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37 CFR 1.501
INFORMATION DISCLOSURE CITATION IN A PATENT

(Sheet 1 of 3)

Docket Number (Optional) C13-03896.RE3	Patent Number 8,032,278
Applicant Kenneth E. Flick	
Issue Date October 4, 2011	Art Unit 3661

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	6430164 B1	2002-08-06	Jones et al.	370	313	1999-11-01
	6606561 B2	2003-08-12	Flick	701	213	2001-05-17
	7149623 B2	2006-12-12	Flick	701	207	2003-03-07
	7720597 B2	2010-05-18	Flick	701	207	2005-03-09
	8032278 B2	2011-10-04	Flick	701	036	2007-07-03
	8032278 C1	2016-12-28	Flick	701	036	2015-09-14
	8032278 C2	2019-02-06	Flick	701	036	2016-10-28

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	☐	CellPort Delivers Wireless, Vehicle-Based Applications Platform; Announces CP2100 Mobile Network Server, CellPort Labs, Inc., July 26, 1999.
	☐	FLICK, U.S. Provisional Application No. 60/205,178, filed May 17, 2000.
	☐	FLICK, U.S. Provisional Application No. 60/222,777, filed August 3, 2000.
	☐	FLICK, U.S. Provisional Application No. 60,236,890, filed September 29, 2000.
	☐	FLICK, U.S. Provisional Application No. 60/252,125, filed November 20, 2000.
	☐	FLICK, U.S. Provisional Application No. 60/251,552, filed December 6, 2000.

EXAMINER	DATE CONSIDERED

This collection of information is required by 37 CFR 1.501. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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37 CFR 1.501 INFORMATION DISCLOSURE CITATION IN A PATENT (Sheet 2 of 3)	Docket Number (Optional) C13-03896.RE3	Patent Number 8,032,278
	Applicant Kenneth E. Flick	
	Issue Date October 4, 2011	Art Unit 3661

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

		FLICK, U.S. Provisional Application No. 60/258,005, filed December 22, 2000.
		FLICK, U.S. Provisional Application No. 60,264,811, filed January 29, 2001.
		OMEGA PATENTS, LLC v. CALAMP CORP., 18-1309 (Fed. Cir. 2019)
		SAE On-Board Diagnostics for Light and Medium Duty Vehicles Standards Manual, SAE HS-3000, Society of Automotive Engineers, Inc., 1994.
		SAE On-Board Diagnostics for Light and Medium Duty Vehicles Standards Manual, SAE HS-3000, Society of Automotive Engineers, Inc., 1997.
		SPELT ET AL., A Demonstration Project for the ITS Data Bus Prototype, ISBN: 0-7803-5086-3, pp. I22/1 - I22/6, 1998

EXAMINER	DATE CONSIDERED

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37 CFR 1.501 **INFORMATION DISCLOSURE CITATION IN A PATENT** **(Sheet 3 of 3)**	Docket Number (Optional) C13-03896.RE3	Patent Number 8,032,278
	Applicant Kenneth E. Flick	
	Issue Date October 4, 2011	Art Unit 3661

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

		WITHAM ET AL., U.S. Provisional Application No. 60/246,463, filed November 7, 2000.
		WRIGHT, Prep for a Multimedia Future, Auto Electronics, pp. 78-88, August 19, 1999.

EXAMINER	DATE CONSIDERED

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CellPort Delivers Wireless, Vehicle-Based Applications Platform; Announces CP2100 Mobile Network Server

New Mobile Server Integrates On-Board Commercial Applications with Wireless

Connectivity to Link Vehicles to Intranets and the Internet

Jul 26, 1999, 01:00 ET from CellPort Labs, Inc.

BOULDER, Colo., July 26 /PRNewswire/ -- CellPort Labs, Inc., a leading provider of vehicle-based voice and data connectivity systems, today announced the CP2100, a mobile network server designed to enable bi-directional data communications and network management functions within vehicles and provide real-time, wireless connectivity between vehicles and remote applications. With the emergence of wireless data, in particular wireless IP networks, the CP2100 will enable users to extend corporate enterprise management systems to vehicles and mobile computing devices.

Now, vehicle manufacturers, application developers and corporate IT departments can easily network software and hardware applications, and cost-effectively connect a wide range of vehicles to their networks, including Extranets, Intranets and Internet sites. The new CP2100 eliminates a major obstacle currently facing Telematics, Intelligent Transport System (ITS) and mobile Infotainment systems -- that of integrating various data management functions within the vehicle and linking them with a centralized application via wireless communication networks.

CellPort offers the first commercial product designed specifically to manage the growing list of in-vehicle networks, including IDB, CAN, USB and more. The CP2100 is also a universal gateway for real-time wireless data communication, extending the Internet Protocol (IP) over wireless networks to the vehicle. Using the CP2100, application designers can seamlessly integrate enterprise software solutions or any other Internet accessible resource to vehicles around the world. CellPort's new product enables the various data networks and electronic devices within a vehicle to function as a node on the Internet.

"With the growth of Internet-based systems, coupled with current and developing wireless IP networks, the CP2100 provides the network 'plumbing' needed to deploy multiple applications within the vehicle environment," says Pat Kennedy, CEO of CellPort. "Our customers realize the complexity of melding protocol conversion, applications networking and wireless capabilities into a single product and they welcome CellPort's commitment to solve that problem with the CP2100."

"GTE developed the WIN(4) network to meet the growing demand for commercial wireless data communications. We expect vehicle-based mobile data systems to be a driving force as companies worldwide develop programs for everything from fleet management to Infotainment," says Larry Simmons, manager, WIN(4) distribution, GTE Wireless. "Enabling technologies, like CellPort's CP2100, further encourage the rapid deployment of telematics applications and help transform exciting concepts into working solutions."

THE CP2100 IN USE

Customers for the CP2100 can vary, from vehicle manufacturers and Telematics suppliers to application platform developers. Currently, CellPort is working with several partners to integrate the CP2100 into practical solutions. In most cases, partners are looking for a server solution that can collect and manage data to/from a vehicle, then transmit the data real-time via a wireless network. Markets for the CP2100 include tracking and monitoring of fleet vehicles, operation of agricultural machinery and heavy equipment, railroads, vehicle road testing, military operations and in-vehicle information/entertainment systems.

As a participant in the IDB Demonstration Program that recently won ITS America's 1999 Award for Outstanding Achievement in Intelligent Vehicles, CellPort provided connectivity to the Internet for many IDB-based vehicle systems on three IDB demonstration vehicles.

"Wireless connectivity and protocol conversion are key ingredients for the successful implementation of advanced Telematics systems and the development of Internet-based systems within the vehicle," says Allan Kirson, Chair, SAE IDB Committee. "CellPort's technology proved invaluable in linking the wide range of IDB-based systems and applications in our three demonstration vehicles to fixed networks via wireless links."

CP2100 TECHNICAL DESCRIPTION

The CP2100 integrates several technical capabilities, identified by CellPort through customer feedback and market research, required to turn vehicles into nodes on networks via wireless communications. The technical features of the CP2100 include protocol conversion for a variety of vehicle buses and devices, wireless gateway communications independent of wireless links, and embedded application router management capabilities.

The CP2100 architecture allows vehicle networks and RF links to be separated by a controller/gateway, providing a software application layer between the airlink and the vehicle. This allows telemetry, data collection, two-way communication, as well as a command and control interface to be created independent of the wireless data link. Application software can be developed to poll, filter, collect, process and store data collected from the vehicular network. Some examples of vehicular data sources are Class II native networks, transponders, sensors, timers, engine control computers, GPS receivers, and operator data terminals. Data from the host can be sent to the vehicle to communicate with the operator, provide GPS information, run diagnostic routines, reconfigure data collection routines, download code and run executable software.

Fitted within the vehicle, the CP2100 provides network controller and server capabilities based on an integrated PowerPC 823 embedded computing system. It operates using the QSSL Neutrino operating system and I/O subsystem, to support RS232, Ethernet and Universal Serial Bus (USB) connectivity. Java platform integration is also managed via third party tools. The CP2100 supports a variety of emerging vehicle bus interfaces, including IDB, J1708, J1850, CAN and ODBII. Wireless airlink capabilities include cellular, spread spectrum radio, satellite and private radio. In addition to standard internal power and autonomous control features, an optional battery backup power system is available to provide continued service during emergency or vehicle downtime.

PRICING AND AVAILABILITY

The CP2100 is available immediately directly from CellPort and pricing starts at $995. Quantity pricing is also available. For more information contact Tom Curray at (303) 541-0722, email the company at info@cellport.com, or visit the company Web site at www.cellport.com.

ABOUT CELLPORT LABS

CellPort Labs, Inc. is a Boulder, Colo.-based company that develops and markets mobile, wireless connectivity products for cellular phones, Telematics, Intelligent Transport Systems and mobile Infotainment systems. The company provides technical solutions for voice applications through its Hands-Free Connectivity System. For vehicle-based data network and wireless connectivity, the company's CP2100 represents the industry's first off-the-shelf product to provide an open technical architecture that combines server, router and wireless gateway functionality. CellPort has received investments from AT&T Wireless and the Flanders Language Valley Fund, and is a member of the IDB Forum and Telematics Supplier Consortium. The company has provided technical solutions for organizations like DaimlerChrysler, US Army, and the Society of Automotive Engineers. For more information about CellPort and its products, call (303) 541-0722, email the company at info@cellport.com or visit the CellPort's Web site is www.cellport.com.

SOURCE CellPort Labs, Inc.

05-18-00

A/PROV

05/17/00
1c784 U.S. PTO

1c682 U.S. PTO
05/17/00

PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2)

Docket No.	58066	Type (+) -->	[+]

INVENTOR(s)/APPLICANT(s)

LAST NAME	FIRST NAME	MID. INIT.	RESIDENCE (CITY/STATE OR COUNTRY)
FLICK	Kenneth	E.	Douglasville, GA

TITLE OF THE INVENTION (280 Characters Max)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

CORRESPONDENCE ADDRESS

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STATE	Florida	ZIP CODE	32802-3791	COUNTRY	U.S.

ENCLOSED APPLICATION PARTS *(check all that apply)*

✓	Specification	*Number of Pages*	20		✓	Small Entity Statement
	Drawing(s)	*Number of Sheets*				Other (specify)

METHOD OF PAYMENT

	A check or money order is enclosed to cover the Provisional Filing Fees		PROVISIONAL FILING FEE AMOUNT ($)	$75.00
✓	The Commissioner is hereby authorized to charge the Provisional Filing Fees and/or credit any discrepancies in fee amounts to Deposit Account No.:	01-0484		

[ ] Additional inventors are being named on separately numbered sheets attached hereto.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[✓] No.

[ ] Yes, The name of the U.S. Government agency and the Government contract number are ________

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ERIC LINK

(TYPED OR PRINTED NAME OF PERSON MAILING PAPER OR FEE)

Eric Link

(SIGNATURE OF PERSON MAILING PAPER OR FEE)

Respectfully Submitted,

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Date: May 17, 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Kenneth E. FLICK
Serial:	Not Yet Assigned
Attorney's Docket No.:	58066
Filed:	Herewith

For: VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled: VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION described in:

(x) the specification filed herewith
( ) application serial no. ______________ filed ______________
( ) patent no. ______________ issued ______________

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

(x) no such person, concern, or organization
( ) persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

60205179 . 051700

FULL NAME ______________________________

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( ) INDIVIDUAL ( ) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Kenneth E. Flick
NAME OF INVENTOR

SIGNATURE OF INVENTOR

5-17-00
DATE

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

Field of the Invention

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

Description of the Invention

The invention includes a unit to be mounted in the vehicle and a monitoring station. The unit in the vehicle includes a GPS receiver, and a transmitter which may transmit on the control band of the cellular telephone network, or, via a voice or other data channel of the cellular network, or other wireless communications network. For example, the transmitter could also be a satellite transmitter.

The GPS receiver determines the vehicle location. In addition, the GPS receiver may be connected to a controller which controls and/or performs a number of vehicle tracking and/or security functions. Wireless vehicle location determining devices and approaches other than GPS may also be used in some embodiments of the invention. For example, vehicle location systems based upon multiple receptions from adjacent cellular receivers can also be used.

The monitoring station is interfaced to the cellular telephone network, or other communications

network, to thereby communicate with the vehicle unit. In addition, the monitoring station is also connected to the Internet to provide a number of advantageous features including updating the user or other authority when away from the vehicle of the vehicle's position. These features and advantages are described in further detail below. The monitoring station may also be connected to the telephone network in order to provide various preprogrammed communications, such as to the user or other authority.

The system preferably implements one or more of the following features:

1. 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 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.

2. Detects an optional vehicle 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.

3. Detects an optional vehicle alarm systems 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.

4. 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 WEB site. The vehicle would be equipped with a security system as disclosed in U.S. Patent No. 5,654,688, for example, which determines an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

5. 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 max speed limit and duration thereof can be selected by the user.

6. 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 selectable by the user.

7. Detects 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.

8. 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 also preferably has access to a WEB or Internet site that will display a map and silently contact the vehicle to acquire it's current location, speed, direction of travel, and previous multiple

locations with speeds, for example, the user's personal identification number (PIN) can be instantly activated by just a phone call. No additional installation is required.

Certain annual pre-pay package arrangement may be available. For example, up to 10 access entries per month can be provided on a low monthly billing of $4.90. Up to 30 access entries could be provided for $8.25 per month.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the WEB site. The user may control various vehicle functions remotely via the telephone or WEB 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 & installation is relatively inexpensive, and is on the order of about $190.00. 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 user a predetermined command (Command 7) 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 an embodiment of the vehicle unit are provided below as relating to use of red and green LED indicators operated by the system controller.

Red LED verification of GPS receiving signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
  Blinking = when searching GPS location.
  Constant = found location.
  Off = no GPS signal found.
With yellow wire not having positive 12 volts:
  Off = LED not functioning.

Green LED verification of receiving the cell tower signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
  Blinking = Cell control channel signal is detected.
  Constant = sending micro burst signal. Stays on 5-seconds after each time system is transmitting.
  Off = no cell tower signal received.
With yellow wire not having positive 12 volts:

Off = LED not functioning.

An example of representative DIP switch feature selection is as follows. Switch 1 may be used for adding orange wire for controlling arm/disarming of system. When On, the orange wire controls arm/disarm as follows: to arm, Orange wire is grounded and Yellow wire does not have 12 volts positive. To disarm, the Orange wire is not grounded. When switch 1 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 orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until system is disarmed. To disarm the Yellow wire is connected to 12 volts positive.

09/234,053

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

The Red Wire is connected to 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.

The Black Wire is connected to Ground.

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:

1. If the system is in an armed mode and Lat/Long changes, then Alert "A" is given.

2. 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".

3. If the DIP switch 1 is in the Off position then:
   a. if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues the 500 ma ground.
   b. if the yellow wire sees grounded 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 system is disarmed

The Gray Wire is for Input and Output, and can be connected to an alarm siren or horn positive terminal. In addition:

1. With 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 "B" alarm activation is given.

2. 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.

3. 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.

4. The Gray wire bypass operates as follows:
   a. After Alert warning "B" bypass all future Alert "B" until system is disarmed.
   b. After Alert warning "C" bypass all future Alert "C" until system is armed.
   c. After Alert warning "D" bypass all future Alert "D" until no 12 volt pulses are detected on the gray wire within 3 seconds of yellow wire having 12 volts.

5. With system armed or disarmed. The Output: Internal + 12v, 1 amp transistor with pulses 1 second on & 1 sec off to activate siren or

honk car horn or flashing light relay.

a. Non-stop activation from (Command "4")

b. 30-second activation from (Command "5")

6. Turn off the above Alert "A" from (Command "1")

The Orange Wire is for the starter interrupt and arm/disarm system, and operates as follows:

1. If dip switch 1 is in the:
    a. On position and:
        i. the Orange wire has 12 volts or neutral, the system switches to the disarmed mode
        ii. the Orange wire is grounded, then the system is switched to the armed mode
        iii. and the starter interrupt output will not automatically operate. Can only be activated from "Command #4"
    b. Off position and:
        i. the Orange wire does not effect the arming or disarming of the system.
        ii. 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.

2. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.

3. 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:

Green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6").

Red Wire provides a constant 12v output from the Red power wire.

Blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7")

Pink wire provides a 250ma., 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 Orange wire for 10-seconds (starter interrupt), with these circuits in sequence:

First: Activates Gray wire for 1-second. (siren/horn)

After first stops: Activates Green wire for 1 second to lock the doors.

After second stops: Activate Blue wire for 1 second to unlock the doors.

After third stops: Activate Pink wire for 1 second to activate optional item.

Representative warning alerts are as follows:

Alert Warning "A": Automatic activation of "Command 8" and the vehicle unit contacts monitor station to instantly call 3 phone numbers with the message "Your Vehicle is stolen please confirm then call 911 to advise police of web site 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" until the system is re-armed.

Alert Warning "B": 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.

Alert Warning "C": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle PANIC activated please confirm". This is with system disarmed and

detecting the Gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After the first activation then this is bypassed until the ignition turns on again.

Alert Warning "D": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the this 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 yellow wire having seen 12 volts positive. All future alert "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts.

Alert Warning "E": 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 alert "E" are bypassed until:

1. First: More than 13.5 volts are detected on the red wire and
2. Second: After yellow wire stops having positive voltage the red wire then must detects more than 12 volts.

Alert Warning "F": 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)

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) Web site to indicate present location and past events in memory.

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

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

b. 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 250ma. 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:

a) 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:

- i) Once instantly.
- ii) Once in 1 hour if at the same location.
- iii) Once in 6 hours if at the same location.
- iv) Once in 12 hours if at the same location.

v) Once every 24 hours if at the same location.

b) 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 contains 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:

a) 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 same then only update stationary total time.

b) If the GPS antenna is not receiving any signal:

i) Then enter last known GPS location and with indication this was the last known GPS location before GPS signal stopped and how long no GPS signal was received. And enter GPS location in the on-hold file.

c) When vehicle is traveling above ###MPH for ##-minutes.

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

a) The user's vehicle has issued a stolen alert:

i) 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 Web site address and an identification number, such as the user's PIN, to allows the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

ii) 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.

b) 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.

c) 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 transmission 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 begins 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.

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PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2)

Docket No.	58068	Type (+) --→	[+]

INVENTOR(s)/APPLICANT(s)			
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TITLE OF THE INVENTION (280 Characters Max)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

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ENCLOSED APPLICATION PARTS *(check all that apply)*

✓	Specification	*Number of Pages*	24		Small Entity Statement
✓	Drawing(s)	*Number of Sheets*	5		Other (specify) ____________

METHOD OF PAYMENT

✓	A check or money order is enclosed to cover the Provisional Filing Fees		PROVISIONAL FILING FEE AMOUNT ($)	**$150.00**
✓	The Commissioner is hereby authorized to charge or credit any discrepancies in fee amounts to Deposit Account No.:	**01-0484**		

[ ] Additional inventors are being named on separately numbered sheets attached hereto.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[✓] No. [ ] Yes

Respectfully Submitted,

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Date: August 3, 2000

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VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

Field of the Invention

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

Description of the Invention

The invention includes a unit to be mounted in the vehicle and a monitoring station. The unit in the vehicle includes a GPS receiver, and a transmitter which may transmit on the control band of the cellular telephone network, or, via a voice or other data channel of the cellular network, or other wireless communications network. For example, the transmitter could also be a satellite transmitter.

The GPS receiver determines the vehicle location. In addition, the GPS receiver may be connected to a controller which controls and/or performs a number of vehicle tracking and/or security functions. Wireless vehicle location determining devices and approaches other than GPS may also be used in some embodiments of the invention. For example, vehicle location systems based upon multiple receptions from adjacent cellular receivers can also be used.

The monitoring station is interfaced to the cellular telephone network, or other communications

network, to thereby communicate with the vehicle unit. In addition, the monitoring station is also connected to the Internet to provide a number of advantageous features including updating the user or other authority when away from the vehicle of the vehicle's position. These features and advantages are described in further detail below. The monitoring station may also be connected to the telephone network in order to provide various preprogrammed communications, such as to the user or other authority.

The system preferably implements one or more of the following features:

1. 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 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.

2. Detects an optional vehicle 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.

3. Detects an optional vehicle alarm systems 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.

4. 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 WEB site. The vehicle would be equipped with a security system as disclosed in U.S. Patent No. 5,654,688, for example, which determines an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

5. 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 max speed limit and duration thereof can be selected by the user.

6. 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 selectable by the user.

7. Detects 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.

8. 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 also preferably has access to a WEB or Internet site that will display a map and silently contact the vehicle to acquire it's current location, speed, direction of travel, and previous multiple

locations with speeds, for example, the user's personal identification number (PIN) can be instantly activated by just a phone call. No additional installation is required.

Certain annual pre-pay package arrangement may be available. For example, up to 10 access entries per month can be provided on a low monthly billing of $4.90. Up to 30 access entries could be provided for $8.25 per month.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the WEB site. The user may control various vehicle functions remotely via the telephone or WEB 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 & installation is relatively inexpensive, and is on the order of about $190.00. 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 user a predetermined command (Command 7) 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 an embodiment of the vehicle unit are provided below as relating to use of red and green LED indicators operated by the system controller.

Red LED verification of GPS receiving signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
  Blinking = when searching GPS location.
  Constant = found location.
  Off = no GPS signal found.
With yellow wire not having positive 12 volts:
  Off = LED not functioning.

Green LED verification of receiving the cell tower signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
  Blinking = Cell control channel signal is detected.
  Constant = sending micro burst signal. Stays on 5-seconds after each time system is transmitting.
  Off = no cell tower signal received.
With yellow wire not having positive 12 volts:

Off = LED not functioning.

An example of representative DIP switch feature selection is as follows. Switch 1 may be used for adding orange wire for controlling arm/disarming of system. When On, the orange wire controls arm/disarm as follows: to arm, Orange wire is grounded and Yellow wire does not have 12 volts positive. To disarm, the Orange wire is not grounded. When switch 1 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 orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until 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:

The Red Wire is connected to 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.

The Black Wire is connected to Ground.

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:

1. If the system is in an armed mode and Lat/Long changes, then Alert "A" is given.

2. 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".

3. If the DIP switch 1 is in the Off position then:
   a. if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues the 500 ma ground.
   b. if the yellow wire sees grounded 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 system is disarmed

The Gray Wire is for Input and Output, and can be connected to an alarm siren or horn positive terminal. In addition:

1. With 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 "B" alarm activation is given.

2. 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.

3. 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.

4. The Gray wire bypass operates as follows:
   a. After Alert warning "B" bypass all future Alert "B" until system is disarmed.
   b. After Alert warning "C" bypass all future Alert "C" until system is armed.
   c. After Alert warning "D" bypass all future Alert "D" until no 12 volt pulses are detected on the gray wire within 3 seconds of yellow wire having 12 volts.

5. With system armed or disarmed. The Output: Internal + 12v, 1 amp transistor with pulses 1 second on & 1 sec off to activate siren or

honk car horn or flashing light relay.

a. Non-stop activation from (Command "4")

b. 30-second activation from (Command "5")

6. Turn off the above Alert "A" from (Command "1")

The Orange Wire is for the starter interrupt and arm/disarm system, and operates as follows:

1. If dip switch 1 is in the:
   a. On position and:
      i. the Orange wire has 12 volts or neutral, the system switches to the disarmed mode
      ii. the Orange wire is grounded, then the system is switched to the armed mode
      iii. and the starter interrupt output will not automatically operate. Can only be activated from "Command #4"
   b. Off position and:
      i. the Orange wire does not effect the arming or disarming of the system.
      ii. 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.

2. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.

3. 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:

Green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6").

Red Wire provides a constant 12v output from the Red power wire.

Blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7")

Pink wire provides a 250ma., 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 Orange wire for 10-seconds (starter interrupt), with these circuits in sequence:

First: Activates Gray wire for 1-second. (siren/horn)
After first stops: Activates Green wire for 1 second to lock the doors.
After second stops: Activate Blue wire for 1 second to unlock the doors.
After third stops: Activate Pink wire for 1 second to activate optional item.

Representative warning alerts are as follows:

Alert Warning "A": Automatic activation of "Command 8" and the vehicle unit contacts monitor station to instantly call 3 phone numbers with the message "Your Vehicle is stolen please confirm then call 911 to advise police of web site 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" until the system is re-armed.

Alert Warning "B": 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.

Alert Warning "C": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle PANIC activated please confirm". This is with system disarmed and

detecting the Gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After the first activation then this is bypassed until the ignition turns on again.

Alert Warning "D": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the this 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 yellow wire having seen 12 volts positive. All future alert "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts.

Alert Warning "E": 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 alert "E" are bypassed until:

1. First: More than 13.5 volts are detected on the red wire and
2. Second: After yellow wire stops having positive voltage the red wire then must detects more than 12 volts.

Alert Warning "F": 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)

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) Web site to indicate present location and past events in memory.

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

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

b. 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 250ma. 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:

a) 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:

- i) Once instantly.
- ii) Once in 1 hour if at the same location.
- iii) Once in 6 hours if at the same location.
- iv) Once in 12 hours if at the same location.

v) Once every 24 hours if at the same location.

b) 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 contains 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:

a) 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 same then only update stationary total time.
b) If the GPS antenna is not receiving any signal:
    i) Then enter last known GPS location and with indication this was the last known GPS location before GPS signal stopped and how long no GPS signal was received. And enter GPS location in the on-hold file.

c) When vehicle is traveling above ###MPH for ##-minutes.

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

a) The user's vehicle has issued a stolen alert:

i) 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 Web site address and an identification number, such as the user's PIN, to allows the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

ii) 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.

b) 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.

c) 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 transmission 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 begins 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.

The device or unit may be initially manufactured and shipped without all of the features being fully functional. One advantage of this is to prevent the unit at will from sending messages when being initially installed and tested in the vehicle, thereby reducing potential false alarms and burdens on the communications system, as well as potential charges to the user. After the unit is fully installed, a communication or transmission from the monitoring center may be sent to the unit enabling one or more selected features, such as during registration during which information is conveyed to the monitoring center and payment is made or authorized by the user.

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 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 transmitting again until 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 labeled "Alert A".

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 transmitting again until 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 labeled "Alert B".

