



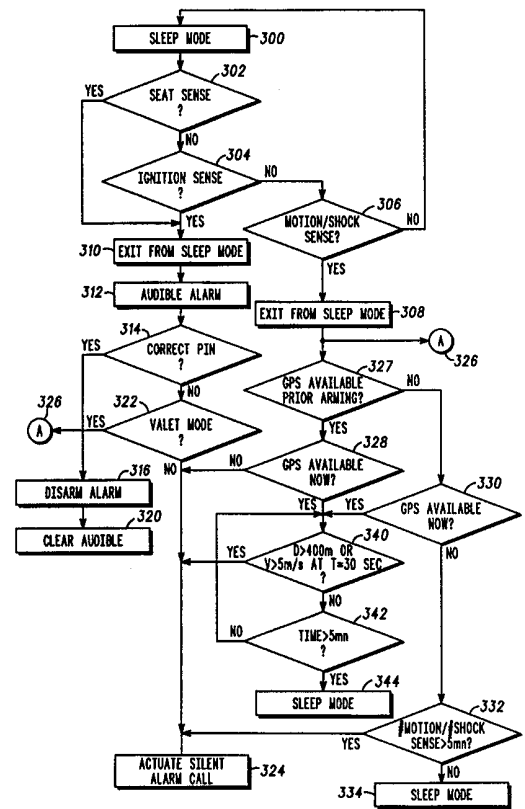
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(54) Title: VEHICLE SECURITY METHOD AND APPARATUS HAVING A VALET MODE

(57) Abstract

A vehicle security apparatus comprises an ignition sensor (54), a first counter (210) responsive to the ignition sensor (54), a vehicle acceleration event detector (202), a second counter (204) responsive to the vehicle acceleration event detector (202), and a rate-of-speed event detector (212). An alarm signal inhibitor (220) is responsive to the first counter (210), the second counter (204), and the rate-of-speed event detector (212) to at least temporarily inhibit generation of an alarm signal by an alarm signal generator (222). Vehicle security methods are also disclosed.



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VEHICLE SECURITY METHOD AND APPARATUS HAVING A VALET MODE

Cross-reference to Related Application

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The present application is related to the following application:
“METHOD AND APPARATUS FOR DATA COMMUNICATION USING
A MULTI-NUMBER MOBILE TELEPHONE”, having Docket No.
AP01612 and Serial No. 09/030,326, filed February 25, 1998.

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The subject matter of the above-identified related application is
hereby incorporated by reference into the disclosure of this application.

Field of the Invention

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The present invention relates to vehicle security methods and systems.

Background of the Invention

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Many vehicle alarm systems are operative to generate an audible alarm
signal upon detecting a vehicle break-in event. An authorized individual can
deactivate the audible alarm signal by performing an appropriate action,
such as one to unarm the vehicle alarm system. Alternatively, the vehicle
alarm system may automatically deactivate the audible alarm after a
predetermined time period.

25

There are situations in which known vehicle alarm systems undesirably
generate alarm signals. Some of these situations can be classified as false
alarm situations, wherein the vehicle is inadvertently disturbed. The
aforementioned disturbance of the vehicle undesirably triggers the audible
alarm signal even though a break-in event or a theft event has not occurred.

Other situations are encountered when an authorized individual gives his/her vehicle to a valet or a like parking attendant. The valet is implicitly granted limited authority to park the vehicle, and thereafter, to retrieve the vehicle for the authorized individual. If the authorized individual were to
5 arm the vehicle alarm system prior to giving the vehicle to the valet, use of the vehicle by the valet would undesirably trigger the audible alarm signal. Consequently, the authorized individual may be limited in his/her use of the vehicle alarm system in valet parking situations.

What is needed is an improved approach

Brief Description of the Drawings

FIG. 1 is a block diagram of an embodiment of a vehicle security system in accordance with the present invention;

5 FIG. 2 is a block diagram of an embodiment of a portion of the vehicle security apparatus provided by the controller;

FIG. 3 is a flow chart of an embodiment of a method performed by the mobile station;

10 FIG. 4 is a flow chart of embodiment of another method performed by the mobile station;

FIG. 5 is a flow chart of another embodiment of a method performed by the mobile station; and

FIG. 6 is a flow chart of an embodiment of a telephone number management method performed by the mobile station.

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Detailed Description of Preferred Embodiments

Embodiments of the present invention provide a vehicle security method and apparatus having a valet mode of operation. In the valet mode, an alarm signal, which otherwise would be generated in response to a disturbed vehicle condition, is at least temporarily inhibited based upon parameters including a number of ignition events, a number of vehicle acceleration events, and a rate of speed. By at least temporarily inhibiting the alarm signal, some false alarm conditions can be avoided. Further, an authorized individual can arm the apparatus in the valet mode prior to presenting the vehicle to a valet.

Embodiments of the present invention further provide a vehicle security method and apparatus which detect a pre-alarm condition based upon uncorrected vehicle distance information and/or uncorrected vehicle speed information from a satellite positioning system. In response to detecting the pre-alarm condition, a pre-alarm call is placed to a central station to receive information to correct either or both of the vehicle distance and vehicle speed. An alarm condition is then detected based upon corrected vehicle distance information and/or corrected vehicle speed information. By detecting the alarm condition based upon corrected, rather than uncorrected, vehicle motion parameters, some false alarm conditions can be avoided.

FIG. 1 is a block diagram of an embodiment of a vehicle security system in accordance with the present invention. The vehicle security system includes a mobile station 20 and a central station 22. The mobile station 20 provides a vehicle security apparatus or a like monitoring apparatus for a vehicle. Typically, the mobile station 20 is installed in or otherwise associated with the vehicle. The central station 22 provides or

assists in providing services, such as a tracking service or a theft reporting service, based upon the data received from the mobile station 20. The central station 22 typically provides the services to a plurality of mobile stations (e.g. a plurality of vehicles) including the mobile station 20.

5 The mobile station 20 includes a mobile telephone 24 having a transceiver 26 and an antenna 30. The mobile telephone 24 preferably includes a cellular telephone having a cellular transceiver and a cellular antenna. Alternatively, the mobile telephone 24 can include an alternative radio telephone such as a personal communications system telephone or a
10 satellite telephone.

 The transceiver 26 is responsive to a number assignment module (NAM) 32. The number assignment module 32 provides a plurality of telephone numbers or like telecommunication codes for the mobile telephone 24. Preferably, the number assignment module 32 includes a dual-NAM to
15 provide a first telephone number and a second telephone number for the mobile telephone 24. In general, the number assignment module 32 can include a multi-NAM to provide a plurality of telephone numbers for the mobile telephone 24.

 The mobile telephone 24 is responsive to a controller 40. The
20 controller 40 includes a microcontroller, a microprocessor, or a like processor to direct the operation of the mobile station 20. The controller 40 provides or assists in providing various vehicle security features such as vehicle alarm, vehicle theft reporting, vehicle tracking, roadside assistance, travel assistance, and personal emergency features. The controller 40
25 provides the features based upon vehicle data received from one or more sensors 42 and a positioning system 44. Optionally, the controller 40 can provide features further based upon a gyro 46 and an antilock brake system (ABS) 48.

The sensors 42 can include various vehicle alarm sensors including but not limited to a seat sensor 50, a shock sensor 52, an ignition sensor 54, a motion sensor 56, and a speed sensor 58. Optionally, the sensors 42 can include other sensors such as an airbag sensor and/or a crash sensor. In
5 general, the sensors 42 provide data indicating a state of the vehicle.

The positioning system 44 is used to determine a position of the vehicle. Preferably, the positioning system 44 includes a Global Positioning Satellite (GPS) receiver 60 and an associated GPS antenna 62. In this case, the positioning system 44 determines the position of the vehicle based upon
10 signals received from a plurality of satellites such as a GPS constellation 64. It is noted, however, that alternative absolute positioning systems are also within the scope of the present invention.

The GPS receiver 60 also provides a GPS clock 66 to determine a time based upon signals received from the GPS constellation 64. The GPS clock
15 66 is used to synchronize a clock maintained by the controller 40. Preferably, the clock is synchronized by the GPS clock 66 each time the system is activated.

Overall, the GPS receiver 60 and the GPS clock 66 can provide data such as time, date, position, quality, velocity, heading, and a list of satellites
20 used for a position fix.

The controller 40 determines a vehicle distance-of-travel, a vehicle speed, and a vehicle rate of speed based upon information from the positioning system 44. If information from the positioning system 44 is unavailable, the controller 40 determines the aforementioned vehicle
25 parameters using information from the gyro 46 and/or the ABS 48. In particular, the gyro 46 can provide orientation information and ABS 48 can provide wheel speed information from which the aforementioned vehicle parameters are determined using dead reckoning as is known in the art. The

aforementioned vehicle parameters are used for detecting a pre-alarm condition and an alarm condition, which are subsequently described in more detail.

A handset 70 is associated with the mobile telephone 24. The handset
5 70 can include a cellular handset having a display 72 and a user input device 74. Preferably, the display 72 includes a liquid crystal display to display visible information to an end user. The user input device 74 preferably includes a mobile telephone keypad 76, such as a cellular telephone keypad, augmented with a plurality of service buttons. The service buttons can
10 include a personal emergency button 80, a roadside assistance button 82, and a travel assistance button 84.

The controller 40 is responsive the telephone keypad 76 to provide standard features using the mobile telephone 24. Examples of standard mobile telephone features include, but are not limited to, dialing a telephone
15 number, initiating an outgoing call, answering an incoming call, and terminating a call.

An audible input device such as a microphone 86, and an audible output device such as a speaker 88 are associated with the mobile telephone 24. The microphone 86 and the speaker 88 facilitate voice or other audible
20 communications using the mobile telephone 24. The microphone 86 and the speaker 88 can be integrated with or otherwise associated with the handset 70, or can be mounted in the vehicle for hands-free operation.

