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(12) **United States Patent**
Obradovich

(10) **Patent No.: US 6,577,928 B2**
(45) **Date of Patent: Jun. 10, 2003**

(54) **MULTIMEDIA INFORMATION AND CONTROL SYSTEM FOR AUTOMOBILES**

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(73) Assignee: **American Calcar Inc.**, Wilmington, DE (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/848,391**

(22) Filed: **May 3, 2001**

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Related U.S. Application Data

(63) Continuation of application No. 09/355,433, filed as application No. PCT/US98/01119 on Jan. 5, 1998, which is a continuation-in-part of application No. 08/789,934, filed on Jan. 28, 1997, now Pat. No. 6,009,355.

(51) **Int. Cl.**[7] **G05D 1/00**; G06F 7/00

(52) **U.S. Cl.** **701/1**; 701/29

(58) **Field of Search** 701/29, 30, 34, 701/33; 340/436, 438, 439, 426

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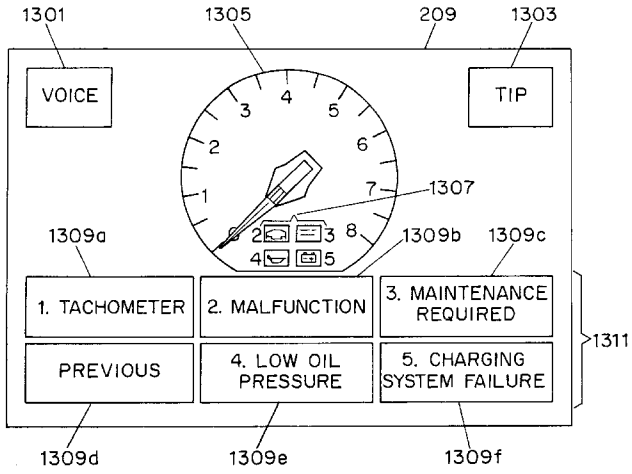
Primary Examiner—Jacques H. Louis-Jacques
(74) *Attorney, Agent, or Firm*—Kaye Scholer LLP

(57) **ABSTRACT**

In a multimedia information and control system for use in an automobile, at least one interface is employed which enables a user to access information concerning the automobile and control vehicle functions in an efficient manner. The user may select one of a plurality of displayed options on a screen of such an interface. Through audio, video and/or text media, the user is provided with information concerning the selected option and the vehicle function corresponding thereto. Having been so informed, the user may activate the selected option to control the corresponding vehicle function.

17 Claims, 17 Drawing Sheets



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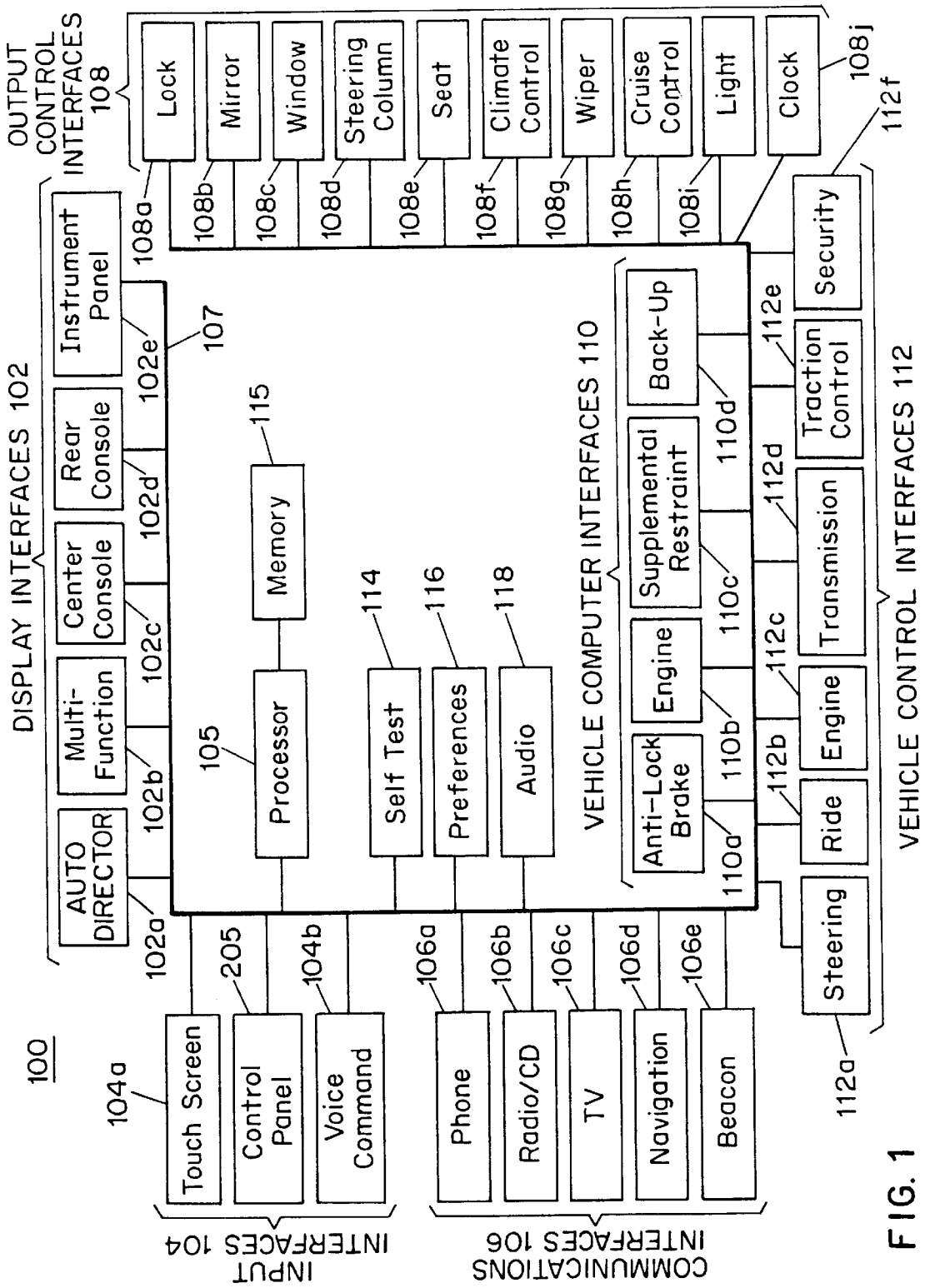
100
DISPLAY INTERFACES 102
AUTO DIRECTOR
Multi-Function
Center Console
Rear Console
Instrument Panel
102a
102b
102c
102d
102e
OUTPUT CONTROL INTERFACES 108
Lock
Mirror
Window
Steering Column
Seat
Climate Control
Wiper
Cruise Control
Light
Clock
108a
108b
108c
108d
108e
108f
108g
108h
108i
108j
107
105
Processor
Memory
115
Self Test
114
Preferences
116
Audio
118
VEHICLE COMPUTER INTERFACES 110
Anti-Lock Brake
Engine
Supplemental Restraint
Back-Up
110a
110b
110c
110d
VEHICLE CONTROL INTERFACES 112
Steering
Ride
Engine
Transmission
Traction Control
Security
112a
112b
112c
112d
112e
112f
INPUT INTERFACES 104
Touch Screen
Control Panel
Voice Command
104a
205
104b
COMMUNICATIONS INTERFACES 106
Phone
Radio/CD
TV
Navigation
Beacon
106a
106b
106c
106d
106e

FIG. 1

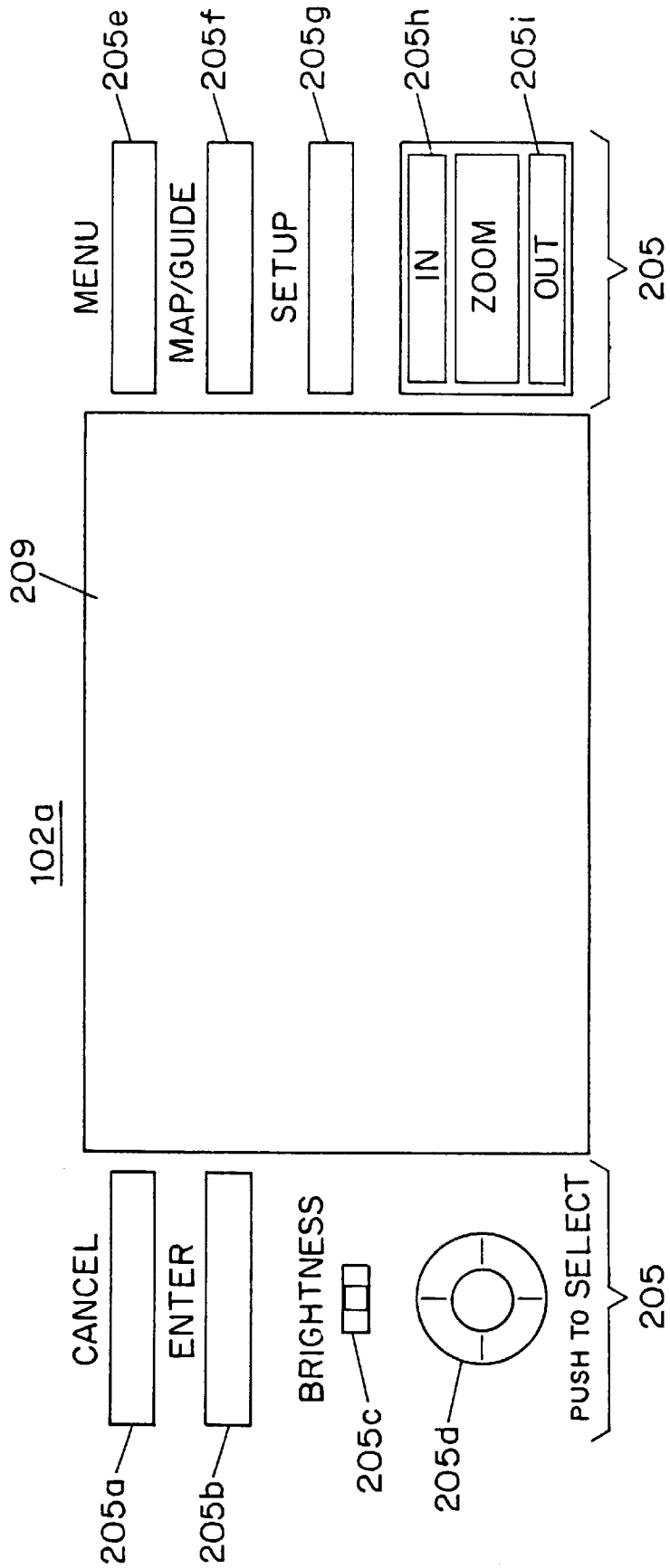
MENU
MAP/GUIDE
SETUP
IN
ZOOM
OUT
205e
205f
205g
205h
205i
205
209
102a
CANCEL
ENTER
BRIGHTNESS
PUSH TO SELECT
205a
205b
205c
205d
205

FIG. 2

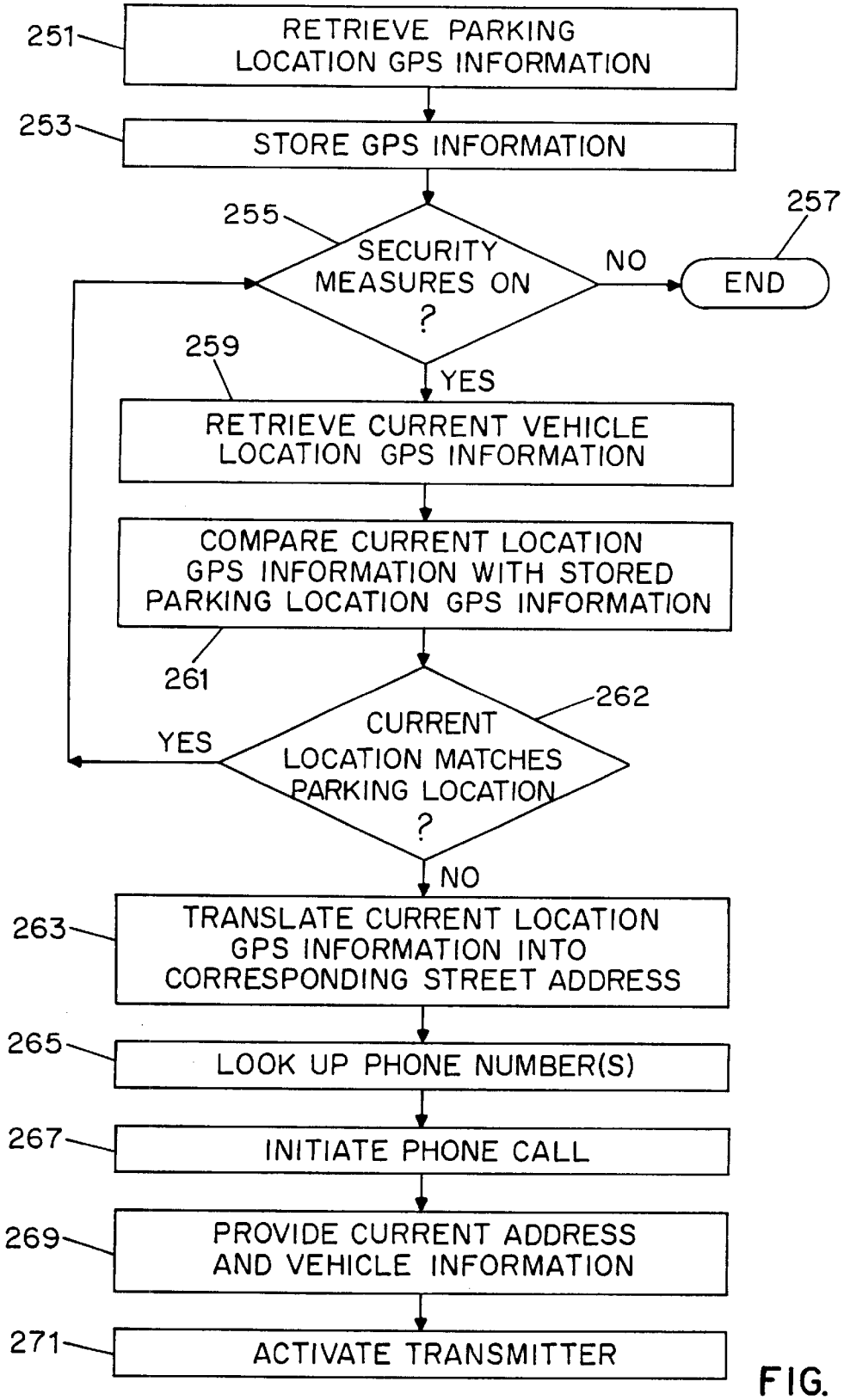
251
RETRIEVE PARKING LOCATION GPS INFORMATION
253
STORE GPS INFORMATION
255
SECURITY MEASURES ON ?
NO
257
END
YES
259
RETRIEVE CURRENT VEHICLE LOCATION GPS INFORMATION
COMPARE CURRENT LOCATION GPS INFORMATION WITH STORED PARKING LOCATION GPS INFORMATION
261
262
CURRENT LOCATION MATCHES PARKING LOCATION ?
YES
NO
263
TRANSLATE CURRENT LOCATION GPS INFORMATION INTO CORRESPONDING STREET ADDRESS
265
LOOK UP PHONE NUMBER(S)
267
INITIATE PHONE CALL
269
PROVIDE CURRENT ADDRESS AND VEHICLE INFORMATION
271
ACTIVATE TRANSMITTER

