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Hoffman et al.

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(54) **PERSONAL SECURITY AND TRACKING SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1234 days.

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US 2007/0243855 A1 Oct. 18, 2007

Related U.S. Application Data

(63) Continuation of application No. 10/628,094, filed on Jul. 25, 2003, now Pat. No. 7,038,590, which is a continuation of application No. 09/284,598, filed as application No. PCT/US98/00896 on Jan. 20, 1998, now Pat. No. 6,624,754, which is a continuation-in-part of application No. 08/881,054, filed on Jun. 24, 1997, now Pat. No. 6,239,700, and a continuation-in-part of application No. 08/786,411, filed on Jan. 21, 1997, now Pat. No. 5,742,233.

(51) **Int. Cl.**
G08B 23/00 (2006.01)

(52) **U.S. Cl.** **340/573.1**; 340/539.13; 340/8.1; 455/404.2

(58) **Field of Classification Search** 340/573.1, 340/573.4, 539.1, 539.11–539.13, 825.49, 340/8.1; 379/37, 38; 455/404.1, 404.2, 456.1
See application file for complete search history.

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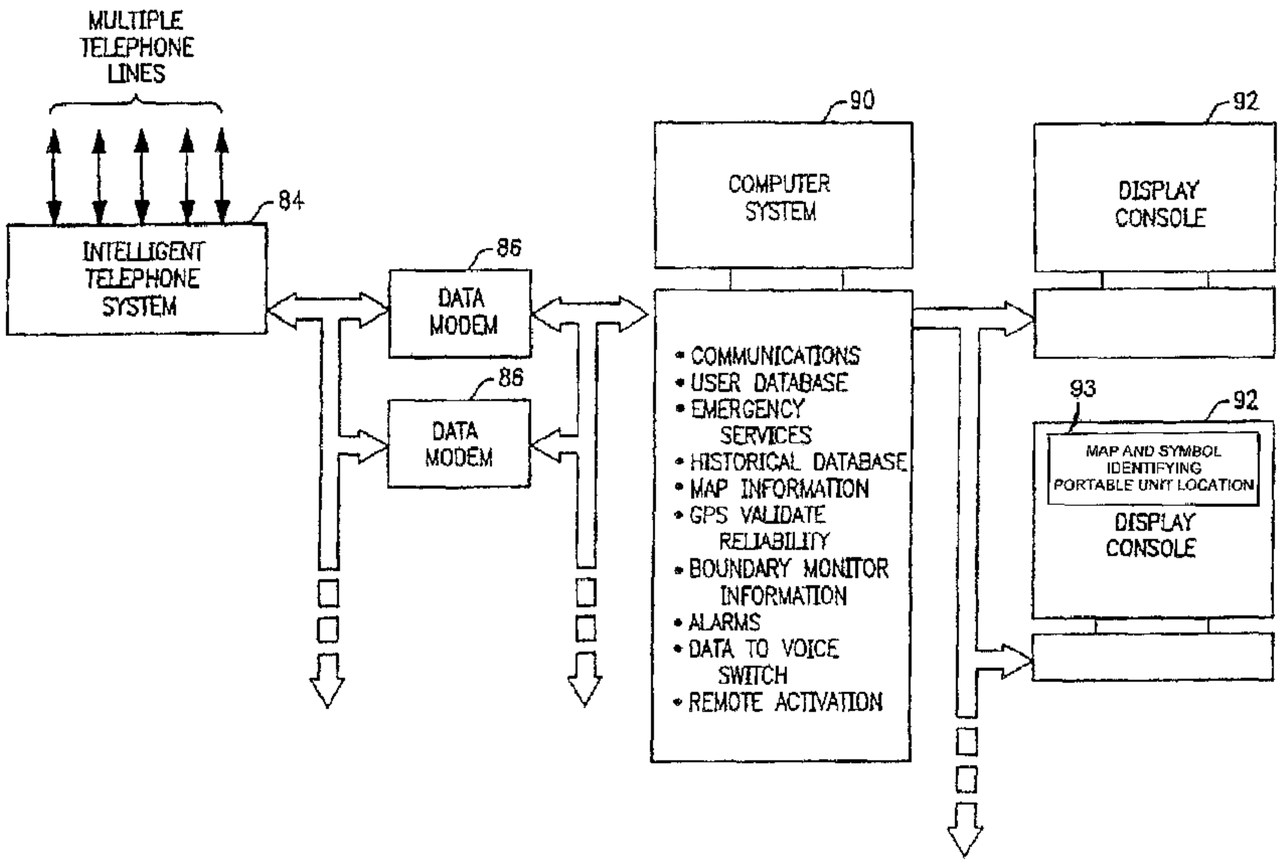
Primary Examiner — Thomas J Mullen
(74) *Attorney, Agent, or Firm* — Wolf, Greenfield & Sacks, P.C.

(57) **ABSTRACT**

A signaling system is provided for rendering an alarm for an individual in distress combined with a locating and tracking system to thus alert and direct appropriate personnel to the needs of the individual in distress and to monitor the location of that individual. The system comprises a portable signaling unit, a remote alarm switch device, a central dispatch station, and makes use of a wireless communication system. The portable signaling unit and the remote alarm switch may be adapted to be worn at different locations on the person's body. The remote alarm switch way be concealed in the form of a wristband or in the form of any other object such as a broach, pendant, or keychain.

21 Claims, 9 Drawing Sheets



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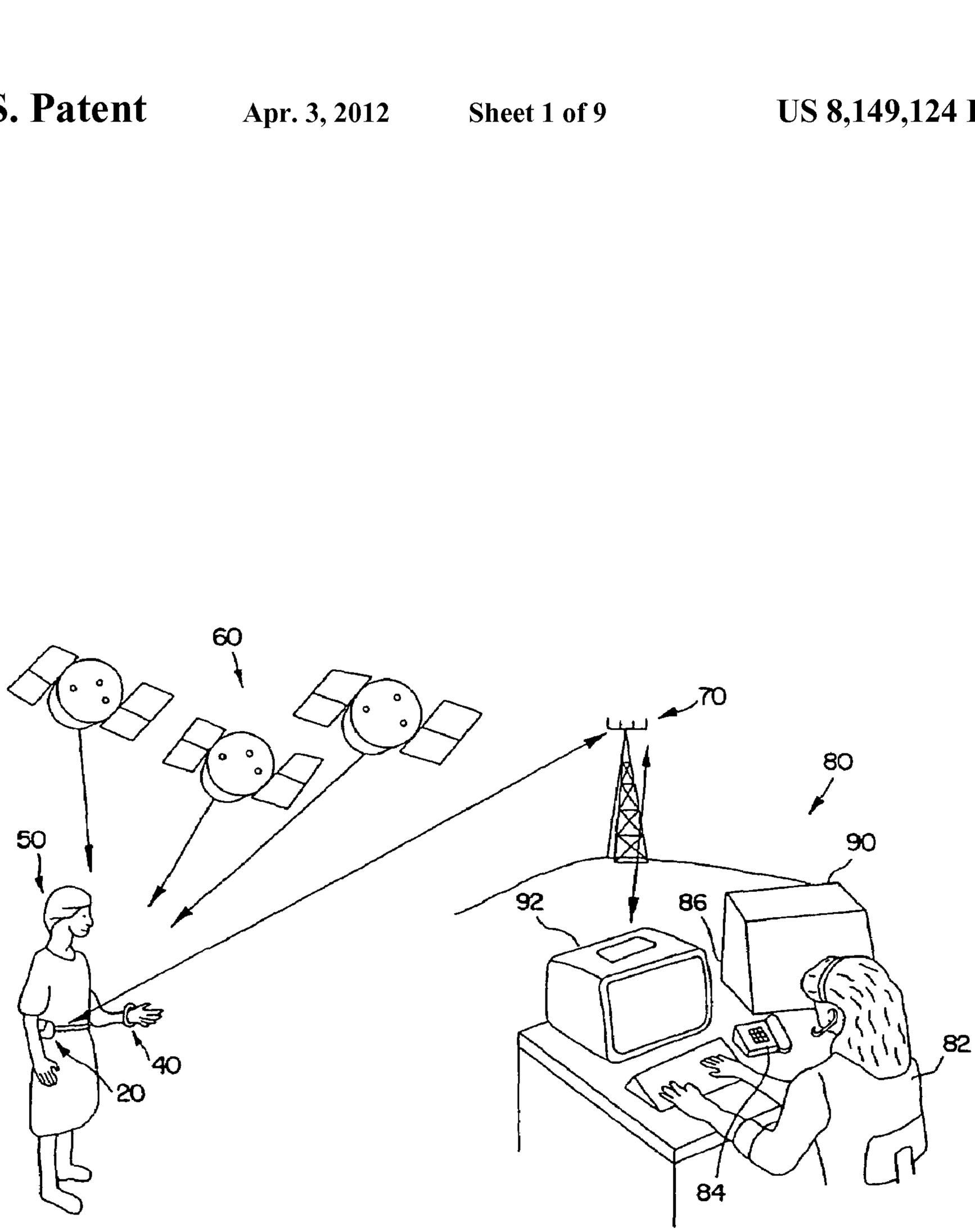


