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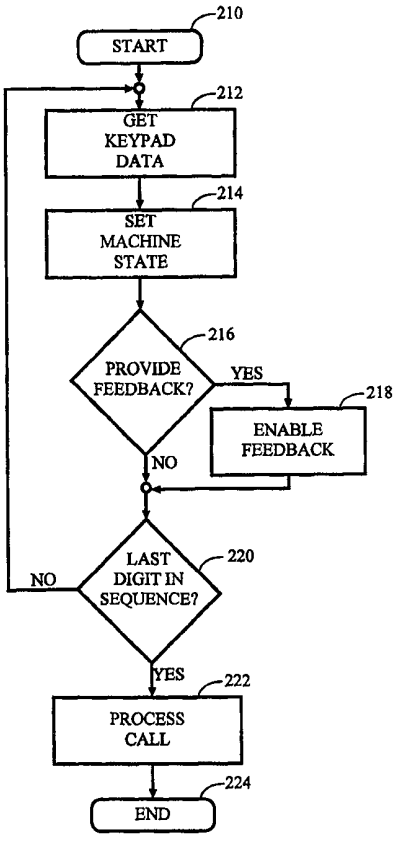
(54) Title: SYSTEM AND METHOD FOR USER FEEDBACK IN A WIRELESS COMMUNICATION DEVICE

(57) Abstract

A system (100) and method for providing feedback to the user of a wireless communication device utilizes state data indicative of the present logical state of the wireless communication device. The logic state is based on the dialing plan of the geographic location of the user and is stored within the wireless communication device (100). Based on user activation of keys of the keypad (118) of the wireless communication device, the system changes from one logic state to another (214). At each change of logic state, data is present to indicate whether or not feedback should be provided (216) to the user. If feedback is enabled (218), the wireless communication device provides audible and/or visual feedback to the user. The wireless communication device can mimic operation of a conventional telephone by generating secondary dial tones in response to the user selection of certain key sequences on the keypad. Key sequences, such as special feature codes, result in the generation of a secondary dial tone or other form of feedback to the user. When the user has completed entry of a sequence of digits (220), the wireless communication device transmits the destination telephone number (222) and any additional digits, such as special feature codes, selected by the user.



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SYSTEM AND METHOD FOR USER FEEDBACK IN A WIRELESS COMMUNICATION DEVICE

BACKGROUND OF THE INVENTION

I. Field Of The Invention

The present invention is related generally to a wireless communication device and, more particularly, to a system and method for providing feedback signals to a user to assist in operating a wireless communication device.

II. Description Of The Related Art

Wireless communication devices, such as cellular telephones, are widely used as a replacement for conventional telephone systems. In addition to functioning as a replacement for a conventional telephone, wireless communication devices offer the advantage of portability, thus enabling the user to establish a wireless communication link between virtually any two locations on Earth.

Although wireless communication devices provide communication capability equivalent to that provided by conventional telephone systems, there are operational and procedural differences between operation of the two different systems. For example, a conventional telephone is physically wired to a telephone exchange. A user activates the conventional telephone by picking up the receiver, thus placing the telephone in an "Off Hook" condition. If the user is making an outgoing call, the telephone exchange generates an audible dial tone in the receiver when the conventional telephone is in the Off Hook in. In this manner, the user knows that the telephone is active and ready to accept a destination telephone number. The user simply presses buttons corresponding to the desired destination telephone number. When the first button is pressed, the dial tone is eliminated. Thus, the conventional telephone system provides the user with some form of feedback to indicate that the telephone is working properly.

Modern conventional telephone systems include a number of predetermined codes that the user can also dial to select certain special features.

For example, "Special Feature" codes may be entered by the user prior to dialing the destination telephone number. Examples of Special Feature codes are "*82" to transmit caller ID, "*67" to block caller ID, "*72" to activate call forwarding, and "*70" to cancel call waiting. Other predetermined special feature codes are well known. To select one of these special features, the user simply enters the feature code before dialing the destination telephone number. The dial tone is eliminated when the user presses the first button (*e.g.*, the "*" key) of the feature code. When the system has accepted a feature code, a feature confirmation tone, such as a series of audible "beeps" followed by a new dial tone, sometimes referred to as a secondary dial tone, is generated to indicate to the user that the user-entered action has been accepted by the telephone system. For example, the following sequence of events occurs when the user wishes to transmit caller ID to a particular long-distance number:

<primary dial tone>
*82
<feature confirmation tone/secondary dial tone>
16195551234

where the primary dial tone is the tone initially heard by the user when the receiver is picked up and the secondary dial tone is generated by the telephone system following the user entry of a feature code. It should be noted that the primary and secondary dial tones may be identical tones, but occur at different points in the call processing sequence of events. In some embodiments, the secondary dial tone may generate a different tone, such as a pulsed dial tone, to distinguish it from the primary dial tone. Thus, the user interacts with the telephone system to enter the desired data and is provided with audible feedback from the telephone system to acknowledge receipt of the requested features.

