

**UNITED STATES DISTRICT COURT
THE MIDDLE DISTRICT OF FLORIDA
ORLANDO DIVISION**

CASE NO. 6:13-cv-1950-PGB-DAB

**OMEGA PATENTS, LLC,
a Georgia limited liability company,**

Plaintiff,

v.

**CALAMP CORP.,
a Delaware corporation,**

Defendant.

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DEFENDANT CALAMP CORP.'S OPENING CLAIM CONSTRUCTION BRIEF

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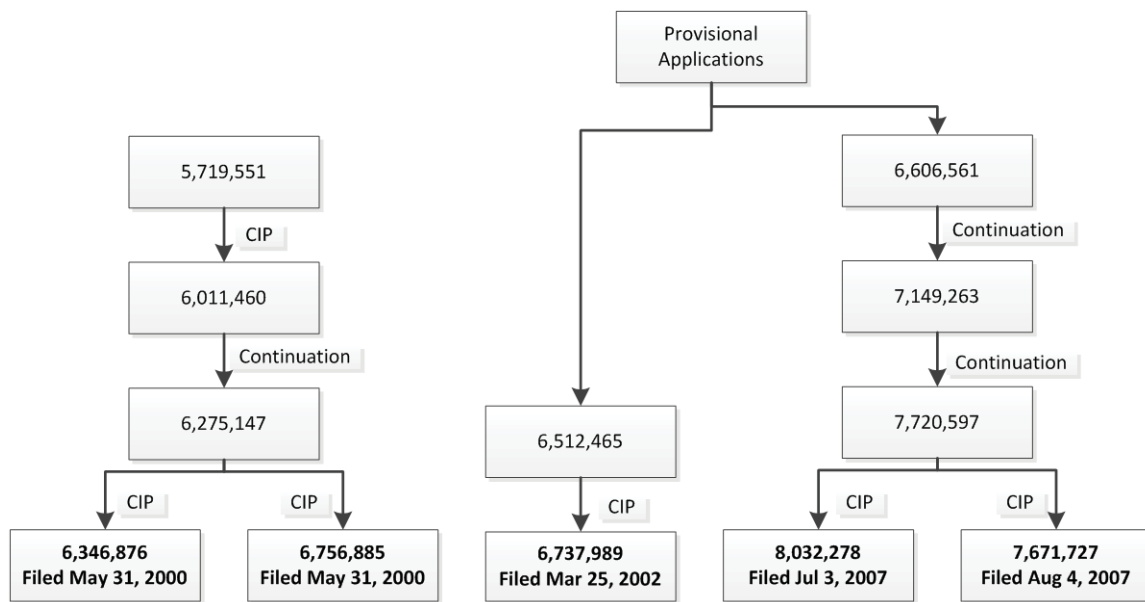
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In accordance with the Court’s Order dated March 14, 2014, Defendant CalAmp Corp. (“CalAmp”) hereby presents its Opening Claim Construction Brief.

I. INTRODUCTION.

A. Patents-in-Suit.

Omega Patents, LLC (“Omega”) is asserting five patents-in-suit in this case: U.S. Pat. Nos. 6,346,876 (“the ‘876 patent”); 6,737,989 (“the ‘989 patent”); 6,756,885 (“the ‘885 patent”); 7,671,727 (“the ‘727 patent”); and 8,032,278 (“The ‘278 patent”). The following tree shows the inter-relation between the patents-in-suit (shown in bold):



The patents-in-suit are all based on continuations-in-part (“CIPs”) of earlier applications. Unlike a continuation application, in which the claims are entitled to the filing date of parent application, a CIP application contains new matter, added as of the actual filing date of the application, and thus the claims must be analyzed individually to determine the proper priority date for each claim, and there is no presumption of an

entitlement to an earlier priority date. See PowerOasis, Inc. v. T-Mobile USA, Inc., 522 F.3d 1299, 1305 (Fed. Cir. 2008). Once a defendant puts forth prior art that is earlier than the actual filing date of a CIP, the burden is on the patentee to show why it contends any claim is entitled to an earlier priority date. Id.

B. Terms Requiring Construction

The parties previously met and conferred, and exchanged preliminary constructions for a number of terms and phrases, and have agreed on the constructions for “controller” and “multi-vehicle compatible controller” as follows:

<u>Term</u>	<u>Agreed Construction</u>
controller	electronic circuitry that performs one or more control functions
multi-vehicle compatible controller	electronic circuitry that performs one or more control functions, and can operate with more than one vehicle

While the parties have agreed on the above constructions, a dispute remains regarding the proper construction of the following eleven terms and phrases:

- A. data communications bus / vehicle data communications bus /
vehicle data bus
- B. vehicle device
- C. command signal
- D. device codes
- E. function
- F. remote vehicle speed exceeded notification

- G. downloading interface
- H. enabling data
- I. programming instruction
- J. transmitter
- K. receiver

II. LEGAL STANDARDS GOVERNING CLAIM CONSTRUCTION.

The claims of a patent define the legal scope of protection afforded the invention. To determine whether there is infringement of a U.S. patent, one must first ascertain the scope of the claims. The legal meaning of each claim must be construed in light of the words of the claim, the specification, and the prosecution history. Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), aff'd, 517 U.S. 370 (1996).

During the process of “claim construction,” the court determines the meaning of disputed claim language. Markman v. Westview Instruments, Inc., 517 U.S. 370 (1996). In doing so, the court should rely primarily on intrinsic evidence: the claims, specifications and file histories of the respective patents-in-suit. If the claim language is ambiguous after a review of the intrinsic evidence, a court may consider extrinsic evidence, such as dictionary definitions or testimony from the inventor or an expert. See Bell & Howell Document Mgmt. Prods. Co. v. Altek Systems, 132 F.3d 701, 705-706 (Fed. Cir. 1997). However, proper claim construction analysis always begins with the words of the claim. See Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996). “It is a ‘bedrock principle’ of patent law that ‘the claims of a patent define

the invention to which the patentee is entitled the right to exclude.” Phillips v. AWH Corp., 415 F. 3d 1303, 1312 (Fed. Cir. 2005) (quoting Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc., 381 F.3d 1111, 1115 (Fed. Cir. 2004)).

The words of a claim should be given “their ordinary and customary meaning.” Vitronics, 90 F.3d at 1582. “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application.” Phillips, 415 F.3d at 1313. “Claims ‘must be read in view of the specification, of which they are a part.’” Id. at 1315 (citing Markman, 52 F.3d at 979). “The words of patent claims have the meaning and scope with which they are used in the specification and the prosecution history.” Phillips, 415 F. 3d at 1315 (quoting Kinik Co. v. ITC, 362 F.3d 1359, 1365 (Fed. Cir. 2004)).

Further,

[I]t is always necessary to review the specification to determine whether the inventor has used any terms in a manner inconsistent with their ordinary meaning. The specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication.... [T]he specification is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.

Vitronics, 90 F.3d at 1582 (citation omitted).

“In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words. In such circumstances, general purpose

dictionaries may be helpful.” Phillips, 415 F.3d at 1314 (citation omitted). However, in this case, most terms were specifically described by the patentee, and the intrinsic evidence is sufficient to determine the proper meaning, without reference to extrinsic evidence, including general purpose dictionaries. While Omega contends that many of the terms identified by CalAmp require no construction, relying simply on the jury applying an unstated “ordinary” meaning does not fulfill the requirement of defining the claim scope, and improperly leaves to the jury the task of determining the scope and meaning of the claims. “When the parties raise an actual dispute regarding the scope of these claims, the court, not the jury must resolve the parties’ dispute.” O2 Micro Int’l Ltd. V. Beyond Innovation Tech. Co., 521 F.3d 1351, 1360-61 (Fed. Cir. 2008) (“the ‘ordinary’ meaning of a term does not resolve the parties’ dispute, and claim construction requires the court to determine what claim scope is appropriate in the context of the patent-in-suit.”).

In the present case, the specifications of the patents describe what the inventor actually invented, and in many instances, the specification does not describe merely an embodiment of the invention, it describes the actual invention. See Decisioning.com v. Federated Department Stores, Inc., 527 F.3d 1300, 1309 (Fed. Cir. 2008) (Particular description “does not merely describe a preferred embodiment of the invention. Rather, it describes the invention itself.”); see also Netcraft Corp. v. eBay, Inc., 549 F.3d 1394, 1399 (Fed. Cir. 2008) (construing a claim term as limited to the only embodiment described in the specification because the specification “consistently describe[d] the invention in terms of [this embodiment]”). Claims must not be construed in a vacuum,

but must be construed in view of the specification, and the extent of the written description and enabling disclosure (or lack thereof) provided therein. Rather than relying on an undefined “ordinary meaning” which may improperly expand the scope of the claims well beyond the invention described in the specification, the Court must look to the meaning provided by the specification to ensure that the scope of the claims is consistent with “what the inventor actually invented.” Phillips, 415 F.3d at 1316.

Determining proper claim scope also requires consideration of statements or disclaimers made during the prosecution of the patents. “[B]y distinguishing the claimed invention over the prior art, an applicant is indicating what the claims do not cover, he is by implication surrendering such protection.” Ekchian v. Home Depot, Inc., 104 F.3d 1299, 1304 (Fed. Cir. 1997). “Prosecution arguments ... which draw distinctions between the patented invention and the prior art are useful for determining whether the patentee intended to surrender territory, since they indicate in the inventor’s own words what the invention is not.” MBO Labs, Inc. v. Becton, Dickinson & Co., 474 F.3d 1323, 1330, 81 U.S.P.Q.2d 1661, 1666 (Fed. Cir. 2007). This is also true with respect to the prosecution of related patents. See Microsoft Corp. v. Multi-Tech. Sys., 357 F.3d 1340, 1350 (Fed. Cir. 2004) (“any statement of the patentee in the prosecution of a related application as to the scope of the invention would be relevant to claim construction...”).

“The construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.” Renishaw PLC v. Marposs Societa'per Azioni, 158 F.3d 1243, 1250 (Fed. Cir. 1998).

Once a term or phrase is defined, that definition should be used consistently throughout the claims, unless the patentee has clearly indicated that the term or phrase should have different meanings. See PODS, Inc. v. Porta Stor, Inc., 484 F.3d 1359, 1366 (Fed. Cir. 2007) (“We apply a presumption that the same terms appearing in different portions of the claims should be given the same meaning unless it is clear from the specification and prosecution history that the terms have different meanings at different portions of the claims.”). Similarly, common terms used across related patents should also be given similar meanings. See NTP, Inc. v. Research in Motion, Ltd., 418 F.3d 1282, 1293 (Fed. Cir. 2005) (“Because [plaintiff’s] patents all derive from the same parent application and share many common terms, we must interpret the claims consistently across all asserted patents.”); see also In re Katz, 639 F.3d 1303, 1325 (Fed. Cir. 2011).

As noted above, courts are also authorized to “rely on extrinsic evidence, which ‘consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises.’” Phillips, 415 F.3d at 1317 (quoting Markman, 52 F.3d at 980). “However, while extrinsic evidence ‘can shed useful light on the relevant art,’ ... it is ‘less significant than the intrinsic record in determining ‘the legally operative meaning of claim language.’” Id. (quoting C.R. Bard, Inv. v. U.S. Surgical Corp., 388 F.3d 858, 862 (Fed. Cir. 2004) (in turn quoting Vanderlande Indus. Nederland BV v. Int’l Trade Comm’n, 366 F.3d 1311, 1318 (Fed. Cir. 2004))).

“In sum, extrinsic evidence may be useful to the court, but it is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the

intrinsic evidence.” Phillips, 415 F.3d at 1319.

III. DETERMINING THE MEANING OF THE ASSERTED CLAIMS.

As set forth in detail in its Disclosure of Asserted Claims and Infringement Contentions, Omega Patents, LLC (“Omega”) has currently alleged infringement of the following claims:

U.S. Pat. No. 6,346,876

– Claims 1, 3-5, 12, 14, 16, 28, 34-36 and 41

U.S. Pat. No. 6,737,989

– Claims 23, 31, 32, 34 and 35

U.S. Pat. No. 6,756,885

– Claims 1-3, 12, 14 and 24

U.S. Pat. No. 7,671,727

– Claims 1, 10, 11, 19 and 25

U.S. Pat. No. 8,032,278

– Claims 1-6, 8, 11-14, 16, 18, 19 and 21

From the asserted claims, the parties have identified a number of terms and phrases that either one or both parties believe should be construed. The proper construction of these terms and phrases is evident from the intrinsic evidence, and there is no need to consult extrinsic evidence. The claim terms in the patents-in-suit are defined in the relevant specifications, and should be given their ordinary and customary meaning, as would have been known to a person of ordinary skill in the art at the time of the invention. Phillips, 415 F.3d at 1312-1313 (Fed. Cir. 2005) (citations omitted). Thus the

claims should be construed as they would have been understood by one knowledgeable in the vehicle telematics industry at the time of filing of the respective patents.

It is the person of ordinary skill in the field of the invention through whose eyes the claims are construed. Such person is deemed to read the words used in the patent documents with an understanding of their meaning in the field, and to have knowledge of any special meaning and usage in the field. The inventor's words that are used to describe the invention- - the inventor's lexicography- - must be understood and interpreted by the court as they would be understood and interpreted by a person in that field of technology. Thus the court starts the decision-making process by reviewing the same resources as would that person, *viz.*, the patent specification and the prosecution history.

Id. at 1314 (quoting Multiform Desiccants, Inc. v. Medzam, Ltd., 133 F.3d 1473, 1477

(Fed. Cir. 1998)).

A. Qualifications of Persons of Ordinary Skill in the Art.

The relevant field of art for purposes of construing the claims of the patents-in-suit is the vehicle telematics industry. A person of ordinary skill in the art in that field would have at least an undergraduate degree in electrical engineering, automotive engineering, or an equivalent engineering discipline, and several years' experience in designing, manufacturing, installing and/or working on vehicle telematics systems. Alternatively, additional years of practical experience may replace the engineering degree, or completion of post-graduate engineering studies may reduce the years of practical experience necessary.

B. Construing Claims Pursuant to 35 U.S.C. §112, ¶6.

“An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure,

material, or acts described in the specification and equivalents thereof.” 35 U.S.C. §112, ¶6.

“To determine whether a means-plus-function limitation is definite, a court applies a two-step analysis. First, a court identifies the particular claimed function. ... After identifying the particular claimed function, a court, in the second step of the analysis, looks to the specification and identifies the corresponding structure, material, or acts that perform that function. HTC Corp. v. IPCom GmbH & Co., KG, 667 F.3d 1270, 1278 (Fed. Cir. 2012) (citations omitted).

The structure described in the specification must be identified as corresponding to the specific means. Default Proof Credit System, Inc. v. Home Depot U.S.A., Inc., 412 F.3d 1291, 1298 (Fed. Cir. 2005) (“A structure disclosed in the specification qualifies as ‘corresponding’ only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim.”) Further, “[i]f an applicant fails to set forth an adequate disclosure, the applicant has in effect failed to particularly point out and distinctly claim the invention as required by the second paragraph of section 112.” Id. (citations omitted).

IV. TERMS AND PHRASES TO BE CONSTRUED.

The case law cited above clearly sets forth the hierarchy for claim construction. The starting point is necessarily the plain language of the claims. Based on the clear language of the claims, read in the context of the patent specification, and the knowledge of those skilled in the art at the time, these terms and phrases may be construed in such a

way as to clearly and simply construe the claim language and define the scope of the claim, in a way that will be helpful to the trier of fact.

For convenience, the intrinsic evidence upon which CalAmp relies to support its proposed constructions is attached as follows: **Exhibit A** – U.S. Pat. No. 6,346,876; **Exhibit B** – U.S. Pat. No. 6,756,885; **Exhibit C** – U.S. Pat. No. 7,671,727; and **Exhibit D** – U.S. Pat. No. 8,032,278. (Note that U.S. Pat. No. 6,737,989 is omitted, as none of the disputed terms are from the asserted claims of this patent).

A. “data communications bus / vehicle data communications bus / vehicle data bus”

“wired connection for transferring data to and from vehicle devices”

This term (as specified below) is found in the following asserted claims:

data communications bus - ‘876 patent - claims 1, 3-5, 12, 14, 16, 28, 34-36, 41;

‘885 patent - claims 1-3, 12, 14, 24;

vehicle data communications bus - ‘727 patent - claims 1, 10, 11, 19, 25; and

vehicle data bus - ‘278 patent - claims 1-6, 8, 11, 12, 13, 14, 16, 18, 19-21.

The patents-in-suit use several similar terms to describe a vehicle’s data communications bus. All are intended to have the same meaning, and thus should be given the same construction. In all of the patents-in-suit, the data communications bus is described as a wired connection for transferring data to and from vehicle devices. See, e.g., ‘876 patent at col. 2, lines 16-19 (“various electronic modules or devices may be linked by a single signal wire in a bus Digital messages are communicated to all modules over the data communications bus.”), Fig. 1; see also ‘885 patent at col. 2, lines

18-19, Fig. 1; '727 patent at col. 2, lines 44-45 (“vehicle data communications bus extending throughout the vehicle”); '278 patent at col. 2, line 53 (“vehicle data bus extending throughout the vehicle”). Thus the bus is a wired connection, and it is for transferring data (“digital messages”) to and from vehicle devices.

Omega’s proposed construction attempts to describe not only the bus, but the data sent on the bus. This exceeds the scope of the term, and even were it proper, there is no support for the requirement “each message including one or more device addresses.” The '727 and '278 patents make no mention of messages including device addresses, so it cannot be a requirement taught in those patents. While the '876 and '885 patents do mention device addresses, they make it clear that including a device address is an optional feature in some systems: “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.” '885 patent at col. 2, lines 20-22 (emphasis added). Thus even if it were within the scope of defining the bus to also define the type of data on the bus (which it is not), the requirement asserted by Omega is not present in two of the patents in which claims containing this term appear, and is described as optional (“may”) in the other two patents in which claims containing this term appear. Thus the intrinsic evidence supports CalAmp’s proposed construction.

B. “vehicle device”

“electrical or electronic components in a vehicle that can be controlled and/or the status thereof read”

This term is found in the following asserted claims:

'876 patent - claims 1, 3-5, 12, 14, 16, 28, 34-36, 41;

'885 patent - claims 1-3, 12, 14, 24;

'727 patent - claims 1, 10, 11, 19, 25; and

'278 patent - claims 1-6, 8, 11, 12, 13, 14, 16, 18, 19-21.

The patents-in-suit consistently describe vehicle devices as electrical or electronic components in a vehicle that can be controlled and/or the status thereof read. Because the term “vehicle device” is quite broad, and susceptible to many meanings, it is not proper to simply overlook this term and let the jury determine its proper meaning, and thereby determine the proper scope of the claim. As noted above, that is the province of claim construction. Construction of this term is necessary because it was specifically defined in the patents.

Vehicle device is defined specifically as electrical or electronic components in a vehicle that can be controlled and/or the status thereof read. See, e.g., '876 patent at col. 6, lines 61-62; '885 patent at col. 6, lines 41-42 (“the vehicle 21 includes a number of **electrical/electronic devices that can be controlled and/or the status thereof read**”) (emphasis added). The other patents describe a particular vehicle device that meets the proposed construction. See '727 patent at col. 2, lines 46-47 (“vehicle device generating data related to vehicle speed on the vehicle data communications bus”); '727 patent at col. 3, lines 9-11 (“The at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus may include a vehicle position determining device.”); '278 patent at col. 3, lines 1-3 (“control operable vehicle devices, and/or read information therefrom via the vehicle data communications bus.”); '278 patent at col. 6,

lines 38-39 (“vehicle device may comprise at least one door lock actuator 62.”); ‘278 patent at col. 10, line 48 (“vehicle device is a vehicle horn”); ‘278 patent at col. 10, line 51 (“vehicle device is a vehicle alarm indicator siren”); see also Fig. 10.

All of the above vehicle devices are electrical or electronic components in a vehicle that can be controlled and/or the status thereof read, and thus CalAmp’s proposed construction, taken directly from the specification, is correct.

C. “command signal”

“signal generated on the data communications bus for operating a vehicle device to cause a desired function to be performed at the vehicle”

This term is found in the following asserted claims:

‘876 patent - claims 1, 3-5, 12, 14, 16, 28, 34-36, 41

The only asserted claims in which the term “command signal” is found are claims of the ‘876 patent. The ‘876 patent defines a command signal as a signal generated on the data communications bus for operating a vehicle device to cause a desired function to be performed at the vehicle. The command signal is generated on the data communications bus. See ‘876 patent at col. 7, lines 43-45 (“controller 25’ preferably **generates at least one set of command signals on the control bus.**”) (emphasis added). The command signal is for operating a vehicle device. See ‘876 patent at col. 3, lines 19-20 (“will **cause an operation** or response from the vehicle device.”) (emphasis added). Command signals may be “**for operating** the alarm indicating device” (‘876 patent, col. 3, line 39), “**for operating** the door lock actuators” (‘876 patent, col. 3, lines 41-42), or **for operating** a remote start device (‘876 patent, col. 3, lines 42-45). These operations

“**cause a desired function to be performed** at the vehicle....” See 876 patent at col. 5, lines 45-49 (defining “function”) (emphases added).

CalAmp’s proposed construction is again taken directly from the description provided in the specification, which is the best source to interpret claim language, and it accurately conveys the meaning of the term as it was described in the patent.

D. “device codes”

“signal from a vehicle device read on the vehicle bus”

This term is found in the following asserted claims:

‘876 patent - claims 1, 3-5, 12, 14, 16, 28, 34-36, 41; and

‘885 patent - claims 1-3, 12, 14, 24.

The patent describes “device codes” as a signal from a vehicle device that is read on the vehicle bus. See ‘876 patent at col. 9, lines 22-23; see also ‘885 patent at col. 3, lines 12-13; (“**reading** a device code from the data communications bus”); ‘876 patent at col. 9, lines 32-33; see also ‘885 patent at col. 3, lines 13-14 (“determining the match between the **read** device code and the stored device codes.”)(emphases added). Figs. 5 and 6 of both the ‘876 and ‘885 patent specifically identify that the codes are **read**. Should there be any doubt that the figures indeed show that device codes are read from the vehicle bus, the descriptions of these figures further confirm that the device codes are read from the vehicle bus: “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.” (emphasis added).

Both the ‘876 and ‘885 patents describe reading a device code from the bus, and attempting to determine a match between a read code and a stored code. See ‘876 patent at col. 9:15-18; 9:29-39; Figs. 5, 6; ‘885 patent at col. 3:5-18; 3:19-26; 3:27-24; 3:35-48; 4:9-24; 9:1-10; Figs. 5, 6. This is in contrast to the “command signals” (as shown in Fig. 3 of the ‘876 and ‘885 patents), which are generated on (or “written to”) the data communications bus for operating a vehicle device to cause a desired function to be performed, as described in Section IV.C. above. Omega’s proposed construction of device code appears to equate it with a command signal, and ignore the distinction between the two made in the ‘876 and ‘885 patents.

As the respective specifications make clear, a device code is a different term, and a different thing from a command signal. The specifications address them separately, and define them with different characteristics, and a proper construction of “device code” cannot make it the same as a command signal. CalAmp’s proposed construction reflects the differences in the two terms as set forth in the specification, and properly construes the claim terms in view of the written description.

E. “function”

“an operation of a vehicle device, such as remote starting the engine, remotely unlocking the vehicle doors, or changing the mode of a security system between armed and disarmed”

This term is found in the following asserted claims:

'885 patent - claim 24.

As with the terms above, the term “function” is defined specifically in the patent. The only asserted claim in which this term appears is claim 24 of the ‘885 patent. The ‘885 patent provides a single definition for “function”: “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.” ‘885 patent at col. 5, lines 24-29(emphasis added). While the operations that constitute a function are couched as an example, they are the only operations described in the patent, and thus they do not describe one embodiment, they describe the invention. There are no other “functions” described in the patent. See ‘885 Patent at col. 3:63-4:8; 5:16-34; 8:1-11; Fig. 3.

This construction of “function” encompasses the extent of the functions that the patentee demonstrated he invented, and thus the term cannot be expanded beyond the support in the specification to encompass more than the inventor invented. See Phillips, 415 F.3d at 1316; see also Wang Labs. v. America Online, Inc., 197 F.3d 1377, 1384 (Fed. Cir. 1999) (“usage ‘preferred’ does not of itself broaden the claims beyond their support in the specification.”); Renishaw PLC v. Marposs Societa'per Azioni, 158 F.3d 1243, 1290 (Fed. Cir. 1998) (“The construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.”)

F. “remote vehicle speed exceeded notification”

“a message sent from a vehicle indicating that the vehicle has exceeded a particular speed”

This term is found in the following asserted claims:

‘727 patent - claims 1, 10, 11, 19, 25.

This term appears only in the ‘727 patent. The ‘727 patent describes in multiple areas that the speed exceeded notification device is in the vehicle. See ‘727 patent at col. 4:48-59 (describing the wireless communication device (in the vehicle) that sends the notification, as shown in Figs. 1-3). However, before the wireless communication device (which is located in the vehicle) can send a remote vehicle speeded exceeded notification to a location outside the vehicle, it must first receive such notification from the controller, which is also located within the vehicle. See ‘727 patent at col. 6:4-21 (describing the controller (in the vehicle) that can send the speed exceeded notification to the wireless communications device). See also Figs. 4, 5, 6 (flowcharts showing that the speed exceeded notification is sent from the controller in the vehicle, in **accordance with the present invention**). Thus not just in one embodiment, but in the invention itself, the notification is sent from the vehicle. See Netcraft, 549 F.3d at 1399. Thus there can be no dispute that as the invention is described in the ‘727 patent, any remote vehicle speed exceeded notification must be sent from the vehicle.

Omega’s proposed instruction attempts to ignore this teaching, and describes a nebulous message without an origin. However, Omega’s support includes column 3, lines 33-35, and column 6, lines 31-34, which specifically note that the controller (in the

vehicle) cooperates with the wireless communication device (in the vehicle) to send a remote vehicle speed exceeded notification. Thus Omega's proposed construction expands the scope of the claim well beyond what is described in the specification. In contrast, CalAmp's proposed construction is supported directly by the specification, and thus "remote vehicle speed exceeded notification" should properly be construed as "a message sent from a vehicle indicating that the vehicle has exceeded a particular speed."

G. "downloading interface"

"connection that can receive data"

This term is found in the following asserted claims:

'278 patent - claims 1-6, 8, 11, 12, 13, 14, 16, 18, 19-21.

The only asserted claims in which this term appears are in the '278 patent. The specification provides several examples of a downloading interface, all of which are a connection that can receive data. While Omega contends that it is not necessary to construe this term, without reference to the specification, it is not clear what this term means. Jurors may believe that this is referring to software interface for downloading, or some other type of interface. Withholding guidance from the jury will likely lead to confusion, and thus this term should be construed according to the specification. While the construction may appear quite simple, providing the jury with such construction fulfills the mandate of claim construction, and avoids possible misinterpretation. See O2 Micro, 521 F.3d at 1360-61.

The patent describes the downloading interface as hardware: a connection to the tracking unit. Data may be received over this connection. See '278 patent at col. 2:63-

67; 3:4-16; 3:37-44; 24:4-12; 24:14-51; 25:5-28; Figs. 10-15. Thus the downloading interface is a connection that can receive data.

H. “enabling data”

“a vehicle device code or codes, an instruction to select a code or codes, or the data or sequence to allow the controller to generate a vehicle device code or codes”

This term is found in the following asserted claims:

‘278 patent - claims 1-6, 8, 11, 12, 13, 14, 16, 18, 19-21.

The term “enabling data” lacks any common meaning, and lacks any specific structure. Because it does not convey adequate structure to one of ordinary skill in the art, it should be construed pursuant to 35 U.S.C. §112, ¶6. It is a structureless means – data – for performing a vague function – enabling. Thus it is properly limited to the specific structure disclosed in the specification. Even if not considered to be means-plus-function, the only written description and enabling support is the limited description in the specification, and thus the term is properly limited to the written description provided by the specification.

The only description of enabling data is as follows: “The enabling data may be the vehicle device code or codes, an instruction to select a code or codes from among those already stored, or the data or sequence to allow the controller 111 to generate the vehicle device code or codes, for example.” ‘278 patent at col. 24, lines 8-12. While there are several other references to “enabling data,” none describe what it is. See ‘278

patent at col. 2:63-67; 3:4-16; 3:37-44; 24:4-7; 25:14-28; Figs. 10-15. As noted above, where a term

I. “programming instruction”

“code which instructs the controller to perform an operation”

This term is found in the following asserted claims:

‘278 patent - claims 8, 16, 21.

This is another term which may appear simple, but which is susceptible to multiple meanings, and it would be error to allow the jury to interpose a meaning not supported by the specification. The only asserted claims in which this term appears are in the ‘278 patent. From the context of these claims and the specification (see ‘278 patent at col. 3:4-16; 3:37-44; 24:4-14; 24:46-51; Figs. 10-15), the programming instruction is for programming the controller, meaning that it is code which instructs the controller to perform an operation.

J. “transmitter”

“device that sends signals”

This term is found in the following asserted claims:

‘876 patent - claims 1, 3-5, 12, 14, 16; and

‘885 patent - claims 1-3, 12, 14.

This term is used in asserted claims of both the ‘876 and ‘885 patents. A transmitter has a commonly understood meaning to those of ordinary skill in the art, which meaning is confirmed by the specification: a transmitter is a device that sends signals. The ‘876 and ‘885 patent do not appear to specifically define transmitter to limit

its commonly understood meaning. See ‘876 patent at col. 3:5-12; 3:63-4:9; 4:14-28; 4:33-36; 5:35-54; 5:55-6:2; 6:3-16; 6:17-27; see also ‘885 patent at col. 3:5-12; 3:49-62; 4:5-8; 4:9-24; 5:16-34; 5:35-62; 5:64-6:8.

The patents describe the transmitter as sending signals, and do not restrict the specific type of signals being sent. In fact, the patent specifically notes that while the transmitter may utilize a direct radio frequency link, it may also use “other communications infrastructure” including “via satellite, or cellular communications, via the public switched telephone network (PSTN) and/or over the world wide web or Internet....” ‘876 patent at col. 5, line 62-col. 6, line 2; see also ‘885 patent at col. 5, lines 42-50.. Thus the patent specifically discloses a wired transmitter when using the public switched telephone network (PSTN). Omega’s proposed construction would preclude certain of the transmitters specifically disclosed in the specification, and thus is too narrow. In contrast, CalAmp’s proposed construction is more accurate, and reflects the disclosure of the specification.

K. “receiver”

“device that receives signals”

This term is found in the following asserted claims:

‘876 patent - claims 1, 3-5, 12, 14, 16; and

‘885 patent - claims 1-3, 12, 14.

This term is used in asserted claims of both the ‘876 and ‘885 patents. A receiver has a commonly understood meaning to those of ordinary skill in the art, which meaning is confirmed by the specification: a receiver is a device that receives signals. See, e.g.,

‘876 patent at col. 3, lines 7-8; see also ‘885 patent at col. 5, line 17 (“receiver for receiving signals from the transmitter”). The ‘876 and ‘885 patent do not appear to specifically define receiver to limit its commonly understood meaning. See ‘876 patent at col. 3:5-12; 3:63-4:9; 4:14-28; 4:33-36; 5:35-54; 5:55-6:2; 6:3-16; 6:17-27; see also ‘885 patent at col. 3:5-12; 3:49-62; 4:5-8; 4:9-24; 5:16-34; 5:35-62; 5:64-6:8.

The patents describe the receiver as receiving signals, and do not restrict the specific type of signals being sent. In fact, the patent specifically notes that while the receiver may utilize a direct radio frequency link, it may also use “other communications infrastructure” including “via satellite, or cellular communications, via the public switched telephone network (PSTN) and/or over the world wide web or Internet....” ‘876 patent at col. 5, line 62-col. 6, line 2; see also ‘885 patent at col. 5, lines 42-50. Thus the patent appear to specifically disclose a wired receiver when using the public switched telephone network (PSTN). Omega’s proposed construction would preclude certain of the receivers specifically disclosed in the specification, and thus is too narrow. In contrast, CalAmp’s proposed construction is more accurate, and reflects the disclosure of the specification.

V. CONCLUSION.

CalAmp’s proposed constructions are based on the intrinsic evidence, without the need for any extrinsic evidence. The terms selected are those that were defined in the specifications, and those that may have multiple meanings, and thus should properly be construed for the jury. CalAmp’s proposed constructions properly reflect the meanings of the terms and phrases as such would have been known to one of skill in the art at the

time of the invention, as informed by the specification. CalAmp respectfully submits that its proposed constructions accurately reflect the correct meaning of the identified terms and phrases, and that such constructions will assist the trier of fact in applying the claims to the accused devices. For these reasons, and those stated more fully above, CalAmp respectfully requests that the Court adopt its proposed constructions.

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CERTIFICATE OF SERVICE

I HEREBY CERTIFY, that I electronically filed a true and correct copy of DEFENDANT CALAMP CORP.'S OPENING CLAIM CONSTRUCTION BRIEF, on September 5, 2014 with the Clerk of Court using CM/ECF. I also certify that the foregoing document is being served this day on parties as listed (through counsel or those reflected as appearing without counsel) in the below Service List via transmission of Notices of Electronic Filing generated by CM/ECF or in some other authorized manner for those counsel or parties who are not authorized to receive electronically Notices of Electronic Filing.

s/ Joel A. Kauth
Attorney

SERVICE LIST

***Omega Patents, LLC v. CalAmp Corp.
Case No. 6:13-cv-1950-PGB-DAB
United States District Court, Middle District of Florida***

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US006346876B1

(12) **United States Patent**
Flick(10) **Patent No.:** **US 6,346,876 B1**
(45) **Date of Patent:** ***Feb. 12, 2002**(54) **MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM GENERATING COMMAND SIGNALS ON A DATA BUS AND ASSOCIATED METHODS**4,794,368 A * 12/1988 Grossheim et al. 340/527
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(List continued on next page.)