FIG. 1

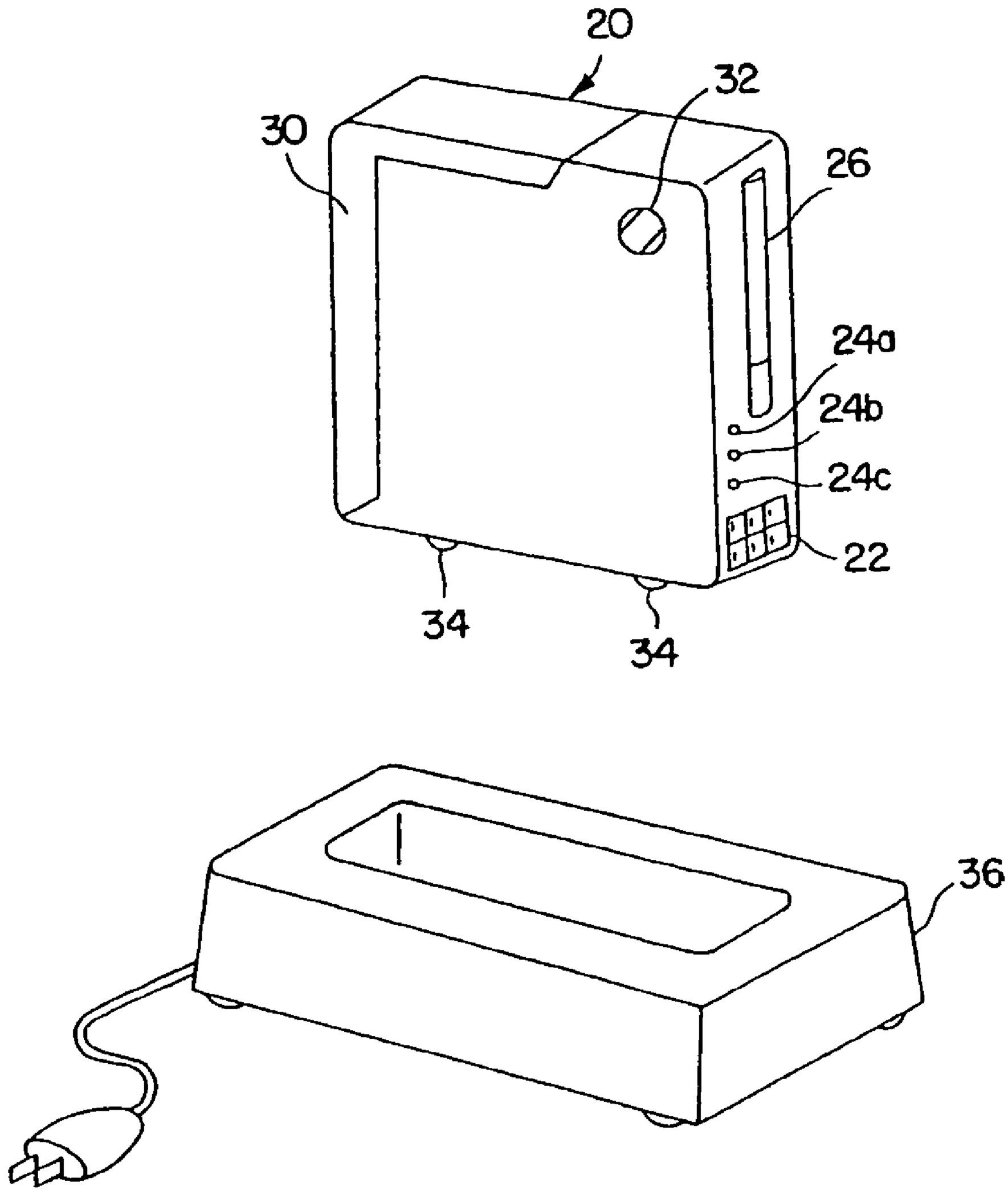


FIG. 2

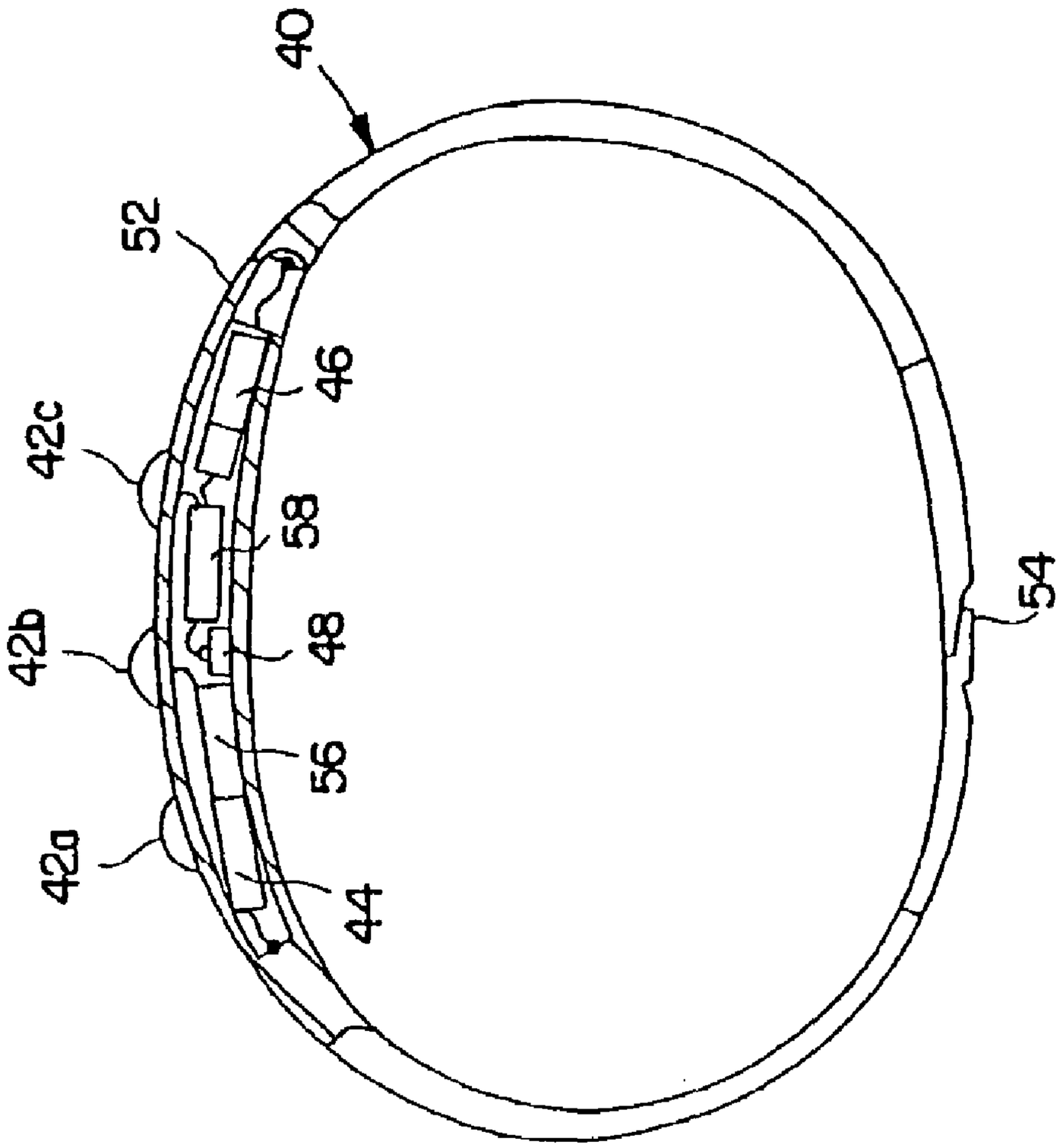


FIG. 3B

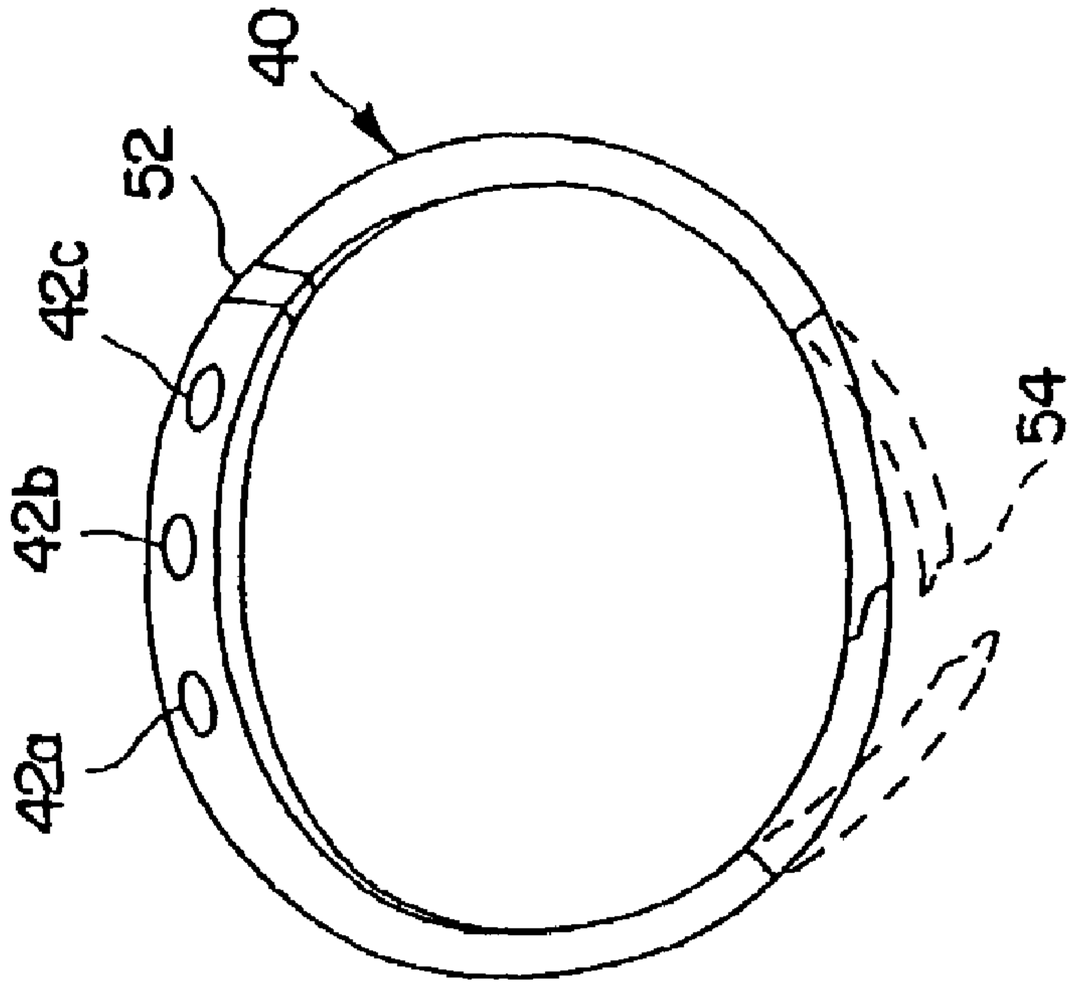
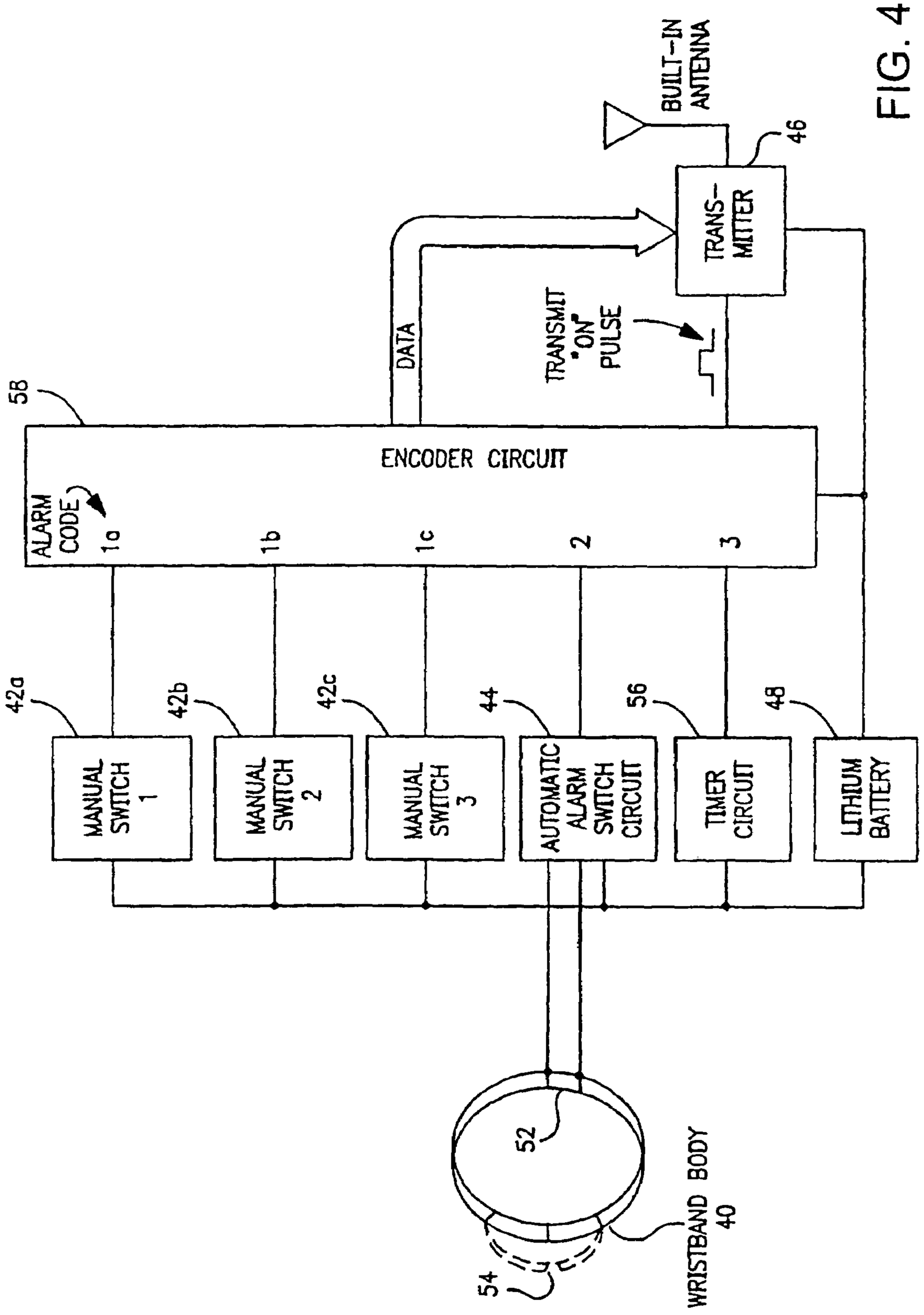