In contrast, wireless communication devices do not typically generate a dial tone. The user turns on power to the wireless communication device, which results in a registration process. For example, a cellular telephone registers with a nearby cell site controller. However, the phone itself is not considered to be in the Off Hook condition. The user enters a sequence of digits corresponding to the destination telephone number. The cellular telephone

temporarily stores the digits in a dialed digits storage area. To establish a communication link, the user presses a "Send" button. In response, a transmitter within the cellular telephone transmits the data in the dialed digits storage area to the cell site controller. In turn, the cell site controller establishes a communication link with the telephone device corresponding to the destination telephone number. Thus, the typical wireless communication device does not provide a dial tone as feedback to the user.

Wireless communication devices also have the capability of special feature codes. To activate a particular special feature code, the user presses the buttons in a manner similar to that of a conventional telephone. However, as discussed above, the cellular telephone does not generate a dial tone. Thus, the special feature codes and destination telephone number are all entered into the dialed digits storage area and transmitted to the cell site controller when the user presses the Send button.

Although some users can readily adapt to the procedural differences in using a wireless communication device, it is inconvenient for some users to learn different procedures for using a conventional telephone system in a wireless communication device. Therefore, it can be appreciated that there is a significant need for a system and method that simplifies operation of a wireless communication device. The present invention provides this and other advantages, as will be apparent from the following description and accompanying figures.

SUMMARY OF THE INVENTION

The present invention is embodied in a system and method to provide feedback to the user of a wireless communication device. In an exemplary embodiment, the system includes a keypad comprising a plurality of keys that may be selectively activated by a user. The keypad senses user operation of the keys. The device also includes a data structure to store a state diagram indicative of a logical state of the wireless communication device wherein the particular logic state of the wireless communication device is based on a sequence in which the keys are activated by the user. The system also

includes a feedback device to provide feedback to the user when the wireless communication device is in a selected logic state.

In one embodiment, the system includes an audio output device, such as a speaker, to provide audio feedback signals to the user. The signals may take the form of a dial tone similar to that used in a conventional telephone communication system. Alternatively, the system may include a visual display and provide visual feedback to the user in the selected logic state.

The system may also include a transmitter to transmit data signals to a location remote from the wireless communication device. The transmitter transmits data, such as a destination telephone number, to the remote location when activated by the user. The transmitter may also transmit other data, such as special feature codes, or the like, when activated by the user. The transmitter may be manually activated by the user by pressing a button on the keypad. Alternatively, the transmitter may be automatically activated when the user activates the keypad to place the wireless communication device in a predetermined logic state.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of an exemplary embodiment of the wireless communication device of the present invention.

FIG. 2 illustrates the state data storage area of the wireless communication device of FIG. 1.

FIG. 3 illustrates a data table implementing the state data storage area of FIG. 2.

FIG. 4 is a flowchart illustrating the operation of the wireless communication device of FIG. 1 to provide user feedback.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a technique for providing feedback to the user of a wireless communication device to thereby emulate operation of a conventional telephone. The invention thereby increases the comfort level of the user in operating two different types of communication devices.

The present invention is embodied in a system **100** illustrated in the functional block diagram of FIG. 1. The system **100** includes a central processing unit (CPU) **102**, which controls operation of the system. A memory **104**, which may include both read-only memory (ROM) and random access memory (RAM), provides instructions and data to the CPU **102**. A portion of the memory **104** may also include non-volatile random access memory (NVRAM). As will be discussed in greater detail below, the (NVRAM) portion of the memory **104** may be used to store one or more destination telephone numbers and associated data.