The mobile telephone 24 communicates with a mobile telephone infrastructure 90 to provide mobile communications. The mobile telephone
25 infrastructure 90 can include one or more cellular telephone antennas 91 and one or more mobile telephone switching offices 92.

The controller 40 is responsive to the service buttons to initiate service-specific features in cooperation with the central station 22. In these cases,

the mobile telephone 24 and the central station 22 communicate via the mobile telephone infrastructure 86 and a public telephone network 100 and/or a private branch exchange 102. Service-specific features can include a visible component displayed by the display 72 or another display, and/or
5 an audible component presented by the speaker 88.

A user-initiated selection of the personal emergency button 80 initiates a personal emergency call to be directed to the central station 22. The personal emergency call can be placed using either the first telephone number or the second telephone number. The central station 22 provides
10 one or more personal emergency services 104 for the mobile station 20 in response to receiving the call.

A user-initiated selection of the roadside assistance button 82 initiates a roadside assistance call to be directed to the central station 22. The roadside assistance call can be placed using either the first telephone number or the
15 second telephone number. The central station 22 provides one or more roadside assistance services 106 for the mobile station 20 in response to receiving the call.

A user-initiated selection of the travel assistance button 84 initiates a travel assistance call to be directed to the central station 22. The travel
20 assistance call can be placed using either the first telephone number or the second telephone number. The central station 22 provides one or more travel assistance services 108 for the mobile station 20 in response to receiving the call.

As described earlier, the controller 40 provides one or more vehicle
25 alarm/security/monitoring features. The controller 40 cooperates with the central station 22 to provide a stolen vehicle/silent alarm feature 110. Three modes of operation are available for this feature: an armed mode, a valet mode, and an unarmed mode. The unarmed mode is typically employed

while the vehicle is attended by an authorized individual such as the vehicle owner. The armed mode is selected to monitor the vehicle when unattended by an authorized individual. The valet mode is selected to monitor the vehicle when temporarily attended by a valet or another like individual responsible for parking the vehicle. The vehicle is monitored using the
5 sensors 42, the positioning system 44, and optionally, the gyro 46 and the ABS 48.

The armed mode, the valet mode, and the unarmed mode are user-selectable using the user input device 74 or another input device. For
10 example, the alarm can be unarmed by entering a personal identification number (PIN) or another code using the user input device 74.

When in either the armed mode or the valet mode, the controller 40 functions in a sleep mode until a disturbed vehicle condition is sensed. In the sleep mode, the controller 40 maintains various components, such as the
15 mobile telephone 24, in either an unpowered state or a reduced power state.

A disturbed vehicle condition is sensed using one or more of the sensors 42. Upon sensing the disturbed vehicle condition, the controller 40 performs additional processing steps to determine whether to inhibit generation of an alarm signal. As described earlier, inhibiting generation of
20 the alarm signal is beneficial in avoiding some false alarm situations.

Detailed descriptions of these processing steps is provided with reference to FIGS. 2 to 5. In response to generation of the alarm signal, the controller 40 directs the mobile telephone 24 to place a telephone call to the central station 22 using the second telephone number provided by the number
25 assignment module 32.

Prior to communicating with the central station 22, the controller 40 directs the mobile telephone 24 to be powered. The mobile telephone 24 can be powered by the vehicle battery, or alternatively, by a mobile telephone

battery.

The central station 22 automatically answers the call from the mobile telephone 24. The call provides either a bi-directional data/voice communication link or a bi-directional data-only communication link
5 between the mobile station 20 and the central station 22. Within the call, the controller 40 communicates data derived from the sensors 42, the positioning system 44, the gyro 46, and/or the ABS 48, to the central station 22. For example, the data can include position or tracking data for the vehicle and other conditions of the vehicle. Other status data also can be
10 communicated. Preferably, the first successful transmission of GPS data upon each activation also includes user/activation information such as a user identification code, a call type, sensor status information, and an operator identification code providing re-dial information. The central station 22 can track the position until the vehicle is recovered.

15 A differential global positioning system (DGPS) reference station 112 associated with the central station 22 provides correction information to improve the accuracy of the position or tracking data. The DGPS reference station 112 can provide delta GPS data such as position change from GPS data, quality, velocity, heading, and a list of satellites used for a position fix.
20 The central station 22 communicates the correction information within the call. The controller 40 determines corrected vehicle motion parameters based upon the correction information.

Optionally, audio signals can be communicated within the call. The audio signals can include voice signals sensed by the microphone 86, and
25 communicated from the mobile station 20 to the central station 22. Additionally, the audio signals can include voice signals communicated from the central station 22 to the mobile station 20 for audible presentation using the speaker 88.

Should a failure occur with the sensors 42 resulting in a lack of a call being placed to the central station 22, the ability exists for the central station 22 to call the mobile telephone 24 in a silent monitoring mode.

When the vehicle alarm apparatus is unarmed, the mobile telephone 24
5 reverts to using the first telephone number in the number assignment module 32. The first telephone number is used for outgoing and incoming calls when the alarm is unarmed.

An audible indicator 114 is responsive to the controller 40. The audible indicator 114 includes a speaker, a buzzer, or an alternative
10 transducer to generate an audible alarm signal. The audible alarm signal can include a first audible signal generated in response to a disturbed vehicle condition, or a second audible signal generated in response to an alarm condition.

The controller 40 is responsive to a hidden panic sensor 116 to establish
15 a communication link with the central station 22 in response to a user action. Under a duress situation, for example, a vehicle operator can initiate the communication link without knowledge by an attacker. The communication link is provided by a call placed using either the first telephone number or the second telephone number. The central station 22 can silently monitor
20 audible events within the vehicle as sensed by the microphone 86. If the situation is determined to be safe, the central station 22 can open a two-way conversation with vehicle occupants using the microphone 86 and the speaker 88.

It is noted that the controller 40 can detect other alarm conditions. In
25 response to detecting a loss in a primary power source, the controller 40 can initiate an alarm condition and can direct that a second power source be used. If the mobile station 20 is out of range of the mobile telephone infrastructure 90, alarm actuation is maintained in a stand-by mode pending

recovery of mobile telephone service. Alarm actuation is continued if the antenna 30 is damaged as long as mobile telephone service is maintained. If the antenna 30 is damaged beyond its ability to maintain mobile telephone service, alarm actuation is maintained in a stand-by mode pending return of
5 the mobile telephone service.

FIG. 2 is a block diagram of an embodiment of a portion of the vehicle security apparatus provided by the controller 40. A vehicle disturbance detector 200 is responsive to at least one of the sensors 42 to detect a disturbed vehicle condition. The disturbed vehicle condition can include a
10 disturbed seat condition sensed by the seat sensor 50, an ignition event sensed by the ignition sensor 54, a motion event sensed by the motion sensor 56, or a shock event sensed by the shock sensor 52.

A vehicle acceleration event detector 202 detects events in which the vehicle acceleration is greater than a first predetermined threshold. The
15 vehicle acceleration event detector 202 determines the vehicle acceleration based upon information from at least one of the positioning system 44, the gyro 46, the ABS 48, and the speed sensor 50. Thereafter, the vehicle acceleration is compared to the first predetermined threshold using a
20 comparator indigenous to the acceleration event detector 202. If the vehicle acceleration is greater than or equal to the first predetermined threshold, a vehicle acceleration event is detected. Before a subsequent vehicle acceleration event is detected, the vehicle acceleration must return to a value below a second predetermined threshold. Preferably, the second
25 predetermined threshold is less than the first predetermined threshold, and is less than zero (indicating a deceleration event).

A counter 204 is responsive to the vehicle acceleration event detector 202 to count a number of vehicle acceleration events upon entering the valet mode. The counter 204 is reset to zero upon activating the valet mode.

A vehicle ignition event detector 206 detects vehicle ignition events in response to the ignition sensor 54. Preferably, the vehicle ignition events include events in which the vehicle is started, such as by inserting a key into an ignition key hole and turning the key. A counter 210 is responsive to the
5 vehicle ignition event detector 206 to count a number of vehicle ignition events upon entering the valet mode. The counter 210 is reset to zero upon activating the valet mode.

A rate of speed event detector 212 detects events in which the vehicle rate of speed is greater than a predetermined threshold. The rate of speed
10 event detector 212 determines the vehicle rate of speed based upon information from at least one of the positioning system 44, the gyro 46, the ABS 48, and the speed sensor 50. Thereafter, the vehicle rate of speed is compared to a predetermined threshold. If the vehicle rate of speed is greater than or equal to the predetermined threshold, a vehicle rate-of-speed
15 event is detected.

A distance/speed event detector 214 detects events in which either a distance traveled by the vehicle in the valet mode attains or exceeds a distance threshold, or a vehicle speed attains or exceeds a speed threshold. The distance/speed event detector 214 is responsive to information from at
20 least one of the positioning system 44, the gyro 46, the ABS 48, and the speed sensor 50 to determine the distance and the speed.

A clock 216 provides a real-time clock for the vehicle security apparatus. The clock is synchronized by the GPS clock 66. The clock 216 is used to monitor a time duration within the valet mode, and a time
25 duration upon sensing a disturbed vehicle event.

An alarm signal inhibitor 220 is responsive to the vehicle disturbance detector 200, the counter 204, the counter 210, the rate of speed event detector 212, the distance/speed event detector 214, and the clock 216. The

alarm signal inhibitor 220 is operative to at least temporarily inhibit an alarm signal generator 222 to generate an alarm signal and/or an optional pre-alarm signal.

5 As is described in more detailed with reference to FIGS. 3 to 5, the mobile telephone 24 places a pre-alarm telephone call to the central station 22 in response to a pre-alarm signal. In the pre-alarm call, status information is communicated to the central station 22, and DGPS correction information is received from the central station 22.