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Douglasville, GA (US) 30135**FOREIGN PATENT DOCUMENTS**DE 195 30 721 A1 2/1997 H02J/9/04
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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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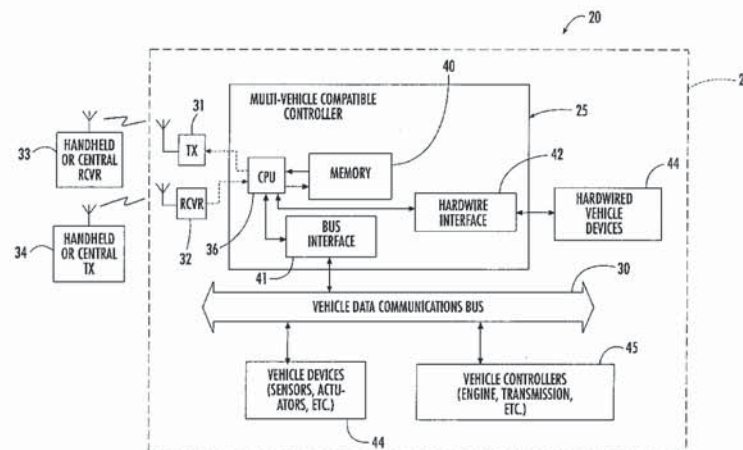
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Mark Thompson, "The Thick and Thin of Car Cabling," *IEEE Spectrum*, pp. 42-45 (2/96).(21) Appl. No.: **09/583,332**(22) Filed: **May 31, 2000****Related U.S. Application Data**

(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.⁷** **B60R 25/10**(52) **U.S. Cl.** **340/426; 340/531; 340/533; 307/10.2; 180/287**(58) **Field of Search** **340/426, 425.5, 340/428, 429, 430, 576, 539, 825.69, 531, 533, 534; 180/167, 287; 307/10.2, 10.3, 10.4, 10.5**(56) **References Cited****U.S. PATENT DOCUMENTS**4,055,772 A 10/1977 Leung 307/10 R
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4,760,275 A 7/1988 Sato et al. 307/10 R
4,792,783 A 12/1988 Burgess et al. 340/22(57) **ABSTRACT**

A control system includes a transmitter and a receiver for receiving signals from the remote transmitter, and a multi-vehicle compatible controller cooperating with the transmitter and receiver. The multi-vehicle compatible controller preferably generates at least one set of command signals on the data communications bus for the at least one vehicle device. The at least one set of command signals may include at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide compatibility with a plurality of different vehicles. Multiple signals or codes can be generated on the data communications bus, and only that code for the given vehicle will cause an operation or response from the vehicle device. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus. The features are also readily implemented in an adaptor to use with conventional security or other control system controllers for vehicles.

51 Claims, 8 Drawing Sheets

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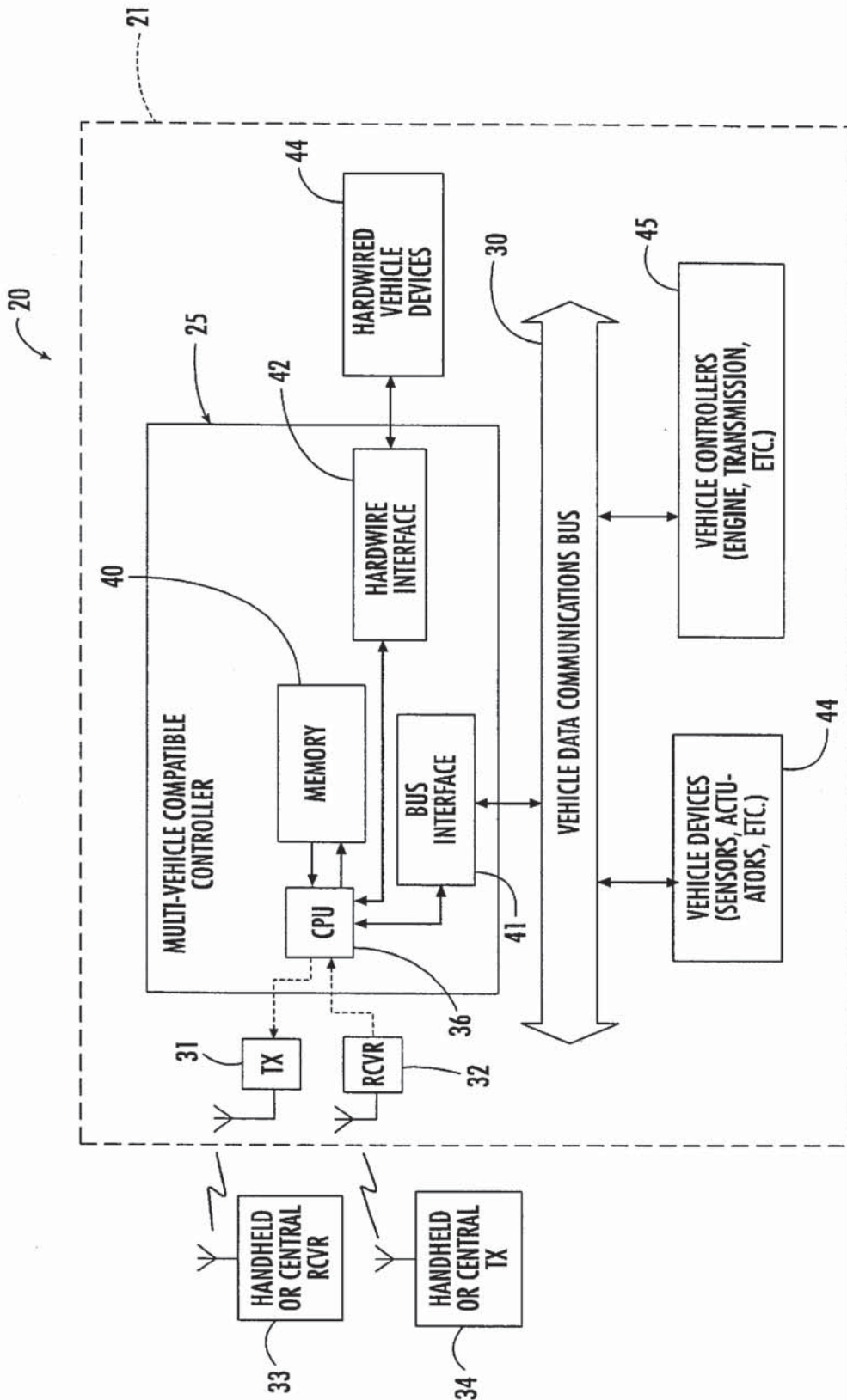


FIG. 1.

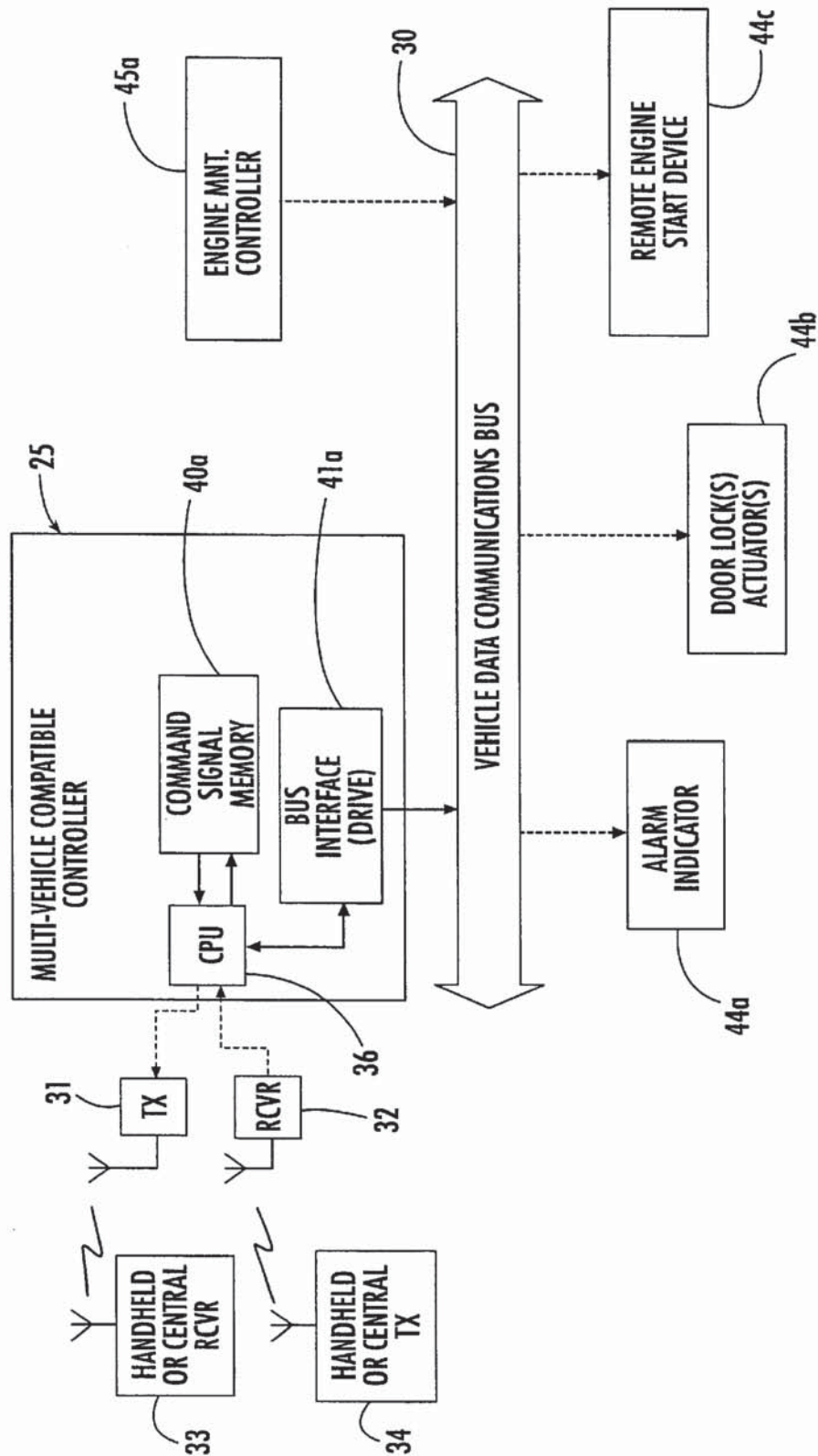
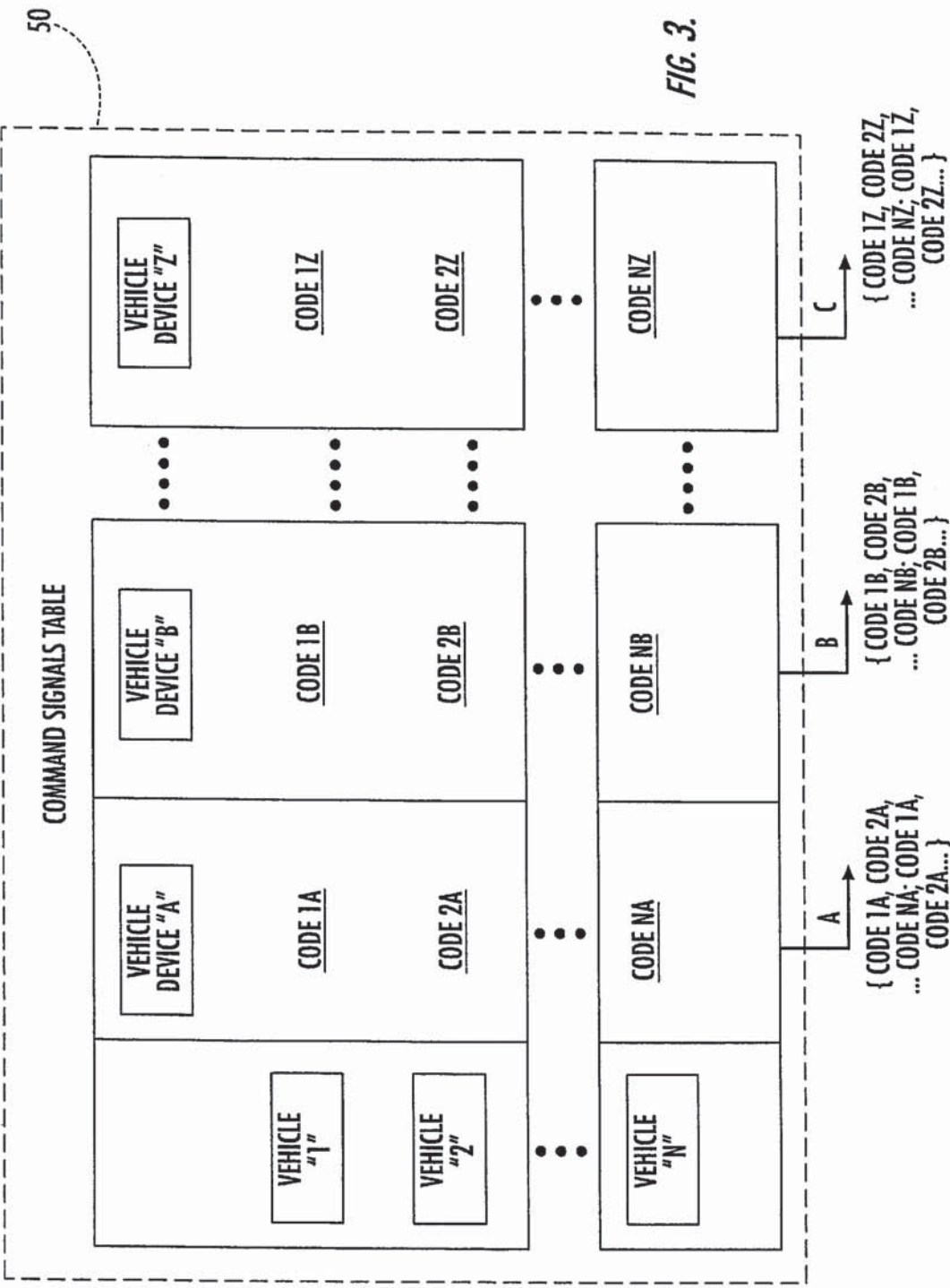


FIG. 2.



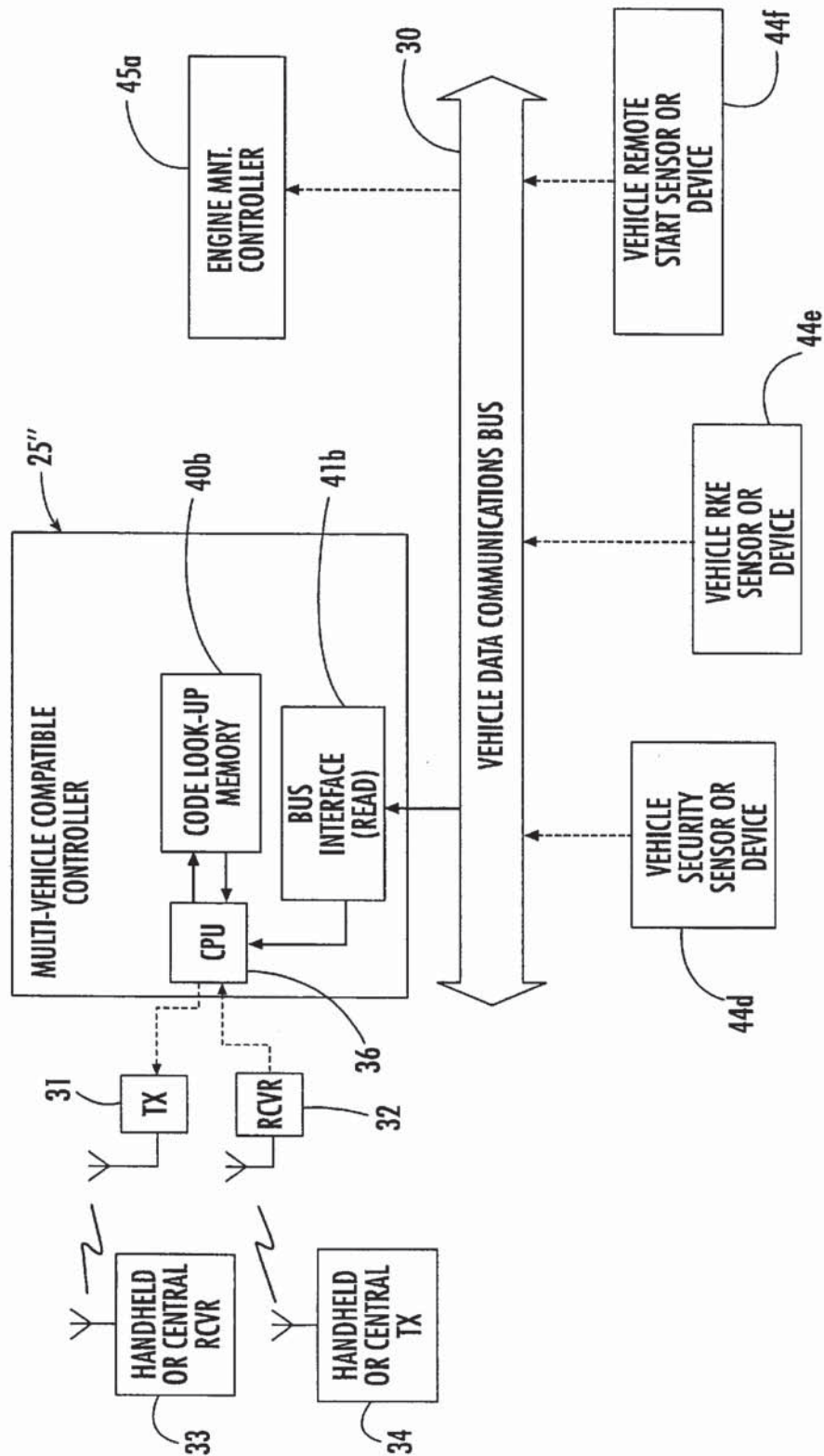


FIG. 4.

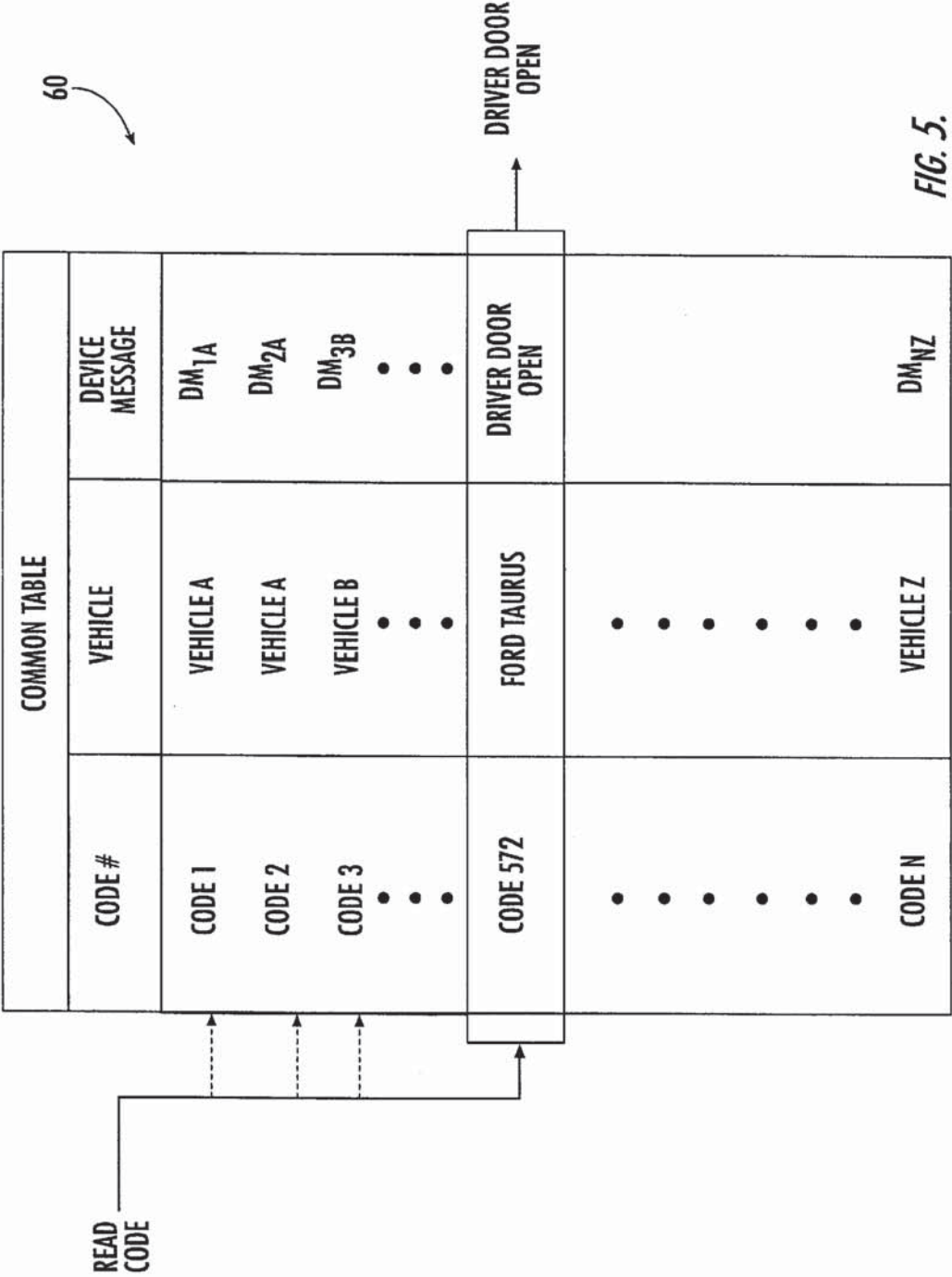


FIG. 5.

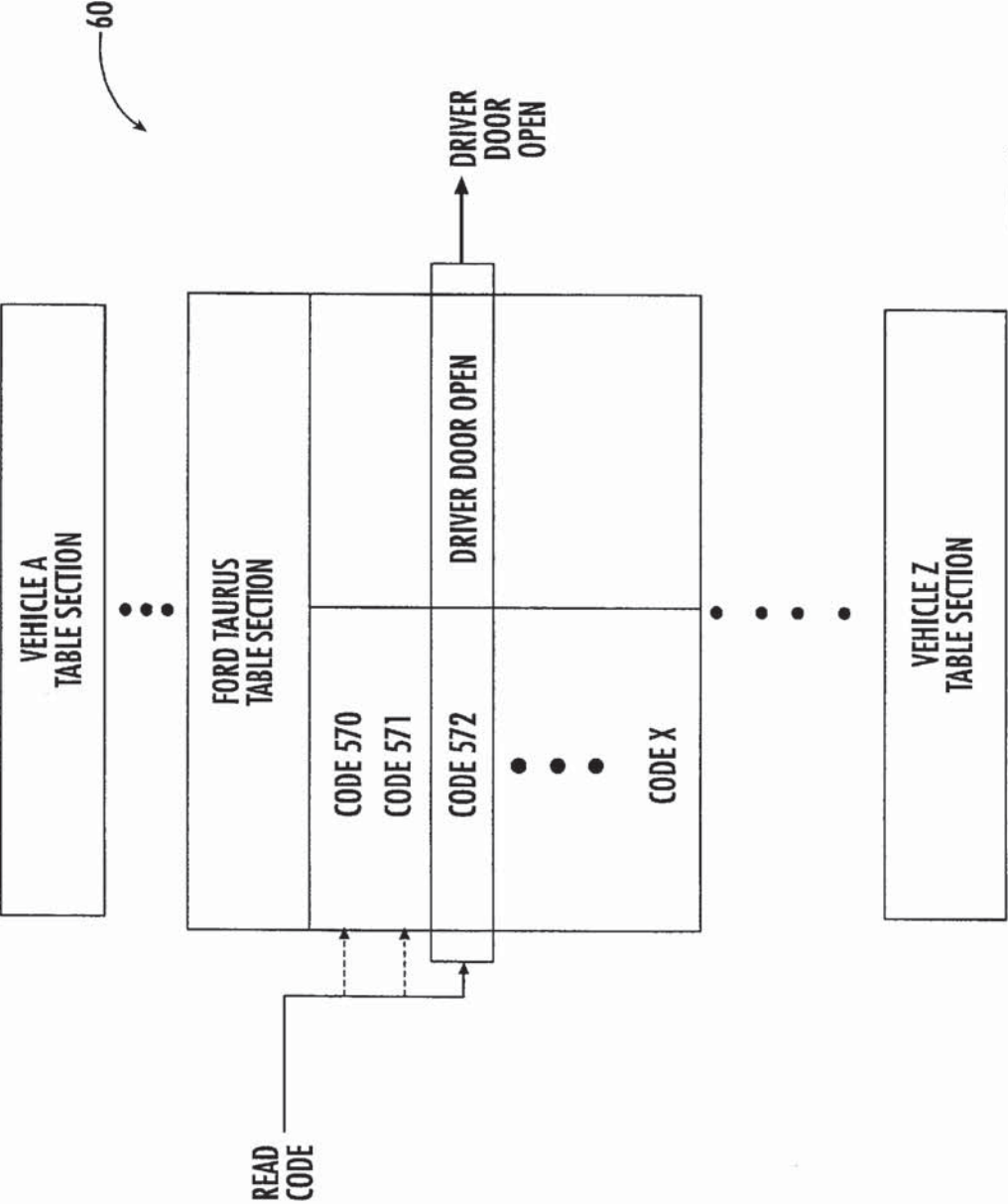


FIG. 6.

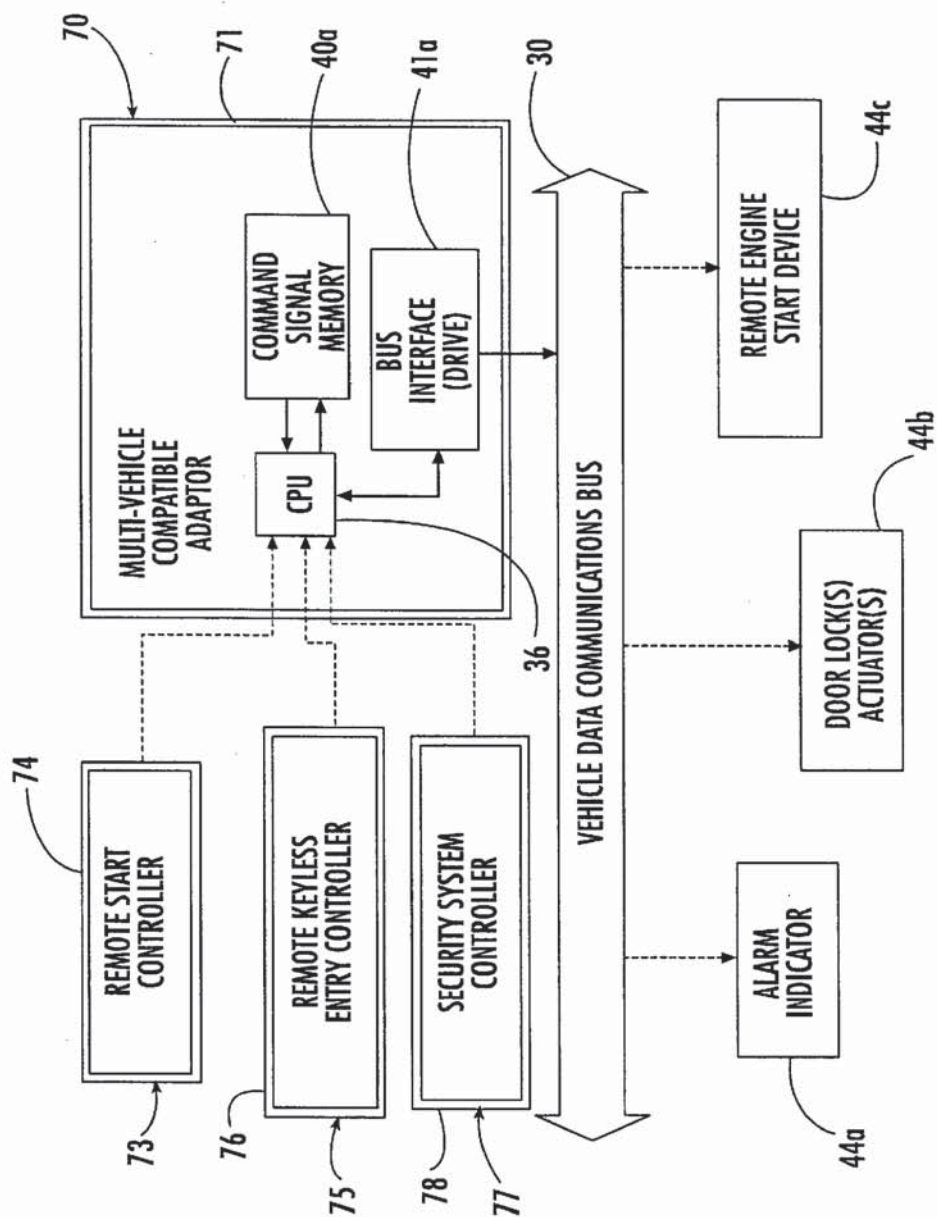


FIG. 7.

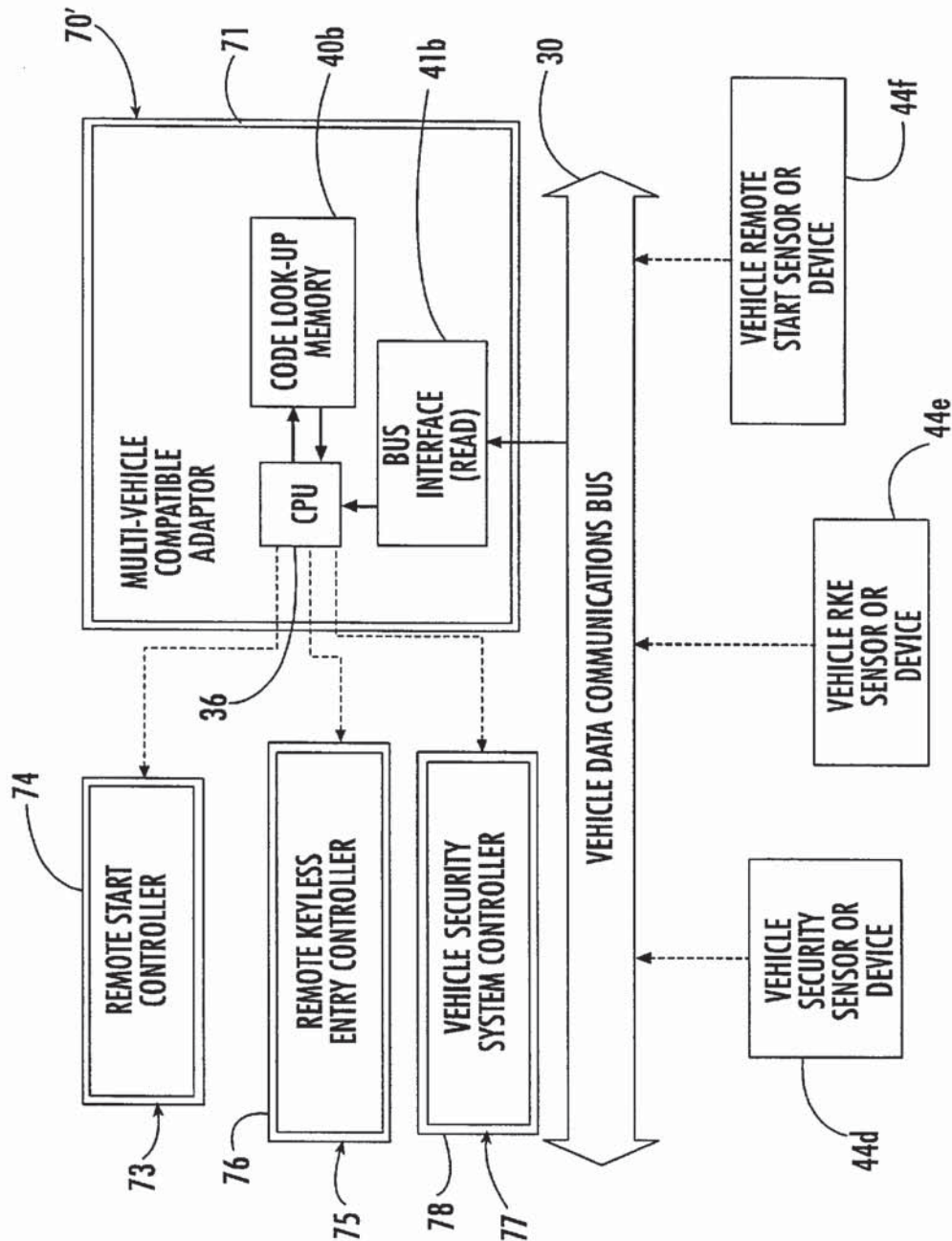


FIG. 8.

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MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM GENERATING COMMAND SIGNALS ON 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, U.S. Pat. No. 6,275,147 which in turn, is a continuation of Ser. No. 09/023,838 now U.S. Pat. No. 6,011,460, filed Feb. 13, 1998 which in turn, is a continuation-in-art of Ser. No. 08/701,356 now U.S. Pat. No. 5,719,551 filed Aug. 22, 1996.

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 micro-wave 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.