The system **100**, which is typically embodied in a wireless communication device such as a cellular telephone, also includes a housing **106** that contains a transmitter **108** and a receiver **110** to allow transmission and reception of data, such as audio communications, between the system **100** and a remote location, such as a cell site controller (not shown). The transmitter **108** and receiver **110** may be combined into a transceiver **112**. An antenna **114** is attached to the housing **106** and electrically coupled to the transceiver **112**. The operation of the transmitter **108**, receiver **110**, and antenna **114** is well known in the art and need not be described herein.

The system **100** may include an optional display **116** to conveniently display instructions to the user as well as user-entered data, such as destination telephone numbers and alphanumeric text. However, the display **116** is not necessary for satisfactory operation of the present invention. A keypad **118** is attached to the housing **106** for operation by the user in a conventional manner. As will be described below, the keypad **118** provides a convenient input device by which destination telephone numbers and alphanumeric text may be entered by the user.

The system **100** also includes a state data storage area **122** which contains information regarding the current logic state of the wireless communication device. Specifically, the state data storage area **122** contains data related to the dialing plan for the geographic location in which the system **100** is used. The dialing plan data is used to determine which logic states require feedback to the user. The state data storage area **122** may be part of the memory **104** or a separate storage area. While depicted as a conventional

memory, those skilled in the art can appreciate that the state data storage area **122** may be any suitable data structure. Operational details of the state data storage area **122** are provided below.

An audible output device **124** provides audible feedback signal, such as a dial tone, to assist the user in the operation of the system **100**. In an exemplary embodiment, the audible output device **124** is in the form of a speaker that serves to provide voice signals to the user as well as the audible feedback signals. As will be discussed in detail below, the audible output device **124** generates audible output signals for the user when the wireless communication device is in certain predetermined logic states, as determined by the state data storage area **122**.

The system **100** also includes a dialed digits storage area **126**. The dialed digits storage area **126** stores destination telephone numbers in preparation for transmission to their remote location (*e.g.*, a cell site controller). When the user enters a destination telephone number via the keypad **118**, the digits entered by the user are temporarily stored in the dialed digits storage area. Similarly, the user may select a destination telephone number from an electronic telephone number storage area, which is typically part of the NVRAM portion of the memory **104**. The dialed digits storage area **126** receives the destination telephone number, whether manually entered by the user via the keypad or selected by the user from the NVRAM portion of the memory **104**. In operation, the transmitter **108** transmits the data in the dialed digits storage area **126** to establish a communication link between the wireless communication device and the communication device associated with the destination telephone number. The dialed digits storage area **126** also stores any special feature codes that have been selected by the user. In typical operation, the user selects one or more special feature codes prior to selecting the destination telephone number. A conventional telephone systems processes the special feature codes as they are entered by the user. In contrast, the wireless communication device sequentially transmits these special feature codes and the destination telephone number only after the user has specified both special feature codes and the destination telephone number. For example, when the user presses the Send button on a cellular telephone, the cellular

telephone transmits any special feature codes and the destination telephone number to a cell site controller. The special feature codes are processed by the cell site controller along with the destination telephone number.

The various components of the system **100** are coupled together by a bus system **128** which may include a power bus, control signal bus, and status signal bus in addition to a data bus. However, for the sake of clarity, the various buses are illustrated in FIG. 1 as the bus system **128**.

The user of the wireless communication device enters a destination telephone number by selectively activating keys of the keypad **118**. The particular format and number of digits required to successfully complete a telephone call depend on the geographic location. Each country has its own set of rules regarding telephone numbers. For example, the United States is divided into geographic regions, each having a three-digit area code. In addition, subscribers within a particular area code are assigned a seven-digit telephone number comprising a three-digit telephone exchange number and a four-digit subscriber number. The number of digits required to successfully complete the call depend on the location of the caller and the called party. For example, calls may be made within one's area code by simply dialing the seven-digit local number (*i.e.*, the exchange number and subscriber number). However, for calls outside one's area code, it is necessary to dial ten digits (*i.e.*, the area code, the exchange number, and the subscriber number). In addition, subscribers in the United States must typically dial a 1 before the area code to indicate to the telephone system that a long-distance call is being made.

Each country generates its own set of rules regarding dialing procedures within that country. These rules, sometimes known as dialing plans, are used to control phone systems within each respective country. In addition, international agreements have been reached whereby country codes may be added to place an international long-distance call.