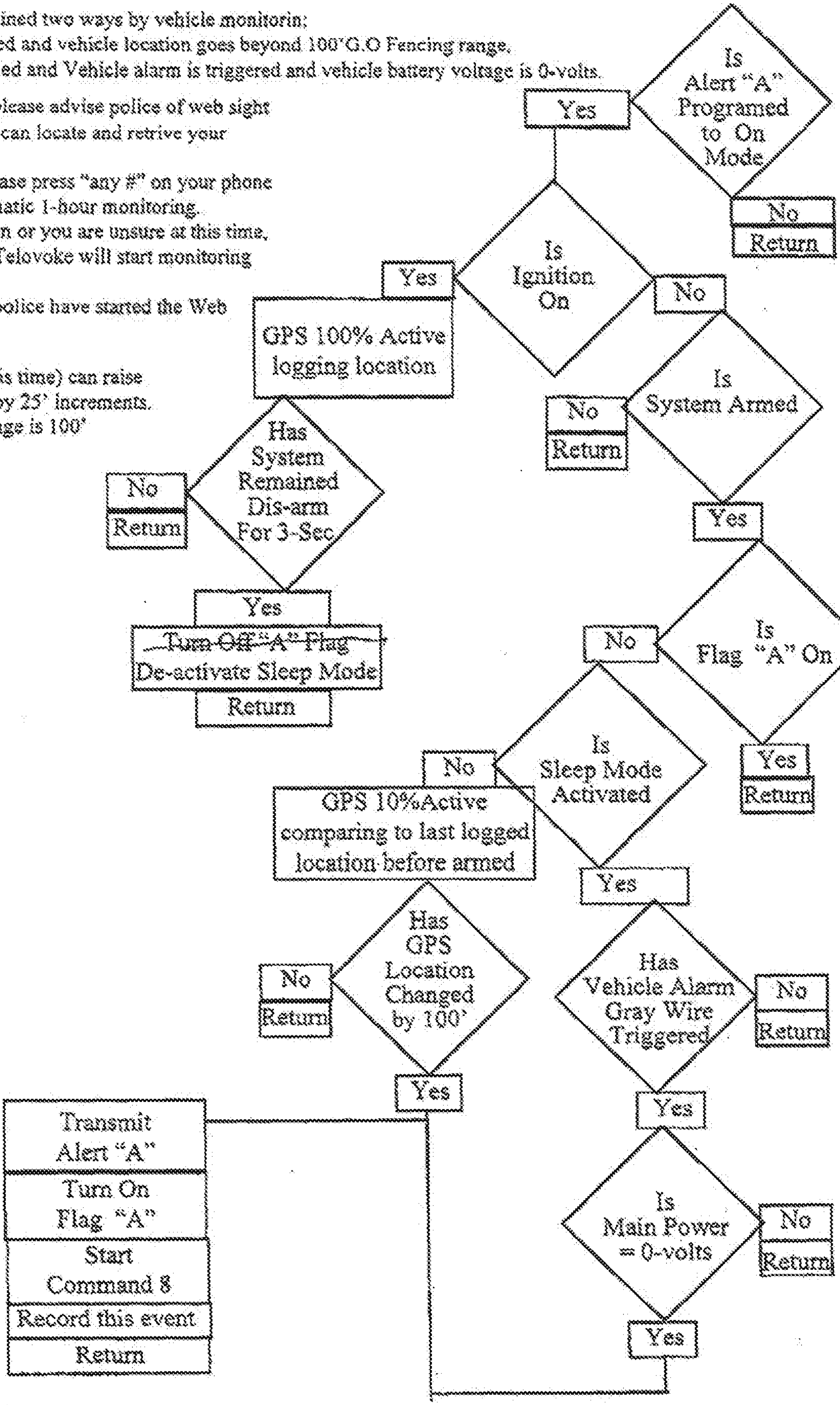
Yet another feature of the invention relates to a low vehicle battery alert. For example, the unit may monitor the battery voltage over a predetermined time such as ten minutes. The ten minute window prevents false tripping, for example, when the voltage dips during engine cranking. In particular, the voltage can be sensed and determined whether it is greater than zero (eg. greater than six volts)and less than a high value (eg. 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 vehicle is being serviced and battery is disconnected this will cause the battery voltage to 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 transmitting again until 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 labeled "Alert E".

Alert "A" = Vehicle Stolen Alert

Vehicle stolen is determined two ways by vehicle monitorin:
1. Tracking system armed and vehicle location goes beyond 100'G.O Fencing range.
2. Tracking system Armed and Vehicle alarm is triggered and vehicle battery voltage is 0-volts.

Your vehicle is stolen, please advise police of web sight and your pin# so police can locate and retrive your vehicle.
If this is a false alert please press "any #" on your phone now to deactivate automatic 1-hour monitoring.
If vehicle has been stolen or you are unsure at this time, hang up an call police. Telovoke will start monitoring for upto
1-hour vehicle or until police have started the Web monitoring.

Televoke (not user at this time) can raise or lower G.O.Fencing by 25' increments.
G.O Fencing default range is 100'

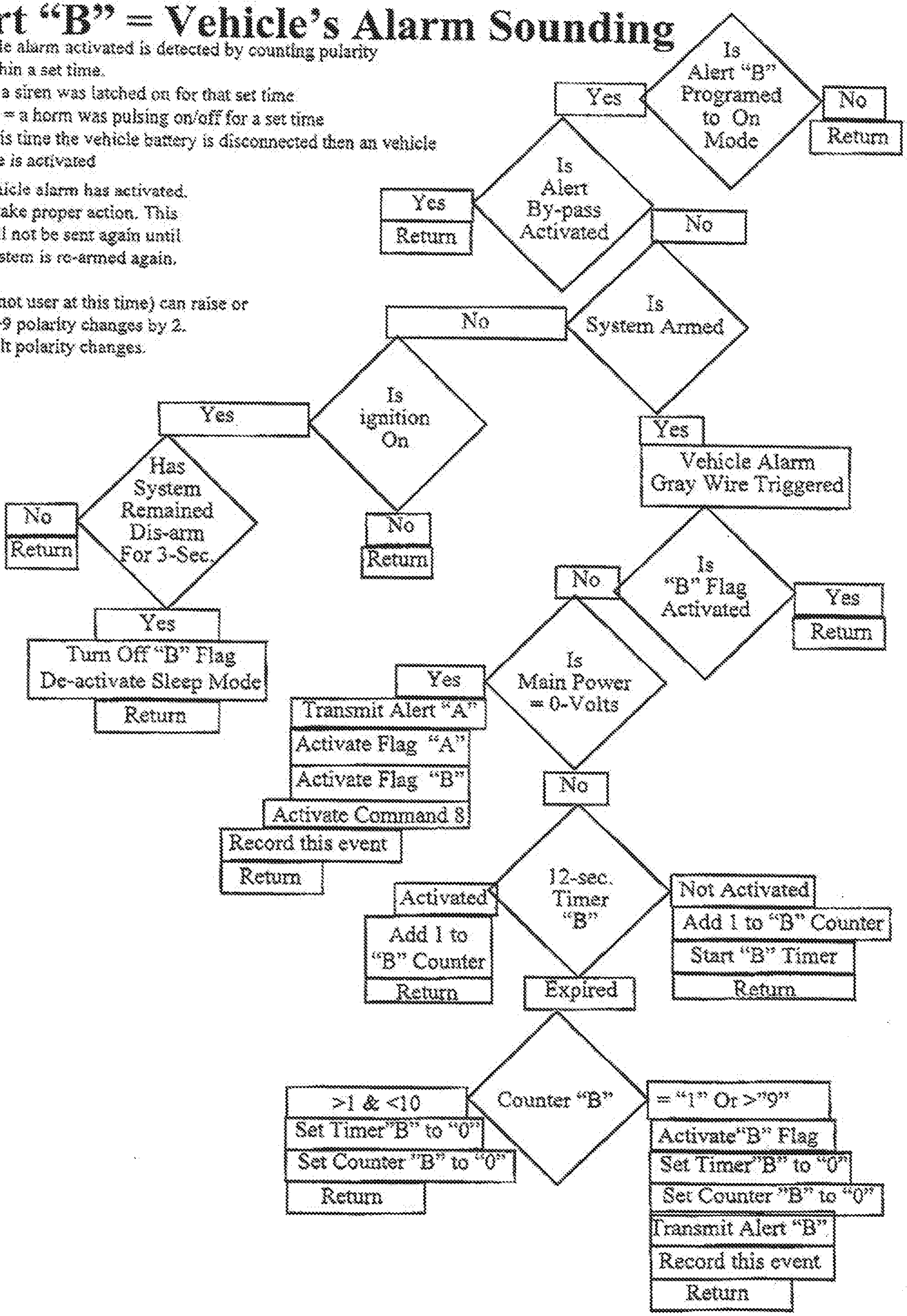


Alert “B” = Vehicle’s Alarm Sounding

Your vehicle alarm activated is detected by counting polarity changeswithin a set time.
1 change = a siren was latched on for that set time
>9 changes = a horn was pulsing on/off for a set time
If during this time the vehicle battery is disconnected then an vehicle stolen mode is activated

Your vehicle alarm has activated. Please take proper action. This alert will not be sent again until your system is re-armed again.

Televoke (not user at this time) can raise or lower the >9 polarity changes by 2.
>9 is default polarity changes.



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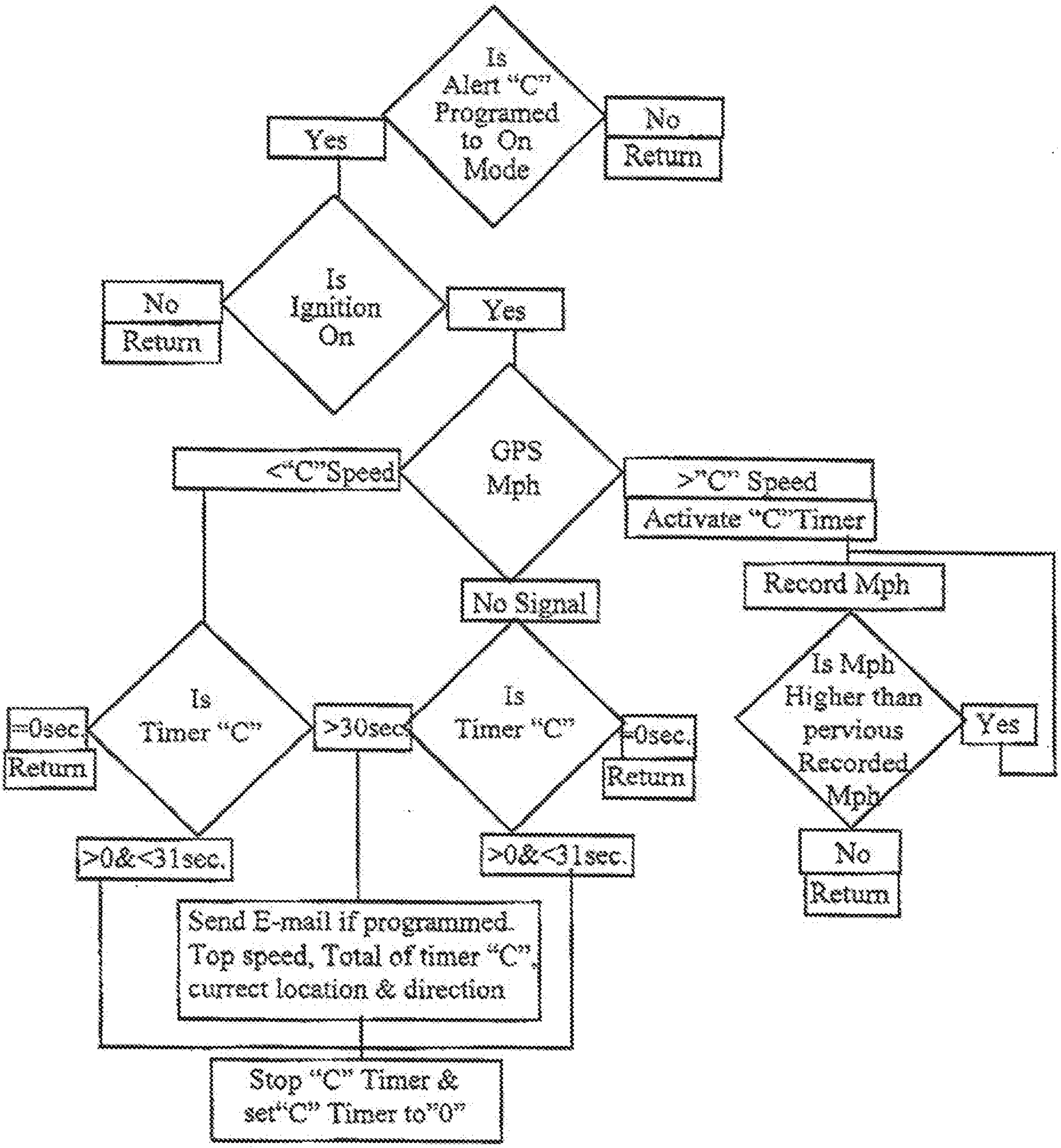
Alert "C" = Speeding Too Long Of Time

Vehicle was traveling faster than 80 m.p.h. for a longer time than 30 seconds. GPS indicates the speed.
If pre-programed to do so, records this as an event and will send e-mail instantly of Top speed, total time,direction and location speeding had stopped.
Alert "C" operation an be turned on or off by user
80 M.p.h. is default speed. Televoke (not user at this time) can raise or lower the speed by 5 m.p.h. increments.
30-seconds time is default. Televoke (not user at this time) can raise or lower the time by 5 minutes increments.

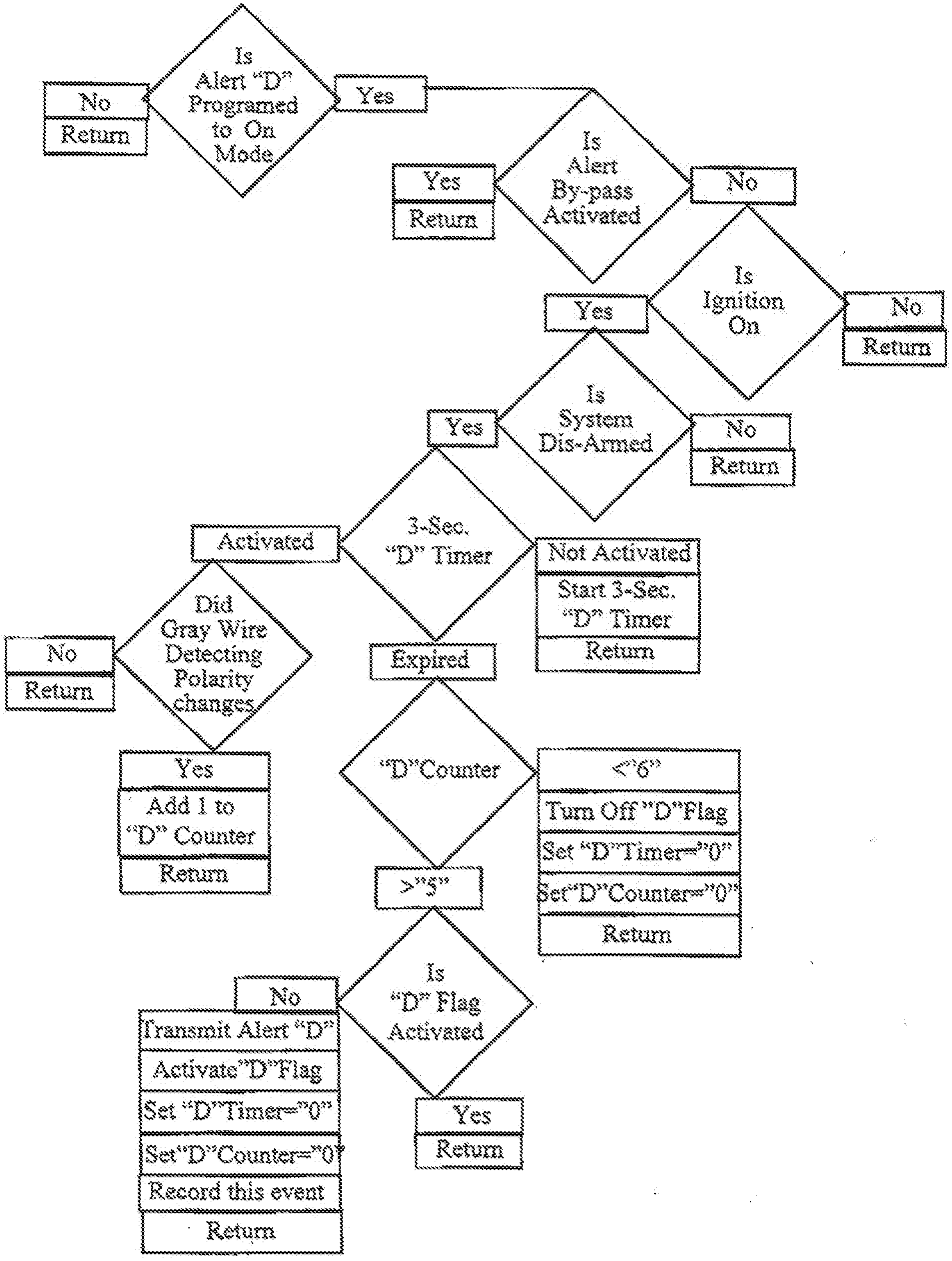


Is Alert "C" Programed to On Mode
Yes
No
Return
Is Ignition On
No
Return
Yes
GPS Mph
<"C"Speed
>"C" Speed
Activate "C"Timer
No Signal
Record Mph
Is Mph Higher than pervious Recorded Mph
Yes
No
Return
Is Timer "C"
=0sec.
Return
>30sec
Is Timer "C"
=0sec.
Return
>0&<31sec.
>0&<31sec.
Send E-mail if programmed. Top speed, Total of timer "C", currect location & direction
Stop "C" Timer & set"C" Timer to"0"

Alert "D" = Unauthorized Transmitter Alert

Your vehicle was programmed to operate from a new ignition key or remote transmitter. Please take proper action. This alert will not be sent again till the vehicles alert signal stops.

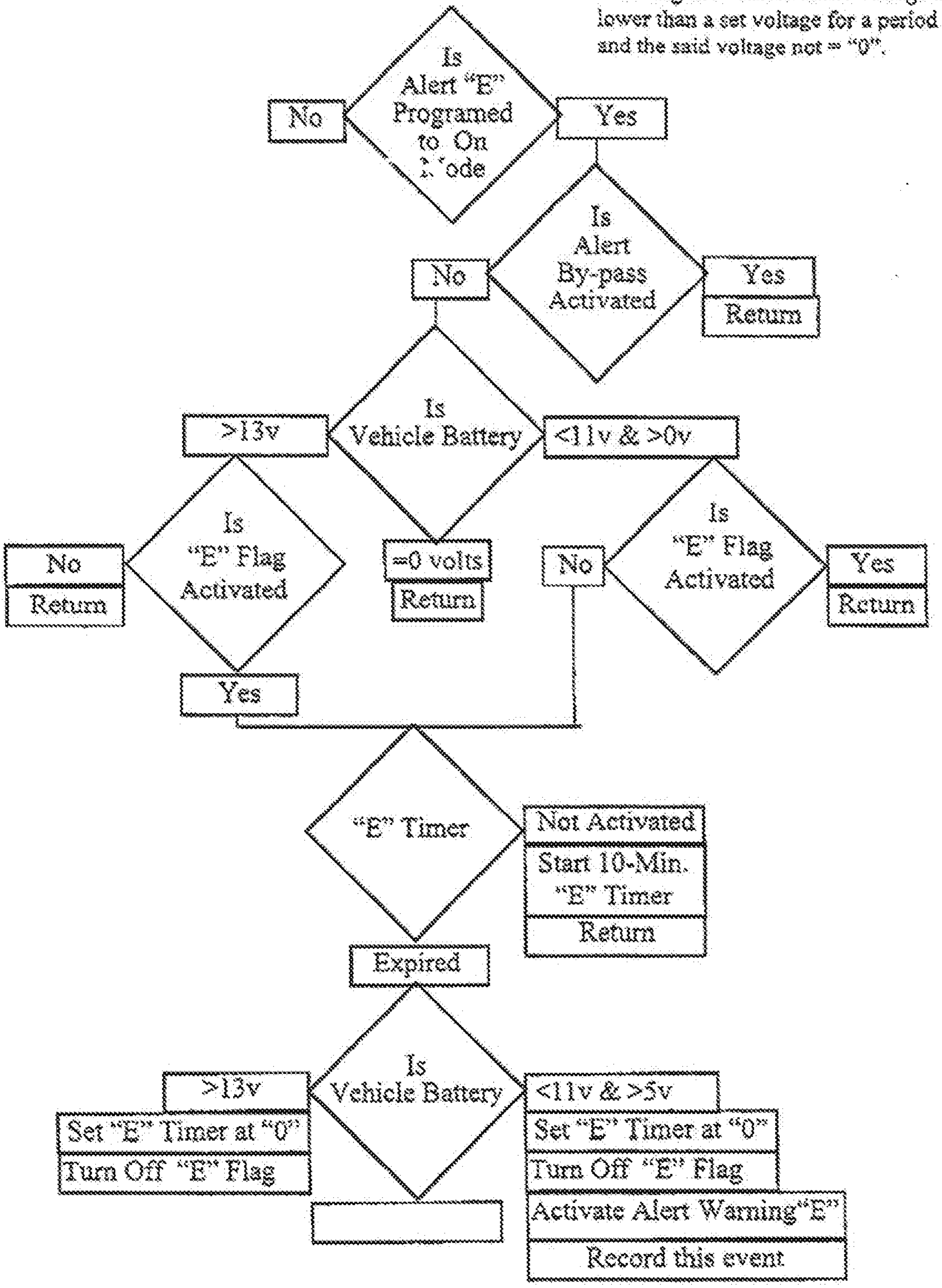
Unauthorized Transmitter Alert is activated when ignition key is turned on and detects a plurality of polarity changes on Gray wire within a set time. This Alert is prevented from activated again until said circuit returns to normal.



Alert "E" = Low Car Battery Power

Your vehicle has a low battery voltage indication. Please take proper action. This alert will not be sent again until your vehicles battery has retained the proper voltage.

Low battery power Alert is activated by detecting the vehicle batter voltage being lower than a set voltage for a period of time and the said voltage not = "0".



10-02-00 Approv

PROVISIONAL APPLICATION COVER SHEET

09/29/00 JC812 U.S. PTO

JC714 U.S. PTO 60/236890 09/29/00

This is a request for filing a **PROVISIONAL APPLICATION** under 37 CFR 1.53(b)(2)

Docket No.	58076	Type (+) --- [+]

INVENTOR(s)/APPLICANT(s)			
LAST NAME	FIRST NAME	MID. INIT.	RESIDENCE (CITY/STATE OR COUNTRY)
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TITLE OF THE INVENTION (280 Characters Max)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

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ENCLOSED APPLICATION PARTS *(check all that apply)*

✓	Specification	*Number of Pages*	24	☐	Small Entity Statement
✓	Drawing(s)	*Number of Sheets*	5	☐	Other (specify) ____________

METHOD OF PAYMENT

✓	A check or money order is enclosed to cover the Provisional Filing Fees		PROVISIONAL FILING FEE AMOUNT ($)	$75.00
✓	The Commissioner is hereby authorized to charge the filing fee and/or any discrepancies to Deposit Account No.:	01-0484		

[ ] Additional inventors are being named on separately numbered sheets attached hereto.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[✓] No. [ ] Yes

Respectfully Submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Kenneth E. FLICK

Serial: Not Yet Assigned

Attorney's Docket No.: 58076

Filed: Herewith

For: **VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION**

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled: **VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION** described in:

(x) the specification filed herewith
( ) application serial no. ______________ filed ______________________
( ) patent no. __________________________ issued ____________________

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

(x) no such person, concern, or organization
( ) persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

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( ) INDIVIDUAL ( ) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Kenneth E. Flick
NAME OF INVENTOR

SIGNATURE OF INVENTOR

9-28-00
DATE

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VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

Field of the Invention

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

Description of the Invention

The invention includes a unit to be mounted in the vehicle and a monitoring station. The unit in the vehicle includes a GPS receiver, and a transmitter which may transmit on the control band of the cellular telephone network, or, via a voice or other data channel of the cellular network, or other wireless communications network. For example, the transmitter could also be a satellite transmitter.

The GPS receiver determines the vehicle location. In addition, the GPS receiver may be connected to a controller which controls and/or performs a number of vehicle tracking and/or security functions. Wireless vehicle location determining devices and approaches other than GPS may also be used in some embodiments of the invention. For example, vehicle location systems based upon multiple receptions from adjacent cellular receivers can also be used.

The monitoring station is interfaced to the cellular telephone network, or other communications

network, to thereby communicate with the vehicle unit. In addition, the monitoring station is also connected to the Internet to provide a number of advantageous features including updating the user or other authority when away from the vehicle of the vehicle's position. These features and advantages are described in further detail below. The monitoring station may also be connected to the telephone network in order to provide various preprogrammed communications, such as to the user or other authority.

The system preferably implements one or more of the following features:

1. 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 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.

2. Detects an optional vehicle 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.

3. Detects an optional vehicle alarm systems 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.

4. 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 WEB site. The vehicle would be equipped with a security system as disclosed in U.S. Patent No. 5,654,688, for example, which determines an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

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5. 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 max speed limit and duration thereof can be selected by the user.

6. 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 selectable by the user.

7. Detects 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.

8. 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 also preferably has access to a WEB or Internet site that will display a map and silently contact the vehicle to acquire it's current location, speed, direction of travel, and previous multiple

locations with speeds, for example, the user's personal identification number (PIN) can be instantly activated by just a phone call. No additional installation is required.

Certain annual pre-pay package arrangement may be available. For example, up to 10 access entries per month can be provided on a low monthly billing of $4.90. Up to 30 access entries could be provided for $8.25 per month.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the WEB site. The user may control various vehicle functions remotely via the telephone or WEB 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 & installation is relatively inexpensive, and is on the order of about $190.00. 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 user a predetermined command (Command 7) 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 an embodiment of the vehicle unit are provided below as relating to use of red and green LED indicators operated by the system controller.

Red LED verification of GPS receiving signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
    Blinking = when searching GPS location.
    Constant = found location.
    Off = no GPS signal found.
With yellow wire not having positive 12 volts:
    Off = LED not functioning.

Green LED verification of receiving the cell tower signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
    Blinking = Cell control channel signal is detected.
    Constant = sending micro burst signal. Stays on 5-seconds after each time system is transmitting.
    Off = no cell tower signal received.
With yellow wire not having positive 12 volts:

Off = LED not functioning.

An example of representative DIP switch feature selection is as follows. Switch 1 may be used for adding orange wire for controlling arm/disarming of system. When On, the orange wire controls arm/disarm as follows: to arm, Orange wire is grounded and Yellow wire does not have 12 volts positive. To disarm, the Orange wire is not grounded. When switch 1 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 orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until 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:

The Red Wire is connected to 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.

The Black Wire is connected to Ground.

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:

1. If the system is in an armed mode and Lat/Long changes, then Alert "A" is given.

2. 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".

3. If the DIP switch 1 is in the Off position then:
   a. if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues the 500 ma ground.
   b. if the yellow wire sees grounded 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 system is disarmed

The Gray Wire is for Input and Output, and can be connected to an alarm siren or horn positive terminal. In addition:

1. With 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 "B" alarm activation is given.

2. 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.

3. 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.

4. The Gray wire bypass operates as follows:
a. After Alert warning "B" bypass all future Alert "B" until system is disarmed.
b. After Alert warning "C" bypass all future Alert "C" until system is armed.
c. After Alert warning "D" bypass all future Alert "D" until no 12 volt pulses are detected on the gray wire within 3 seconds of yellow wire having 12 volts.

5. With system armed or disarmed. The Output: Internal + 12v, 1 amp transistor with pulses 1 second on & 1 sec off to activate siren or

honk car horn or flashing light relay.

a. Non-stop activation from (Command "4")

b. 30-second activation from (Command "5")

6. Turn off the above Alert "A" from (Command "1")

The Orange Wire is for the starter interrupt and arm/disarm system, and operates as follows:

1. If dip switch 1 is in the:
    - a. On position and:
        - i. the Orange wire has 12 volts or neutral, the system switches to the disarmed mode
        - ii. the Orange wire is grounded, then the system is switched to the armed mode
        - iii. and the starter interrupt output will not automatically operate. Can only be activated from "Command #4"
    - b. Off position and:
        - i. the Orange wire does not effect the arming or disarming of the system.
        - ii. 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.

2. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.

3. 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:

Green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6").

Red Wire provides a constant 12v output from the Red power wire.

Blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7")

Pink wire provides a 250ma., 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 Orange wire for 10-seconds (starter interrupt), with these circuits in sequence:

First: Activates Gray wire for 1-second. (siren/horn)

After first stops: Activates Green wire for 1 second to lock the doors.

After second stops: Activate Blue wire for 1 second to unlock the doors.

After third stops: Activate Pink wire for 1 second to activate optional item.

Representative warning alerts are as follows:

Alert Warning "A": Automatic activation of "Command 8" and the vehicle unit contacts monitor station to instantly call 3 phone numbers with the message "Your Vehicle is stolen please confirm then call 911 to advise police of web site 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" until the system is re-armed.

Alert Warning "B": 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.

Alert Warning "C": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle PANIC activated please confirm". This is with system disarmed and

detecting the Gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After the first activation then this is bypassed until the ignition turns on again.

Alert Warning "D": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the this 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 yellow wire having seen 12 volts positive. All future alert "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts.

Alert Warning "E": 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 alert "E" are bypassed until:

1. First: More than 13.5 volts are detected on the red wire and
2. Second: After yellow wire stops having positive voltage the red wire then must detects more than 12 volts.

Alert Warning "F": 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)

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) Web site to indicate present location and past events in memory.

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

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

b. 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 250ma. 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:

a) 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:

i) Once instantly.

ii) Once in 1 hour if at the same location.

iii) Once in 6 hours if at the same location.

iv) Once in 12 hours if at the same location.

v) Once every 24 hours if at the same location.

b) 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 contains 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.

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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:

a) 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 same then only update stationary total time.

b) If the GPS antenna is not receiving any signal:

i) Then enter last known GPS location and with indication this was the last known GPS location before GPS signal stopped and how long no GPS signal was received. And enter GPS location in the on-hold file.

c) When vehicle is traveling above ###MPH for ##-minutes.

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

a) The user's vehicle has issued a stolen alert:

i) 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 Web site address and an identification number, such as the user's PIN, to allows the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

ii) 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.

b) 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.

c) 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 transmission 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 begins 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.

The device or unit may be initially manufactured and shipped without all of the features being fully functional. One advantage of this is to prevent the unit at will from sending messages when being initially installed and tested in the vehicle, thereby reducing potential false alarms and burdens on the communications system, as well as potential charges to the user. After the unit is fully installed, a communication or transmission from the monitoring center may be sent to the unit enabling one or more selected features, such as during registration during which information is conveyed to the monitoring center and payment is made or authorized by the user.

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 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 transmitting again until 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 labeled "Alert A".

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 transmitting again until 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 labeled "Alert B".

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 determined whether it is greater than zero (eg. greater than six volts)and less than a high value (eg. 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 vehicle is being serviced and battery is disconnected this will cause the battery voltage to 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 transmitting again until 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 labeled "Alert E".

Yet another advantageous feature of some embodiments of 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 that 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.

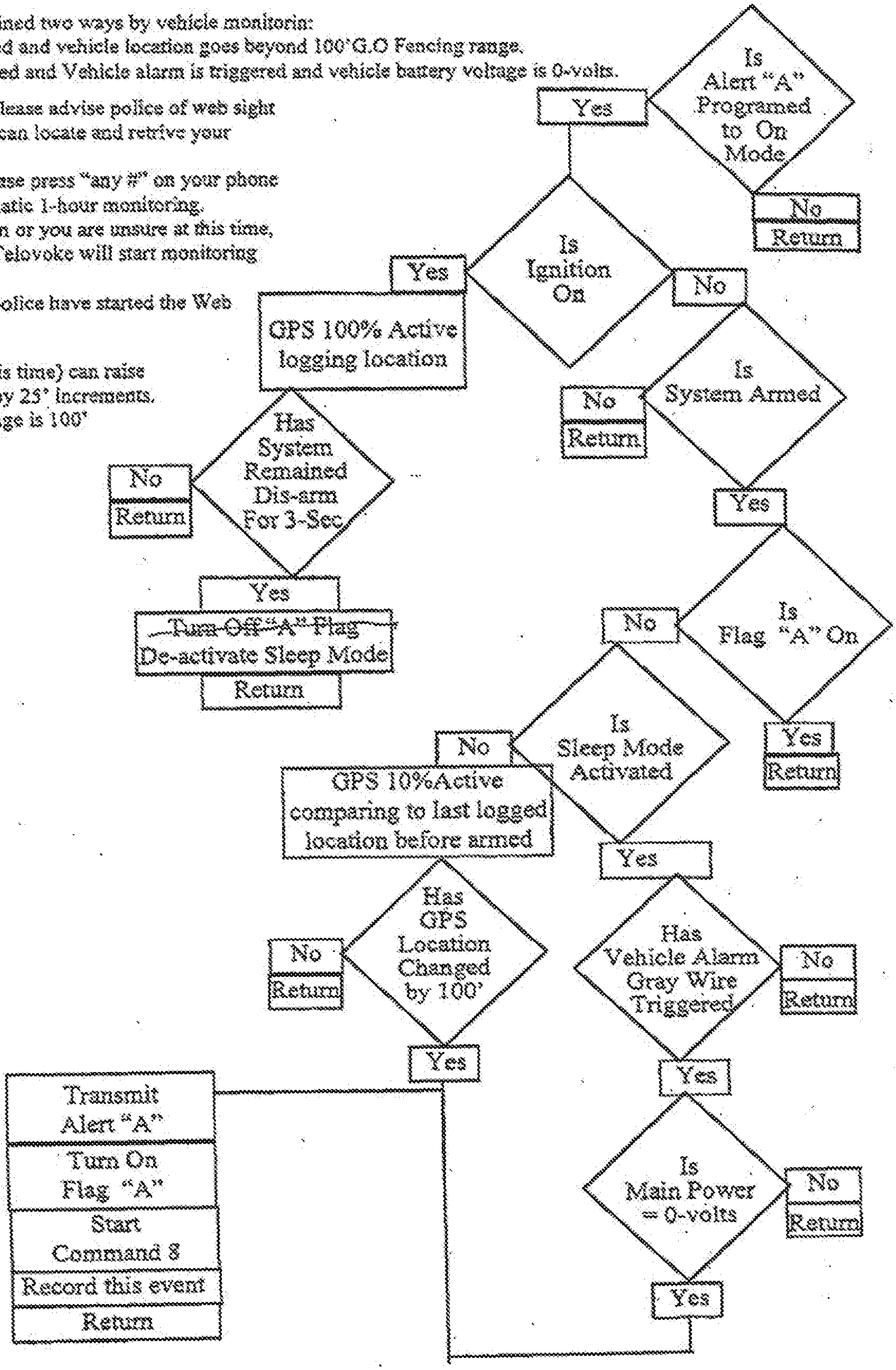
Yet another feature of the invention relates to permitting more colorful audible alert messages to be generated for the user. The user can, in some embodiments, access an internet site to type or enter the text for a message to be sent, such as to alert the user that his vehicle is being stolen. The 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.

Alert "A" = Vehicle Stolen Alert

Vehicle stolen is determined two ways by vehicle monitorin:
1. Tracking system armed and vehicle location goes beyond 100'G.O Fencing range.
2. Tracking system Armed and Vehicle alarm is triggered and vehicle battery voltage is 0-volts.

Your vehicle is stolen, please advise police of web sight and your pin# so police can locate and retrive your vehicle.
If this is a false alert please press "any #" on your phone now to deactivate automatic 1-hour monitoring.
If vehicle has been stolen or you are unsure at this time, hang up an call police. Telovoke will start monitoring for upto
1-hour vehicle or until police have started the Web monitoring.

Televoke (not user at this time) can raise or lower G.O.Fencing by 25' increments.
G.O Fencing default range is 100'

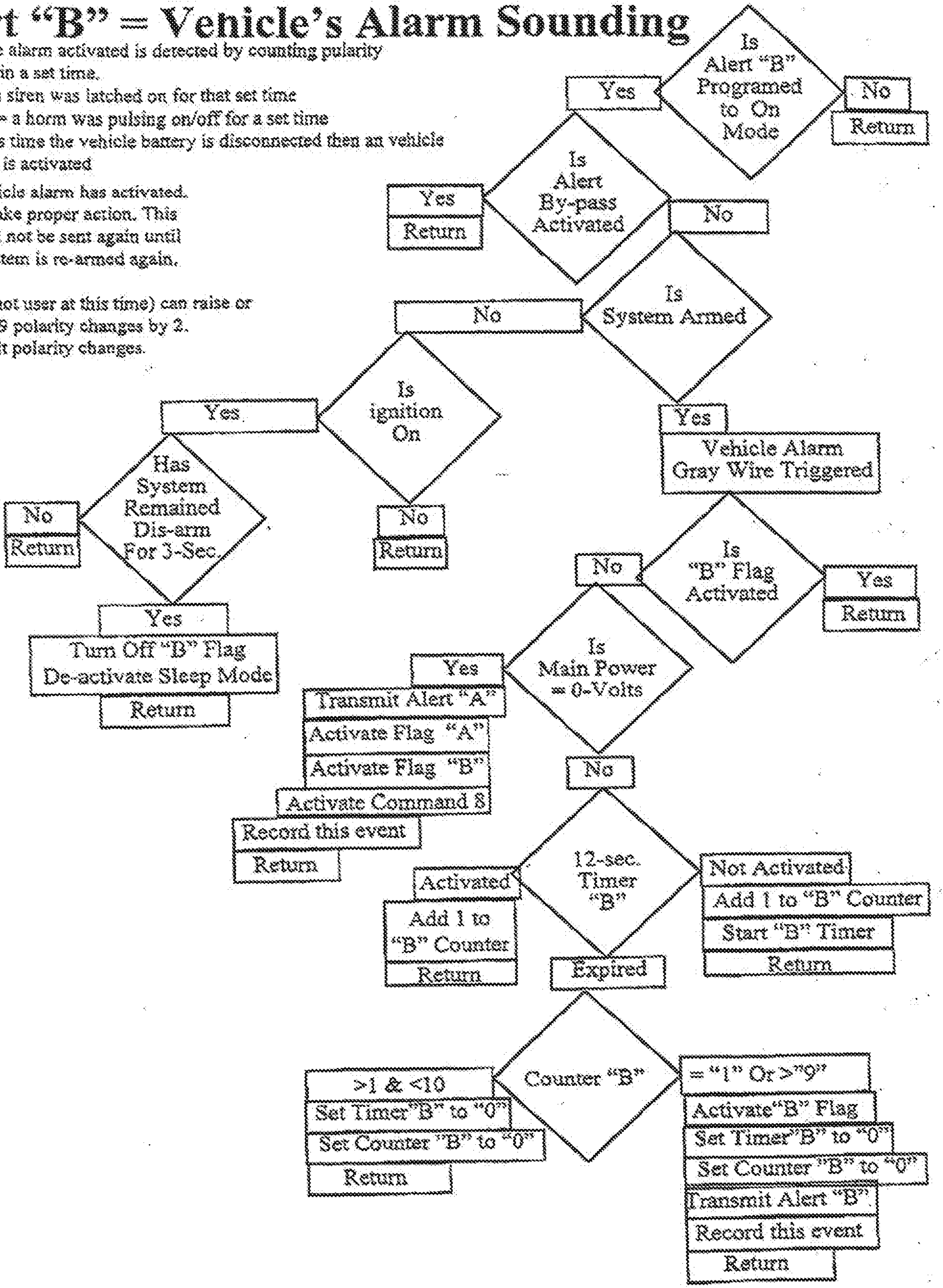


Alert "B" = Venicle's Alarm Sounding

Your vehicle alarm activated is detected by counting polarity changeswithin a set time.
1 change = a siren was latched on for that set time
>9 changes = a horm was pulsing on/off for a set time
If during this time the vehicle battery is disconnected then an vehicle stolen mode is activated

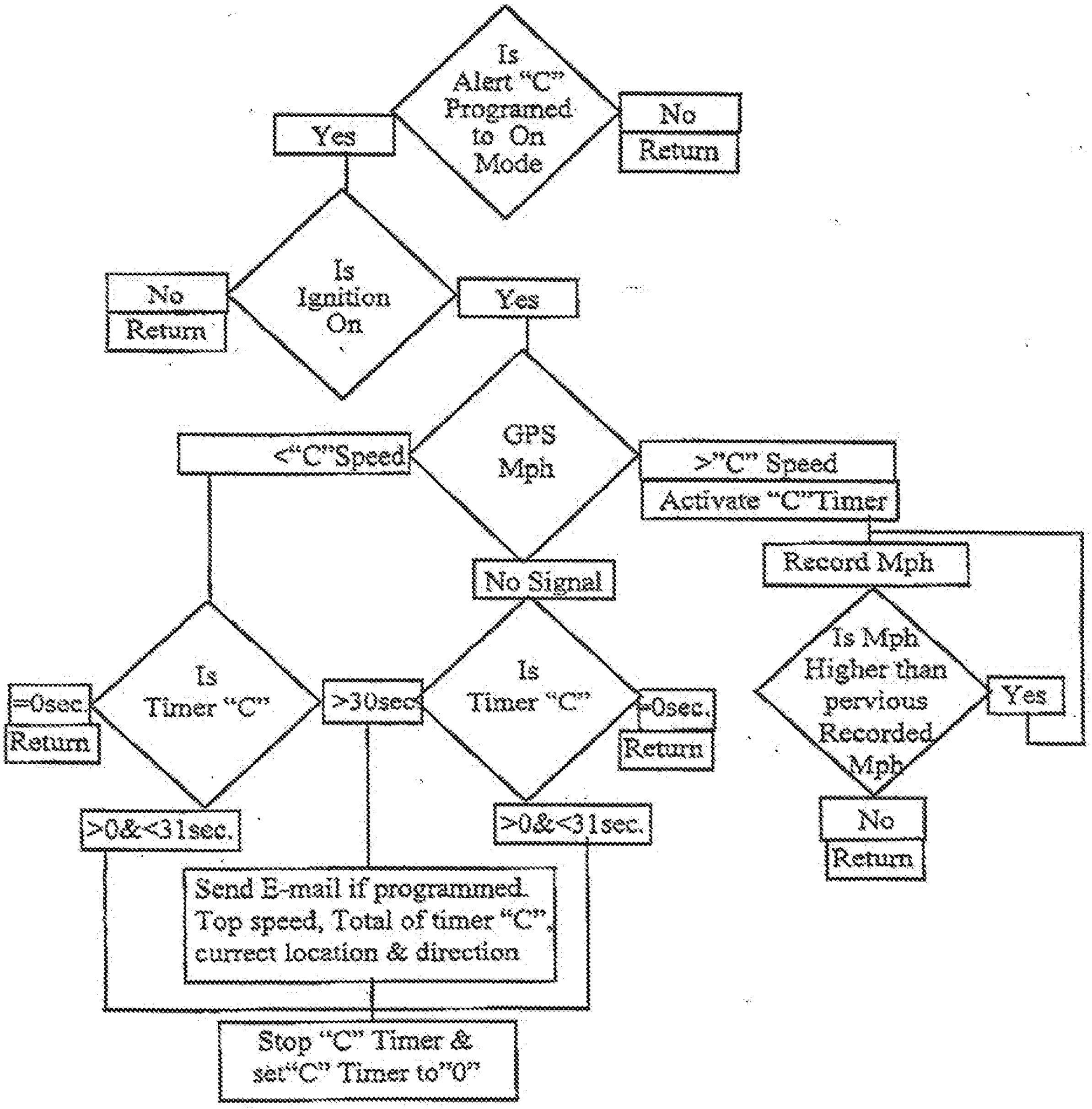
Your vehicle alarm has activated.
Please take proper action. This
alert will not be sent again until
your system is re-armed again.

Televoke (not user at this time) can raise or
lower the >9 polarity changes by 2.
>9 is default polarity changes.



Alert "C" = Speeding Too Long Of Time

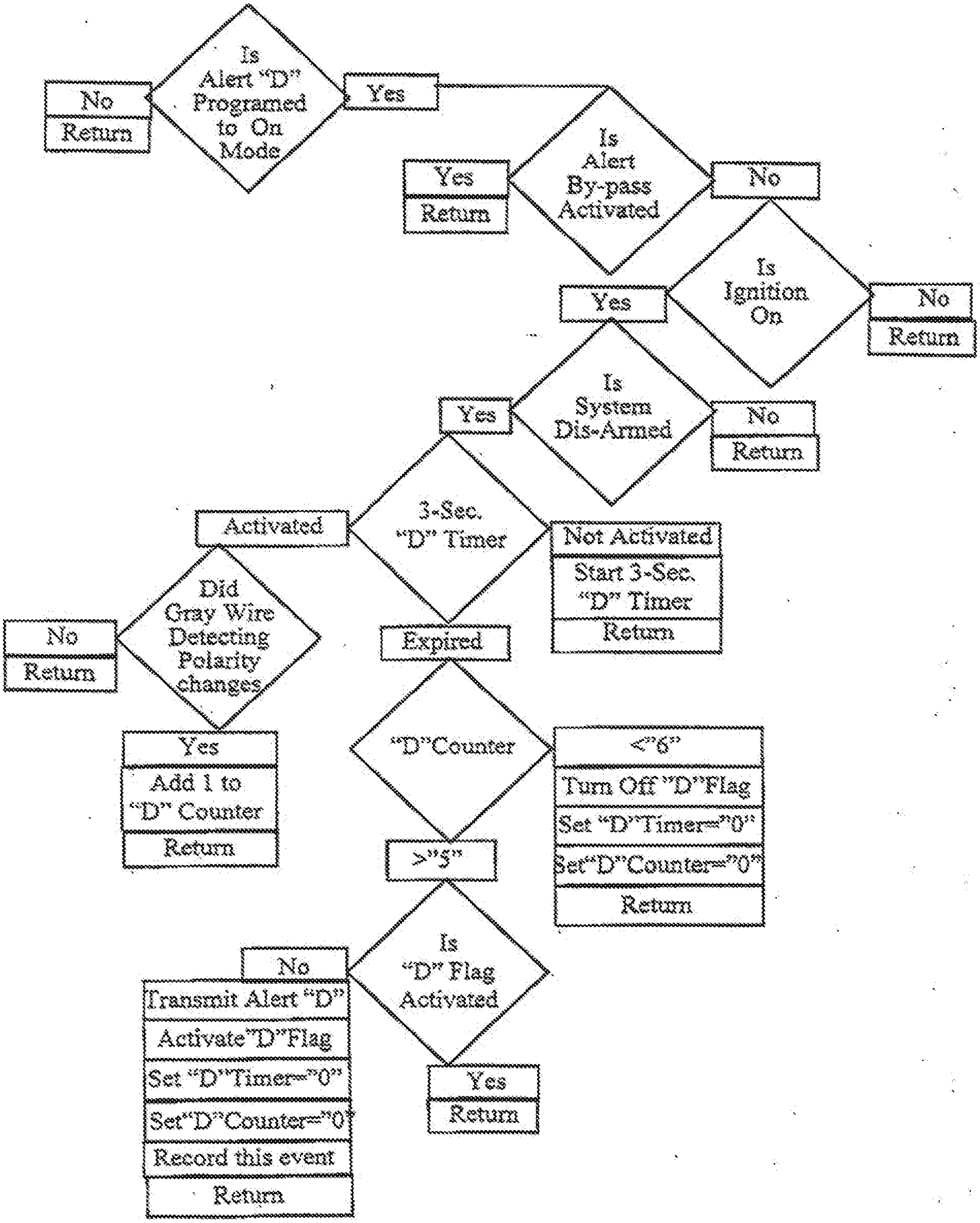
Vehicle was traveling faster than 80 m.p.h. for a longer time than 30 seconds. GPS indicates the speed.
If pre-programed to do so, records this as an event and will send e-mail instantly of Top speed, total time,direction and location speeding had stopped.
Alert "C" operation an be turned on or off by user
80 M.p.h. is default speed. Televoke (not user at this time) can raise or lower the speed by 5 m.p.h. increments.
30-seconds time is default. Televoke (not user at this time) can raise or lower the time by 5 minutes increments.


Is Alert "C" Programed to On Mode
Yes
No
Return
Is Ignition On
No
Return
Yes
GPS Mph
<"C"Speed
>"C" Speed
Activate "C"Timer
No Signal
Record Mph
Is Mph Higher than pervious Recorded Mph
Yes
No
Return
Is Timer "C"
=0sec.
Return
>0&<31sec.
>30sec
Is Timer "C"
=0sec.
Return
>0&<31sec.
Send E-mail if programmed. Top speed, Total of timer "C", currect location & direction
Stop "C" Timer & set"C" Timer to"0"

Alert "D" = Unauthorized Transmitter Alert

Your vehicle was programmed to operate from a new ignition key or remote transmitter. Please take proper action. This alert will not be sent again till the vehicles alert signal stops.

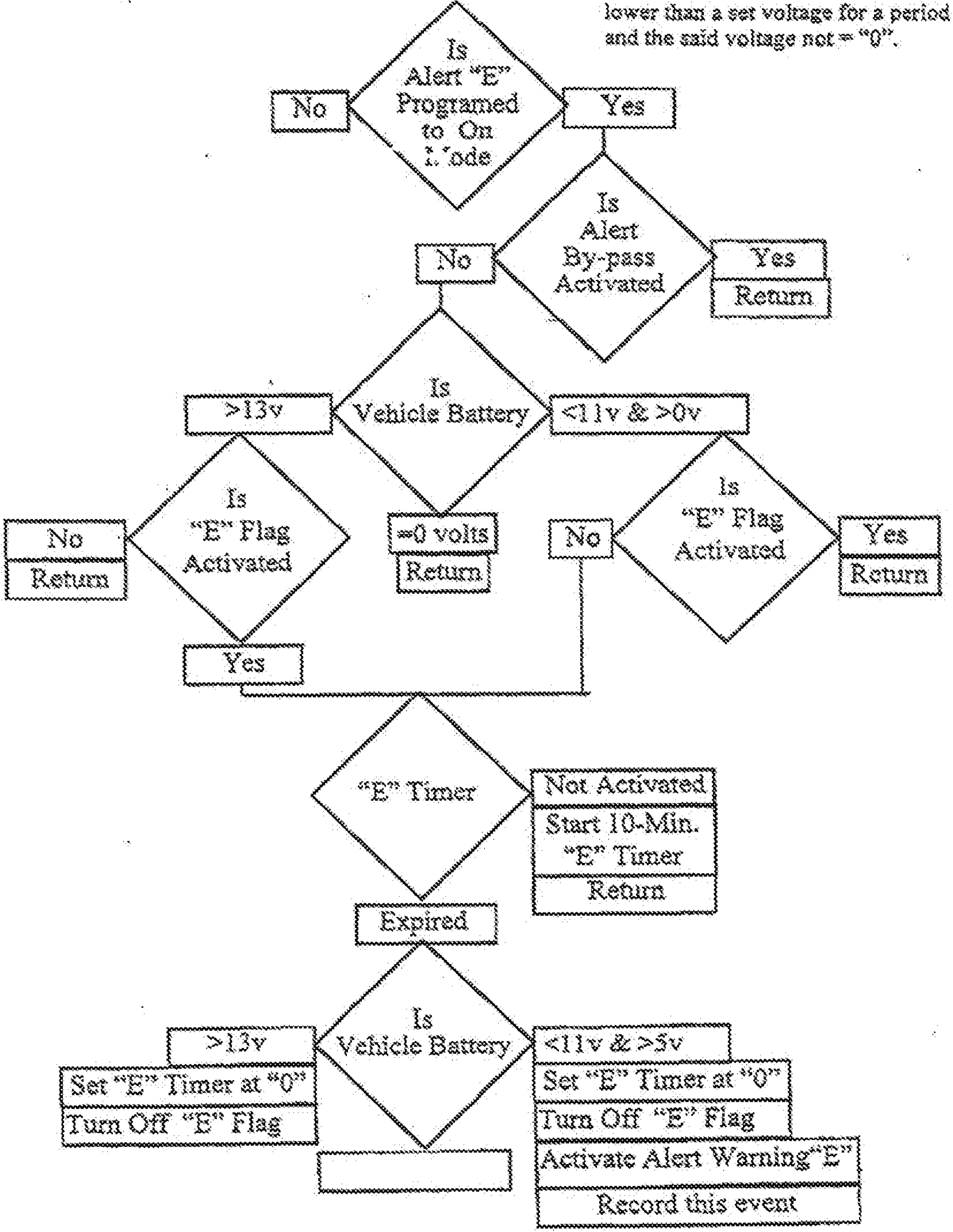
Unauthorized Transmitter Alert is activated when ignition key is turned on and detects a plurality of polarity changes on Gray wire within a set time. This Alert is prevented from activated again until said circuit returns to normal.



Alert "E" = Low Car Battery Power

Your vehicle has a low battery voltage indication. Please take proper action. This alert will not be sent again until your vehicles battery has retained the proper voltage.

Low battery power Alert is activated by detecting the vehicle batter voltage being lower than a set voltage for a period of time and the said voltage not = "0".



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JC813 U.S. PTO 60/252125 11/20/00

PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2)

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TITLE OF THE INVENTION (280 Characters Max)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

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ENCLOSED APPLICATION PARTS *(check all that apply)*

✓	Specification	*Number of Pages*	29		✓	Applicant qualifies as a Small Entity under 35 CFR under §§1.19 and 1.27
✓	Drawing(s)	*Number of Sheets*	6			Other (specify) ____

METHOD OF PAYMENT

✓	A check or money order is enclosed to cover the Provisional Filing Fees		PROVISIONAL FILING FEE AMOUNT ($)	$75.00
✓	The Commissioner is hereby authorized to charge or credit any discrepancies in fee amounts to Deposit Account No.:	01-0484		

[ ] Additional inventors are being named on separately numbered sheets attached hereto.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[✓] No. [ ] Yes

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Date: November 20, 2000

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

Field of the Invention

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

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Description of the Invention

The invention includes a unit to be mounted in the vehicle and a monitoring station. The unit in the vehicle includes a GPS receiver, and a transmitter which may transmit on the control band of the cellular telephone network, or, via a voice or other data channel of the cellular network, or other wireless communications network. For example, the transmitter could also be a satellite transmitter.

The GPS receiver determines the vehicle location. In addition, the GPS receiver may be connected to a controller which controls and/or performs a number of vehicle tracking and/or security functions. Wireless vehicle location determining devices and approaches other than GPS may also be used in some embodiments of the invention. For example, vehicle location systems based upon multiple receptions from adjacent cellular receivers can also be used.

The monitoring station is interfaced to the cellular telephone network, or other communications

network, to thereby communicate with the vehicle unit. In addition, the monitoring station is also connected to the Internet to provide a number of advantageous features including updating the user or other authority when away from the vehicle of the vehicle's position. These features and advantages are described in further detail below. The monitoring station may also be connected to the telephone network in order to provide various preprogrammed communications, such as to the user or other authority.

The system preferably implements one or more of the following features:

1. 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 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.