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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 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 invention are provided by a vehicle 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. The multi-vehicle compatible controller preferably generates at least one set of command signals on the data communications bus 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 a plurality of different vehicles. In other words, multiple signals or codes can be generated on the data communications bus, and only that code for the given vehicle and device will cause an operation or response from the vehicle device. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus.

The at least one vehicle device may, of course, comprise a plurality of vehicle devices. Accordingly, the multi-vehicle compatible controller may generate a respective set of command signals for each of the vehicle devices. In one embodiment, the multi-vehicle compatible controller generates the different command signals sequentially. Of course, the multi-vehicle compatible controller may preferably generate command signals, with each representing digitally coded information, and the multi-vehicle compatible controller may include a memory for storing data relating to the command signals.

The remote control system may be for vehicle security, remote keyless entry, or remote vehicle starting, or combinations of such features, for example. More particularly, the at least one vehicle device may comprise an alarm indicating device, and the at least one set of command signals may be for operating the alarm indicating device. The at least one vehicle device may be one or more door lock actuators, and the at least one set of command signals may be for operating the door lock actuators. In addition, the at least one vehicle device may comprise at least one device relating to starting a vehicle engine, and the at least one set of command signals may be for operating such a device.

In accordance with another aspect of the invention, the multi-vehicle compatible controller may generate each command signal of a set of command signals a plurality of times. This may ensure that the signal is received even when there is other data traffic on the data communications bus.

The multi-vehicle compatibility concept may be extended to an adaptor device, such as for after-market installation, and may be especially advantageous when used in combination with a conventional vehicle function controller. In other words, the multi-vehicle compatible controller may comprise a controller, such as a conventional security, keyless entry, or remote start controller, and a multi-vehicle adaptor connected to the controller. The multi-vehicle adaptor may generate the at least one set of command signals on the data communications bus responsive to a signal from the controller.

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.

The multi-vehicle compatible controller may, in some embodiments, also be for reading signals on the data communications bus. This reading function may also have multi-vehicle compatibility.

A method aspect of the invention is directed to a control method for a vehicle comprising a data communications bus and at least one vehicle device connected to the data communications bus. The method preferably comprises generating at least one set of command signals on the data communications bus for the at least one vehicle device and wherein 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 a plurality of different vehicles. The method may also include receiving signals at the vehicle from a remote transmitter, and the generation of command signals may be further based on receiving such signals.

Another method aspect of the invention is for adapting a control system for a vehicle to be compatible with different vehicles, wherein each vehicle includes a data communications bus and at least one vehicle device connected to the data communications bus. The control system preferably includes a transmitter and a receiver for receiving signals from the transmitter, and a controller cooperating with the transmitter and receiver. The method for adapting preferably comprises monitoring an output of the controller, and generating at least one set of command signals on the data communications bus responsive to the output of the controller. Again, the at least one set of command signals preferably includes at least one working command signal and at least one non-working command signal for a given vehicle 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

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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 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 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

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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 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 hardware 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

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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 FOR READING FROM A DATA BUS AND ASSOCIATED METHODS" (attorney docket no. 16635H), 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 to the data communications bus, the control system comprising:

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

a multi-vehicle compatible controller at the vehicle and cooperating with said transmitter and receiver, said multi-vehicle compatible controller generating at least one set of command signals on the data communications bus for the at least one vehicle device, the at least one set of command signals comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles.

2. 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 generates a respective set of command signals for each vehicle device of the plurality thereof.

3. A control system according to claim 1 wherein said multi-vehicle compatible controller generates command signals sequentially.

4. A control system according to claim 1 wherein said multi-vehicle compatible controller generates command signals each representing digitally coded information.

5. A control system according to claim 1 wherein said multi-vehicle compatible controller comprises a memory for storing data relating to the at least one set of command signals.

6. A control system according to claim 1 wherein the at least one vehicle device comprises an alarm indicating device; and wherein the at least one set of command signals is for operating the alarm indicating device.

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7. A control system according to claim 1 wherein the at least one vehicle device comprises at least one vehicle door lock actuator; and wherein the at least one set of command signals is for operating the at least one door lock actuator.

8. A control system according to claim 1 wherein the at least one vehicle device comprises at least one device relating to starting a vehicle engine; and wherein the at least one set of command signals is for operating the at least one vehicle device relating to starting the vehicle engine.

9. A control system according to claim 1 wherein said multi-vehicle compatible controller generates each command signal of the at least one set of command signals a plurality of times.

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

a controller for generating at least one controller signal; and

a multi-vehicle compatible adaptor connected to said controller for generating the at least one set of command signals on the data communications bus responsive to the at least one controller signal.

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

12. A control system according to claim 1 wherein said multi-vehicle compatible controller is further 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 reading compatibility with a plurality of different vehicles.

13. 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.

14. 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.

15. 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.

16. 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.

17. 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.

18. 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 remote 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 generating at least one set of command signals on the data communications bus responsive to the controller, the at least one set of command signals comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles.

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19. An adaptor according to claim 18 wherein the at least one vehicle device comprises a plurality of vehicle devices; and wherein said multi-vehicle compatible adaptor circuit generates a respective set of command signals for each vehicle device of the plurality thereof.

20. An adaptor according to claim 18 wherein said multi-vehicle compatible adaptor circuit generates command signals sequentially.

21. An adaptor according to claim 18 wherein said multi-vehicle compatible adaptor circuit generates command signals each representing digitally coded information.

22. An adaptor according to claim 18 wherein said multi-vehicle compatible adaptor circuit comprises a memory for storing data relating to the at least one set of command signals.

23. An adaptor according to claim 18 wherein the at least one vehicle device comprises an alarm indicating device; and wherein the at least one set of command signals is for operating the alarm indicating device.

24. An adaptor according to claim 18 wherein the at least one vehicle device comprises at least one vehicle door lock actuator; and wherein the at least one set of command signals is for operating the at least one door lock actuator.

25. An adaptor according to claim 18 wherein the at least one vehicle device comprises at least one device relating to starting a vehicle engine; and wherein the at least one set of command signals is for operating the at least one vehicle device relating to starting the vehicle engine.

26. An adaptor according to claim 18 wherein said multi-vehicle compatible adaptor circuit generates each command signal of the at least one set of command signals a plurality of times.

27. An adaptor according to claim 18 wherein said multi-vehicle compatible adaptor circuit is further 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 reading compatibility with a plurality of different vehicles.

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

generating at least one set of command signals on the data communications bus for the at least one vehicle device, the at least one set of command signals comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles.

29. A method according to claim 28 further comprising receiving a signal from a transmitter; and wherein generating the at least one set of command signals is responsive to receiving the signal from the transmitter.

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

31. A method according to claim 29 wherein the transmitter comprises at least a central station transmitter.

32. A method according to claim 29 wherein the transmitter comprises a handheld transponder to be carried by a user when away from the vehicle.

33. A method according to claim 28 wherein the at least one vehicle device comprises a plurality of vehicle devices; and further comprising generating a respective set of command signals for each vehicle device of the plurality thereof.

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34. A method according to claim 28 wherein the command signals are generated sequentially.

35. A method according to claim 28 the command signals each represent digitally coded information.

36. A method according to claim 28 further comprising storing in a memory data relating to the at least one set of command signals.

37. A method according to claim 28 wherein the at least one vehicle device comprises an alarm indicating device; and wherein the at least one set of command signals is for operating the alarm indicating device.

38. A method according to claim 28 wherein the at least one vehicle device comprises at least one vehicle door lock actuator; and wherein the at least one set of command signals is for operating the at least one door lock actuator.

39. A method according to claim 28 wherein the at least one vehicle device comprises at least one device relating to starting a vehicle engine; and wherein the at least one set of command signals is for operating the at least one vehicle device relating to starting the vehicle engine.

40. A method according to claim 28 wherein each command signal of the at least one set of command signals is generated a plurality of times.

41. A method according to claim 28 further 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 to thereby provide reading compatibility with a plurality of different vehicles.

42. A method for adapting a control system for a vehicle to be compatible with plurality of different vehicles, each vehicle comprising a data communications bus and at least one vehicle device connected to the data communications bus, 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 method comprising:

monitoring an output of the controller; and

generating at least one set of command signals on the data communications bus responsive to the output of the controller, the at least one set of command signals comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles.

43. A method according to claim 42 wherein the at least one vehicle device comprises a plurality of vehicle devices; and further comprising generating a respective set of command signals for each vehicle device of the plurality thereof.

44. A method according to claim 42 wherein the command signals are generated sequentially.

45. A method according to claim 42 wherein the command signals each represent digitally coded information.

46. A method according to claim 42 further comprising storing in a memory data relating to the at least one set of command signals.

47. A method according to claim 42 wherein the at least one vehicle device comprises an alarm indicating device; and wherein the at least one set of command signals is for operating the alarm indicating device.

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48. A method according to claim 42 wherein the at least one vehicle device comprises at least one vehicle door lock actuator; and wherein the at least one set of command signals is for operating the at least one door lock actuator.

49. A method according to claim 42 where the at least one vehicle device comprises at least one device relating to starting a vehicle engine; and wherein the at least one set of command signals is for operating the at least one vehicle device relating to starting the vehicle engine.

50. A method according to claim 42 wherein each command signal of the at least one set of command signals is generated a plurality of times.

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51. A method according to claim 42 further 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 to thereby provide reading compatibility with a plurality of different vehicles reading signals on the data communications bus.

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US006756885B1

(12) **United States Patent**
Flick(10) **Patent No.: US 6,756,885 B1**
(45) **Date of Patent: Jun. 29, 2004**(54) **MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM FOR READING FROM A DATA BUS AND ASSOCIATED METHODS**EP 0 699 562 A2 7/1995 B60R/16/02
WO WO 97/28988 8/1997 B60R/16/02**OTHER PUBLICATIONS**(75) Inventor: **Kenneth E. Flick**, Douglasville, GA (US)(73) Assignee: **Omega Patents, L.L.C.**, Douglasville, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) bydays.days.

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(21) Appl. No.: **09/583,257**(22) Filed: **May 31, 2000****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.**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(56) **References Cited****U.S. PATENT DOCUMENTS**4,055,772 A 10/1977 Leung 307/10 R
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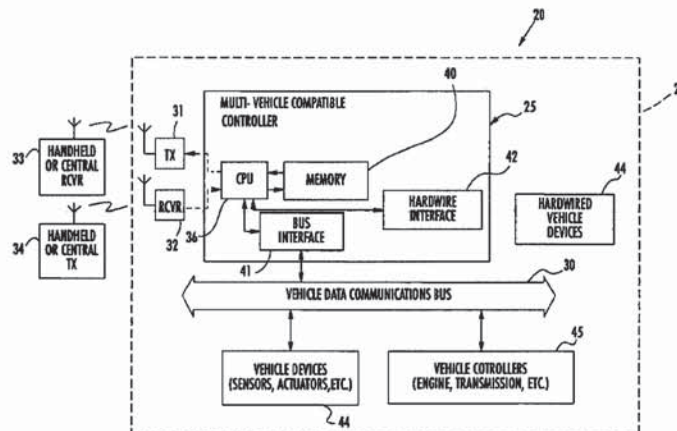
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Primary Examiner—Toan N. Pham(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.(57) **ABSTRACT**

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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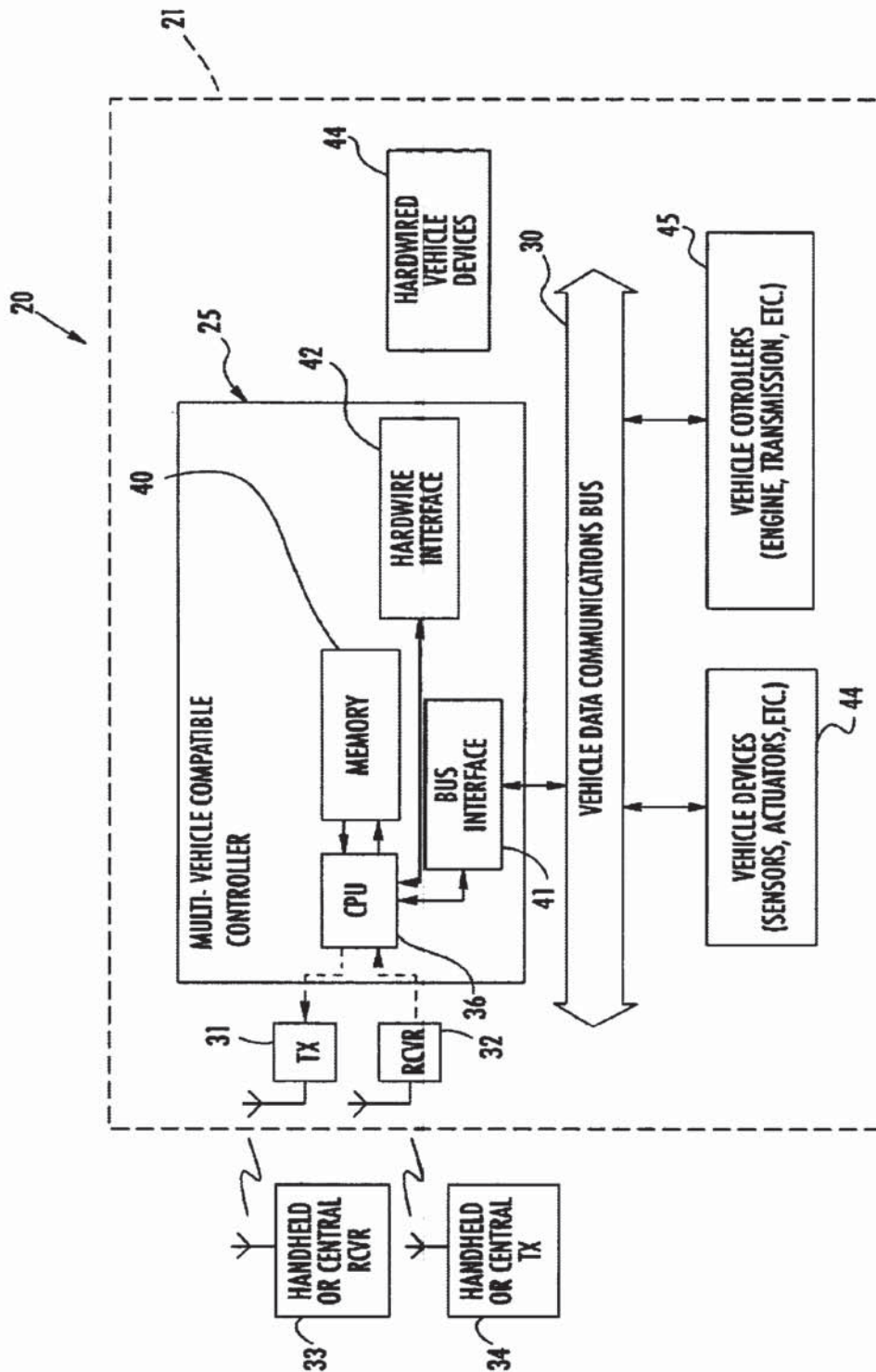


FIG. 1

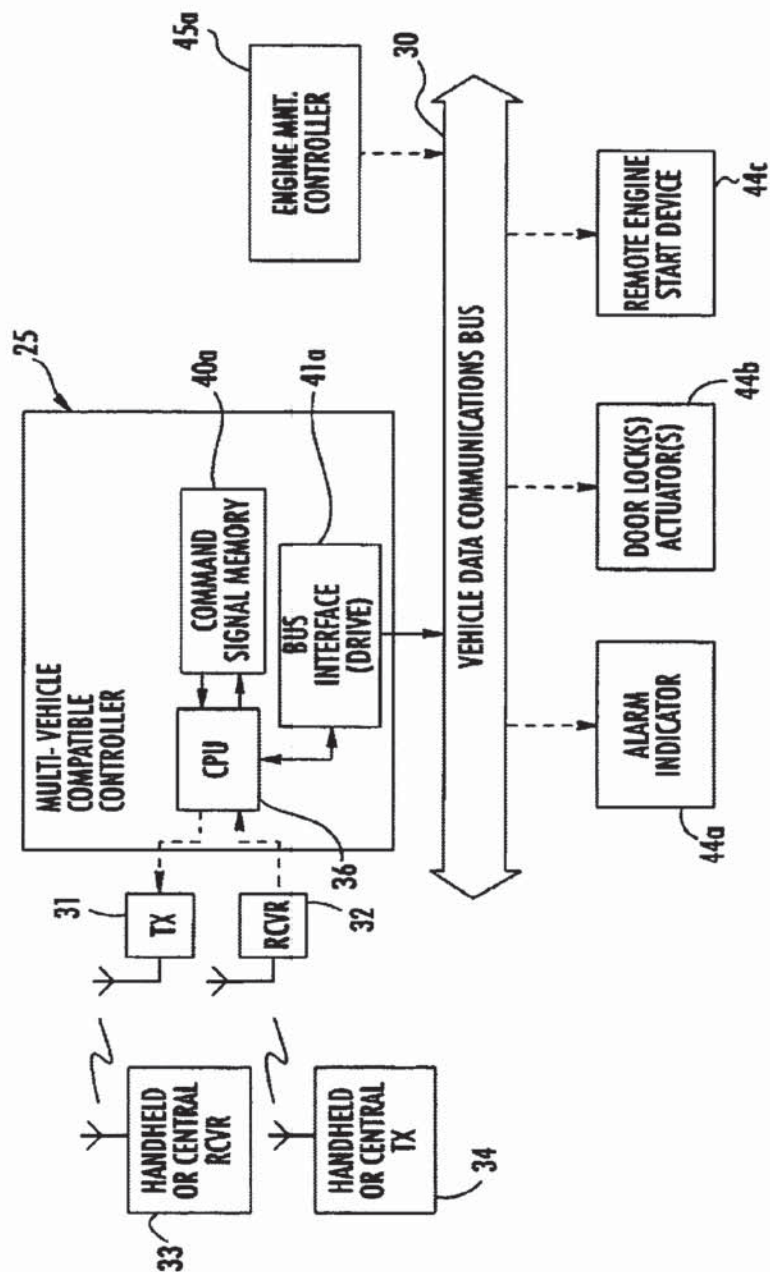
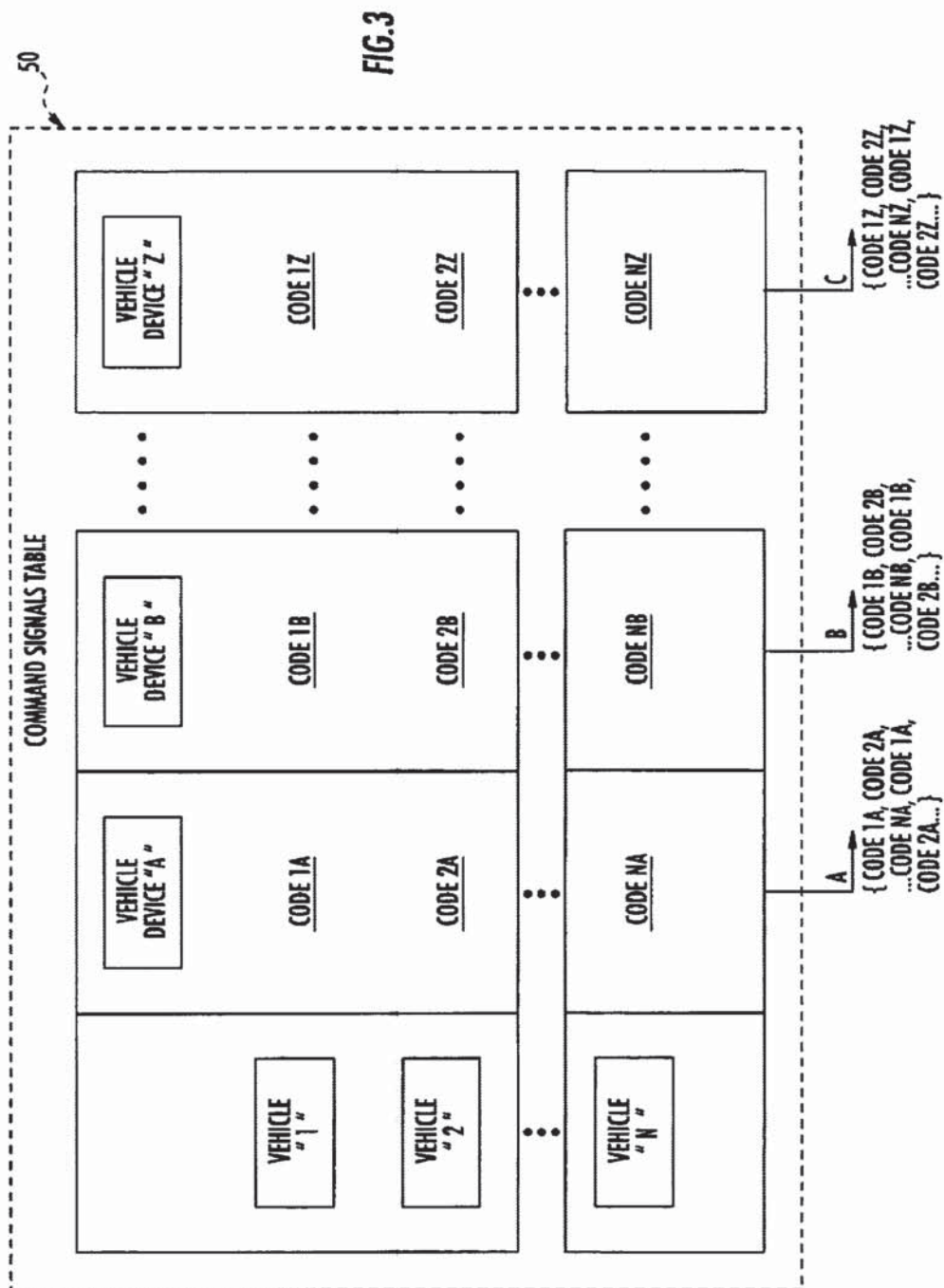


FIG. 2



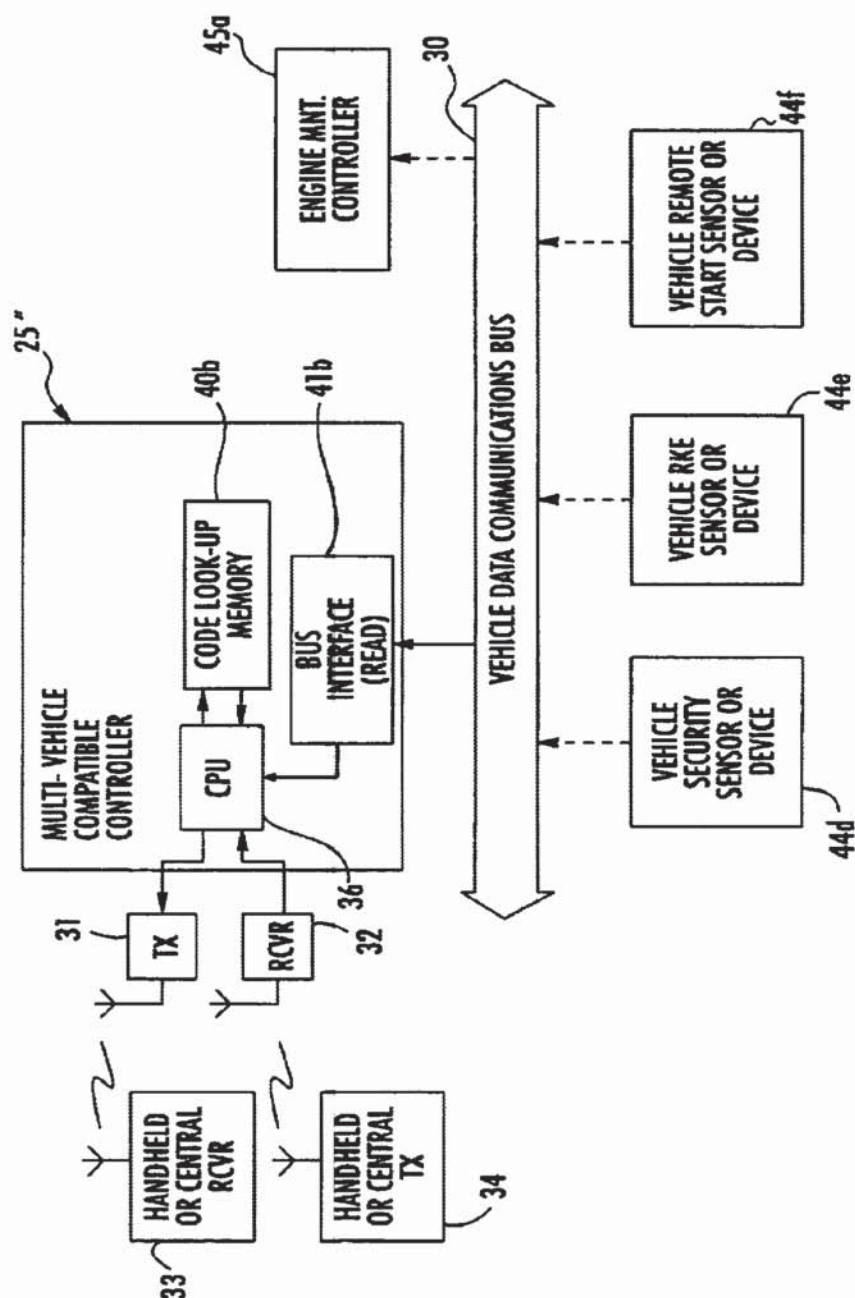


FIG. 4

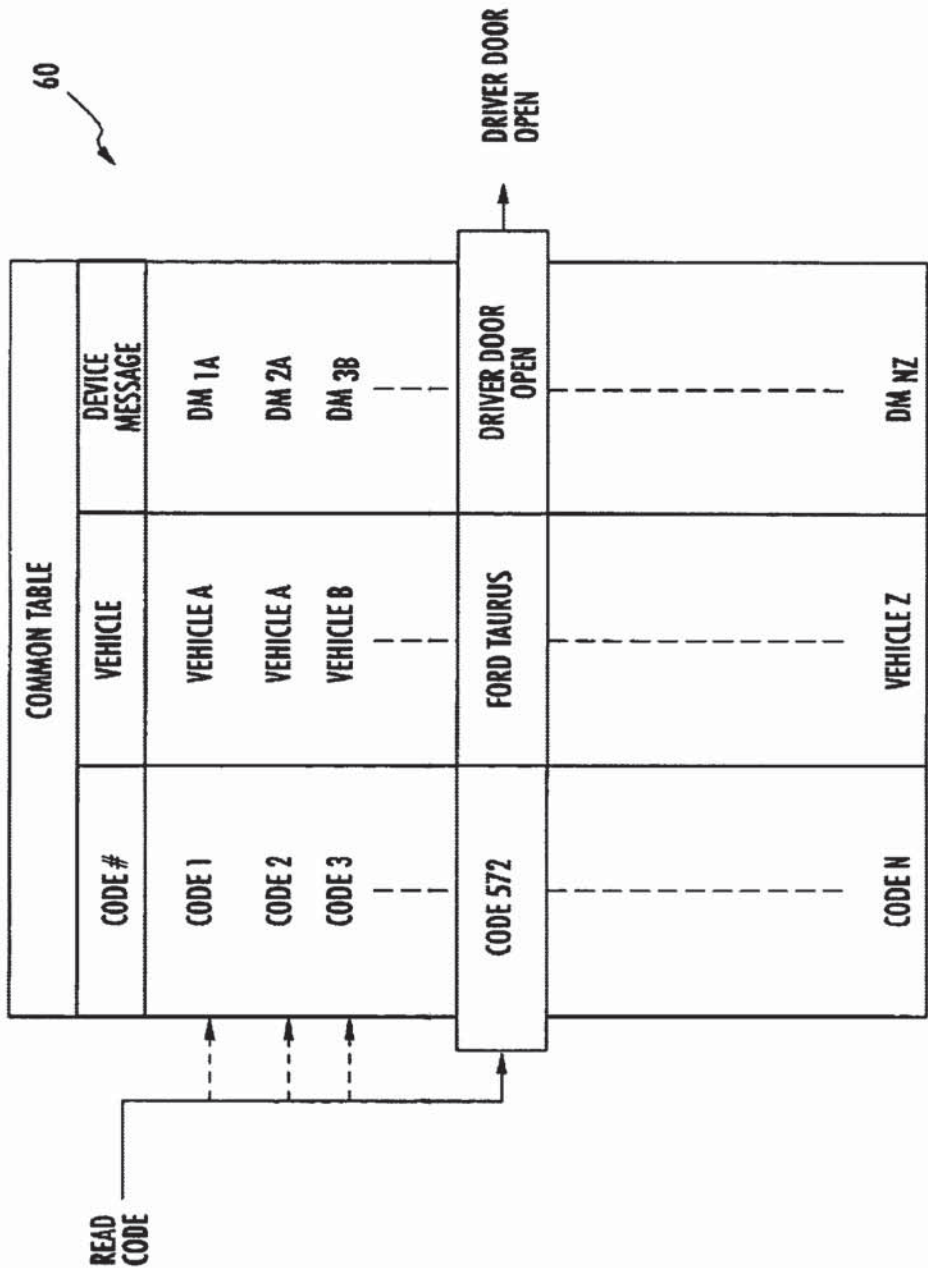


FIG. 5

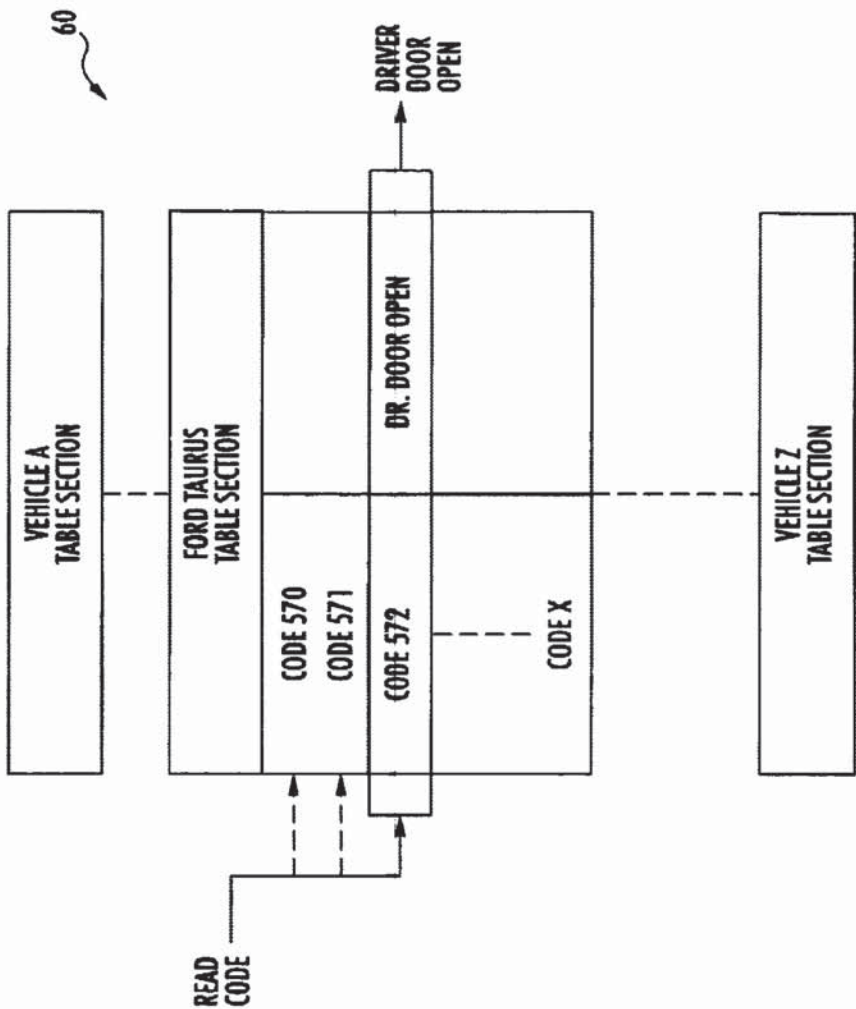


FIG. 6

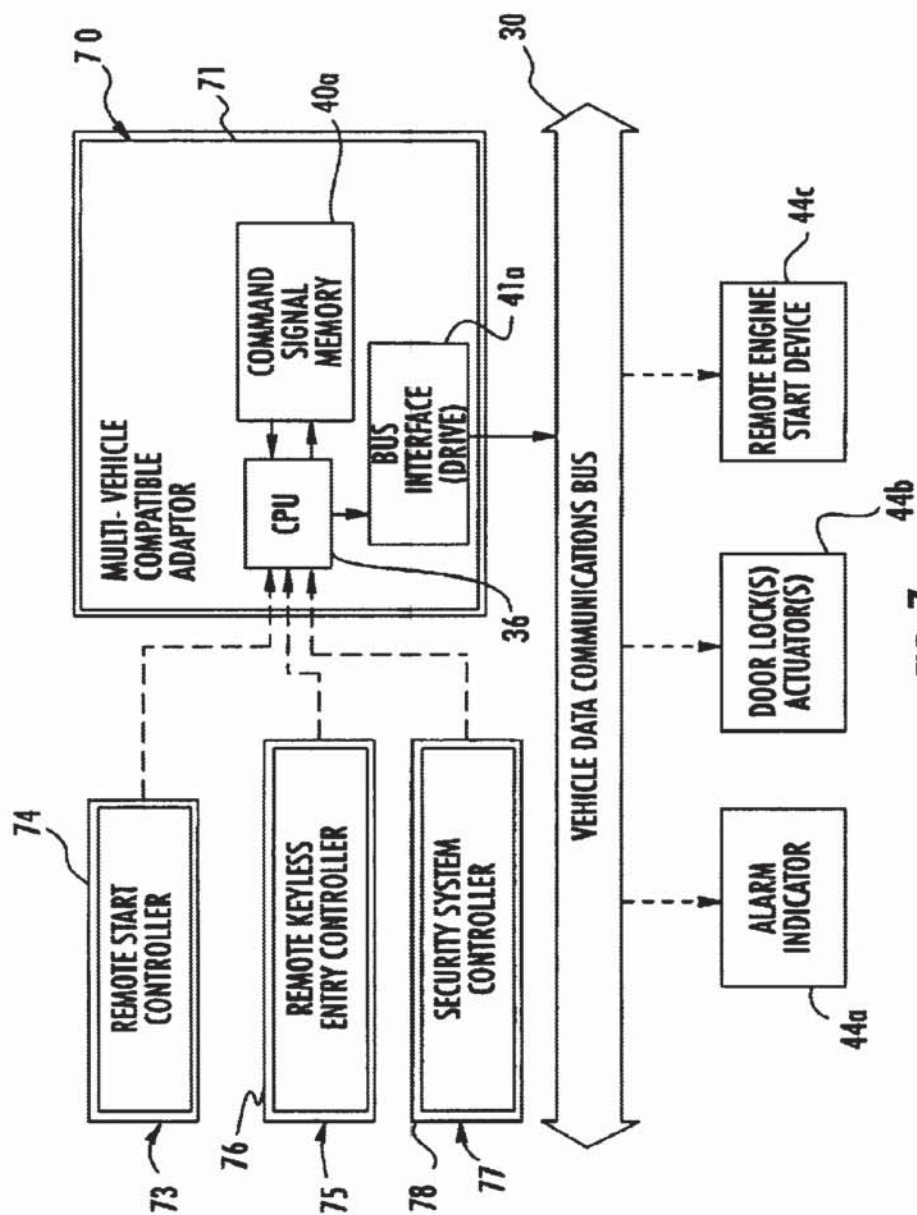


FIG. 7

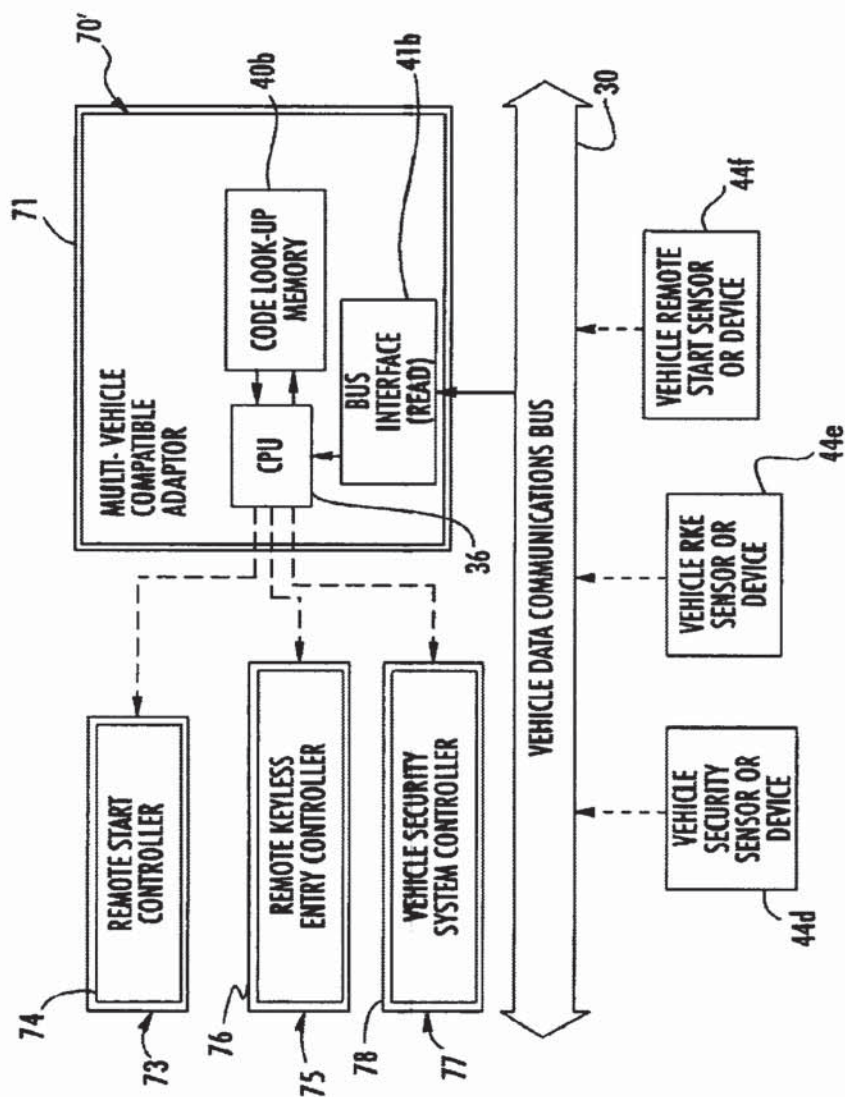


FIG. 8

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

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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 device 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

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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 hardware 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

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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.