The state data storage area **122** contains data relating to the dialing plan for a particular country in which the wireless communication device is intended to be used. For example, the state data storage area **122** contains data relating to the United States dialing plan for wireless communication devices manufactured for use in the United States. Similarly, the state data storage area

122 may be programmed with data relating to dialing plans for other countries. Alternatively, the state data storage area **122** may contain dialing plans for more than one country. For example, an individual using the wireless communication device in Europe may wish to have dialing plans for multiple European countries (*e.g.*, France, Germany, Italy, and the like). The appropriate dialing plan may be selected using an option menu. The use of option menus is well known and need not be discussed herein.

The state data storage area **122** is used to determine the current logic state of the wireless communication device. The audible output device **124** is used to generate an audio feedback signal to the user when the wireless communication device is in predetermined ones of the logic states. FIG. 2 illustrates a state diagram **200** to further explain the operation of the state data storage area **122** for the United States dialing plan. The United States dialing plan for cellular phones itself is defined in an industry standard known as TIA/EIA 660. The system **100** begins at an initial state, State 1. Prior to the user entering any digits on the keypad **118**. The first digit entered by the user on the keypad **118** causes the system **100** to change from the State 1 to a different state depending on the value of the digit entered on the keypad. If the user enters the numeric digit "0" on the keypad **118**, the system **100** changes to a state, State 2. From the State 2, the user enters additional digits that cause the system **100** to change states as each digit is entered on the keypad **118**. As illustrated in FIG. 2, if the user enters the numeric digit "1" while in the State 2, the system **100** changes from the State 2 to a State 5. If the user enters an additional numeric digit "1" while in the State 5, the system **100** changes to a state, State 8 that indicates the user's intention to place an international long-distance call. As can be appreciated by those of ordinary skill in the art, a user will enter additional digits indicative of a country code, city code, telephone number, and the like. The specific sequence of digits entered by the user depend on the destination telephone number. Details of this sequence need not be described herein.

Similarly, from the State 1, the user can enter the numeric digit "1" on the keypad **118** causing the system **100** to change to a state, State 3. The entry of any numeric digit N, where N represents any number from 2 to 9,

causes the system **100** to change from the State 3 to a state, State 6. The entry of any subsequent numeric digit X, where X is any number from 0 to 9, causes the system **100** to change from the State 6 to a state, State 9. The entry of additional numeric digits from the State 9 would be indicative of a U.S. long-distance call. As those of ordinary skill in the art can appreciate, the entry of 8 additional numeric digits (1 + area code + telephone number) is required to complete a U.S. long-distance call if the system is at the State 9.

From the State 1, the entry of any numeric digit N (*i.e.*, 2-9) causes the system **100** to change to a state, State 4. The subsequent entry of any numeric digit X (*i.e.*, 0-9) causes the system **100** to change from the State 4 to a state, State 7. As illustrated in FIG. 2, the entry of additional numeric digits is indicative of a local call.

Special feature codes are also included in the state diagram **200**. From the State 1, the entry of the "*" digit causes the system **100** to change to a state, State 11. The subsequent entry of any digit N (*i.e.*, 2-9) causes the system **100** to change to a state, State 12. As illustrated in FIG. 2, the subsequent entry of any digit X (*i.e.*, 0-9) while in the State 12 causes the system **100** to change to a state, State 13.

As can be appreciated by those of ordinary skill in the art, a total of 7 numeric digits, beginning with the numeric digit N (*i.e.*, 2-9), is indicative of a local call. Thus, each entry on the keypad **118** causes the system **100** to change states. At each state of the state diagram **200**, the system **100** determines whether or not to provide feedback to the user. For example, the system may provide a dial tone to the user in response to the entry of a special feature code. The system **100** may also provide feedback at other selected states of the wireless communication device. In an exemplary embodiment of the system, the system **100** determines a feedback condition at each state of the state diagram **200**.

The state diagram **200** is readily stored in the state data storage area **122** in the form of a data table **202** illustrated in FIG. 3. While shown in FIG. 3 as the data table **202**, those of ordinary skill in the art will recognize that any suitable data structure may be used to store the data corresponding to the state diagram **200**. The present invention is not limited by the specific form of

data structure used to store data corresponding to the state diagram **200**. Each state of the state diagram **200** is used as an index to the data table **202**. At each state, the user may enter a numeric digit X (*i.e.*, 0-9) or a control digit, such as the "*" key or the "#" key. The entry of an additional digit points to a specific location in the data table **202** that indicates the next state of the system **100**. For example, if the wireless communication device is in the State 1, and the user presses the control digit *, the data in the data table **202** indicates the next state for the wireless communication device is the State 11. In addition, the data table **202** contains data indicative of the feedback that is applicable to that particular state. In an exemplary embodiment, the data table includes one bit of feedback data for each state of the system **100**. The feedback data bit in the data table **202** indicates whether some form of feedback should be provided to the user based on the present machine state.