FIG. 3

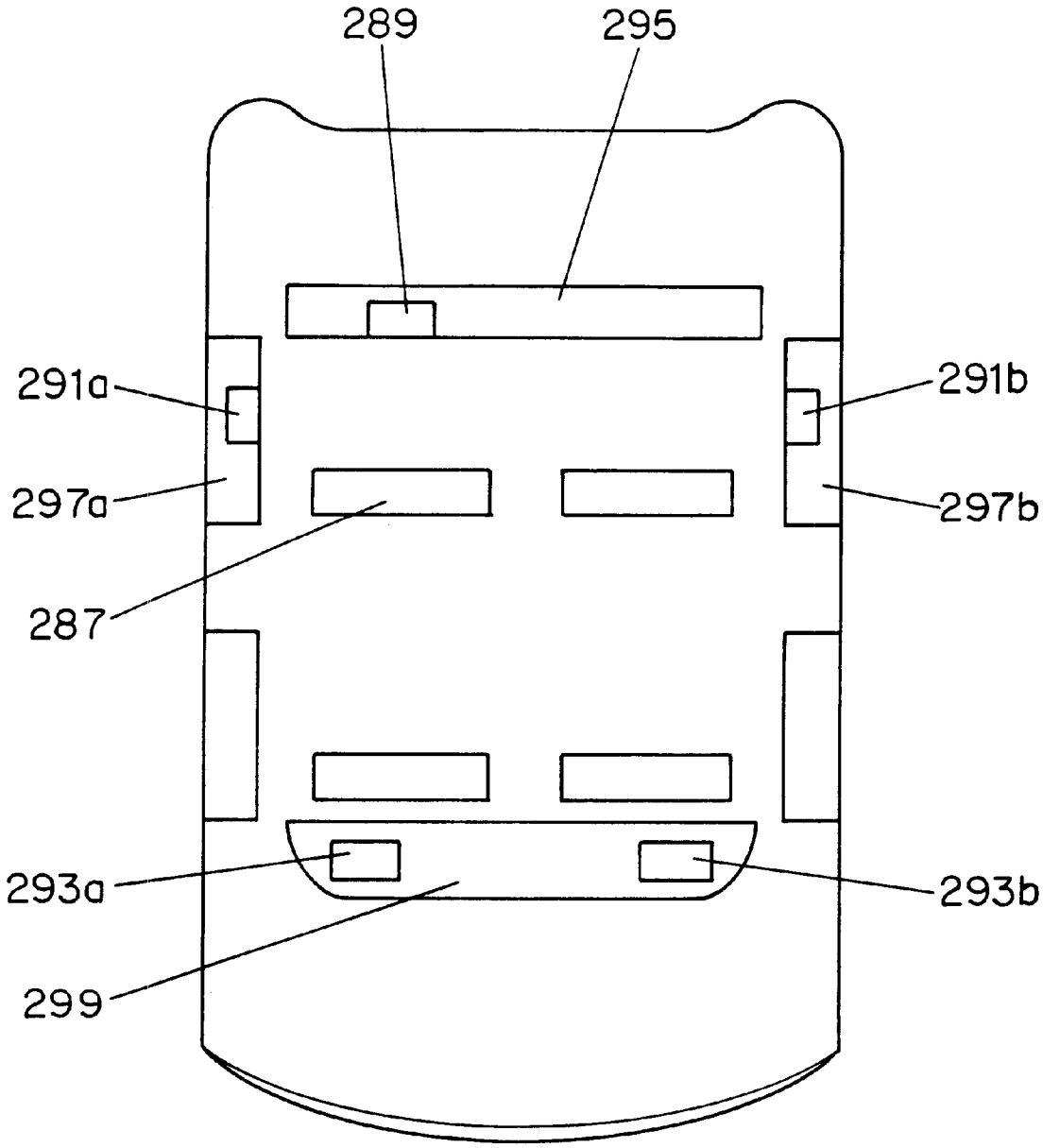

FIG. 4

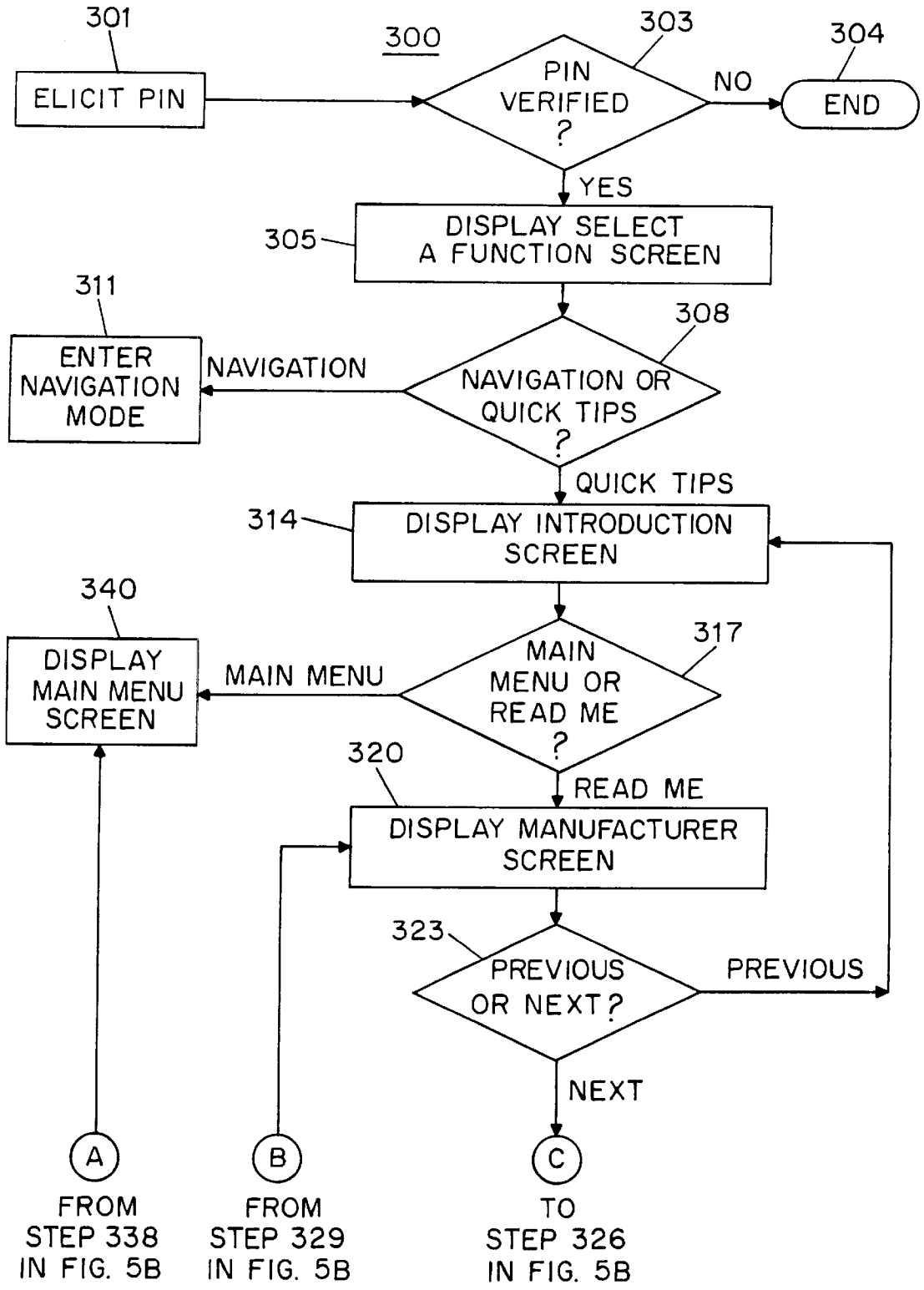
301
ELICIT PIN
300
303
PIN VERIFIED ?
NO
304
END
YES
305
DISPLAY SELECT A FUNCTION SCREEN
311
ENTER NAVIGATION MODE
NAVIGATION
308
NAVIGATION OR QUICK TIPS ?
QUICK TIPS
314
DISPLAY INTRODUCTION SCREEN
340
DISPLAY MAIN MENU SCREEN
MAIN MENU
317
MAIN MENU OR READ ME ?
320
READ ME
DISPLAY MANUFACTURER SCREEN
323
PREVIOUS OR NEXT?
PREVIOUS
NEXT
A
FROM STEP 338 IN FIG. 5B
B
FROM STEP 329 IN FIG. 5B
C
TO STEP 326 IN FIG. 5B

FIG. 5A

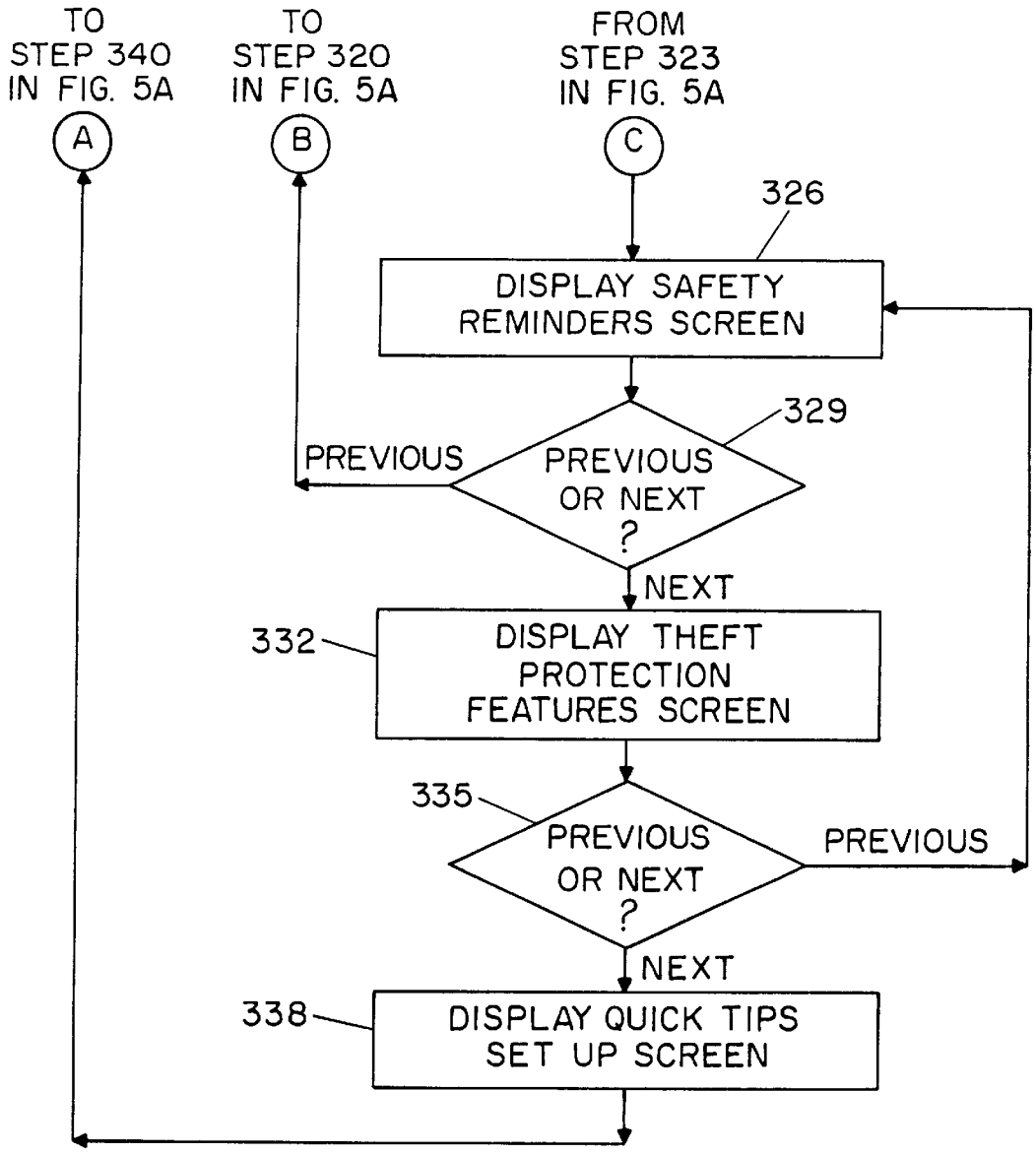
TO
STEP 340
IN FIG. 5A
A
TO
STEP 320
IN FIG. 5A
B
FROM
STEP 323
IN FIG. 5A
C
326
DISPLAY SAFETY
REMINDERS SCREEN
329
PREVIOUS
PREVIOUS
OR NEXT
?
NEXT
332
DISPLAY THEFT
PROTECTION
FEATURES SCREEN
335
PREVIOUS
OR NEXT
?
PREVIOUS
NEXT
338
DISPLAY QUICK TIPS
SET UP SCREEN