FIG. 3A

FIG. 4


BUILT-IN ANTENNA
46
TRANS-MITTER
DATA
TRANSMIT "ON" PULSE
5B
ENCODER CIRCUIT
ALARM CODE
1a
1b
1c
2
3
42a
42b
42c
44
56
48
MANUAL SWITCH 1
MANUAL SWITCH 2
MANUAL SWITCH 3
AUTOMATIC ALARM SWITCH CIRCUIT
TIMER CIRCUIT
LITHIUM BATTERY
52
54
WRISTBAND BODY 40

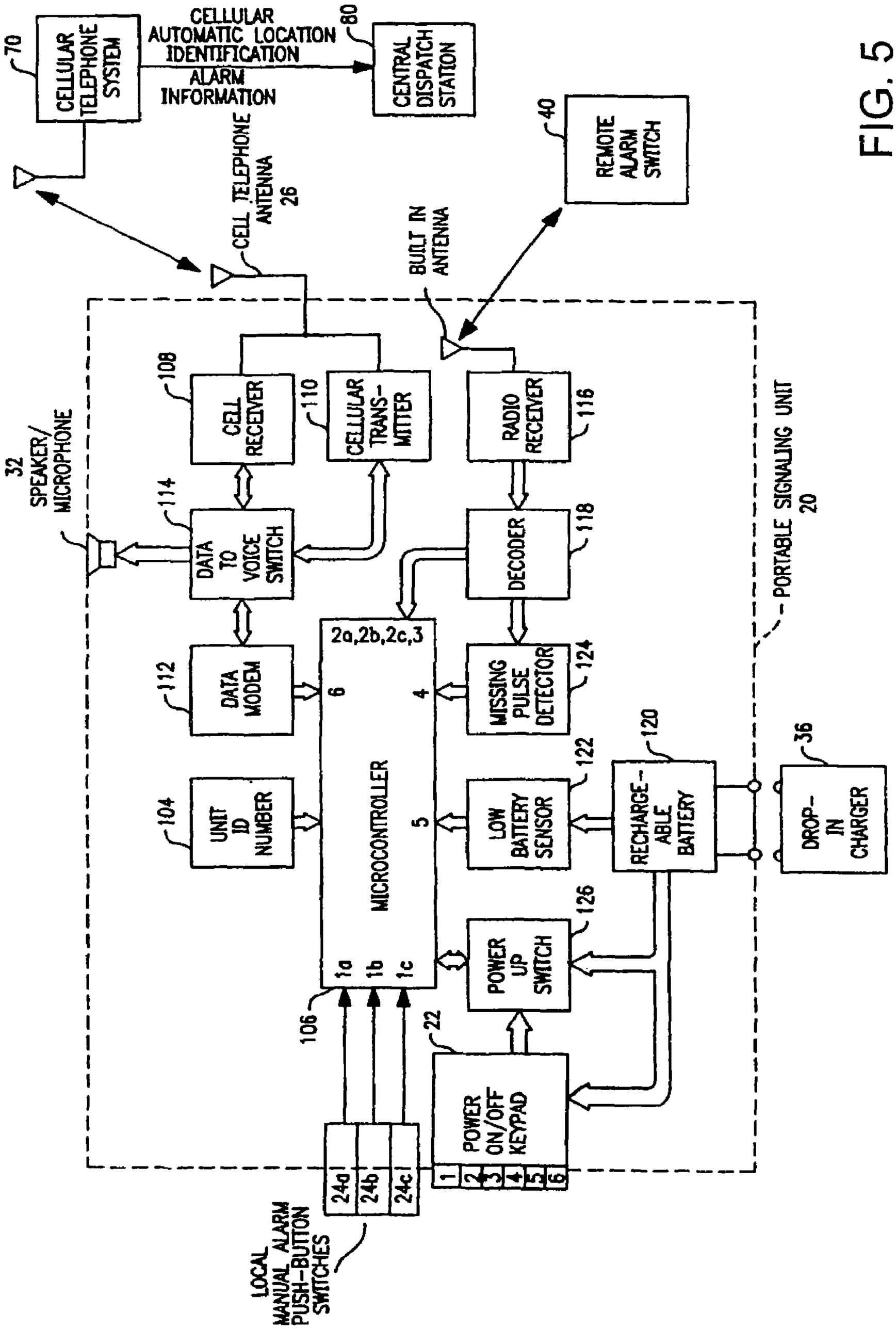
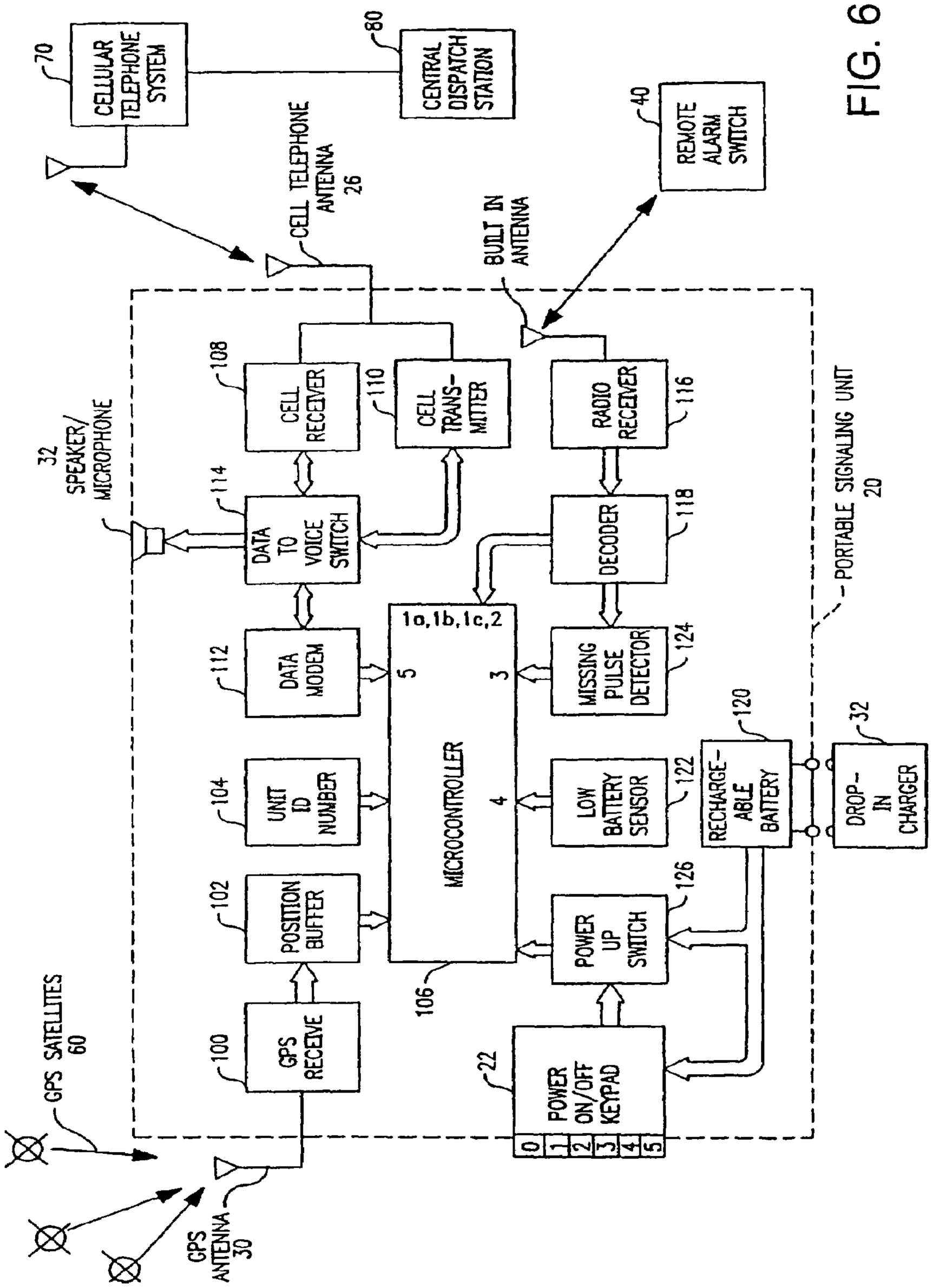