For example, if the user has entered a special feature code, such as the digits *82, placing the system **100** in the State 13, the feedback data bit is at a high logic level. Under these conditions, the system **100** triggers the audible output device **124** (see FIG. 1) to provide an audible feedback signal to the user. In an exemplary embodiment, the audible output device **124** provides audible feedback in the form of a dial tone, in a manner similar to the operation of a conventional telephone in which secondary dial tone is generated in response to the entry of a special feature code. Alternatively, the system **100** can provide visible feedback using the display **116** or some other form of visible output, such as a light-emitting diode (LED) (not shown). Similarly, the system **100** can provide feedback to the user for other feature codes, or other selected states. For example, if the wireless communication device is a wireless local loop (WLL) telephone, it is possible to generate a dial tone in State 1 when the user picks up the receiver. The system **100** may further generate a secondary dial tone if the user enters a special feature code on a WLL telephone. This form of feedback mimics operation of a conventional telephone system by making the WLL telephone operate in a manner familiar to users of a conventional telephone system, thus greatly simplifying operation for a user unfamiliar with the operational procedures of a wireless communication device.

It should be noted that the state diagram **200** in FIG. 2 and the data table **202** in FIG. 3 do not illustrate each possible state of the system **100**. The number of possible machine states is dependent on the specific calling plan implemented in the country in which the system **100** is operated. For the sake of brevity, only a limited number of machine states are illustrated in FIGS. 2 and 3 for the United States dialing plan. It is possible to enter data entries on the keypad **118** (see FIG. 1) that result in inoperable or illegal logic states of the wireless communication device. For example, if the system **100** is in the State 3, the entry of a numeric digit "0" or a numeric digit "1" on the keypad **118** results in an illegal logic state. Therefore, the data entries illustrated in the data table **202** indicate that the system **100** is in an illegal state and the present call is terminated.

Special feature codes and the destination telephone number entered by the user are stored in the dialed digits storage area **126**, in the manner previously described. That is, the user enters one or more special feature codes followed by the destination telephone number. The destination telephone number may be manually entered from the key pad or selected from a phone book storage area in the NVRAM portion of the memory **104**. It should be noted that the system **100** transmits the data in a dialed digit storage area **126** in the manner identical to a conventional wireless communication device. The special feature codes and destination telephone number are transmitted together in response to the user pressing the Send button even though the feedback signal is generated for the user. Thus, the feedback signal is provided only to assist the user in the entry of data into the wireless communication device and does not affect the manner in which the wireless communication device interacts with a remote location (*e.g.*, a cell site controller).

Alternatively, the system **100** can use the state diagram **200** (see Fig. 3) to automatically determine when to transmit the data in the dialed digits storage area **126**. For example, the system **100** can determine when a complete and valid telephone number has been entered into the dialed digits storage area. For example, the entry of a special feature code followed by a seven-digit telephone number would be interpreted by the system **100** as a special feature code combined with a local telephone number. In response to the completion of

the local telephone number, the transmitter **108** (see Fig. 1) can automatically transmit the data in the dialed digits storage area to a remote location (*e.g.*, a cell site controller). This technique is particularly effective with a WLL telephone, which may not include a Send button. Even when the data in the dialed digits storage area **126** is automatically transmitted to a remote location, system **100** transmits feature codes and destination telephone number together and thus does not affect the operation of the wireless communication system.

The system **100** may be advantageously programmed with a data table for different countries. For example, the data table **202**, illustrated in FIG. 3, corresponds to the calling plan used in the United States. However, an additional data table **202'** (not shown) may contain data related to the calling plan for a different country, such as India. Alternatively, the data table **202** may include data for a plurality of countries, as discussed above. The user may select the data table for use by the system **100** using a convenient menu feature in a well-known manner. With an appropriate menu selected, the system **100** may display a list of countries whose dialing plans are stored within the state data storage area **122** (see FIG. 1). The user can select the appropriate country based on the displayed list. For the sake of brevity, the state diagram **200** and data table **202** will not be discussed for other dialing plans. However, those of ordinary skill in the art will recognize that the entry of digits on the keypad **118** (see FIG. 1) will cause the system **100** to change states in accordance with the specific dialing plan of the country. Details on the use of data tables to store dialing plans are provided in U.S. Patent Application No. 08/608,924, filed on February 29, 1996 and entitled "TELEPHONE NUMBER PARSER FOR WIRELESS LOCAL LOOP TELEPHONES," which is incorporated herein by reference in its entirety.