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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.

* * * * *

(12) **United States Patent**
Flick

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(45) **Date of Patent:** **Mar. 2, 2010**

(54) **SPEED EXCEEDED NOTIFICATION DEVICE FOR VEHICLE HAVING A DATA BUS AND ASSOCIATED METHODS**

(58) **Field of Classification Search** 340/441, 340/936, 989, 426.19, 466, 988, 901, 902, 340/992, 993; 701/213, 207, 209, 24, 33, 701/35, 36

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See application file for complete search history.

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 340 days.

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Primary Examiner—Daryl Pope

(63) Continuation-in-part of application No. 11/076,259, filed on Mar. 9, 2005, which is a continuation of application No. 10/383,496, filed on Mar. 7, 2003, now Pat. No. 7,149,623, which is a continuation of application No. 09/859,972, filed on May 17, 2001, now Pat. No. 6,606,561.

(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

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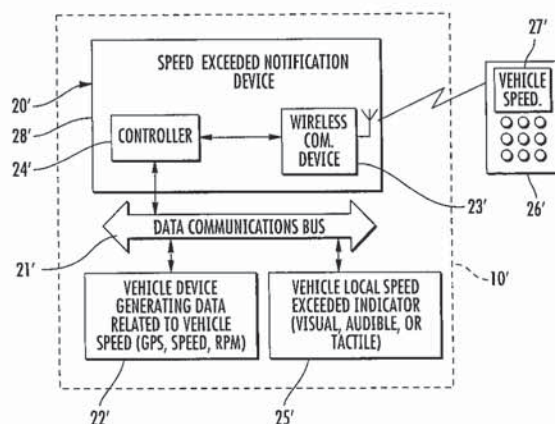
(57) **ABSTRACT**

A speed exceeded notification device is for a vehicle of a type including a vehicle data communications bus extending throughout the vehicle, and at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus. The speed exceeded notification device may include a wireless communications device, and a controller to be coupled to the vehicle data communications bus. The controller may be for reading the data related to vehicle speed from the vehicle data communications bus, and determining when a vehicle speed exceeds a speed threshold for a first time period. Based thereon, the controller may cooperate with the wireless communications device to send a remote vehicle speed exceeded notification.

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25 Claims, 6 Drawing Sheets



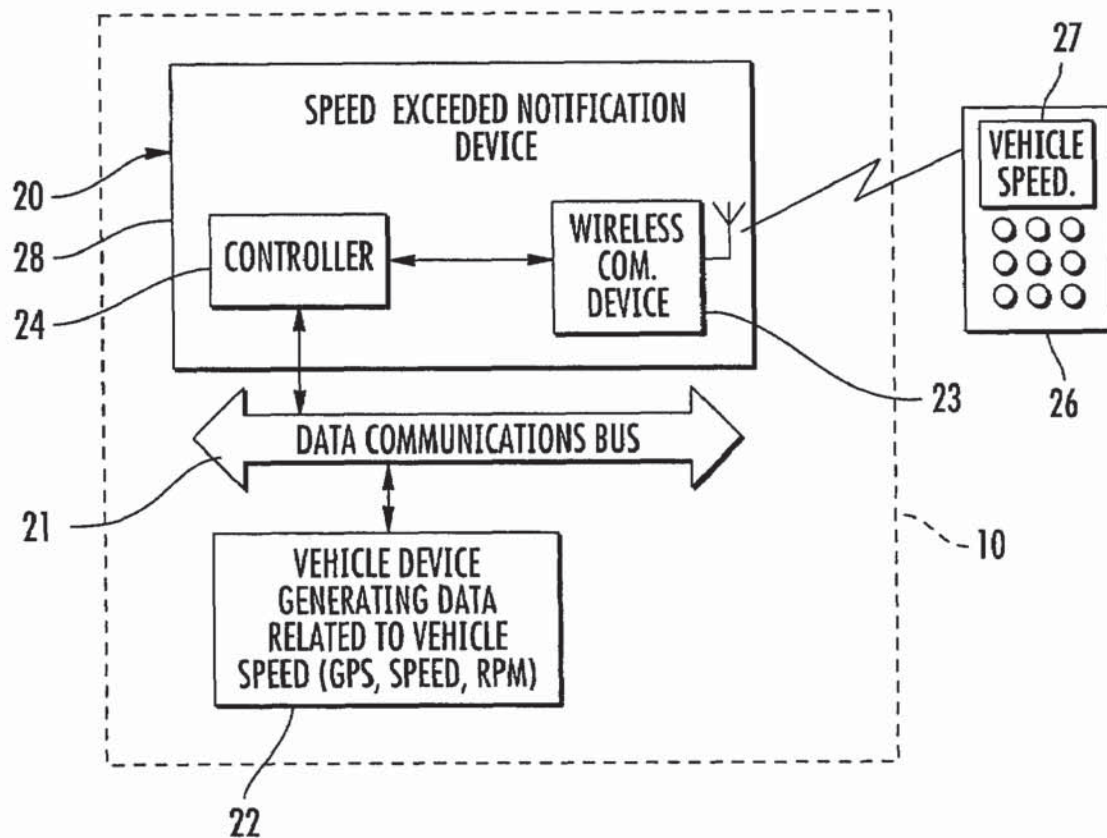
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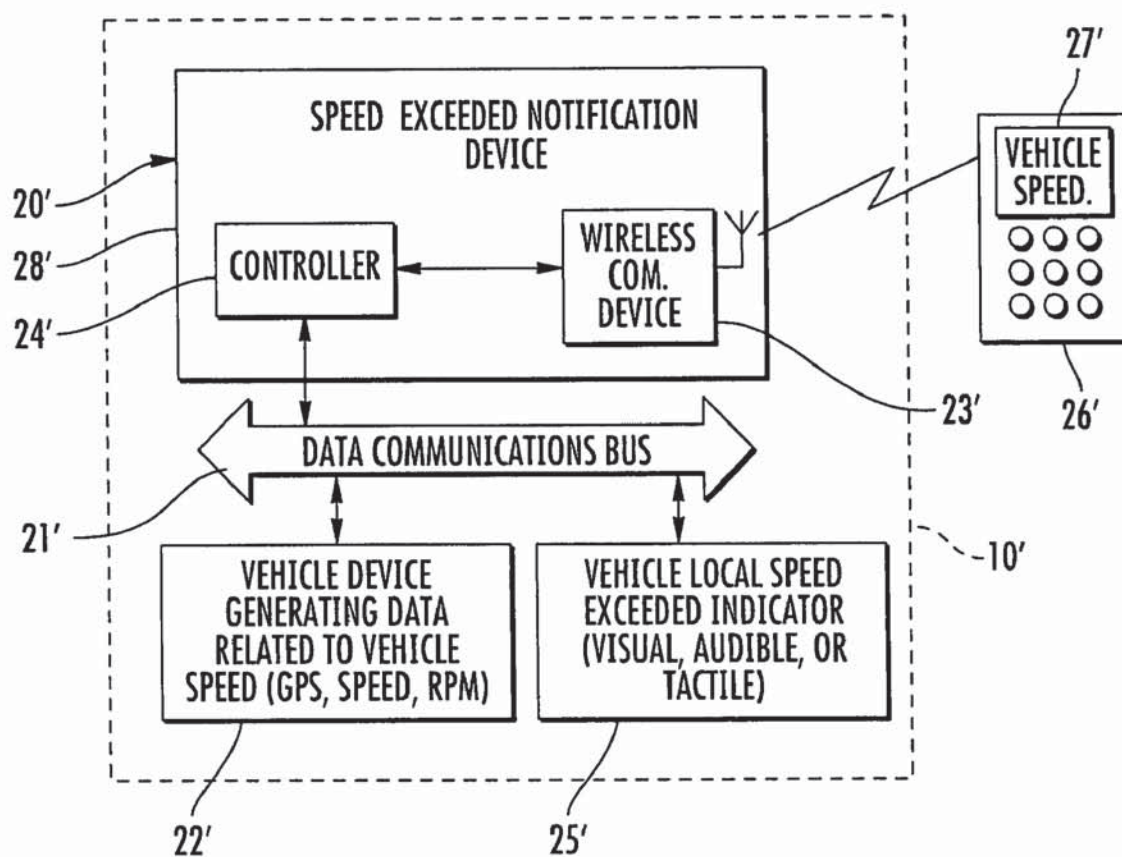
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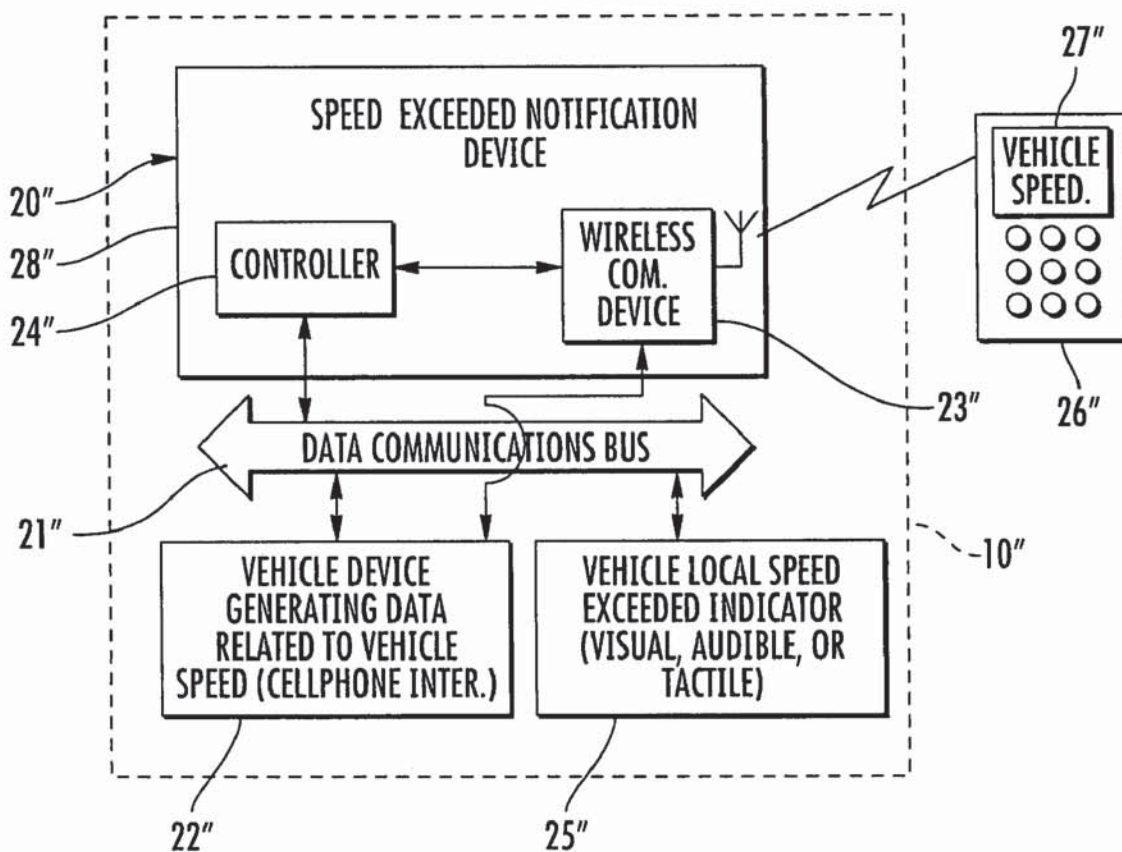
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**FIG. 1**

**FIG. 2**

**FIG. 3**

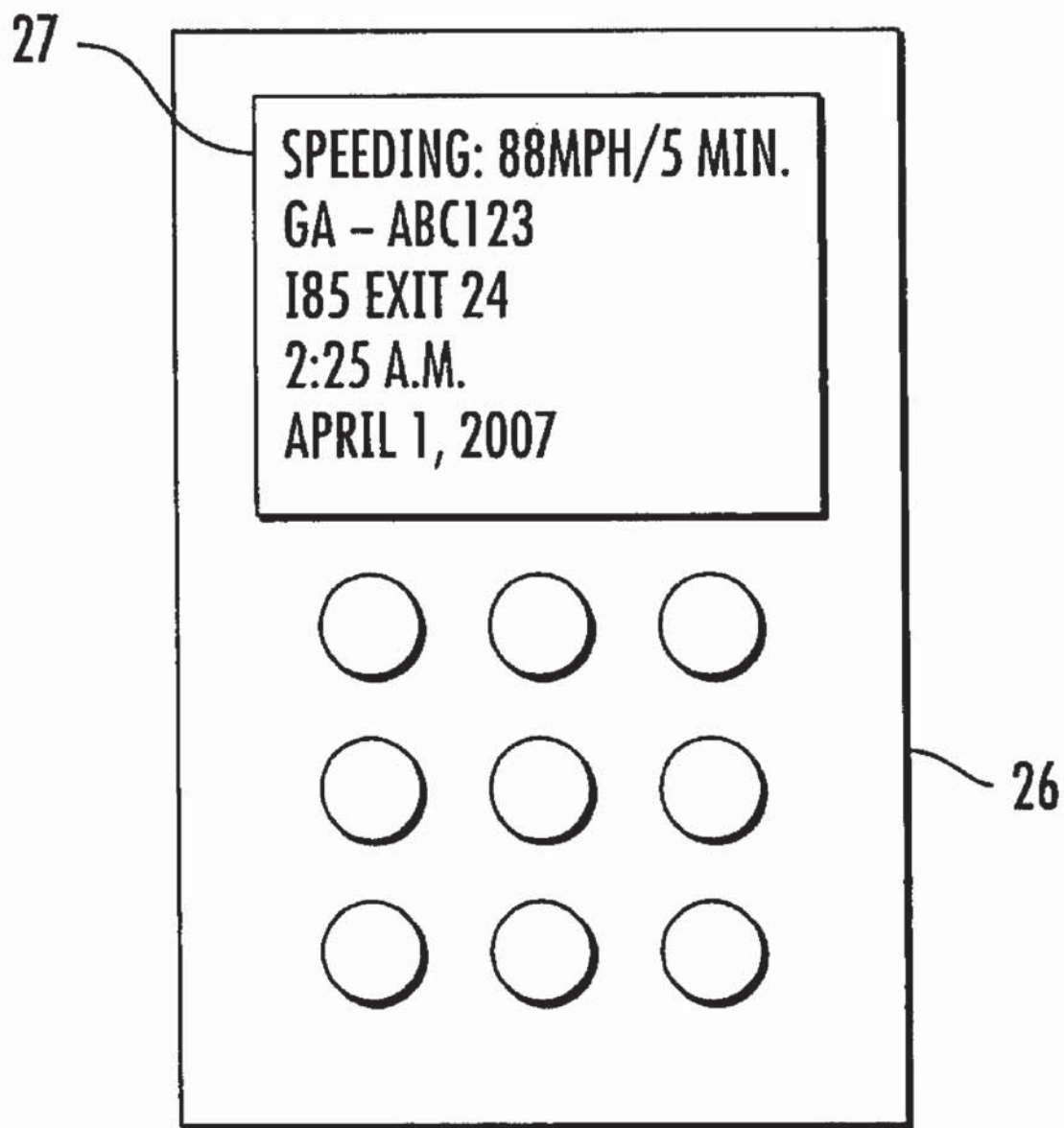
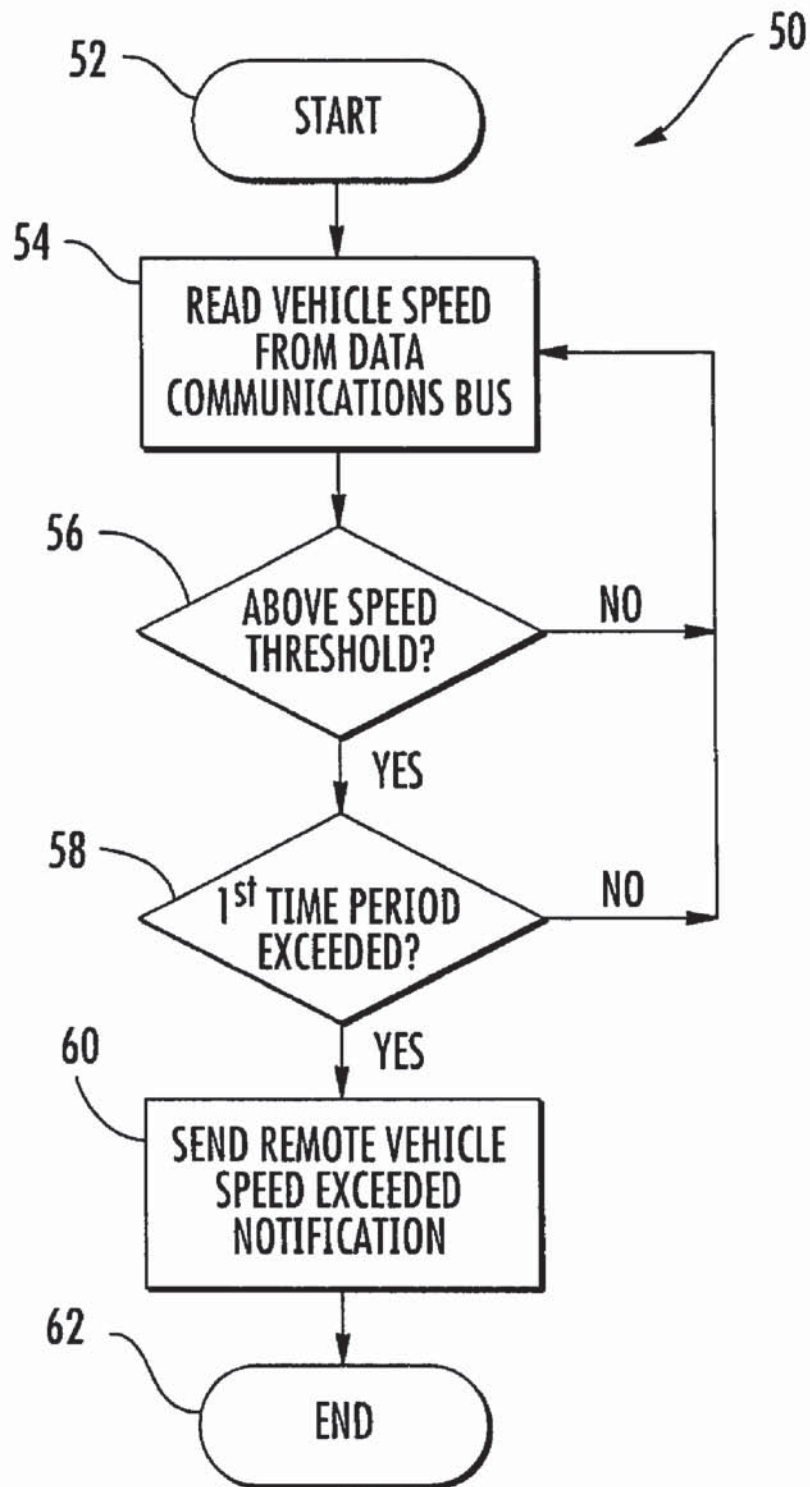
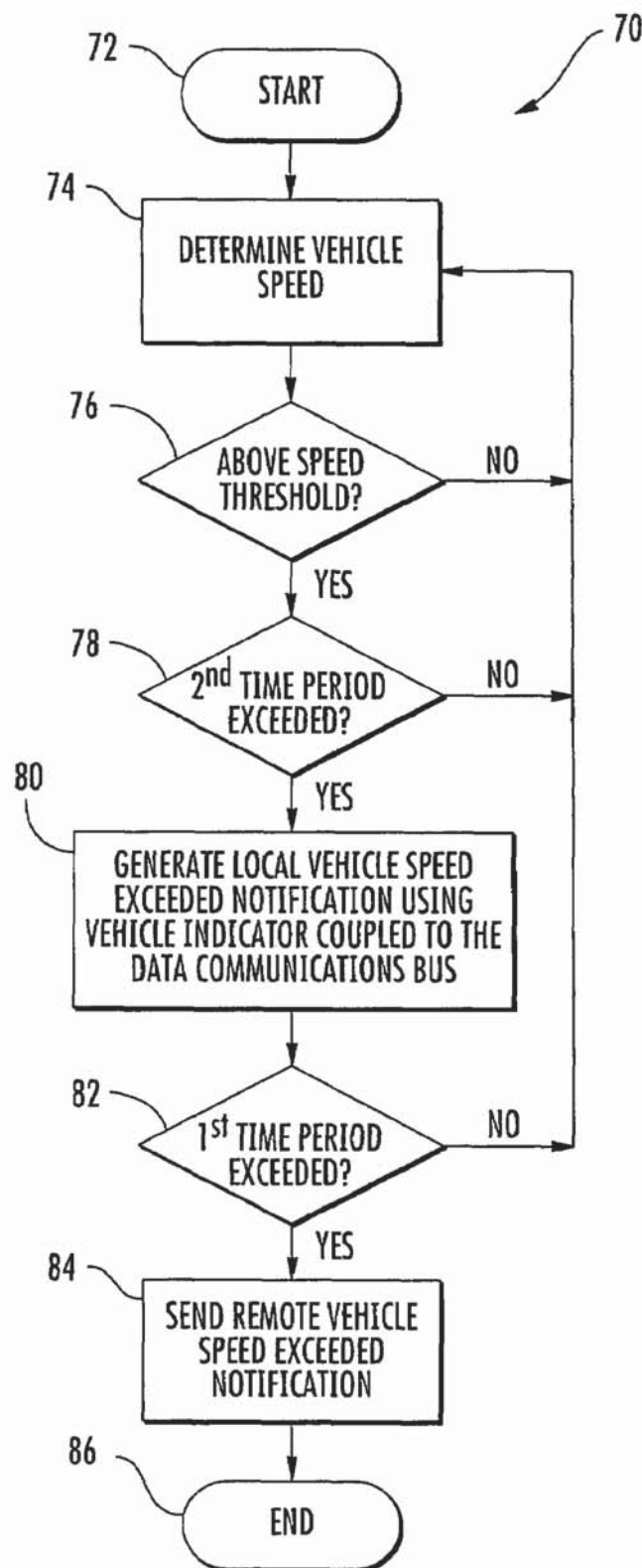


FIG. 4

***FIG. 5***

**FIG. 6**

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SPEED EXCEEDED NOTIFICATION DEVICE FOR VEHICLE HAVING A DATA BUS AND ASSOCIATED METHODS

RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. patent application Ser. No. 11/076,259 filed Mar. 9, 2005; which is a continuation of U.S. patent application Ser. No. 10/383,496 filed Mar. 7, 2003, now U.S. Pat. No. 7,149,623; which is a continuation of U.S. patent application Ser. No. 09/859,972 filed May 17, 2001 now U.S. Pat. No. 6,606,561; which, in turn, was based upon provisional patent application Ser. Nos. 60/264,811 filed on Jan. 29, 2001; 60/258,005, filed Dec. 22, 2000; 60/251,552, filed Dec. 6, 2000; 60/252,125, filed Nov. 20, 2000; 60/236,890, filed Sep. 29, 2000; 60/246,463, filed Nov. 7, 2000; 60/222,777, filed Aug. 3, 2000; 60/205,178, filed May 17, 2000, the entire contents of each of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to the field of vehicle devices, and, more particularly, to a vehicle speed exceeded notification device, and related methods.

BACKGROUND OF THE INVENTION

Motor vehicles, such as passenger cars, trucks, busses, fleet vehicles, etc. are widely used, and knowing the locations of such vehicles is often desired. For example, should a vehicle be stolen it would be beneficial to know the vehicle's location so that authorities could be promptly and accurately directed to retrieve the vehicle. Indeed, the tracking system could plot the getaway path of the thief.

For a company with hired drivers, it may be desirable to know the driver's whereabouts during the course of the day. Similarly, a rental car agency or other fleet operator, for example, may wish to know the whereabouts of its fleet of vehicles.

It may also be desirable to track the location of a vehicle as it is used throughout the course of a normal day. For parents of younger or older drivers, for example, knowledge of the vehicle's location may provide some assurance that the driver is at designated locations and following a prescribed route.

The widespread availability and use of the Internet has prompted a number of vehicle tracking systems to also make use of the Internet. For example, TelEvoke, Inc. proposed such a system in combination with Clifford Electronics. The system was to provide notification, control and tracking services via the telephone or the Internet. Users could be notified via phone, e-mail, or a pager of events such as a car alarm being triggered. Users could control the vehicle remote devices via the phone, the web, or a PDA, such as unlocking car doors. Additionally, users could track TelEvoke-enabled vehicles on the Internet or via the telephone. An Internet map could be viewed by the user showing the actual and prior vehicle locations. TelEvoke offered its services via a centralized fully automated Network Operations Center. To reduce the communications costs, it was proposed to use the control channel of the cellular telephone network.

A number of significance advances in vehicle tracking technology are disclosed, for example, in U.S. Pat. No. 7,015,830 to Flick, and assigned to the assignee of the present invention. This patent discloses a vehicle tracking unit for a vehicle of a type including a vehicle data bus extending throughout the vehicle and at least one operable vehicle

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device connected thereto. The at least one operable vehicle device may be responsive to at least one data bus code on the vehicle data bus. The vehicle tracking unit may include a vehicle position determining device, a wireless communications device, and a controller cooperating with the vehicle position determining device and the wireless communications device to send vehicle position information to a user. Moreover, the controller may generate the at least one data bus code on the vehicle data bus to control the at least one operable vehicle device based upon a command signal received by the wireless communications device.

Another significant advance in vehicle tracking relates to speed exceeded notifications and is disclosed in U.S. Pat. No. 6,888,495 to Flick and assigned to the assignee of the present invention. The patent discloses a tracking system controller being switchable to be in an armed mode for cooperating with a vehicle position determining device and a wireless communications device to generate, and send a speeding alert message based upon the vehicle exceeding a speed threshold for longer than a predetermined time indicative of aggressive driving of the vehicle. A monitoring station may generate a series of speeding alert message notifications for a user based upon receiving the speeding alert message from the vehicle tracking unit. The monitoring station may cancel any remaining speeding alert message notifications of the series based upon a cancellation command response from an entity already having received the speeding alert message notification. Accordingly, if the user may be reached at different telephone numbers or different users are desirably notified of the alert, then unnecessary notifications are avoided. Of course, other approaches for using a vehicle tracker to influence/monitor a vehicle regarding excessive speed may also be desirable.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the present invention to provide a speed exceeded notification device which may be readily used in a vehicle including a data communications bus and related methods.

This and other objects, features, and advantages in accordance with the present invention are provided by a speed exceeded notification device to be installed in a vehicle of a type comprising a vehicle data communications bus extending throughout the vehicle. The vehicle may have at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus, for example. The speed exceeded notification device may comprise a wireless communications device, and a controller to be coupled to the vehicle data communications bus. In addition, the controller may be for reading the data related to vehicle speed from the vehicle data communications bus and determining when a vehicle speed exceeds a speed threshold for a first time period. Based on the exceeding of the speed threshold, the controller may cooperate with the wireless communications device to send a remote vehicle speed exceeded notification, for example. Accordingly, the speed exceeded notification device is readily integrated in a vehicle having a data communications bus, and this may be especially useful in vehicle after-market applications, where such functionality is desirably added to a vehicle after its manufacture.

The controller may also be for determining when the vehicle speed exceeds the speed threshold for a second time period less than the first time period and, in response thereto, generating a local vehicle speed exceeded notification. In other words, the device may provide a pre-warning in the form of the local speed exceeded notification so that the driver

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is encouraged to slow down before a full speeding notification will be sent from the vehicle, such as to an employer or authority figure.

The local vehicle speed exceeded notification may comprise at least one of an audible notification, a visual notification, and a tactile notification, for example. At least one of the speed threshold, the first time period, and the second time period may be user selectable.

The at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus may include a vehicle position determining device. For example, the vehicle position determining device may include a Global Positioning System (GPS) receiver. Alternatively, the positioning determining device may cooperate with the wireless communications device, particularly where the wireless communications device comprises a cellular communications device, for example.

The remote vehicle speed exceeded notification may further comprise an identity of the vehicle, a speed of the vehicle, and/or a vehicle position, for example. The remote vehicle speed exceeded notification may further comprise a time the vehicle exceeded the speed threshold.

A method aspect is for generating a speed exceeded notification in a vehicle of a type comprising a vehicle data communications bus extending throughout the vehicle, and at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus. The method may comprise using a controller coupled to the vehicle data communications bus for reading the data related to vehicle speed from the vehicle data communications bus. The method may also comprise using the controller for determining when a vehicle speed exceeds a speed threshold for a first time period, and based thereon, cooperating with a wireless communications device to send a remote vehicle speed exceeded notification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic block diagram of a speed exceeded notification device in accordance with the invention.

FIG. 2 is schematic block diagram of another embodiment of a speed exceeded notification device in accordance with the invention.

FIG. 3 is schematic block diagram of yet another embodiment of a speed exceeded notification device in accordance with the invention.