70
CELLULAR TELEPHONE SYSTEM
CELLULAR AUTOMATIC LOCATION IDENTIFICATION
ALARM INFORMATION
80
CENTRAL DISPATCH STATION
CELL TELEPHONE ANTENNA 26
BUILT IN ANTENNA
40
REMOTE ALARM SWITCH
32
SPEAKER/ MICROPHONE
108
CELL RECEIVER
110
CELLULAR TRANS-MITTER
116
RADIO RECEIVER
114
DATA TO VOICE SWITCH
118
DECODER
PORTABLE SIGNALING UNIT 20
2a,2b,2c,3
112
DATA MODEM
6
4
124
MISSING PULSE DETECTOR
104
UNIT ID NUMBER
MICROCONTROLLER
5
122
LOW BATTERY SENSOR
120
RECHARGE-ABLE BATTERY
36
DROP-IN CHARGER
126
POWER UP SWITCH
1a
1b
1c
106
22
POWER ON/OFF KEYPAD
1
2
3
4
5
6
24a
24b
24c
LOCAL MANUAL ALARM PUSH-BUTTON SWITCHES

FIG. 5


70
CELLULAR TELEPHONE SYSTEM
80
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40
REMOTE ALARM SWITCH
BUILT IN ANTENNA
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SPEAKER/ MICROPHONE
108
CELL RECEIVER
110
CELL TRANS-MITTER
116
RADIO RECEIVER
114
DATA TO VOICE SWITCH
118
DECODER
1a,1b,1c,2
MICROCONTROLLER
112
DATA MODEM
5
3
MISSING PULSE DETECTOR
124
104
UNIT ID NUMBER
4
LOW BATTERY SENSOR
122
120
RECHARGE-ABLE BATTERY
32
DROP-IN CHARGER
102
POSITION BUFFER
126
POWER UP SWITCH
106
GPS SATELLITES 60
100
GPS RECEIVE
22
POWER ON/OFF KEYPAD
0 1 2 3 4 5
GPS ANTENNA 30

FIG. 6

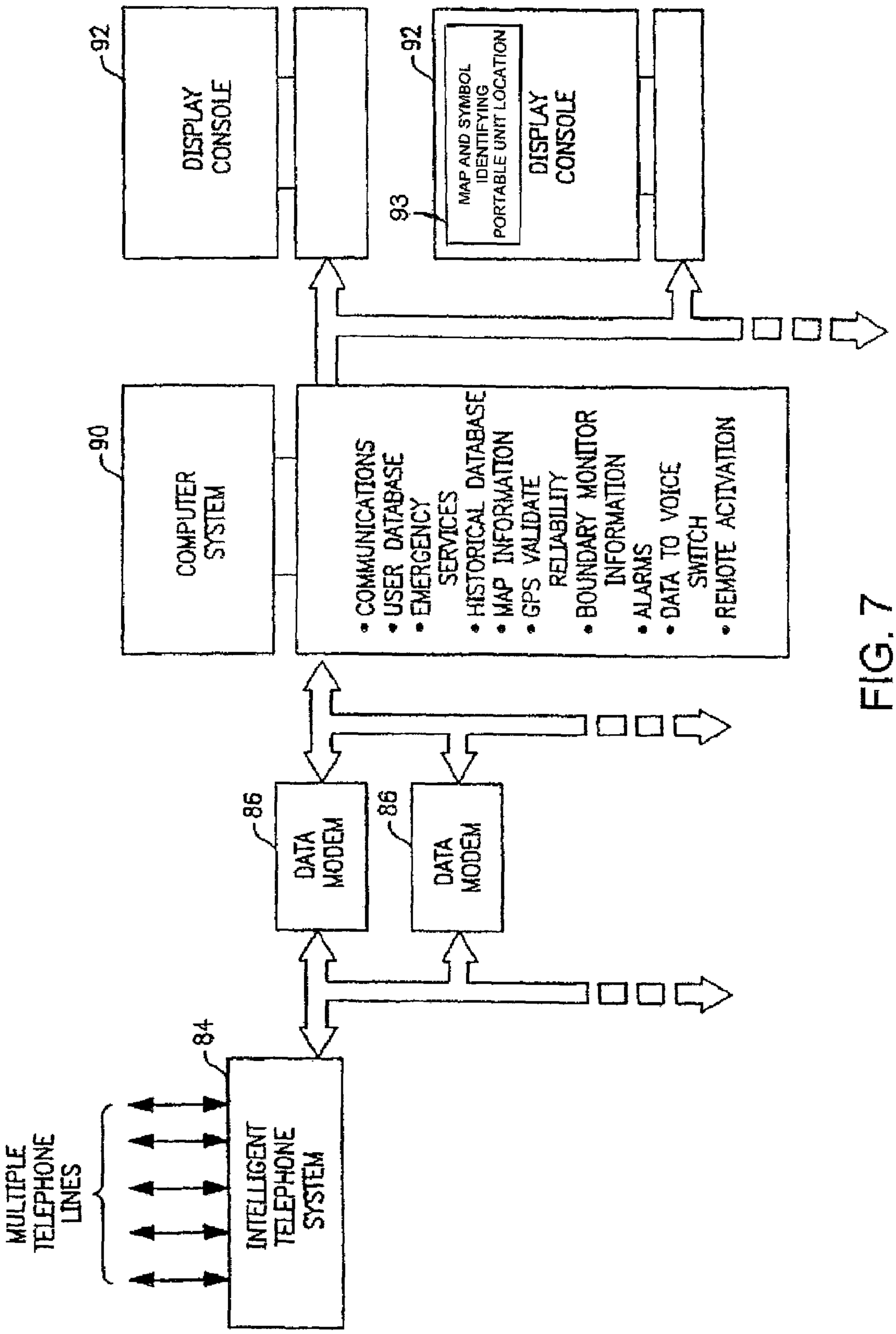
92
DISPLAY CONSOLE
92
MAP AND SYMBOL IDENTIFYING PORTABLE UNIT LOCATION
93
DISPLAY CONSOLE
90
COMPUTER SYSTEM
• COMMUNICATIONS
• USER DATABASE
• EMERGENCY SERVICES
• HISTORICAL DATABASE
• MAP INFORMATION
• GPS VALIDATE RELIABILITY
• BOUNDARY MONITOR INFORMATION
• ALARMS
• DATA TO VOICE SWITCH
• REMOTE ACTIVATION
86
DATA MODEM
86
DATA MODEM
84
INTELLIGENT TELEPHONE SYSTEM
MULTIPLE TELEPHONE LINES

FIG. 7

Situation	Activation Method	Information received, verified, displayed and stored at central dispatch station		
		Unit Serial/ID Number	Alarm Code	Location Coordi-nates
INITIATED FROM PORTABLE SIGNALING UNIT:				
1. Person 50 is able to alert the central dispatch station 80 by depressing one of several manual alarm push-button switches on portable signaling unit 20 relating to various health conditions or a threat to personal safety.	Manual alarm push-button switch 24a, 24b, 24c, etc. is depressed on portable signaling unit 20 which activates portable signaling unit 20 to alert central dispatch station 80.	XXXXXXX	1A, 1B, 1C, Etc.	XX.XXXX YY.YYYY ZZZZ
2. Person 50 is able to alert the central dispatch station 80 by depressing one of several manual alarm push-button switches on remote alarm switch unit 40 relating to various health conditions or a threat to personal safety.	Manual alarm push-button switch 42a, 42b, 42c, etc. is depressed on remote alarm switch unit 40. Radio transmitter 46 sends a unique code to receiver 116, decoded by decoder 118, which activates signaling unit 20 to alert central dispatch station 80.	XXXXXXX	2A, 2B, 2C, Etc.	XX.XXXX YY.YYYY ZZZZ
3. remote alarm switch unit 40 is forcibly removed from person 50 before he or she is able to summon help.	Automatic alarm switch circuit 44 is operated when remote alarm switch clasp is opened, or wristband is cut or broken. Radio transmitter 46 sends a unique code to receiver 116, decoded by decoder circuit 118, which then activates portable signaling unit 20 to alert central dispatch station 80.	XXXXXXX	3	XX.XXXX YY.YYYY ZZZZ

FIG. 8A

4. Portable signaling unit 20 is forcibly removed from person 50 before he or she is able to summon help.	Portable signaling unit 20 fails to receive a periodically transmitted signal from remote alarm switch 40 due to separation distance. A uniquely coded signal is normally detected at receiver 116 and decoded by decoder 118. If missing pulse detector 124 fails to be reset by the periodic signal, then microcontroller 106 senses this as an alarm state. Signaling unit 20 is then activated to alert central dispatch station 80.	XXXXXXX	4	XX,XXXX YY,YYY ZZZZ
5. Low battery condition is sensed in portable signaling unit 20.	Low battery sensor circuit 122 activates portable signaling device 20 to alert the central dispatch center 80 that a low battery condition exists. There will be enough battery power remaining for limited operation.	XXXXXXX	5	XX,XXXX YY,YYY ZZZZ
INITIATED FROM CENTRAL DISPATCH STATION:				
6. Current location of person is desired. Information is requested by subscriber on an "as needed" basis such as locating a lost person.	Central dispatch station 80 activates portable signaling unit 20 via cellular telephone system 70 for a limited time to determine and display position of portable signaling unit 20.	XXXXXXX	6	XX,XXXX YY,YYY ZZZZ
7. Person is to be monitored for compliance within preset boundary.	Central dispatch station 80 activates portable signaling unit 20 via cellular telephone system 70 at predetermined time intervals to track position of portable signaling unit 20 within preset boundaries. Alarm is activated at the central dispatch station if boundary limits are violated.	XXXXXXX	6	XX,XXXX YY,YYY ZZZZ
8. Spot check to insure system is working and to compile historical data.	Central dispatch station activates portable signaling unit 20 via cellular telephone system 70 at predetermined time intervals. Central dispatch station 80 alarm is activated if there is no response or invalid data is received.	XXXXXXX	6	XX,XXXX YY,YYY ZZZZ

FIG. 8B

PERSONAL SECURITY AND TRACKING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of and claims priority under 35 U.S.C. §120 to U.S. patent application Ser. No. 10/628,094, filed on Jul. 25, 2003, entitled "Personal Security and Tracking System", now U.S. Pat. No. 7,038,590, which is a continuation of U.S. patent application Ser. No. 09/284,598, filed on Apr. 16, 1999, entitled "Personal Security and Tracking System", now U.S. Pat. No. 6,624,754, which is a National Stage application of, and claims priority under 35 U.S.C. §119(a) to PCT Application No. PCT/US98/00896, filed Jan. 20, 1998, which is a continuation-in part of U.S. patent application Ser. No. 08/881,054, filed on Jun. 24, 1997, now U.S. Pat. No. 6,239,700, and which is a continuation-in part of U.S. patent application Ser. No. 08/786,411, filed Jan. 21, 1997, now U.S. Pat. No. 5,742,233.