The operation of the system **100** is illustrated in the flowchart of FIG. 4 where, at a start **210**, the system **100** is in the State 1 (see FIG. 2). As discussed above, a WLL telephone may provide audible feedback to the user in the State 1 when the user picks up the receiver. In step **212**, the system **100** receives keypad data from the keypad **118** (see FIG. 1) in response to user operation of the keypad. Based on the user-entered digit, the system **100** enters a new machine state in step **214**. In decision 216, the system **100** determines

whether or not to provide feedback. As discussed above, the feedback data bit in the data table **202** (see FIG. 3) indicates whether feedback will be provided for the particular state. If the feedback bit is set to a high logic level, the result of decision **216** is YES. In that event, the system **100** enables feedback in step **218**. As previously discussed, the feedback may be in the form of audio feedback using the audible output device **124** or visual feedback using the display **116** or a dedicated device, such as an LED. For the sake of convenience, the feedback data bit is set to a logic high when feedback is applied. However, those skilled in the art will recognize that a low logic level may also be used to provide a similar indication. Thus, the present invention is not limited by the specific logic state used to enable feedback by the system **100**.

If the feedback data bit in the data table **202** (see FIG. 3) indicates that feedback is not provided, the result of decision **216** is NO. In that event, or after the execution of step **218**, the system **100** moves to decision 220 to determine whether the digit just entered by the user is the last digit in the sequence. The system **100** determines whether the digit is the last digit in the sequence based on the state data storage area **122** (see FIG. 1). If the digit is not the last digit in the sequence, the result of decision **220** is NO. In that event, the system **100** returns to step **212** to retrieve additional keypad data from the keypad **118**. If the digit is the last digit in a sequence, the result of decision **220** is YES. In that event, the system processes the call in step **222**. As discussed above, processing the call includes transmission of data in the dialed digits storage area **126**. The data in the dialed digits storage area is transmitted by the transmitter **108** to a remote location, such as a cell site controller. As noted above, the special feature codes are also stored in the dialed digits storage area and transmitted along with the destination telephone number in step **222**. Thus, special feature codes are not transmitted to the cell site controller until the entire destination telephone number has been entered. The system **100** ends the calling process at **224** with a communication link having been established using any special feature codes entered by the user. Thus, the system **100** advantageously mimics operation of a conventional telephone and eliminates the need to learn multiple different procedures for wireless communication devices and for conventional telephones.

It is to be understood that even though various embodiments and advantages of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made in detail, yet remain within the broad principles of the invention. Therefore, the present invention is to be limited only by the appended claims.

What is claimed is:

CLAIMS

1. A system to provide user feedback in a wireless communication device, the system comprising:

a housing;

a transceiver within the housing to communicate with a communication device remote from the system;

an antenna affixed to the housing and electrically coupled to the transceiver;

a battery to provide electrical power to the system;

a keypad supported by the housing and comprising a plurality of keys selectively activated by a user, the keypad sensing user operation of the keys;

a data structure to store a state diagram indicative of a logic state of the wireless communication device, the logic state being altered in response to user operation of the keys and having at least a first selected logic state based on a predetermined sequence of keys operated by the user; and

an audio output device to provide audio signals to the user, the audio output device providing an audible feedback signal when the wireless communication device is in the selected logic state.

2. The system of claim 1 wherein the data structure is in tabular form and includes a first data portion indicative of a next logic state for each of the keys that can be selectively activated by the user and a second date portion indicative of a feedback state with the audio output device providing the audible feedback signal if the second data portion has a first logic state and providing no audible feedback signal if the second data portion has a second logic state different from the first logic state.

3. The system of claim 1 wherein the data structure includes data indicative of a logic state associated with a telephone communication system feature code and the predetermined sequence of keys operated by the user corresponds to the system feature code.

4. The system of claim 1 wherein the selected logic state corresponds to response to user activation of keys to select a feature code and the audio output device generates the audible feedback signal in response to user activation of keys to select the feature code.