2. Detects an optional vehicle 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.

3. Detects an optional vehicle alarm systems 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.

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4. 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 WEB site. The vehicle would be equipped with a security system as disclosed in U.S. Patent No. 5,654,688, for example, which determines an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

5. 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 max speed limit and duration thereof can be selected by the user.

6. Detects a low battery voltage such as for a predetermined time and transmits a signal to the monitoring station to contact up to 3

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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 selectable by the user.

7. Detects 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.

8. 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 also preferably has access to a WEB or Internet site that will display a map and silently contact the vehicle to acquire it's current location, speed, direction of travel, and previous multiple locations with speeds, for example, the user's personal identification number (PIN) can be instantly activated

by just a phone call. No additional installation is required.

Certain annual pre-pay package arrangement may be available. For example, up to 10 access entries per month can be provided on a low monthly billing of $4.90. Up to 30 access entries could be provided for $8.25 per month.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the WEB site. The user may control various vehicle functions remotely via the telephone or WEB 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 & installation is relatively inexpensive, and is on the order of about $190.00. 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 user a predetermined command (Command 7) 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 an embodiment of the vehicle unit are provided below as relating to use of red and green LED indicators operated by the system controller.

Red LED verification of GPS receiving signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
    Blinking = when searching GPS location.
    Constant = found location.
    Off = no GPS signal found.
With yellow wire not having positive 12 volts:
    Off = LED not functioning.

Green LED verification of receiving the cell tower signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
    Blinking = Cell control channel signal is detected.
    Constant = sending micro burst signal. Stays on 5-seconds after each time system is transmitting.
    Off = no cell tower signal received.
With yellow wire not having positive 12 volts:
    Off = LED not functioning.

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An example of representative DIP switch feature selection is as follows. Switch 1 may be used for adding orange wire for controlling arm/disarming of system. When On, the orange wire controls arm/disarm as follows: to arm, Orange wire is grounded and Yellow wire does not have 12 volts positive. To disarm, the Orange wire is not grounded. When switch 1 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 orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until 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:

The Red Wire is connected to 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.

The Black Wire is connected to Ground.

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:

1. If the system is in an armed mode and Lat/Long changes, then Alert "A" is given.
2. 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".

3. If the DIP switch 1 is in the Off position then:

   a. if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues the 500 ma ground.

   b. if the yellow wire sees grounded 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 system is disarmed

The Gray Wire is for Input and Output, and can be connected to an alarm siren or horn positive terminal. In addition:

1. With 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 "B" alarm activation is given.
2. 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.

3. 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.

4. The Gray wire bypass operates as follows:

   a. After Alert warning "B" bypass all future Alert "B" until system is disarmed.

   b. After Alert warning "C" bypass all future Alert "C" until system is armed.

   c. After Alert warning "D" bypass all future Alert "D" until no 12 volt pulses are detected on the gray wire within 3 seconds of yellow wire having 12 volts.

5. With system armed or disarmed. The Output: Internal + 12v, 1 amp transistor with pulses 1 second on & 1 sec off to activate siren or honk car horn or flashing light relay.

   a. Non-stop activation from (Command "4")

   b. 30-second activation from (Command "5")

6. Turn off the above Alert "A" from (Command "1")

The Orange Wire is for the starter interrupt and arm/disarm system, and operates as follows:

1. If dip switch 1 is in the:

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- a. On position and:
    - i. the Orange wire has 12 volts or neutral, the system switches to the disarmed mode
    - ii. the Orange wire is grounded, then the system is switched to the armed mode
    - iii. and the starter interrupt output will not automatically operate. Can only be activated from "Command #4"
- b. Off position and:
    - i. the Orange wire does not effect the arming or disarming of the system.
    - ii. 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.

2. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.
3. 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:

Green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6").

Red Wire provides a constant 12v output from the Red power wire.

Blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7")

Pink wire provides a 250ma., 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 Orange wire for 10-seconds (starter interrupt), with these circuits in sequence:

First: Activates Gray wire for 1-second. (siren/horn)

After first stops: Activates Green wire for 1 second to lock the doors.

After second stops: Activate Blue wire for 1 second to unlock the doors.

After third stops: Activate Pink wire for 1 second to activate optional item.

Representative warning alerts are as follows:

Alert Warning "A": Automatic activation of "Command 8" and the vehicle unit contacts monitor station to instantly call 3 phone numbers with the message "Your Vehicle is stolen please confirm then call 911 to advise police of web site 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" until the system is re-armed.

Alert Warning "B": 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.

Alert Warning "C": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle PANIC activated please confirm". This is with system disarmed and detecting the Gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After the first activation then this is bypassed until the ignition turns on again.

Alert Warning "D": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the this 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 yellow wire having seen 12 volts positive. All future alert "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts.

Alert Warning "E": 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 alert "E" are bypassed until:

1. First: More than 13.5 volts are detected on the red wire and

2. Second: After yellow wire stops having positive voltage the red wire then must detects more than 12 volts.

Alert Warning "F": 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)

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) Web site to indicate present location and past events in memory.
Command 4:	(Hijack or Stolen) monitoring station Command to vehicle system to activate:

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

b. 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 250ma. 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:

a) 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:

i) Once instantly.

ii) Once in 1 hour if at the same location.

iii) Once in 6 hours if at the same location.

iv) Once in 12 hours if at the same location.

v) Once every 24 hours if at the same location.

b) 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 contains 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:

a) 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 same then only update stationary total time.

b) If the GPS antenna is not receiving any signal:

  i) Then enter last known GPS location and with indication this was the last known GPS location before GPS signal stopped and how long no GPS signal was received. And enter GPS location in the on-hold file.

c) When vehicle is traveling above ###MPH for ##-minutes.

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

a) The user's vehicle has issued a stolen alert:

i) 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 Web site address and an identification number, such as the user's PIN, to allows the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

ii) 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.

b) 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.

c) 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 transmission 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 begins 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.

The device or unit may be initially manufactured and shipped without all of the features being fully functional. One advantage of this is to prevent the unit at will from sending messages when being initially installed and tested in the vehicle, thereby reducing potential false alarms and burdens on the communications system, as well as potential charges to the user. After the unit is fully installed, a communication or transmission from the monitoring center may be sent to the unit enabling one or more selected features, such as during registration during which information is conveyed to the monitoring center and payment is made or authorized by the user.

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 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 transmitting again until 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 labeled "Alert A".

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 transmitting again until 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 labeled "Alert B".

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 determined whether it is greater than zero (eg. greater than six volts)and less than a high value (eg. 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 vehicle is being serviced and battery is disconnected this will cause the battery voltage to 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

transmitting again until 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 labeled "Alert E".

Yet another advantageous feature of some embodiments of 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 that 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 of the invention 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.

Yet another advantageous feature of the invention relates to interfacing with a factory-installed security system. In accordance with this aspect of the invention, the purpose is to detect when the factory security or alarm system is triggered so

that the user can be notified when away from the vehicle using the capabilities of the tracking and security system described herein. The tracking system would include a voltage and/or current sensing circuit connected to detect repetitive battery spikes based upon an electrical item being turned on and off at the vehicle.

More particularly, with the with the GPS-2000 tracking system armed and the ignition key in the off condition, if the vehicle factory alarm becomes triggered, it causes the car horn and lights to flash and/or the horn to honk. Accordingly, the detector circuit can detect these indications as either dips in the voltage or increases in current flow from the vehicle battery. If these electrical events are detected for a predetermined minimum time of about 30 seconds, for example, and not longer than a predetermined maximum time of about 63 seconds, for example, the GPS-2000 tracker will send the vehicle alarm activated message.

The circuitry for detecting a voltage dip, for example, is of a type commonly included in other conventional vehicle security systems for other purposes, such as detecting tampering, for example. This detection circuitry needs no further description herein.

As will be readily appreciated by those skilled in the art, the reason for the minimum and maximum times is to avoid false alarms. For example, a similar electrical condition can be generated as the car radiator fan cycles on and off after the engine is turned off. By waiting the predetermined minimum time of about 30 seconds, the tracker would not falsely determine this to be operation of the factory security

system. Opening and closing of the car doors could also create a similar electrical system drain, but would be unlikely to extend for 30 seconds. Accordingly, the minimum time would also avoid a false alarm in this instance of opening and closing the vehicle doors.

The maximum predetermined time could be implemented to avoid flashing operation of the hazard lights, for example, from causing a false alarm. A typical factory alarm would flash the lights and/or honk the horn for about 60 seconds before stopping. Flashing of the hazard lights would likely be for more than about 63 seconds, for example. Accordingly, a false alarm indication based on operation of the hazard lights would also be avoided by the invention.

As will also be appreciated by those skilled in the art, different values for the minimum and maximum times are contemplated by the invention. In addition, in some embodiments only one of the minimum or maximum times may be used.

Another aspect of the invention relates to a user's ability to cancel further sequential notifications. More particularly, in response to an alarm alert, sequential notifications are typically given by sequentially calling a series of telephone numbers. In accordance with this aspect of the invention, the user who receives the call, may cancel any further notifications. In other words, the user can be prompted by voice messages to make a certain keypad entry to thereby cancel further notifications if desired. This can avoid additional telephone or system usage charges, and also reduces the possible nuisance of unnecessary calls to other persons.

Stopping further notifications upon merely determining that the telephone has been answered may be ineffective, since oftentimes an answering machine may receive the call. Accordingly, it may be preferred to have the user actively cancel further notifications, in contrast to merely stopping further calls upon determining that the telephone call has been completed.

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

Yet another aspect of the invention 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.

Still another aspect of the invention 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 ever 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.

In examples, 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.

Another aspect of the invention relates to having the capability to interface the tracker device with a siren and/or the vehicle horn. Typically the siren is locally connected to ground, such as in the engine compartment, and the output of the tracker unit would provide a positive supply voltage, eg. 12 volts, to drive the siren. Also typically, the vehicle horn is connected to the positive voltage supply, and pressing the horn switch connects the horn to the vehicle ground to thereby complete the circuit and sound the horn. In accordance with this aspect of the invention, the output drive of the tracker unit can be a single wire with pulses of alternating polarity.

More particularly, the output terminal or wire, eg. the gray wire as described above, supplies

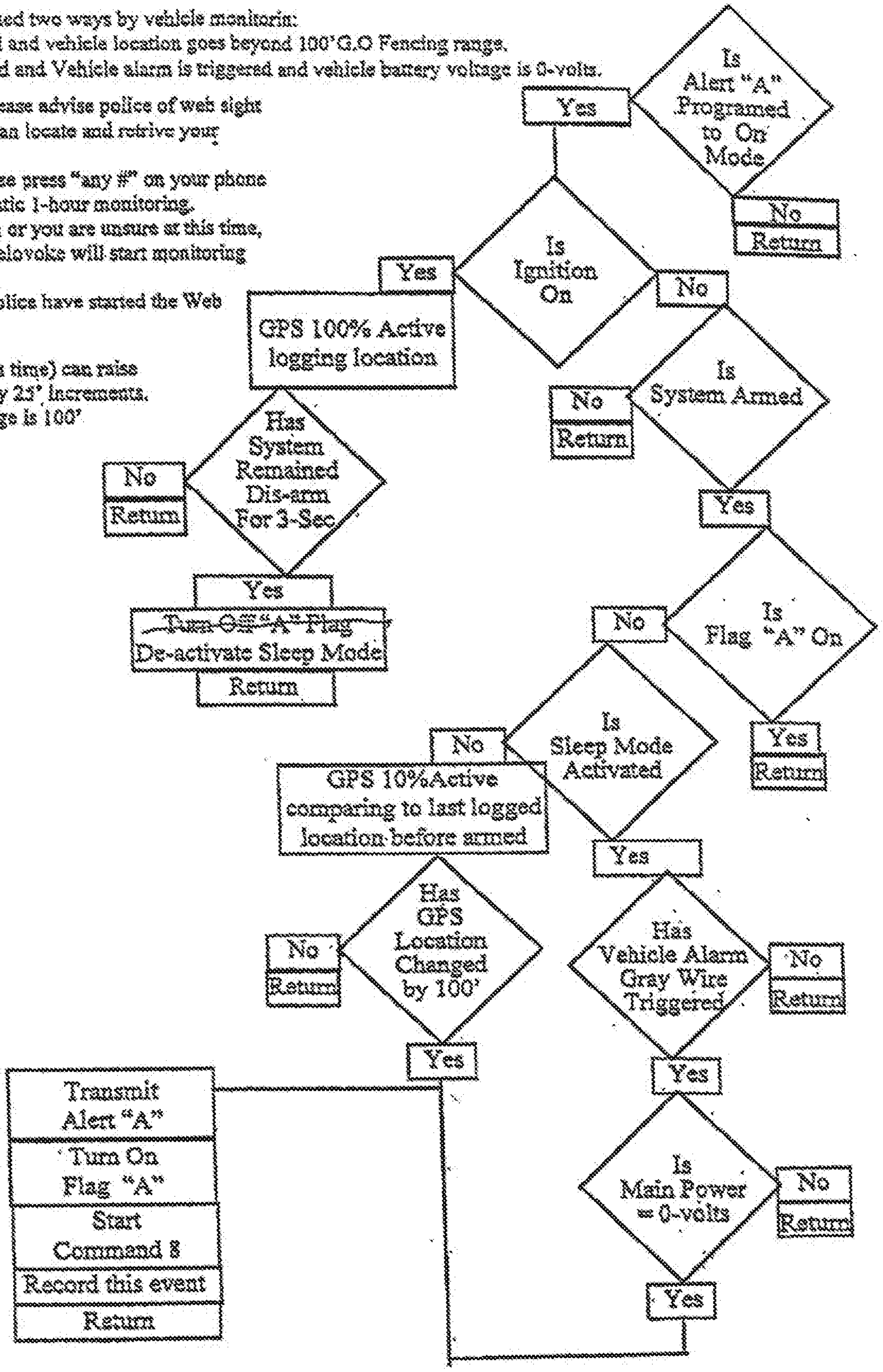
pulses of alternating polarity. For example, a first pulse can be at the positive supply voltage, and a second pulse can be at the vehicle ground. Each pulse can be about one-half to one second long. The pulses can alternate in a series and with a slight spacing between adjacent pulses. In other security type systems, an intervening relay may be provided to provide for dual polarity capability. However, the tracker unit desirably monitors activation of the horn wire to determine whether the factory or aftermarket security controller is sounding an alarm. The intervening relay would prevent such a determination. Accordingly, the circuitry for providing the alternating polarity pulses of the invention provides the dual compatibility and also permits sensing of the horn activation as described above. Thus, the invention provides the dual compatibility with a single output wire or terminal, and requires no special installation.

Alert "A" = Vehicle Stolen Alert

Vehicle stolen is determined two ways by vehicle monitorin:
1. Tracking system armed and vehicle location goes beyond 100' G.O Fencing range.
2. Tracking system Armed and Vehicle alarm is triggered and vehicle battery voltage is 0-volts.

Your vehicle is stolen, please advise police of web sight and your pin# so police can locate and retrive your vehicle.
If this is a false alert please press "any #" on your phone now to deactivate automatic 1-hour monitoring.
If vehicle has been stolen or you are unsure at this time, hang up an call police. Telovoke will start monitoring for upto
1-hour vehicle or until police have started the Web monitoring.

Televoke (not user at this time) can raise or lower G.O.Fencing by 25' increments.
G.O Fencing default range is 100'



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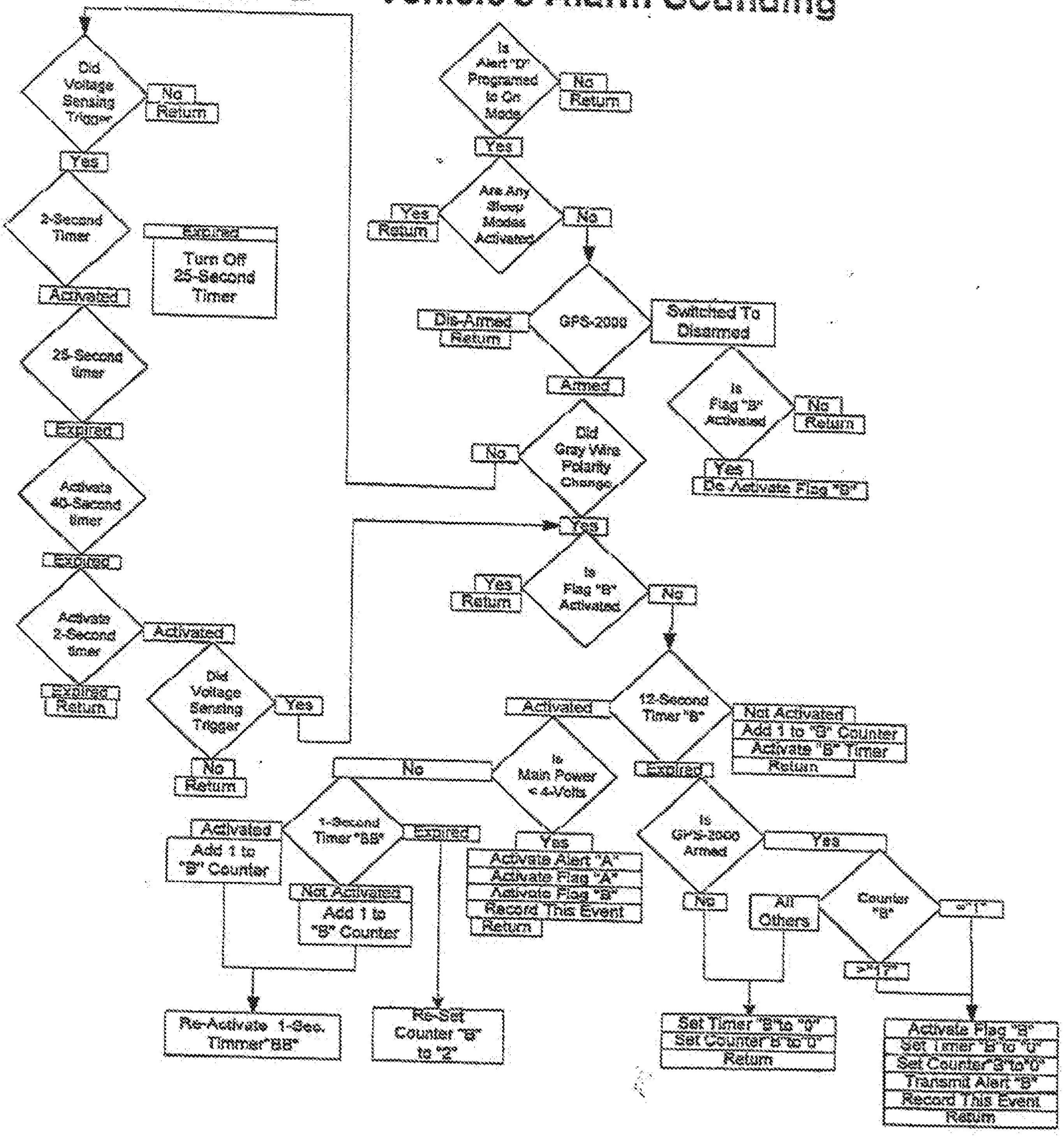
Alert "B" = Vehicle's Alarm Sounding



Your vehicle alarm activated is detected by counting the pularity changes within a set time.

One change = a siren was latched on for the set time of 12 seconds.

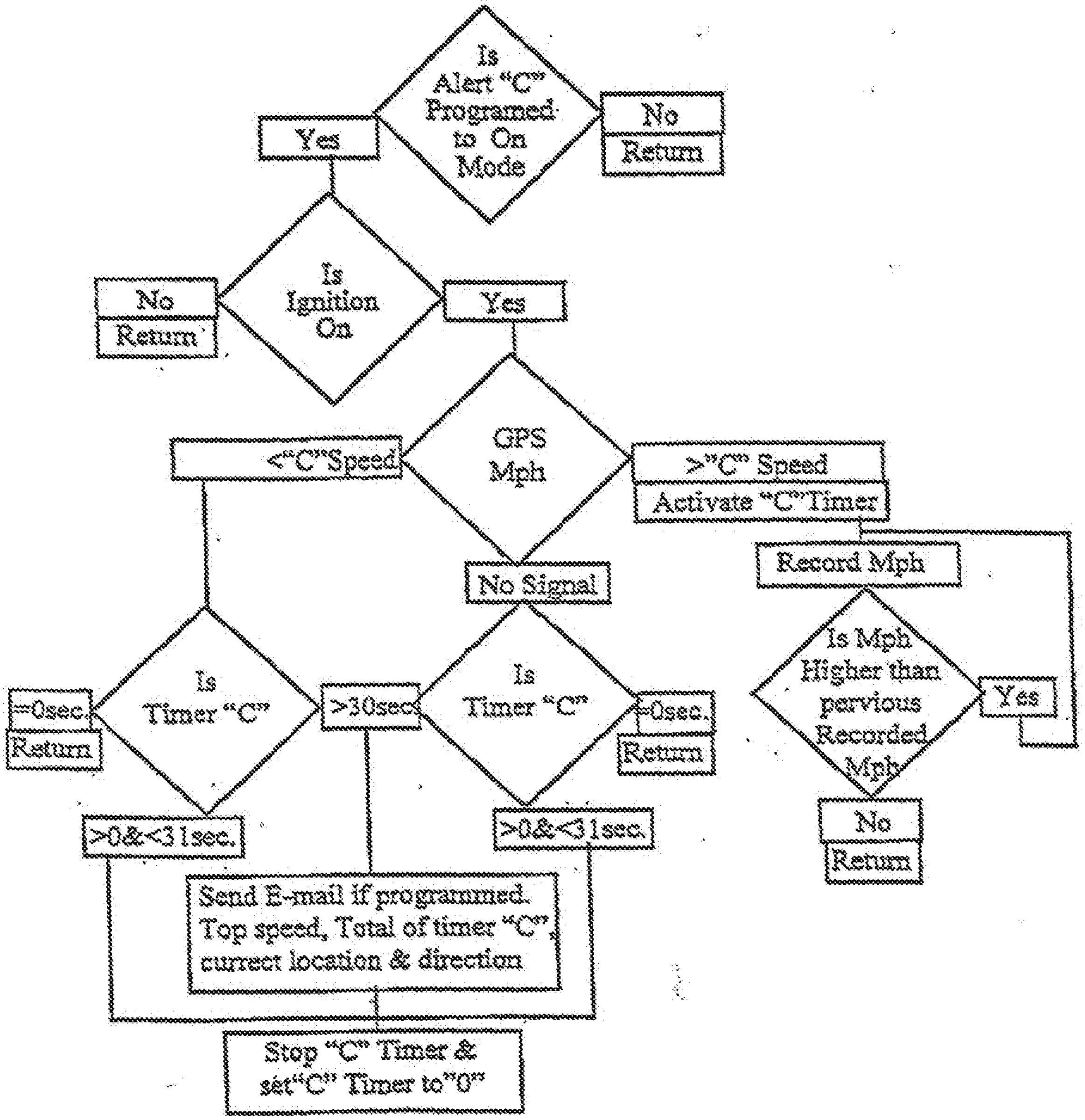
>17 changes = a car horn was pulsing on/off each time in less than one-second and after 12-seconds continues honking of 18 times = 9 horn hons no more than 1-second apart.

If the car batery power is removed during the 12-seconds then alert "A" is sent to inform the vehicle is being stolen.

One alert B is transmitted then GPS-200 will not send another alert till the GPS-2000 is disarmed and rearmed.

Alert "C" = Speeding Too Long Of Time

Vehicle was traveling faster than 80 m.p.h. for a longer time than 30 seconds. GPS indicates the speed.
If pre-programed to do so, records this as an event and will send e-mail instantly of Top speed, total time,direction and location speeding had stopped.
Alert "C" operation an be turned on or off by user
80 M.p.h. is default speed. Televoke (not user at this time) can raise or lower the speed by 5 m.p.h. increments.
30-seconds time is default. Televoke (not user at this time) can raise or lower the time by 5 minutes increments.


Is Alert "C" Programed to On Mode
Yes
No
Return
Is Ignition On
No
Return
Yes
GPS Mph
<"C"Speed
>"C" Speed
Activate "C"Timer
No Signal
Record Mph
Is Mph Higher than pervious Recorded Mph
Yes
No
Return
Is Timer "C"
=0sec.
Return
>0&<31sec.
>30sec
Is Timer "C"
=0sec.
Return
>0&<31sec.
Send E-mail if programmed. Top speed, Total of timer "C", currect location & direction
Stop "C" Timer & set"C" Timer to"0"

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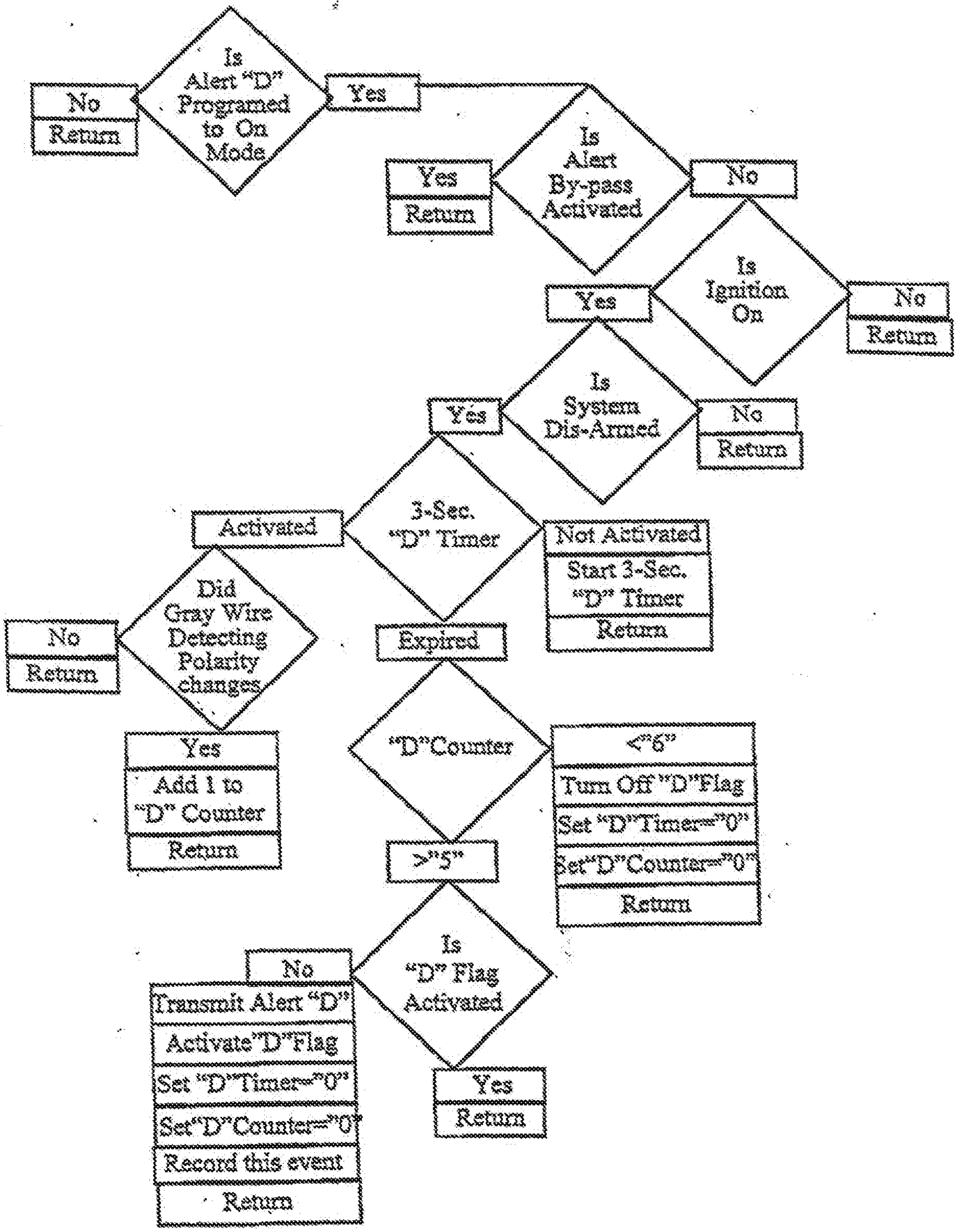
Alert "D" = Unauthorized Transmitter Alert

Your vehicle was programmed to operate from a new ignition key or remote transmitter. Please take proper action. This alert will not be sent again till the vehicles alert signal stops.