FIG. 4 is an enlarged schematic front view of the cellular telephone as in the system of FIG. 1 illustrating a remote speed exceeded notification.

FIG. 5 is a flowchart of operation of a speed exceeded notification device in accordance with the present invention.

FIG. 6 is another flowchart of operation of another embodiment of a speed exceeded notification device in accordance with the present invention.

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 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 invention to those skilled in the art. Like numbers refer to like elements through-

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out, and prime and multiple prime notation are used to indicate similar elements in alternative embodiments.

Referring initially to FIG. 1, a first embodiment of a speed exceeded notification device 20 is now described. The speed exceeded notification device 20 is illustratively installed in a vehicle 10 of a type comprising a vehicle data communications bus 21 extending throughout the vehicle. Illustratively, a vehicle device 22 generates data related to vehicle speed on the vehicle data communications bus 21. Of course, in other embodiments, more than one vehicle device may generate data related to the vehicle speed. The data related to the vehicle speed may include a vehicle speed signal that includes a digital vehicle speed code. Alternatively or additionally, the data related to vehicle speed may be geographical position data, such as based upon GPS position data; or engine RPM in combination with transmission gearing, for example, that may be used to calculate the vehicle speed.

The speed exceeded notification device 20 includes a wireless communications device 23 and a controller 24 coupled to the vehicle data communications bus 21. The controller 24 is for reading the data related to vehicle speed from the vehicle data communications bus 21, and for determining when a vehicle speed exceeds a speed threshold for a first time period. The speed threshold may be user selectable and may be in a range of about 55 to 80 miles per hour, for example. The speed threshold may also be determined based upon the vehicle's location, and a look-up table having the speeds for various roads, as will be appreciated by those skilled in the art.

The first time period may also be user selectable and may be in a range of about 30 seconds to 5 minutes. Of course, other speed ranges, and time durations may also be used. If the speed threshold is exceeded for the first time period, the controller 24 cooperates with the wireless communications device 23 to send a remote vehicle speed exceeded notification.

The controller 24 may be provided by a processor operating under stored program control, and/or may include discrete analog and digital circuits as will be appreciated by those skilled in the art. The controller 24, in some embodiments, may be a multi-vehicle compatible controller such as described in U.S. Pat. Nos. 6,346,876; 6,756,885; 6,756,886; 6,812,829; 7,010,402; 7,046,126; 7,068,153; 7,091,822 and 7,224,083 all assigned to the assignee of the present invention and incorporated herein by reference. In other embodiments, the controller 24 may be a single vehicle or single vehicle platform controller as will also be appreciated by those skilled in the art.

The wireless communications device 23 may be a cellular telephone communication device that sends the remote vehicle speed exceeded notification as a text message, for example. In another embodiment, the wireless communications device 23 may be another type of wireless communications device using another protocol, for example, and may send the notification in another format, such as an email, or voice message, for example, as will be appreciated by those skilled in the art. Of course, the wireless communications device 23 may be included within a common housing 28 of the device 20, or may be a separate and removable device, such as the user's personal cellular telephone.

A remote wireless device, such as the illustrated cellphone 26, is for receiving the remote vehicle speed exceeded signal from the wireless device 23 at the vehicle. The remote wireless device may be a PDA, pager, etc. or other wireless device capable of receiving messages from the wireless communications device 23. The remote wireless device 26 may also be a fixed central monitoring station that may act upon the speeding notification, or that may forward the speeding notification

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onto a subscriber, such as an employer, parent or relative, or other authority figure as will be appreciated by those skilled in the art. The remote wireless device in the form of the cell-phone 26 illustratively includes a display 27 that may be used to display a speeding notification. The remote wireless device 26 may communicate directly with the wireless communications device 23 in the vehicle 10, or may communicate via intervening cellular communications infrastructure, and/or Internet infrastructure as will also be appreciated by those skilled in the art.

Referring now to the embodiment shown in FIG. 2, the illustrated controller 24' of the speed exceeded notification device 20' may also determine when the vehicle speed exceeds the speed threshold for a second time period less than the first time period. If the vehicle speed exceeds the speed threshold for a second time period less than the first time period, the controller 24' generates a local vehicle speed exceeded notification on a vehicle indicator 25'. The second time period may also be user selectable and may be in a range of about 2 seconds to 1 minute, for example. In other words, this local vehicle speed notification may serve as a warning to the driver to slow down before the remote speed exceeded notification is sent.

The vehicle local speed exceeded indicator 25' may produce an audible notification, such as a door chime, a horn honk, a radio volume adjustment, or an automated voice message for example. Alternatively or additionally, the vehicle local speed exceeded indicator 25' may produce a visual notification, such as a flash of the dome light, illumination or flashing of a dashboard light, or operation of any other visual indicator, for example. In addition, the vehicle local speed exceeded indicator 25' may be a tactile notification indicator, such as a causing steering wheel vibration, seat vibration, etc. The local indication may be repetitive and increasing in urgency as the full first time period is approached. For example, the repetition frequency, audible pitch, or volume may be progressively increasing. The local speed notification on the vehicle indicator 25' allows the driver of the vehicle to reduce the speed of the vehicle and avoid sending of the remote vehicle speed exceeded notification to the remote wireless device 26'.

Moreover, in the illustrated embodiment, this vehicle local speed exceeded indicator 25' is connected to the vehicle data bus 21' and may be an existing vehicle device as installed during vehicle manufacture, or may be added as an aftermarket item as will be appreciated by those skilled in the art. In some other embodiments, the local speed exceeded indicator 25' may be hardwired to the controller 24', and may even be contained within the housing 28' of the speed exceeded notification device 20' as will also be appreciated by those skilled in the art. Those other elements shown in FIG. 2, and not discussed in detail, are indicated by prime notation and are similar to those elements discussed above with respect to FIG. 1.

Referring now additionally to the embodiment shown in FIG. 3, another variation is now described as relating to generating the vehicle speed data. In this embodiment of the speed exceeded notification device 20'', the data related to the vehicle speed is generated based upon cooperation with the wireless communications device 23''. For example, the wireless communications device 23'' may be a cellular telephone based device that generates position data either based upon an internal GPS receiver, or based upon triangulation or other cellular telephone-based position determining approaches. In other words, the vehicle device generating data related to vehicle speed 22'', on the vehicle data communications bus 21'' may be an interface circuit between the wireless communications device 23'' and the data communications bus as will be appreciated by those skilled in the art. Those other ele-

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ments shown in FIG. 3, and not discussed in detail, are indicated by double prime notation and are similar to those elements discussed above with respect to FIGS. 1 and 2.

Referring additionally to FIG. 4, an exemplary remote vehicle speed exceeded notification is shown on the display 27 of the remote wireless device 26 and includes an identity of the vehicle by its license plate number, GA-ABC123. The remote vehicle speed exceeded notification also includes a speed of the vehicle, 88 mph for a time of 5 minutes; a vehicle position, I85 at Exit 24; and the time and date the vehicle exceeded the speed threshold, 2:25 AM, Apr. 1, 2007. Of course, additional or alternative vehicle information may be sent by the controller 24 to the remote vehicle speed exceeded display device 26, as will be appreciated by those having ordinary skill in the art. For example, a speed versus time profile could be generated on the display 27. Additionally, the controller 24 can advantageously send the remote vehicle speed exceeded notifications to the remote wireless device 26 in real time when the speed and time thresholds are exceeded, on a regular schedule, or based on any other triggering event, such as a collision indicated by an airbag deployment, for example.

Referring now additionally to the flowchart 50 of FIG. 5, a method for speed exceeded notification in a vehicle of a type comprising a vehicle data communications bus extending throughout the vehicle is now described. After the start at Block 52, the method includes using a controller 24 coupled to the vehicle data communications bus 21 for reading the data related to vehicle speed from the vehicle data communications bus (Block 54). From the vehicle data it is determined when a vehicle speed exceeds a speed threshold (Block 56) for a first time period (Block 58). The method further includes using the controller 24 cooperating with the wireless communications device 23 to send a remote vehicle speed exceeded notification to the remote wireless device 26 (Block 60) if both the speed threshold (Block 56) and time threshold (Block 58) have been exceeded, before ending at Block 62.

Referring now additionally to the flowchart 70 of FIG. 6, another method is described for speed exceeded notification in a vehicle of a type comprising a vehicle data communications bus 21 extending throughout the vehicle, and at least one vehicle indicator 25 coupled to the vehicle data communications bus 21. Beginning at Block 72, the method includes using a controller 24 coupled to the vehicle data communications bus 21 for determining a vehicle speed (Block 74). The controller 24 determines if the vehicle exceeds the speed threshold (Block 76), and if for a second time period (Block 78). If the speed threshold is exceeded for the second time period, the controller 24 generates a local vehicle speed exceeded notification using a vehicle indicator 25 coupled to the vehicle data communications bus (Block 80). The controller 24 then determines when the vehicle speed exceeds a speed threshold for a first time period (Block 82) longer than the second time period, and based thereon cooperates with the wireless communications device 23 to send a remote vehicle speed exceeded notification (Block 84) before stopping at Block 86.

This application is related to copending patent applications entitled, VEHICLE DEVICE TO ACTIVATE A VISUAL OR AUDIBLE ALERT AND ASSOCIATED METHODS, and SPEED EXCEEDED NOTIFICATION DEVICE FOR VEHICLE HAVING A DATA BUS AND ASSOCIATED METHODS, which are filed on the same date and by the same assignee and inventor, the disclosures of which are hereby incorporated by reference in their entirety. 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. Therefore, it is understood that the invention is not to be limited to the specific embodiments disclosed, and

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that other modifications and embodiments are intended to be included within the scope of the appended claims.

That which is claimed is:

1. A speed exceeded notification device for a vehicle of a type comprising a vehicle data communications bus extending throughout the vehicle, and at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus, the speed exceeded notification device comprising:

a wireless communications device; and
a controller to be coupled to the vehicle data communications bus for
reading the data related to vehicle speed from the vehicle data communications bus, and
determining when a vehicle speed exceeds a speed threshold for a first time period and based thereon cooperating with said wireless communications device to send a remote vehicle speed exceeded notification.

2. The speed exceeded notification device according to claim 1 wherein said controller is also for determining when the vehicle speed exceeds the speed threshold for a second time period less than the first time period and generating a local vehicle speed exceeded notification.

3. The speed exceeded notification device according to claim 2 wherein the local vehicle speed exceeded notification comprises at least one of an audible notification, a visual notification, and a tactile notification.

4. The speed exceeded notification device according to claim 2 wherein at least one of the speed threshold, the first time period, and the second time period is user selectable.

5. The speed exceeded notification device according to claim 1 wherein the at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus comprises a vehicle position determining device.

6. The speed exceeded notification device according to claim 5 wherein said vehicle position determining device comprises a Global Positioning System (GPS) receiver.

7. The speed exceeded notification device according to claim 5 wherein the vehicle position determining device cooperates with said wireless communications device.

8. The speed exceeded notification device according to claim 7 wherein said wireless communications device comprises a cellular communications device.

9. The speed exceeded notification device according to claim 1 wherein the remote vehicle speed exceeded notification further comprises an identity of the vehicle.

10. The speed exceeded notification device according to claim 1 wherein the remote vehicle speed exceeded notification further comprises a speed of the vehicle.

11. The speed exceeded notification device according to claim 1 wherein the remote vehicle speed exceeded notification further comprises a vehicle position.

12. The speed exceeded notification device according to claim 1 wherein the remote vehicle speed exceeded notification further comprises a time the vehicle exceeded the speed threshold.

13. A speed exceeded notification device for a vehicle of a type comprising a vehicle data communications bus extending throughout the vehicle, and at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus, the speed exceeded notification device comprising:

a wireless communications device; and
a controller to be coupled to the vehicle data communications bus for
reading the data related to vehicle speed from the vehicle data communications bus,

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determining when a vehicle speed exceeds a speed threshold for a first time period and based thereon cooperating with said wireless communications device to send a remote vehicle speed exceeded notification, and

determining when the vehicle speed exceeds the speed threshold for a second time period less than the first time period and generating a local vehicle speed exceeded notification so that a driver of the vehicle can reduce the speed of the vehicle and avoid sending of the remote vehicle speed exceeded notification.

14. The speed exceeded notification device according to claim 13 wherein the local vehicle speed exceeded notification comprises at least one of an audible notification, a visual notification, and a tactile notification.

15. The speed exceeded notification device according to claim 13 wherein at least one of the speed threshold, the first time period, and the second time period is user selectable.

16. The speed exceeded notification device according to claim 13 wherein the at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus comprises a vehicle position determining device.

17. The speed exceeded notification device according to claim 16 wherein the vehicle position determining device cooperates with said wireless communications device.

18. The speed exceeded notification device according to claim 13 wherein the remote vehicle speed exceeded notification further comprises at least one of an identity of the vehicle, a speed of the vehicle, a vehicle position, and a time the vehicle exceeded the speed threshold.

19. A method for speed exceeded notification in a vehicle of a type comprising a vehicle data communications bus extending throughout the vehicle, and at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus, the method comprising:

using a controller coupled to the vehicle data communications bus for

reading the data related to vehicle speed from the vehicle data communications bus, and

determining when a vehicle speed exceeds a speed threshold for a first time period and based thereon cooperating with a wireless communications device to send a remote vehicle speed exceeded notification.

20. The method according to claim 19 further comprising also using the controller for determining when the vehicle speed exceeds the speed threshold for a second time period less than the first time period and generating a local vehicle speed exceeded notification.

21. The method according to claim 20 wherein the local vehicle speed exceeded notification comprises at least one of an audible notification, a visual notification, and a tactile notification.

22. The method according to claim 20 wherein at least one of the speed threshold, the first time period, and the second time period is user selectable.

23. The method according to claim 19 wherein the at least one vehicle device generating data related to vehicle speed on the vehicle data communications bus comprises a vehicle position determining device.

24. The method according to claim 23 wherein the vehicle position determining device cooperates with the wireless communications device.

25. The method according to claim 19 wherein the remote vehicle speed exceeded notification further comprises at least one of an identity of the vehicle, a speed of the vehicle, a vehicle position, and a time the vehicle exceeded the speed threshold.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,671,727 B2
APPLICATION NO. : 11/844703
DATED : March 2, 2010
INVENTOR(S) : Flick et al.

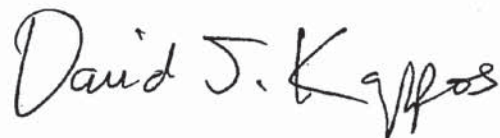
Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 3, Line 41	Delete: "is schematic" Insert: --is a schematic--
Column 3, Line 44	Delete: "is schematic" Insert: --is a schematic--
Column 5, Line 33	Delete: "such as a causing" Insert: --such as causing a--

Signed and Sealed this

Seventeenth Day of August, 2010



David J. Kappos
Director of the United States Patent and Trademark Office

(12) **United States Patent**
Flick

(10) **Patent No.:** **US 8,032,278 B2**
(45) **Date of Patent:** **Oct. 4, 2011**

(54) **VEHICLE TRACKING UNIT WITH
DOWNLOADABLE CODES AND
ASSOCIATED METHODS**

(58) **Field of Classification Search** 701/36,
701/207-209; 340/500, 506, 515, 531, 533-534
See application file for complete search history.

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

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 840 days.

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(65) **Prior Publication Data**

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(Continued)

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/076,259,
filed on Mar. 9, 2005, now Pat. No. 7,720,597, which is
a continuation of application No. 10/383,496, filed on
Mar. 7, 2003, now Pat. No. 7,149,623, which is a
continuation of application No. 09/859,972, filed on
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(74) *Attorney, Agent, or Firm* — Allen, Dyer, Doppelt,
Milbrath & Gilchrist, P.A.

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(57) **ABSTRACT**

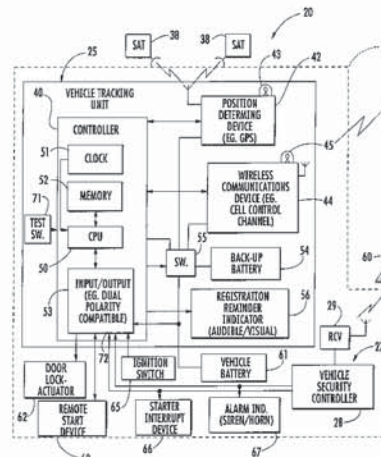
A multi-vehicle compatible tracking unit is for a vehicle
including a vehicle data bus extending throughout the vehicle.
The vehicle tracking unit may include a vehicle position
determining device, a wireless communications device, and a
multi-vehicle compatible controller for cooperating with the
vehicle position determining device and the wireless commu-
nications device to send vehicle position information. The
multi-vehicle compatible controller may be coupled to the
vehicle data bus for communication thereover with at least
one vehicle device using at least one corresponding vehicle
device code from among a plurality thereof for different
vehicles. A downloading interface may be included for per-
mitting downloading of enabling data related to the at least
one corresponding vehicle device code for use by the multi-
vehicle compatible controller.

(51) **Int. Cl.**

G01C 21/00 (2006.01)

(52) **U.S. Cl.** 701/36; 701/33; 382/104; 382/988;
455/575.9

22 Claims, 13 Drawing Sheets



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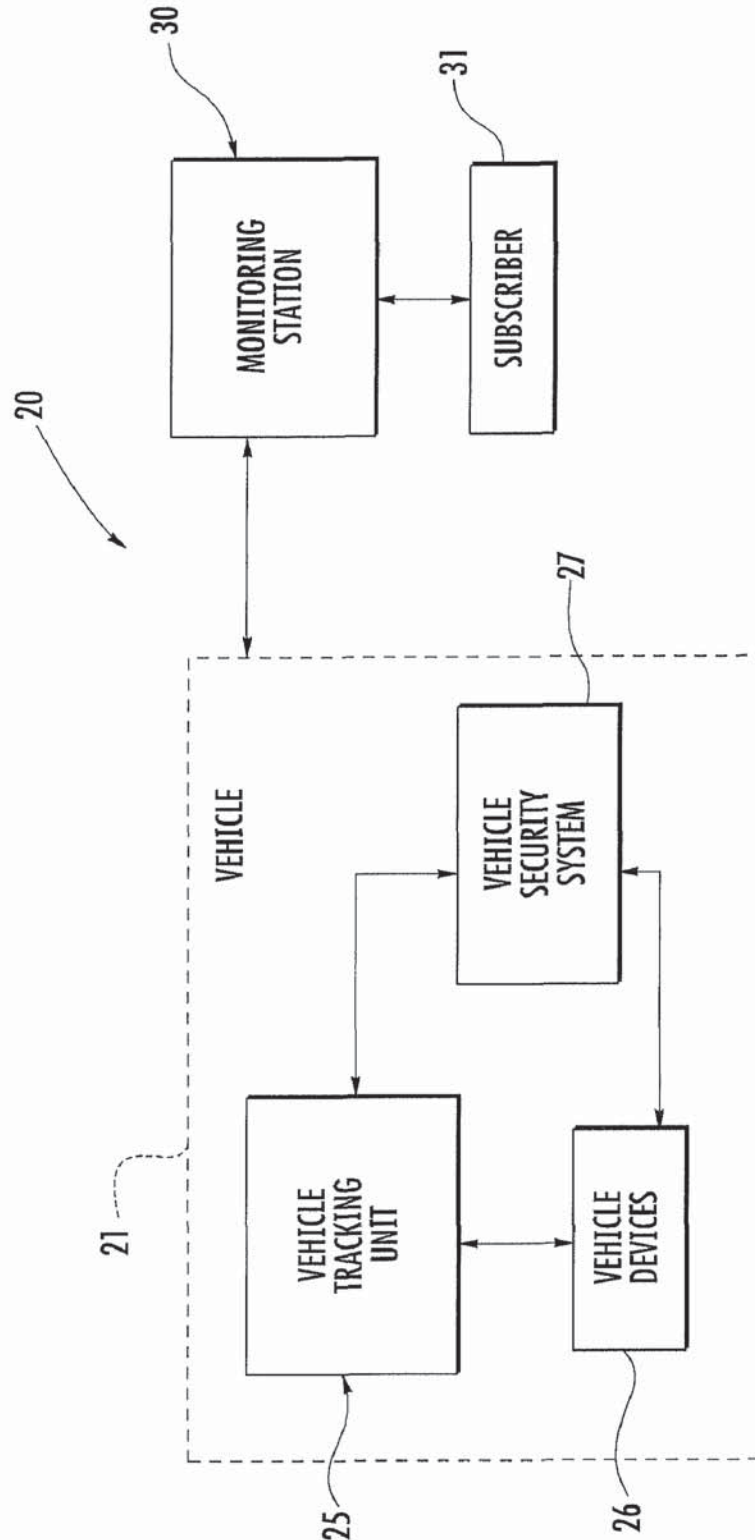


FIG. 1

The diagram illustrates a vehicle security system (20) with the following components and connections:

- Vehicle Tracking Unit (40):** The central control unit containing:
 - Controller (51):** Includes a **Clock (52)**, **Memory (53)**, and **CPU (50)**.
 - Input/Output (53):** Described as dual polarity compatible.
 - TEST SW. (71):** Connected to the CPU.
- Position Determining Device (43):** Such as GPS, connected to the Controller.
- Wireless Communications Device (44):** Such as a cell control channel, connected to the Controller and having an antenna (45).
- SW. (55):** A switch connected to the Controller, a **Back-up Battery (54)**, and the **Registration Reminder Indicator (56)**.
- Registration Reminder Indicator (56):** Audible/visual, connected to the SW. (55).
- Vehicle Battery (61):** Connected to the SW. (55) and the **Vehicle Security Controller (28)**.
- Ignition Switch (65):** Connected to the Controller and the **Starter Interrupt Device (66)**.
- Door Lock-Actuator (62):** Connected to the Controller.
- Remote Start Device (63):** Connected to the Controller.
- Alarm Ind. (Siren/Horn) (67):** Connected to the Vehicle Security Controller (28).
- Vehicle Security Controller (28):** Connected to the Vehicle Battery (61) and the Alarm Ind. (67).
- External Connections:**
 - SAT (38):** Two satellite units connected to the Position Determining Device (43).
 - RCV (29):** A receiver connected to the Vehicle Security Controller (28) via an antenna.
 - Mobile Phone (60):** Shown as an external device.

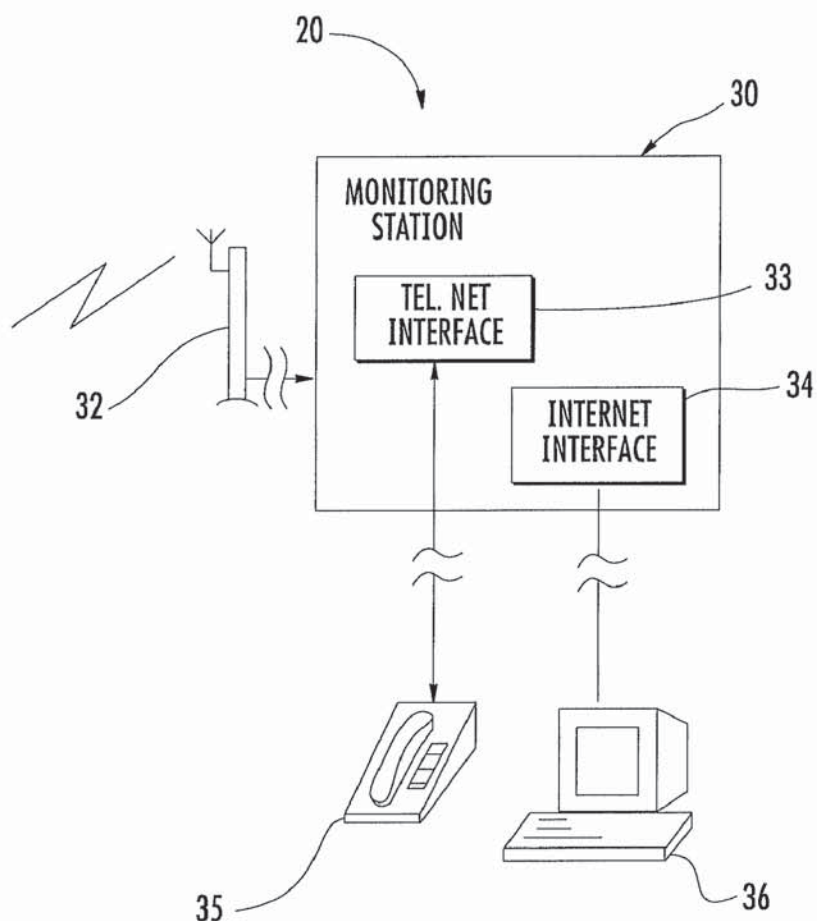


FIG. 3

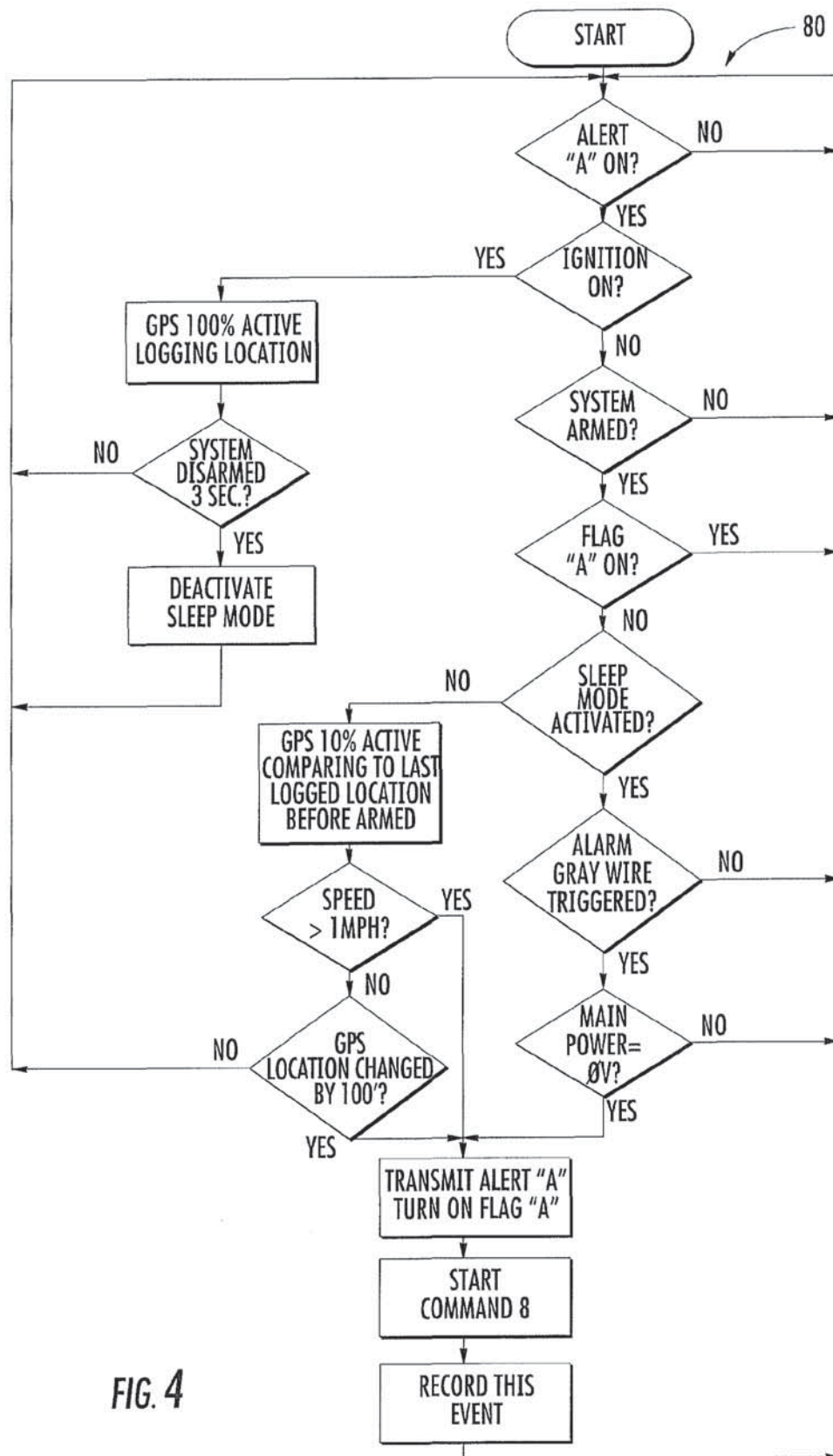


FIG. 4

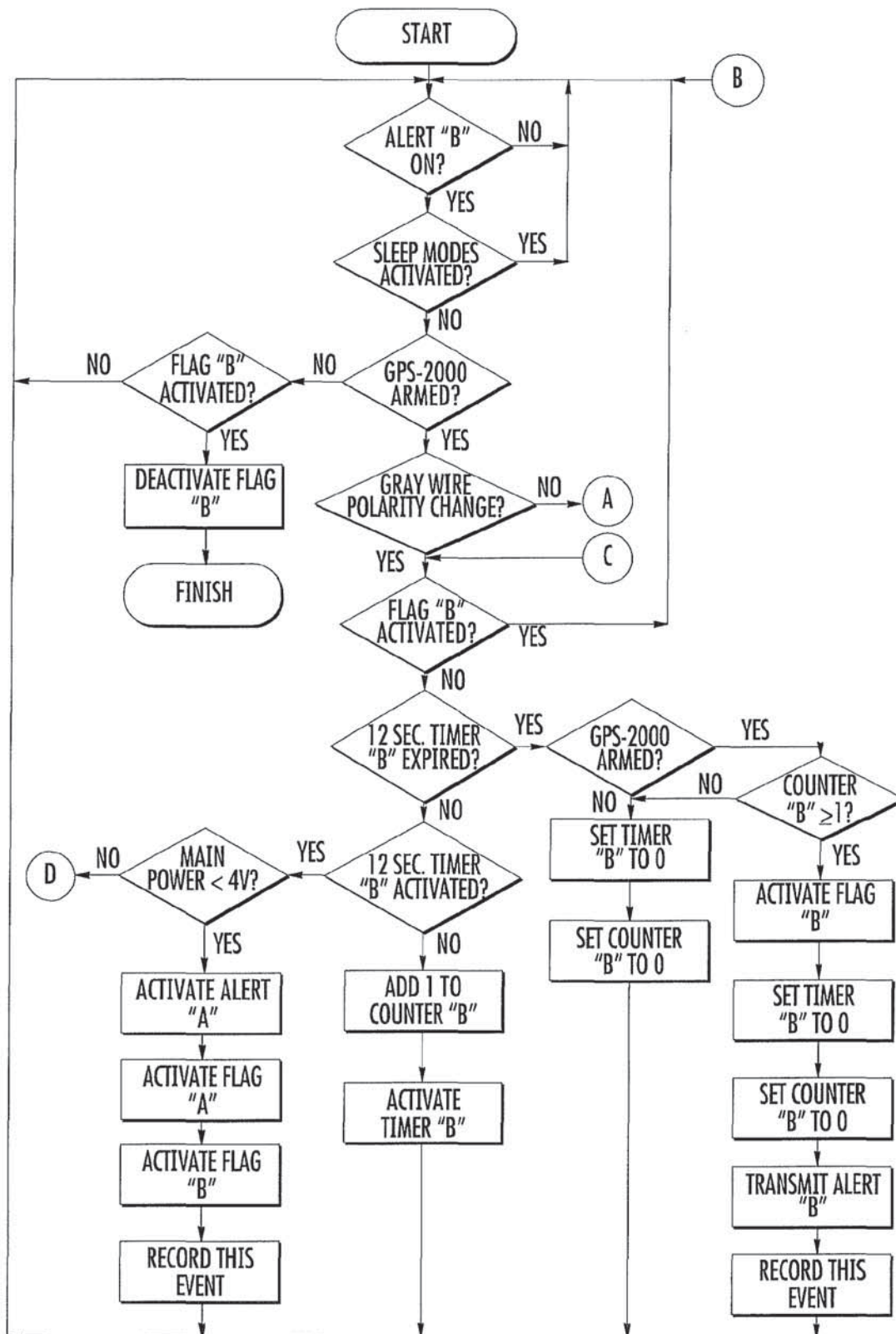


FIG. 5A

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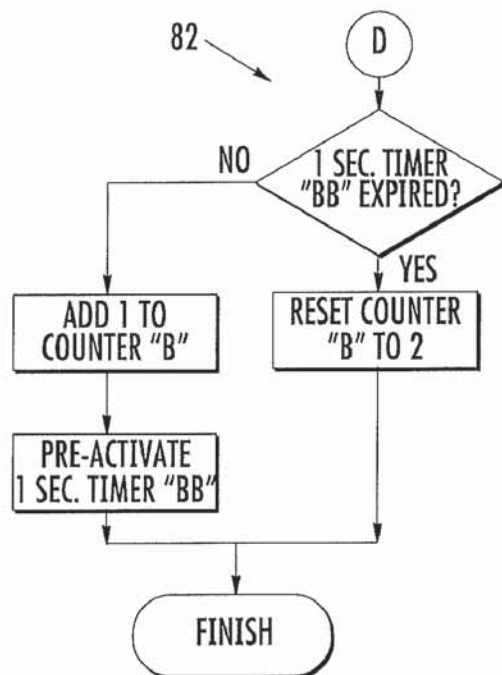