5. The system of claim 1 wherein the audio output device includes a dial tone generator to generate a dial tone as the audible feedback signal.

6. The system of claim 1 wherein the keypad detects user operation thereof to operate the predetermined sequence of keys and further detects user operation of the keypad to select a destination telephone number, the transceiver transmitting the predetermined sequence of keys and the destination telephone number to the remote communication device.

7. A system to provide user feedback in a wireless communication device having a plurality of logic states, the system comprising:

a keypad comprising a plurality of keys selectively activated by a user, the keypad sensing user operation of the keys and causing the wireless communication device to enter a logic state based on a sequence in which the keyboard senses user operation of the keys;

a data structure to store data indicative of dialing rules for a predetermined geographic area, the data structure relating the dialing rules to the logic state of the wireless communication device based on the sequence in which the keyboard senses user operation of the keys;

a processor to analyze a current logic state based on the dialing rules and on the sequence in which the keyboard senses user operation of the keys, the processor generating a feedback enable signal if the current logic state is a selected logic state based on user operation of the keys in a predetermined sequence; and

an output device to provide a feedback signal to the user when enabled by the feedback enable signal.

8. The system of claim 7 wherein the data structure is in tabular form and includes a first data portion indicative of a next logic state for each of the keys that can be selectively activated by the user and a second date portion indicative of a feedback state with the processor providing the feedback enable signal if the second data portion has a first logic state and providing no feedback enable signal if the second data portion has a second logic state different from the first logic state.

9. The system of claim 7, further including an audio output device wherein the feedback signal is an audio output signal generated by the audio output device.

10. The system of claim 9 wherein the audio output device generates a dial tone as the audio feedback signal.

11. The system of claim 7, further including an visual output device wherein the feedback signal is an visual output signal generated by the visual output device.

12. The system of claim 11 wherein the visual output device is a two dimensional display and the visual output signal is generated by the display.

13. The system of claim 7 wherein the geographic region is a country and the data structure stores data indicative of the dialing rules for the country.

14. The system of claim 13 wherein the geographic region is the United States and the data structure stores data indicative of the dialing rules for the United States.

15. The system of claim 7 wherein the geographic region comprises a plurality of countries, each having a set of dialing rules and the data structure stores data indicative of dialing rules for each of the plurality of countries, the system further including a selector to select one of the plurality of countries wherein the processor analyzes the current logic state based on the dialing rules of the selected country and on the sequence in which the keyboard senses user operation of the keys.

16. The system of claim 7 wherein the data structure includes data indicative of dialing rules for a system feature code for the predetermined geographic area and the predetermined sequence of keys operated by the user corresponds to the system feature code.

17. A method for providing user feedback in a wireless communication device, the method comprising the steps of:

sensing user operation of a keypad comprising a plurality of keys,

storing data indicative of a logic state of the wireless communication device, the logic state being altered in response to user operation of the keys;

using the stored data to determine a current logic state based on a sequence in which the user operates the keys; and

if the current logic state is a selected logic state based on a predetermined sequence of keys operated by the user, activating a feedback device to provide feedback to the user at least while the current logic state is the selected logic state.

18. The method of claim 17 wherein the step of storing data uses a data structure having a first data portion indicative of a next logic state for each of the keys that can be selectively activated by the user and a second date portion indicative of a feedback state wherein the step of activating the feedback device activates the feedback device if the second data portion has a first logic state and does not activate the feedback device if the second data portion has a second logic state different from the first logic state.

19. The method of claim 17 for use with an audio output device wherein the step of activating the feedback signal activates the audio output device.

20. The method of claim 17 for use with an visual output device wherein the step of activating the feedback signal activates the visual output device.

21. The method of claim 20 wherein the visual output device is a two dimensional display and the step of activating the feedback signal activates at least a portion of the two dimensional display.

22. The method of claim 17 wherein the logic state of the wireless communication device is based on dialing rules for a geographic region and the step of storing data stores data indicative of the dialing rules for the geographic region.

23. The method of claim 17 wherein the logic state of the wireless communication device is based on dialing rules for a geographic region and the step of storing data stores data indicative of the dialing rules for a plurality of geographic regions, the method further including the step of selecting one of the plurality of geographic regions and the step of using the stored data uses the stored data for the selected geographic region.