10 In response to generation of the alarm signal, the mobile telephone 24 places a silent alarm telephone call to the central station 22. If a pre-alarm call is already in progress, the mobile telephone 24 need not re-place the telephone call to the central station 22. In the silent alarm call, tracking information is communicated to the central station. Additionally, audible events sensed by the microphone 86 can be communicated to the central
15 station 22 for operator monitoring purposes.

Various thresholds and other parameters used by the vehicle security apparatus and method are provided by vehicle profile data 224. Preferably, the vehicle profile data 224 are stored in a memory device such as a read-only memory or a random access memory. It is also preferred that the
20 vehicle profile data 224 include a first set of parameters suited for urban valet parking conditions, and a second set of parameters suited for suburban or rural valet parking conditions. The set of parameters used by the vehicle security apparatus can be user-selected by the user input device 74 or another input device.

25 FIG. 3 is a flow chart of an embodiment of a method performed by the mobile station 20. Although the method is described with reference to elements of FIGS. 1 and 2, the method can be performed using alternative elements. The method is performed after a vehicle-unattended mode (either

the armed mode or the valet mode) has been initiated.

As indicated by block 300, the method includes a step of operating the vehicle security apparatus in a sleep mode. In the sleep mode, various components of the mobile station 20, such as the mobile telephone 24, are
5 unpowered or otherwise operated to reduce power consumption.

The method includes steps of determining if a disturbed seat event occurs (block 302) and sensing if an ignition event occurs (block 304). The disturbed seat event is sensed using the seat sensor 50. The disturbed seat event is typically sensed in response to the presence of an individual sitting
10 in the driver's seat. The ignition event is sensed using the ignition sensor 54. The ignition event typically is sensed in response to activation of the vehicle, such as by inserting and turning a key within an ignition key-hole.

If neither a disturbed seat event nor an ignition event is sensed, a step of determining if a vehicle motion event or a vehicle shock event occurs is
15 performed (as indicated by block 306). The vehicle motion event is sensed using the motion sensor 56. The vehicle shock event is sensed using the shock sensor 52. If neither the vehicle motion event nor the vehicle shock event has occurred, flow of the method returns to block 300 to continue operating in the sleep mode. If either the vehicle motion event or the
20 vehicle shock event is sensed, a step of exiting from the sleep mode is performed (block 308). The step of exiting from the sleep mode includes powering various components of the mobile station 20 which were otherwise unpowered in the sleep mode.

If either a disturbed seat event or an ignition event is sensed in blocks
25 302 and 304, a step of exiting from the sleep mode is performed (block 310). The step of exiting from the sleep mode includes powering various components of the mobile station 20 which were otherwise unpowered in the sleep mode. Thereafter, a step of generating an audible alarm is performed

(block 312). This step includes the controller 40 generating a signal to activate the audible indicator 114. In turn, the audible indicator 114 generates an audible alarm signal within the vehicle.

The audible alarm signal can be halted by unarming the vehicle security apparatus. The vehicle security apparatus is unarmed in response to a user action received by the user input device 74 or another input device. Preferably, the alarm is unarmed in response to receiving a predetermined personal identification number (PIN) or another code using the user input device 74.

As indicated by block 314, the method includes a step of determining if a correct PIN or another predetermined user action is received. If the correct PIN is received, steps of disarming the alarm (block 316) and clearing or otherwise halting the audible alarm (block 320) are performed.

If an incorrect PIN or user action is received, a step of determining whether the vehicle security apparatus is in a valet mode is performed (block 322). If the vehicle security apparatus is not in the valet mode, but rather is in a non-valet armed mode, a step of actuating a silent alarm call is performed as indicated by block 324. The silent alarm call is actuated by generating an alarm signal using the alarm signal generator 222. In response to generation of the alarm signal, the mobile telephone 24 places a telephone call to the central station 22. Within the telephone call, the controller 40 can communicate vehicle positioning data derived from the positioning system 44, if available, and can communicate audio signals sensed by the microphone 86. In this way, the central station 22 can track the location of the vehicle, and an operator at the central station 22 can monitor audible events within the vehicle. If GPS data is unavailable, a last known position is transmitted.

For use in subsequent descriptions in this application, a flow point 326 is defined. At the flow point 326, a disturbed vehicle condition has been sensed and the vehicle security apparatus has exited from the sleep mode.

If the vehicle security apparatus is in the valet mode (as determined in block 322), or if either a vehicle motion event or a vehicle shock event has been sensed (as determined in block 306), a step of determining if first vehicle positioning data was available prior to arming the alarm is performed (block 327). The first vehicle positioning data indicates a position of the vehicle at or about at the time of arming the alarm.

10 Preferably, the first vehicle positioning data includes positioning data derived from the GPS receiver 60.

If the first vehicle positioning data was available prior to arming the alarm, a step of determining an availability of second vehicle positioning data is performed (block 328). The second vehicle positioning data indicates a position of the vehicle after a disturbed vehicle condition is detected.

15 Preferably, the second vehicle positioning data includes positioning data derived from the GPS receiver 60. If the second vehicle positioning data is unavailable, flow of the method is directed to block 324 to actuate the silent alarm call.

20 If the first vehicle positioning data was unavailable prior to arming the alarm, a step of determining an availability of second vehicle positioning data is performed (block 330). The second vehicle positioning data indicates a position of the vehicle after a disturbed vehicle condition is detected.

25 Preferably, the second vehicle positioning data includes positioning data derived from the GPS receiver 60.

If both the first vehicle positioning data and the second vehicle positioning data are unavailable, the motion sensor 56 and the shock sensor 52 are monitored for a time duration such as 5 minutes. A step of

determining if disturbed vehicle events are sensed by the motion sensor 56 and/or the shock sensor 52 is performed (block 332). If an additional motion event or shock event is sensed within the time duration, flow of the method is directed to block 324 to activate the silent alarm call. If no
5 additional motion event or shock event is sensed within the time duration, a step of returning to the sleep mode is performed as indicated by block 334.

If the second vehicle positioning data is available in either blocks 328 or 330, a step of determining if a vehicle displacement or distance exceeds a first threshold, or if a vehicle speed exceeds a second threshold for a
10 predetermined time duration is performed (block 340). Preferably, the first threshold is about 400 meters, the second threshold is about 5 meters/second, and the predetermined time duration is about 30 seconds. Alternatively, the first threshold can be about a quarter of a mile, and the second threshold can be about 30 miles per hour.

15 If either the first threshold or the second threshold is exceeded, flow of the method is directed to block 324 to activate the silent alarm call. If neither the first threshold or the second threshold is exceeded, a step of determining if a time duration after sensing the disturbed vehicle event has attained or exceeded a time threshold is performed (step 342). Preferably,
20 the time threshold is about 5 minutes. If the time duration has not exceeded the time threshold, flow of the method is directed back to block 340. If the time duration has attained or exceeded the time threshold, a step of returning to the sleep mode is performed as indicated by block 344.

FIG. 4 is a flow chart of embodiment of another method performed by
25 the mobile station 20. Rather than repeating the description of some steps described with reference to FIG. 3, FIG. 4 illustrates steps performed upon encountering flow point 323 in FIG. 3. Although the method is described with reference to elements of FIGS. 1 and 2, the method can be performed

using alternative elements.

As indicated by block 400, the method includes a step of determining if first vehicle positioning data was available from the positioning system 44 prior to arming the alarm. The first vehicle positioning data indicates a position of the vehicle at or about at the time of arming the alarm. Preferably, the first vehicle positioning data includes positioning data derived from the GPS receiver 60.

If the first vehicle positioning data was available prior to arming the alarm, a step of determining if second vehicle positioning data is available from the positioning system 44 is performed (block 402). The second vehicle positioning data indicates a position of the vehicle after a disturbed vehicle condition is detected. Preferably, the second vehicle positioning data includes positioning data derived from the GPS receiver 60.

If the second vehicle positioning data is unavailable, an optional step of determining if speed data is available from the ABS 48 is performed (block 404). If speed data is available from the ABS 48, subsequent steps for at least temporarily inhibiting an alarm signal are based upon data from the ABS 48 rather than data from the positioning system 44. If speed data is unavailable from the ABS 48, flow of the method is directed to block 324 to actuate the silent alarm call. The absence of speed data from the ABS 48 may correspond to transport of the vehicle by another vehicle, e.g. a flat-bed truck.

If the first vehicle positioning data was unavailable prior to arming the alarm (as determined in block 400), a step of determining if second vehicle positioning data is available from the positioning system 44 is performed (block 406). The second vehicle positioning data indicates a position of the vehicle after a disturbed vehicle condition is detected. Preferably, the second vehicle positioning data includes positioning data derived from the

GPS receiver 60.

If both the first vehicle positioning data and the second vehicle positioning data are unavailable, the motion sensor 56 and the shock sensor 52 are monitored for a time duration, such as 5 minutes. A step of
5 determining if disturbed vehicle events are sensed by the motion sensor 56 and/or the shock sensor 52 is performed (block 410). If an additional motion event or shock event is sensed within the time duration, flow of the method is directed to block 324 to activate the silent alarm call. If no
10 additional motion event or shock event is sensed within the time duration, a step of returning to the sleep mode is performed as indicated by block 412.

If the second vehicle positioning data is available in either blocks 402 or 406, or if data is available from the ABS 48 in block 404, flow of the method is directed to block 420. Block 420 indicates a step of determining
15 if a vehicle distance exceeds a first threshold, or if a vehicle speed exceeds a second threshold for a predetermined time duration. Preferably, the first threshold is about 200 meters, the second threshold is about 5 meters/second, and the predetermined time duration is about 3 seconds. Alternatively, the first threshold can be about a quarter of a mile, and the second threshold can
20 be about 30 miles per hour.