FIG. 5B

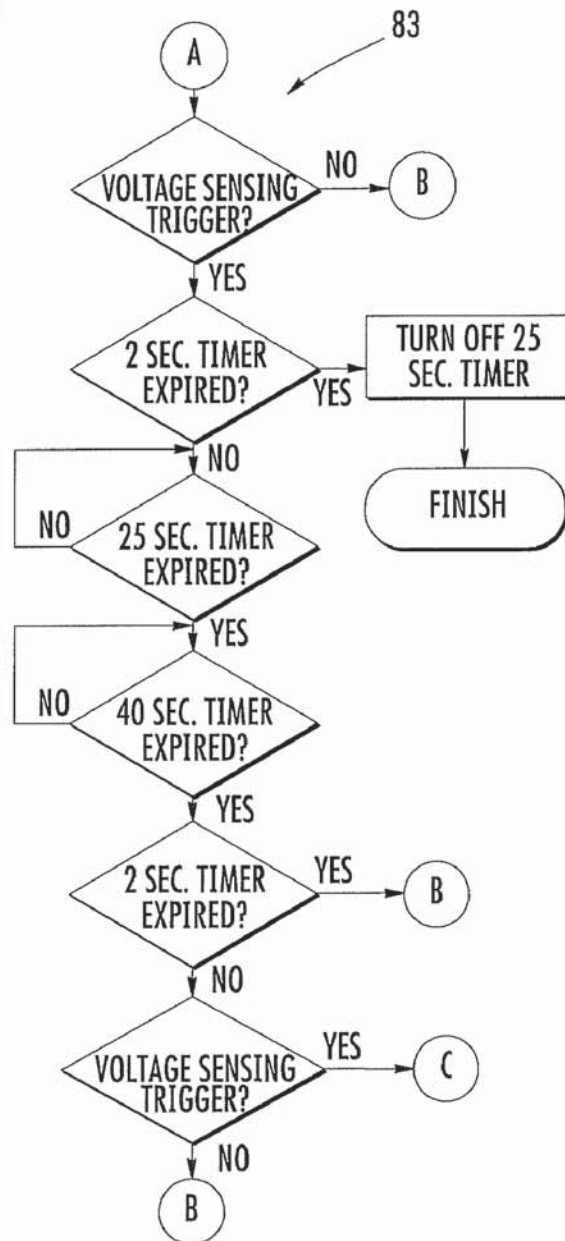


FIG. 5C

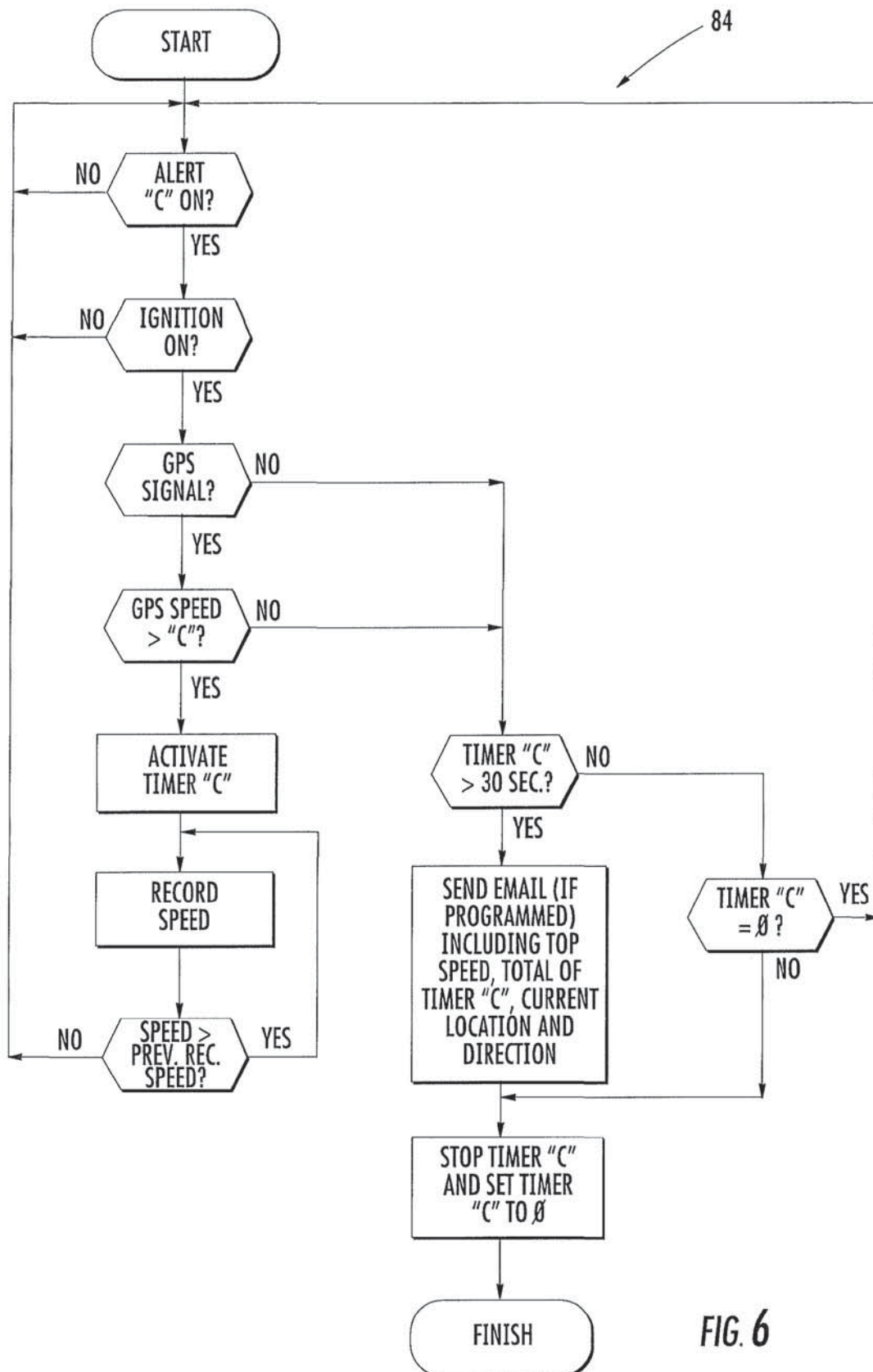
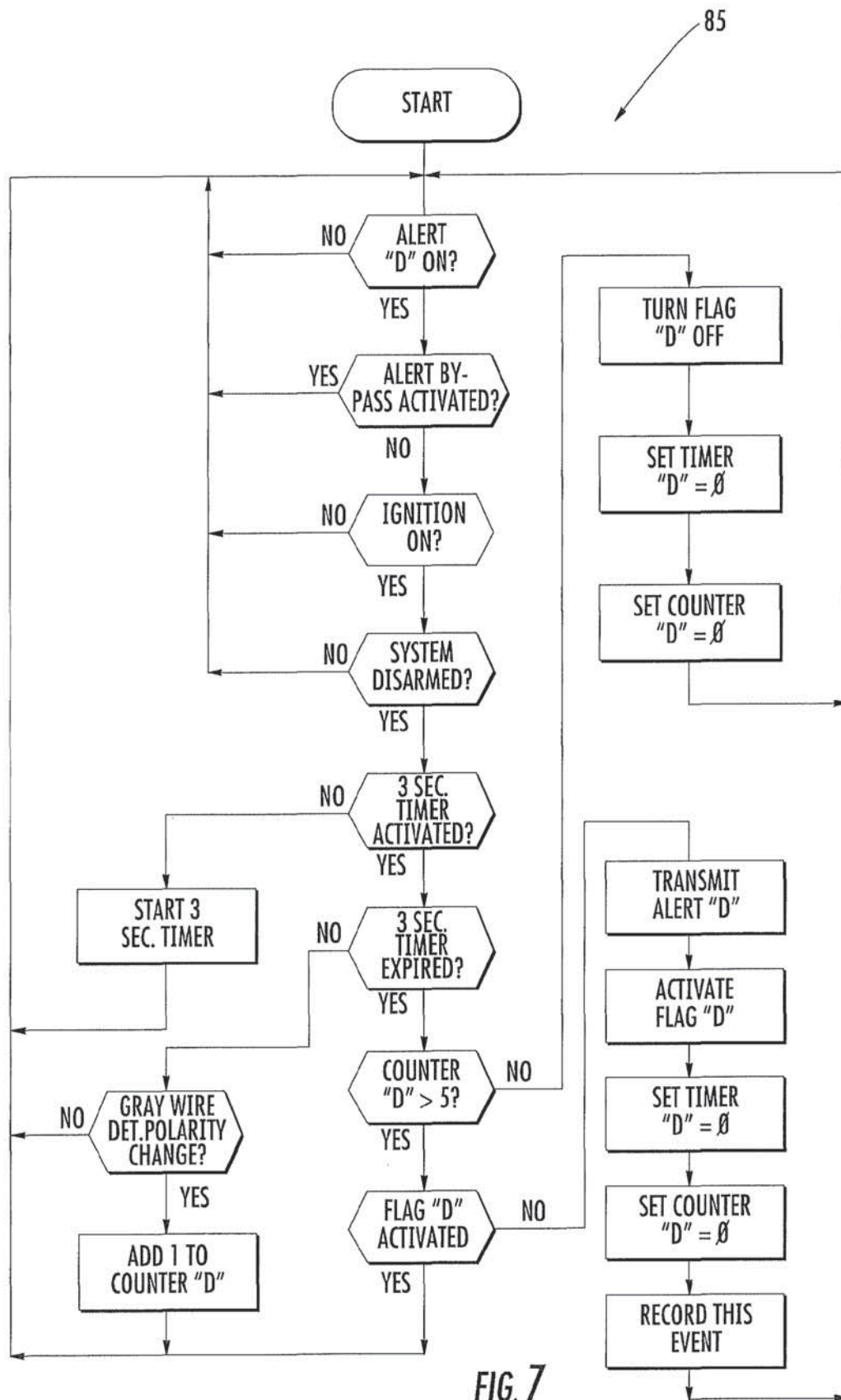


FIG. 6



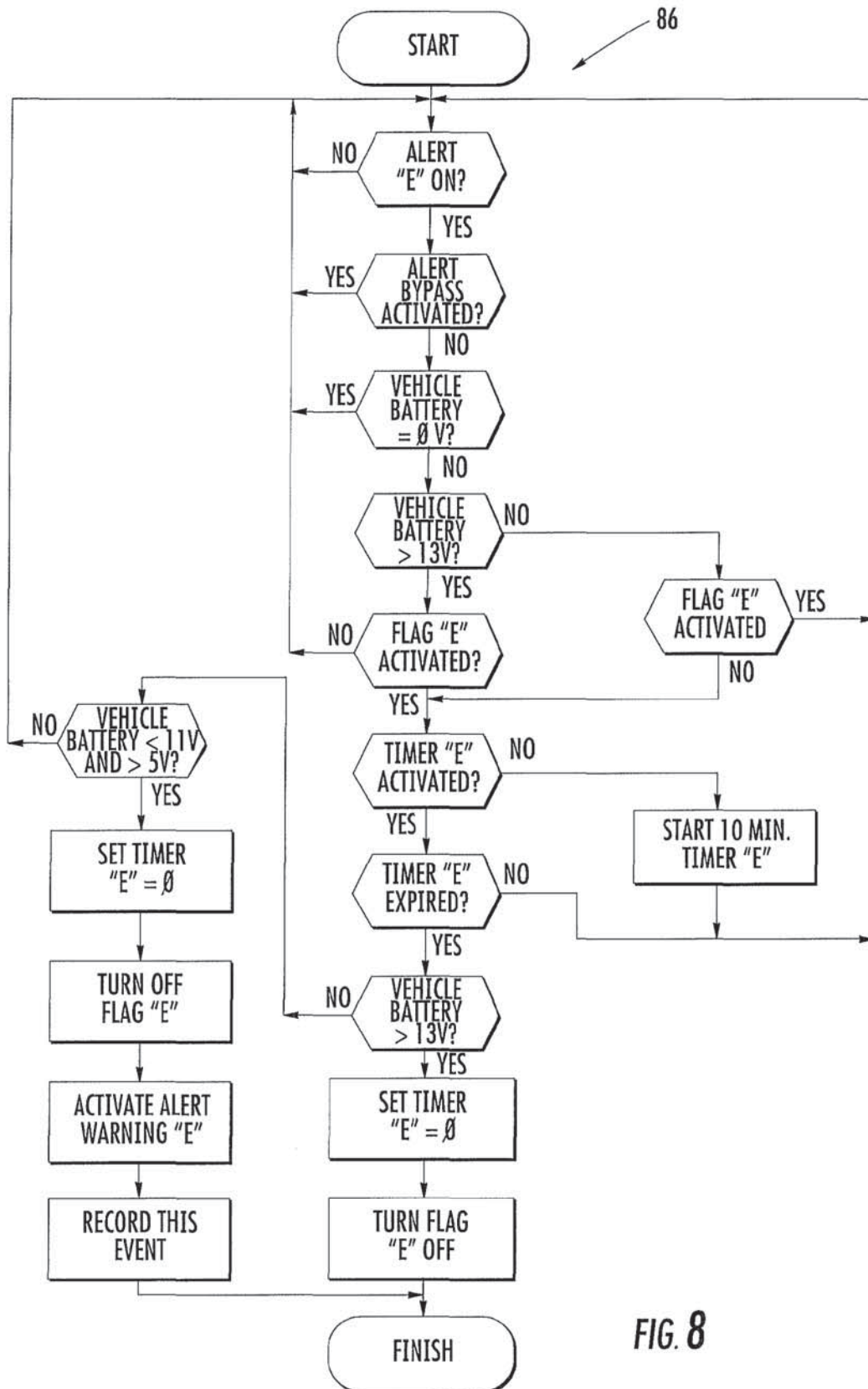


FIG. 8

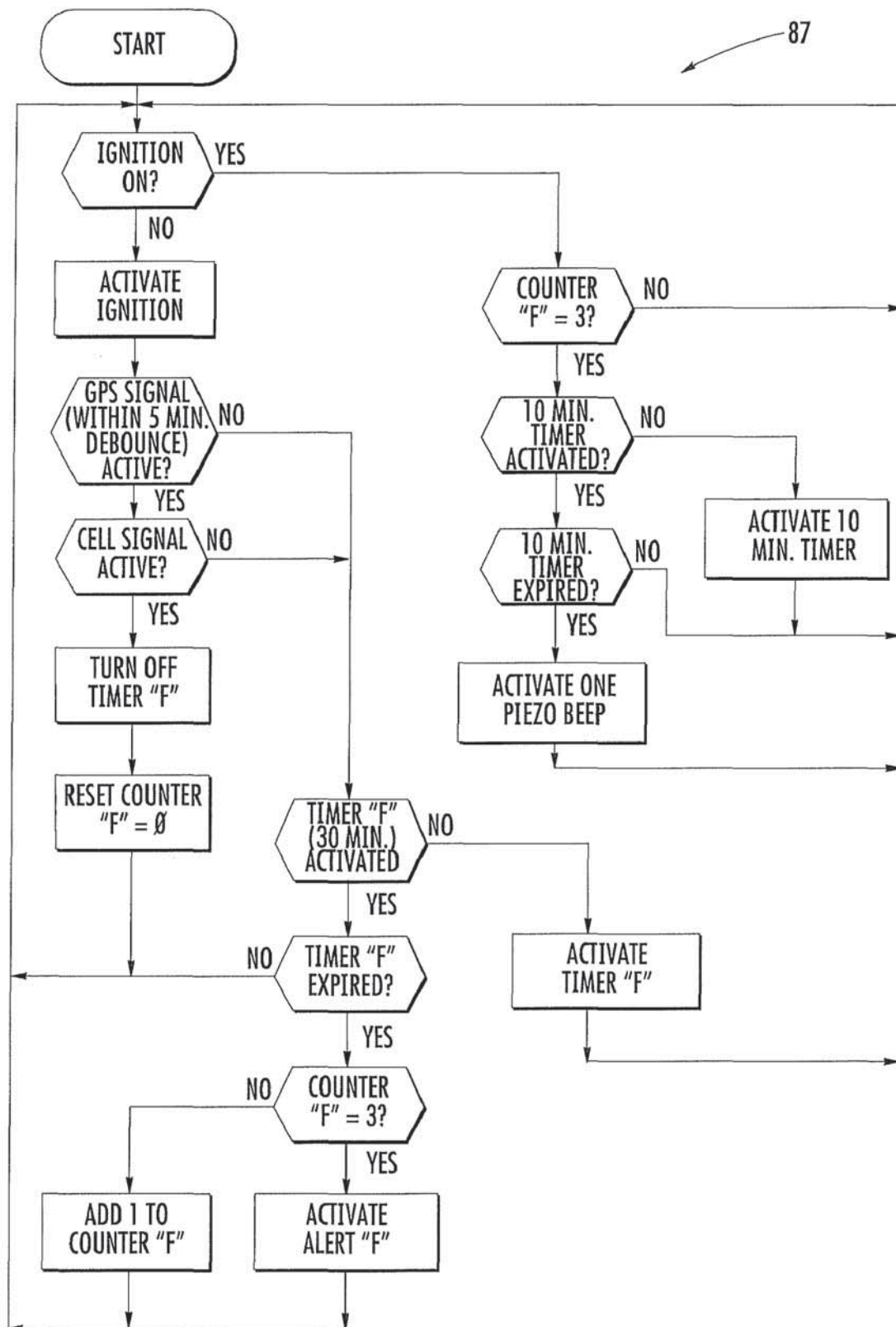


FIG. 9

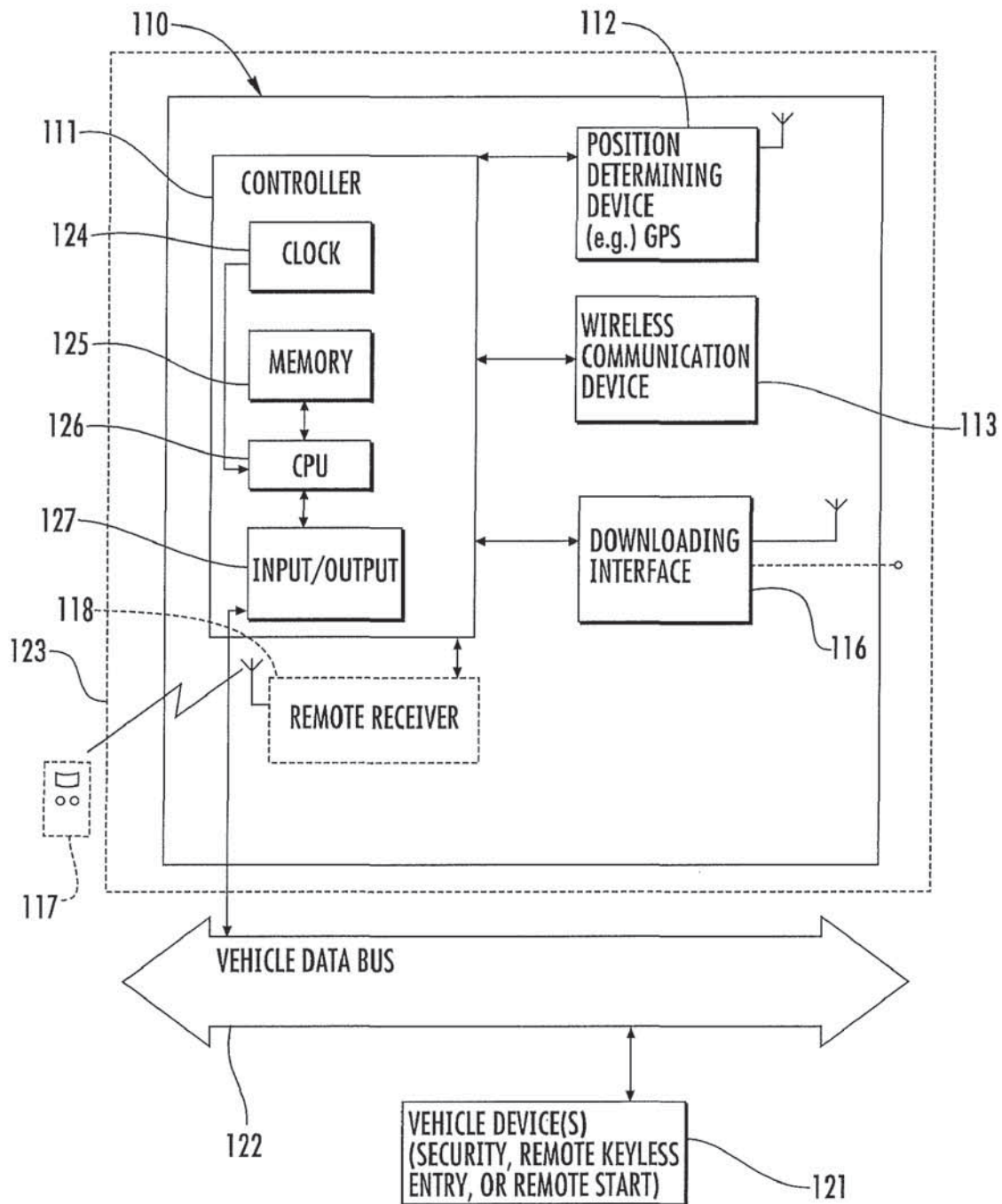


FIG. 10

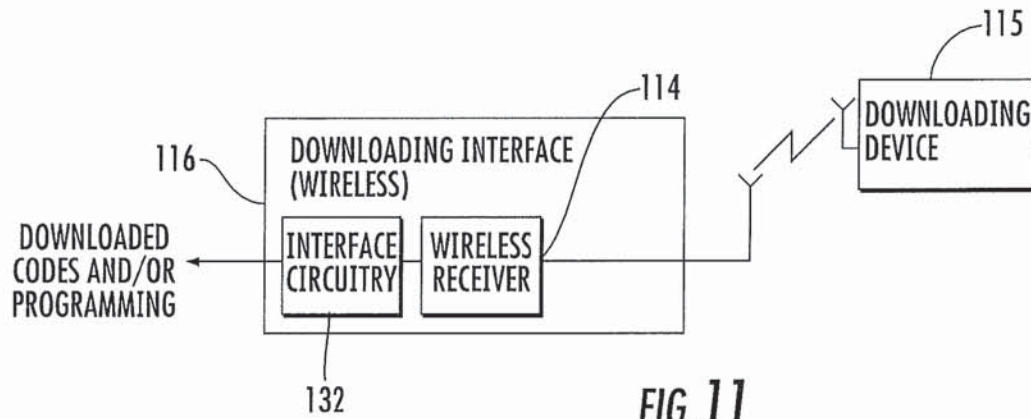


FIG. 11

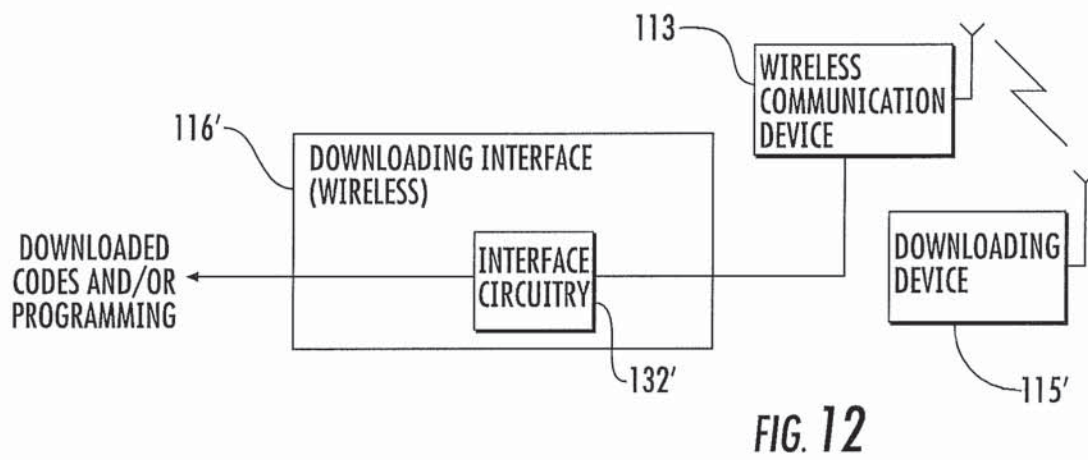


FIG. 12

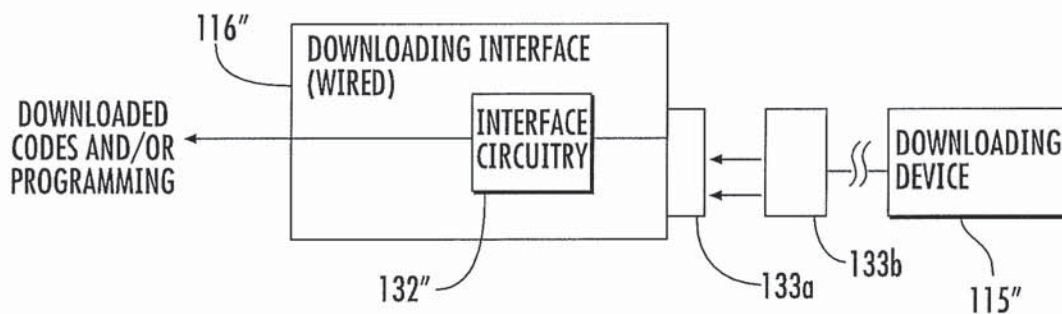


FIG. 13

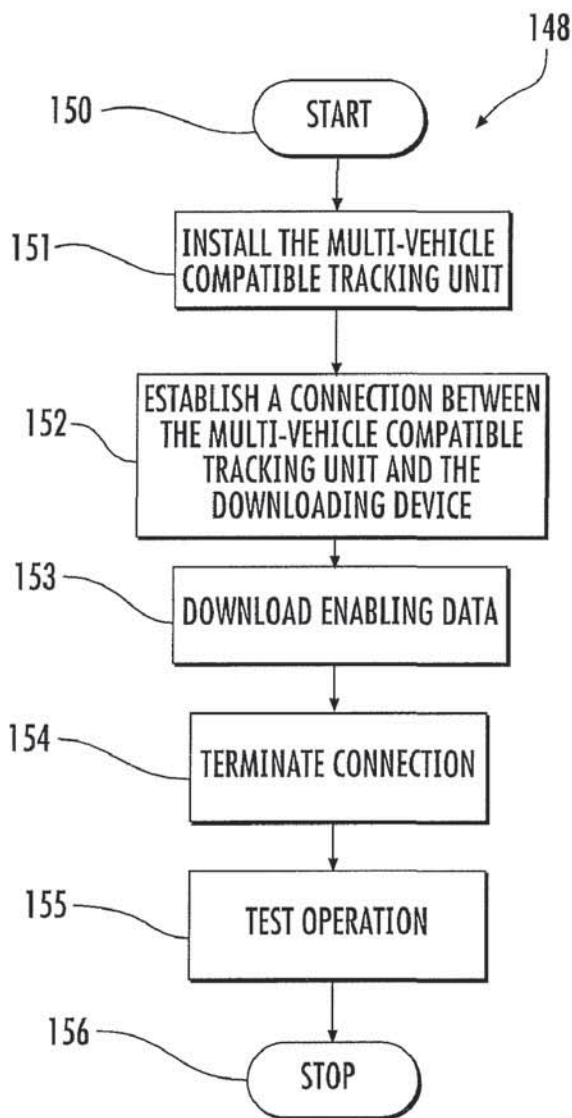


FIG. 14

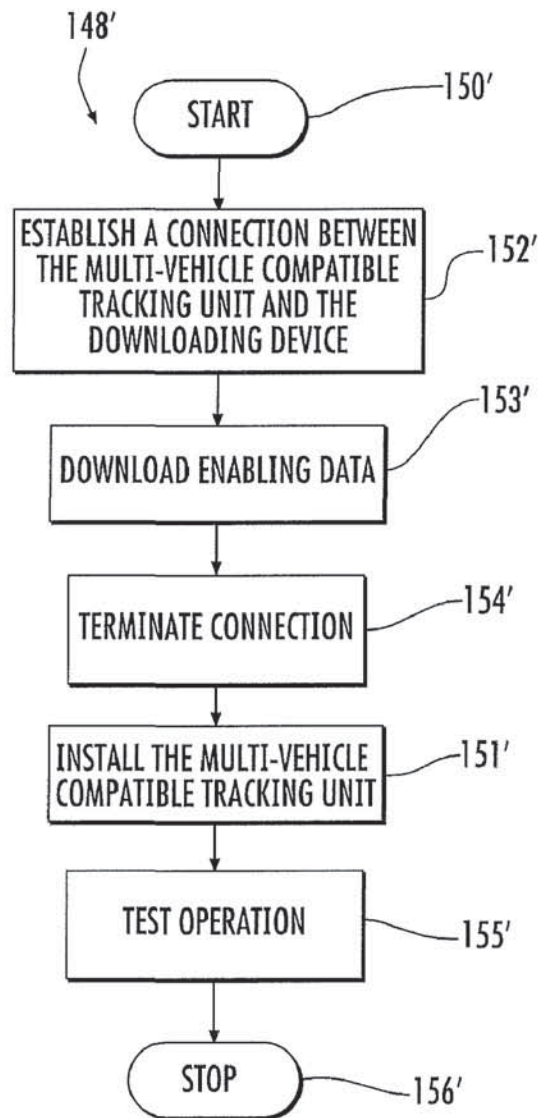


FIG. 15

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VEHICLE TRACKING UNIT WITH DOWNLOADABLE CODES AND ASSOCIATED METHODS

RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. patent application Ser. No. 11/076,259 filed Mar. 9, 2005 now U.S. Pat. No. 7,720,597, which is a continuation of U.S. patent application Ser. No. 10/383,496 filed Mar. 7, 2003 now U.S. Pat. No. 7,149,623, which is a continuation of U.S. patent application Ser. No. 09/859,972 filed on May 17, 2001 now U.S. Pat. No. 6,606,561 which, in turn, was based upon provisional patent application Ser. Nos. 60/264,811 filed on Jan. 29, 2001; 60/258,005, filed Dec. 22, 2000; 60/251,552, filed Dec. 6, 2000; 60/252,125, filed Nov. 20, 2000; 60/236,890, filed Sep. 29, 2000; 60/246,463, filed Nov. 7, 2000; 60/222,777, filed Aug. 3, 2000; and 60/205,178, filed May 17, 2000, the entire contents of each of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to the field of vehicle devices, and, more particularly, to a tracking system for vehicles, and related methods.

BACKGROUND OF THE INVENTION

Motor vehicles, such as passenger cars, trucks, busses, fleet vehicles, etc. are widely used and knowing the locations of such vehicles is often desired. For example, should a vehicle be stolen, it would be beneficial to know the vehicle's location so that authorities could be promptly and accurately directed to retrieve the vehicle. Indeed, the tracking system could plot the getaway path of the thief.

For a company with hired drivers, it may be desirable to know the driver's whereabouts during the course of the day. Similarly, a rental car agency or other fleet operator, for example, may wish to know the whereabouts of its fleet of vehicles.

It may also be desirable to track the location of a vehicle as it is used throughout the course of a normal day. For parents of younger or older drivers, for example, knowledge of the vehicle's location may provide some assurance that the driver is at designated locations and following a prescribed route.

A number of patents disclose various systems and approaches to tracking vehicles. For example, U.S. Pat. No. 5,223,844 discloses a tracking system including a control center and a mobile unit installed in the vehicle. The mobile unit may send security warnings to the command center via a wireless transceiver. Position information for the vehicle is determined using a GPS receiver at the vehicle.

U.S. Pat. No. 5,515,043 discloses a similar system which may send one or more preprogrammed telephone messages to a user when away from the vehicle. The user may remotely access location information or cause certain commands to be carried out by entering a personal identification number (PIN).

The widespread availability and use of the Internet has prompted a number of vehicle tracking systems to also make use of the Internet. For example, TelEvoke, Inc. proposed such a system in combination with Clifford Electronics. The system was to provide notification, control and tracking services via the telephone or the Internet. Users could be notified via phone, e-mail, or pager of events such as a car alarm being triggered. Users could control the vehicle remote devices via

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phone, web, or PDA such as unlocking car doors. Additionally, users could track TelEvoke-enabled vehicles on the Internet or via the telephone. An Internet map could be viewed by the user showing the actual and prior vehicle locations. TelEvoke offered its services via a centralized fully automated Network Operations Center. To reduce the communications costs, it was proposed to use the control channel of the cellular telephone network.

There are, of course, a number of vehicles which come from the manufacturer with some form of security system already installed. In addition, a number of vehicles are also equipped with aftermarket security systems. Many conventional vehicle tracking units may not be readily installed in vehicles, particularly those vehicles already including a vehicle security system. In addition, complexity of installation may significantly increase the system costs.

A number of patents disclose various security and control systems that address data bus interoperability. For example, U.S. Pat. No. 5,719,551, assigned to Omega Patents, LLC, the assignee of the present invention, discloses a vehicle security system for a vehicle including a data bus connecting a plurality of vehicle devices. A signal enabling circuit enables the alarm controller to operate using a set of desired signals selected from a plurality of possible sets for different vehicles. U.S. Pat. No. 6,011,460, assigned to Omega Patents, LLC, discloses a similar system where the set of desired signals from the plurality of different sets of signals for different vehicles is obtained, such as by connection and communication with a downloading device. Additionally, U.S. Pat. No. 6,756,885, also assigned to Omega Patents, LLC, discloses a multi-vehicle control system whereby a multi-vehicle compatible controller stores a set of device codes for a given vehicle device for a plurality of different vehicles. Device codes are read from the data communications bus, and a match between a read device code and the stored device codes is determined to provide compatibility with different vehicles.

Unfortunately, such advanced techniques for dealing with multiple device codes for a vehicle having a data communications bus have not yet been developed for vehicle tracking units.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the present invention to provide a multi-vehicle compatible tracking unit which may be used to control operable vehicle devices, and/or read information therefrom via the vehicle data communications bus and related methods.

