsequently be compared using the table 60 as will be understood by those skilled in the art. In other embodiments, individual bits or blocks thereof may be compared as they are received.

An alternate embodiment of the common table 60 is now explained with reference to FIG. 6. In this case the overall or common table 60', may be considered parsed or divided into a plurality of vehicle table sections. The first table section is for vehicle A, and the last for vehicle Z in the illustrated embodiment. This embodiment also illustrates the driver door for the Ford Taurus as being matched from the read signal from the data communications bus 30. What is of interest in this embodiment, is that upon initial set-up or an initial learning period, only the codes for the learned vehicle need then later be compared to the read code. Accordingly, a time savings may be realized.

Those of skill in the art will recognize that the tables 60 and 60' of FIGS. 5 and 6 are exemplary illustrations from among many possible configurations of look-up tables that may be used in accordance with the present invention. Other configurations are also contemplated by the present invention.

Since it may also be desirable to re-install the multi-vehicle compatible controller 25" in another vehicle, the controller may be reset and another vehicle learned or configured during an initial set-up. This concept is generally described as an embodiment of a desired signal enabling function or feature in related parent U.S. patent application Ser. No. 09/382,245 filed Aug. 25, 1999, which in turn, is a continuation of U.S. Pat. No. 6,011,460, which in turn, is a continuation-in-part of U.S. Pat. No. 5,719,551, and the disclosure of each of which are incorporated herein by reference in its entirety.

Turning now to FIG. 7, we again revisit the command signal concept for driving the communications bus 30 with a plurality of signal codes to provide the multi-vehicle compatibility. In this variation, the multi-vehicle controller is divided into two sections or portions. More particularly, the multi-vehicle compatibility is provided by the illustrated multi-vehicle compatible adaptor 70. The adaptor 70 illustratively includes the CPU 36, the command signal memory 40a, and the bus interface 41a. The adaptor 70 also includes its own housing 71. The adaptor 70, may include a hardwire interface as discussed above, or such could already be provided with any of the controllers 73, 75 or 77 as would more typically be the case.

The adaptor 70 is fed signals from one or more of the illustrated conventional controllers, that is, one or more of the remote start controller 73, the remote keyless entry controller 75 or the security system controller 77. Each of these controllers 73, 75 and 77 may also include its own respective housing 74, 76 and 78.

As will be appreciated by those skilled in the art, one scenario where the adaptor 70 may be especially useful is to adapt a conventional security or other system controller to operate via the data communications bus 30. Since the data bus technology is being slowly phased in by automobile manufacturers, suppliers may provide their conventional systems for conventional vehicles, and add the adaptor 70 with the conventional controller when the vehicle requires interface to the data communications bus 30.

Turning now to FIG. 8, it can be seen that similar concepts can be extended to the multi-vehicle compatible adaptor 70' for the other direction of communication, that is, from the data communications bus 30 to one or more of the controllers 73, 75 and 77. The adaptor 70' illustratively includes the CPU 36, bus interface circuit 41b for reading the bus, and the code look-up memory 40b as described above with reference to FIG. 4.

The operation of the multi-vehicle compatible adaptor 70' will be readily understood by those of skill in the art based upon the above provided descriptions relating to FIGS. 4-6 without requiring further discussion herein. Of course, as will be appreciated by those skilled in the art, the adaptors 70, 70' may be used independently, may be used together, or may be combined into a single unit.

Other features relating to vehicle control systems are disclosed in copending patent applications entitled "REMOTE START SYSTEM FOR A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS" (attorney docket no. 16635E) and "MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM GENER-

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ATING COMMAND SIGNALS ON A DATA BUS AND ASSOCIATED METHODS" (attorney docket no. 16635G), the entire disclosures of which are incorporated herein by reference.

Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Accordingly, it is understood that the invention is not to be limited to the illustrated embodiments disclosed, and that other modifications and embodiments are intended to be included within the spirit and scope of the appended claims.

That which is claimed:

1. A control system for a vehicle comprising a data communications bus and at least one vehicle device connected thereto, the control system comprising:

a transmitter and a receiver for receiving signals from said transmitter; and

a multi-vehicle compatible controller cooperating with said transmitter and said receiver and for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles.

2. A control system according to claim 1 wherein said multi-vehicle compatible controller comprises a memory for the stored device codes.

3. A control system according to claim 2 wherein said multi-vehicle compatible controller comprises a processor cooperating with said memory for determining the match between the read device code and the stored device codes.

4. A control system according to claim 1 wherein the at least one vehicle device comprises a plurality of vehicle devices; and wherein said multi-vehicle compatible controller stores a respective set of device codes for each of the plurality of vehicle devices.

5. A control system according to claim 1 wherein the at least one vehicle device comprises a vehicle sensor; and wherein the stored device codes relate to the vehicle sensor.