If either the first threshold or the second threshold is exceeded, flow of the method is directed to block 422 to activate a first communication with
the central station, a silent pre-alarm call. In this step, the mobile telephone 24 places a telephone call to the central station 22. It is preferred that the
25 silent pre-alarm call be a data-only call. In this case, the silent pre-alarm call is absent of audio signals sensed by the microphone 86.

The central station 22 automatically answers the silent pre-alarm call. As indicated by block 424, a step of communicating status information from the mobile station 24 to the central station 22 is performed within the silent

pre-alarm call. Preferably, the status information includes the mode of the vehicle security apparatus, the speed of the vehicle, the position of the vehicle, the rate of speed of the vehicle, and the number of vehicle acceleration events. If GPS data is unavailable, a last known position of the
5 vehicle is transmitted.

As indicated by block 426, a step of receiving correction information is performed within the silent pre-alarm call. Preferably, the correction information includes corrected vehicle position and speed information. The central station 22 determines the corrected vehicle position and speed using
10 information from the DGPS reference station 112. This corrected information is sent from the central station to the vehicle. By relying on the central station to correct the vehicle's distance and/or speed measurements, false alarms can be minimized.

As indicated by block 430, the method includes a step of determining if
15 a corrected vehicle distance exceeds a third threshold, or if a corrected vehicle speed exceeds a fourth threshold for a predetermined time duration. Preferably, the third threshold is about 200 meters, the fourth threshold is about 5 meters/second, and the predetermined time duration is about 30 seconds. Alternatively, the third threshold can be about a quarter of a mile,
20 and the fourth threshold can be about 30 miles per hour.

If neither the third threshold nor the fourth threshold is exceeded, a step of determining if a time duration after sensing the disturbed vehicle event has attained or exceeded a time threshold is performed (step 432). Preferably, the time threshold is about 5 minutes. If the time duration has
25 not exceeded the time threshold, flow of the method is directed back to block 424. If the time duration has attained or exceeded the time threshold, a step of returning to the sleep mode is performed as indicated by block 434.

If either the third threshold or the fourth threshold is exceeded (as determined in block 432), a step of generating an alarm signal to actuate a silent alarm call with operator monitoring is performed (block 436). In this step, the mobile telephone 24 initiates a second communication to the central station 22 and sends audio signals sensed by the microphone 86 in addition to vehicle tracking data. As a result, an operator at the central station 22 can monitor audible events within the vehicle along with vehicle tracking data. Although the first call 422 and the second call 436 are shown as two separate telephone calls, they could be combined to a single call.

Referring back to block 420, if neither the first threshold nor the second threshold is exceeded, flow of the method is directed to block 440. In this step, a rate of speed of the vehicle is determined and compared to a rate-of-speed threshold. If the rate of speed attains or exceeds the rate-of-speed threshold, flow of the method is directed to block 422. If the rate of speed is less than the rate-of-speed threshold, flow of the method is directed to block 442.

The steps indicated by block 442, 444 and 446 function to at least temporarily inhibit flow of the method to block 436. In this way, the alarm signal which actuates a silent alarm call with operator monitoring is at least temporarily inhibited based upon a number of vehicle acceleration events, a number of ignition events, and a time in the valet mode.

The step indicated by block 442 comprises counting a number of vehicle acceleration events, and comparing the number of vehicle acceleration events to a threshold. If the number of vehicle acceleration events attains or exceeds the threshold, flow of the method is directed to block 436 to generate an alarm signal to actuate the silent alarm call with operator monitoring. If the number of vehicle acceleration events is less than the threshold, flow of the method is directed to block 444. Preferably,

the threshold is selected from an urban-environment threshold and a suburban/rural-environment threshold. The urban-environment threshold is greater than the suburban/rural-environment threshold since more stop-and-go events are expected when parking in an urban environment.

5 The step indicated by block 444 comprises counting a number of ignition events, and comparing the number of ignition events to a threshold. If the number of ignition events exceeds the threshold, flow of the method is directed to block 436 to generate an alarm signal. The alarm signal actuates the silent alarm call with operator monitoring. If the number of ignition
10 events is less than or equal to the threshold, flow of the method is directed to block 446. Preferably, the threshold is either one or two for a suburban/rural environment, and is either three or four for an urban environment.

15 The step indicated by block 446 comprises determining an elapsed time in the valet mode, and comparing the elapsed time to a threshold. If the elapsed time attains or exceeds the threshold, flow of the method is directed to block 436 to generate an alarm signal. The alarm signal actuates the silent alarm call with operator monitoring. If the elapsed time in the valet mode is less than the threshold, flow of the method is directed to block 450.

20 The step indicated by block 450 comprises determining if a time duration after sensing the disturbed vehicle event has attained or exceeded a time threshold. Preferably, the time threshold is about 5 minutes. If the time duration has not exceeded the time threshold, flow of the method is directed back to block 420. By directing flow of the method back to block
25 420, the steps indicated by blocks 440, 442, 444, and 446 may be repeated one or more times. As a result, the alarm signal can be temporarily inhibited at a first time based a first rate of speed, a first number of acceleration events, and a first number of ignition events at the first time.

At a second time, however, the alarm signal can be generated based upon at least one of a second rate of speed, a second number of acceleration events, and a second number of ignition events.

If the time duration has attained or exceeded the time threshold, a step
5 of returning to the sleep mode is performed as indicated by block 412. Thereafter, the method may be subsequently performed in response to a subsequently-sensed disturbed vehicle condition.

FIG. 5 is a flow chart of an alternative embodiment of a method performed by the mobile station 20. This method can be performed as an
10 alternative to the method described with reference to FIG. 4. Rather than repeating the description of some steps described with reference to FIG. 3, FIG. 5 illustrates steps performed upon encountering flow point 323 in FIG. 3. Although the method is described with reference to elements of FIGS. 1 and 2, the method can be performed using alternative elements.

15 As indicated by block 500, the method includes a step of determining if first vehicle positioning data was available from the positioning system 44 prior to arming the alarm. This step can be performed as described with reference to block 400 in FIG. 4.

If the first vehicle positioning data was available prior to arming the
20 alarm, a step of determining if second vehicle positioning data is available from the positioning system 44 is performed (block 502). This step can be performed as described with reference to block 402 in FIG. 4.

If the second vehicle positioning data is unavailable, a step of
25 determining if dead reckoning information is available from the gyro 46 is performed (block 504). If the information is available from the gyro 46, subsequent steps for at least temporarily inhibiting an alarm signal are based upon information from the gyro 46 rather than data from the positioning system 44. If information is unavailable from the gyro 46, flow of the

method is directed to block 324 to generate an alarm signal to actuate the silent alarm call with operator monitoring.

If the first vehicle positioning data was unavailable prior to arming the alarm (as determined in block 500), a step of determining if second vehicle
5 positioning data is available from the positioning system 44 is performed (block 506). This step can be performed as described with reference to block 406 in FIG. 4.

If both the first vehicle positioning data and the second vehicle positioning data are unavailable, the motion sensor 56 and the shock sensor
10 52 are monitored for a time duration such as 5 minutes. A step of determining if disturbed vehicle events are sensed by the motion sensor 56 and/or the shock sensor 52 is performed (block 510). If an additional motion event or shock event is sensed within the time duration, flow of the method is directed to block 324 to generate an alarm signal to actuate the
15 silent alarm call with operator monitoring. If no additional motion event or shock event is sensed within the time duration, a step of returning to the sleep mode is performed as indicated by block 512.

If the second vehicle positioning data is available in either blocks 502 or 506, or if data is available from the gyro 46 in block 504, flow of the
20 method is directed to block 520. Block 520 indicates a step of determining if a vehicle distance exceeds a first threshold, or if a vehicle speed exceeds a second threshold for a predetermined time duration. Preferably, the first threshold is about 200 meters, the second threshold is about 5 meters/second, and the predetermined time duration is about 30 seconds. Alternatively, the
25 first threshold can be about a quarter of a mile, and the second threshold can be about 30 miles per hour.

If either the first threshold or the second threshold is exceeded, flow of the method is directed to block 324 to generate an alarm signal to actuate the

silent alarm call with operator monitoring.

If neither the first threshold nor the second threshold is exceeded, flow of the method is directed to block 540. In this step, a rate of speed of the vehicle is determined and compared to a rate-of-speed threshold. If the rate
5 of speed attains or exceeds the rate-of-speed threshold, flow of the method is directed to block 324 to generate an alarm signal to actuate the silent alarm call with operator monitoring. If the rate of speed is less than the rate-of-speed threshold, flow of the method is directed to block 542.

The step indicated by block 542 comprises counting a number of
10 vehicle acceleration events, and comparing the number of vehicle acceleration events to a threshold. If the number of vehicle acceleration events attains or exceeds the threshold, flow of the method is directed to block 324 to generate an alarm signal to actuate the silent alarm call with operator monitoring. If the number of vehicle acceleration events is less
15 than the threshold, flow of the method is directed to block 544. Preferably, the threshold is selected from an urban-environment threshold and a suburban/rural-environment threshold. The urban-environment threshold is greater than the suburban/rural-environment threshold since more stop-and-go events are expected when parking in an urban environment.

20 The step indicated by block 544 comprises counting a number of ignition events, and comparing the number of ignition events to a threshold. If the number of ignition events exceeds the threshold, flow of the method is directed to block 324 to generate an alarm signal to actuate the silent alarm call with operator monitoring. If the number of ignition events is less than
25 or equal to the threshold, flow of the method is directed to block 546. Preferably, the threshold is either one or two for a suburban/rural environment, and is either three or four for an urban environment.

The step indicated by block 546 comprises determining an elapsed time in the valet mode, and comparing the elapsed time to a threshold. If the elapsed time attains or exceeds the threshold, flow of the method is directed to block 324 to generate an alarm signal to actuate the silent alarm call with operator monitoring. If the elapsed time in the valet mode is less than the threshold, flow of the method is directed to block 550.