FIG. 5B

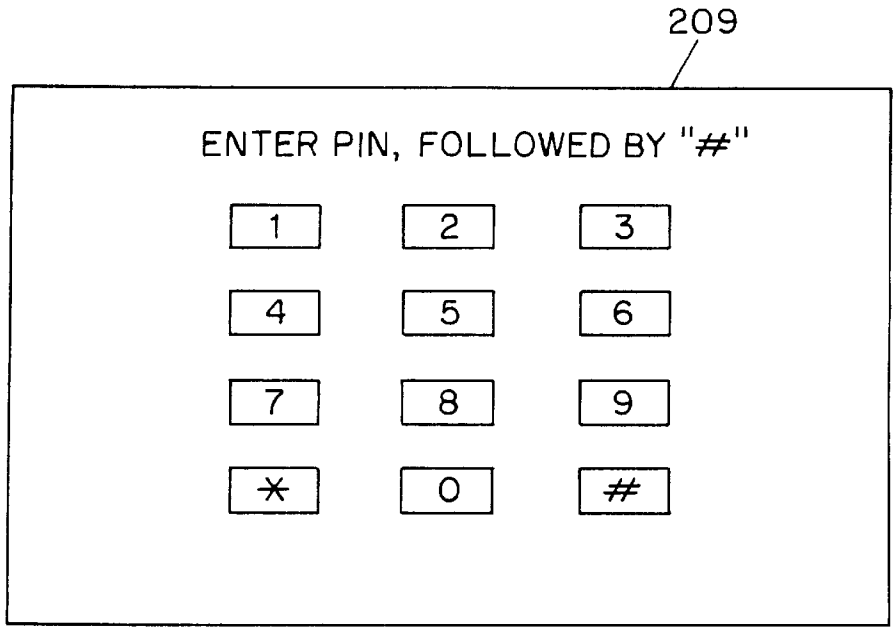
209
ENTER PIN, FOLLOWED BY "#"
1
2
3
4
5
6
7
8
9
*
0
#

FIG. 6

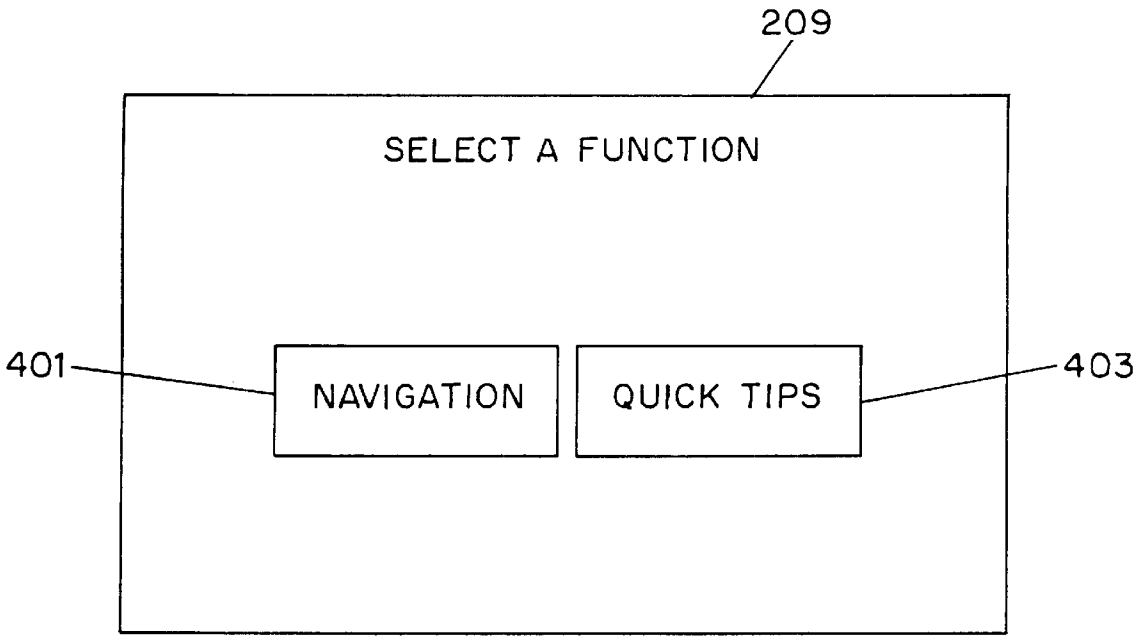
209
SELECT A FUNCTION
401
NAVIGATION
QUICK TIPS
403

FIG. 7

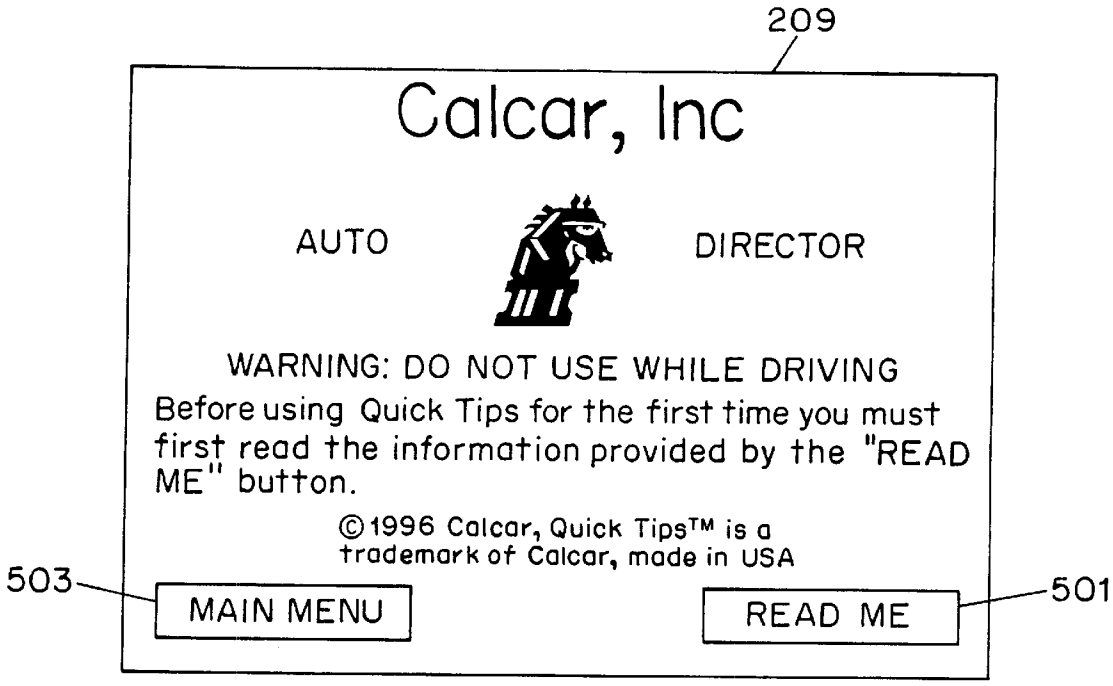
209
Calcar, Inc
AUTO
DIRECTOR
WARNING: DO NOT USE WHILE DRIVING
Before using Quick Tips for the first time you must first read the information provided by the "READ ME" button.
©1996 Calcar, Quick Tips™ is a trademark of Calcar, made in USA
503
MAIN MENU
READ ME
501

FIG. 8

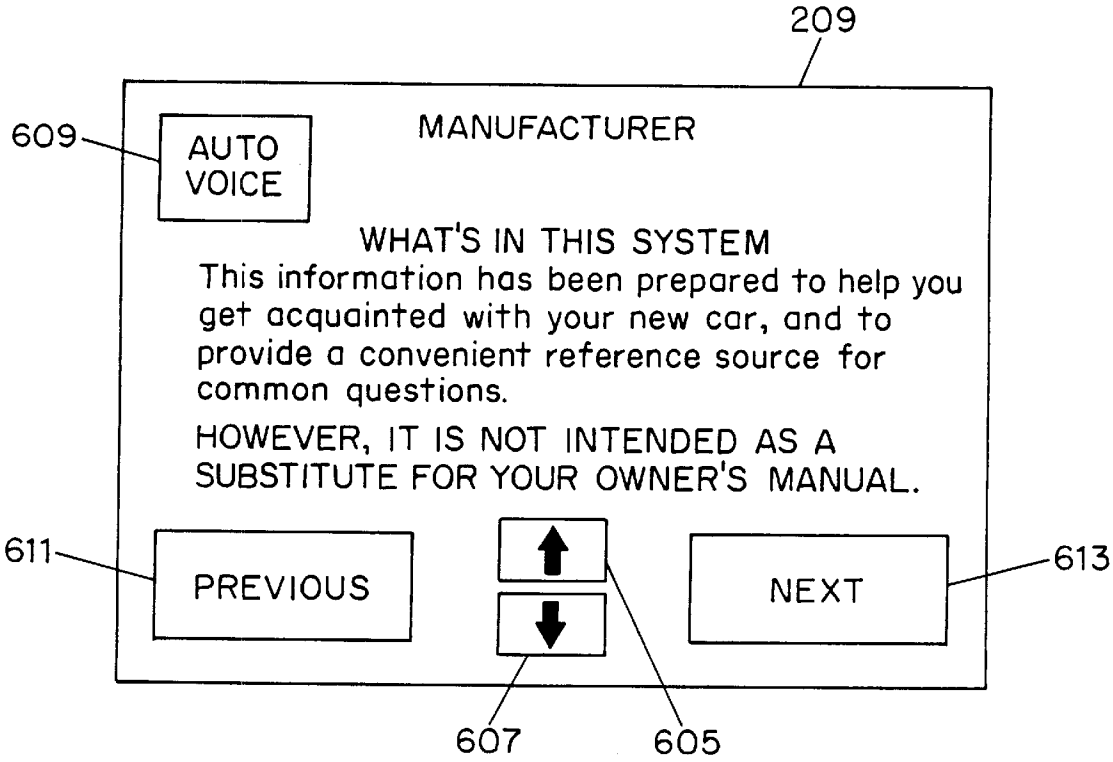
209
609
AUTO VOICE
MANUFACTURER
WHAT'S IN THIS SYSTEM
This information has been prepared to help you get acquainted with your new car, and to provide a convenient reference source for common questions.
HOWEVER, IT IS NOT INTENDED AS A SUBSTITUTE FOR YOUR OWNER'S MANUAL.
611
PREVIOUS
NEXT
613
607
605

FIG. 9

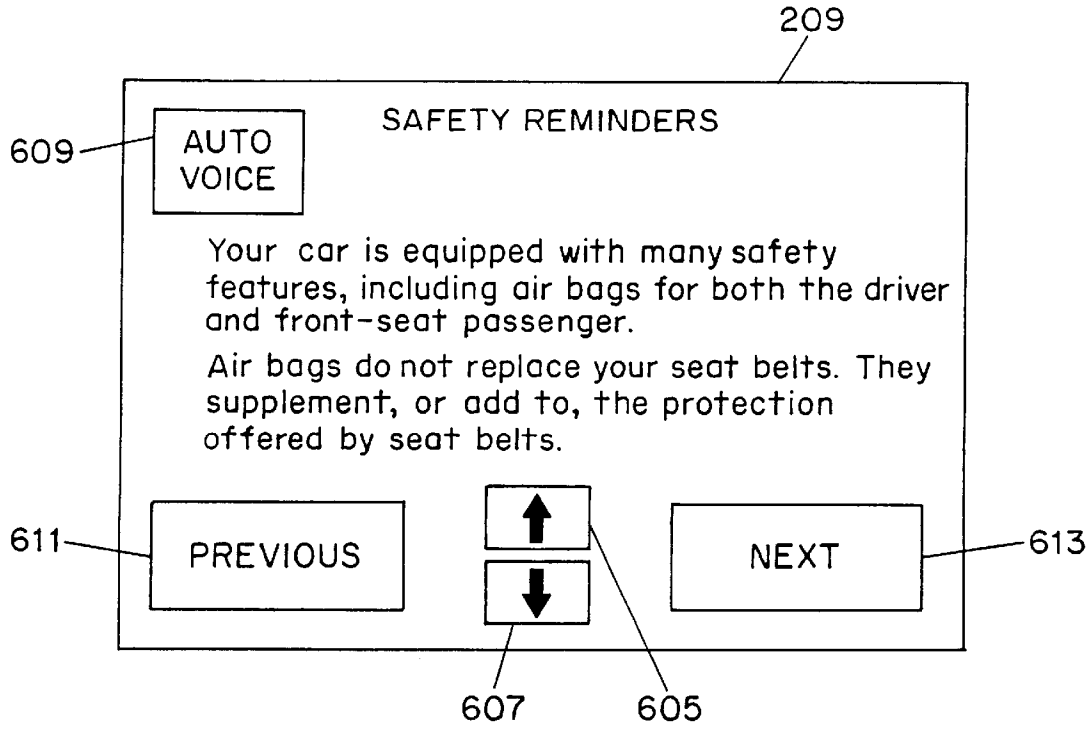
209
609
AUTO VOICE
SAFETY REMINDERS
Your car is equipped with many safety features, including air bags for both the driver and front-seat passenger.
Air bags do not replace your seat belts. They supplement, or add to, the protection offered by seat belts.
611
PREVIOUS
NEXT
613
607
605