6. A control system according to claim 5 wherein the stored device codes relate to vehicle security.

7. A control system according to claim 5 wherein the stored vehicle codes relate to keyless entry for the vehicle.

8. A control system according to claim 5 wherein the stored device codes relate to remote starting a vehicle engine.

9. A control system according to claim 1 wherein said multi-vehicle compatible controller comprises:

a multi-vehicle compatible adaptor connected to the data communications bus for determining the match between the read device code and the stored device codes and generating an output signal responsive thereto; and

a controller connected to said multi-vehicle compatible adaptor and being responsive to output signals therefrom.

10. A control system according to claim 9 wherein said controller further comprises a first housing; and said multi-vehicle adaptor comprises a second housing.

11. A control system according to claim 1 wherein said transmitter comprises a remote handheld transmitter to be carried by a user when away from the vehicle; and wherein said receiver is at the vehicle.

12. A control system according to claim 1 wherein said transmitter comprises at least a central station transmitter; and wherein said receiver is at the vehicle.

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13. A control system according to claim 1 wherein said receiver comprises a remote receiver to be carried by a user when away from the vehicle; and wherein said transmitter is at the vehicle.

14. A control system according to claim 1 wherein said receiver comprises at least a central station transmitter; and wherein said transmitter is at the vehicle.

15. A control system according to claim 1 wherein said transmitter comprises a transponder transmitter to be carried by a user; and wherein said receiver is at the vehicle.

16. An adaptor for adapting a control system for a vehicle to be compatible with a plurality of different vehicles, each vehicle comprising a data communications bus and at least one vehicle device connected thereto, the control system comprising a transmitter and a receiver for receiving signals from the transmitter, and a controller cooperating with the transmitter and receiver, the adaptor comprising:

a housing; and

a multi-vehicle compatible adaptor circuit mounted in said housing for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles.

17. An adaptor according to claim 16 wherein said multi-vehicle compatible adaptor circuit comprises a memory for the stored device codes.

18. An adaptor according to claim 17 wherein said multi-vehicle compatible adaptor circuit comprises a processor cooperating with said memory for determining the match between the read device code and the stored device codes.

19. An adaptor according to claim 16 wherein the at least one vehicle device comprises a plurality of vehicle devices; and wherein said multi-vehicle compatible adaptor circuit stores a respective set of device codes for each of the plurality of vehicle devices.

20. An adaptor according to claim 16 wherein the at least one vehicle device comprises a vehicle sensor; and wherein the stored device codes relate to the vehicle sensor.

21. An adaptor according to claim 16 wherein the stored vehicle codes relate to vehicle security.

22. An adaptor according to claim 16 wherein the stored vehicle codes relate to keyless entry for the vehicle.

23. An adaptor according to claim 16 wherein the stored vehicle codes relate to remote starting a vehicle engine.

24. A control method for a vehicle comprising a data communications bus and at least one vehicle device connected thereto, the method comprising:

storing a set of device codes for a given vehicle device for a plurality of different vehicles;

reading a device code from the data communications bus; and

determining a match between a read device code and the stored device codes and performing a function based thereon to thereby provide compatibility with a plurality of different vehicles.

25. A method according to claim 24 further comprising receiving a signal from a transmitter; and wherein performing the function is also based upon receiving the signal from the transmitter.

26. A method according to claim 25 wherein the transmitter comprises a handheld remote transmitter to be carried by a user when away from the vehicle.

27. A method according to claim 25 wherein the transmitter comprises at least a central station transmitter.

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28. A method according to claim 25 wherein the transmitter comprises a handheld transponder to be carried by a user when away from the vehicle.

29. A method according to claim 24 wherein the function comprises transmitting a signal from the vehicle to a remote receiver. 5

30. A method according to claim 29 wherein the remote receiver comprises a handheld receiver to be carried by the user when away from the vehicle.

31. A method according to claim 29 wherein the remote receiver comprises at least one central station remote receiver. 10

32. A method according to claim 24 wherein the at least one vehicle device comprises a plurality of vehicle devices; and wherein storing comprises storing a respective set of device codes for each of the plurality of vehicle devices. 15

33. A method according to claim 24 wherein the at least one vehicle device comprises a vehicle sensor; and wherein the stored device codes relate to the vehicle sensor.