The step indicated by block 550 comprises determining if a time duration after sensing the disturbed vehicle event has attained or exceeded a time threshold. Preferably, the time threshold is about 5 minutes. If the time duration has not exceeded the time threshold, flow of the method is directed back to block 520. By directing flow of the method back to block 520, the steps indicated by blocks 520, 540, 542, 544, and 546 may be repeated one or more times. As a result, the alarm signal can be temporarily inhibited at a first time based a first rate of speed, a first number of acceleration events, a first number of ignition events, and a first time in the valet mode. At a second time, however, the alarm signal can be generated based upon at least one of a second rate of speed, a second number of acceleration events, a second number of ignition events, and a second time in the valet mode.

If the time duration has attained or exceeded the time threshold, a step of returning to the sleep mode is performed as indicated by block 512. Thereafter, the method may be subsequently performed in response to a subsequently-sensed disturbed vehicle condition.

FIG. 6 is a flow chart of an embodiment of a telephone number management method performed by the mobile station 20. Although the method is described with reference to elements of FIGS. 1 and 2, the method can be performed using alternative elements.

As indicated by block 600, the method includes a step of determining if a first vehicle security mode is initiated. The first vehicle security mode can be initiated by receiving a corresponding user action, such as a depression of one or more buttons, from the user input device 74 or another input device.

5 Preferably, the first vehicle security mode comprises a vehicle-unattended mode, i.e. a mode to monitor a vehicle while unattended by an authorized individual. The first vehicle security mode can include either the armed mode or the valet mode.

In the first vehicle security mode, a step of directing the mobile
10 telephone 24 to make the second telephone number its active telephone number is performed as indicated by block 601. The controller 40 communicates a control signal to the mobile telephone 24 to perform this step. If the first telephone number was previously active, this step acts to automatically direct the mobile telephone 24 to switch from the first
15 telephone number to the second telephone number.

As indicated by block 602, the controller 40 directs that components of the mobile telephone 24 be unpowered. Preferably, at least a portion, and preferably an entire portion, of the transceiver 26 is directed to be unpowered in this step. Components of the mobile telephone 24 remain
20 unpowered until data communication with the central station 22 is to be performed.

As indicated by block 604, a step of detecting a security condition is performed. The security condition can include a disturbed vehicle condition, a pre-alarm condition, or an alarm condition.

25 As indicated by block 606, the method includes a step of directing the mobile telephone 24 to be powered in response to the security condition. In this step, the controller 40 generates a control signal to initiate the mobile telephone 24 to be powered. The mobile telephone 24 can be powered by

the vehicle battery or by a mobile telephone battery.

As indicated by block 610, a step of placing a security call using the second telephone number is performed by the mobile telephone 24. The security call is placed by the mobile telephone 24 while being temporarily
5 powered during the first vehicle security mode.

As indicated by block 616, the method includes a step of directing the mobile telephone 24 to communicate data to the central station 22 in the security call. The data can include vehicle data and/or positioning data generated using the sensors 42, the positioning system 44, the gyro 46,
10 and/or the ABS 48. Preferably, the data comprise vehicle positioning data and/or theft reporting data.

As indicated by block 618, an optional step of directing the mobile telephone 24 to communicate audio signals in the call can be performed. This step can be directed in dependence upon the status of the vehicle. For
15 example, based upon the status, the mobile telephone 24 can be directed to communicate voice signals in addition to data signals. The voice signals can provide silent audio monitoring by the central station 22 of audible events within the vehicle. Further, the voice signals can be two-way to allow two-way voice communication between the central station 22 and the vehicle.

20 Upon completing the call, a step of directing the mobile telephone 24 to be unpowered is performed, as indicated by block 620. In this step, the controller 40 generates a control signal to direct at least a portion of, and preferably an entire portion of the transceiver 26 to be unpowered.

Components of the mobile telephone 24 remain unpowered until subsequent
25 communication with the central station 22 is to be performed, or until the mobile telephone 24 is powered for use by an end user. Hence, the steps indicated by blocks 604, 606, 610, 616, 618, and 620 can be repeated one or more times while in the first vehicle security mode.

As indicated by block 622, the method includes a step of determining if a second vehicle security mode is initiated. Preferably, the second vehicle security mode comprises a vehicle-attended mode, or an alternative unarmed or deactivated alarm mode. The second vehicle security mode can be
5 initiated by receiving a corresponding user action, such as depressing one or more buttons in accordance with a personal identification number, from the user input device 74 or another input device.

If the second vehicle security mode is initiated, a step of directing the mobile telephone 24 to make the first telephone number its active telephone
10 number is performed (as indicated by block 624). The controller 40 communicates a control signal to the mobile telephone 24 to perform this step. If the second telephone number was previously active, this step acts to automatically direct the mobile telephone 24 to switch from the second telephone number to the first telephone number. In the second vehicle
15 security mode, the end user can use the mobile telephone 24 for standard telephone communications and service-specific communications.

Flow of the method is directed back to block 600. The first telephone number remains active until a user-initiated activation of the first vehicle security mode is performed.
20

Although described with reference to a vehicle security system, it is noted that the herein-described methods and systems can be used in other security applications. It is also noted that wheel speed information from a traction control system can be used as an alternative to the ABS 48.

Thus, there has been described herein several embodiments including
25 preferred embodiments of a vehicle security method and apparatus having a valet mode.

Because the various embodiments of the present invention provide a valet mode of operation, they provide a significant improvement in allowing

an authorized individual to arm a vehicle security apparatus prior to presenting a vehicle to a valet. Additionally, by providing more than one set of parameters for detecting an alarm condition, embodiments of the present invention provide a significant improvement in providing alarm conditions suited for parking in either an urban environment or a suburban environment.

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What is claimed is:

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Claims

1. A vehicle security method comprising the steps of:
sensing a disturbed vehicle condition; then
determining a first vehicle movement at a first time, dependent on
10 sensing the disturbed vehicle condition; then
inhibiting an alarm signal based on the first rate of speed; then
determining a second vehicle movement at a second time; and then
generating the alarm signal based on the second vehicle movement.
- 15 2. A vehicle security method of claim 1 wherein the step of
determining a first vehicle movement comprises a step of determining a first
rate of vehicle speed, and the step of determining a second vehicle
movement comprises a step of determining a second rate of vehicle speed.
- 20 3. A vehicle security method of claim 2 wherein the disturbed
vehicle condition is sensed by at least one of a seat sensor, an ignition sensor,
a motion sensor, and a shock sensor.
- 25 4. A vehicle security method of claim 2 further comprising a step
of initiating a telephone call in response to the step of generating the alarm
signal.

5. A vehicle security method of claim 2 wherein the first rate of speed is less than a predetermined threshold, and wherein the second rate of speed is greater than the predetermined threshold.
- 5 6. A vehicle security method of claim 2 further comprising a step of initiating a vehicle-unattended mode prior to sensing the disturbed vehicle condition.

7. A vehicle security method comprising the steps of:
sensing a disturbed vehicle condition; then
counting a number of vehicle acceleration events, dependent on sensing
the disturbed vehicle condition; then
5 temporarily inhibiting an alarm signal if the number of vehicle
acceleration events is less than a predetermined threshold; and then
generating the alarm signal if the number of vehicle acceleration events
is greater than the predetermined threshold.
- 10 8. A vehicle security method of claim 7 wherein the disturbed
vehicle condition is sensed by at least one of a seat sensor, an ignition sensor,
a motion sensor, and a shock sensor.
- 15 9. A vehicle security method of claim 7 further comprising a step
of initiating a telephone call in response to the step of generating the alarm
signal.
- 20 10. A vehicle security method of claim 7 further comprising a step
of detecting a vehicle acceleration event by comparing a vehicle acceleration
to a threshold.
- 25 11. A vehicle security method of claim 7 further comprising a step
of initiating a vehicle-unattended mode prior to sensing the disturbed vehicle
condition, and wherein the number of vehicle acceleration events is counted
during the vehicle-unattended mode.

12. An apparatus comprising:
a vehicle security apparatus, responsive to at least one vehicle
disturbance detector, to temporarily inhibit an alarm signal if a number of
5 vehicle acceleration events is less than a predetermined threshold and to
generate the alarm signal if the number of vehicle acceleration events is
greater than the predetermined threshold.

13. A vehicle security method comprising the steps of:
10 sensing a disturbed vehicle condition; then
counting a number of ignition events, dependent on sensing the
disturbed vehicle condition then;
temporarily inhibiting an alarm signal if the number of ignition events
is less than a predetermined threshold; and then
15 generating the alarm signal if the number of ignition events is greater
than the predetermined threshold.

14. A vehicle security method of claim 13 wherein the disturbed
vehicle condition is sensed by at least one of a seat sensor, an ignition sensor,
20 a motion sensor, and a shock sensor.

15. A vehicle security method of claim 13 further comprising a step
of initiating a telephone call in response to the step of generating the alarm
signal.

25

16. A vehicle security method of claim 13 further comprising a step
of sensing an ignition event by an ignition sensor.

17. A vehicle security method of claim 13 further comprising a step of initiating a vehicle-unattended mode prior to sensing the disturbed vehicle condition, and wherein the number of ignition events is counted during the
5 vehicle-unattended mode.

18. An apparatus comprising:
a vehicle security apparatus, responsive to at least one vehicle disturbance detector, to temporarily inhibit an alarm signal if a number of
10 ignition events is less than a predetermined threshold, and to generate the alarm signal if the number of ignition events is greater than the predetermined threshold.