Unauthorized Transmitter Alert is activated when ignition key is turned on and detects a plurality of polarity changes on Gray wire within a set time. This Alert is prevented from activated again until said circuit returns to normal.



Alert "E" = Low Car Battery Power

Your vehicle has a low battery voltage indication. Please take proper action. This alert will not be sent again until your vehicles battery has retained the proper voltage.

Low battery power Alert is activated by detecting the vehicle batter voltage being lower than a set voltage for a period of time and the said voltage not = "0".

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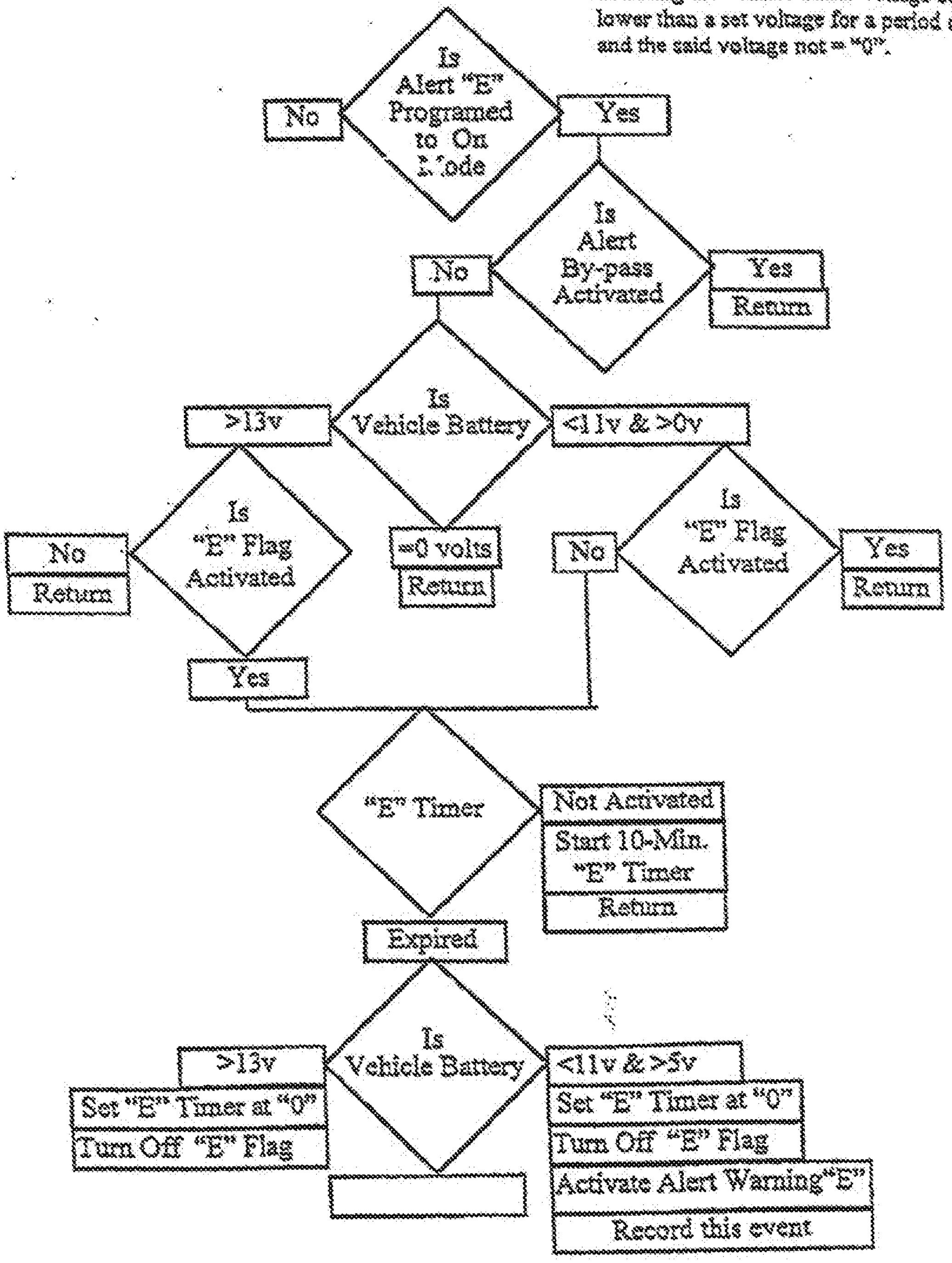
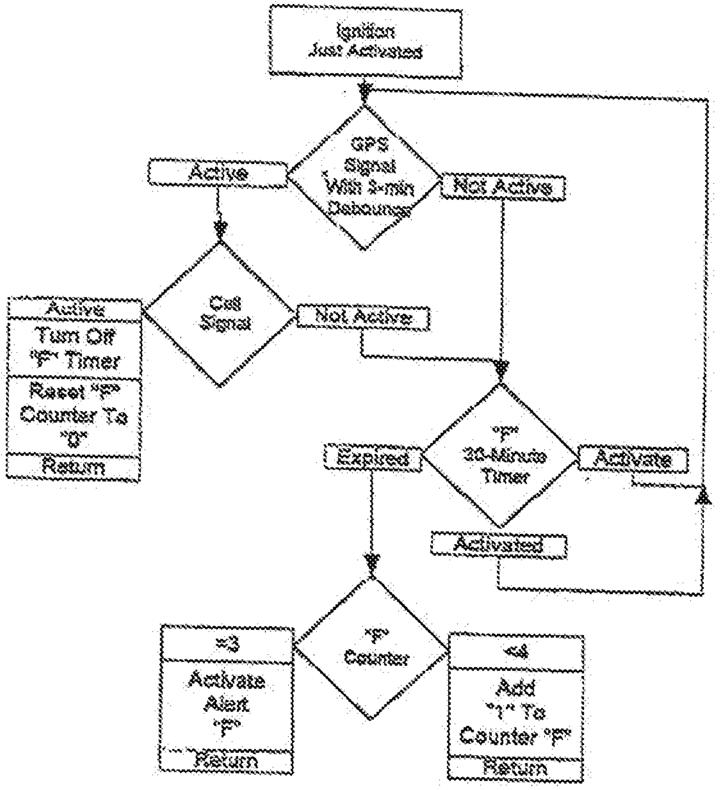
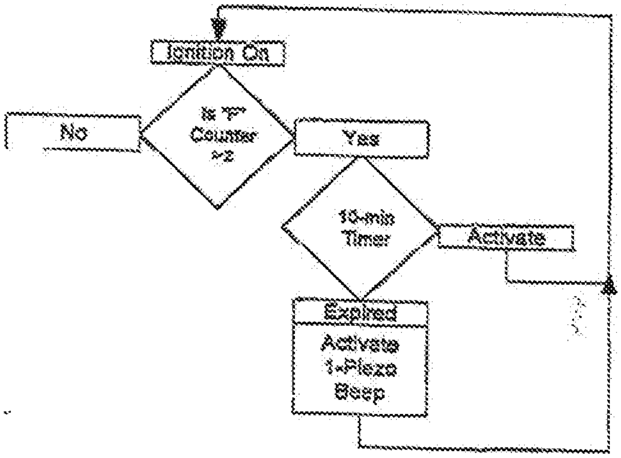


Alert "F" = GPS / Cell not active Alert





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jc714 U.S. PTO 60/251552 12/06/00

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PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2)

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TITLE OF THE INVENTION (280 Characters Max)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

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ENCLOSED APPLICATION PARTS *(check all that apply)*

✓	Specification	*Number of Pages*	33	✓	Applicant qualifies as a Small Entity under 35 CFR under §§1.19 and 1.27
✓	Drawing(s)	*Number of Sheets*	6		Other (specify) ________

METHOD OF PAYMENT

	A check or money order is enclosed to cover the Provisional Filing Fees		PROVISIONAL FILING FEE AMOUNT ($)	**$75.00**
✓	The Commissioner is hereby authorized to charge the Provisional Filing Fee and/or charge or credit any discrepancies in fee amounts to Deposit Account No.:	**01-0484**		

[ ] Additional inventors are being named on separately numbered sheets attached hereto.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[✓] No. [ ] Yes

Respectfully Submitted,

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Date: December 6, 2000

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Eric Link
(SIGNATURE OF PERSON MAILING PAPER OR FEE)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

Field of the Invention

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

Description of the Invention

The invention includes a unit to be mounted in the vehicle and a monitoring station. The unit in the vehicle includes a GPS receiver, and a transmitter which may transmit on the control band of the cellular telephone network, or, via a voice or other data channel of the cellular network, or other wireless communications network. For example, the transmitter could also be a satellite transmitter.

The GPS receiver determines the vehicle location. In addition, the GPS receiver may be connected to a controller which controls and/or performs a number of vehicle tracking and/or security functions. Wireless vehicle location determining devices and approaches other than GPS may also be used in some embodiments of the invention. For example, vehicle location systems based upon multiple receptions from adjacent cellular receivers can also be used.

The monitoring station is interfaced to the cellular telephone network, or other communications

network, to thereby communicate with the vehicle unit. In addition, the monitoring station is also connected to the Internet to provide a number of advantageous features including updating the user or other authority when away from the vehicle of the vehicle's position. These features and advantages are described in further detail below. The monitoring station may also be connected to the telephone network in order to provide various preprogrammed communications, such as to the user or other authority.

The system preferably implements one or more of the following features:

1. 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 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.

2. Detects an optional vehicle 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.

3. Detects an optional vehicle alarm systems 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.

4. 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 WEB site. The vehicle would be equipped with a security system as disclosed in U.S. Patent No. 5,654,688, for example, which determines an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

5. 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 max speed limit and duration thereof can be selected by the user.

6. 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 selectable by the user.

7. Detects 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.

8. 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 also preferably has access to a WEB or Internet site that will display a map and silently contact the vehicle to acquire it's current location, speed, direction of travel, and previous multiple locations with speeds, for example, the user's personal identification number (PIN) can be instantly activated

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by just a phone call. No additional installation is required.

Certain annual pre-pay package arrangement may be available. For example, up to 10 access entries per month can be provided on a low monthly billing of $4.90. Up to 30 access entries could be provided for $8.25 per month.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the WEB site. The user may control various vehicle functions remotely via the telephone or WEB 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 & installation is relatively inexpensive, and is on the order of about $190.00. 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 user a predetermined command (Command 7) 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 an embodiment of the vehicle unit are provided below as relating to use of red and green LED indicators operated by the system controller.

Red LED verification of GPS receiving signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:

Blinking = when searching GPS location.

Constant = found location.

Off = no GPS signal found.

With yellow wire not having positive 12 volts:

Off = LED not functioning.

Green LED verification of receiving the cell tower signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:

Blinking = Cell control channel signal is detected.

Constant = sending micro burst signal. Stays on 5-seconds after each time system is transmitting.

Off = no cell tower signal received.

With yellow wire not having positive 12 volts:

Off = LED not functioning.

An example of representative DIP switch feature selection is as follows. Switch 1 may be used for adding orange wire for controlling arm/disarming of system. When On, the orange wire controls arm/disarm as follows: to arm, Orange wire is grounded and Yellow wire does not have 12 volts positive. To disarm, the Orange wire is not grounded. When switch 1 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 orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until 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:

The Red Wire is connected to 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.

The Black Wire is connected to Ground.

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:

1. If the system is in an armed mode and Lat/Long changes, then Alert "A" is given.
2. 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".

3. If the DIP switch 1 is in the Off position then:

a. if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues the 500 ma ground.

b. if the yellow wire sees grounded 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 system is disarmed

The Gray Wire is for Input and Output, and can be connected to an alarm siren or horn positive terminal. In addition:

1. With 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 "B" alarm activation is given.

2. 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.

3. 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.

4. The Gray wire bypass operates as follows:

   a. After Alert warning "B" bypass all future Alert "B" until system is disarmed.

   b. After Alert warning "C" bypass all future Alert "C" until system is armed.

   c. After Alert warning "D" bypass all future Alert "D" until no 12 volt pulses are detected on the gray wire within 3 seconds of yellow wire having 12 volts.

5. With system armed or disarmed. The Output: Internal + 12v, 1 amp transistor with pulses 1 second on & 1 sec off to activate siren or honk car horn or flashing light relay.

   a. Non-stop activation from (Command "4")

   b. 30-second activation from (Command "5")

6. Turn off the above Alert "A" from (Command "1")

The Orange Wire is for the starter interrupt and arm/disarm system, and operates as follows:

1. If dip switch 1 is in the:

a. On position and:

i. the Orange wire has 12 volts or neutral, the system switches to the disarmed mode

ii. the Orange wire is grounded, then the system is switched to the armed mode

iii. and the starter interrupt output will not automatically operate. Can only be activated from "Command #4"

b. Off position and:

i. the Orange wire does not effect the arming or disarming of the system.

ii. 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.

2. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.

3. 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:

Green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6").

Red Wire provides a constant 12v output from the Red power wire.

Blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7")

Pink wire provides a 250ma., 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 Orange wire for 10-seconds (starter interrupt), with these circuits in sequence:

First: Activates Gray wire for 1-second. (siren/horn)

After first stops: Activates Green wire for 1 second to lock the doors.

After second stops: Activate Blue wire for 1 second to unlock the doors.

After third stops: Activate Pink wire for 1 second to activate optional item.

Representative warning alerts are as follows:

Alert Warning "A": Automatic activation of "Command 8" and the vehicle unit contacts monitor station to instantly call 3 phone numbers with the message "Your Vehicle is stolen please confirm then call 911 to advise police of web site 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" until the system is re-armed.

Alert Warning "B": 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.

Alert Warning "C": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle PANIC activated please confirm". This is with system disarmed and detecting the Gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After the first activation then this is bypassed until the ignition turns on again.

Alert Warning "D": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the this 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 yellow wire having seen 12 volts positive. All future alert "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts.

Alert Warning "E": 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 alert "E" are bypassed until:

1. First: More than 13.5 volts are detected on the red wire and

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2. Second: After yellow wire stops having positive voltage the red wire then must detects more than 12 volts.

Alert Warning "F": 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)

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) Web site to indicate present location and past events in memory.

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

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

b. 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 250ma. 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:

a) 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:

i) Once instantly.

ii) Once in 1 hour if at the same location.

iii) Once in 6 hours if at the same location.

iv) Once in 12 hours if at the same location.

v) Once every 24 hours if at the same location.

b) 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 contains 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:

a) 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 same then only update stationary total time.

b) If the GPS antenna is not receiving any signal:

  i) Then enter last known GPS location and with indication this was the last known GPS location before GPS signal stopped and how long no GPS signal was received. And enter GPS location in the on-hold file.

c) When vehicle is traveling above ###MPH for ##-minutes.

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

a) The user's vehicle has issued a stolen alert:

i) 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 Web site address and an identification number, such as the user's PIN, to allows the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

ii) 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.

b) 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.

c) 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 transmission 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 begins 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.

The device or unit may be initially manufactured and shipped without all of the features being fully functional. One advantage of this is to prevent the unit at will from sending messages when being initially installed and tested in the vehicle, thereby reducing potential false alarms and burdens on the communications system, as well as potential charges to the user. After the unit is fully installed, a communication or transmission from the monitoring center may be sent to the unit enabling one or more selected features, such as during registration during which information is conveyed to the monitoring center and payment is made or authorized by the user.

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 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 transmitting again until 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 labeled "Alert A".

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 transmitting again until 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 labeled "Alert B".

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 determined whether it is greater than zero (eg. greater than six volts)and less than a high value (eg. 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 vehicle is being serviced and battery is disconnected this will cause the battery voltage to 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

transmitting again until 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 labeled "Alert E".

Yet another advantageous feature of some embodiments of 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 that 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 of the invention 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.

Yet another advantageous feature of the invention relates to interfacing with a factory-installed security system. In accordance with this aspect of the invention, the purpose is to detect when the factory security or alarm system is triggered so

that the user can be notified when away from the vehicle using the capabilities of the tracking and security system described herein. The tracking system would include a voltage and/or current sensing circuit connected to detect repetitive battery spikes based upon an electrical item being turned on and off at the vehicle.

More particularly, with the with the GPS-2000 tracking system armed and the ignition key in the off condition, if the vehicle factory alarm becomes triggered, it causes the car horn and lights to flash and/or the horn to honk. Accordingly, the detector circuit can detect these indications as either dips in the voltage or increases in current flow from the vehicle battery. If these electrical events are detected for a predetermined minimum time of about 30 seconds, for example, and not longer than a predetermined maximum time of about 63 seconds, for example, the GPS-2000 tracker will send the vehicle alarm activated message.

The circuitry for detecting a voltage dip, for example, is of a type commonly included in other conventional vehicle security systems for other purposes, such as detecting tampering, for example. This detection circuitry needs no further description herein.

As will be readily appreciated by those skilled in the art, the reason for the minimum and maximum times is to avoid false alarms. For example, a similar electrical condition can be generated as the car radiator fan cycles on and off after the engine is turned off. By waiting the predetermined minimum time of about 30 seconds, the tracker would not falsely determine this to be operation of the factory security

system. Opening and closing of the car doors could also create a similar electrical system drain, but would be unlikely to extend for 30 seconds. Accordingly, the minimum time would also avoid a false alarm in this instance of opening and closing the vehicle doors.

The maximum predetermined time could be implemented to avoid flashing operation of the hazard lights, for example, from causing a false alarm. A typical factory alarm would flash the lights and/or honk the horn for about 60 seconds before stopping. Flashing of the hazard lights would likely be for more than about 63 seconds, for example. Accordingly, a false alarm indication based on operation of the hazard lights would also be avoided by the invention.

As will also be appreciated by those skilled in the art, different values for the minimum and maximum times are contemplated by the invention. In addition, in some embodiments only one of the minimum or maximum times may be used.

Another aspect of the invention relates to a user's ability to cancel further sequential notifications. More particularly, in response to an alarm alert, sequential notifications are typically given by sequentially calling a series of telephone numbers. In accordance with this aspect of the invention, the user who receives the call, may cancel any further notifications. In other words, the user can be prompted by voice messages to make a certain keypad entry to thereby cancel further notifications if desired. This can avoid additional telephone or system usage charges, and also reduces the possible nuisance of unnecessary calls to other persons.

Stopping further notifications upon merely determining that the telephone has been answered may be ineffective, since oftentimes an answering machine may receive the call. Accordingly, it may be preferred to have the user actively cancel further notifications, in contrast to merely stopping further calls upon determining that the telephone call has been completed.

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

Yet another aspect of the invention 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.

Still another aspect of the invention 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 ever 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.

In examples, 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.

Another aspect of the invention relates to having the capability to interface the tracker device with a siren and/or the vehicle horn. Typically the siren is locally connected to ground, such as in the engine compartment, and the output of the tracker unit would provide a positive supply voltage, eg. 12 volts, to drive the siren. Also typically, the vehicle horn is connected to the positive voltage supply, and pressing the horn switch connects the horn to the vehicle ground to thereby complete the circuit and sound the horn. In accordance with this aspect of the invention, the output drive of the tracker unit can be a single wire with pulses of alternating polarity.

More particularly, the output terminal or wire, eg. the gray wire as described above, supplies

pulses of alternating polarity. For example, a first pulse can be at the positive supply voltage, and a second pulse can be at the vehicle ground. Each pulse can be about one-half to one second long. The pulses can alternate in a series and with a slight spacing between adjacent pulses. In other security type systems, an intervening relay may be provided to provide for dual polarity capability. However, the tracker unit desirably monitors activation of the horn wire to determine whether the factory or aftermarket security controller is sounding an alarm. The intervening relay would prevent such a determination. Accordingly, the circuitry for providing the alternating polarity pulses of the invention provides the dual compatibility and also permits sensing of the horn activation as described above. Thus, the invention provides the dual compatibility with a single output wire or terminal, and requires no special installation.

Yet another aspect of the invention relates to power conservation and extending the protection period provided by the tracking device when the vehicle is not being used. The GPS receiver of the device may operate down to a supply voltage of about 3 volts, while the cellular radio portion may require a voltage of at least about 11 volts or 11.2 volts. The device will also typically include a back-up battery. The back-up battery may provide power when the vehicle battery is disconnected, such as by a would-be thief, or otherwise.

Typical vehicle security systems, for example, connect the back-up battery in parallel with the vehicle electrical system. Of course when the vehicle is operating, the vehicle battery and back-up battery are being charged by the alternator, which, in turn, is driven by the vehicle engine. When the vehicle is not used for a relatively long period of time, the voltage of both the back-up battery and the vehicle battery will gradually decay, such as based upon the receiver in the security system continuing to operate. Fortunately, however, the conventional vehicle security system may operate down to a voltage of about 6 volts. Accordingly, although the back-up battery voltage has decayed (along with the parallel connected vehicle battery), the relatively low operating voltage fo the security system is still typically sufficient to permit proper operation for a relatively long period of time.

The tracking device in accordance with the invention will typically include the cellular radio portion which requires a relatively high 11 volts or so to continue to operate. The tracking unit, despite various other power conserving features discussed herein, will still draw current. Accordingly, the voltage of the vehicle battery will also decay over time as the user is away from the vehicle. In accordance with this aspect of the invention, the back-up battery, however, is not continuously connected in parallel with the vehicle battery. Instead, the back-up battery is connected in parallel when the ignition key is on, for example, which will provide for charging of the back-up battery. Initially, when the vehicle is turned off, and the system armed, the back-up battery is not connected. Rather, the vehicle battery alone supplies the device initially. The back-up battery thus remains fully charged as it is not being drained by the load of the tracking device.

In one embodiment, if sufficient time passes, then the voltage of the battery will decay below a predetermined value, such as about 11.5 or 11.2 volts, for example. At this point, the back-up battery will be connected to the tracking device, and the vehicle battery will be disconnected. These voltage sensing and switching functions can be readily implemented using conventional circuits in the tracking device as will be appreciated by those skilled in the art. Accordingly, the tracking device can continue to operate normally for an additional period and at a sufficiently high voltage to permit the cellular radio to operate. Of course, as will be appreciated by those skilled in the art, this feature can be extended to other areas as well, especially where a vehicle device or circuit may require a relatively high operating voltage.

In other embodiments, if sufficient time passes, then the voltage of the battery will decay below a predetermined value, such as about 11.5 to 4-volts, for example. At this point, the back-up battery will stay disconnected from the tracking device, and the vehicle battery will stay connected. This allows the cellular radio to sleep at 11.5 volts and the GPS and other circuits to still operate from the vehicle battery to as low as 3-volts. Once an alert is detected from GPS or other circuits then the cellular radio is awakened and operates from the back-up battery, still at about 12-volts. These voltage sensing and switching functions can be readily implemented using conventional circuits in the tracking device as will be appreciated by those skilled in the art. Accordingly, the tracking device can continue to operate normally for alerts to be sent to the monitoring station for an additional period and at a sufficiently high voltage to permit the

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cellular radio to operate. Of course, as will be appreciated by those skilled in the art, this feature can be extended to other areas as well, especially where a vehicle device or circuit may require a relatively high operating voltage.

Yet another feature of the invention 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. More particularly, a typical arrangement may provide eight basic codes and two "wildcard" 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.

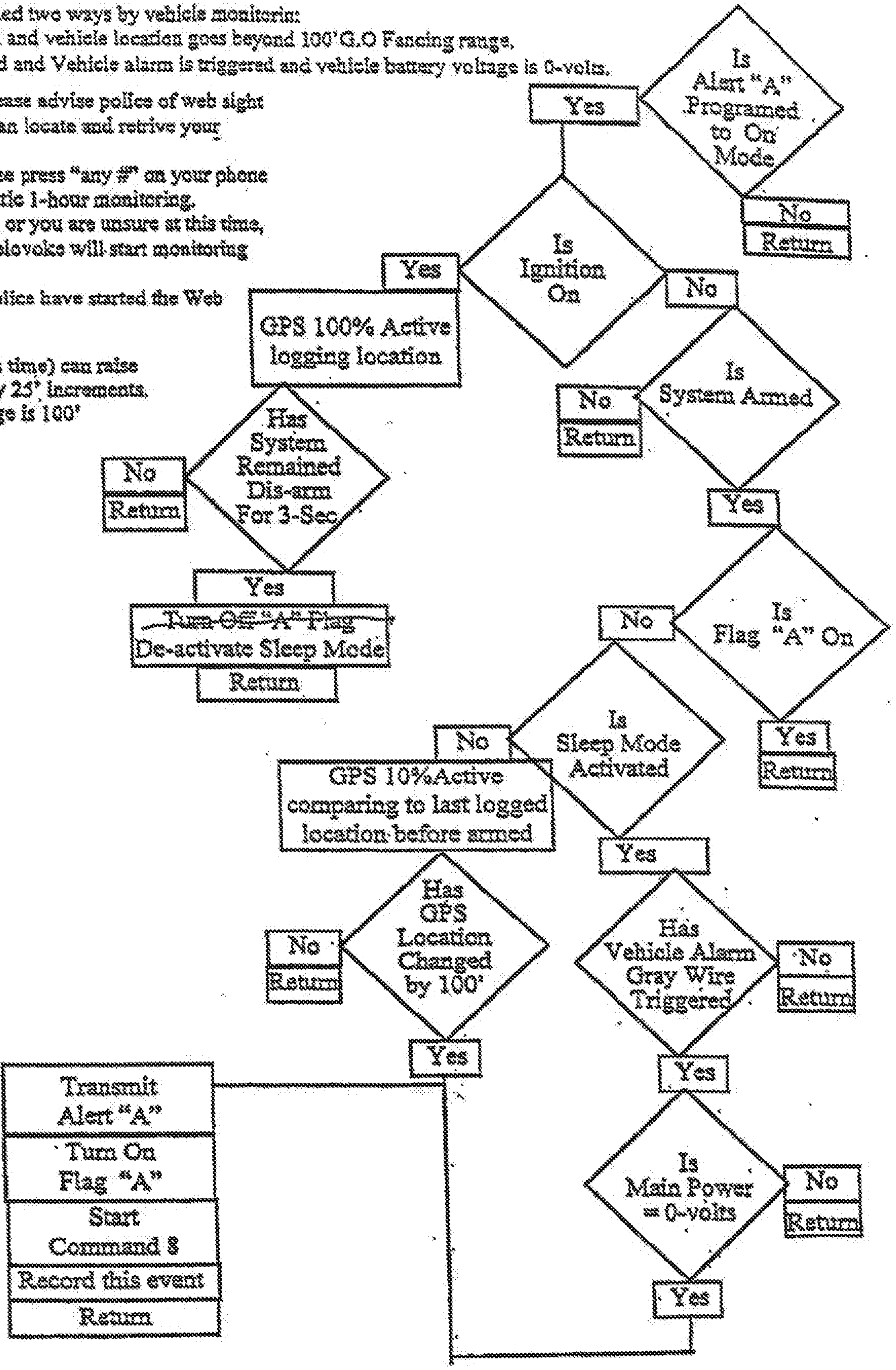
In accordance with this feature of the invention, the tracking device may respond differently to the same code or command depending upon the state or condition of the tracking device. For example, if an alarm is triggered at the vehicle, it may be desired that the tracking device continue to send the 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.