FIELD OF INVENTION

The present invention relates to a signaling system that enables an individual in distress to initiate an alarm to alert appropriate personnel combined with a locating and tracking system that enables the alerted personnel to monitor the location of the individual in distress.

BACKGROUND

We are constantly reminded of the need for personal security in today's society. All too often in the news we hear of missing persons and the dramatic searches which ensue. For each heroic story of a "just-in-time" rescue of a person who is abducted, lost, in a threatening situation, or in need of emergency medical care, there are many more personal dramas which unfortunately end in tragedy. It follows that immediate notification of an emergency situation and a prompt response from police, paramedics, fire department, or another service organization are essential for the well-being of the individual.

Today's technology provides us with public services such as the 911 telephone number for rapidly summoning emergency help if we are able to access a telephone, dial the number, and communicate our location. However, these services fall short in the case of a young child, a mentally incompetent or medically incapacitated person, someone lost in the woods, or the victim of an abduction or kidnapping. These situations necessitate a security system that travels with the individual, is not limited in range, is able to define and signal an emergency situation without human intervention, and identifies the individual's location. Such a system would provide protection to the individual and peace of mind to those responsible for his or her care and well-being.

A number of prior art devices have been proposed for use as personal alarms and tracking systems, as well as to automate the dispatch of proper authorities to a person in an emergency situation. U.S. Pat. No. 4,694,284 issued to Levelle et al. discloses a collar to prevent abduction. The Levelle et al. device does not allow the user to manually activate any one of several alarm states or levels. It relies on a wide range of available receivers, such as directional radio receivers, amateur radio receivers, or television receivers to give an approximate location of the collar, not the individual, once the collar is removed.

U.S. Pat. Nos. 4,744,083, 4,839,656, and 4,965,586 issued to O'Neill disclose variations of a system that uses positioning determining satellites in a geostationary orbit. This system is intended to be used to generate terrain maps, to test message transfer link signal quality, and for determining the elevation of an object by comparing transmitted information with a stored terrain map. It is not intended for use as a personal security system, nor is it capable of being so used.

U.S. Pat. No. 4,799,062 issued to Sanderford et al. discloses a radio position determination and apparatus based on measured times-of-arrival of radio signals from a plurality of land-based transmitters. This patent is concerned with errors due to multipath (signal reflection) problems causing errors in locating the signal source.

U.S. Pat. No. 4,818,998 issued to Apsell et al. provides a system for tracking stolen motor vehicles, not individuals, using radio direction-finding methods. This system is initiated only after a delay in reporting and verification through a national database of registered users of the system. The method of using radio direction-finding techniques also delays locating the vehicle.

U.S. Pat. No. 4,819,860 issued to Hargrove et al. discloses a wrist-mounted device for sensing vital functions. It is activated only when preset pulse rate and body temperature limits are exceeded. The user relies on an emergency aircraft locator beacon in order to be found. There is no provision for a manually activated security alarm.

U.S. Pat. Nos. 4,885,571, 4,918,432, and 4,952,913 issued to Pauley et al. describe methods of monitoring prisoners confined to a "house arrest." These methods are intended for use within the restricted limits of a field monitoring device.

U.S. Pat. No. 5,021,794 issued to Lawrence discloses a personal emergency locator using UHF radio direction-finding and distance-measuring equipment to find a person. This patent only provides for remote activation by a child's parent of the wearer's locating transmitter; it does not provide for the wearer to initiate the alarm. As in other prior art of this type, this device also relies on a timeconsuming method of radio direction-finding techniques and skills to eventually locate the person wearing the alarm.

U.S. Pat. No. 5,027,314 issued to Linwood et al. describes a system and method for tracking a number of subjects, each wearing a personal infrared transmitter, detected by a plurality of receivers in a pre-determined area. This system is limited to identification and tracking within line-of-sight in confined areas and does not lend itself for use in widespread geographical areas.

U.S. Pat. No. 5,196,825 issued to Young discloses an apparatus for monitoring the location of a person and determining whether the person is in distress using a transceiver and at least one remote receiver. In the monitor mode, the alarm activation apparatus must continuously transmit a signal which is used to activate the alarm. This feature has limitations due to the fact that the transmitter is always on, shortening the life of available battery power. Again, as in other references previously mentioned, the user must be located by radio direction-finding equipment.

U.S. Pat. No. 5,225,809 issued to Bunn discloses a personal security system that requires constructing a plurality of automatic direction-finding antennas in an appropriately organized and spaced relation within the geographical area to be monitored. Once a rough estimate of where the transmitting signal is located, a more precise location must be determined by the use of direction-finding equipment.

U.S. Pat. No. 5,225,842 issued to Brown et al. discloses a vehicle or any other animate or inanimate object tracking and navigation system employing GPS satellites and a remote GPS receiver. Although the Brown et al. system uses GPS technology, it does provide the advantages of an optimal

personal security system. Specifically, this system does not contemplate active and/or passive alarm signal generation by a personal security device.

U.S. Pat. No. 5,334,974 issued to Simms et al. discloses a fully automatic security system to be used to protect passengers in a motor vehicle. This system also lacks certain elements of an optimal personal security system, including the ability to provide personal security independent of a vehicle and the ability of a central station to initiate a status request of the mobile unit.

U.S. Pat. No. 5,357,254 issued to Kah, Jr. discloses a location monitoring system that utilizes a radio transmitter and a radio receiver to monitor the movement of a person or object. The receiver sounds an alarm at a predetermined time after failure to receive a signal. This system requires the use of a receiver to determine range and direction to locate the user. As in other prior art of this type, Kah, Jr. '254 also relies on using a method of radio direction- and range-finding which takes time and skill to eventually locate the person wearing the alarm.

U.S. Pat. No. 5,396,227 issued to Carroll et al. discloses a system that monitors an individual for compliance with a protective order. The system is activated when the violator's transmitter is detected by the victim's receiving apparatus.

U.S. Pat. No. 5,461,390 issued to Hoshen addresses the problem for monitoring a number of prisoners within a specified boundary and is useful for "house arrest" and stalker detection. This patent relates to monitoring a subject's location and comparing the location listed on a database as to where the subject should be.

U.S. Pat. No. 5,515,419 issued to Sheffer describes a tracking system and method for tracking a movable object carrying a cellular phone unit. The phone unit includes a processor for generating the emergency signal. The location of the user is determined by the cellular phone system's identifying or control channel signals received by the phone and only gives a general location of the user.

U.S. Pat. No. 5,559,520 issued to Barzegar discloses an information system for automatically providing mobile vehicles dispatch information related to their geographical location. This system is described to provide routing information to vehicles, rather than to provide a personal security and tracking system for individuals.

Despite the above-described tracking and security devices and systems, it is important to note that the prior art generally is limited to transmitting an alarm, the source of which is located by a complex array of antennas or by a direction-finding receiver, either of which would require undue time to locate a person in distress.

Systems utilizing GPS technology for tracking vehicles have not fully addressed the requirements of a portable, personal security system. Nor do extant systems, developed for tracking a person, that are limited to applications such as monitoring prisoners within range of a field monitoring device.

Current available technology does not address the case of an individual who is helpless in an emergency situation where information is required so that the appropriate authorities can respond quickly and efficiently to a distress signal generated by the individual. Providing personal security for persons at risk demands a fully automated and responsive system for summoning assistance.

In order to meet the demands created by a situation where an individual with limited time, opportunity, or ability to generate a distress signal encounters danger, becomes lost, or experiences another condition that requires assistance, the ideal personal security and tracking system will comprise an alarm trigger and separate signaling unit, such that the signaling unit will generate an alarm signal in response to activation of the alarm trigger to enable a locating system to identify the location of the signaling unit, which should remain with the individual. The alarm could be generated by the individual directly, as by manual activation of the alarm trigger or manual activation of the signaling unit itself, or indirectly, as where the alarm trigger is removed from the individual or where the portable signaling unit becomes separated from the alarm trigger by a predetermined distance, thereby automatically generating an alarm signal. The ideal system should further allow for the generation of varying levels of alarm signals.

Further, the ideal system would use a locating system that does not constrain an individual to a given geographical area and that contains multiple redundancies to provide for faster, more accurate, and more reliable signal source location information than do known systems and devices.

SUMMARY OF THE PRESENT INVENTION

Accordingly, it is an object and advantage of the present invention to provide a personal security and tracking system for individuals which quickly and accurately provides a central dispatch station with data identifying the type of alarm and the location of an individual.

It is another object and advantage of the present invention to provide a computer system which will interpret, validate, and store all data received at the central dispatch station.

It is yet another object and advantage of the present invention to provide a system that makes available to a dispatch operator all validated data received at the central dispatch station together with any stored information about the individual assigned to the portable signaling unit.

It is a further object and advantage of the present invention to provide a means for displaying the type of alarm and the location of the individual in a convenient format, part of which will display the individual's location on a digitized map, all of which will allow efficient dispatching of appropriate emergency assistance to the exact location of the person in distress in possession of the signaling unit.

It is a still further object and advantage of the present invention to provide a fully automatic personal security system and communication protocol which is operative under the most severe circumstances to automatically summon an emergency response in accordance with the specific personal needs of the person assigned to the portable signaling unit.

It is yet a further object and advantage of the present invention to provide a personal security system as described above which allows the individual to manually summon assistance in an emergency situation.