19. A vehicle security method comprising the steps of:
15 sensing a disturbed vehicle condition;
initiating first communication with a central station based on at least one of an uncorrected vehicle distance and an uncorrected vehicle speed, dependent on sensing the disturbed vehicle condition;
receiving correction information from the central station dependent on
20 at least one of an uncorrected vehicle distance and an uncorrected vehicle speed;
correcting at least one of the uncorrected vehicle distance and uncorrected vehicle speed dependent on the received correction information;
then
25 inhibiting an alarm signal dependent on at least one of the corrected vehicle distance and vehicle speed;
initiating second communication with the central station based on at least one of the corrected vehicle distance and the corrected vehicle speed;

determining at least one of another vehicle distance and another vehicle speed dependent on the received correction information; and
generating the alarm signal based the at least one of another vehicle distance and another vehicle speed.

5

20. A vehicle security method of claim 19 wherein the first communication is data-only, and wherein the second communication includes data and audio.

10

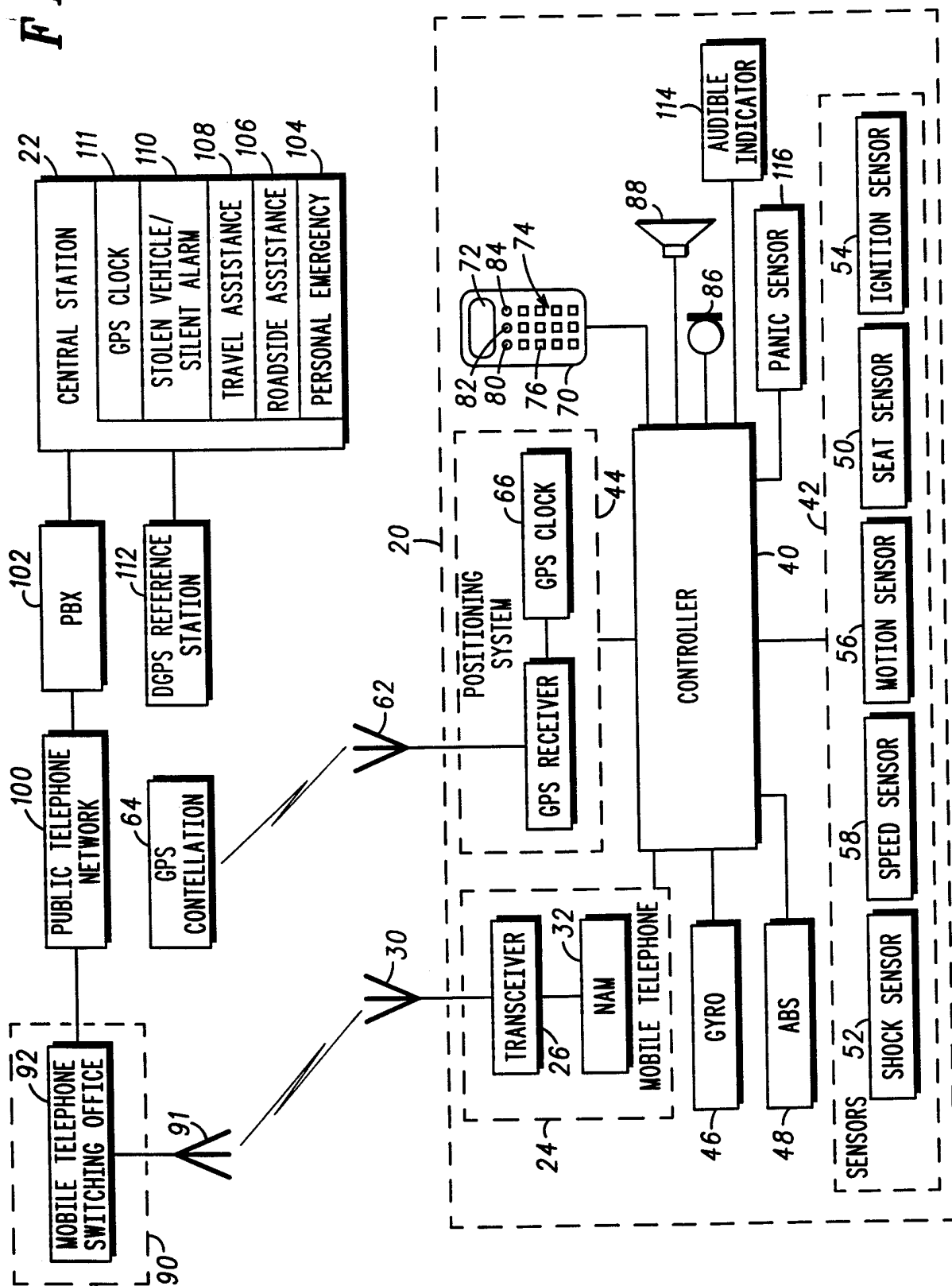
21. A vehicle security method comprising the steps of:
sensing a disturbed vehicle condition;
counting a number of ignition events, dependent on sensing the disturbed vehicle condition; then
counting a number of vehicle acceleration events; then
15 determining a rate of speed; and then
temporarily inhibiting an alarm signal based on the number of ignition events, the number of vehicle acceleration events, and the rate of speed.

15

22. A vehicle security apparatus comprising:
20 an ignition sensor;
a first counter responsive to the ignition sensor;
a vehicle acceleration event detector;
a second counter responsive to the vehicle acceleration event detector;
a rate of speed detector;
25 an alarm signal inhibitor responsive to the first counter, the second counter, and the rate of speed detector; and
an alarm signal generator responsive to the alarm signal inhibitor.