FIG. 10

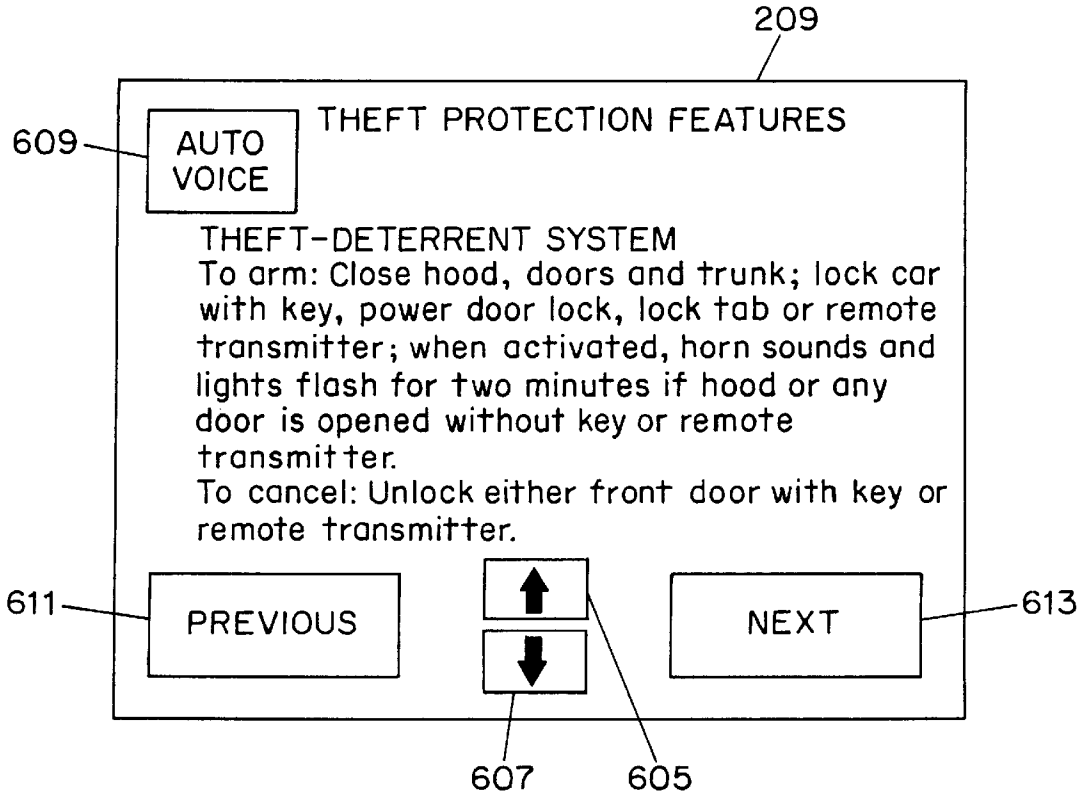
209
609
AUTO VOICE
THEFT PROTECTION FEATURES
THEFT-DETERRENT SYSTEM
To arm: Close hood, doors and trunk; lock car with key, power door lock, lock tab or remote transmitter; when activated, horn sounds and lights flash for two minutes if hood or any door is opened without key or remote transmitter.
To cancel: Unlock either front door with key or remote transmitter.
611
PREVIOUS
NEXT
613
607
605

FIG. 11

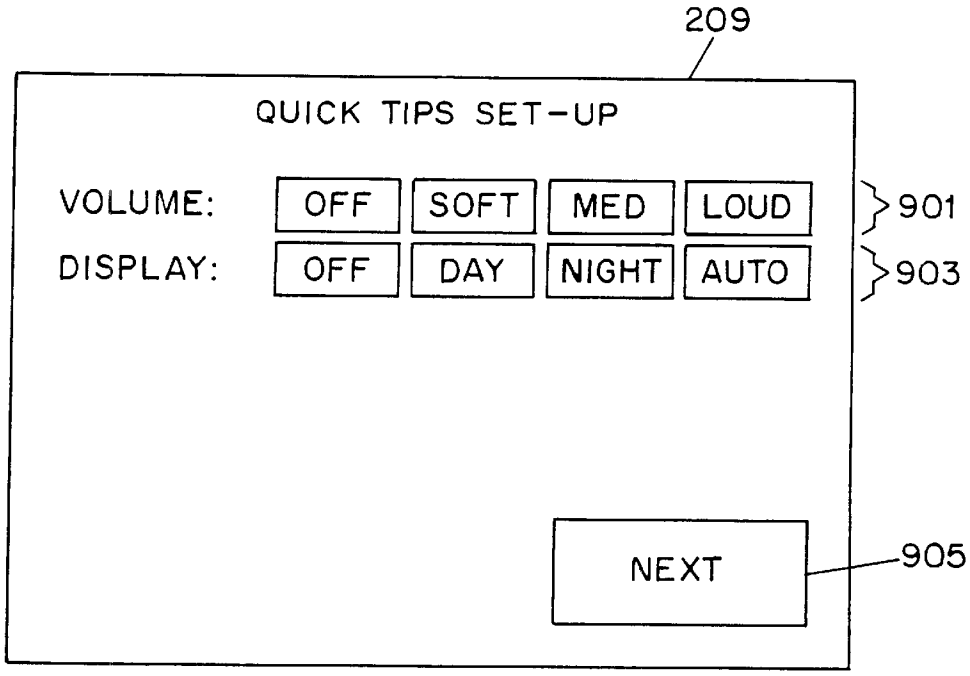
209
QUICK TIPS SET-UP
VOLUME:
OFF
SOFT
MED
LOUD
901
DISPLAY:
OFF
DAY
NIGHT
AUTO
903
NEXT
905

FIG. 12

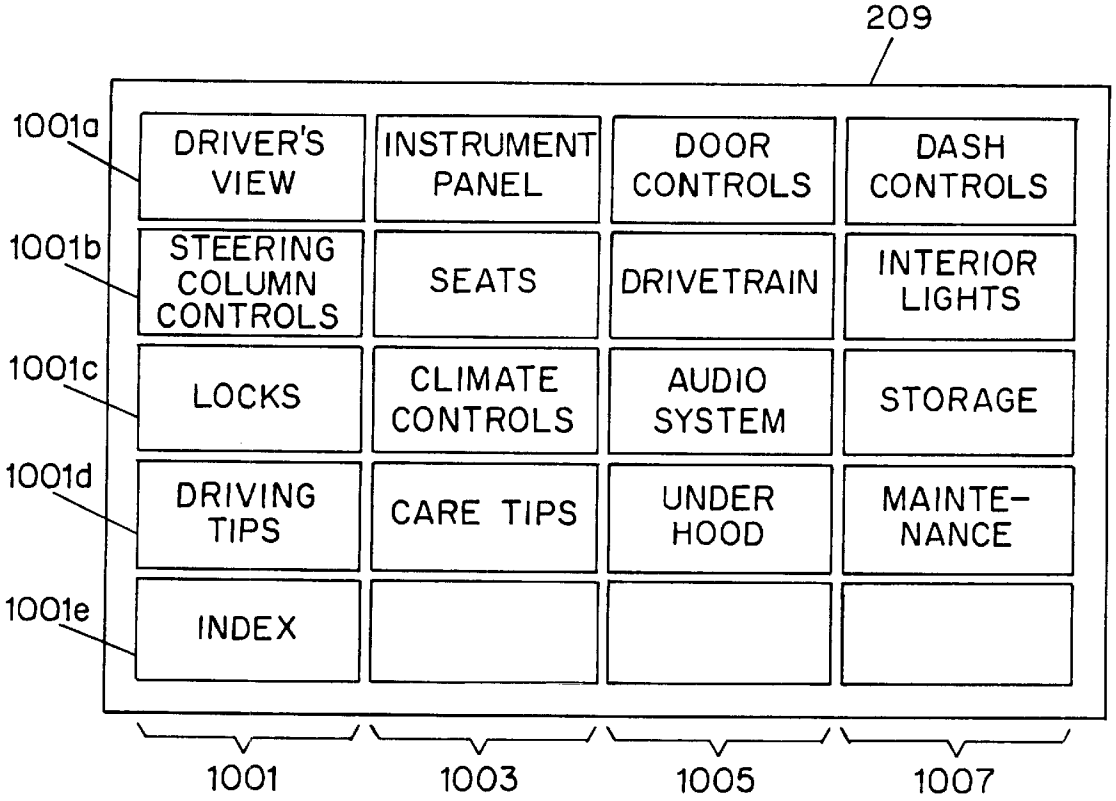
209
1001a
DRIVER'S VIEW
INSTRUMENT PANEL
DOOR CONTROLS
DASH CONTROLS
1001b
STEERING COLUMN CONTROLS
SEATS
DRIVETRAIN
INTERIOR LIGHTS
1001c
LOCKS
CLIMATE CONTROLS
AUDIO SYSTEM
STORAGE
1001d
DRIVING TIPS
CARE TIPS
UNDER HOOD
MAINTE-NANCE
1001e
INDEX
1001
1003
1005
1007

FIG. 13

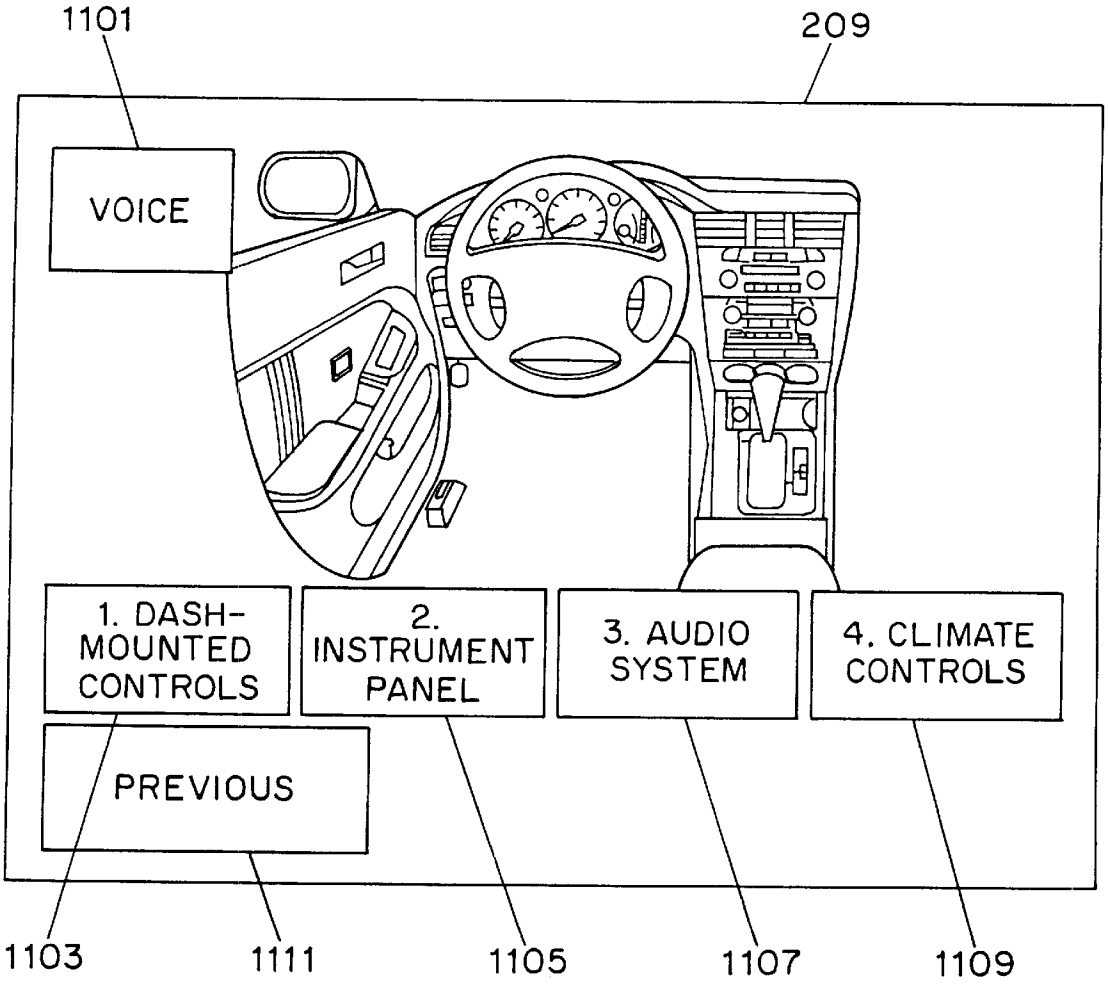
1101
209
VOICE
1. DASH-MOUNTED CONTROLS
2. INSTRUMENT PANEL
3. AUDIO SYSTEM
4. CLIMATE CONTROLS
PREVIOUS
1103
1111
1105
1107
1109

FIG. 14

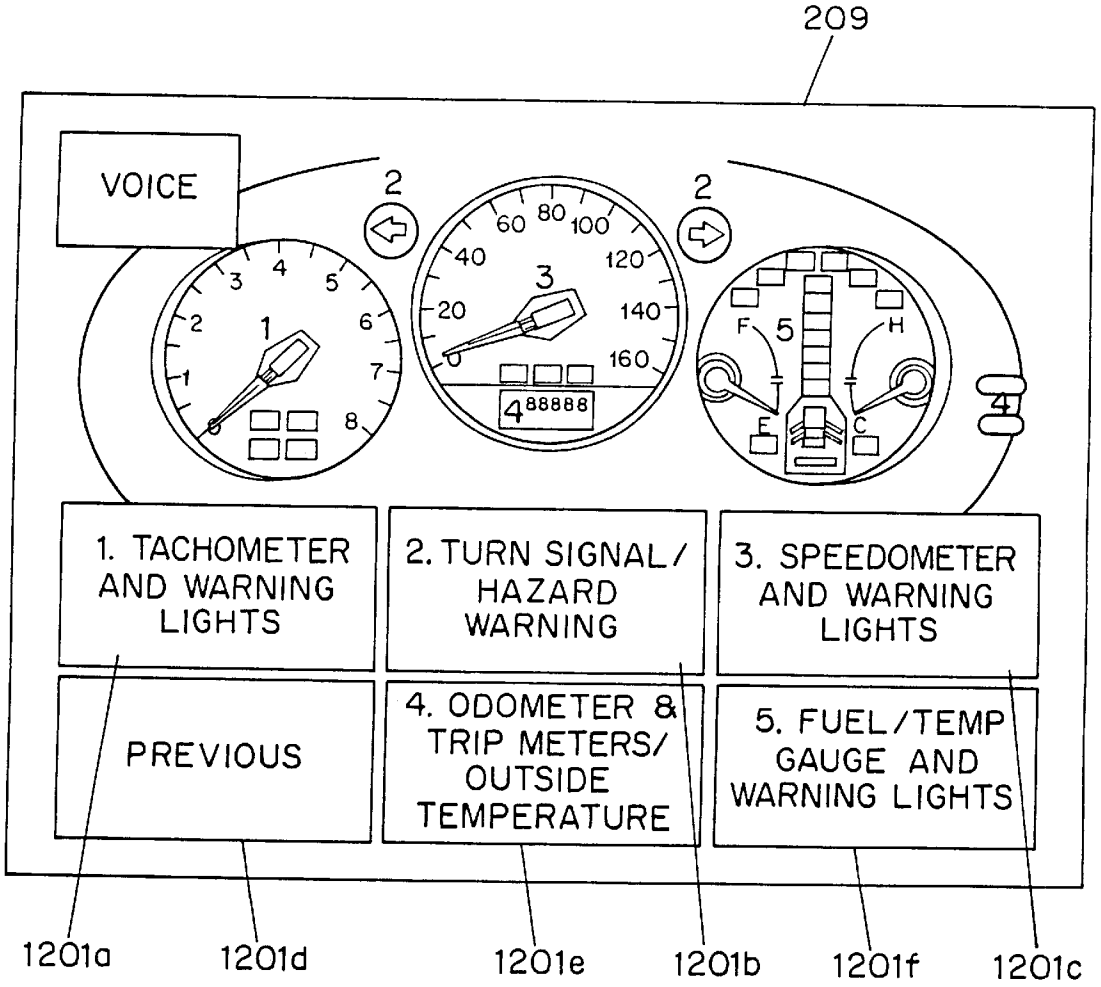
209
VOICE
2
2
1
2
3
4
5
F
H
E
C
1. TACHOMETER AND WARNING LIGHTS
2. TURN SIGNAL/ HAZARD WARNING
3. SPEEDOMETER AND WARNING LIGHTS
PREVIOUS
4. ODOMETER & TRIP METERS/ OUTSIDE TEMPERATURE
5. FUEL/TEMP GAUGE AND WARNING LIGHTS
1201a
1201d
1201e
1201b
1201f
1201c