It is another object and advantage of the present invention to provide a personal security system as described above which may be operated under pre-defined or user specified circumstances such as to alert of a health trauma where the individual is able to manually summon assistance.

It is yet another object and advantage of the present invention to provide an automatic means for summoning an emergency response without the necessity of intervention by the individual in distress should the remote alarm switch be removed from the individual by forceful or unauthorized means.

It is a further object and advantage of the present invention to provide an automatic means for summoning an emergency response without the necessity of intervention by the individual in distress should the portable signaling unit be separated from the proximity of the remote alarm switch.

It is a still further object and advantage of the present invention to provide a portable, intelligent signaling unit.

It is yet a further object and advantage of the present invention to provide a signaling unit that can be carried or securely attached to a person without hindering personal activity.

Another object and advantage of the present invention is to provide a personal security system as described above which allows the central dispatch operator to selectively establish two-way digital contact with the portable signaling unit.

Yet another object and advantage of the present invention is to provide a personal security system as described above which allows the central dispatch operator to selectively establish two-way voice contact with the person carrying the portable signaling unit.

A further object and advantage of the present invention is to provide a personal security system which gives the central dispatch operator control to initiate a request for the locating information.

A still further object and advantage of the present invention is to provide for the central dispatch station to monitor the location of a person within preset boundaries which, when violated, would activate an alarm at the central dispatch station.

Yet a further object and advantage of the present invention is to provide for a reliable remote alarm switch unit that does not need to be continuously transmitting in order to be operational.

It is another object and advantage of the present invention to provide for circuits in the signaling unit not required in the actual sensing of an alarm to remain off or in the standby mode therefore conserving battery power.

It is yet another object and advantage of the present invention to provide a means to alert a dispatch operator of the need for maintenance in the case of a low battery condition in the portable signaling unit.

It is still another object and advantage of the present invention to provide for a reliable personal security and tracking system that can be periodically interrogated and tested for malfunction by the central dispatch station.

It is a further object and advantage of the present invention to provide for a reliable personal security and tracking system that can be periodically interrogated by the central dispatch station to compile historical data.

It is still a further object and advantage of the present invention to provide a signaling unit that is not limited in geographical range.

It is yet a further object and advantage of the present invention to combine the advantages of long-range locating and navigation systems, like that used in wireless location technology such as the Automatic Location Identification (ALI) of cellular telephone transmissions, Global Positioning System (GPS) of satellites, LORAN-C, or GLONASS, with the extensive communications capabilities of a wireless communication system, such as a cellular telephone system, digital personal communications system (PCS), or communication satellites, to yield a practical personal security and tracking system with the above-described emergency assistance capabilities.

The present invention is a personal security and tracking system that comprises a portable signaling unit and a remote alarm switch unit, each to be worn or carried by an individual being monitored. The system further comprises a central dispatch station to which distress signals and position coordinates are transmitted. The system employs the use of wireless location technology such as the Automatic Location Identification (ALI) of cellular telephone transmissions, Global-Positioning System (GPS) of satellites or other types of locating systems, such as LORAN-C or GLONASS, that may perform the function of providing accurate position coordinates. The system further employs a means for data and voice communications between the portable signaling unit and the central dispatch station.

Accordingly, the personal security and tracking system of the present invention provides a reliable personal alarm system for individuals and has the additional advantages in that it quickly and accurately provides a central dispatch operator with information concerning the nature of the alarm and the location of the individual. The system further provides a computer system that will interpret, validate, and store all data received at the central dispatch station that is entered into the computer system, as well as a system that makes available to a dispatch operator all validated data received at the central dispatch station together with any stored information corresponding to the individual assigned to the portable signaling unit, such as subscriber information, emergency telephone numbers, boundary information, etc. that is entered into the computer system.

In addition, the system of the present invention provides a means for displaying to a dispatch operator the type of alarm and the location of the individual in a convenient format, part of which will display the individual's location on a digitized map, all of which will allow efficient dispatching of appropriate emergency assistance to the exact location of the individual in distress in possession of the signaling unit.

The system of the present invention is a fully automatic personal security system and communication protocol that is operative under the most severe circumstances to summon an emergency response automatically in accordance with the specific personal needs of the individual. Optionally, the system allows an individual to manually summon assistance in an emergency situation.

The system may be operated under pre-defined standard or user-specified circumstances, such as to alert emergency services personnel of a health trauma or a situation in which the remote alarm switch is forcibly removed from the individual, as in a kidnapping. Forceful or unauthorized removal of the remote alarm switch from the individual automatically generates an urgent alarm signal that summons emergency assistance once the remote alarm switch is opened or broken. Additionally, removal of the portable signaling unit from the individual also automatically generates an urgent alarm signal when the portable signaling unit has been removed to a distance where it can no longer sense a periodic signal from the remote alarm switch.

The system of the present invention comprises a small, portable, durable, water-proof, intelligent signaling unit that can be securely attached to an individual without hindering personal activity and that is not limited in geographical range. The system provides a reliable alarm switch that does not need to be continuously transmitting to be operational and permits circuits that are not required in the actual sensing of an alarm to remain off or in a standby mode, therefore conserving battery power. The system further provides a means to alert a dispatch operator of the need for maintenance in the case of a low battery condition in the portable signaling unit.

The personal security system of the present invention gives the central dispatch operator the ability to initiate a request for location coordinate information for the individual being monitored. In addition, the system permits the central dispatch station to monitor the location of an individual within predefined boundaries such that, when violated, the system would generate an alarm signal to the central dispatch station. The system further allows a central dispatch operator to selec-

tively establish two-way digital contact with the portable signaling unit and, optionally, two-way voice contact with the person carrying the portable signaling unit. The system also enables a central dispatch station to periodically interrogate and test the system for malfunction and to compile historical data.

The personal security and tracking system of the present invention combines the advantages of wireless location technology, such as the Automatic Location Identification (ALI) of cellular telephone transmissions, Global Positioning System (GPS) of satellites, LORAN-C, or GLONASS, with the extensive communications capabilities of a wireless communication system, such as a cellular telephone system, digital personal communications system PCS), or communication satellites, to yield a practical personal security and tracking system with the above-described emergency assistance capabilities.

It should be noted that the invention is not limited to the security and tracking of a person. The invention is capable of protecting the security of animals and inanimate objects. The invention can pinpoint and monitor the location of anything capable of carrying a portable signaling unit due to the fact that it can be interrogated by the central dispatch station.

The system of the present invention may additionally be integrated with existing Emergency Locator Transponder (ELT) systems, which are used to locate downed aircraft by providing the geographic location (i.e., latitude and longitude) of the aircraft.

The above-described and other objects, features, and advantages of the present invention will become more apparent from the following detailed description of the preferred embodiments and certain modifications thereof when taken together with the accompanying drawings in which:

DRAWING FIGURES

FIG. **1** is a schematic of a personal security and tracking system in accordance with an embodiment of the present invention;

FIG. **2** is a perspective drawing of a portable signaling unit which is included in the personal security and tracking system of FIG. **1**;

FIGS. **3**A and **3**B are perspective drawings of a remote alarm switch unit which is included in the personal security and tracking system of FIG. **1**;

FIG. **4** is a block diagram of the major circuit components in the remote alarm switch unit of FIGS. **3**A and **3**B;

FIG. **5** is a block diagram of the major circuit components in the personal security and tracking system of FIG. I including a detailed block diagram of the portable signaling unit of FIG. **2**;

FIG. **6** is a block diagram of the major circuit components in an alternate embodiment of the personal security and tracking system of FIG. **1** including a detailed block diagram of the portable signaling unit of FIG. **2**;

FIG **7** is a block diagram showing the functional components of a central dispatch station employed by the present invention; and

FIGS. **8**A and **8**B shows various situations, alarm activation methods and the associated information received, displayed and stored at the central dispatch station.

DETAILED DESCRIPTION OF EMBODIMENTS

Referring to FIG. **1**, the personal security and tracking system according to the present invention generally includes a portable signaling unit **20** and a remote alarm switch unit **40** shown here in a configuration of a wristband. Either or both of portable signaling unit **20** and remote alarm switch unit **40** can be worn or carried by an individual **50** being monitored.

The personal security and tracking system shown in FIG. **1** employs, as part of cellular telephone system **70**, wireless location technology, such as a cellular telephone Automatic Location Identification (ALI) system, in order to identify the origination location of an alarm signal generated by portable signaling unit **20** in response to a triggering of remote alarm switch unit **40**. It should be appreciated by one skilled in the art that other types of locating systems, such as a Global Positioning System (GPS), LORAN-C, or GLONASS, may perform the function of providing accurate position coordinates and may be substituted therefor. Hence, the present invention should not be construed as limited to ALI.

A cellular telephone system **70** provides a means for data and voice communications between the portable signaling unit **20** and a central dispatch station **80**. The cellular telephone system **70** may be any conventional cellular telephone system. It should also be appreciated by one skilled in the art that other types of communication devices such as satellite transceivers or any other two-way wireless communication system may perform the function of the cellular telephone system **70** and may easily be substituted therefor. Hence, the present invention should not be construed as limited to a cellular telephone system.

The portable security and tracking system also includes a central dispatch station **80**. The central dispatch station **80** is manned by one or more dispatch operators **82** and includes an intelligent telephone system **84**, one or more data modems **86**, a computer system **90**, and one or more display consoles **92**. The computer system **90** comprises means to store and access communications information, a user database, an emergency services database, map display information, and unit identifier and alarm status display information. The computer system **90** further comprises one or more data-to-voice switches and has remote activation capability, plotting algorithms, boundary monitoring alarm features, and the capability to store and retrieve historical data. In a preferred embodiment, display console **92** displays the alarm signal origination location, the user identification, and an alarm code, as described in FIG. **7**. A number of suitable map programs incorporating many of these features are commercially available and suitable for use with the present invention.

FIG. **2** shows a portable signaling unit **20** that includes a main power on-off keypad **22**. Local alarm push-button switches **24***a*, **24***b*, **24***c*, etc. allow the use of the portable signaling unit **20** by campers, hikers, or skiers, etc., when the additional features of the remote alarm switch unit **40** may not be required. A cellular telephone antenna **26** is embodied in the casing of the signaling unit **20**. In another variation, a GPS receiving antenna **30** could also be embodied in the outer part of the casing of signaling unit **20** when a GPS receiver is used for determining the location of the signaling unit. A speaker-microphone element **32** gives the central dispatch operator **82** the option to conduct two-way voice communications with the individual in distress. Two electrical contacts **34** are mounted to the base for use with a drop-in battery charger **36**, as known in the art of portable communications systems. Portable signaling unit **20** can be manufactured in various configurations for attaching it securely to the individual **50**, including by use of a belt, belt clip, or carry strap. Another variation of the configuration could incorporate a sensor to detect if the portable signaling unit **20** was involuntarily removed from the individual and would automatically trigger an alarm signal to the central dispatch station.