25

FIG. 1



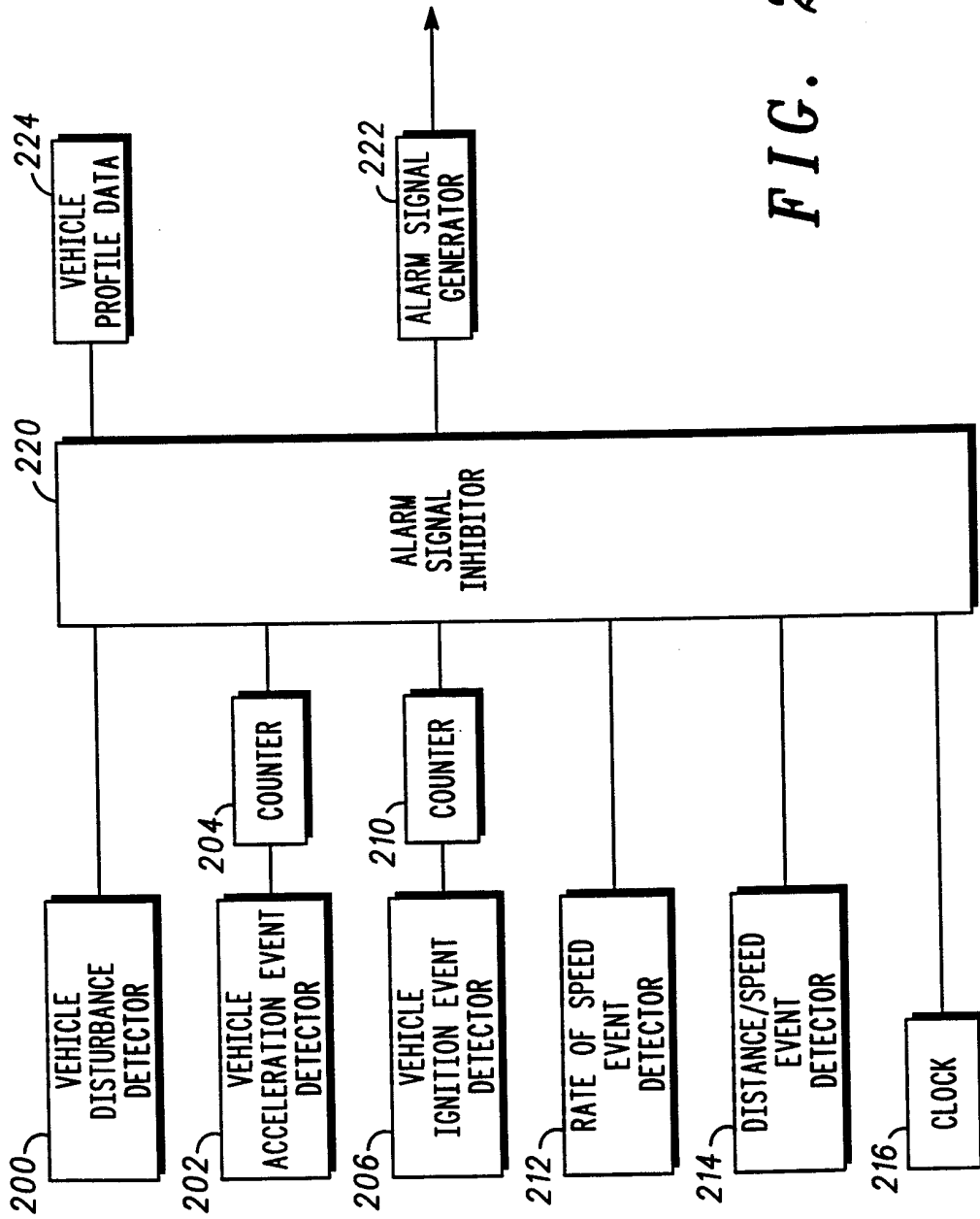


FIG. 2

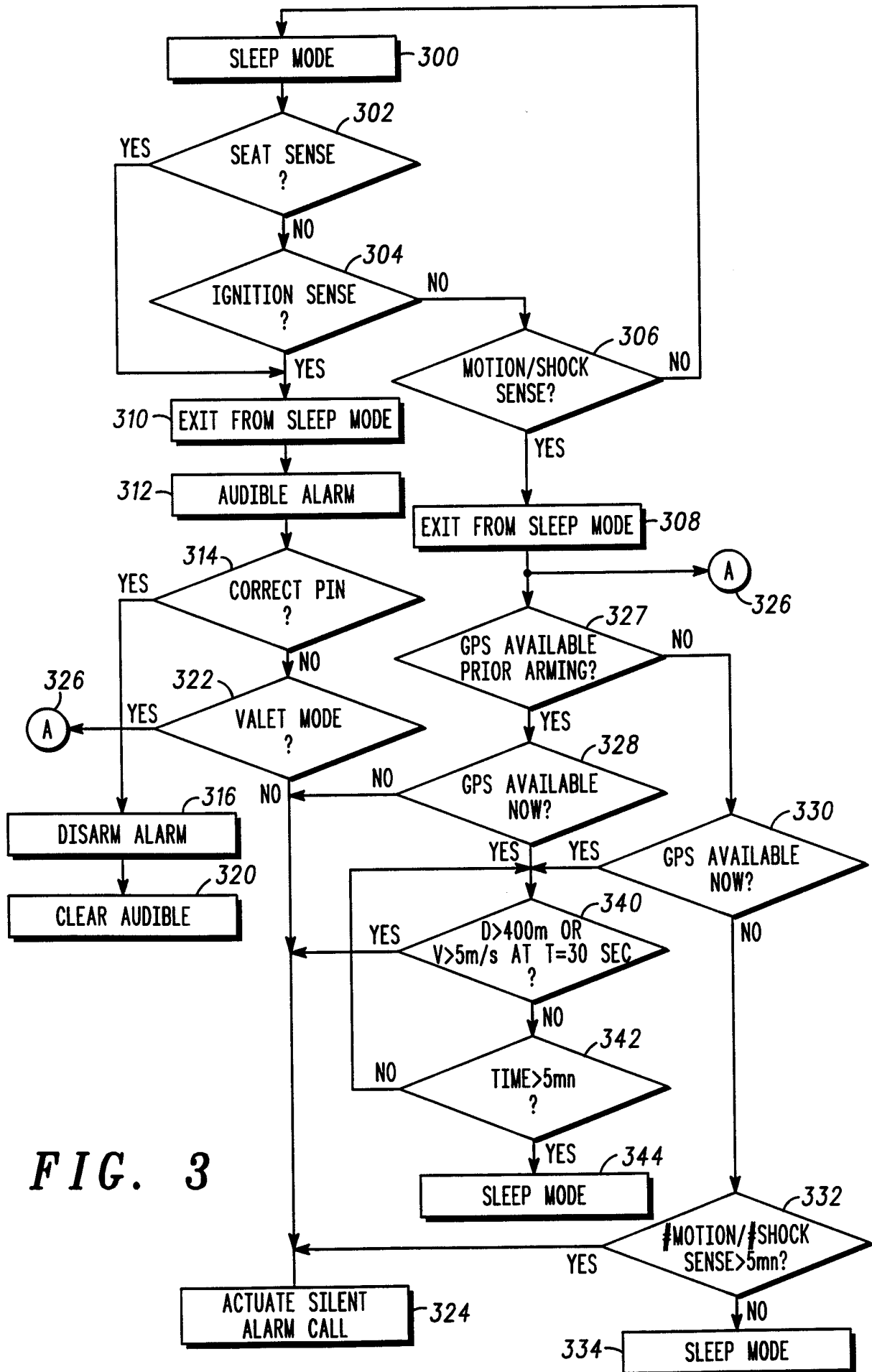
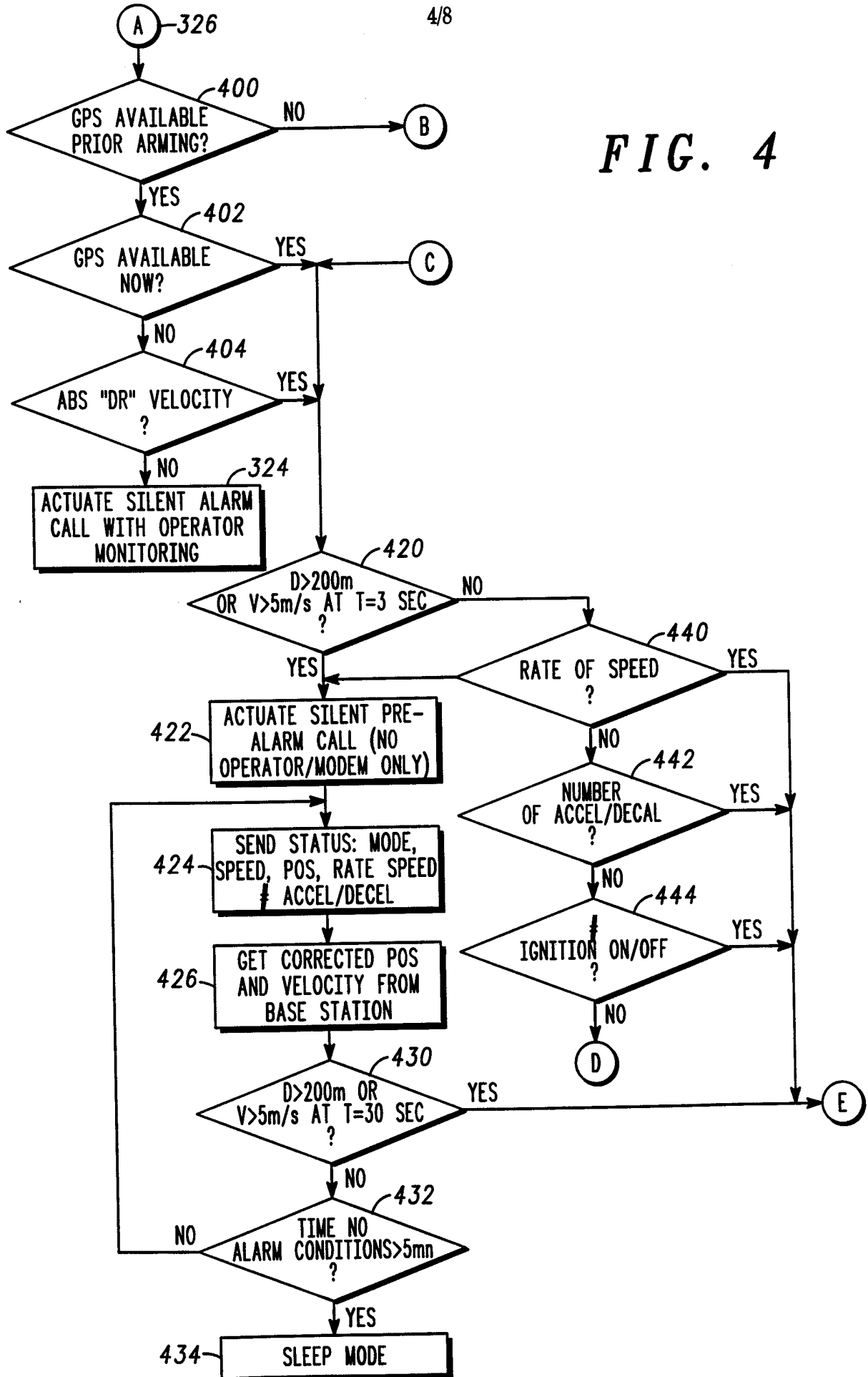