Alert "A" = Vehicle Stolen Alert

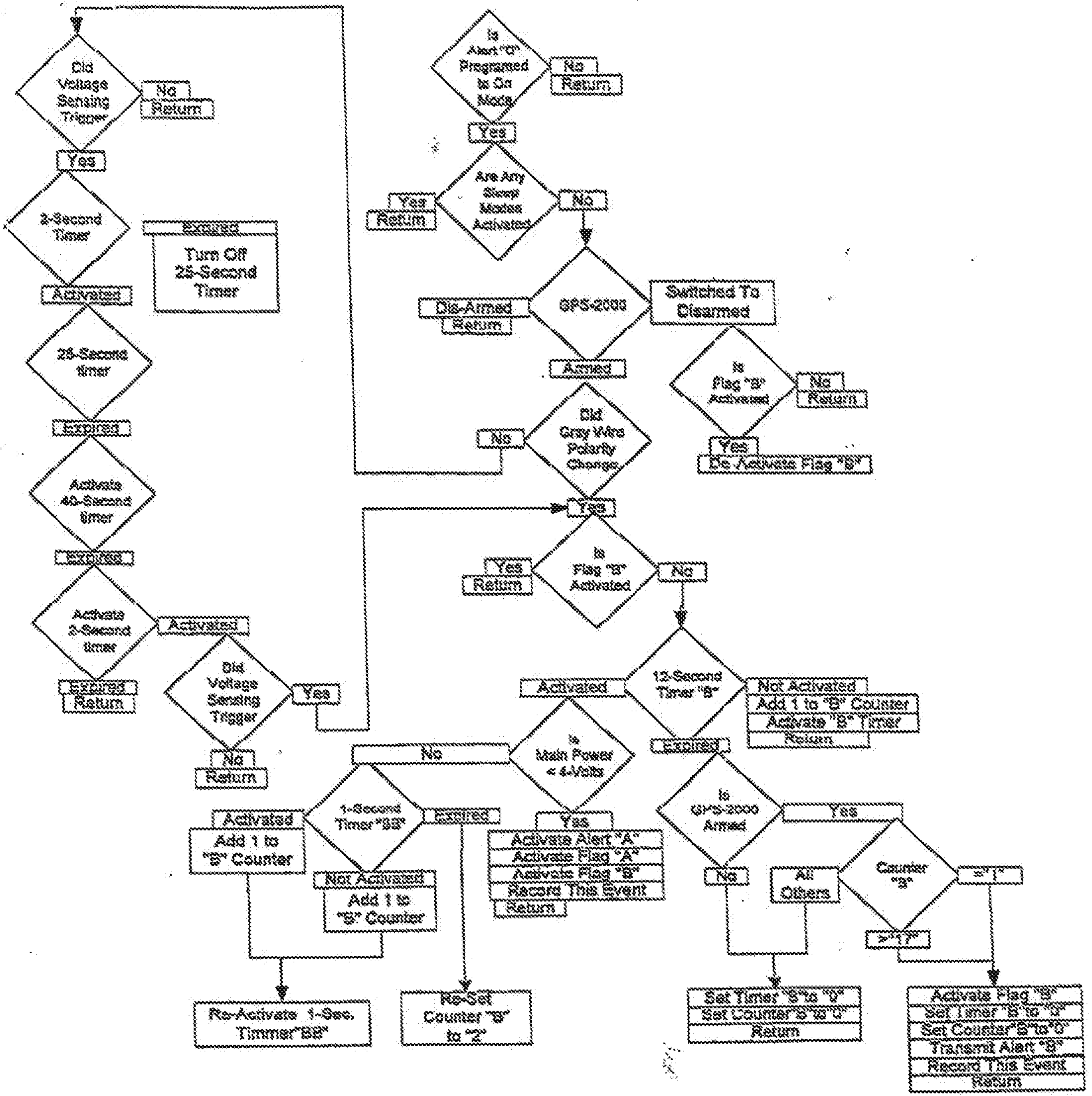
Vehicle stolen is determined two ways by vehicle monitorin:
1. Tracking system armed and vehicle location goes beyond 100' G.O Fencing range,
2. Tracking system Armed and Vehicle alarm is triggered and vehicle battery voltage is 0-volts.

Your vehicle is stolen, please advise police of web sight
and your pin# so police can locate and retrive your
vehicle.
If this is a false alert please press "any #" on your phone
now to deactivate automatic 1-hour monitoring.
If vehicle has been stolen or you are unsure at this time,
hang up an call police. Televoke will start monitoring
for upto
1-hour vehicle or until police have started the Web
monitoring.

Televoke (not user at this time) can raise
or lower G.O.Fencing by 25' increments.
G.O Fencing default range is 100'



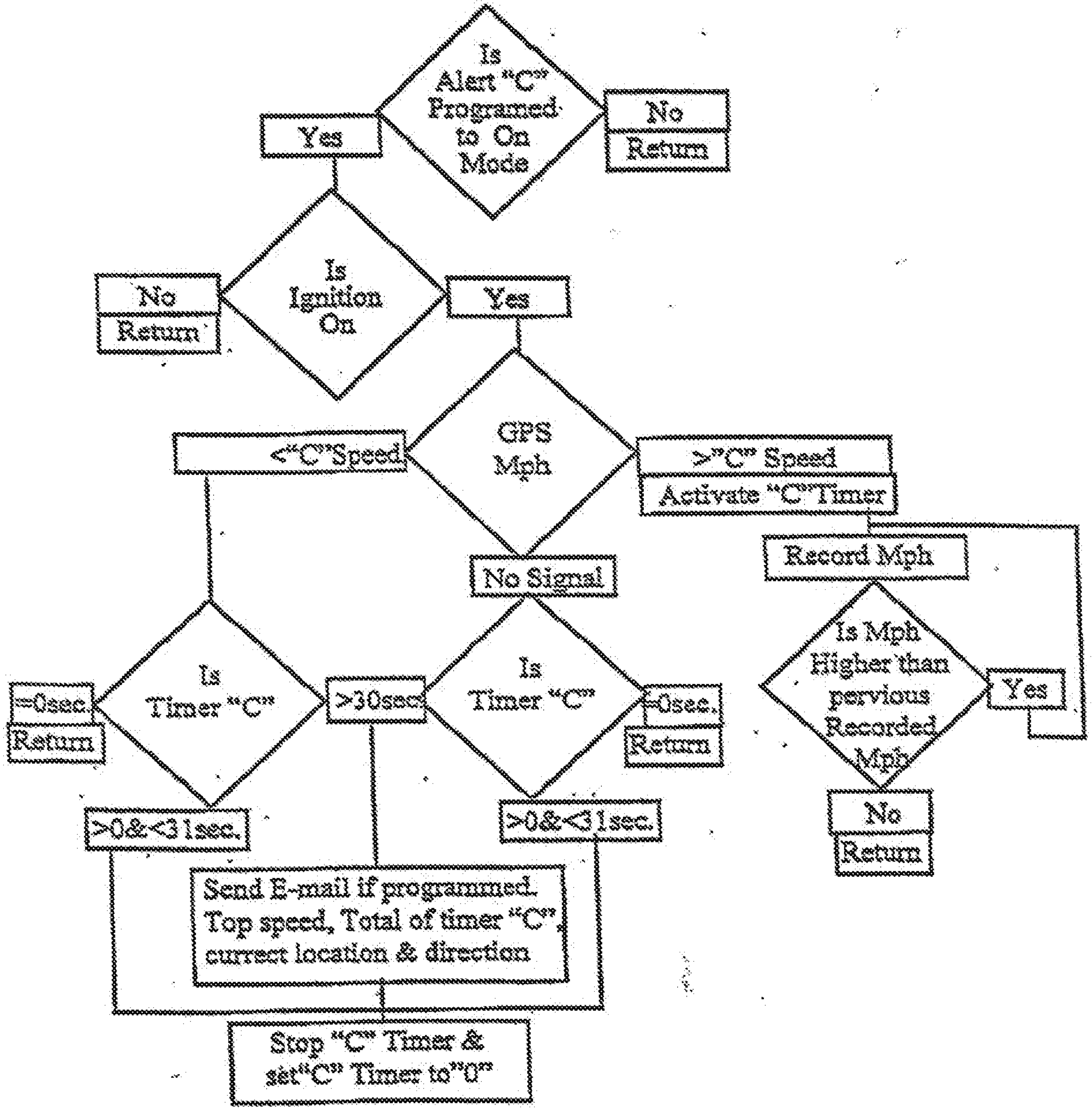
Alert "B" = Vehicle's Alarm Sounding



Your vehicle alarm activated is detected by counting the pularity changes within a set time.
One change = a siren was latched on for the set time of 12 seconds.
>17 changes = a car horn was pulsing on/off each time in less than one-second and after 12-seconds continues honking of 18 times = 9 horn hons no more than 1-second apart.
If the car batery power is removed during the 12-seconds then alert "A" is sent to inform the vehicle is being stolen.
One alert B is transmitted then GPS-200 will not send another alert till the GPS-2000 is disarmed and rearmed.

Alert "C" = Speeding Too Long Of Time

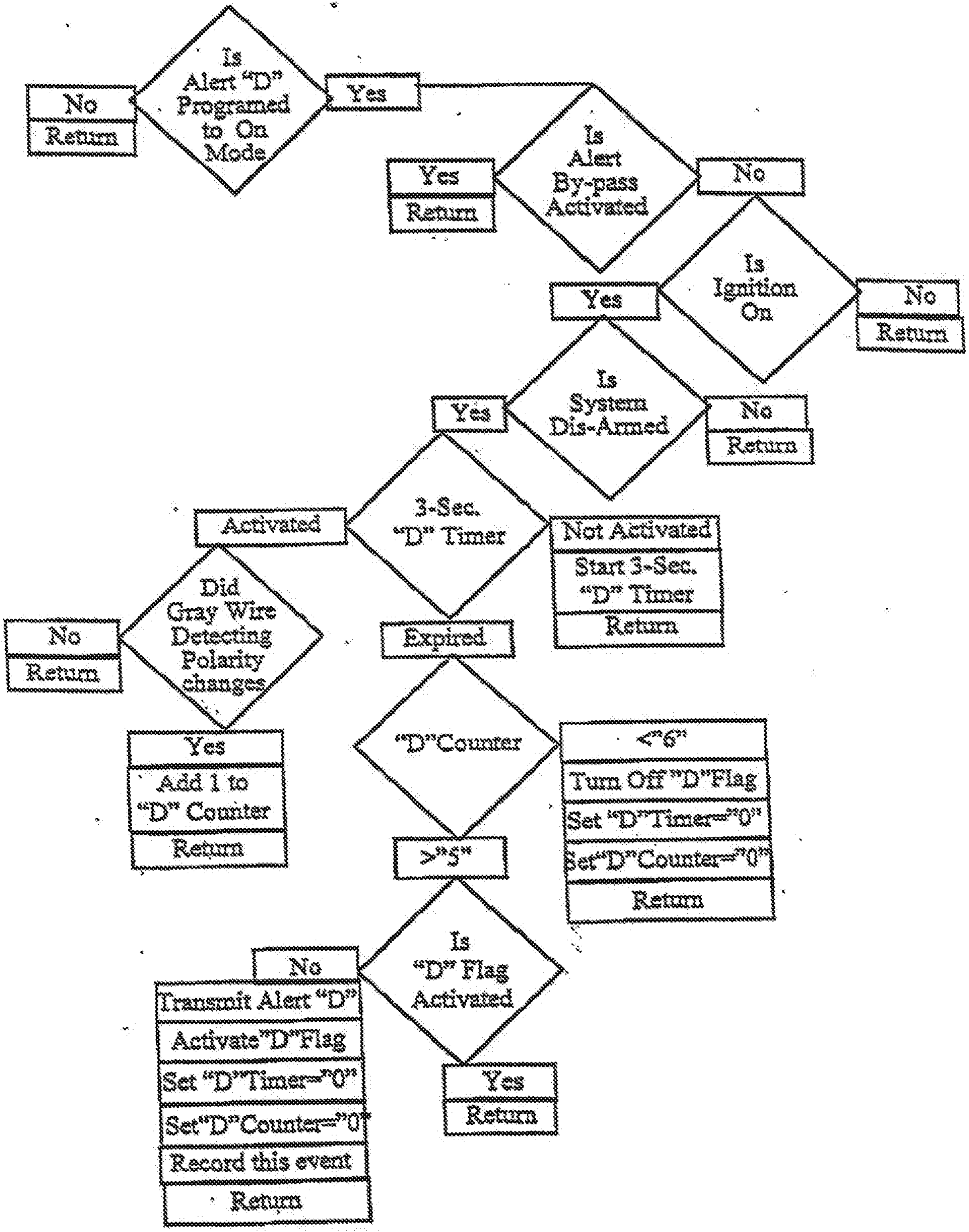
Vehicle was traveling faster than 80 m.p.h. for a longer time than 30 seconds. GPS indicates the speed.
If pre-programed to do so, records this as an event and will send e-mail instantly of Top speed, total time,direction and location speeding had stopped.
Alert "C" operation an be turned on or off by user
80 M.p.h. is default speed. Televoke (not user at this time) can raise or lower the speed by 5 m.p.h. increments.
30-seconds time is default. Televoke (not user at this time) can raise or lower the time by 5 minutes increments,


Is Alert "C" Programed to On Mode
Yes
No
Return
Is Ignition On
No
Return
Yes
GPS Mph
<"C"Speed
>"C" Speed
Activate "C"Timer
No Signal
Record Mph
Is Mph Higher than pervious Recorded Mph
Yes
No
Return
Is Timer "C"
=0sec.
Return
>30sec.
>0&<31sec.
Is Timer "C"
=0sec.
Return
>0&<31sec.
Send E-mail if programmed. Top speed, Total of timer "C", currect location & direction
Stop "C" Timer & set"C" Timer to"0"

Alert "D" = Unauthorized Transmitter Alert

Your vehicle was programmed to operate from a new ignition key or remote transmitter. Please take proper action. This alert will not be sent again till the vehicles alert signal stops.

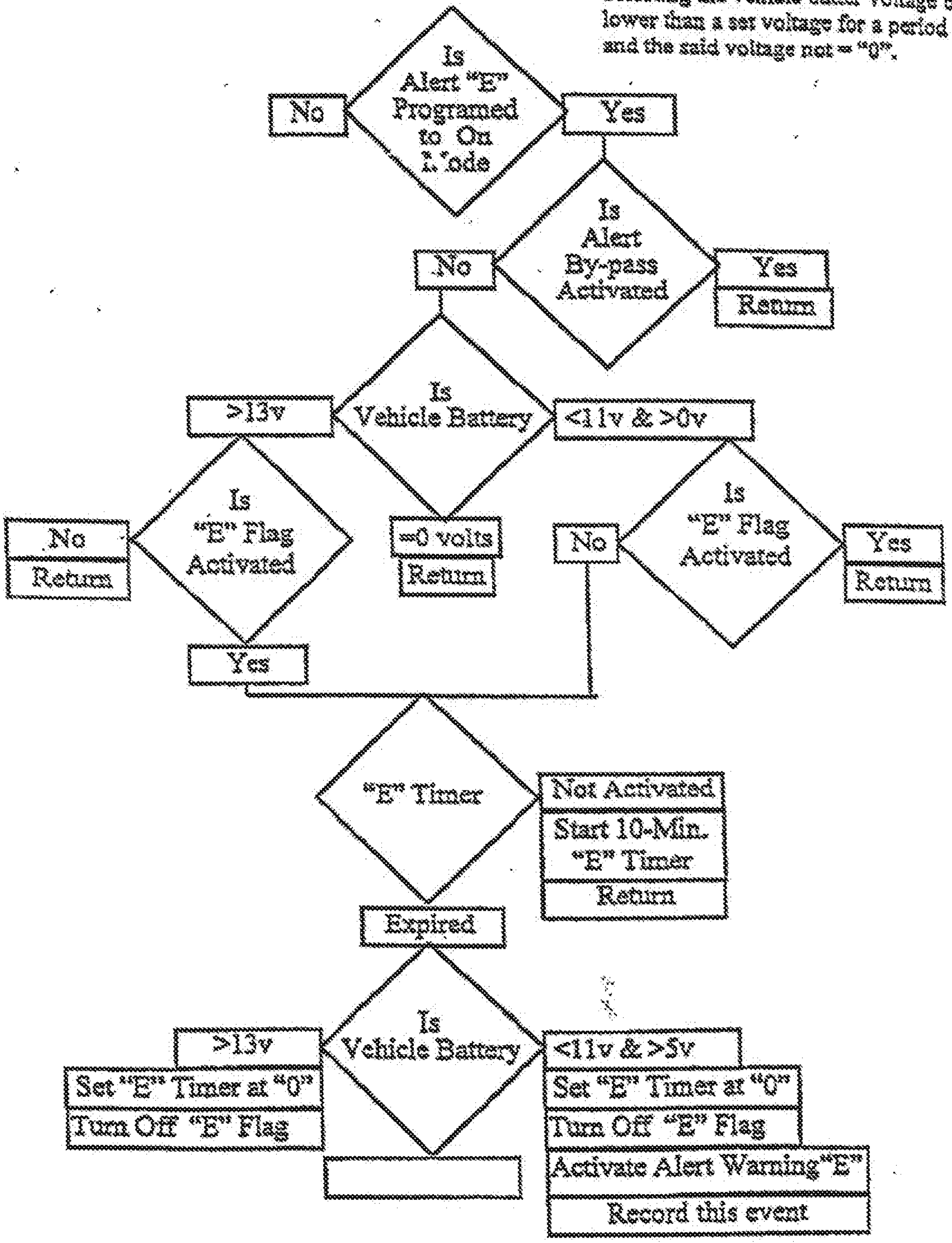
Unauthorized Transmitter Alert is activated when ignition key is turned on and detects a plurality of polarity changes on Gray wire within a set time. This Alert is prevented from activated again until said circuit returns to normal.



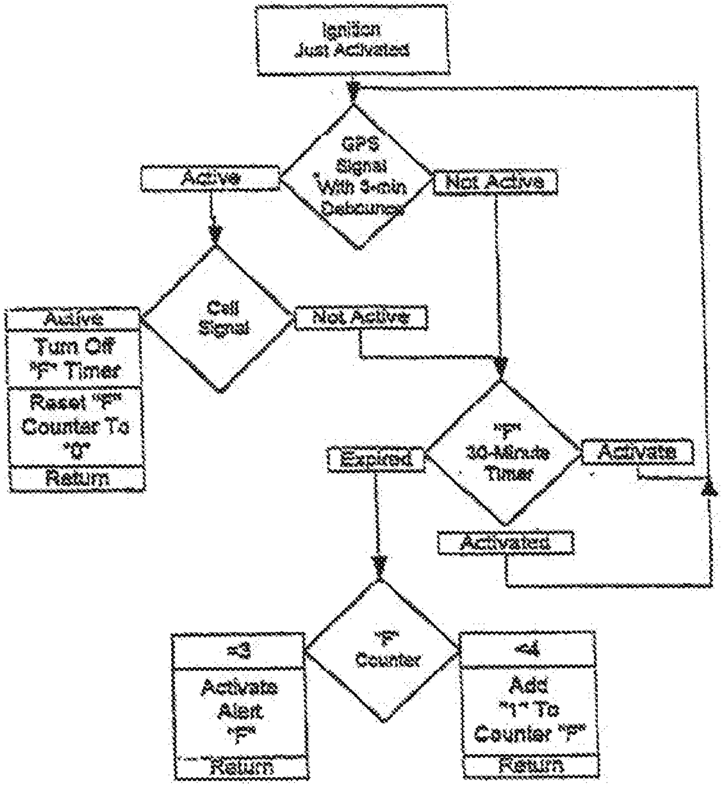
Alert "E" = Low Car Battery Power

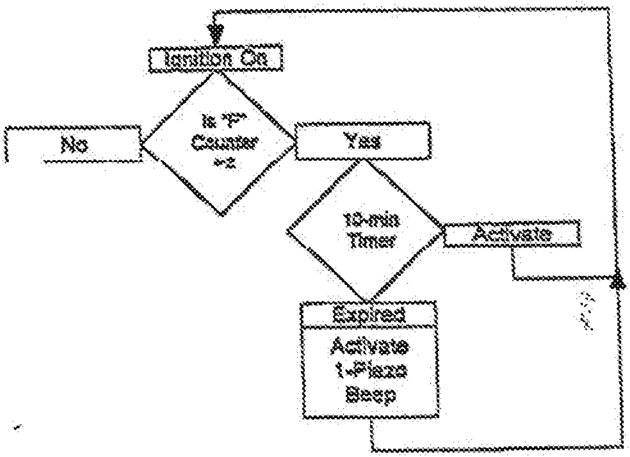
Your vehicle has a low battery voltage indication. Please take proper action. This alert will not be sent again until your vehicles battery has retained the proper voltage.

Low battery power Alert is activated by detecting the vehicle batter voltage being lower than a set voltage for a period of time and the said voltage not = "0".



Alert "F" = GPS / Cell not active Alert





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PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2)

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TITLE OF THE INVENTION (280 Characters Max)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

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ENCLOSED APPLICATION PARTS *(check all that apply)*

✓	Specification	*Number of Pages*	35	✓	Applicant qualifies as a Small Entity under 35 CFR under §§1.19 and 1.27
✓	Drawing(s)	*Number of Sheets*	6		Other (specify) ____________

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[ ] Additional inventors are being named on separately numbered sheets attached hereto.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
[✓] No. [ ] Yes

Respectfully Submitted,

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Date: December 22, 2000

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VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

Field of the Invention

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

Description of the Invention

The invention includes a unit to be mounted in the vehicle and a monitoring station. The unit in the vehicle includes a GPS receiver, and a transmitter which may transmit on the control band of the cellular telephone network, or, via a voice or other data channel of the cellular network, or other wireless communications network. For example, the transmitter could also be a satellite transmitter.

The GPS receiver determines the vehicle location. In addition, the GPS receiver may be connected to a controller which controls and/or performs a number of vehicle tracking and/or security functions. Wireless vehicle location determining devices and approaches other than GPS may also be used in some embodiments of the invention. For example, vehicle location systems based upon multiple receptions from adjacent cellular receivers can also be used.

The monitoring station is interfaced to the cellular telephone network, or other communications

network, to thereby communicate with the vehicle unit. In addition, the monitoring station is also connected to the Internet to provide a number of advantageous features including updating the user or other authority when away from the vehicle of the vehicle's position. These features and advantages are described in further detail below. The monitoring station may also be connected to the telephone network in order to provide various preprogrammed communications, such as to the user or other authority.

The system preferably implements one or more of the following features:

1. 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 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.

2. Detects an optional vehicle 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.

3. Detects an optional vehicle alarm systems 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.

4. 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 WEB site. The vehicle would be equipped with a security system as disclosed in U.S. Patent No. 5,654,688, for example, which determines an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

5. 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 max speed limit and duration thereof can be selected by the user.

6. 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 selectable by the user.

7. Detects 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.

8. 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 also preferably has access to a WEB or Internet site that will display a map and silently contact the vehicle to acquire it's current location, speed, direction of travel, and previous multiple locations with speeds, for example, the user's personal identification number (PIN) can be instantly activated

by just a phone call. No additional installation is required.

Certain annual pre-pay package arrangement may be available. For example, up to 10 access entries per month can be provided on a low monthly billing of $4.90. Up to 30 access entries could be provided for $8.25 per month.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the WEB site. The user may control various vehicle functions remotely via the telephone or WEB 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 & installation is relatively inexpensive, and is on the order of about $190.00. 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 user a predetermined command (Command 7) 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 an embodiment of the vehicle unit are provided below as relating to use of red and green LED indicators operated by the system controller.

Red LED verification of GPS receiving signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
- Blinking = when searching GPS location.
- Constant = found location.
- Off = no GPS signal found.

With yellow wire not having positive 12 volts:
- Off = LED not functioning.

Green LED verification of receiving the cell tower signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
- Blinking = Cell control channel signal is detected.
- Constant = sending micro burst signal. Stays on 5-seconds after each time system is transmitting.
- Off = no cell tower signal received.

With yellow wire not having positive 12 volts:
- Off = LED not functioning.

An example of representative DIP switch feature selection is as follows. Switch 1 may be used for adding orange wire for controlling arm/disarming of system. When On, the orange wire controls arm/disarm as follows: to arm, Orange wire is grounded and Yellow wire does not have 12 volts positive. To disarm, the Orange wire is not grounded. When switch 1 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 orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until 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:

The Red Wire is connected to 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.

The Black Wire is connected to Ground.

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:

1. If the system is in an armed mode and Lat/Long changes, then Alert "A" is given.
2. 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".

3. If the DIP switch 1 is in the Off position then:

a. if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues the 500 ma ground.

b. if the yellow wire sees grounded 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 system is disarmed

The Gray Wire is for Input and Output, and can be connected to an alarm siren or horn positive terminal. In addition:

1. With 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 "B" alarm activation is given.

2. 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.

3. 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.

4. The Gray wire bypass operates as follows:
    a. After Alert warning "B" bypass all future Alert "B" until system is disarmed.
    b. After Alert warning "C" bypass all future Alert "C" until system is armed.
    c. After Alert warning "D" bypass all future Alert "D" until no 12 volt pulses are detected on the gray wire within 3 seconds of yellow wire having 12 volts.

5. With system armed or disarmed. The Output: Internal + 12v, 1 amp transistor with pulses 1 second on & 1 sec off to activate siren or honk car horn or flashing light relay.
    a. Non-stop activation from (Command "4")
    b. 30-second activation from (Command "5")

6. Turn off the above Alert "A" from (Command "1")

The Orange Wire is for the starter interrupt and arm/disarm system, and operates as follows:

1. If dip switch 1 is in the:

a. On position and:
  i. the Orange wire has 12 volts or neutral, the system switches to the disarmed mode
  ii. the Orange wire is grounded, then the system is switched to the armed mode
  iii. and the starter interrupt output will not automatically operate. Can only be activated from "Command #4"

b. Off position and:
  i. the Orange wire does not effect the arming or disarming of the system.
  ii. 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.

2. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.

3. 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:

Green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6").

Red Wire provides a constant 12v output from the Red power wire.

Blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7")

Pink wire provides a 250ma., 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 Orange wire for 10-seconds (starter interrupt), with these circuits in sequence:

First: Activates Gray wire for 1-second. (siren/horn)

After first stops: Activates Green wire for 1 second to lock the doors.