FIG. 15A

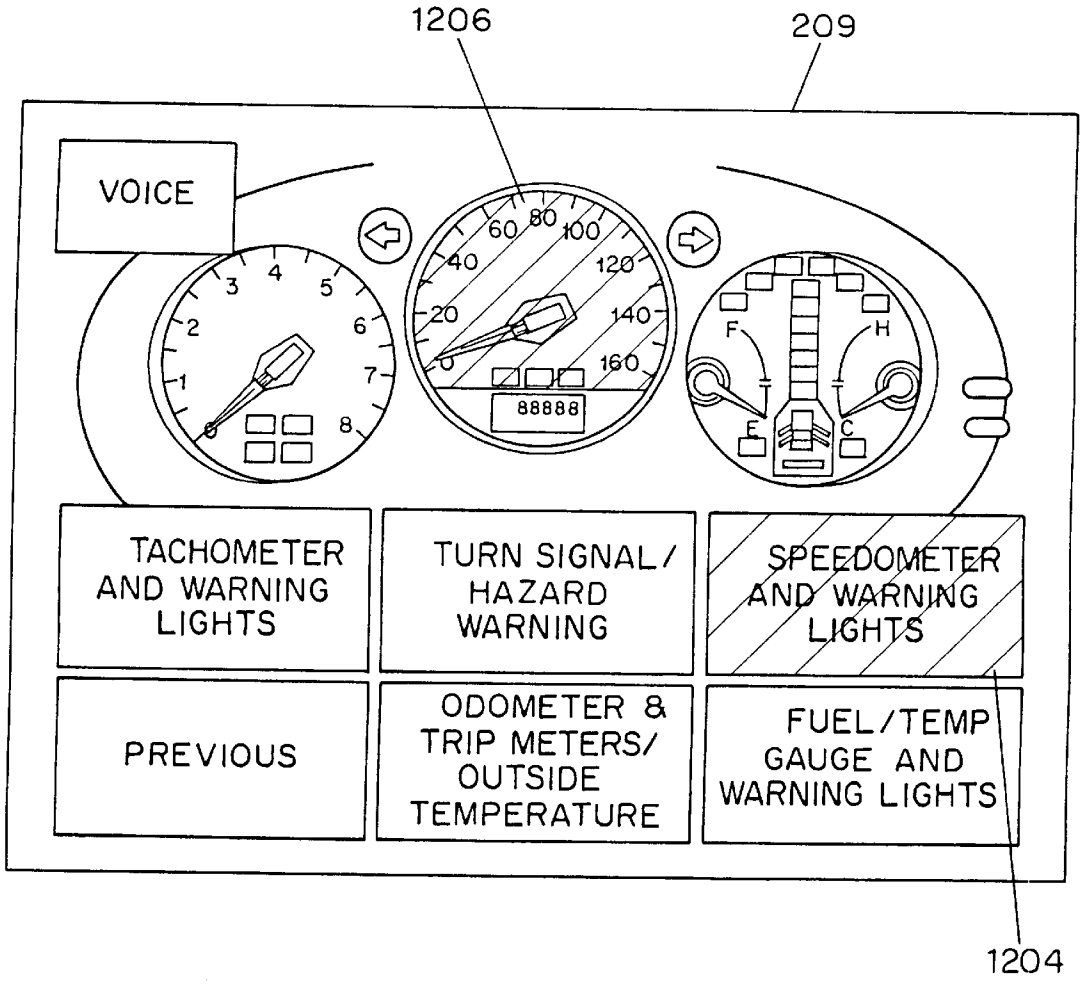
1206
209
VOICE
0
20
40
60
80
100
120
140
160
88888
1
2
3
4
5
6
7
8
F
H
E
C
TACHOMETER AND WARNING LIGHTS
TURN SIGNAL/ HAZARD WARNING
SPEEDOMETER AND WARNING LIGHTS
PREVIOUS
ODOMETER & TRIP METERS/ OUTSIDE TEMPERATURE
FUEL/TEMP GAUGE AND WARNING LIGHTS
1204

FIG. 15B

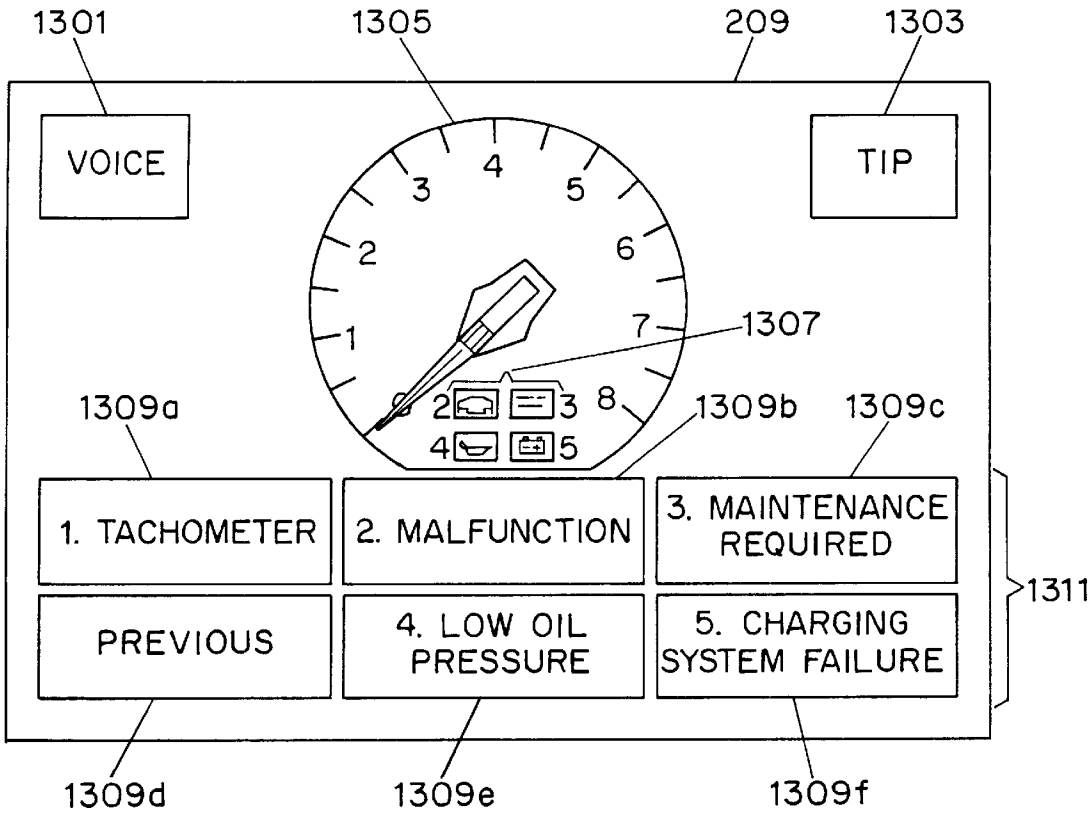
1301
1305
209
1303
VOICE
TIP
1307
1309a
1309b
1309c
1. TACHOMETER
2. MALFUNCTION
3. MAINTENANCE REQUIRED
PREVIOUS
4. LOW OIL PRESSURE
5. CHARGING SYSTEM FAILURE
1311
1309d
1309e
1309f

FIG. 16

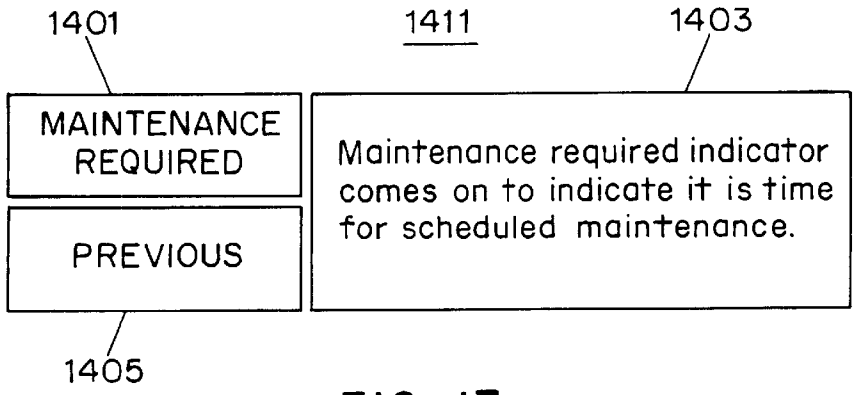
1401
1411
1403
MAINTENANCE REQUIRED
PREVIOUS
Maintenance required indicator comes on to indicate it is time for scheduled maintenance.
1405

FIG. 17

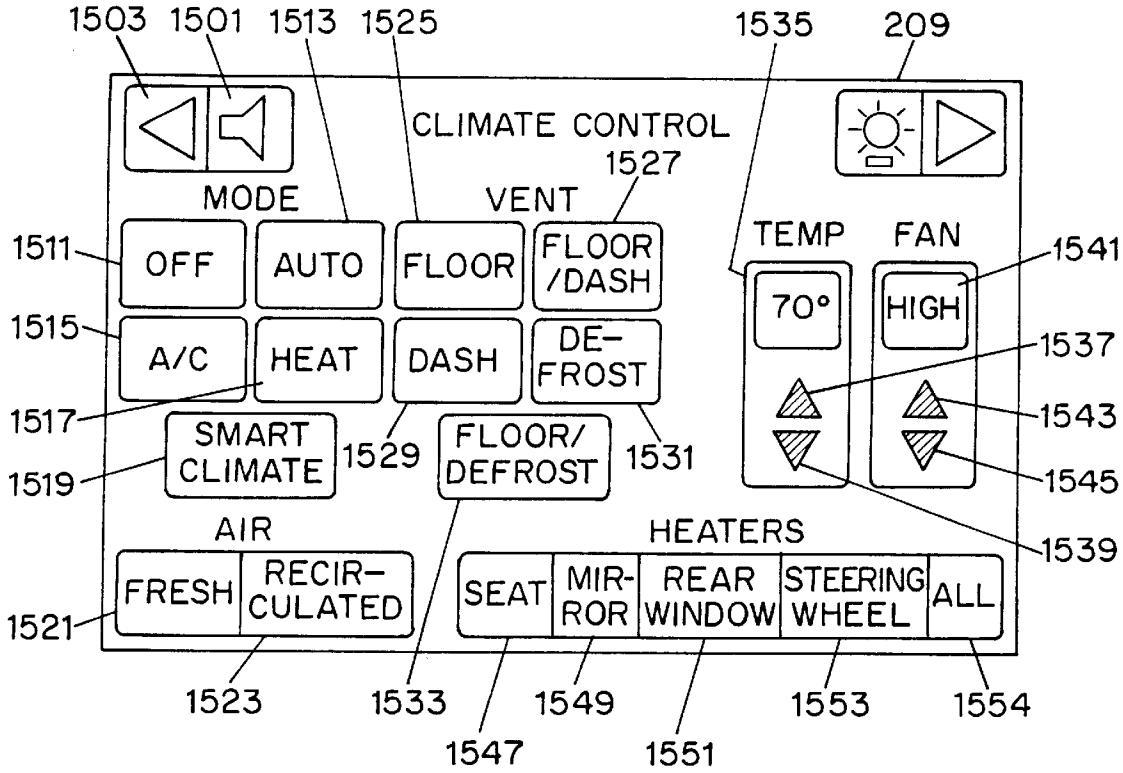
1503
1501
1513
1525
1535
209
CLIMATE CONTROL
1527
MODE
VENT
TEMP
FAN
1511
OFF
AUTO
FLOOR
FLOOR /DASH
70°
HIGH
1541
1515
A/C
HEAT
DASH
DE-FROST
1537
1517
1543
SMART CLIMATE
1529
FLOOR/ DEFROST
1531
1519
1545
1539
AIR
HEATERS
FRESH
RECIR-CULATED
SEAT
MIR-ROR
REAR WINDOW
STEERING WHEEL
ALL
1521
1523
1533
1549
1553
1554
1547
1551

FIG. 18

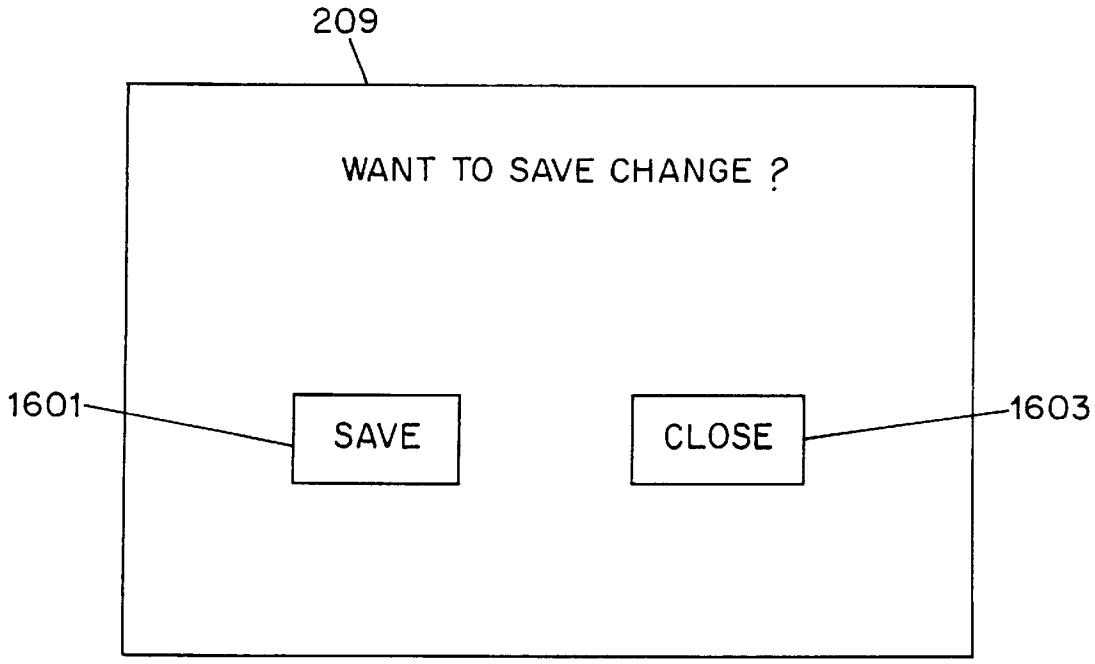
209
WANT TO SAVE CHANGE ?
1601
SAVE
CLOSE
1603