FIG. 3

FIG. 4



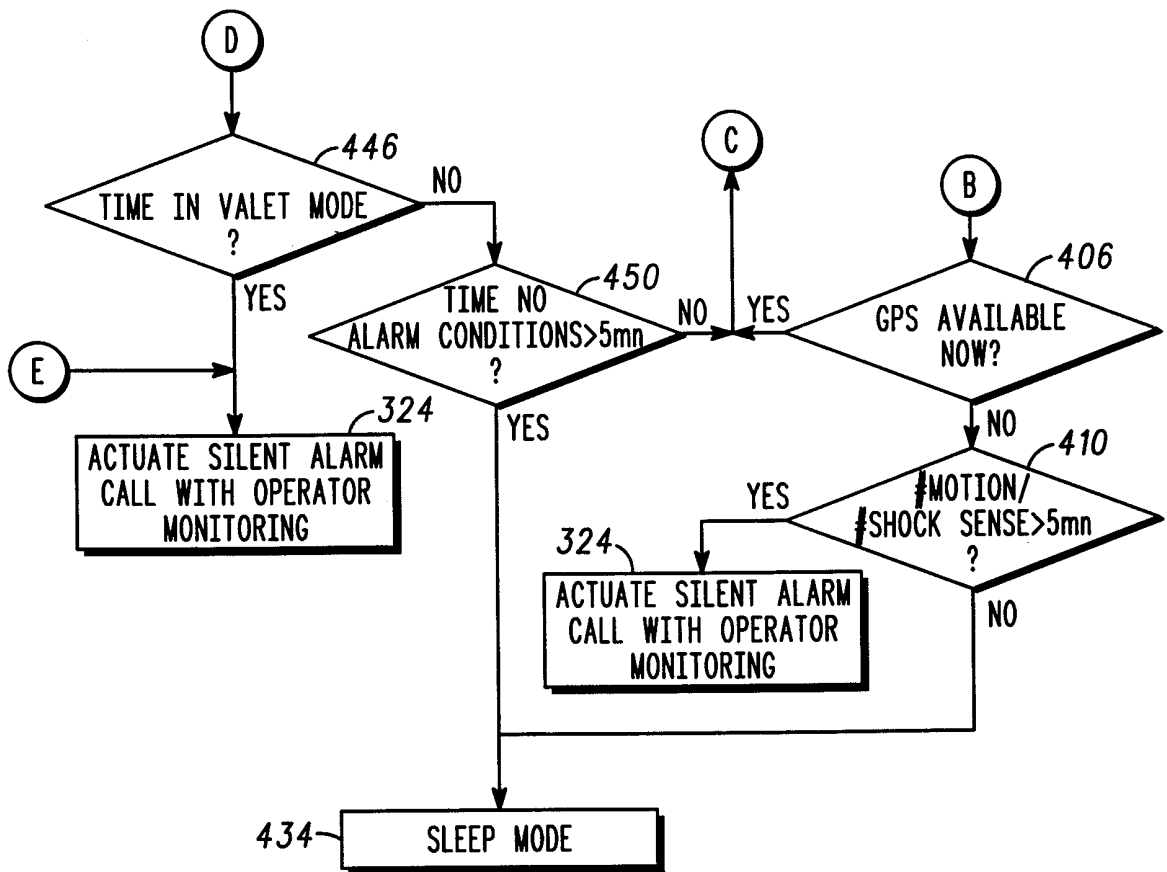


FIG. 5

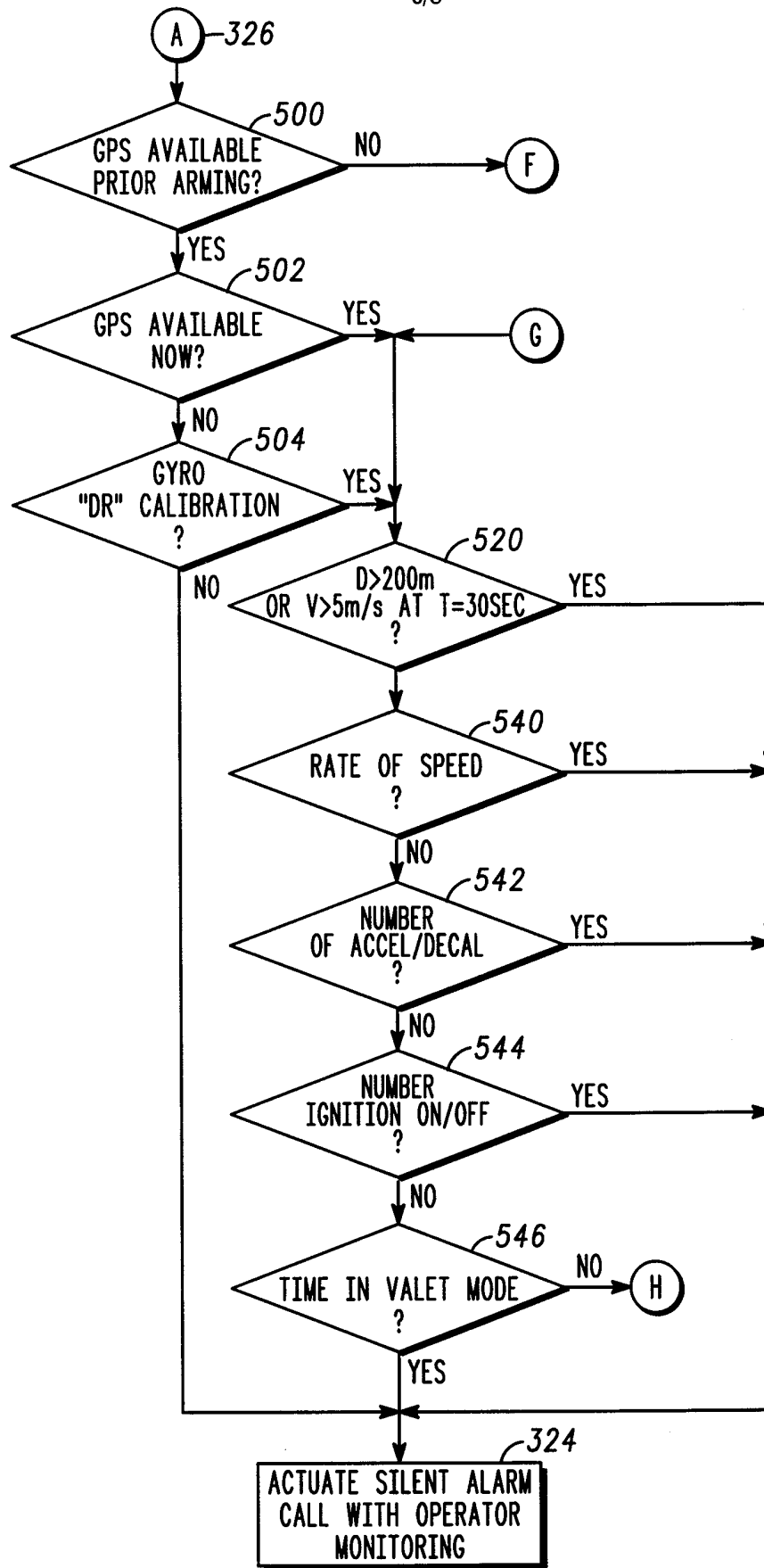


FIG. 6

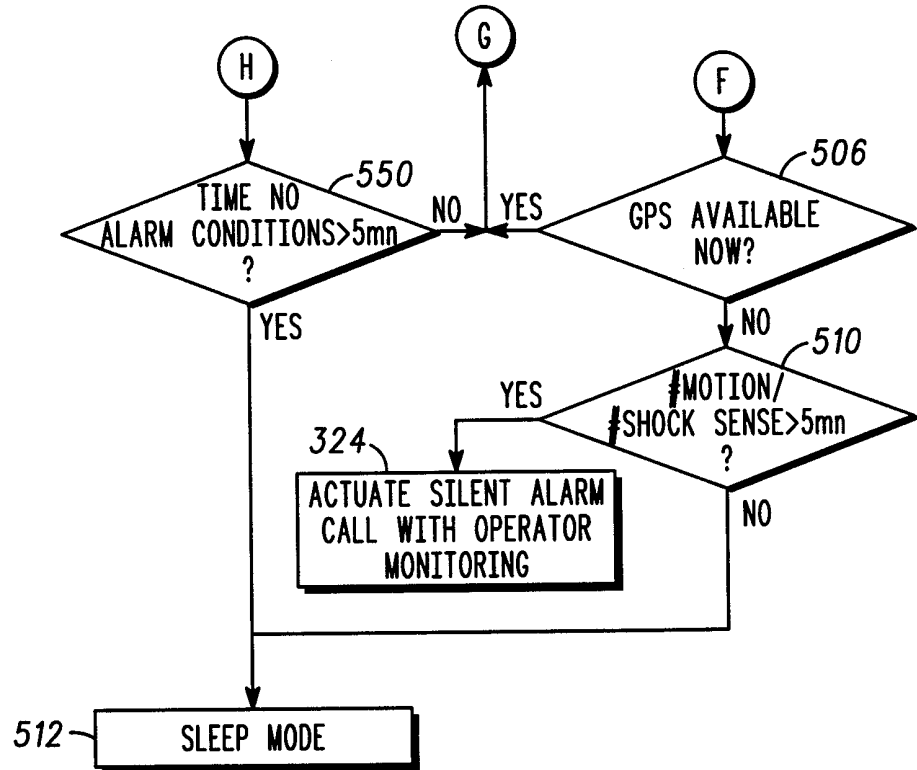


FIG. 7

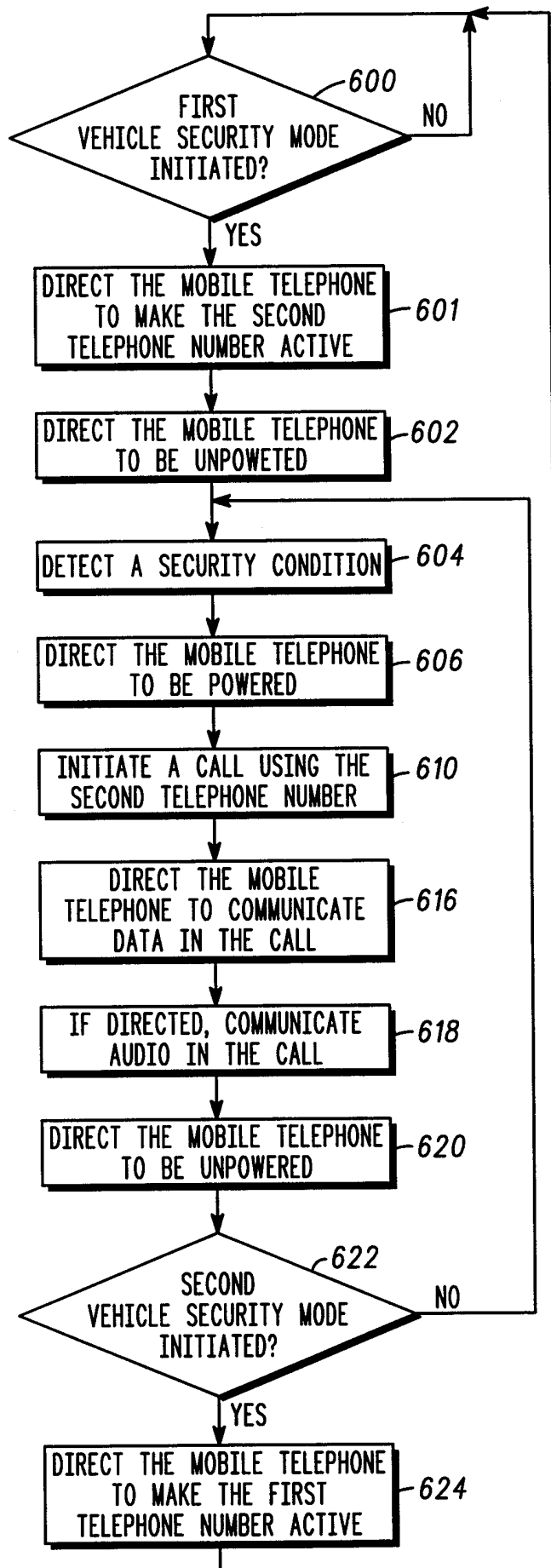


FIG. 8