After second stops: Activate Blue wire for 1 second to unlock the doors.

After third stops: Activate Pink wire for 1 second to activate optional item.

Representative warning alerts are as follows:

Alert Warning "A": Automatic activation of "Command 8" and the vehicle unit contacts monitor station to instantly call 3 phone numbers with the message "Your Vehicle is stolen please confirm then call 911 to advise police of web site 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" until the system is re-armed.

Alert Warning "B": 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.

Alert Warning "C": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle PANIC activated please confirm". This is with system disarmed and detecting the Gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After the first activation then this is bypassed until the ignition turns on again.

Alert Warning "D": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the this 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 yellow wire having seen 12 volts positive. All future alert "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts.

Alert Warning "E": 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 alert "E" are bypassed until:

1. First: More than 13.5 volts are detected on the red wire and

2. Second: After yellow wire stops having positive voltage the red wire then must detects more than 12 volts.

Alert Warning "F": 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)

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) Web site to indicate present location and past events in memory.
Command 4:	(Hijack or Stolen) monitoring station Command to vehicle system to activate:

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

b. 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 250ma. 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:

a) 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:

i) Once instantly.

ii) Once in 1 hour if at the same location.

iii) Once in 6 hours if at the same location.

iv) Once in 12 hours if at the same location.

v) Once every 24 hours if at the same location.

b) 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 contains 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:

- a) 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 same then only update stationary total time.
- b) If the GPS antenna is not receiving any signal:
  - i) Then enter last known GPS location and with indication this was the last known GPS location before GPS signal stopped and how long no GPS signal was received. And enter GPS location in the on-hold file.
- c) When vehicle is traveling above ###MPH for ##-minutes.

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

a) The user's vehicle has issued a stolen alert:

i) 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 Web site address and an identification number, such as the user's PIN, to allows the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

ii) 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.

b) 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.

c) 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 transmission 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 begins 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.

The device or unit may be initially manufactured and shipped without all of the features being fully functional. One advantage of this is to prevent the unit at will from sending messages when being initially installed and tested in the vehicle, thereby reducing potential false alarms and burdens on the communications system, as well as potential charges to the user. After the unit is fully installed, a communication or transmission from the monitoring center may be sent to the unit enabling one or more selected features, such as during registration during which information is conveyed to the monitoring center and payment is made or authorized by the user.

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 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 transmitting again until 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 labeled "Alert A".

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 transmitting again until 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 labeled "Alert B".

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 determined whether it is greater than zero (eg. greater than six volts)and less than a high value (eg. 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 vehicle is being serviced and battery is disconnected this will cause the battery voltage to 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

transmitting again until 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 labeled "Alert E".

Yet another advantageous feature of some embodiments of 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 that 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 of the invention 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.

Yet another advantageous feature of the invention relates to interfacing with a factory-installed security system. In accordance with this aspect of the invention, the purpose is to detect when the factory security or alarm system is triggered so

that the user can be notified when away from the vehicle using the capabilities of the tracking and security system described herein. The tracking system would include a voltage and/or current sensing circuit connected to detect repetitive battery spikes based upon an electrical item being turned on and off at the vehicle.

More particularly, with the with the GPS-2000 tracking system armed and the ignition key in the off condition, if the vehicle factory alarm becomes triggered, it causes the car horn and lights to flash and/or the horn to honk. Accordingly, the detector circuit can detect these indications as either dips in the voltage or increases in current flow from the vehicle battery. If these electrical events are detected for a predetermined minimum time of about 30 seconds, for example, and not longer than a predetermined maximum time of about 63 seconds, for example, the GPS-2000 tracker will send the vehicle alarm activated message.

The circuitry for detecting a voltage dip, for example, is of a type commonly included in other conventional vehicle security systems for other purposes, such as detecting tampering, for example. This detection circuitry needs no further description herein.

As will be readily appreciated by those skilled in the art, the reason for the minimum and maximum times is to avoid false alarms. For example, a similar electrical condition can be generated as the car radiator fan cycles on and off after the engine is turned off. By waiting the predetermined minimum time of about 30 seconds, the tracker would not falsely determine this to be operation of the factory security

system. Opening and closing of the car doors could also create a similar electrical system drain, but would be unlikely to extend for 30 seconds. Accordingly, the minimum time would also avoid a false alarm in this instance of opening and closing the vehicle doors.

The maximum predetermined time could be implemented to avoid flashing operation of the hazard lights, for example, from causing a false alarm. A typical factory alarm would flash the lights and/or honk the horn for about 60 seconds before stopping. Flashing of the hazard lights would likely be for more than about 63 seconds, for example. Accordingly, a false alarm indication based on operation of the hazard lights would also be avoided by the invention.

As will also be appreciated by those skilled in the art, different values for the minimum and maximum times are contemplated by the invention. In addition, in some embodiments only one of the minimum or maximum times may be used.

Another aspect of the invention relates to a user's ability to cancel further sequential notifications. More particularly, in response to an alarm alert, sequential notifications are typically given by sequentially calling a series of telephone numbers. In accordance with this aspect of the invention, the user who receives the call, may cancel any further notifications. In other words, the user can be prompted by voice messages to make a certain keypad entry to thereby cancel further notifications if desired. This can avoid additional telephone or system usage charges, and also reduces the possible nuisance of unnecessary calls to other persons.

Stopping further notifications upon merely determining that the telephone has been answered may be ineffective, since oftentimes an answering machine may receive the call. Accordingly, it may be preferred to have the user actively cancel further notifications, in contrast to merely stopping further calls upon determining that the telephone call has been completed.

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

Yet another aspect of the invention 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.

Still another aspect of the invention 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 ever 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.

In examples, 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.

Another aspect of the invention relates to having the capability to interface the tracker device with a siren and/or the vehicle horn. Typically the siren is locally connected to ground, such as in the engine compartment, and the output of the tracker unit would provide a positive supply voltage, eg. 12 volts, to drive the siren. Also typically, the vehicle horn is connected to the positive voltage supply, and pressing the horn switch connects the horn to the vehicle ground to thereby complete the circuit and sound the horn. In accordance with this aspect of the invention, the output drive of the tracker unit can be a single wire with pulses of alternating polarity.

More particularly, the output terminal or wire, eg. the gray wire as described above, supplies

pulses of alternating polarity. For example, a first pulse can be at the positive supply voltage, and a second pulse can be at the vehicle ground. Each pulse can be about one-half to one second long. The pulses can alternate in a series and with a slight spacing between adjacent pulses. In other security type systems, an intervening relay may be provided to provide for dual polarity capability. However, the tracker unit desirably monitors activation of the horn wire to determine whether the factory or aftermarket security controller is sounding an alarm. The intervening relay would prevent such a determination. Accordingly, the circuitry for providing the alternating polarity pulses of the invention provides the dual compatibility and also permits sensing of the horn activation as described above. Thus, the invention provides the dual compatibility with a single output wire or terminal, and requires no special installation.

Yet another aspect of the invention relates to power conservation and extending the protection period provided by the tracking device when the vehicle is not being used. The GPS receiver of the device may operate down to a supply voltage of about 3 volts, while the cellular radio portion may require a voltage of at least about 11 volts or 11.2 volts. The device will also typically include a back-up battery. The back-up battery may provide power when the vehicle battery is disconnected, such as by a would-be thief, or otherwise.

Typical vehicle security systems, for example, connect the back-up battery in parallel with the vehicle electrical system. Of course when the vehicle is operating, the vehicle battery and back-up battery are being charged by the alternator, which, in turn, is driven by the vehicle engine. When the vehicle is not used for a relatively long period of time, the voltage of both the back-up battery and the vehicle battery will gradually decay, such as based upon the receiver in the security system continuing to operate. Fortunately, however, the conventional vehicle security system may operate down to a voltage of about 6 volts. Accordingly, although the back-up battery voltage has decayed (along with the parallel connected vehicle battery), the relatively low operating voltage fo the security system is still typically sufficient to permit proper operation for a relatively long period of time.

The tracking device in accordance with the invention will typically include the cellular radio portion which requires a relatively high 11 volts or so to continue to operate. The tracking unit, despite various other power conserving features discussed herein, will still draw current. Accordingly, the voltage of the vehicle battery will also decay over time as the user is away from the vehicle. In accordance with this aspect of the invention, the back-up battery, however, is not continuously connected in parallel with the vehicle battery. Instead, the back-up battery is connected in parallel when the ignition key is on, for example, which will provide for charging of the back-up battery. Initially, when the vehicle is turned off, and the system armed, the back-up battery is not connected. Rather, the vehicle battery alone supplies the device initially. The back-up battery thus remains fully charged as it is not being drained by the load of the tracking device.

In one embodiment, if sufficient time passes, then the voltage of the battery will decay below a predetermined value, such as about 11.5 or 11.2 volts, for example. At this point, the back-up battery will be connected to the tracking device, and the vehicle battery will be disconnected. These voltage sensing and switching functions can be readily implemented using conventional circuits in the tracking device as will be appreciated by those skilled in the art. Accordingly, the tracking device can continue to operate normally for an additional period and at a sufficiently high voltage to permit the cellular radio to operate. Of course, as will be appreciated by those skilled in the art, this feature can be extended to other areas as well, especially where a vehicle device or circuit may require a relatively high operating voltage.

In other embodiments, if sufficient time passes, then the voltage of the battery will decay below a predetermined value, such as about 11.5 to 4-volts, for example. At this point, the back-up battery will stay disconnected from the tracking device, and the vehicle battery will stay connected. This allows the cellular radio to sleep at 11.5 volts and the GPS and other circuits to still operate from the vehicle battery to as low as 3-volts. Once an alert is detected from GPS or other circuits then the cellular radio is awakened and operates from the back-up battery, still at about 12-volts. These voltage sensing and switching functions can be readily implemented using conventional circuits in the tracking device as will be appreciated by those skilled in the art. Accordingly, the tracking device can continue to operate normally for alerts to be sent to the monitoring station for an additional period and at a sufficiently high voltage to permit the cellular radio to operate. Of course, as will be appreciated by those skilled in the art, this feature can be extended to other areas as well, especially where a vehicle device or circuit may require a relatively high operating voltage.

Yet another feature of the invention 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. More particularly, a typical arrangement may provide eight basic codes and two "wildcard" 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 of the invention, 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 of the invention, 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, an alert may be generated based upon the vehicle detecting an acceleration beyond a predetermined level. The vehicle acceleration could readily be determined by a relatively inexpensive acceleration sensor as will be appreciated by those skilled in the art. The acceleration could also be calculated by speedometer information. Decelerations, or negative accelerations, could also be used to trigger an alert. The acceleration generated alert could be used to reduce wear and tear on the vehicle or to discourage aggressive driving and especially Drag Racing . The acceleration alert need not be generated and sent immediately, but could be sent with position information, since a user may not need realtime notification of the acceleration limit being exceeded.

Yet another aspect of the invention is directed to ensuring that car owners will activate the monitoring service from the beginning and not wait months or years until the vehicle is stolen, for example, to then activation the system in an attempt to avoid monthly service charges. When power is initially connected to the device it will communicate with the cellular equipment. Unfortunately, it may be virtually impossible to sort out all of the communications traffic to determine when someone has obtained a vehicle with the unit, but has not fully registered or subscribed to the service. In accordance with this aspect of the invention, a driver annoyance may be triggered to encourage the driver or owner to register the unit and begin paying the monthly service fees. For example, an annoying chirp could be generated every ten minutes when the vehicle ignition is on. Alternately or additionally a visual annoyance could also be provided. The audio chirp could be readily provided by a small piezoelectric indicator carried by the device.

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.

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. Patent Nos. 5,719,551 and 6,011,460 assigned to the assignee of the present invention.

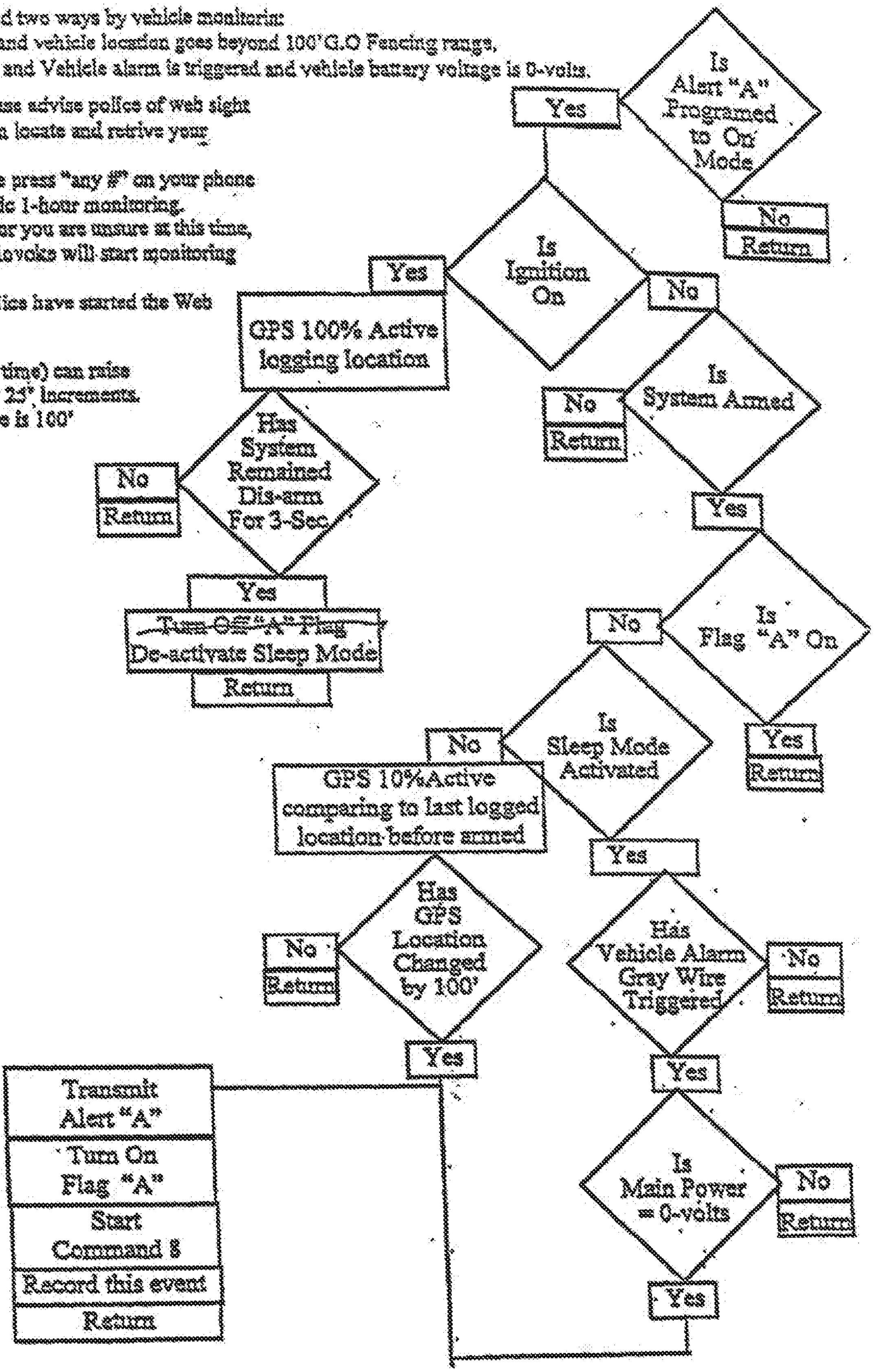
Alert "A" = Vehicle Stolen Alert

Vehicle stolen is determined two ways by vehicle monitorin:

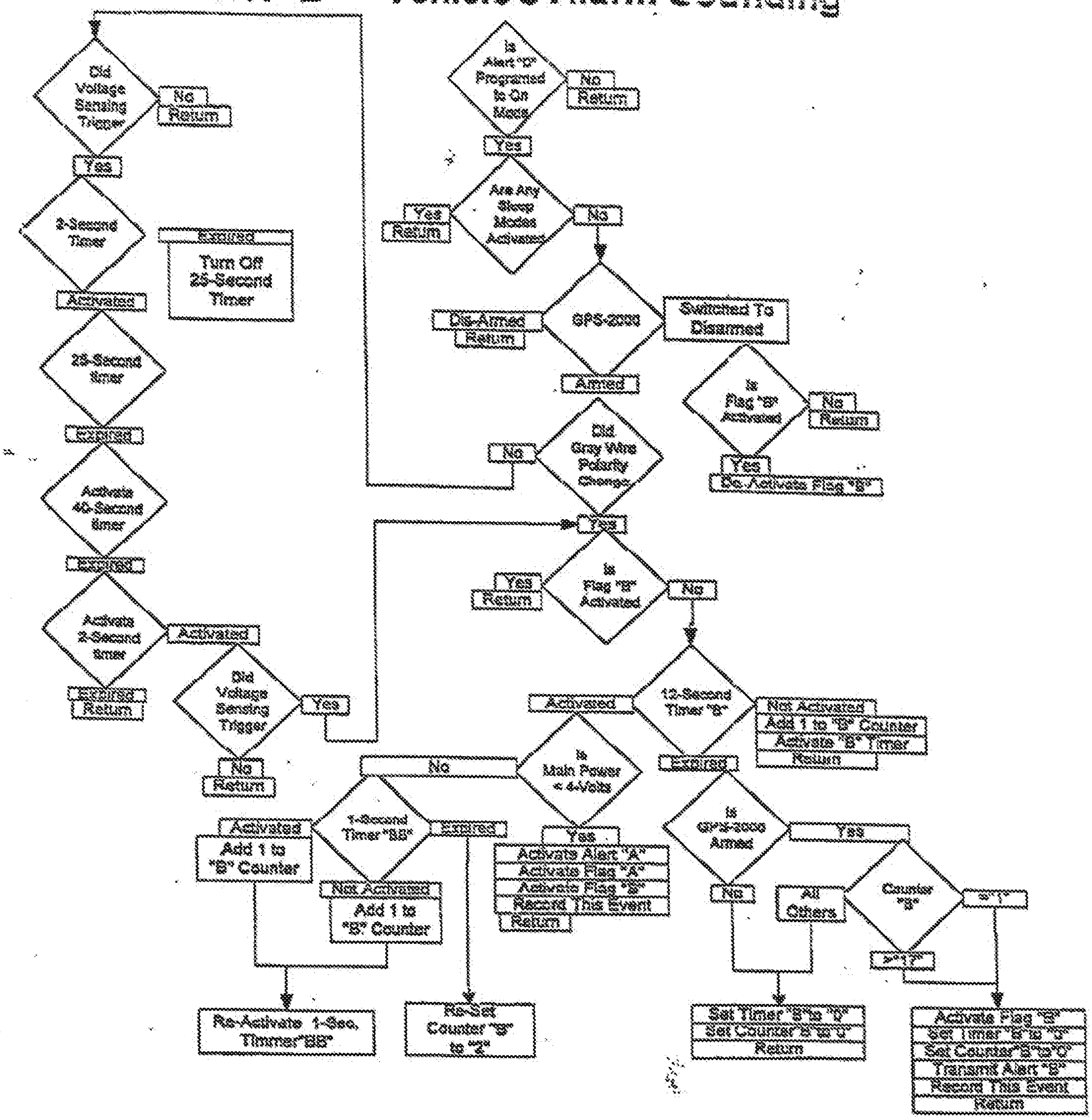
1. Tracking system armed and vehicle location goes beyond 100' G.O Fencing range.
2. Tracking system Armed and Vehicle alarm is triggered and vehicle battery voltage is 0-volts.

Your vehicle is stolen, please advise police of web sight and your pin# so police can locate and retrive your vehicle.
If this is a false alert please press "any #" on your phone now to deactivate automatic 1-hour monitoring.
If vehicle has been stolen or you are unsure at this time, hang up an call police. Televoke will start monitoring for upto
1-hour vehicle or until police have started the Web monitoring.

Televoke (not user at this time) can raise or lower G.O.Fencing by 25' increments.
G.O Fencing default range is 100'



Alert "B" = Vehicle's Alarm Sounding



Your vehicle alarm activated is detected by counting the pularity changes within a set time.

One change = a siren was latched on for the set time of 12 seconds.

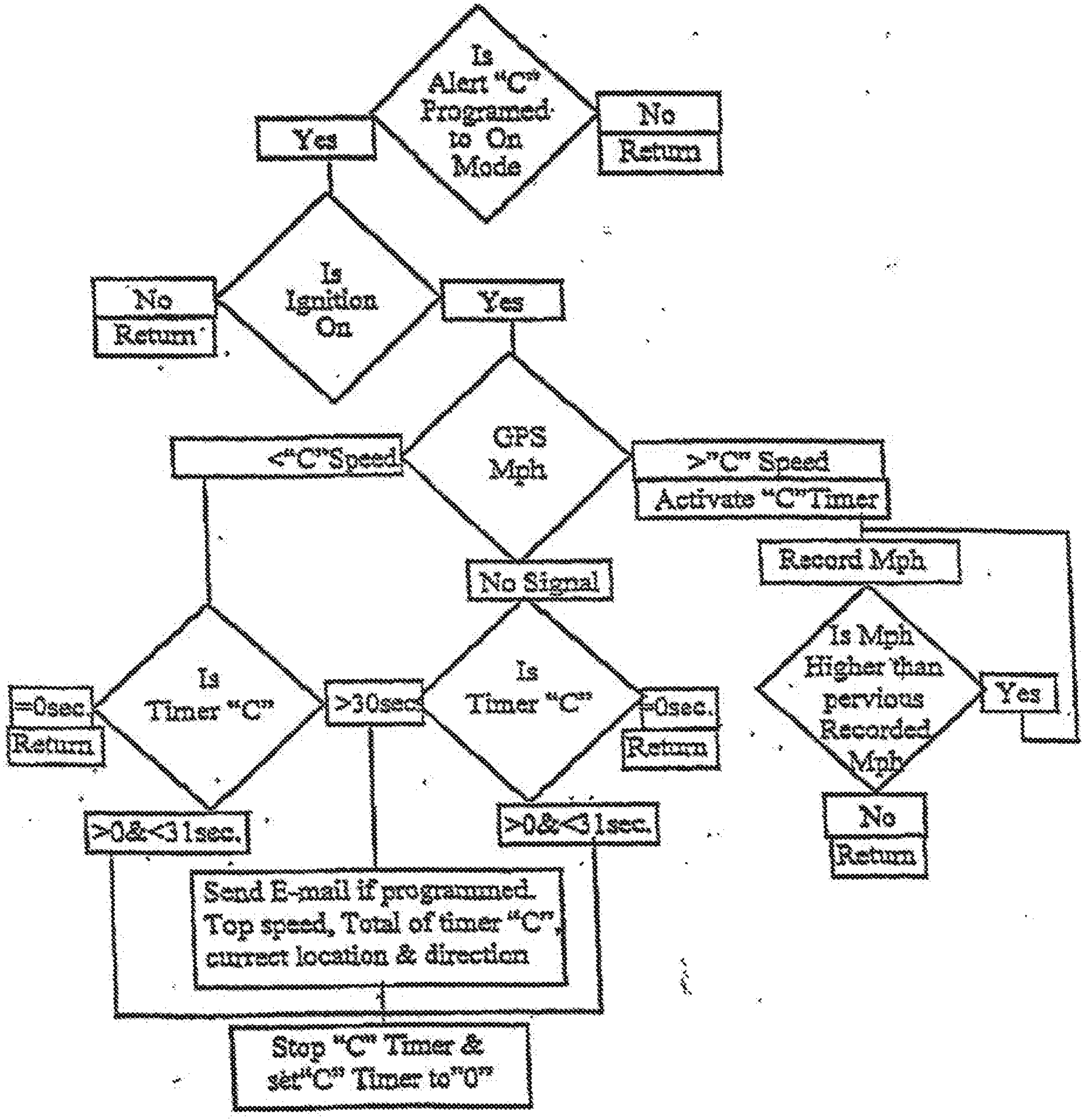
>17 changes = a car horn was pulsing on/off each time in less than one-second and after 12-seconds continues honking of 18 times = 9 horn hons no more than 1-second apart.

If the car batery power is removed during the 12-seconds then alert "A" is sent to inform the vehicle is being stolen.

One alert B is transmitted then GPS-200 will not send another alert till the GPS-2000 is disarmed and reamed.

Alert “C” = Speeding Too Long Of Time

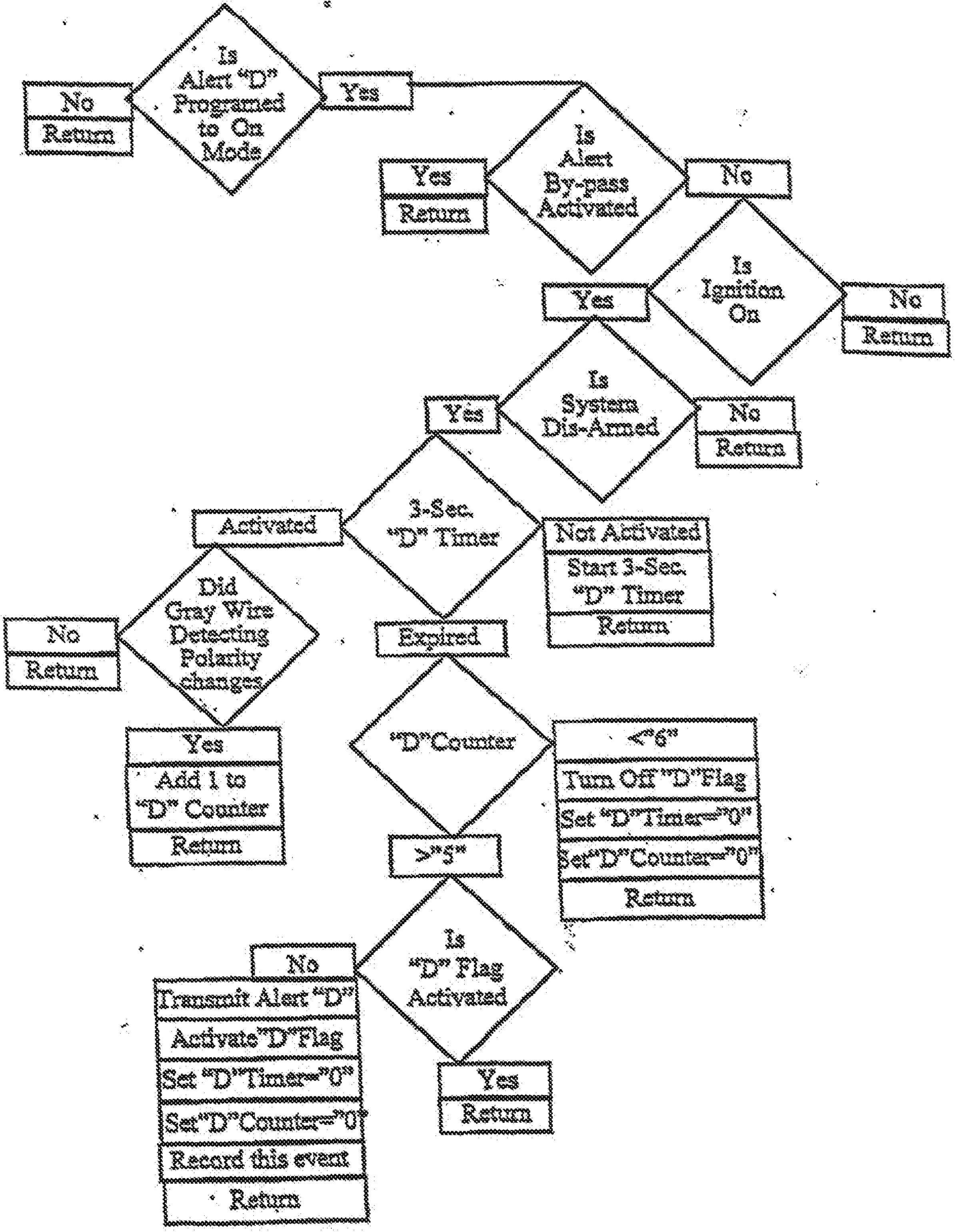
Vehicle was traveling faster than 80 m.p.h. for a longer time than 30 seconds. GPS indicates the speed.
If pre-programed to do so, records this as an event and will send e-mail instantly of Top speed, total time,direction and location speeding had stopped.
Alert “C” operation an be turned on or off by user
80 M.p.h. is default speed. Televoke (not user at this time) can raise or lower the speed by 5 m.p.h. increments.
30-seconds time is default. Televoke (not user at this time) can raise or lower the time by 5 minutes increments,


Is Alert “C” Programed to On Mode
Yes
No
Return
Is Ignition On
No
Return
Yes
GPS Mph
<“C”Speed
>”C” Speed
Activate “C”Timer
Record Mph
No Signal
Is Mph Higher than pervious Recorded Mph
Yes
No
Return
Is Timer “C”
=0sec.
Return
>30sec
Is Timer “C”
=0sec.
Return
>0&<31sec.
>0&<31sec.
Send E-mail if programmed. Top speed, Total of timer “C”, currect location & direction
Stop “C” Timer & set“C” Timer to”0”

Alert "D" = Unauthorized Transmitter Alert

Your vehicle was programmed to operate from a new ignition key or remote transmitter. Please take proper action. This alert will not be sent again till the vehicles alert signal stops.