FIG. 19

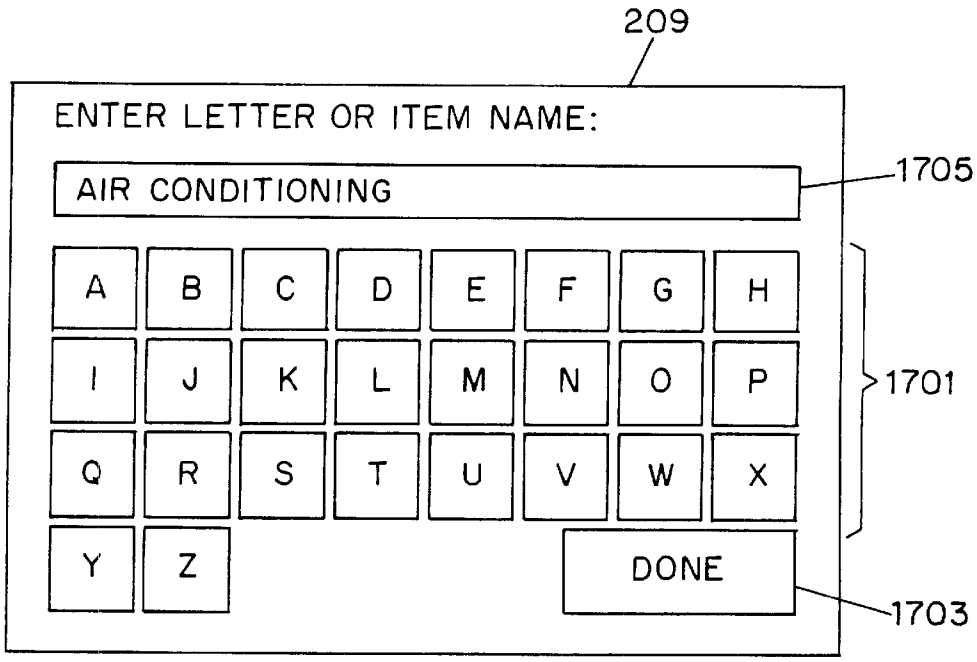
209
ENTER LETTER OR ITEM NAME:
AIR CONDITIONING
1705
A B C D E F G H
I J K L M N O P
Q R S T U V W X
Y Z
DONE
1701
1703

FIG. 20

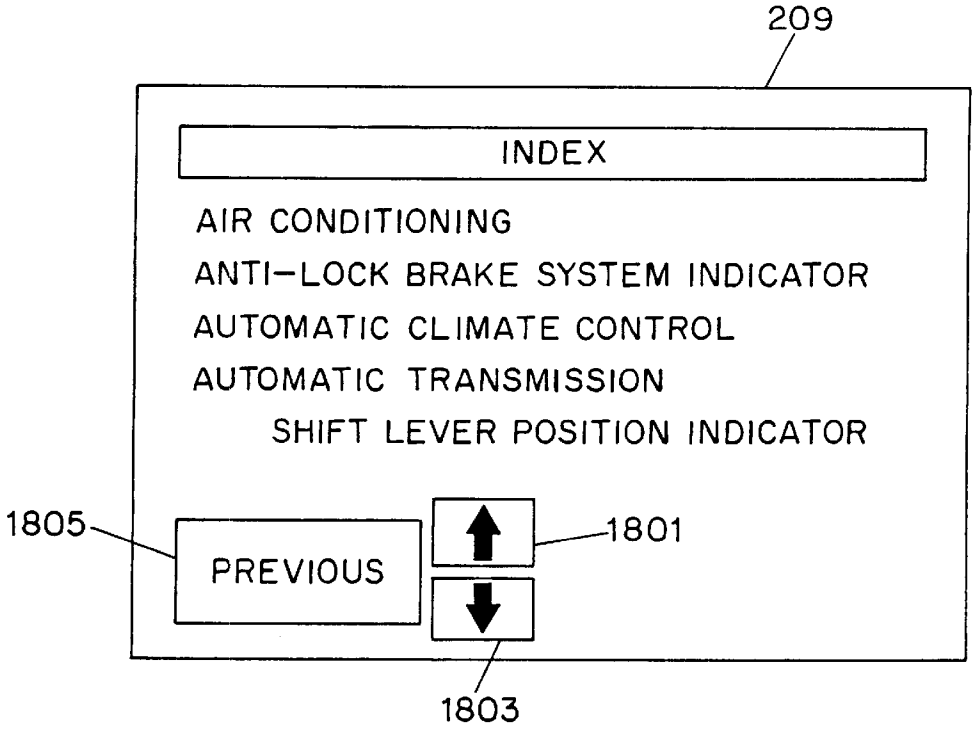
209
INDEX
AIR CONDITIONING
ANTI-LOCK BRAKE SYSTEM INDICATOR
AUTOMATIC CLIMATE CONTROL
AUTOMATIC TRANSMISSION
SHIFT LEVER POSITION INDICATOR
1805
PREVIOUS
1801
1803

FIG. 21

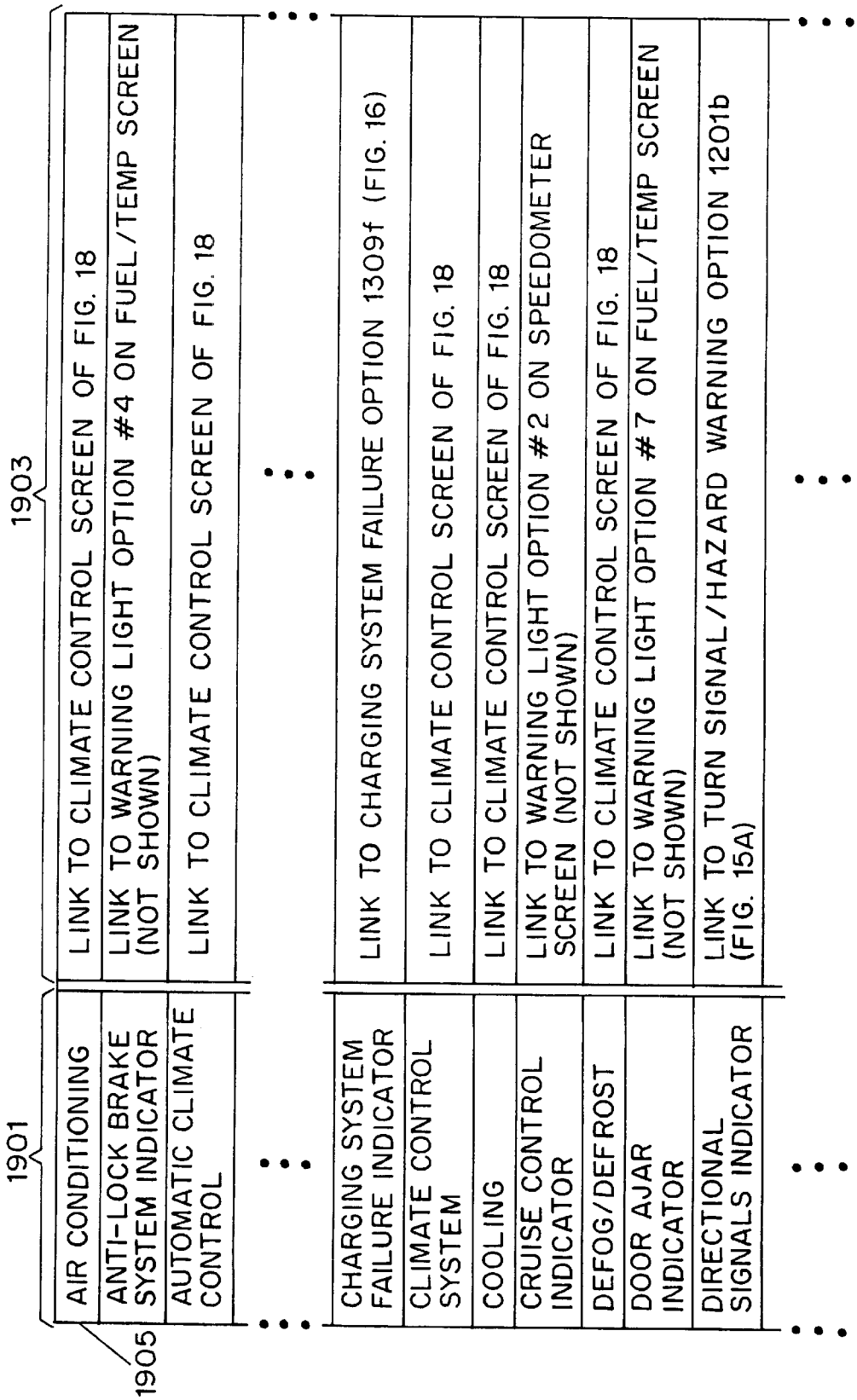
1901
1903
1905
AIR CONDITIONING
ANTI-LOCK BRAKE SYSTEM INDICATOR
AUTOMATIC CLIMATE CONTROL
CHARGING SYSTEM FAILURE INDICATOR
CLIMATE CONTROL SYSTEM
COOLING
CRUISE CONTROL INDICATOR
DEFOG/DEFROST
DOOR AJAR INDICATOR
DIRECTIONAL SIGNALS INDICATOR
LINK TO CLIMATE CONTROL SCREEN OF FIG. 18
LINK TO WARNING LIGHT OPTION #4 ON FUEL/TEMP SCREEN (NOT SHOWN)
LINK TO CLIMATE CONTROL SCREEN OF FIG. 18
LINK TO CHARGING SYSTEM FAILURE OPTION 1309f (FIG. 16)
LINK TO CLIMATE CONTROL SCREEN OF FIG. 18
LINK TO CLIMATE CONTROL SCREEN OF FIG. 18
LINK TO WARNING LIGHT OPTION #2 ON SPEEDOMETER SCREEN (NOT SHOWN)
LINK TO CLIMATE CONTROL SCREEN OF FIG. 18
LINK TO WARNING LIGHT OPTION #7 ON FUEL/TEMP SCREEN (NOT SHOWN)
LINK TO TURN SIGNAL/HAZARD WARNING OPTION 1201b (FIG. 15A)

FIG. 22

MULTIMEDIA INFORMATION AND CONTROL SYSTEM FOR AUTOMOBILES

This application is a continuation of U.S. application Ser. No. 09/355,433 accorded a filing date of Jul. 27, 1999, which is a National Stage of International Application No. PCT/US98/01119 filed on Jan. 5, 1998, and which is a continuation-in-part of U.S. application Ser. No. 08/789,934 filed on Jan. 28, 1997, maturing into U.S. Pat. No. 6,009,355 issued on Dec. 28, 1999.

TECHNICAL FIELD

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia". Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option when selected is highlighted, for example, in yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The retrieved information is presented to the user in text, voice and/or graphics.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. **1** is a block diagram of an automobile information and control system in accordance with the invention;

FIG. **2** illustrates a control panel and a display interface for a user to interact with the system of FIG. **1**;

FIG. **3** illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. **1**;

FIG. **4** illustrates an arrangement of speakers in an automobile in accordance with the invention;

FIGS. **5**A and **5**B jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. **6** illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. **7** illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. **8** illustrates an introduction screen including features thereof in accordance with the invention;

FIG. **9** illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. **10** illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. **11** illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. **12** illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. **13** illustrates a MAIN MENU screen including features thereof in accordance with invention;

FIG. **14** illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. **15**A illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. **15**B illustrates an association of an item with an option corresponding thereto on a second INSTRUMENT PANEL screen in accordance with the invention;

FIG. **16** illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. **17** illustrates a segment of the screen of FIG. **16** providing the user with information regarding a particular function of the automobile;

FIG. **18** illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. **19** illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. **20** illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. **21** illustrates an INDEX screen with listed items for which information is available; and

FIG. **22** is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. **1** to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

FIG. **1** illustrates information and control system **100** embodying the principles of the invention for use in an automobile. System **100** is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface **102***a* to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface **102***a*, or multifunction display interface **102***b* to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. **1**, central to system **100** is processor **105** connected to memory **115**. Data bus **107** connects processor **105** to display interfaces **102**, input interfaces **104**, communications interfaces **106**, output control interfaces **108**, vehicle computer interfaces **110**, vehicle control interfaces **112**, self-test interface **114**, preferences interface **116**, and audio interface **118**.

Display interfaces **102** include, inter alia, AUTO DIRECTOR display interface **102***a*, which is illustrated in FIG. **2**, together with control panel **205** in FIG. **1**. By way of example, but not limitation, the hardware of interface **102***a* and control panel **205** are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface **102***a* and control panel **205** are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface **102***a* includes a conventional liquid crystal display screen **209**, and LCD driver (not shown) for processor **105** to control the display on screen **209**. Interface **102***a* also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface **104***a* in FIG. **1**. With this circuitry, the user can interact with processor **105** by, say, touching a displayed option on screen **209**. Through interface **104***a*, processor **105** receives from the touch screen circuitry a signal identifying the location on screen **209** where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor **105** determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface **102***a*, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel **205** comprises CANCEL switch **205***a*, ENTER switch **205***b*, BRIGHTNESS switch **205***c*, PUSH TO SELECT knob **205***d*, MENU switch **205***e*, MAP/GUIDE switch **205***f*, SETUP switch **205***g*, ZOOM IN switch **205***h* and ZOOM OUT switch **205***i*. BRIGHTNESS switch **205***c* comprises a standard variable resistor such that when it is pushed one way, operating circuitry **121** responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch **205***h* when pressed enables the automobile user to enlarge a particular visual area of interest on screen **209**, affording better details. On the other hand, ZOOM OUT switch **205***i* when pressed performs the inverse function to switch **205***h*. As an alternative to the touch-screen capability, switch **205***d* similar to a standard joystick is provided for the user to move from one displayed option to another on screen **209** in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch **205***b*. The functions of the other switches are described hereinbelow as they are called out in the operation of system **100**. In this illustrative embodiment, AUTO DIRECTOR display interface **102***a* and control panel **205** are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. **1**, display interfaces **102** also include multifunction display interface **102***b*, center console display interface **102***c*, rear console display interface **102***d*, and instrument panel display interface **102***e*.