34. A method according to claim 24 wherein the stored vehicle codes relate to vehicle security. 20

35. A method according to claim 24 wherein the stored vehicle codes relate to keyless entry for the vehicle.

36. A method according to claim 24 wherein the stored vehicle codes relate to remote starting a vehicle engine. 25

37. A method for adapting a control system for a vehicle to be compatible with a plurality of different vehicles, each vehicle comprising a data communications bus and at least one vehicle device connected thereto, the control system comprising a transmitter and a receiver for receiving signals from the transmitter, and a controller at the vehicle and cooperating with the transmitter and receiver, the method comprising: 30

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storing a set of device codes for a given vehicle device for a plurality of different vehicles;

reading a device code from the data communications bus; and

determining a match between a read device code and the stored device codes and performing a function based thereon to thereby provide compatibility with a plurality of different vehicles.

38. A method according to claim 37 wherein the receiver is at the vehicle and the transmitter is remote therefrom; and further comprising receiving a signal from the transmitter and performing the function further based thereon.

39. A method according to claim 37 wherein the transmitter is at the vehicle and the receiver is remote therefrom; and wherein the function comprises transmitting a signal from the vehicle to the remote receiver.

40. A method according to claim 37 wherein the at least one vehicle device comprises a plurality of vehicle devices; and wherein storing comprises storing a respective set of device codes for each of the plurality of vehicle devices.

41. A method according to claim 37 wherein the at least one vehicle device comprises a vehicle sensor; and wherein the stored device codes relate to the vehicle sensor.

42. A method according to claim 37 wherein the stored vehicle codes relate to vehicle security.

43. A method according to claim 37 wherein the stored vehicle codes relate to keyless entry for the vehicle.

44. A method according to claim 37 wherein the stored vehicle codes relate to remote starting a vehicle engine.

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United States Patent
Flick

(10) **Number:** **US 6,756,885 C1**(45) **Certificate Issued:** ***Aug. 1, 2017**

(54) **MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM FOR READING FROM A DATA BUS AND ASSOCIATED METHODS**

G07C 9/00817 (2013.01); *G07C 2009/00222* (2013.01); *G07C 2009/00261* (2013.01); *G07C 2009/00793* (2013.01); *G07C 2009/00825* (2013.01); *G07C 2009/00849* (2013.01)

(75) Inventor: **Kenneth E. Flick**, Douglasville, GA (US)

(58) **Field of Classification Search**

None

See application file for complete search history.

(73) Assignee: **OMEGA PATENTS, L.L.C.**, Douglasville, GA (US)

(56) **References Cited**

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Filed: **May 31, 2000**

To view the complete listing of prior art documents cited during the proceeding for Reexamination Control Number 90/013,741, please refer to the USPTO's public Patent Application Information Retrieval (PAIR) system under the Display References tab.

Primary Examiner — Ovidio Escalante

(*) Notice: This patent is subject to a terminal disclaimer.

(57) **ABSTRACT**

A control system includes a transmitter, a receiver for receiving signals from the transmitter, and a multi-vehicle compatible controller cooperating with the transmitter and receiver. The multi-vehicle compatible controller is for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from a data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus. The multi-vehicle compatible controller may include a memory for the stored device codes, and a processor cooperating with the memory for determining the match between the read device code and the stored device codes. The approach is useful for a number of vehicle remote control functions including vehicle security, remote keyless entry and remote starting. The multi-vehicle compatibility concept is also extended to an adaptor device which can be used in combination with a conventional remote function controller.

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/382,245, filed on Aug. 25, 1999, now Pat. No. 6,275,147, which is a continuation of application No. 09/023,838, filed on Feb. 13, 1998, now Pat. No. 6,011,460, which is a continuation-in-part of application No. 08/701,356, filed on Aug. 22, 1996, now Pat. No. 5,719,551.

(51) **Int. Cl.**

B60R 25/10 (2013.01)

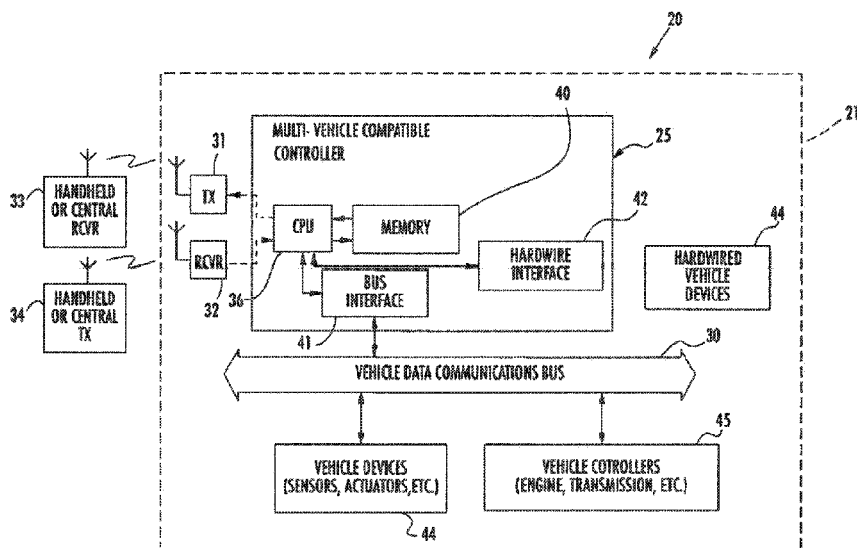
B60R 25/04 (2013.01)