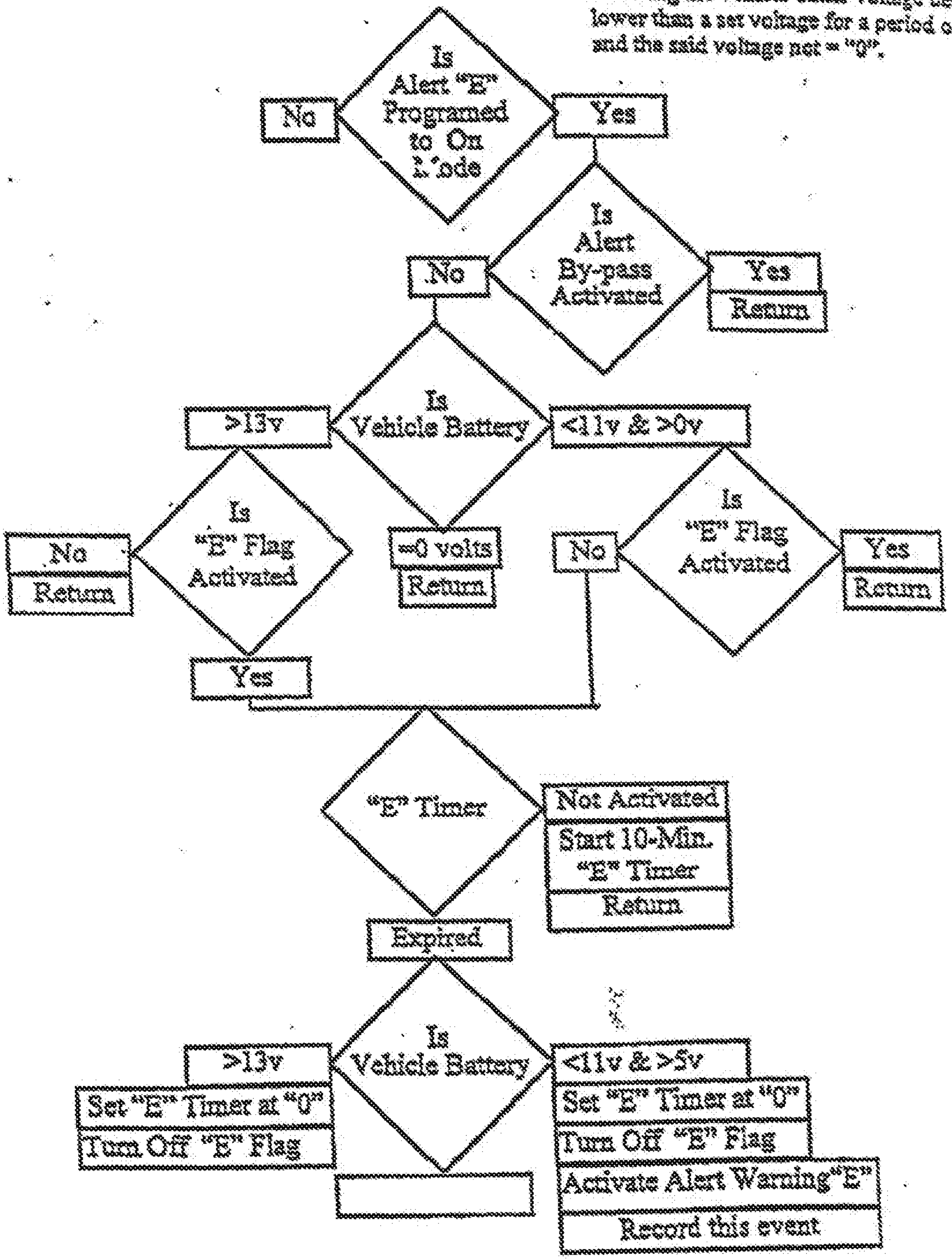
Unauthorized Transmitter Alert is activated when ignition key is turned on and detects a plurality of polarity changes on Gray wire within a set time. This Alert is prevented from activated again until said circuit returns to normal.



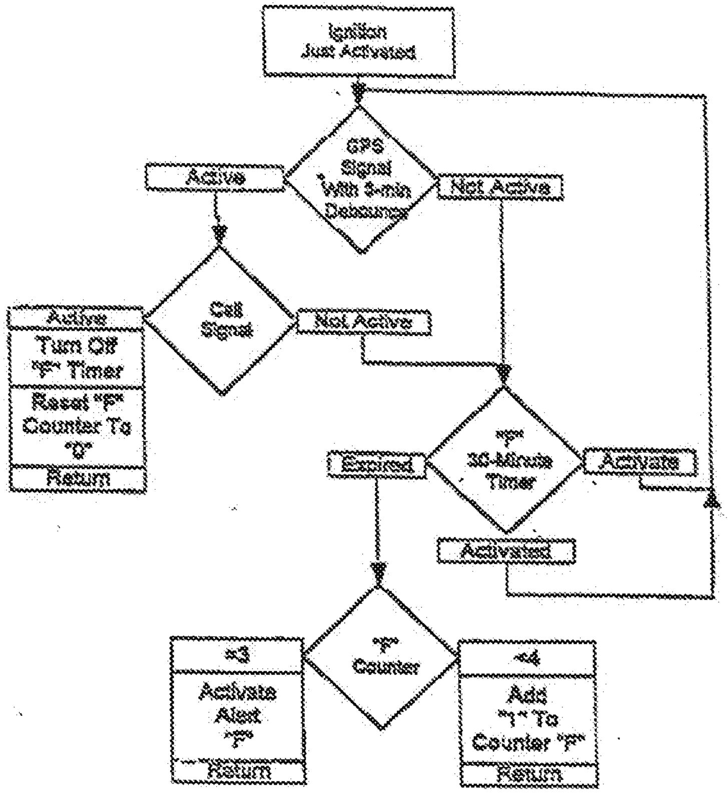
Alert "E" = Low Car Battery Power

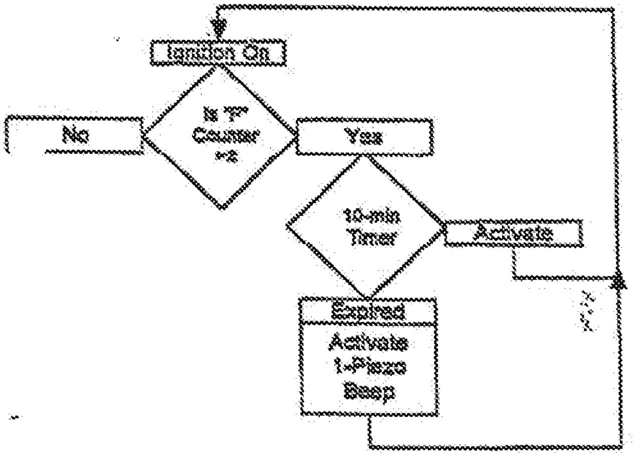
Your vehicle has a low battery voltage indication. Please take proper action. This alert will not be sent again until your vehicles battery has retained the proper voltage.

Low battery power Alert is activated by detecting the vehicle batter voltage being lower than a set voltage for a period of time and the said voltage not = "0".



Alert "F" = GPS / Cell not active Alert





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1c944 U.S. PTO

PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2)

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TITLE OF THE INVENTION (280 Characters Max)

VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

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ENCLOSED APPLICATION PARTS *(check all that apply)*

✓	Specification	*Number of Pages*	38	✓	Applicant qualifies as a Small Entity under 35 CFR under §§1.19 and 1.27
✓	Drawing(s)	*Number of Sheets*	6		Other (specify) ____________

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[ ] Additional inventors are being named on separately numbered sheets attached hereto.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
[✓] No. [ ] Yes

Respectfully Submitted,

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Date: January 29, 2001

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VEHICLE TRACKING SYSTEM WITH THEFT NOTIFICATION

Field of the Invention

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

Description of the Invention

The invention includes a unit to be mounted in the vehicle and a monitoring station. The unit in the vehicle includes a GPS receiver, and a transmitter which may transmit on the control band of the cellular telephone network, or, via a voice or other data channel of the cellular network, or other wireless communications network. For example, the transmitter could also be a satellite transmitter.

The GPS receiver determines the vehicle location. In addition, the GPS receiver may be connected to a controller which controls and/or performs a number of vehicle tracking and/or security functions. Wireless vehicle location determining devices and approaches other than GPS may also be used in some embodiments of the invention. For example, vehicle location systems based upon multiple receptions from adjacent cellular receivers can also be used.

The monitoring station is interfaced to the cellular telephone network, or other communications

network, to thereby communicate with the vehicle unit. In addition, the monitoring station is also connected to the Internet to provide a number of advantageous features including updating the user or other authority when away from the vehicle of the vehicle's position. These features and advantages are described in further detail below. The monitoring station may also be connected to the telephone network in order to provide various preprogrammed communications, such as to the user or other authority.

The system preferably implements one or more of the following features:

1. 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 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.
2. Detects an optional vehicle 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.
3. Detects an optional vehicle alarm systems 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.
4. 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 WEB site. The vehicle would be equipped with a security system as disclosed in U.S. Patent No. 5,654,688, for example, which determines an unauthorized transmitter and provides an alert feature. This patent is incorporated herein in its entirety by reference.

5. 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 max speed limit and duration thereof can be selected by the user.

6. 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 selectable by the user.

7. Detects 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.

8. 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 also preferably has access to a WEB or Internet site that will display a map and silently contact the vehicle to acquire it's current location, speed, direction of travel, and previous multiple locations with speeds, for example, the user's personal identification number (PIN) can be instantly activated by just a phone call. No additional installation is required.

Certain annual pre-pay package arrangement may be available. For example, up to 10 access entries per month can be provided on a low monthly billing of $4.90. Up to 30 access entries could be provided for $8.25 per month.

The present invention provides a number of other significant advantages including optional access from any phone or from any computer to access the WEB site. The user may control various vehicle functions remotely via the telephone or WEB 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 & installation is relatively inexpensive, and is on the order of about $190.00. 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 user a predetermined command (Command 7) 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 an embodiment of the vehicle unit are provided below as relating to use of red and green LED indicators operated by the system controller.

Red LED verification of GPS receiving signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
    Blinking = when searching GPS location.
    Constant = found location.
    Off = no GPS signal found.
With yellow wire not having positive 12 volts:
    Off = LED not functioning.

Green LED verification of receiving the cell tower signal, using the LED built into the system controller:

With yellow wire having positive 12 volts:
    Blinking = Cell control channel signal is detected.
    Constant = sending micro burst signal. Stays on 5-seconds after each time system is transmitting.
    Off = no cell tower signal received.
With yellow wire not having positive 12 volts:
    Off = LED not functioning.

An example of representative DIP switch feature selection is as follows. Switch 1 may be used for adding orange wire for controlling arm/disarming of system. When On, the orange wire controls arm/disarm as follows: to arm, Orange wire is grounded and Yellow wire does not have 12 volts positive. To disarm, the Orange wire is not grounded. When switch 1 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 orange wire activates a constant 500 ma grounded output to operate an external starter interrupt relay until 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:

The Red Wire is connected to 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.

The Black Wire is connected to Ground.

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:

1. If the system is in an armed mode and Lat/Long changes, then Alert "A" is given.
2. 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".
3. If the DIP switch 1 is in the Off position then:
   a. if 12 volts is on yellow wire, the system is disarmed and the orange wire discontinues the 500 ma ground.
   b. if the yellow wire sees grounded 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 system is disarmed

The Gray Wire is for Input and Output, and can be connected to an alarm siren or horn positive terminal. In addition:

1. With 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 "B" alarm activation is given.
2. 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.

3. 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.
4. The Gray wire bypass operates as follows:

a. After Alert warning "B" bypass all future Alert "B" until system is disarmed.

b. After Alert warning "C" bypass all future Alert "C" until system is armed.

c. After Alert warning "D" bypass all future Alert "D" until no 12 volt pulses are detected on the gray wire within 3 seconds of yellow wire having 12 volts.

5. With system armed or disarmed. The Output: Internal + 12v, 1 amp transistor with pulses 1 second on & 1 sec off to activate siren or honk car horn or flashing light relay.

a. Non-stop activation from (Command "4")

b. 30-second activation from (Command "5")

6. Turn off the above Alert "A" from (Command "1")

The Orange Wire is for the starter interrupt and arm/disarm system, and operates as follows:

1. If dip switch 1 is in the:

a. On position and:

i. the Orange wire has 12 volts or neutral, the system switches to the disarmed mode

ii. the Orange wire is grounded, then the system is switched to the armed mode

iii. and the starter interrupt output will not automatically operate. Can only be activated from "Command #4"

b. Off position and:

i. the Orange wire does not effect the arming or disarming of the system.

ii. 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.

2. Command 4 activates Orange wire to have 500 ma. negative until Command 1 is received.

3. 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:

Green wire provides a 250 ma, negative 1 second pulse for Lock Doors. (Command "6").

Red Wire provides a constant 12v output from the Red power wire.

Blue wire provides a 250 ma., negative 1 second pulse for Unlock Doors (Command "7")

Pink wire provides a 250ma., 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 Orange wire for 10-seconds (starter interrupt), with these circuits in sequence:

First: Activates Gray wire for 1-second. (siren/horn)

After first stops: Activates Green wire for 1 second to lock the doors.

After second stops: Activate Blue wire for 1 second to unlock the doors.

After third stops: Activate Pink wire for 1 second to activate optional item.

Representative warning alerts are as follows:

Alert Warning "A": Automatic activation of "Command 8" and the vehicle unit contacts monitor station to instantly call 3 phone numbers with the message "Your Vehicle is stolen please confirm then call 911 to advise police of web site 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" until the system is re-armed.

Alert Warning "B": 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.

Alert Warning "C": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the message "Vehicle PANIC activated please confirm". This is with system disarmed and detecting the Gray wire having 12 volts pulsing or on constant for longer than 10-seconds. After the first activation then this is bypassed until the ignition turns on again.

Alert Warning "D": the vehicle unit contacts the monitoring station to instantly call 3 phone numbers with the this 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 yellow wire having seen 12 volts positive. All future alert "D" are bypassed until no 12 volt pulses are detected on the gray wire within 3 seconds of the yellow wire seeing 12 volts.

Alert Warning "E": 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 alert "E" are bypassed until:

1. First: More than 13.5 volts are detected on the red wire and
2. Second: After yellow wire stops having positive voltage the red wire then must detects more than 12 volts.

Alert Warning "F": 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)

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) Web site to indicate present location and past events in memory.

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

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

b. 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 250ma. 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:

a) 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:

i) Once instantly.

ii) Once in 1 hour if at the same location.

iii) Once in 6 hours if at the same location.

iv) Once in 12 hours if at the same location.

v) Once every 24 hours if at the same location.

b) 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 contains 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:

a) 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 same then only update stationary total time.

b) If the GPS antenna is not receiving any signal:

  i) Then enter last known GPS location and with indication this was the last known GPS location before GPS signal stopped and how long no GPS signal was received. And enter GPS location in the on-hold file.

c) When vehicle is traveling above ###MPH for ##-minutes.

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

a) The user's vehicle has issued a stolen alert:

  i) 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 Web site address and an identification number, such as the user's PIN, to allows the police to locate where your vehicle has been, where it is now and keep tracking it until the police can retrieve the vehicle.

ii) 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.

b) 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.

c) 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 transmission 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 begins 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.

The device or unit may be initially manufactured and shipped without all of the features being fully functional. One advantage of this is to prevent the unit at will from sending messages when being initially installed and tested in the vehicle, thereby reducing potential false alarms and burdens on the communications system, as well as potential charges to the user. After the unit is fully installed, a communication or transmission from the monitoring center may be sent to the unit enabling one or more selected features, such as during registration during which information is conveyed to the monitoring center and payment is made or authorized by the user.

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 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 transmitting again until 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 labeled "Alert A".

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 transmitting again until 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 labeled "Alert B".

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 determined whether it is greater than zero (eg. greater than six volts)and less than a high value (eg. 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 vehicle is being serviced and battery is disconnected this will cause the battery voltage to 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 transmitting again until 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 labeled "Alert E".

Yet another advantageous feature of some embodiments of 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 that 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 of the invention 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.

Yet another advantageous feature of the invention relates to interfacing with a factory-installed security system. In accordance with this aspect of the invention, the purpose is to detect when the factory security or alarm system is triggered so that the user can be notified when away from the vehicle using the capabilities of the tracking and security system described herein. The tracking system would include a voltage and/or current sensing circuit connected to detect repetitive battery spikes based upon an electrical item being turned on and off at the vehicle.

More particularly, with the with the GPS-2000 tracking system armed and the ignition key in the off condition, if the vehicle factory alarm becomes triggered, it causes the car horn and lights to flash and/or the horn to honk. Accordingly, the detector circuit can detect these indications as either dips in the voltage or increases in current flow from the vehicle battery. If these electrical events are detected for a predetermined minimum time of about 30 seconds, for example, and not longer than a predetermined maximum time of about 63 seconds, for example, the GPS-2000 tracker will send the vehicle alarm activated message.

The circuitry for detecting a voltage dip, for example, is of a type commonly included in other conventional vehicle security systems for other purposes, such as detecting tampering, for example. This detection circuitry needs no further description herein.

As will be readily appreciated by those skilled in the art, the reason for the minimum and maximum times is to avoid false alarms. For example, a similar electrical condition can be generated as the car radiator fan cycles on and off after the engine is turned off. By waiting the predetermined minimum time of about 30 seconds, the tracker would not falsely determine this to be operation of the factory security system. Opening and closing of the car doors could also create a similar electrical system drain, but would be unlikely to extend for 30 seconds. Accordingly, the minimum time would also avoid a false alarm in this instance of opening and closing the vehicle doors.

The maximum predetermined time could be implemented to avoid flashing operation of the hazard lights, for example, from causing a false alarm. A typical factory alarm would flash the lights and/or honk the horn for about 60 seconds before stopping. Flashing of the hazard lights would likely be for more than about 63 seconds, for example. Accordingly, a false alarm indication based on operation of the hazard lights would also be avoided by the invention.

As will also be appreciated by those skilled in the art, different values for the minimum and maximum times are contemplated by the invention. In addition, in some embodiments only one of the minimum or maximum times may be used.

Another aspect of the invention relates to a user's ability to cancel further sequential notifications. More particularly, in response to an alarm alert, sequential notifications are typically given by sequentially calling a series of telephone numbers. In accordance with this aspect of the invention, the user who receives the call, may cancel any further notifications. In other words, the user can be prompted by voice messages to make a certain keypad entry to thereby cancel further notifications if desired. This can avoid additional telephone or system usage charges, and also reduces the possible nuisance of unnecessary calls to other persons.

Stopping further notifications upon merely determining that the telephone has been answered may be ineffective, since oftentimes an answering machine may receive the call. Accordingly, it may be preferred to have the user actively cancel further notifications, in contrast to merely stopping further calls upon determining that the telephone call has been completed.

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

Yet another aspect of the invention 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.

Still another aspect of the invention 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 ever 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.

In examples, 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.

Another aspect of the invention relates to having the capability to interface the tracker device with a siren and/or the vehicle horn. Typically the siren is locally connected to ground, such as in the engine compartment, and the output of the tracker unit would provide a positive supply voltage, eg. 12 volts, to drive the siren. Also typically, the vehicle horn is connected to the positive voltage supply, and pressing the horn switch connects the horn to the vehicle ground to thereby complete the circuit and sound the horn. In accordance with this aspect of the invention, the output drive of the tracker unit can be a single wire with pulses of alternating polarity.

More particularly, the output terminal or wire, eg. the gray wire as described above, supplies pulses of alternating polarity. For example, a first pulse can be at the positive supply voltage, and a second pulse can be at the vehicle ground. Each pulse can be about one-half to one second long. The pulses can alternate in a series and with a slight spacing between adjacent pulses. In other security type systems, an intervening relay may be provided to provide for dual polarity capability. However, the tracker unit desirably monitors activation of the horn wire to determine whether the factory or aftermarket security controller is sounding an alarm. The intervening relay would prevent such a determination. Accordingly, the circuitry for providing the alternating polarity pulses of the invention provides the dual compatibility and also permits sensing of the horn activation as described above. Thus, the invention provides the dual compatibility with a single output wire or terminal, and requires no special installation.

Yet another aspect of the invention relates to power conservation and extending the protection period provided by the tracking device when the vehicle is not being used. The GPS receiver of the device may operate down to a supply voltage of about 3 volts, while the cellular radio portion may require a voltage of at least about 11 volts or 11.2 volts. The device will also typically include a back-up battery. The back-up battery may provide power when the vehicle battery is disconnected, such as by a would-be thief, or otherwise.

Typical vehicle security systems, for example, connect the back-up battery in parallel with the vehicle electrical system. Of course when the vehicle is operating, the vehicle battery and back-up battery are being charged by the alternator, which, in turn, is driven by the vehicle engine. When the vehicle is not used for a relatively long period of time, the voltage of both the back-up battery and the vehicle battery will gradually decay, such as based upon the receiver in the security system continuing to operate. Fortunately, however, the conventional vehicle security system may operate down to a voltage of about 6 volts. Accordingly, although the back-up battery voltage has decayed (along with the parallel connected vehicle battery), the relatively low operating voltage fo the security system is still typically sufficient to permit proper operation for a relatively long period of time.

The tracking device in accordance with the invention will typically include the cellular radio portion which requires a relatively high 11 volts or so to continue to operate. The tracking unit, despite various other power conserving features discussed herein, will still draw current. Accordingly, the voltage of the vehicle battery will also decay over time as the user is away from the vehicle. In accordance with this aspect of the invention, the back-up battery, however, is not continuously connected in parallel with the vehicle battery. Instead, the back-up battery is connected in parallel when the ignition key is on, for example, which will provide for charging of the back-up battery. Initially, when the vehicle is turned off, and the system armed, the back-up battery is not connected. Rather, the vehicle battery alone supplies the device initially. The back-up battery thus remains fully charged as it is not being drained by the load of the tracking device.

In one embodiment, if sufficient time passes, then the voltage of the battery will decay below a predetermined value, such as about 11.5 or 11.2 volts, for example. At this point, the back-up battery will be connected to the tracking device, and the vehicle battery will be disconnected. These voltage sensing and switching functions can be readily implemented using conventional circuits in the tracking device as will be appreciated by those skilled in the art. Accordingly, the tracking device can continue to operate normally for an additional period and at a sufficiently high voltage to permit the cellular radio to operate. Of course, as will be appreciated by those skilled in the art, this feature can be extended to other areas as well, especially where a vehicle device or circuit may require a relatively high operating voltage.

In other embodiments, if sufficient time passes, then the voltage of the battery will decay below a predetermined value, such as about 11.5 to 4-volts, for example. At this point, the back-up battery will stay disconnected from the tracking device, and the vehicle battery will stay connected. This allows the cellular radio to sleep at 11.5 volts and the GPS and other circuits to still operate from the vehicle battery to as low as 3-volts. Once an alert is detected from GPS or other circuits then the cellular radio is awakened and operates from the back-up battery, still at about 12-volts. These voltage sensing and switching functions can be readily implemented using conventional circuits in the tracking device as will be appreciated by those skilled in the art. Accordingly, the tracking device can continue to operate normally for alerts to be sent to the monitoring station for an additional period and at a sufficiently high voltage to permit the cellular radio to operate. Of course, as will be appreciated by those skilled in the art, this feature can be extended to other areas as well, especially where a vehicle device or circuit may require a relatively high operating voltage.

Yet another feature of the invention 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. More particularly, a typical arrangement may provide eight basic codes and two "wildcard" 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 of the invention, 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 of the invention, 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, an alert may be generated based upon the vehicle detecting an acceleration beyond a predetermined level. The vehicle acceleration could readily be determined by a relatively inexpensive acceleration sensor as will be appreciated by those skilled in the art. The acceleration could also be calculated by speedometer information. Decelerations, or negative accelerations, could also be used to trigger an alert. The acceleration generated alert could be used to reduce wear and tear on the vehicle or to discourage aggressive driving and especially Drag Racing . The acceleration alert need not be generated and sent immediately, but could be sent with position information, since a user may not need realtime notification of the acceleration limit being exceeded.

Yet another aspect of the invention is directed to ensuring that car owners will activate the monitoring service from the beginning and not wait months or years until the vehicle is stolen, for example, to then activation the system in an attempt to avoid monthly service charges. When power is initially connected to the device it will communicate with the cellular equipment. Unfortunately, it may be virtually impossible to sort out all of the communications traffic to determine when someone has obtained a vehicle with the unit, but has not fully registered or subscribed to the service. In accordance with this aspect of the invention, a driver annoyance may be triggered to encourage the driver or owner to register the unit and begin paying the monthly service fees. For example, an annoying chirp could be generated every ten minutes when the vehicle ignition is on. Alternately or additionally a visual annoyance could also be provided. The audio chirp could be readily provided by a small piezoelectric indicator carried by the device.

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.

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. Patent Nos. 5,719,551 and 6,011,460 assigned to the assignee of the present invention.

Yet another aspect of the invention 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:

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

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

(3) 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.

(4) 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.

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

(6) 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.

(7) Code 7 -- Turn off the 80 mph speed limit reporting.

(8) Code 8 -- Increase speed limit 5mph and increase the time 5 minutes.

(9) 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 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 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 vehicles 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.