FIGS. **3**A and **3**B show one embodiment of the remote alarm switch unit **40** in the form of a wristband assembly. Remote alarm switch unit **40** can be in the form of any other object, such as a broach, pendant, or keychain. Regardless of its construction, remote alarm switch unit **40** comprises a series of manual alarm push-buttons **42***a*, **42***b*, **42***c*, etc. These manual alarm push-buttons can be marked with different symbols and/or color codes for easy reference by the user. For example, green, yellow and red may be used to indicate increasing order of alarm priority.

Remote alarm switch unit **40** further comprises a miniature radio transmitter having a built-in antenna **46**, a lithium battery **48**, an encoder circuit **58**, and an automatic switch circuit **44** that is activated if remote alarm switch unit **40** is removed from individual **50** by forcefull or unauthorized means. In the wristband configuration of remote alarm switch unit **40** as shown, a section of insulation material **52**, e.g., non-electro-conductive plastic, is provided so that the clasp portion **54** of the wristband can provide a closed circuit to the automatic alarm switch circuit **44**. These components enable remote alarm switch unit **40** to automatically generate a signal if the circuit is determined to be open (e.g., when the remote alarm switch unit **40** is unintentionally removed from the individual).

Remote alarm switch unit **40** also comprises a timer circuit **56**, which enables remote alarm switch unit **40** to transmit a periodic signal so that portable signaling unit **20** can determine that remote alarm switch unit **40** is within the preset location range of portable signaling unit **20** (i.e., a "normal" condition: the portable signaling unit **20** is still being worn or carried by the individual).

Further, remote alarm switch unit **40** contains circuitry that enables remote alarm switch unit **40** to be in a nontransmitting mode when in a non-triggered state, except during transmission of the periodic signals. In this way, battery power is conserved, unlike where remote alarm switch unit **40** is continuously transmitting in the triggered state.

In practice, the central dispatch station **80** will interpret an alarm signal generated by portable signaling unit **20** when portable signaling unit **20** fails to receive a periodic signal from remote alarm switch unit **40** as indicating that remote alarm switch unit **40** is not within the preset location range of portable signaling unit **20**. Since the central dispatch station **80** has not received an alarm indication that remote alarm switch unit **40** has been removed from the individual by forceful or unauthorized means, it must be that portable signaling unit **20** has been removed from the individual.

FIG. **4** shows a functional block diagram of the circuits in the remote alarm switch unit **40**. The various manual alarm switches **42***a*, **42***b*, and **42***c* are shown. Also shown are automatic alarm switch circuit **44**, encoder circuit **58**, timer circuit **56**, miniature radio transmitter having a built-in antenna **46**, and lithium battery **48**.

FIG. **5** shows a system block diagram which includes portable signaling unit **20**, drop-in battery charger **36**, a cellular telephone system **70** with wireless location technology such as a cellular telephone Automatic Location Identification (ALI) system, remote alarm switch unit **40**, and central dispatch station **80**. Contained within the portable signaling unit **20** are 3 local alarm switches **24***a*, **24***b*, **24***c*, a programmed unit serial identification code circuit **104**, a microcontroller **106**, a cellular telephone receiver **108** with a pre-assigned telephone number, a cellular telephone antenna **26**, and a cellular telephone transmitter **110**. The cellular telephone circuit **110** also comprises a pre-programmed telephone number for the central dispatch station **80**, a redial counter, and alternate telephone numbers to provide for failsafe operation. Also included in the portable signaling unit are a data modem **112**, a data-to-voice switching circuit **114**, a remote alarm radio receiver with built-in antenna **116**, a decoder circuit **118**, a speaker-microphone element **32**, a rechargeable battery **120**, a low battery sensor circuit **122**, a missing pulse detector **124**, and a power-up switch circuit **126**.

FIG. **6** shows an alternative system block diagram which incorporates the use of GPS satellite network **60**, a GPS receiving antenna **30**, a GPS receiving circuit **100**, and a position buffer circuit **102**, in association with the circuits described above with reference to FIG. **5**.

The general method of operation of the personal security tracking system is described as follows:

The portable signaling unit **20** can be worn or carried by the user, preferably under the wearer's clothing so as to not be visible to a possible perpetrator.

As shown in FIG. **5**, the portable signaling unit **20** is first put into service by an authorized person, parent, or guardian who enters a security code at the main power on/off key pad **22**. The portable signaling unit **20** is now in a stand-by mode so as to conserve battery power. In the stand-by mode only those circuits essential to sensing an alarm condition are powered on. These essential circuits include remote alarm radio receiver **116**, decoder circuit **118**, missing pulse detector **124**, cellular telephone receiving circuit **108**, data modem circuit **112**, microcontroller **106** and a low battery sensing circuit **122**. The microcontroller **106** continuously polls the alarm inputs to detect a change in security conditions. It also commands and directs circuit operations. The data-to-voice switch circuit **114** remains in the data mode and cannot be switched to the voice mode until it receives the power up command. The remainder of the circuits remain off until an alarm input is detected.

As shown in FIG. **8** the portable signaling unit **20** is activated to the alarm mode when any one of the following conditions prevail:

(a) When the person in distress has enough control in the situation to manually activate the portable signaling unit **20** (FIG. **2**).

This is done by depressing any one of the manual pushbutton switches **24***a*, **24***b*, **24***c*, etc. on the portable signaling unit **20**. The selection of the proper manual push-button switches **24***a*, **24***b*, **24***c*, etc. is related to various health conditions or a threat to the individual's personal safety, based on a pre-arranged agreement with the central dispatch station. E.g., depressing manual alarm push-button switch **24***c* can mean "I'm okay, just checking in, as pre-arranged", depressing manual alarm push-button switch **24***b* can mean "I am in need of medical assistance", and depressing manual alarm push-button switch **24***a* can mean "Help, my life is in danger!"

Referring to FIG. **5**, depressing any one of the pushbutton switches **24***a*, **24***b*, **24***c*, etc. on the portable signaling unit **20** sends a signal to microcontroller **106** and sets alarm input number **1***a*, **1***b*, **1***c*, etc. corresponding to the manual switch that was depressed.

(b) When the person in distress has enough control in the situation to manually activate the remote alarm switch unit **40** (FIGS. **3**A and **3**B).

This is done by depressing any one of the manual push-button switches **42***a*, **42***b*, or **42***c*, etc. The selection of the proper manual alarm push-button switch **42***a*, **42***b* or **42***c*, etc., is related to various, health conditions or a threat to the individual's personal safety, as described in paragraph (a) above.

Referring to FIG. **4**, depressing any one of the push-button switches **42***a*, **42***b*, or **42***c*, etc. on the remote alarm switch unit **40** sends a pulse to the encoder circuit **58**. The encoder circuit **58** then sends a uniquely coded data pulse and a transmit "on"

command to the miniature radio transmitter **46**. In FIG. **5**, a radio frequency signal, with the unique code denoting which manual switch was depressed, is sent from the remote alarm switch unit **40** to the portable signaling unit **20**. The signal is detected by the remote alarm radio receiver **116** and decoded by the decoder circuit **118**. Decoder **118** sets alarm input number **2***a*, **2***b*, or **2***c*, etc. in the microcontroller **106** corresponding to the manual switch that was depressed in the remote alarm switch unit **40**. Coding and decoding the remote alarm switch unit **40** signal will prevent false triggering of the portable signaling unit **20** from other stray and random radio frequency sources.

(c) When the remote alarm switch unit **40** is removed from the individual **50** by forceful or unauthorized means before the individual is able to summon help.

In FIG. **4**, the automatic alarm switch circuit **44** is activated when, in this example, the wristband clasp assembly **54** is opened, or if the wristband is cut or broken. In either case, the automatic alarm switch circuit **44** senses that electrical continuity around the wristband is broken creating an open electrical circuit. The automatic alarm switch circuit **44** then sends a pulse to the encoder circuit **58**. The encoder circuit **58** sends a uniquely coded pulse and a transmit "on" command to the miniature radio transmitter **46**. In FIG. **5**, a radio frequency signal, with the unique code denoting the automatic alarm switch circuit **44** activation, is sent to the portable signaling unit **20**. The signal is detected by remote alarm radio receiver **116** and decoded by decoder circuit **118**. Decoder **118** sets alarm input number **3** in the microcontroller **106**.

(d) When the portable signaling unit **20** is removed from the individual **50** by forceful or unauthorized means before the individual can summon help.

A feature of the portable security and tracking system provides for detecting the separation of the portable signaling unit **20** from the remote alarm switch unit **40**. A scenario might be where the portable signaling unit **20** is removed from the individual **50** by a perpetrator and discarded and the remote alarm switch (in the form of a wristband for example) is untouched. Its operation is described as follows:

The portable signaling unit **20** must receive a radio frequency signal from the remote alarm switch unit **40** at a predetermined time interval. A failure to receive this signal will activate the portable signaling unit **20** to transmit an alarm. This failure to receive the signal may be when the distance between the portable signaling unit **20** and the remote alarm switch unit **40** becomes too great to detect the signal or it may be caused by a battery or transmitter failure in the remote alarm switch unit **40**.

In FIG. **4**, the timer circuit **56** in remote alarm switch unit **40** sends a pulse to the encoder circuit **58** at a predetermined time interval, e.g., once every minute. The encoder circuit **58** sends a uniquely coded pulse and a short transmit "on" command to the miniature radio transmitter **46**.

In FIG. **5**, a radio frequency signal, with a unique code denoting a timer circuit activation, is sent to the portable signaling unit **20**. The signal is detected by remote alarm radio receiver circuit **116** in the portable signaling unit **20**. The unique code is decoded by the decoder circuit **118** and sent to missing pulse detector circuit **124**. If missing pulse detector **124** fails to be reset within a predetermined time interval by the periodic signal, e.g., 1.5 minutes, then alarm input number **4** is set in microcontroller **106**. The separation distance at which the portable signaling unit **20** is activated is set by adjusting the power output of the miniature radio transmitter **46** in the remote alarm switch unit **40**.

(e) When a low battery condition is sensed by the low battery sensor circuit **122**.

In FIG. **5**, the low battery sensor circuit **122** is preset to allow a sufficient amount of remaining battery voltage to ensure reliable activation of the portable signaling unit **20**. When the voltage drops below a preset voltage threshold, alarm input flag number **5** is set in the microcontroller **106**.