This and other objects, features, and advantages in accordance with the present invention are provided by a multi-vehicle compatible tracking unit for a vehicle comprising a vehicle data bus extending throughout the vehicle. The multi-vehicle compatible tracking unit may include a vehicle position determining device, a wireless communications device, and a multi-vehicle compatible controller for cooperating with the vehicle position determining device and the wireless communications device to send vehicle position information. The multi-vehicle compatible controller may be coupled to the vehicle data bus for communication thereover with at least one vehicle device. The at least one vehicle device may use at least one corresponding vehicle device code from among a plurality thereof for different vehicles. The tracking unit may also include a downloading interface for permitting downloading of enabling data related to the at least one corresponding vehicle device code for use by the multi-vehicle compatible controller. Accordingly, the multi-vehicle compatible

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tracking unit may be used to control operable vehicle devices, and/or read information therefrom via the vehicle data communications bus.

The downloading interface may comprise either a wired or wireless signal downloading interface. The wired signal downloading interface may comprise a connector for temporary connection to a downloading device, for example. The wireless signal downloading interface may include a wireless receiver for temporary connection to a downloading device. The wireless signal downloading interface may also be in the form of a connection to the wireless communications device used for sending position information. The downloading interface may also be for permitting downloading of at least one programming instruction for the multi-vehicle compatible controller, in some embodiments.

The corresponding at least one vehicle code may be for reading from the at least one vehicle device, and/or for writing to the at least one vehicle device. Further, the multi-vehicle compatible tracking unit may comprise a remote transmitter. At least one vehicle remote control function responsive to the remote transmitter may be performed by the multi-vehicle compatible controller. For example, the at least one vehicle remote control function may include at least one of a vehicle security function, a remote keyless entry function, and a remote engine starting function. Also, the wireless position determining device may comprise a Global Positioning System (GPS) receiver. A tracking unit may also include a common housing for its various components.

A method aspect is for using a multi-vehicle compatible tracking unit for a vehicle comprising a vehicle data bus extending throughout the vehicle. The multi-vehicle compatible tracking unit may include a vehicle position determining device, a wireless communications device, and a multi-vehicle compatible controller for cooperating with the vehicle position determining device and the wireless communications device to send vehicle position information. The multi-vehicle compatible controller may be coupled to the vehicle data bus for connection thereover with at least one vehicle device using at least one corresponding vehicle device code from among a plurality of thereof for different vehicles. The method may include downloading the enabling data related to at least one corresponding vehicle device code for use by the multi-vehicle compatible controller via a downloading interface.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified block diagram of a vehicle tracking system in accordance with the present invention.

FIG. 2 is a more detailed block diagram of the vehicle tracking unit as shown in FIG. 1.

FIG. 3 is a more detailed block diagram of the monitoring station as shown in FIG. 1.

FIG. 4 is a flowchart for operation of the vehicle tracking system as shown in FIG. 1 illustrating a vehicle stolen alert.

FIGS. 5A-5C are a flowchart for operation of the vehicle tracking system as shown in FIG. 1 illustrating a vehicle alarm sounding alert.

FIG. 6 is a flowchart for operation of the vehicle tracking system as shown in FIG. 1 illustrating a vehicle speeding alert.

FIG. 7 is a flowchart for operation of the vehicle tracking system as shown in FIG. 1 illustrating an unauthorized transmitter learned alert.

FIG. 8 is a flowchart for operation of the vehicle tracking system as shown in FIG. 1 illustrating a low battery alert.

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FIG. 9 is a flowchart for operation of the vehicle tracking system as shown in FIG. 1 illustrating a GPS or cellular unit failure alert.

FIG. 10 is a simplified block diagram of a multi-vehicle compatible tracking unit in accordance with the invention.

FIG. 11 is a more detailed block diagram of an embodiment of the downloading interface as shown in FIG. 10.

FIG. 12 is a more detailed block diagram of another embodiment of a downloading interface as shown in FIG. 10.

FIG. 13 is a more detailed block diagram of yet another embodiment of the downloading interface as shown in FIG. 10.

FIG. 14 is a flowchart showing a method in accordance with the invention.

FIG. 15 is a flowchart showing another embodiment of a method in accordance with the invention.

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

Referring to FIGS. 1-3, the vehicle tracking system 20 in accordance with the invention is now initially described. The vehicle system 20 illustratively includes a vehicle tracking unit 25 to be mounted in the vehicle 21 and a monitoring station 30 which is remote from the vehicle and which is typically in a fixed location. In the illustrated embodiment, the vehicle tracking unit 25 interfaces with various vehicle devices, such as may include security sensors, door locks, etc. as will be appreciated by those skilled in the art.

The vehicle tracking unit 25 is also illustratively connected to a separate vehicle security system 27 as may already be installed in the vehicle 21, from the factory or installed as an aftermarket product. Those of skill in the art will appreciate that in some embodiments of the vehicle tracking system 20 a separate vehicle security system 27 may not be needed, and/or various features thereof can be readily incorporated in the vehicle tracking unit 25.

The monitoring station 30 may typically service a number of subscribers 31. As shown perhaps best in FIG. 3, the monitoring station 30 may include a user interface, such as the schematically illustrated telephone network interface 33 and the internet interface 34 which are schematically coupled to a telephone 35, and a computer 36, respectively. Of course in other embodiments, other interfaces may be used and only one of the illustrated interfaces may be needed. Those of skill in the art will also recognize that messages may be sent to a subscriber or user via preprogrammed voice messages, e-mail messages, facsimile messages, pager alerts, etc. In addition commands or instructions from the subscriber can also be input to the monitoring station 30 via the telephone network interface 33 and/or the internet interface 34, from the subscribers telephone 35 or computer 36.

The monitoring station 30 is illustratively connected to a cellular telephone tower 32 which, in turn, may communicate with the vehicle tracking unit 25 in some embodiments. Of course, in other embodiments other communications

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approaches are also contemplated, such as, for example, including satellite communications.

The monitoring station 30 may typically include the necessary modems, and other communications electronics, and computers for its functions which are described in greater detail below. The configuration of such components and their details will be readily apparent to those skilled in the art. Accordingly, no further discussion of these details is needed.

Referring now more specifically to FIG. 2, additional details of the vehicle tracking unit 25 and devices at the vehicle are now further described. The vehicle tracking unit 25 illustratively includes a controller 40, a vehicle position determining device 42, and a wireless communications device 44 connected together. The vehicle position determining device 42 may be provided by a GPS receiver, for example. The GPS receiver typically operates by receiving multiple signals from spaced apart satellites 38 as will be appreciated by those skilled in the art.

In other embodiments, the vehicle position determining device 42 may be provided based upon communications with the cellular telephone network, or based upon other satellite transmissions, for example. As a particular example, time of arrival techniques are available based upon multiple reception paths to determine position via the cellular telephone network as will be appreciated by those skilled in the art. The vehicle position determining device 42 also illustratively includes an indicator 43 associated therewith, such as for indicating an operating mode, or proper operation of the device as will be addressed in greater detail below.

The wireless communications device 44 may be provided by a cellular telephone transceiver configured to operate on a control channel of the cellular network. Such a control channel may provide nearly universal coverage for the tracking system 20 as will be appreciated by those skilled in the art. In addition, the control channel may offer relatively inexpensive communications between the monitoring station 30 and the vehicle tracking unit 25 as will be appreciated by those skilled in the art. The wireless communications device 44 also illustratively includes an optional status indicator 45 with a similar function as the indicator 43 for the vehicle position determining device.

The wireless communications device 44 in other embodiments, may transmit in the voiceband of the cellular network. Alternately, the wireless communications device may communicate over other networks, such as over satellite, or via wireless internet services, as will be appreciated by those skilled in the art.

The controller 40 illustratively includes a central processing unit (CPU) 50 or other logic circuitry which is connected to a clock signal generator 51 and a memory 52. In other embodiments, the memory 52 may be an embedded memory in the CPU 50. The controller 40 also includes schematically illustrated input/output circuitry 53 to interface with various vehicle devices. In particular the input/output circuitry 53 may provide dual polarity compatibility for one or more inputs or outputs as will be described in greater detail below. One or more of the terminals of the input/output circuitry 53 may also provide both input and output functions as will also be described in greater detail below. This may significantly simplify and accelerate installation of the vehicle tracking unit 25 in the vehicle 21.

Also illustratively shown as part of the vehicle tracking unit 25 are a back-up battery 54, and switch 55 connected thereto for selectively powering certain of the components based upon the controller 40. Of course, the vehicle 21 also includes

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an electrical system including the vehicle battery 61. Powering of the vehicle tracking unit 25 is described in greater detail below.

The vehicle 21 also includes a number of other components that may relate to vehicle tracking, security, and/or convenience features provided by the vehicle tracking system 20. For example, the vehicle 21 may include one or more door lock actuators 62, an optional remote starting device 63, a starter interrupt device 66 and an alarm indicator 67. For example, the alarm indicator may be provided by a vehicle horn or vehicle siren, and/or flashing of the lights.

The optional separate security system 27 illustratively includes a vehicle security controller 28 and a receiver 29 connected thereto. As is conventional, the vehicle security system 27 may be switched between armed and disarmed modes, for example, by one or more uniquely coded remote transmitters 60. The vehicle security controller 28 may also be capable of learning a new uniquely coded remote transmitter 60 as will be appreciated by those skilled in the art. The vehicle security controller 28 also illustratively is connected to the starter interrupt device 66 and the alarm indicator 67.

For ease of explanation, a number of the features of the vehicle tracking system 20 are now described. The vehicle tracking system 20 includes a number of features that may simplify installation and maintenance. For example, as shown in FIG. 2, the vehicle tracking unit 25 may have a test switch 71 connected to the controller 40.

In normal operation, the controller 40 may be called upon to operate at least one vehicle device. Of course, the controller 40 also cooperates with the wireless communications device 44 and the vehicle position determining device 42 to determine and send vehicle position information to the monitoring station 30. Moreover, the controller 40 may be switchable to a test mode for test operation of the at least one vehicle device responsive to activation of the test switch 71.

In some embodiments, the at least one vehicle device may be a plurality of vehicle devices that are tested by operation in sequence. For example, the at least one vehicle device may comprise at least one door lock actuator 62. The at least one vehicle device may also comprise the starter interrupt device 66, or the engine remote starter 63 if remote starting is an implemented feature. The at least one vehicle device which is tested, may also be the alarm indicator 67. Accordingly, an installer, for example, can quickly check that the tracking unit has been properly installed.

To further provide for ready determination of proper operation of the vehicle tracking unit 25, one or both of the position determining and wireless communications devices 42, 44 may include associated indicators 43, 45 as mentioned briefly above, and which provide an indication relating to proper operation. Each indicator 43, 45 may indicate a mode of operation of the device, its proper operation, or a partial or complete failure of the device.

Another aspect of the invention is that the controller 40 may provide a selectable polarity for the at least one vehicle device based upon sensing thereof. Accordingly, a predetermined activation of the test switch 71 may cause the controller 40 to sense and select the proper polarity. Pressing the test switch 71 for a predetermined time or in a predetermined pattern may sense and set the polarity.

Another feature of the vehicle tracking unit 25 and vehicle tracking system 20 relates to conservation of the number of codes or messages that need to be sent to the vehicle tracking unit. In particular, the controller 40 may have a plurality of different controller states and respond differently to a same message from the monitoring station 30 at different times depending upon the controller state at a given time. Accord-

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ingly, a number of codes or messages used by the system can be conserved. Various messages are described in greater detail below.

A controller state may change based upon several different occurrences or events. For example the controller may change states in response to a change in at least one vehicle device, or based upon a message received by the wireless communications device 44 from the monitoring station 30, and/or based upon elapsed time. The controller states, for example, may include an alert sent state based upon an alert message being sent from the wireless communications device 44. Thereafter, receipt of a predetermined message by the wireless communications device 44 when the controller 40 is in the alert sent state may confirm receipt of the alert message by the monitoring station.

Receipt of the predetermined message by the wireless communications device 44 when the controller 40 is in another state different than the alert sent state may thus cause a different response by the controller. The alert sent state may comprise at least one of a vehicle stolen alert sent state, a vehicle alarm sounding alert sent state, a vehicle speeding alert sent state, an unauthorized remote transmitter alert sent state, a low vehicle battery alert sent state, and a device malfunction alert sent state. The various alert messages and confirmation thereof are described in greater detail below.

The code or message conservation aspects of the vehicle tracking system 20 also permit sending a sequence of codes or messages within a predetermined time to also cause a different response at the vehicle tracking unit 25. In other words, the plurality of controller states may comprise a received first message state based upon a first message being received by the wireless communications device 44 from the monitoring station 30. Receipt of a second message by the wireless communications device 44 when the controller 40 is in the received first message state, such as within a predetermined time window, for example, may thus cause a different response by the controller than does receipt of the second message when the controller is in another state than the received first message state.

The plurality of controller states may comprise a vehicle finder state sounding an audible signal via the alarm indicator 67 at the vehicle 21. In this state the controller 40 would bypass sending a vehicle alarm sounding alert to the monitoring station 30.

Another aspect of the vehicle tracking system 20 is the provision of certain power conservation and management techniques, such as to permit extended periods where the vehicle 21 is not in operation. During such extended periods, the vehicle battery 61 provides power to the vehicle tracking unit 25 as well as other vehicle devices. Accordingly, the voltage of the vehicle battery 61 drops over time. The vehicle tracking unit 25 may provide a significant drain on the vehicle battery 61 because of the power consumed by the wireless communications device 44 during transmission as will be appreciated by those skilled in the art.

The vehicle position determining device 42, the wireless communications device 44 and the controller 40 may be considered as defining a power load of the vehicle tracking unit 25. The controller 40 may operate the schematically illustrated power switch 55 to isolate the back-up battery 54 from the power load as a voltage of the vehicle battery 61 drops until reaching a threshold. After or below the threshold the controller 40 may cause the back-up battery 54 to selectively power only a first portion of the power load while a second portion of the power load remains powered by the vehicle battery.

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For example, the wireless communications device 44 may have a higher operating voltage than the vehicle position determining device 42. The first portion of the power load that is selectively powered despite the low vehicle battery voltage may thus be the wireless communications device 44. In particular, the wireless communications device 44 may be powered for transmission. Accordingly, the back-up battery 54 can be saved for limited communication using the higher voltage wireless communications device 44. This provides useful features even after an extended period during which the vehicle 21 is left unattended and the vehicle battery 61 gradually discharges.

To further conserve power, the controller 40 may reduce operation of the power load as vehicle battery voltage falls. Conversely, the controller 40 may restore operation of the power load based upon the voltage of the vehicle battery 61 rising again, such as upon being recharged.

Also relating to power consumption, the controller 40 further causes transmission of a low vehicle battery voltage alert to the monitoring station 30 based upon the voltage of the vehicle battery 61 falling below the threshold. The user or subscriber may cause the monitoring station 30 to issue a remote start command. The controller 40 may then generate a remote start output to the remote start device 63 to thereby start the engine and recharge the vehicle battery.

Another feature of the vehicle tracking system 20 is that the vehicle tracking unit 25 may be readily installed and connected to a vehicle 21, such as in the illustrated embodiment where the vehicle includes a starter interrupt device 66 and a separate vehicle security controller 28. More particularly, the controller 40 may switch between an armed mode and a disarmed mode based upon operation of the engine starter interrupt device 66. The controller 40 when in the armed mode may cooperate with the wireless communications device 44 to send an alert message to the monitoring station 30 and including vehicle position information, for example, based upon the vehicle position determining device 42. The controller 40 is also for selectively operating the engine starter interrupt device 66 to provide additional security features.

In one advantageous embodiment, the controller 40 preferably comprises a combination input and output terminal for connection to the engine starter interrupt device. This terminal is at the input/output circuitry 53 and is schematically illustrated by reference numeral 72. The controller 40 may switch to the armed mode when in the disarmed mode and based upon the engine starter interrupt device 66 being operated to disable engine starting. Conversely, the controller 40 may switch to the disarmed mode based upon the engine starter interrupt device 66 being operated to enable engine starting. In other words, the vehicle tracking unit 25 can piggyback its arming and disarming off the existing vehicle security system 27, for example.

The controller 40 may also selectively operate the engine starter interrupt device 66 based upon a command message from the monitoring station 30. The controller 40 may selectively operate the engine starter interrupt device 66 based upon a command message from the monitoring station 30. Alternately, or in addition thereto, the controller 40 may selectively operate the engine starter interrupt device 66 based upon the ignition switch 65.

The following descriptive portions relate to various user or subscriber notifications and features provided by the vehicle tracking system 20. Of course, the controller 40 preferably cooperates with the wireless communications device 44 to send an alert message. The monitoring station 30 may comprise a user interface, such as one or both of the telephone

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network or internet interfaces 33, 34, respectively (FIG. 3), for generating a sequence of alert message notifications based upon receiving the alert message sent from the vehicle tracking unit 25. More particularly, the monitoring station interface permits canceling any remaining alert message notification based upon a cancellation command response from a user or subscriber having already received the alert message notification. The user may send the cancellation response via the telephone 35 or computer 36 (FIG. 3), for example. Thus, if the user may be reached at different telephone numbers or different users are desirably notified of the alert, this aspect of the vehicle tracking system 20 can make the notifications efficiently and without making unnecessary notifications.

The vehicle tracking system 20 may provide any of a number of very useful alerts, as discussed herein. For example, the alert message sent from the vehicle tracking unit may comprise at least one of a vehicle stolen alert message, and a vehicle alarm sounding alert message. The alert message may be one of a vehicle speeding alert message, and a vehicle acceleration alert message. In addition, the alert message may comprise an unauthorized remote transmitter alert message. Also, the alert message may be at least one of a low vehicle battery alert message, and a device malfunction alert message.

The speeding alert may be based upon exceeding a speed threshold for greater than a certain time, which may be user selectable. The acceleration alert may also be useful as such is also indicative of aggressive driving along with the speeding alert. The unauthorized remote transmitter alert increases overall security since a user will be notified if a would-be thief learns an unauthorized transmitter to operate the controller. These alerts are described in greater detail below.

The vehicle tracking system 20 may be implemented as a service to a subscriber. In other words, the subscriber pays a monthly fee for the service. Accordingly, it may be important to encourage a user to register. Similar subscriber or registrations systems in the past have suffered revenue losses since some users would wait to activate the system until the vehicle was stolen. In other words, the user would only subscribe or register and pay a single month's fee.

In accordance with this aspect of the vehicle tracking system 20 prompt user registration is encouraged. In particular, the vehicle tracking unit 25 may include the user registration reminder indicator 56 and the controller 40 may be switchable from an unregistered mode to a registered mode. In the registered mode, the controller 40 may cooperate with the wireless communications device 44 and the vehicle position determining device 42 to determine and send vehicle position information to the monitoring station 30. In the unregistered mode, the controller 40 may activate the user registration reminder indicator 56 to encourage registration by the user.

The controller 40 may be switchable to the registered mode based upon an activation message from the monitoring station 30. For example, when the registration payment has been received, the monitoring station can send one or more messages to the vehicle tracking unit 25 to stop activation of the registration reminder indicator 56. The indicator 56 may be audible, visual or both. For example, the registration reminder indicator 56 could be a beeping sound generated by a small piezoelectric transducer every ten minutes or so when the ignition 65 is on.

In other words, the user registration reminder indicator 56 may provide a minor but irritating annoyance to the user to encourage registration. Upon successfully registering, the annoyance is abated. Accordingly, a relatively straightforward approach is provided to encourage user registration.

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Along these lines, the controller 40 when in the unregistered mode may have reduced features compared to the registered mode. For example, the controller 40 when in the unregistered mode may be restricted or limited in sending messages with the wireless communications device 44. Accordingly, usage of the wireless communications network may be reduced. Transmissions from the vehicle tracking unit 25 may also be beneficially suppressed during original installation, for example.

Returning again to features of the vehicle tracking unit 25 which facilitate installation, the controller 40 may send an alarm indication alert responsive to a continuous activation of the alarm indicator 67 for greater than a predetermined time. Alternately, or in addition thereto, the controller 40 may send an alarm indication alert responsive to a repetitive pattern of alarm indicator 67 activations. In other words, the controller may be configured to distinguish between normal operation of a vehicle horn by the driver, and activation of the horn by the security system 27. As mentioned above, the controller 40 may also monitor signals of at least one of a first and second polarity. The controller 40 thus advantageously piggybacks off the alarm indication generated by the vehicle security system 27 to determine and send a vehicle alarm sounding alert to the monitoring station 30.

In one variation, the controller 40 may monitor signals delivered directly to the vehicle alarm indicator by the vehicle security controller 28. In another variation, the controller 40 monitors signals of voltage dips of the vehicle battery 61. Circuitry is conventionally and readily available for both such functions, as will be readily appreciated by those skilled in the art.

The controller 40 may also include a dual polarity compatible output in the input/output circuitry 53 for a vehicle device, such as the vehicle alarm indicator 67. The controller 40 may further monitor signals relating to activation of the vehicle alarm indicator 67 and send an alarm indication alert with position information from the vehicle position determining device and using the wireless communication device.

For the dual polarity output compatibility, the controller 40 may generate a first polarity output pulse followed by a second polarity output pulse. The controller 40 may also generate a repeating pattern of a first polarity output pulse followed by a second polarity output pulse on the dual polarity compatible output. In yet other embodiments, the controller 40 may sense an actual polarity of the device and thereafter use the actual polarity for the dual polarity compatible output.

Where the vehicle device is a vehicle horn, the controller 40 may typically be configured to generate a negative polarity output on the dual polarity compatible output. Conversely, wherein the vehicle device is a vehicle alarm indicator siren, the controller 40 may be configured to generate a positive polarity output on the dual polarity compatible output.

Another aspect of the vehicle tracking system 20 relates to conserving memory space and/or reducing transmission time over the communications network. In accordance with this advantageous feature, the controller 40 may determine the vehicle position information including a vehicle location and an associated stationary period for each occurrence of the vehicle remaining stationary for greater than a predetermined period. In one embodiment, the controller 40 may cooperate with the wireless transmission device 44 to send the vehicle position information to the monitoring station based upon each occurrence of the vehicle remaining stationary for greater than the predetermined period. In this embodiment, the monitoring station 30 may associate a time with each occurrence of the vehicle remaining stationary for greater

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than the predetermined period. In other words, the monitoring station 30 may time stamp the received information.

In another embodiment, the controller 40 cooperates with the wireless transmission device 44 to send the vehicle position information to the monitoring station 30 for a plurality of occurrences of the vehicle remaining stationary for greater than the predetermined period. In this embodiment, the controller 40 may associate a time with each occurrence of the vehicle remaining stationary for greater than the predetermined period. In other words, the controller time stamps the position and stationary period information.

As an example, the predetermined time which determines whether the vehicle 21 is stationary and the position should be determined, may be less than about three minutes. This time may filter out vehicle stops in normal traffic, but which will keep track of stops where the driver likely leaves the vehicle 21. Accordingly, only the important information necessary to track the vehicle need be stored and/or transmitted thereby reducing the system costs. If the vehicle 21 is stationary overnight, for example, unnecessary position information need not be determined, stored, and/or transmitted to the monitoring station 30.

The controller 40 may comprise the memory 52 for storing the vehicle position information therein. In one configuration, the controller 40 downloads the vehicle position information from the memory 52 to the monitoring station 30 based upon a predetermined schedule. In another configuration, the controller 40 downloads the vehicle position information from the memory 52 to the monitoring station 30 based upon a predetermined event. In yet another configuration, the controller 40 downloads the vehicle position information from the memory 52 to the monitoring station 30 based upon a predetermined percentage of memory usage.

Having now described certain general features and advantages of the vehicle tracking system 20, this description now turns to additional specific details which are provided as examples. In particular, vehicle tracking system 20 preferably implements one or more of the following features:

- a. Detects the vehicle being stolen and transmits a signal to the monitoring station to contact up to 3 people, for example, predetermined by the user, of theft of the vehicle and then starts tracking the vehicle. The contact may be by one or more of the following: an e-mail message, a pager alert, a cellular telephone call, or other telephone call.
- b. Detects an optional vehicle security or alarm system activation and transmits a signal to the monitoring station to contact up to 3 predetermined people to inform them the vehicle's alarm is being activated.
- c. Detects an optional vehicle alarm system's remote PANIC activation and transmits a signal to the monitoring station to contact up to 3 predetermined people to inform them of the vehicle's PANIC being activated.
- d. Detects a vehicle being programmed to operate from an unauthorized remote transmitter, key transponder, other transponder, or other device that has a unique coding, and the vehicle unit transmits a signal to the monitoring station to contact up to 3 predetermined people to inform them of this occurrence. The system can also make available information relating to a number of such coded devices, or a change therein, or when a change occurred. A message can be sent to the user or the information can be available to the user on the website. The vehicle would be equipped with a security system as disclosed in U.S. Pat. No. 5,654,688, for example, which determines

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an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

- e. Detects the vehicle traveling over a predetermined speed, such as for a predetermined time, and transmits a signal to the monitoring station to send a message, such as an e-mail informing the user (and/or others) of this occurrence. Of course, the message could also be sent via a telephone call or page, should additional urgency be required. The vehicle's predetermined maximum speed limit and duration thereof can be selected by the user.
- f. Detects a low battery voltage such as for a predetermined time and transmits a signal to the monitoring station to contact up to 3 predetermined people to inform them of vehicle's low battery voltage. This is especially advantageous during winter so that the vehicle could be started, for example, to prevent a problem before it happens. The time setting is preferably selectable by the user.
- g. Detects the vehicle not moving for a predetermined time and transmits a signal to the monitoring station to send, for example, a nightly e-mail informing the user of all the vehicle's location and stationary time occurrences. The stationary time length is also selectable. This may be advantageous to encourage patrolling personnel not to remain for a long time in a same location.
- h. The vehicle unit preferably includes a back-up battery system making it more reliable.

The vehicle unit may be relatively inexpensive. In addition, the monitoring fee that includes sending up to 60 e-mails and making up to 6 phone calls per month, may also be relatively low. The relatively low monitoring fee is based, at least in part, on the current relatively low rates charged for use of the control channel of the cellular telephone network. It is also noted that access to the control channel provides coverage for almost the entire U.S., for example.

The user or subscriber also preferably has access to an Internet site that will display a map and silently contact the vehicle to acquire its current location, speed, direction of travel, and previous multiple locations with speeds, for example, the user's personal identification number (PIN) can be quickly activated by a telephone call. No additional installation may be required.

Certain annual pre-pay package arrangements may be available. For example, up to 10 access entries per month can be provided on a low monthly billing. Up to 30 access entries could be provided also for a relatively low monthly fee.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the monitoring station internet site. The user may control various vehicle functions remotely via the telephone or the internet site. The only charge may be for additional equipment and installation.

Additional features can also be included with the system and subscribed to by the user in accordance with the invention. For example, these include Hijack, Car Finding, Unlock Doors and Unauthorized Transmitter Alert Features. The equipment and installation is relatively inexpensive. For the hijack feature: from any phone or computer, the user may activate vehicle starter interrupt and sound the horn until the vehicle is retrieved (Command 4).

For the Car Finding feature: from any phone or computer, the user may activate the vehicle's horn, or siren and sound same for 30 seconds. This allows the user to find his vehicle in a crowded parking lot (Command 5).

For the Lock/Unlock vehicle doors feature: from any phone or computer a predetermined command (Command 7)

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activates unlocking of vehicle doors to retrieve keys, for example, that may have been accidentally locked inside the vehicle. Of course, the system can also be used to lock vehicle doors if this was forgotten (Command 6). The unauthorized transmitter alert feature is similarly selected as described above.

In addition, a remote vehicle start feature may also be provided, such as to start the vehicle's engine to heat or cool the vehicle prior to entry. The equipment and installation for remote starting may be relatively low. Some further details of a specific embodiment of the vehicle tracking unit 25 are provided below as relating to use of red and green LED indicators as may be coupled to the controller 40 and operated thereby. Also various representative wires, designated by color, are provided as an example embodiment.

The red LED verifies the GPS receiving signal. With a yellow wire having positive 12 volts, the red LED blinking indicates searching GPS location, constant indicates found location, and off indicates no GPS signal found. With the yellow wire not having positive 12 volts, if the red LED is off, the LED is not functioning.

The green LED verifies receiving the cell tower signal. With the yellow wire having positive 12 volts, blinking indicates the cell control channel signal is detected, constant indicates sending a micro burst signal (LED stays on 5 seconds after each transmission), and off indicates no cell tower signal received. With the yellow wire not having positive 12 volts, off indicates the green LED is not functioning.

An example of representative DIP switch feature selection is as follows. A first switch may be used for adding the orange wire for controlling arm/disarming of the system. When on, the orange wire controls arm/disarm as follows: to arm, the orange wire is grounded and the yellow wire does not have 12 volts positive. To disarm, the orange wire is not grounded. When the first switch is off, then only the yellow wire controls arm/disarm as follows: to arm, the yellow wire is without 12 volts positive, and 30 seconds after continued arm mode then the orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until the system is disarmed. To disarm, the yellow wire is connected to 12 volts positive.

A main 5-pin plug may be provided on the vehicle unit and connected as follows:

- a. The Red Wire is connected to the 12 vdc power. An alert warning "E" is given if the system is armed and the battery voltage becomes lower than 11 volts for longer than ## minutes. This alert feature "E" will not operate again until the voltage is above 12 volts to re-set this feature.
- b. The black wire is connected to ground.
- c. The yellow wire is connected to the ignition 12 volts so that if the key is on, 12 volts is supplied thereto and if the key is off, the yellow wire is connected to ground. Further: if the system is in an armed mode and the Lat/Long changes, then Alert "A" is given. If the system is disarmed and within 2.5 seconds after the yellow wire receives 12 volts and the gray wire detects 3 or more positive pulses the system activates Alert "D". If the first DIP switch is in the off position then: if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues from the 500 ma ground, and if the yellow wire sees ground or neutral, then the system is armed and 30 seconds after the continued arm mode the orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until the system is disarmed.

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d. The gray wire is for input and output, and can be connected to an alarm siren or horn positive terminal. In addition:

- i. With the system armed and if the gray wire detects +12 v pulsing on/off or on constant for more than 10 seconds from an alarm siren or horn honking activation, then alert warning "T" alarm activation is given.
- ii. With system disarmed and if the gray wire detects +12 v pulsing on/off or on constant for more than 10 seconds from an alarm siren or horn honking activation, then alert warning "C" panic activation is given.
- iii. With system disarmed and if the Gray wire detects 3 or more 12 volt positive pulses within 2.5 seconds of yellow wire receiving +12 v and the gray wire by-pass not being activated, then alert warning "D" is given.
- iv. The gray wire bypass operates as follows:
 1. After alert warning "B" bypass all future alert "B" signals until system is disarmed.
 2. After alert warning "C" bypass all future alert "C" signals until system is armed.
 3. After alert warning "D" bypass all future alert "D" signals until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire having 12 volts.
- v. With the system armed or disarmed. The Output: Internal +12 v, 1 amp transistor with pulses 1 second on and 1 seconds off to activate siren or honk car horn or flashing light relay.
 1. Non-stop activation from (Command "4")
 2. 30-second activation from (Command "5")
- vi. Turn off the above alert "A" from (Command "1").
- i. The orange wire is for the starter interrupt and arm/disarm system, and operates as follows:
 - i. If first DIP switch is in the:
 1. On position and: the orange wire has 12 volts or neutral, the system switches to the disarmed mode; the orange wire is grounded, then the system is switched to the armed mode; and the starter interrupt output will not automatically operate. It can only be activated from "Command 4"
 2. Off position and the orange wire does not effect the arming or disarming of the system; 30 seconds after system arms the orange wire will automatically activate constant 500 ma ground until the system is disarmed. And from "command #4". Connect to Starter interrupt relay output.
 - ii. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.
 - iii. After alert warning "B" is activated the first time it is thereafter bypassed while the orange wire remains grounded. Alert warning "B" is re-set to operate again 3 seconds after orange wire becomes ungrounded.

The vehicle unit may also include a Door Lock Plug configured as follows, for example. A green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6"). A red wire provides a constant 12 v output from the red power wire. A blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7"). A pink wire provides a 250 ma., negative 1 second pulse for remote Car Starter (Command "2").

An installation test button may also be provided to work as follows. Pressing the button activates the orange wire for 10-seconds (starter interrupt), with these circuits in sequence. First, it activates the gray wire for 1-second (siren/horn). After the first stops, it activates the green wire for 1 second to lock the doors. After the second stops, it activates the blue

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wire for 1 second to unlock the doors. After the third stops, it activates the pink wire for 1 second to activate an optional item.

Representative warning alerts are as follows:

- a. Alert Warning "A" (FIG. 4): Automatic activation of "Command 8" and the vehicle unit contacts monitoring station to instantly call 3 phone numbers with the message "Your vehicle is stolen please confirm then call 911 to advise police of website and your pin # so police can locate the vehicle". This is detected with the system armed and the GPS indicating movement. Bypasses all future alert warning "A" signals until the system is re-armed.
- b. Alert Warning "B" (FIGS. 5A-5C): the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the following message "Vehicle alarm activated please confirm". This is with the system armed and detecting gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After alert warning "B" is activated the first time, it is thereafter bypassed while the orange wire remains grounded. Alert warning "B" is re-set to operate again 3 seconds after orange wire becomes ungrounded.
- c. Alert Warning "C" (FIG. 6): the vehicle unit contacts the monitoring station to instantly send e-mail message "vehicle was traveling faster than your preset amount of ###" and time limit of "##" seconds. Indicates the vehicle speed and location that the speeding started and how long speeding accrued" (Detected from GPS). This aspect is further understood with reference to the enclosed flowchart 84 of FIG. 6.
- d. Alert Warning "D" (FIG. 7): the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Unauthorized remote transmitter was just programmed to operate your vehicle." This is with the system disarmed and the Gray wire detecting three or more 12 volt pulses within 2.5 seconds of the yellow wire having seen 12 volts positive. All future alerts "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts. This aspect is further understood with reference to the enclosed flowchart 85 of FIG. 7.
- e. Alert Warning "E" (FIG. 8): the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle has low battery voltage and system has changed to low voltage mode". This is with the system armed and detecting the red wire with lower than 11 volts for ## minutes. All future alerts "E" are bypassed until, first, more than 13.5 volts are detected on the red wire and, second, after the yellow wire stops having positive voltage the red wire then must detect more than 12 volts.