Specifically, multifunction display interface **102***b* is installed on the dashboard close to interface **102***a* on the driver side. Like interface **102***a*, interface **102***b* provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface **102***b* duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface **102***a* so that the user can use interface **102***b* to control a selected function while interface **102***a* is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface **102***a* to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface **102***a*, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface **102***a* alone and use interface **102***b* to administer the climate control.

Center console interface **102***c* is installed close to interface **102***a* on the passenger side. Similar to interface **102***b*, interface **102***c* provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface **102***d* is installed on the back of a front seat. Similar to interface **102***c*, interface **102***d* provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface **102***e* is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface **102***a*, the system user may select the display of the information in either an analog or a digital form.

Input interfaces **104** comprise touch screen interface **104***a* and control panel **205** described before, and voice command interface **104***b*. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system **100**.

Communications interfaces **106** include phone interface **106***a*, radio/CD interface **106***b*, television (TV) interface

106*c*, navigation interface **106***d*, and beacon interface **106***e*. Processor **105** interacts with and controls standard phone equipment connected to phone interface **106***a*. Through processor **105**, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface **102***a* or multifunction display interface **102***b*. The user may also operate the phone equipment via remote switches.

Similarly, processor **105** interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface **106***b*. Through processor **105**, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor **105** further interacts with and controls one or more TV receivers in the automobile connected to TV interface **106***c*. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability. It should be noted at this point that it is apparent to a person skilled in the art that wherever the touch screen capability may be used to select or control various options or functions provided by system **100**, the voice command is equally applicable. As such, without further repetition, the explicit mention of use of the voice command as an alternative to that of the touch screen capability in each instance is conveniently omitted in the ensuing discussion.

As further described hereinbelow, navigation interface **106***d* is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory **115**, the inertial guidance system is capable of providing the user with navigational instructions via interface **102***a* or **102***b*. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface **106***d*.

Beacon interface **106***e* is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces **108** include lock interface **108***a*, mirror interface **108***b*, window interface **108***c*, steering column interface **108***d*, seat interface **108***e*, climate control interface **108***f*, wiper interface **108***g*, cruise control interface **108***h*, light interface **108***i* and clock interface **108***j*.

Specifically, lock interface **108***a* comprises output control logic controllable by processor **105** to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface **108***b* comprises output control logic controllable by processor **105** to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface **108***c* comprises output control logic controllable by processor **105** to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface **108***d* comprises output control logic controllable by processor **105** to move the steering column in or out and up or down.

Seat interface **108***e* comprises output control logic controllable by processor **105** to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface **108***f* comprises output control logic controllable by processor **105** to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

Windshield wiper interface **108***g* comprises output control logic controllable by processor **105** to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface **108***g* also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface **108***h* comprises output control logic controllable by processor **105** to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface **108***i* comprises output control logic controllable by processor **105** to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface **108***j* comprises output control logic controllable by processor **105** to set an initial date and time on a conventional clock (not shown) connected to interface **108***j*. System **100** relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces **110** include anti-lock brake computer interface **110***a*, engine computer interface **110***b* and supplemental restraint computer interface **110***c* for processor **105** to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces **110** also include back-up interface **110***d* through which processor **105** receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor **105** any failures of the computers. In response to a computer failure, processor **105** causes a corresponding back-up computer connected to interface **110***d* to provide a back-up function.

Vehicle control interfaces **112** include steering interface **112***a*, ride interface **112***b*, engine interface **112***c*, transmission interface **112***d*, traction control interface **112***e*, and security interface **112***f*.

Specifically, steering interface **112***a* comprises input monitoring and output control logic for processor **105** to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface **102***a*, the user may opt for manual or automatic steering effort ratio control. Interface **112***a* is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface **112***b* comprises input monitoring and output control logic for processor **105** to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface **102***a*, the user may also opt for manual or automatic ride control.

Engine interface **112***c* comprises input monitoring and output control logic allowing for shutting off a specified

number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface **112***d* comprises input monitoring and output control logic for selecting manual or automatic shifting of the transmission. In an automatic shifting mode, interface **112***d* is capable of adapting and storing data according to the driver's inputs. Interface **112***d* also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

Traction control interface **112***e* comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface **112***f* comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface **112***f* also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system **100** incorporates an anti-car-theft technique involving security interface **112***f*. In accordance with this inventive technique, security interface **112***f* further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor **105** receives from the sensor a signal requesting an invocation of the anti-theft routine, processor **105** retrieves from navigation interface **106***d* GPS information identifying the parking location of the automobile, as indicated at step **251** in FIG. **3**. Processor **105** then stores at step **253** the parking location GPS information in memory **115**. At step **255**, processor **105** determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface **108***a* indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor **105** determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step **257**.

Otherwise if processor **105** determines that the security measures remain on, processor **105** at step **259** retrieves from navigation interface **106***d* GPS information identifying the current location of the automobile. Processor **105** then compares at step **261** the current location GPS information with the parking location GPS information previously stored. If processor **105** at step **262** determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step **255** after a predetermined period. Otherwise if processor **105** determines that the current location does not match the parking location, processor **105** assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface **112***f*, processor **105** would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface **112***f* and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it is activated. Continuing the example, processor **105** translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory **115**, as indicated at step **263**. Processor **105** at step **265** looks up one or more phone numbers pre-stored in memory **115** for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor **105** locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor **105** at step **267** initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface **106***a* using the phone number just located. After the phone connection is established, processor **105** provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface **118**, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step **269**. Through the same phone connection, processor **105** may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor **105** at step **271** activates the aforementioned transmitter connected to security interface **112***f* to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor **105** can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

In accordance with another aspect of the invention, after processor **105** determines that the vehicle requires maintenance (e.g., based on cumulative RPM measures described below), relying on the GPS information concerning the current location of the vehicle and the GPS information identifying the locations of a predetermined list of service stations, processor **105** issues an alert to the user when it determines that the vehicle is currently within a predetermined distance from one of the service stations so that the user can conveniently drive to that nearby service station to have the vehicle serviced. To that end, the GPS information concerning the service station locations is stored in memory **115**. After determining that the vehicle requires maintenance, processor **105** from time to time compares the GPS information concerning the current vehicle location with that concerning each service station in the list, thereby identifying the closest service station currently to the vehicle and the distance between them. If such a distance is within

the predetermined distance, e.g., 5 miles, processor **105** causes a message to be displayed on AUTO DIRECTOR interface **102***a* and/or to be announced through audio interface **118** described below, informing the user about the closest service station. In addition, if interface **102***a* is put in a navigation mode, the GPS information concerning such a service station is used by the aforementioned inertial guidance system to direct the user there.

Referring back to FIG. **1**, self-test interface **114** comprises input/output (I/O) control logic for performing an active self-test of system **100** on power up or at the user's request. Specifically, interface **114** polls every other interface in system **100** for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface **114**, where such test results are gathered and caused to be displayed on interface **102***a*.

Preferences interface **116** monitors changes made by the user in selected functions after the user logs on system **100**, and prompts the user to save such preferences. These preferences are stored in memory **115** in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface **118** comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface **118**.

In this illustrative embodiment, AUTO DIRECTOR display interface **102***a* and multifunction display interface **102***b* share the same speakers. As illustrated in FIG. **4**, these speakers are central speaker **289**, front left speaker **291***a*, front right speaker **291***b*, rear left speaker **293***a* and rear right speaker **293***b*. Central speaker **289** is installed on dashboard **295** directly opposite driver seat **287** in the automobile. In addition, speakers **291***a* and **291***b* are installed on the inside of front left door **297***a* and the inside of front right door **297***b*, respectively. Speakers **293***a* and **293***b* are respectively installed in left and right corners of rear shelf **299** in the automobile.

Interface **118** also provides center and rear console display interfaces **102***c* and **102***d* with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface **118** also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD library in memory **115** and routes the requested sounds to the appropriate interfaces. In addition, interface **118** comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces. Moreover, in accordance with another aspect of the invention, the voice messages and any accompanying digital sounds are routed to selected ones of speakers **289**, **291***a*, **291***b*, **293***a* and **293***b* to effectively deliver the messages to the user. For instance, if the messages are extremely important, e.g., messages requiring actions to be taken immediately, to capture the full attention of the user, such messages may be routed to central speaker **289** and thereby directed toward the face of the user. If the messages are less important, e.g., advisories requiring actions to be taken sometime but not immediately, such messages may be routed to front speakers **291***a* and **291***b*. If the messages are still less important, e.g., driving tips and other messages for information only, such messages may be routed to rear speakers **293***a* and **293***b*, rendering the effect of background information.

FIGS. **5**A and **5**B jointly illustrate routine **300** for accessing, through AUTO DIRECTOR display interface **102***a*, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine **300** is stored in memory **115** and initiated when SETUP switch **205***g* in FIG. **2** is pressed. Instructed by routine **300**, processor **105** at step **301** elicits a PIN from the user by displaying a screen of FIG. **6** through interface **102***a*. As shown in FIG. **6**, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen **209**. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface **102***a* or multifunction display interface **102***b*, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface **118**, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel **205** in a manner to be described. In any event, processor **105** then verifies at step **303** the PIN entry by comparing it with the user's preselected PIN. The latter is stored in memory **115**, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine **300** comes to an end, as indicated at step **304**.

Otherwise if the PIN entry is valid, processor **105** at step **305** causes interface **102***a* to display on screen **209** a "SELECT A FUNCTION" screen, which is illustrated in FIG. **7**. As shown in FIG. **7**, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen **209**. By default, NAVIGATION option **401** is highlighted yellow when the screen of FIG. **7** appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue momentarily. System **100** then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen **209** or by pressing ENTER switch **205***b*.

However, if QUICK TIPS option **403** is desired, the user may touch that option on screen **209**, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob **205***d* of FIG. **2** to select QUICK TIPS option **403** by first pushing the knob to the right. In response, processor **105** causes the yellow highlight to move from default NAVIGATION option **401** to QUICK TIPS option **403**. The user can then select the QUICK TIPS option by pressing ENTER switch **205***b*. Upon selection, the yellow highlighted option will again turn blue.

Processor **105** at step **308** detects an activation of either NAVIGATION option **401** or QUICK TIPS option **403**. If NAVIGATION option **401** is activated, processor **105** at step

311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106*d* receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102*a* and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102*a* to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 8.

As shown in FIG. 8, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 9.

As shown in FIG. 9, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205*d* until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205*b*.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205*b*. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205*b*. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205*b*.

Other displayed options on the screen of FIG. 9 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 8 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 5B where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 10 illustrates such a screen.

As shown in FIG. 10, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 5A. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 11 illustrates such a screen.

As shown in FIG. 11, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3 equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 12 illustrates such a screen.

As shown in FIG. 12, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 12 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 5A where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 12 can be invoked at any time by pressing SETUP switch 205*g* to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 13 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes DRIVER'S VIEW option 1001*a*, STEERING COLUMN CONTROLS option 1001*b*, LOCK option 1001*c*, DRIVING TIPS option 1001*d*, and INDEX option 1001*e*. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205*e*.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001*a* is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A

further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob **205***d* to re-select any other displayed option, followed by a depression of ENTER switch **205***b* to activate the selected option. Since LCD screen **209** is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob **205***d* and switch **205***b*, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor **105** causes a voice to be generated on speakers **127** to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option **1001***a*'s being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option **1001***a*, the user decides to select that option. In response, processor **105** causes a "DRIVER'S VIEW" screen to be displayed on screen **209**. Such a screen is illustrated in FIG. **14**. When the DRIVER'S VIEW screen appears, VOICE option **1101** is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option **1101** on screen **209**, or alternatively press ENTER switch **205***b*. VOICE option **1101** would be highlighted yellow when disabled.

As also shown in FIG. **14**, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option **1103**, INSTRUMENT PANEL option **1105**, AUDIO SYSTEM option **1107**, CLIMATE CONTROLS option **1109** and PREVIOUS option **1111** are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option **1105**, instead. By touching option **1105** on screen **209**, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option **1105**. Options **1103**, **1107**, and **1109** are similarly programmed. In this instance, selecting PREVIOUS option **1111** enables the user to return to the MAIN MENU screen of FIG. **13**.

It should be noted at this point that if the user chooses to return to the MAIN MENU screen, DRIVER'S VIEW option **1001***a* previously activated on that screen is highlighted in another distinctive color, e.g., grey, indicating its previous activation status. Advantageously, when the user searches for particular information using the MAIN MENU screen, and the information is not found through certain options activated, these options are now highlighted grey. Knowing those options highlighted grey have been explored, which do not lead to the desired information, the user would not re-activate them by mistake, thereby performing the search effectively. For that matter, in this illustrative embodiment, each option previously activated is highlighted in the above distinctive color, i.e., grey in this instance, indicating its previous activation status.

Continuing the above example, assuming that the user activates option **1105** in FIG. **14** after hearing the aforementioned preview, in response processor **105** causes an "INSTRUMENT PANEL" screen to be displayed on screen **209**. Such a screen is illustrated in FIG. **15**A. As shown in FIG. **15**A, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. **15**A are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option **1201***a* designated "1. TACHOMETER AND WARNING LIGHTS", option **1201***b* designated "2. TURN SIGNAL/HAZARD WARNING", option **1201***c* designated "3. SPEEDOMETER AND WARNING LIGHTS", option **1201***e* designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option **1201***f* designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option **1201***a* corresponds to a voice preview such as "To provide information on tachometer and malfunction, maintenance required, low oil pressure and charging system failure indicators."