(f) When the portable signaling unit **20** needs to be located and/or monitored.

Referring to FIG. **7**, the central dispatch station operator **82** locates the subscriber information including the telephone number of portable signaling unit **20** in the computer system **90** database. The remote activation capability in the computer system **90** is then used to automatically dial the portable signaling unit **20** and transmit a cellular digital packet data (CDPD) transmission via the cellular telephone system **70** to the individual's portable signaling unit **20**. In FIG. **5**, upon receiving the telephone CDPD transmission, cellular telephone receiver circuit **108** sends the received data through the data modem circuit **112** which sets alarm input number **6** in the microcontroller **106**.

Upon sensing any one of the above described alarm input conditions, the microcontroller **106**, then turns on the remainder of the circuits within the portable signaling unit **20** by activating power-up switch circuit **126**.

As shown in FIG. **5**, the programmed unit identification code circuit **104**, the cellular telephone transmitter circuit **110** and the data-to-voice switching circuit **114** are turned on.

FIG. **6** shows a variation of signaling unit **20** which incorporates a GPS receiver to determine the user's location. In this variation, the GPS receiver **100** and the position buffer circuit **102** are also turned on upon sensing any one of the above described alarm input conditions.

In the case of alarm conditions described in (a) through (d), above, the microcontroller **106** commands the cellular telephone transmitter circuit **110** to automatically dial the central dispatch station **80**. The central dispatch station **80** receives the incoming signal and returns a CDPD transmission requesting the portable signaling unit **20** to send its data. The portable signaling unit **20** replies with a CDPD transmission consisting of its unit identification number and the alarm code. In the case where a GPS receiver is used to determine location, a hierarchy of longitude and latitude coordinate data is also included in the CDPD transmission to the central dispatch station **80**.

In the case of (e) above, when the cellular telephone transmitter circuit **110** is activated, the microcontroller **106** then sends a CDPD transmission consisting of its unit identification number and the alarm code. In the case where a GPS receiver is used to determine location, a hierarchy of longitude and latitude coordinate data is also included in the CDPD transmission to the central dispatch station **80**.

In FIG. **7**, the central dispatch station **80** receives the incoming CDPD transmission from the portable signaling unit **20** to the intelligent telephone system **84** via the cellular telephone system **70**. The cellular telephone system **70** provides Automatic Location Identification (ALI) information that gives the location of the origin of the cellular telephone transmissions. This technology has been developed by companies such as XYPOINT and The Associated Group (TruePosition™), in response to a Federal Communications mandate (Report and Order 94-102) that requires E9-1-1 cellular telephone calls be located to within 125 meters (410 feet) of the origination point at a 67% or better accuracy rate.

The signal is routed to a computer system **90** via one or more data modems **86** and is automatically verified by the computer system **90**. Upon verification, an acknowledgment

CDPD transmission is sent back to the portable signaling unit **20** confirming that two-way communications has been established. Should an incoming cellular telephone call be a wrong number, the proper signal will not be detected, the cellular telephone transmitter circuit **110** will time out and will automatically hang up. Once the communications link has successfully been established between the portable signaling unit **20** and the central dispatch station **80**, the portable signaling unit **20** is automatically instructed by the computer system **90** to continue sending CDPD transmissions.

FIG. **7** is a block diagram of the presently preferred embodiment of the central dispatch station **80**. The central dispatch station **80** generally comprises a conventional intelligent telephone system **84** connected to one or more data modems **86** then to a computer system **90** which in turn is connected to one or more display consoles **92**. The computer system **90** contains the communications information, user database, emergency services database, map display information, unit identifier and alarm status display information, one or more data-to-voice switches, remote activation capability, plotting algorithms, boundary monitoring alarm features, and has the capability to store and retrieve historical data. The computer system **90** can be networked so that incoming personal alarm messages may be allocated to the appropriate display consoles **92** to accommodate a high frequency of incoming calls. The computer system **90** and display consoles **92** may be any commercially available brand of microprocessor which includes video monitors.

Incoming cellular calls from portable signaling unit **20** are automatically received and logged by the computer system **90** (via the intelligent telephone system **84** and one or more data modems **86**). The CDPD transmissions along with the ALI information are decoded, validated and routed to display console(s) **92**. As represented by block **93** in FIG. **7**, the display console(s) **92** continuously run a conventional digital map program. Preferably, the map program is capable of (a) displaying detailed geographical area maps complete with street names and addresses, (b) real-time plotting of coordinates data at the appropriate position on the map, (c) a user controlled zoom function, and (d) programmable display windows, symbols, and legend. A number of suitable map programs incorporating these features are commercially available.

Computer system **90** processes and validates the received data. The portable signaling unit identification number is matched with the subscriber name in the database. The alarm code information is decoded and recorded. The ALI location data is analyzed for reliability and stored. The location of portable signaling unit **20** is displayed on one of the display consoles **92** in the form of a quickly recognizable symbol, as represented by block **93** in FIG. **7**. The symbol can represent police, medical or any other key feature that may apply to the specific needs of the subscriber. The symbol appears superimposed on a digitized map on a computer monitor screen **92** at a position which corresponds to the location of the portable signaling unit **20**, as represented by block **93**. Both the user identification data and alarm code are also displayed on the display console **92**. A data-to-voice switch capability in the computer system **90** allows the central dispatch operator **82** to conduct two-way communications with the person in distress via the portable signaling unit **20**. Various display capabilities are utilized to assist a dispatch operator **82** in locating the person in distress. The emergency services database allows a dispatch operator **82** to automatically dial the proper authorities and direct them to the exact location of the person to provide emergency assistance. The data is updated and transmitted at regular intervals until the connection is terminated by a dispatch operator **82**. An important feature of the personal security and tracking system is that when a low battery condition alarm is indicated from the portable signaling unit **20**, an alarm is activated at the central dispatch station **80**. A dispatch operator then notifies the designated person (e.g., parent or guardian) to service the battery.

As described in FIG. **8**, situation number **6**, the central dispatch station can activate any portable signaling unit **20** to obtain an instant display of the current location of the individual carrying the portable signaling unit **20**. This activation would be on an "as needed" basis. For example, if a parent or guardian needed to determine the location of a lost person.

In the case where an individual is to be monitored for compliance within a preset boundary as described in FIG. **8**, situation number **7**, the portable signaling unit **20** is automatically interrogated by the computer system **90** at predetermined time intervals. Should a CDPD transmission from the portable signaling unit yield data that is outside specified boundaries, the computer system **90** will activate an alarm to a dispatch operator **82**.

Also in FIG. **8**, situation **8** describes the self-check capability of the personal security and tracking system of FIG. **1**. The computer system **90** at the central dispatch station **80** can be programmed to automatically interrogate each portable signaling unit **20** at predetermined time intervals. The computer system **90** activates an alarm to a dispatch operator **82** if there is no response or if invalid data is received indicating a malfunction.

Although the description above contains many specifics, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. For example, the remote alarm switch unit **40** can be in the form of a wristband as described here or in the form of any other object, such as a broach, pendant, or keychain. The same arrangement of manual and automatically activated alarm switches could be incorporated in any design configuration. The portable signaling unit **20** can contain a GPS receiving circuit as described herein to provide more accurate location information in open areas where the cellular telephone ALI information may not be as precise. The portable signaling unit **20** can be configured such that it has all of the features of the remote alarm switch unit **40** in addition to its own features, with the exception of the distance-checking feature. The portable signaling unit **20** can also be configured with a small LCD display screen for the hearing impaired to receive messages from the central dispatch station. Thus the scope of the invention should be determined by the appended claims and their legal equivalents rather than by the examples given.

The invention claimed is:

1. A method for tracking a portable signaling unit comprising:

receiving, with a GPS receiver coupled to a portable signaling unit, a GPS signal;

using the GPS signal to determine a position of the portable signaling unit;

transmitting, from the portable signaling unit and over a wireless communication system to a computer, data regarding the position of the portable signaling unit, wherein the data is used to determine a location of the portable signaling unit; and

displaying, on a display, a map having a symbol identifying the location of the portable signaling unit, wherein the display is remote from the computer and connected to the computer by a network.

2. The method of claim **1**, wherein the displaying act further comprises running a digital map program.

3. The method of claim 2, wherein the displaying act further comprises superimposing the symbol on the map.

4. The method of claim 1, wherein the displaying act further comprises displaying detailed geographical area maps including street names and addresses, and plotting data at appropriate positions on said map.

5. The method of claim 1, wherein the data regarding the position of the portable signaling unit is used by the computer to determine a location of the portable signaling unit.

6. The method of claim 1, wherein the display comprises a display console at a central dispatch station.

7. The method of claim 1, wherein the data is transmitted to track the position of the portable signaling unit.

8. The method of claim 1, further comprising receiving a voice communication with the portable signaling unit.

9. The method of claim 1, further comprising transmitting, from the portable signaling unit, an identifier which identifies the portable signaling unit.

10. The method of claim 1, wherein the portable signaling unit comprises a cellular telephone device.

11. The method of claim 1, wherein the portable signaling unit includes an identifier which identifies the portable signaling unit.

12. The method of claim 1, wherein the portable signaling unit comprises a transmitter and a first receiver.

13. The method of claim 12, wherein the portable signaling unit comprises a second receiver separate from the first receiver.

14. The method of claim 13, wherein the first receiver is adapted to a receive a cellular telephone signal and the second receiver is adapted to receive a signal different from the cellular telephone signal.

15. The method of claim 14, wherein the second receiver is adapted to receive a radio signal.

16. The method of claim 12, wherein the first receiver is adapted to receive signals containing voice communications.

17. The method of claim 1, wherein the portable signaling unit comprises:

a transmitter;

a first receiver;

a first antenna;

a second receiver;

a microcontroller; and

a speaker.

18. The method of claim 17, wherein the portable signaling unit further comprises:

a keypad; and

a microphone.

19. The method of claim 17, wherein the portable signaling unit further comprises:

a second antenna; and

a third antenna.

20. The method of claim 17, wherein:

the first receiver is adapted to receive a cellular telephone signal;

the second receiver is adapted to receive a signal different from the cellular telephone signal;

the first receiver is adapted to receive voice communications; and

the transmitter is adapted to transmit voice communications.

21. The method of claim 20, further comprising the acts of:

receiving with the second receiver a first signal containing data; and

transmitting with the transmitter a second signal based on the data received with the

second receiver, the second signal being a cellular telephone signal.

* * * * *