G07C 9/00 (2006.01)

B60R 25/24 (2013.01)

(52) **U.S. Cl.**

CPC **B60R 25/24** (2013.01); **B60R 25/04** (2013.01); **B60R 25/1003** (2013.01); **B60R 25/1018** (2013.01); **G07C 9/00182** (2013.01);



**EX PARTE
REEXAMINATION CERTIFICATE**

THE PATENT IS HEREBY AMENDED AS
INDICATED BELOW. 5

AS A RESULT OF REEXAMINATION, IT HAS BEEN
DETERMINED THAT:

The patentability of claims **1-23**, **25-31** and **37-44** is 10
confirmed.

Claims **24** and **32-36** are cancelled.

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US006756885C2

(12) **EX PARTE REEXAMINATION CERTIFICATE** (11588th)
United States Patent
Flick

(10) **Number:** **US 6,756,885 C2**(45) **Certificate Issued:** **Oct. 25, 2019**

(54) **MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM FOR READING FROM A DATA BUS AND ASSOCIATED METHODS**

(75) Inventor: **Kenneth E. Flick**, Douglasville, GA (US)

(73) Assignee: **OMEGA PATENTS, L.L.C.**, Douglasville, GA (US)

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Related U.S. Application Data

(63) Continuation-in-part of application No. 09/382,245, filed on Aug. 25, 1999, now Pat. No. 6,275,147, which is a continuation of application No. 09/023,838, filed on Feb. 13, 1998, now Pat. No. 6,011,460, which is a continuation-in-part of application No. 08/701,356, filed on Aug. 22, 1996, now Pat. No. 5,719,551.

(51) **Int. Cl.**

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(52) **U.S. Cl.**

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(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

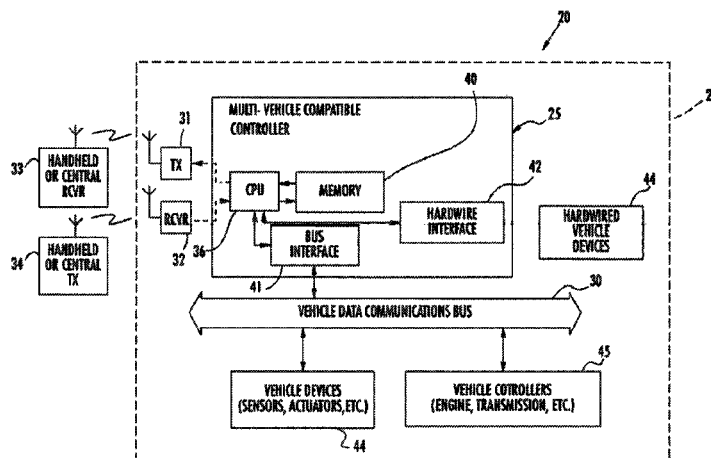
To view the complete listing of prior art documents cited during the proceeding for Reexamination Control Number 90/014,038, please refer to the USPTO's public Patent Application Information Retrieval (PAIR) system under the Display References tab.

Primary Examiner — Roland G Foster

(57) **ABSTRACT**

A control system includes a transmitter, a receiver for receiving signals from the transmitter, and a multi-vehicle compatible controller cooperating with the transmitter and receiver. The multi-vehicle compatible controller is for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from a data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus. The multi-vehicle compatible controller may include a memory for the stored device codes, and a processor cooperating with the memory for determining the match between the read device code and the stored device codes. The approach is useful for a number of vehicle remote control functions including vehicle security, remote keyless entry and remote starting. The multi-vehicle compatibility concept is also extended to an adaptor device which can be used in combination with a conventional remote function controller.

Attention is directed to the decision of *Omega Patents v. Calamp*, Appeal No. 2018-1309, Federal Circuit, April 18, 2019, relating to this patent. This reexamination may not have resolved all questions raised by this decision. See 37 CFR 1.552(c) for *ex parte* reexamination and 37 CFR 1.906(c) for *inter partes* reexamination.



**EX PARTE
REEXAMINATION CERTIFICATE**

NO AMENDMENTS HAVE BEEN MADE TO
THE PATENT 5

AS A RESULT OF REEXAMINATION, IT HAS BEEN
DETERMINED THAT:

The patentability of claims **1-23**, **25-31** and **37-44** is ¹⁰
confirmed.

Claims **24** and **32-36** were previously cancelled.

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