It should be noted at this point that in an alternative embodiment, the association of the displayed options with the corresponding elements on the instrument panel shown in FIG. **15**A is not realized using numeral references, i.e., "1", "2", "3", "4" and "5" described above. Rather, in accordance with yet another aspect of the invention, as soon as one of the displayed options is selected (e.g., by touching the displayed option) on screen **209** and thus highlighted yellow in this instance, the corresponding element on the instrument panel is highlighted in the same color, thereby accomplishing the desired association without using any numeral references. Conversely, knowing a particular element on the instrument panel for which information is sought, the user selects (e.g., by touching) that particular element shown on the INSTRUMENT PANEL screen. Accordingly, the selected element on the screen is highlighted yellow, and at the same time the corresponding option is highlighted in the same color. The activation of the highlighted option may be achieved by, e.g., touching the highlighted option or the corresponding highlighted element on screen **209**.

FIG. **15**B illustrates the INSTRUMENT PANEL screen in the alternative embodiment. For example, as soon as SPEEDOMETER AND WARNING LIGHTS option **1204** is selected and thus highlighted yellow (shown shaded), element **1206** depicting the corresponding speedometer and warning lights is also highlighted yellow (also shown shaded), and vice versa. In fact, the association using the

same highlight in accordance with the invention applies throughout the screens, wherever appropriate, in the alternative embodiment, including the DRIVER'S VIEW screen described above.

Continuing the example in the present illustrative embodiment, assuming that the user in this instance activates option **1201***a* in FIG. **15**A, in response processor **105** causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen **209**. Such a screen is illustrated in FIG. **16**.

FIG. **16** shows VOICE option **1301** similar to option **1101** described before, TIP option **1303**, a tachometer of the automobile denoted **1305**, warning lights collectively denoted **1307**, and options **1309***a* through **1309***f* in display segment **1311**.

When TIP option **1303** appears on screen **209**, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option **1303** is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface **106***d*, etc. Under control of processor **115**, audio interface **118** preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment. As mentioned before, such an emergency warning, along with the associated sound segment, is communicated to the user through central speaker **289** in FIG. **4**, which is disposed directly across driver seat **295**. As a result, the user is able to much appreciate the emergency of the warning due to both of the direction from which the warning is announced and the associated sound segment preceding it.

In any event, if option **1303** is selected in this instance, a voice comes on and utters a tip regarding tachometer **1305** such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment **1311** in lieu of options **1309***a* through **1309***f*.

Similar to the elements on the INSTRUMENT PANEL screen, tachometer **1305** and warning lights **1307** on this screen are individually labeled and correspond to options **1309***a*, **1309***b*, **1309***c*, **1309***e* and **1309***f*, respectively. Assuming in this example that MAINTENANCE REQUIRED option **1309***c* is activated, display segment **1311** would be replaced by new display segment **1411** illustrated in FIG. **17**. As shown in FIG. **17**, item **1401** indicates the subject selected, i.e., "MAINTENANCE REQUIRED". Item **1403** explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option **1405** enables the user to reactivate segment **1311** of FIG. **16**.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. **14**, where CLIMATE CONTROLS option **1109** is available. As a second alternative, the user may press MENU switch **205***e* to invoke the MAIN MENU screen of FIG. **13**, where a "CLIMATE CONTROLS" option within column **1003** is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. **13**, the user may select Index option **1001***e* to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. **18** illustrates the "CLIMATE CONTROL" screen. As shown in FIG. **18**, VOICE option **1501** whose function is similar to that of option **1101** or **1301** described before is indicated in this instance using a pre-selected icon, as opposed to the word "VOICE". With the voice enabled, a first touch on any displayed option on screen **209** causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

Likewise, PREVIOUS option **1503** whose function is similar to that of option **1111** or **1309***d* described before is indicated in this instance using a second pre-selected icon, as opposed to the word "PREVIOUS". Advantageously, relying on icons instead of text describing the options, the user is able to select a desired option efficiently, especially when he/she is not proficient in a particular language (e.g., English in this instance) used in system **100**. It will be appreciated that system **100**, however, may provide different language versions of presentation, from which a user may select a desired language version.

The MODE options in FIG. **18** include OFF option **1511**, AUTO option **1513**, A/C option **1515**, HEAT option **1517**, and SMART CLIMATE option **1519**. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option **1151** is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface **108***f*.

When AUTO option **1153** is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display **1535** then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor **105** in response to the date and time information from clock interface **108***j*, and the GPS information from navigation interface **106***d*. Based on the date and time information, processor **105** knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor **105** knows the region (e.g, New England versus Southern California) where the vehicle is. Processor **105** looks up a table stored in memory **115** containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor **105** periodically to reflect changes in the time of the day and the geographic location of the vehicle.

It should be noted that the actual realization of the temperature range as prescribed may depend on specific situations. For example, where the current temperature inside the vehicle is below the prescribed temperature range and sunlight is detected inside same, to conserve energy, processor **105** causes heaters in the vehicle to heat the vehicle compartment at a low rate, taking into account the sunlight shining through the windows of the vehicle, which helps heat the compartment due to the well known "greenhouse" effect. To that end, conventional devices sensitive to solar energy may be used to detect the presence and intensity of the sunlight inside the vehicle. Depending on the detected intensity, processor **105** accordingly adjusts the heating rates of the heaters to efficiently achieve the prescribed temperature range. In general, the higher the intensity, the lower are the heating rates.

Similarly, A/C option **1515** and HEAT option **1517** respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

SMART CLIMATE option **1519** is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option **1519** is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display **1535** then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display **1541** then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to re-enter the vehicle. Through climate control interface **108***f*, processor **105** determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface **118** to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor **105** determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor **105** would then cause a combination of heaters and/or heat pumps (not shown) connected to interface **108***f* to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. **18** include FRESH option **1521** and RECIRCULATED option **1523**. Only one of these two options can be active at a time. When FRESH option **1521** is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option **1523** allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. **18** include FLOOR option **1525**, FLOOR/DASH option **1527**, DASH option **1529**, DEFROST option **1531** and FLOOR/DEFROST option **1533**. Only one of these five options can be active at a time. When FLOOR option **1525** is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option **1527** enables the user to bifurcate the air flow between the floor and the dashboard. DASH option **1529** enables the user to direct the air flow from the dashboard. DEFROST option **1531** enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option **1533** enables the user to bifurcate the air flow between the floor and windshield.

Temperature display **1535** displays the temperature selected by the user. Touching on up-arrow **1537** increases the selected temperature while touching on down-arrow **1539** decreases same. Continued touching on either up-arrow **1537** or down-arrow **1539** causes the temperature setting to change rapidly.

Similarly, fan speed display **1541** displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow **1543** increases the selected fan speed while touching down-arrow **1539** decreases same.

The HEATERS options in FIG. **18** include SEAT option **1547**, MIRROR option **1549**, REAR WINDOW option **1551**, STEERING WHEEL option **1553**, and ALL option **1554**. One or more of these options can be active at the same time. When SEAT option **1547** is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface **108***f*.

Similarly, MIRROR option **1549** enables the user to activate outside mirror heaters. REAR WINDOW option **1551** enables the user to activate a rear window defroster. STEERING WHEEL option **1553** enables the user to activate a steering wheel heater. Finally, ALL option **1554** enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface **116** monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory **115**. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface **116** causes a SAVE screen to appear on screen **209**. This SAVE screen is illustrated in FIG. **19**. As shown in FIG. **19**, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option **1601** to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option **1603** to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces **102***c* and **102***d*, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option **1001***e* of FIG. **13** to look up information on and/or to control various items in the automobile will now be described. After option **1001***e* is activated, a DATA ENTRY screen illustrated in FIG. **20** is exhibited on screen **209**. As shown in FIG. **20**, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning

letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section **1701** for selection. In addition, DONE option **1703**, when activated, indicates to system **100** that the entry is completed. Subdisplay **1705** is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay **1705**. In response, an INDEX screen shown in FIG. **21** appears on display screen **209**, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system **100** whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance, if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen **209** (although in this instance it would be the same list as shown in FIG. **21** as "AIR CONDITIONING" is the first item with a letter "A" in system **100**). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option **1801** or scroll-down option **1803** to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option **1805** to return to the screen of FIG. **20** to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory **115**. FIG. **22** illustrates such a look-up table, wherein left column **1901** lists each item name in alphabetical order in the index, and right column **1903** lists the corresponding instruction for processor **105** to carry out to access information on that item. For example, according to row **1905** of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor **105** to connect the user to the CLIMATE CONTROL screen of FIG. **18** previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system **100**, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, it will be appreciated that a windows based operating system of the type of the MICROSOFT WINDOWS operating system is installed on system **100**. Specifically, a copy of the operating system software is stored in memory **115**. Utilizing such an operating system, processor **105** can be programmed to control display interfaces **102** to present information through one or more windows on screen **209**. Thus, in that case, the user may activate two or more options from the MAIN MENU screen of FIG. **13**, e.g., the INSTRUMENT PANEL option and CLIMATE CONTROLS option, one after another. Accordingly, in a well-known manner, processor **105** causes the corresponding screens, e.g., the INSTRUMENT PANEL screen of FIG. **15**A and the CLIMATE CONTROL screen of FIG. **18**, to be displayed in respective windows on screen **209**. Advantageously, with the multiple windows, the user may efficiently control and retrieve information from the multiple displayed screens.

Moreover, with the above operating system, processor **105** is responsive to signals generated by an indicator device used to point at and click on a displayed option to select and activate same. For example, such an indicator device may be a mouse, joystick, stylus, trackball or touchpad which may be operable by hand or foot, and wired or wireless.

Further, in the disclosed embodiment, through system **100**, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor **105** may be programmed to accept climate control commands through phone interface **106***a*. In that instance, the user can call from anywhere to establish a phone connection with phone interface **106***a* using a predetermined phone number, through which the user communicates the commands to climate control interface **108***f* to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR display interface **102***a* to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For example, in demonstrating the climate control screen of FIG. **18**, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system **100** according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system **100** to compare the instantaneous tachometer reading (provided by engine control interface **112***c*) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor **105** is

interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on instrument panel display interface **102***e*, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system **100** to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor **105** is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system **100** as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory **115**.

Moreover, other features of system **100** may include capabilities of communications with a third party remote from the vehicle. For example, system **100** may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system **100** may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system **100** is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system **100** is capable of receiving a low-frequency, low-power broadcast covering an area of a limited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface **102***a* or multifunction display interface **102***b*. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system **100** is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system **100** is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system **100**, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

What is claimed is:

1. A system for use in a vehicle comprising:

a memory for storing information concerning a plurality of providers for servicing the vehicle;

a device connected to one or more components of the vehicle for providing at least one measure concerning the vehicle;

a processing element for determining based on the at least one measure a vehicle condition for which a selected service of the vehicle is needed, the processing element identifying one of the plurality of providers in response to the vehicle condition; and

an interface for providing information concerning the identified provider from the memory when a location of the identified provider is within a predetermined distance from a current location of the vehicle.

2. The system of claim **1** wherein data concerning a location of the identified provider is supplied to a navigator for providing directions to reach the location.

3. The system of claim **1** wherein the information is provided via audio media.

4. The system of claim **1** wherein the interface includes a display element, and the information is displayed on the display element.

5. The system of claim **1** wherein the at least one measure includes an RPM measure.

6. The system of claim **1** wherein the identified provider is selected amongst the plurality of providers, and the identified provider is the closest to a current location of the vehicle of all of the plurality of providers.

7. A system for use in a vehicle comprising:

a first device in the vehicle for providing first data concerning locations of a plurality of service providers;

a second device for providing second data concerning a current location of the vehicle;

a third device connected to one or more components of the vehicle for providing at least one measure concerning the vehicle;

a processor for determining based on the at least one measure a vehicle condition for which a selected service of the vehicle is needed;

a mechanism for identifying one of the plurality of service providers in response to the vehicle condition, the service provider being identified based on data concerning a location of the service provider from the first device and the second data; and

an interface for providing information concerning the service provider when the location of the service pro-

vider is within a predetermined distance from the current location of the vehicle.

8. The system of claim **7** wherein the first device includes a memory for storing the first data therein.

9. The system of claim **7** wherein the second data is in accordance with a global positioning system (GPS) format.

10. A method for use in a system in a vehicle, the system including a processing element, a memory, and a device connected to one or more components of the vehicle, the method comprising:

storing in the memory information concerning a plurality of providers for servicing the vehicle;

providing by the device at least one measure concerning the vehicle;

based on the at least one measure, the processing element determining a vehicle condition for which a selected service of the vehicle is needed;

identifying by the processing element identification of one of the plurality of providers in response to the vehicle condition; and

providing information concerning the identified provider from the memory when a location of the identified provider is within a predetermined distance from a current location of the vehicle.

11. The method of claim **10** comprising providing directions to reach a location of the identified provider.

12. The method of claim **10** wherein the information is provided via audio media.

13. The method of claim **10** wherein the information includes display information.

14. The method of claim **10** wherein the at least one measure includes an RPM measure.

15. The method of claim **10** the identified provider is selected amongst the plurality of providers, and the identified provider is the closest to a current location of the vehicle of all of the plurality of providers.

16. A method for use in a system including first and second devices in a vehicle, the method comprising:

providing by the first device data concerning locations of a plurality of service providers;

providing second data concerning a current location of the vehicle;

providing, by the second device connected to one or more components of the vehicle, at least one measure concerning the vehicle;

determining based on the at least one measure a vehicle condition for which a selected service of the vehicle is needed;

identifying one of the plurality of service providers in response to the vehicle condition, the service provider being identified based on data concerning a location of the service provider from the first device and the second data; and

providing information concerning the service provider when the location of the service provider is within a predetermined distance from the current location of the vehicle.

17. The method of claim **16** the second data is in accordance with a GPS format.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,577,928 B2
DATED : June 10, 2003
INVENTOR(S) : Michael L. Obradovich

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

Title page,
Item [54], please change title from "**MULTIMEDIA INFORMATION AND CONTROL SYSTEM FOR AUTOMOBILES**" to -- **TECHNIQUE FOR EFFECTIVELY PROVIDING INFORMATION REGARDING SERVICE OF A VEHICLE** --.

Column 25,
Line 26, after "10", please insert -- further --.

Column 26,
Line 3, after "10", please insert -- wherein --.

Signed and Sealed this

Twenty-first Day of October, 2003

JAMES E. ROGAN
Director of the United States Patent and Trademark Office