The following are representative commands for use in the system:

Command 1: Reset all circuits and system remains asleep until the ignition key is turned on. Resets the triggered mode and unit is asleep to prevent power drain on vehicle battery.

Command 2: (Accessory activation) monitoring station Command to the system to activate Pink wire to pulse 250 ma negative for 1 second.

Command 3: (Vehicle Location) website to indicate present location and past events in memory.

Command 4: (Hijack or Stolen) monitoring station Command to vehicle system to activate:

- iv. Gray wire to pulse 1 sec on/1 sec off with 1 amp positive output and which continues until receive command # 1.

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- v. Orange wire to have 500 ma ground and which continues until receive command # 1.

Command 5: (Car Find) monitoring station Command to system activating Gray wire for 30 seconds pulsing 1 sec on/1 sec off with 1 amp positive output.

Command 6: (Lock Doors) monitoring station Command to system activating Green wire to pulse 1 second with 250 ma negative.

Command 7: (Unlock Doors) monitoring station Command to system to activate Blue wire to pulse 1 second with 250 ma negative.

Command 8: (Start Constant Vehicle Tracking) sends previous 2 events in memory and then every 120 seconds get update of location information sent to the Web site.

The system is also operable in a battery saver mode which operates as follows:

- i. With the ignition key off, if the battery voltage drops below 11.5 volts for more than 5 seconds, the GPS verification wakes up to look:
- ii. Once instantly.
- iii. Once in 1 hour if at the same location.
- iv. Once in 6 hours if at the same location.
- v. Once in 12 hours if at the same location.
- vi. Once every 24 hours if at the same location.
- vii. Activate alert "E" when the battery saver mode is activated, and bypass sending all future Alert "E" until the battery voltage goes above 13 volts for 10 minutes to reset this feature.

Another aspect of the invention relates to automatic vehicle alert e-mails sent containing some or all of the previous system events. This sending can be triggered as follows:

- a. At a user selected predetermined time ## (01-24) of each day, or
- b. At a predetermined memory fill level, such as full or near full.

In addition, each system event may contain one or more of the following:

- a. Vehicle Location
- b. Vehicle total time at location
- c. Time of day
- d. Mph traveling
- e. Total time traveling above MPH
- f. Direction traveling
- g. Delta
- h. Special Alert messages, if any, including:
 - i. GPS signal not received for longer than 5 minutes.
 - ii) Traveling above ###MPH for ## minutes.
 - iii) Vehicle is stolen.
 - iv) Alarm activated.
 - v) Unauthorized remote transmitter alert.
 - vi) Battery saver mode activated
 - vii) Command 1: Reset all circuits and system remains asleep until the ignition key is turned on.
 - viii) Command 2: (Accessory activation)
 - ix) Command 3: (Vehicle Location was retrieved)
 - x) Command 4: (Hijack or Stolen mode activated)
 - xi) Command 5: (Car Find mode activated)
 - xii) Command 6: (Locked Doors)
 - xiii) Command 7: (Unlocked Doors)
 - xiv) Command 8: (Started 2-second incremental Vehicle Tracking)

Another feature of the invention relates to the selectable threshold conditions causing an event to be recorded into the memory of the vehicle unit. For example, this may include: while the yellow wire has 12 volts, record events every "???" default 15 minutes time if the GPS location has changed. If the GPS location is the same then only update stationary total

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time. If the GPS antenna is not receiving any signal then enter last known GPS location and with an indication that this was the last known GPS location before the GPS signal stopped, how long no GPS signal was received, and the GPS location in the on-hold file, when the vehicle is traveling above ### MPH for ##-minutes.

The monitoring station may also provide a number of automated phone calls as described above. These may include:

The user's vehicle has issued a stolen alert:

If vehicle is stolen, after receiving the phone message the user then calls 911 to advise police of the theft, and gives the police the website address and an identification number, such as the user's PIN, to allow the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

If this is a false alert due to vehicle being towed away for service, for example, then the user may press "1" to put the vehicle in an off mode. Once the ignition key is turned on again the system will reset back to its normal operation mode.

The user's vehicle has issued an alarm activated for more than 10 seconds alert. The system will not respond to this alert again until ignition key is turned on again to reset this feature.

The vehicle battery voltage is low or has been disconnected. The tracking system is in low voltage mode. The system will not respond to this alert again until the battery voltage goes above 13 volts for 10 minutes to reset this feature.

The backup battery may be sized according to the GPS receiver and processing power draw. In addition, the battery may also be sized based upon estimated micro burst transmitting power draw. Such transmissions are typically at about 3 watts power to the antenna.

The system according to the invention including the vehicle unit and monitoring station provides a number of significant advantages and features. For example, the police may be directly contacted by the user when the vehicle is stolen. The user receives the telephone message from the monitoring station, and this is done without requiring the intervention of a manual security monitoring operator, such as an ADT operator, for example. In addition, once in the stolen mode, the vehicle unit will periodically continue to send out its location, so that the police may track the vehicle via the WEB, for example. This location sending feature may begin immediately, that is, without requiring the user to contact the vehicle to begin tracking. Having the vehicle contacting the monitoring station is considerably less expensive than other schemes where the vehicle is periodically polled via the cellular network, for example.

The system may also be interfaced to a breath alcohol sensor at the vehicle, for example, and this information recorded in memory. The information could be passed along to the monitoring station, which, in turn, could send out a notification message (e-mail or telephone) that the vehicle is being operated by a driver who may be impaired by alcohol. The vehicle's location could then be tracked to permit the police to detain the driver.

Another aspect of the unit is that it may be able to recognize the desirability to bypass certain security breach triggers or other events. For example, a car finding feature can be provided that will allow the user to sound the horn or siren when near the vehicle to help locate the vehicle, as in a crowded parking area. Without the bypass feature, the unit could recognize the horn or siren as a security breach and transmit such information to the monitoring center. In accordance with this aspect of the invention, the unit would recognize the car finding feature was activated and thereby bypass sending a security breach transmission, for example. Again, false

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alarms and unneeded usage and expense of the communications infrastructure would be avoided.

Yet another aspect of the invention relates to thwarting a would-be thief who attempts to disable the alarm by cutting the battery cable or power supplied to the system. The unit preferably includes a back-up battery. More particularly, upon being in an armed mode and sensing a breach of security, such as the hood opening, for example, the unit will send out a signal indicating the alarm or security breach and while the alarm is indicated, if the battery is disconnected then the unit will send out a message indicating the vehicle is stolen, and also providing the vehicle's current position. Accordingly, the would-be thief is not able to defeat the security system by quickly disrupting power to the unit during an alarm indication or security breach. Also, to prevent additional alerts, this message is prevented from being transmitted again until the user returns to the vehicle to disarm the system and/or turn on the ignition so that the unit sees a voltage above 13 volts, indicating the vehicle has started using the owner's ignition key. This aspect is further understood with reference to the enclosed flowchart 80 (FIG. 4).

Still another aspect of the invention relates to how the unit can discriminate between ordinary usage or honking of the horn as compared to a security system triggered alarm. Most vehicle security systems will provide a pattern of horn soundings as an alarm indication, and this can be determined and used to reduce false alarm transmissions from the unit. For example, the unit can look at the number of leading and trailing edges of the power pulse used to sound the horn. A single pressing of the horn switch by the user will cause two edges within a predetermined time, such as about 10 to 12 seconds. Accordingly, the unit can be configured to not send a security breach transmission to the control center based upon detecting two transitions. Since a number of vehicle security systems may have a continuous sounding of the horn within the predetermined time, the unit can send the transmission upon detecting only a single transition.

A number of other vehicle security systems provide a series of pulses or horn soundings within the predetermined time. Accordingly, the unit may also be configured to send a security breach transmission upon detecting greater than a predetermined number of transitions, such as greater than nine, for example. This number is also typically higher than a user would generate honking the horn several times within the predetermined time. In other terms, the number of transitions of the horn pulses can be counted, and if equal to one, or greater than nine, for example, the transmission is triggered, and otherwise the sounding of the horn is ignored. Also, to prevent additional alerts, this message is prevented from being transmitted again until the user returns to the vehicle to disarm the system and/or turn on the ignition so that the unit sees a voltage above 13 volts, indicating the vehicle has started using the owner's ignition key. This aspect is further understood with reference to the enclosed flowcharts 81-83 (FIGS. 5A-5C).

Yet another feature of the invention relates to a low vehicle battery alert. For example, the unit may monitor the battery voltage over a predetermined time such as ten minutes. The ten minute window prevents false tripping, for example, when the voltage dips during engine cranking. In particular, the voltage can be sensed and it can be determined whether it is greater than zero (e.g. greater than six volts) and less than a high value (e.g. eleven or twelve volts), and, if so, a low battery voltage transmission can be communicated to the monitoring station, and ultimately to the vehicle user when away from the vehicle. If the vehicle is being serviced and the battery is disconnected, this will cause the battery voltage to

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be equal to zero. Then, the low battery voltage transmission will not be communicated to the monitoring station. Also, to prevent additional alerts, this message is prevented from being transmitted again until the user returns to the vehicle to disarm the system and/or turn on the ignition so that the unit sees a voltage above 13 volts, indicating the vehicle has started using the owner's ignition key. Again, false triggerings are reduced. This aspect is further understood with reference to the enclosed flowchart 86 (FIG. 8).

Yet another advantageous feature of some embodiments of the invention relates to the ability to conserve electrical power. More particularly, when the vehicle is stopped and in the armed mode, the GPS receiver may be periodically operated to determine the vehicle position. If the vehicle position changes, this is indicative that the vehicle is being moved or stolen. For example, the GPS receiver may be operated to generate new vehicle position information every 29 seconds. These relatively quick successive position determinations or readings are generally termed hot start. These are relatively less complicated than a cold start position determination which takes longer, since the cold start position determination requires greater time to acquire and receive data from multiple satellites, as will be appreciated by those skilled in the art.

Unfortunately, this relatively high repeated usage of the GPS receiver may cause unnecessary battery drain, especially when the vehicle is left armed and unattended by the user for an extended period. Accordingly, the power conserving feature of the invention permits the GPS receiver to be turned off when the vehicle is in the armed mode, and the GPS receiver is turned on only when needed. For example, a vehicle sensor, such as a shock sensor, motion sensor, ignition sensor, door sensor, or other sensor, or combinations thereof could be used to start the GPS receiver. This sensor could also be used to trigger an alarm if desired; however it need not be so used in all embodiments. The GPS receiver, once turned on, could operate in the normal periodic fashion as described above, or for a fixed period of time. The GPS receiver could also be turned off again after some predetermined time if no further sensor signal is received, or if the position fails to change on subsequent position readings or determinations.

Yet another feature relates to permitting more colorful audible alert messages to be generated for the user. The user can, in some embodiments, access an internet site to type or enter the text for a message to be sent, such as to alert the user that his vehicle is being stolen. The audible message then communicated by a telephone call to the user is generated by a speech message synthesizer based upon the entered text. In accordance with this aspect of the invention, the user could type in phonetically spelled words or phrases, such as to create more colorful messages including slang terms, various accents, and/or to mimic various dialects, for example. The speech synthesizer would then generate the desired message customized for the user. Of course, the system could also permit the user to test or preview the pronunciation generated by the speech message synthesizer based on the entered text message prior to its adoption.

Another aspect relates to requesting GPS position information from a vehicle. If a command is sent downstream to the vehicle requesting that GPS information in turn be sent upstream from the vehicle, and the GPS information is not received within a predetermined time, such as about four minutes, then another command may be sent to the vehicle requesting the GPS information. This may keep repeating until GPS information is received, for a predetermined number of tries, or until a user instructs stopping of the requests.

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This helps to ensure and confirm the activation and reception of GPS tracking coordinates from the vehicle.

Yet another aspect relates to reducing a frequency with which GPS information is sent from the vehicle. More particularly, the unit may be configured to activate GPS information transmission upstream every 2 minutes. To reduce system usage expense and power consumption at the vehicle, this rate of transmission of GPS information could be progressively decreased over time. For example, in one embodiment, upon activation the GPS location signals could be sent every 2 minutes during the first hour, then once an hour for the next 23 hours, after which only one signal would be sent per day.

Turning now to the flowchart 87 of FIG. 9, still another aspect relates to warning the user of an inoperable or malfunctioning GPS or cellular telephone section. More particularly, if the GPS or cellular telephone antenna wire is cut or the mounting position of either is changed causing the antenna to stop receiving the signal the user would not ordinarily know of this problem quickly. In accordance with one embodiment, if the ignition is turned on a predetermined number of times, such as about three, and each time ignition turns on if no GPS or no cell signal is received for a minimum time, such as about 15 to 30 minutes or longer, an audible warning beeper may be activated in the vehicle. This beeper may be sounded once every 15-minutes. At anytime if the GPS or cell signal is received properly then the system re-sets automatically stopping the beeper sound.

As an example, if the ignition key is turned on and no GPS or no Cell signal is being received for 15-minutes, and the vehicle ignition stays on for 45-minutes and there is still no GPS or no cell signal, the unit counts one. Thereafter, if the ignition key is turned on and no GPS or no cell signal is being received for 15-minutes, and the vehicle ignition stays on for 60-minutes and there is still no GPS or no cell signal, a second count is determined. Thereafter, if the ignition is turned on and no GPS or no cell signal is received for 10-minutes, and the vehicle ignition stays on for only 10-minutes and there is still no GPS or no cell signal, no count is determined. Thereafter, if the ignition is turned on and no GPS or no cell signal is being received for 15-minutes, a third count is determined and the beeper is activated as described above. This beeping may continue every 15-minutes while the vehicle ignition stays on as long as the vehicle ignition stays on for 16-minutes and still no GPS or no Cell signal is being received. If thereafter, the ignition is turned on and no GPS or no cell signal is being received, the beeper beeps once and again beeps once every 15-minutes while vehicle ignition stays on. If in 10-minutes both GPS or cell signal is being received, the beeper system is turned off and the warning count is reset.

By way of example, if the ignition key is turned on and no GPS or no cell signal is being received for only 5, 10 or 12 minutes (with the threshold set at 15 minutes), then no count is determined.

In certain circumstances, the GPS signal may fail, but the cell signal may still be working. Accordingly, it may be desirable to send an indication of the failure of the GPS signal to the central monitoring station to thereby alert the user as described above. If the cell signal also failed, or if the cell signal failed by itself, in other embodiments a separate paging device would transmit the failure or loss of the cell signal information to the central monitoring station, to thereby alert the user.

Yet another feature is directed to efficient use of a relatively small number of codes available to communicate with the tracking unit from the cellular network and central station.

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More particularly, a typical arrangement may provide eight basic codes and two Awildcard@ codes. The two wildcard codes are reserved for future or other uses. A particular tracking device will respond directly to any of the eight basic codes. For example, the doors could be locked or unlocked, a present location downloaded from the vehicle, etc.

In accordance with this feature, the tracking device may respond differently to the same code or command depending upon the state or condition of the tracking device. For example, if an alarm is triggered at the vehicle, it may be desired that the tracking device continue to send the alarm signal until confirmation is received that the central monitoring station has received the alarm signal. This confirmation can be sent using the same code as may provide another function if the device were not indicating an alarm. Any of a number of such tracking device conditions may trigger a different message to be interpreted from the received code. For example, if any of the above Alerts A-E were triggered, the receipt of a predetermined code, such as code eight, would confirm receipt of the alert by the central station, and this receipt of code eight would not cause the other response (no alarm triggered) in the tracking device. Of course this concept can be extended to other features as will be appreciated by those skilled in the art.

In accordance with another feature, the rate of sending the location or position data (or change in position data) from the vehicle may be varied to reduce system usage and thereby reduce expenses. More particularly, in one embodiment, the rate of sending may be based upon how long the vehicle has remained stationary. This time period may be selected by the user. For example, the selected time may be in the range of 15 minutes to six hours. If the vehicle has been stationary for the selected time period, then the rate of transmission may be reduced. This reduces or eliminates the need to send home position data and send all the over 15-minute stops made that day. Otherwise, that is when the vehicle is moving, the device may send data at a faster rate. Of course, a system user would not likely be interested in quick updates, especially where the position information is not changing. Conversely, if the vehicle is being moved, it may be desirable to receive more frequent position updates.

Another variation of this transmission rate conservation feature bases the rate of transmission on the vehicle position. For example, a reduced rate of transmission may be selected if the vehicle is in a predetermined area where the user has a lesser interest in quickly updated position information. The user may also have a reduced interest in an area that can be defined outside of a predetermined distance from a reference point.

Yet another variation of the vehicle position transmission rate conservation feature is based upon the vehicle's speed, such as the vehicle's average or maximum speed, for example. Accordingly, if the vehicle is traveling above a preset speed, the rate of transmission may be increased.

In accordance with another aspect of the invention, the tracking device may send the alert indication a predetermined number of times without receiving an acknowledgment as described above, and then wait until the vehicle position has changed before trying again or the cell re-registers or its RSS (received signal strength) changes. Thus, power is conserved. When the vehicle has moved to a new position, any obstructions may no longer be present thereby increasing the likelihood of a successful communication. In addition, the change in position may be determined when the vehicle is sensed to be moving about a predetermined relatively small speed, such as greater than 1 mph, for example.

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In all of the embodiments and variations described herein, the tracking device may communicate with one or more other vehicle devices via a vehicle data communications bus. Further aspects of interfacing with a vehicle data communications bus are described in U.S. Pat. Nos. 5,719,551 and 6,011,460 assigned to the assignee of the present invention, the entire contents of which are incorporated herein by reference.

Yet another aspect relates to efficient use of available codes on the cellular telephone control channel. In one particular example, ten codes may be available to be transmitted from the monitoring station to the vehicle trackers. The first eight or nine codes are command codes that will cause a specific action by the tracking device at the vehicle. The other one or two codes may be wildcard codes as mentioned above, that may set a stand-by mode for one or a group of vehicles, for example.

It may be desirable to provide more than eight commands at the vehicle responsive to the corresponding eight available codes. For example, it may be desirable to set a feature on or off, or to set a different feature setting or threshold. In accordance with this aspect of the invention, the commands at the tracker are determined based upon a series of different command codes being received within a predetermined time window.

For example, the monitoring station may send code 9 that switches the tracker in the car into a stand-by mode for a predetermined time and which causes the tracker to respond with an upstream confirmation code 7 or 9 indicating receiving code 9. During the predetermined time of the stand-by mode another code follows that causes a system programmable feature or setting to change. Note that the second code would otherwise cause a different function at the vehicle. Note that system might operate a function 9 if another code 1-9 is not received in the predetermined time. The following list is exemplary for features resulting from second codes 1-9:

Code 1—Tracker will turn off feature of upstream code caused by vehicle alert being detected.

Code 2—Tracker will turn on feature of upstream code caused by vehicle alert being detected.

Code 3—Tracker deactivates cell receiver from operating due to a non-paying customer for monitoring service. That phone number can then be allocated to another customer.

Code 4—Turn on audio buzzer feature that will sound once each 10 minutes. The monitoring station need only send the command to activate the feature, as the tracker will time the period and drive the buzzer thereafter. The monitoring station will normally not need to send this command because the tracker will be configured out of the box with this feature activated to sound the buzzer every 10 minutes until the next command is received.

Code 5—Turn off the audio buzzer. This is to be sent by the monitoring station after a user has successfully activated his account.

Code 6—Turn on the 80 mph speed limit reporting. This will normally not be sent as this feature will be the default setting of the tracker.

Code 7—Turn off the 80 mph speed limit reporting.

Code 8—Increase speed limit 5 mph and increase the time 5 minutes.

Code 9—Decrease speed limit 5 mph and decrease the time 5 minutes, and wait 5 minutes if another code number follows. It could operate this way to allow another set of codes to change more features.

In this example, in response to the tracker receiving the system code 1-9, the tracker sends an upstream code 7 to acknowledge receipt of the system code 1-9. Upon receipt of code 9 the tracker waits up to 5 minutes to determine if

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another system code is received. If no code is received, then the tracker performs the code 9 operation. Of course, in other embodiments other features or settings can be selected. In general, it may be preferred that the first code sent in a series of two codes, for example, be a code that causes only a minor function to be performed at the vehicle. This is so because if the second code is sent from the monitoring station, but not received at the tracker, only a minor function is performed. For example, the first code may switch between armed and disarmed modes. This is in contrast to using a remote engine starting code or engine shutdown code as the first code. The vehicle may be moving or positioned in a marginal reception area, and the second command may not be received by the tracker within the predetermined time window. As will be appreciated by those skilled in the art, this concept of multiple digit codes, can be extended beyond two digits to three or more.

To further conserve cellular transmissions and as described above, the tracker may be set to record a position based upon a determined event. Only this recorded position information may be downloaded either by user request or at set times. It is desired that such events be relatively few, but that the information still be helpful to the user.

For example, an event for recording of position may be determined based upon the vehicle being stopped for greater than a first time and less than a second time. For example, the first time may be 15 minutes and the second time may be 6 hours. Determination of the vehicle being stopped can be made based upon one or both of the GPS position or the vehicle ignition being turned off. The second time prevents the recording of position information when the vehicle is stopped at the owner's home during the evening, for example. Accordingly, the important information of the vehicle stops being made is recorded and made available to the user, while system communications resources are conserved.

In another example, if the mode is selected to send the vehicle's location every 10 min and the vehicle is in the same location for greater than a set time, then no more vehicle locations are sent until the vehicle location has changed to start the every 10 min reporting again.

Now referring to FIGS. 10 and 11, in yet another embodiment the potential difficulties of interfacing to a vehicle data bus and devices connected thereto are further discussed. The multi-vehicle compatible tracking unit 110 is for a vehicle comprising a vehicle data bus 122 extending throughout the vehicle. The multi-vehicle compatible tracking unit 110 includes a vehicle position determining device 112, a wireless communications device 113, and a multi-vehicle compatible controller 111 for cooperating with the vehicle position determining device and the wireless communications device to send vehicle position information. The vehicle position determining device 112 may be provided by a GPS receiver, for example, or any of the other such devices described in detail above.

The wireless communications device 113 may be provided by a cellular telephone transceiver configured to operate on a control channel of the cellular network, or any of the other such devices described in detail above.

The multi-vehicle compatible controller 111 is coupled to the vehicle data bus 122 for communication thereover with a vehicle device 121. The controller 111 illustratively includes a central processing unit (CPU) 126 or other logic circuitry which is connected to a clock signal generator 124, a memory 125, and input/output circuitry 127 to interface with the vehicle device 121 using at least one corresponding vehicle device code from among a plurality thereof for different vehicles. The corresponding vehicle code may be for reading

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from the vehicle device 121. Similarly, the corresponding vehicle code may be additionally or alternatively for writing to the vehicle device 121.

The multi-vehicle compatible tracking unit 110 also illustratively includes a downloading interface 116 for permitting downloading of enabling data related to the at least one corresponding vehicle device code for use by the multi-vehicle compatible controller 111. The enabling data may be the vehicle device code or codes, an instruction to select a code or codes from among those already stored, or the data or sequence to allow the controller 111 to generate the vehicle device code or codes, for example.

In the embodiment as shown in FIG. 11, the downloading interface 116 is a category of wireless signal downloading interfaces that illustratively include a wireless receiver 114, such as for temporary connection to the downloading device 115. The wireless downloading interface 116 may communicate with the downloading device 115 via any one or more of a number of wireless technologies, such as cellular, satellite, IR, Bluetooth or WiFi technologies for example, as will also be appreciated by those skilled in the art. Interface circuitry 132 is included in the wireless signal downloading interface 116 for controlling communication with the downloading device 115. The interface circuitry 132 may be logic circuitry or other control circuitry along with switching components.

In other embodiments, for example as shown in FIG. 12, the wireless downloading interface 116' does not include the wireless receiver 114, as a temporary wireless communication link is instead provided by sharing the wireless communications device 113 that sends position data as described above.

The downloading interface may also be in the form of a wired signal downloading interface 116" as shown in FIG. 13. The wired signal downloading interface 116" comprises a connector 133a for temporary connection to a downloading device 115" with a mating connector 133b. Interface circuitry 132" is provided for controlling communication with the downloading device 115". The wired downloading interface 116" may connect directly to a downloading device 115", such as a laptop computer, via RS232/429 protocol, USB, FireWire, TCP/IP (Internet), or any other wired protocol as will be appreciated by those skilled in the art. The connector 133a of the wired downloading interface 116" may alternatively be in the form of a socket to accept a memory card or other data storage medium capable of transferring data. The downloading interfaces 116, 116' and 116", may also advantageously be for permitting downloading of programming instructions for the multi-vehicle compatible controller 111, to allow remote programming, for example, as will also be appreciated by those skilled in the art.

Referring again briefly to FIG. 10, the multi-vehicle compatible tracking unit 110 further comprises a remote transmitter 117, such as typically in the form of a small handheld device to be carried by a user when away from the vehicle. The multi-vehicle compatible controller 111 also performs at least one vehicle remote control function responsive to the remote transmitter 117. The remote transmitter 117 illustratively communicates with the remote receiver 118, which is coupled to the multi-vehicle compatible controller 111. The vehicle remote control functions may include a vehicle security function, a remote keyless entry function, and a remote engine starting function, for example, implemented via the data bus 122 using one or more vehicle devices 121. Such a vehicle device 121 may also include another vehicle controller, as well as a sensor, or actuator as will be appreciated by those skilled in the art.

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The multi-vehicle compatible tracking unit **110** illustratively includes a common housing **123** for its various components. In other embodiments, more than one housing may be used for the various components.

Referring additionally to FIGS. **14** and **15**, several methods for using a multi-vehicle compatible tracking unit **110** for a vehicle comprising a vehicle data bus **122** extending throughout the vehicle are described with reference to the respective flowcharts **148**, **148'**. Beginning at Block **150**, the multi-vehicle compatible tracking unit **110** is installed in vehicle (Block **151**). At Block **152** a connection is then established between the multi-vehicle compatible tracking unit **110** and a downloading device **115** using a downloading interface **116**. Enabling data related to at least one corresponding vehicle device code for use by the multi-vehicle compatible controller **111** is downloaded via a downloading interface **116** (Block **153**). Once the enabling data is downloaded, the connection between the multi-vehicle tracking unit **110** and the downloading device **115** is terminated at Block **154**. Of course the multi-vehicle compatible tracking unit **110** may be optionally programmed via the downloading interface while the connection is established. The operation of the tracking unit may be tested at Block **155** before stopping at Block **156**. With particular reference to the flowchart **148'** of FIG. **15**, the multi-vehicle compatible tracking unit **110** may be connected to the downloading device **115** (Block **152'**), etc., before installation in the vehicle (Block **151'**) and testing (Block **155'**).

Other features relating to vehicle control systems are disclosed in copending patent applications entitled VEHICLE TRACKER INCLUDING STATIONARY TIME DETERMINATION AND ASSOCIATED METHODS, Ser. No. 09/859,727 filed May 17, 2001, now U.S. Pat. No. 6,512,465; VEHICLE TRACKER CONSERVING CODES AND RELATED METHODS, Ser. No. 09/859,673 filed May 17, 2001, now U.S. Pat. No. 6,522,267; VEHICLE TRACKER WITH POWER SAVING FEATURES AND RELATED METHODS, Ser. No. 09/859,728 filed May 17, 2001, now U.S. Pat. No. 6,512,466; VEHICLE TRACKER COOPERATING WITH A STARTER INTERRUPT AND RELATED METHODS, Ser. No. 09/859,973 filed May 17, 2001; VEHICLE TRACKER WITH USER NOTIFICATIONS AND ASSOCIATED METHODS, Ser. No. 09/859,733 filed May 17, 2001, now U.S. Pat. No. 6,509,868; VEHICLE TRACKER WITH USER REGISTRATION REMINDER AND RELATED METHODS, Ser. No. 09/859,971 filed May 17, 2001, now U.S. Pat. No. 6,507,786; VEHICLE TRACKER INCLUDING INPUT/OUTPUT FEATURES AND RELATED METHODS, Ser. No. 09/859,972 filed May 17, 2001, now U.S. Pat. No. 6,606,561; and VEHICLE TRACKER WITH TEST FEATURES AND RELATED METHODS, Ser. No. 09/859,729 filed May 17, 2001, now U.S. Pat. No. 6,809,659, 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 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 is:

1. A multi-vehicle compatible tracking unit for a vehicle comprising a vehicle data bus extending throughout the vehicle, the multi-vehicle compatible tracking unit comprising:

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a vehicle position determining device;
a wireless communications device;
a multi-vehicle compatible controller for cooperating with said vehicle position determining device and said wireless communications device to send vehicle position information;
said multi-vehicle compatible controller to be coupled to the vehicle data bus for communication thereover with at least one vehicle device using at least one corresponding vehicle device code from among a plurality thereof for different vehicles; and
a downloading interface for permitting downloading of enabling data related to the at least one corresponding vehicle device code for use by said multi-vehicle compatible controller.

2. The multi-vehicle compatible tracking unit according to claim 1 wherein said downloading interface comprises a wired signal downloading interface.

3. The multi-vehicle compatible tracking unit according to claim 2 wherein said wired signal downloading interface comprises a connector for temporary connection to a downloading device.

4. The multi-vehicle compatible tracking unit according to claim 1 wherein said downloading interface comprises a wireless signal downloading interface.

5. The multi-vehicle compatible tracking unit according to claim 4 wherein said wireless signal downloading interface comprises a wireless receiver for temporary connection to a downloading device.

6. The multi-vehicle compatible tracking unit according to claim 1 wherein the corresponding at least one vehicle code is for reading from the at least one vehicle device.

7. The multi-vehicle compatible tracking unit according to claim 1 wherein the corresponding at least one vehicle code is for writing to the at least one vehicle device.

8. The multi-vehicle compatible tracking unit according to claim 1 wherein said downloading interface is also for permitting downloading of at least one programming instruction for said multi-vehicle compatible controller.

9. The multi-vehicle compatible tracking unit according to claim 1 further comprising a remote transmitter; and wherein said multi-vehicle compatible controller also performs at least one vehicle remote control function responsive to said remote transmitter.

10. The multi-vehicle compatible tracking unit according to claim 9 wherein the at least one vehicle remote control function comprises at least one of a vehicle security function, a remote keyless entry function, and a remote engine starting function.

11. The multi-vehicle compatible tracking unit according to claim 1 wherein said wireless position determining device comprises a Global Positioning System (GPS) receiver.

12. The multi-vehicle compatible tracking unit according to claim 1 further comprising a housing containing said vehicle position determining device, said wireless communications device, said multi-vehicle compatible controller, and said downloading interface.

13. A multi-vehicle compatible tracking unit for a vehicle comprising a vehicle data bus extending throughout the vehicle, the multi-vehicle compatible vehicle tracking unit comprising:

a vehicle position determining device;
a wireless communications device;
a multi-vehicle compatible controller for cooperating with said vehicle position determining device and said wireless communications device to send vehicle position information;

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said multi-vehicle compatible controller to be coupled to the vehicle data bus for communication thereover with at least one vehicle device using at least one corresponding vehicle device code from among a plurality thereof for different vehicles; and

a downloading interface for permitting downloading of enabling data related to the at least one corresponding vehicle device code for use by said multi-vehicle compatible controller;

said downloading interface comprising a connector for temporary connection to a downloading device.

14. The multi-vehicle compatible tracking unit according to claim 13 wherein the corresponding at least one vehicle code is for reading from the at least one vehicle device.

15. The multi-vehicle compatible tracking unit according to claim 13 wherein the corresponding at least one vehicle code is for writing to the at least one vehicle device.

16. The multi-vehicle compatible tracking unit according to claim 13 wherein said downloading interface is also for permitting downloading of at least one programming instruction for said multi-vehicle compatible controller.

17. The multi-vehicle compatible tracking unit according to claim 13 further comprising a remote transmitter; and wherein said multi-vehicle compatible controller also performs at least one vehicle remote control function responsive to said remote transmitter.

18. A multi-vehicle compatible tracking unit for a vehicle comprising a vehicle data bus extending throughout the vehicle, the multi-vehicle compatible vehicle tracking unit comprising:

a vehicle position determining device;
a wireless communications device;

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a multi-vehicle compatible controller for cooperating with said vehicle position determining device and said wireless communications device to send vehicle position information;

said multi-vehicle compatible controller to be coupled to the vehicle data bus for communication thereover with at least one vehicle device using at least one corresponding vehicle device code from among a plurality thereof for different vehicles; and

a downloading interface for permitting downloading of enabling data related to the at least one corresponding vehicle device code for use by said multi-vehicle compatible controller;

said downloading interface comprising a wireless receiver for temporary connection to a downloading device.

19. The multi-vehicle compatible tracking unit according to claim 18 wherein the corresponding at least one vehicle code is for reading from the at least one vehicle device.

20. The multi-vehicle compatible tracking unit according to claim 18 wherein the corresponding at least one vehicle code is for writing to the at least one vehicle device.

21. The multi-vehicle compatible tracking unit according to claim 18 wherein said downloading interface is also for permitting downloading of at least one programming instruction for said multi-vehicle compatible controller.

22. The multi-vehicle compatible tracking unit according to claim 18 further comprising a remote transmitter; and wherein said multi-vehicle compatible controller also performs at least one vehicle remote control function responsive to said remote transmitter.

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