24. The method of claim 17 wherein the step of storing data includes storing data indicative of a user-selectable system feature code and the predetermined sequence of keys operated by the user corresponds to the system feature code.

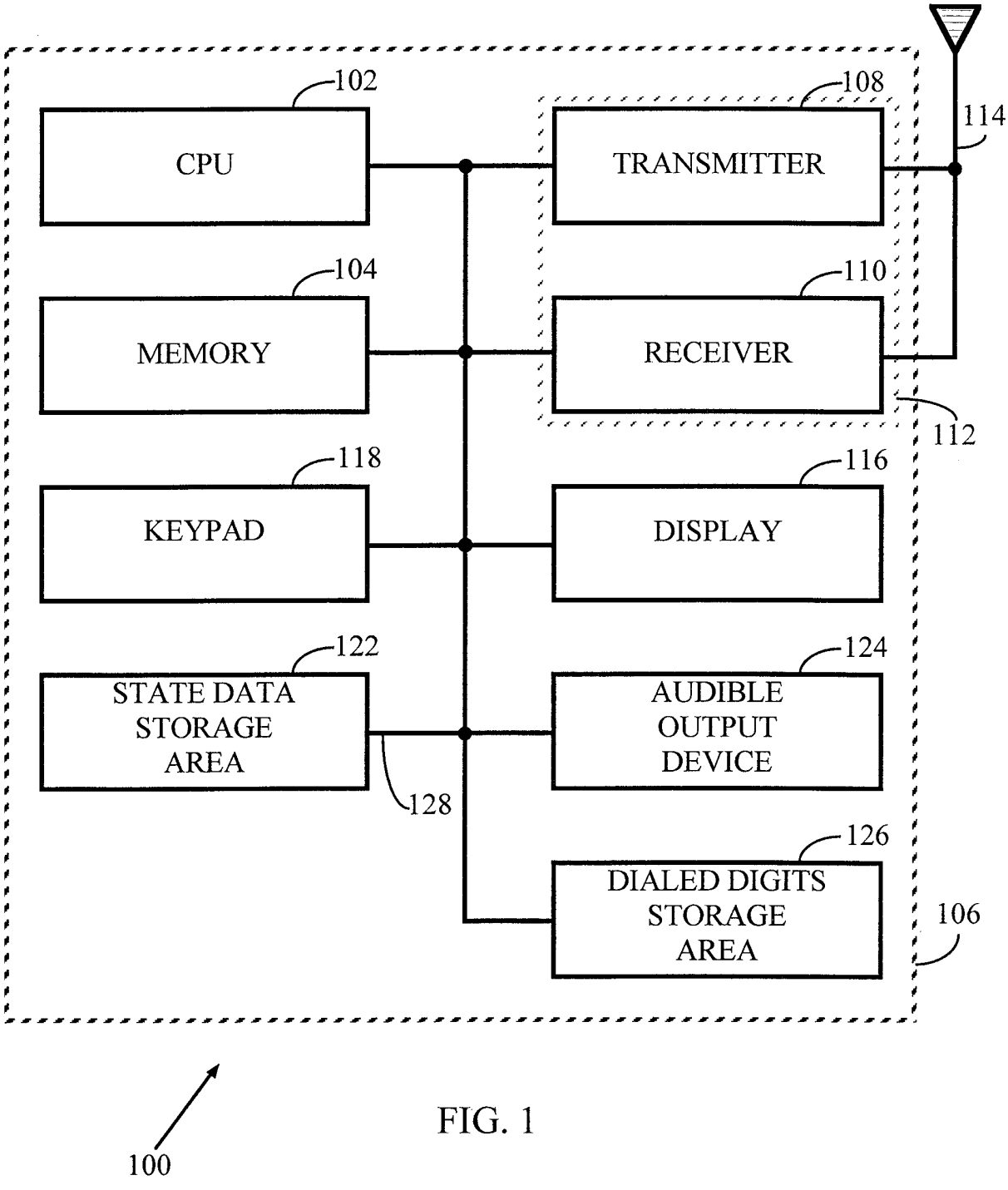
102
CPU
104
MEMORY
118
KEYPAD
122
STATE DATA STORAGE AREA
128
108
TRANSMITTER
110
RECEIVER
112
114
116
DISPLAY
124
AUDIBLE OUTPUT DEVICE
126
DIALED DIGITS STORAGE AREA
106
100

FIG. 1

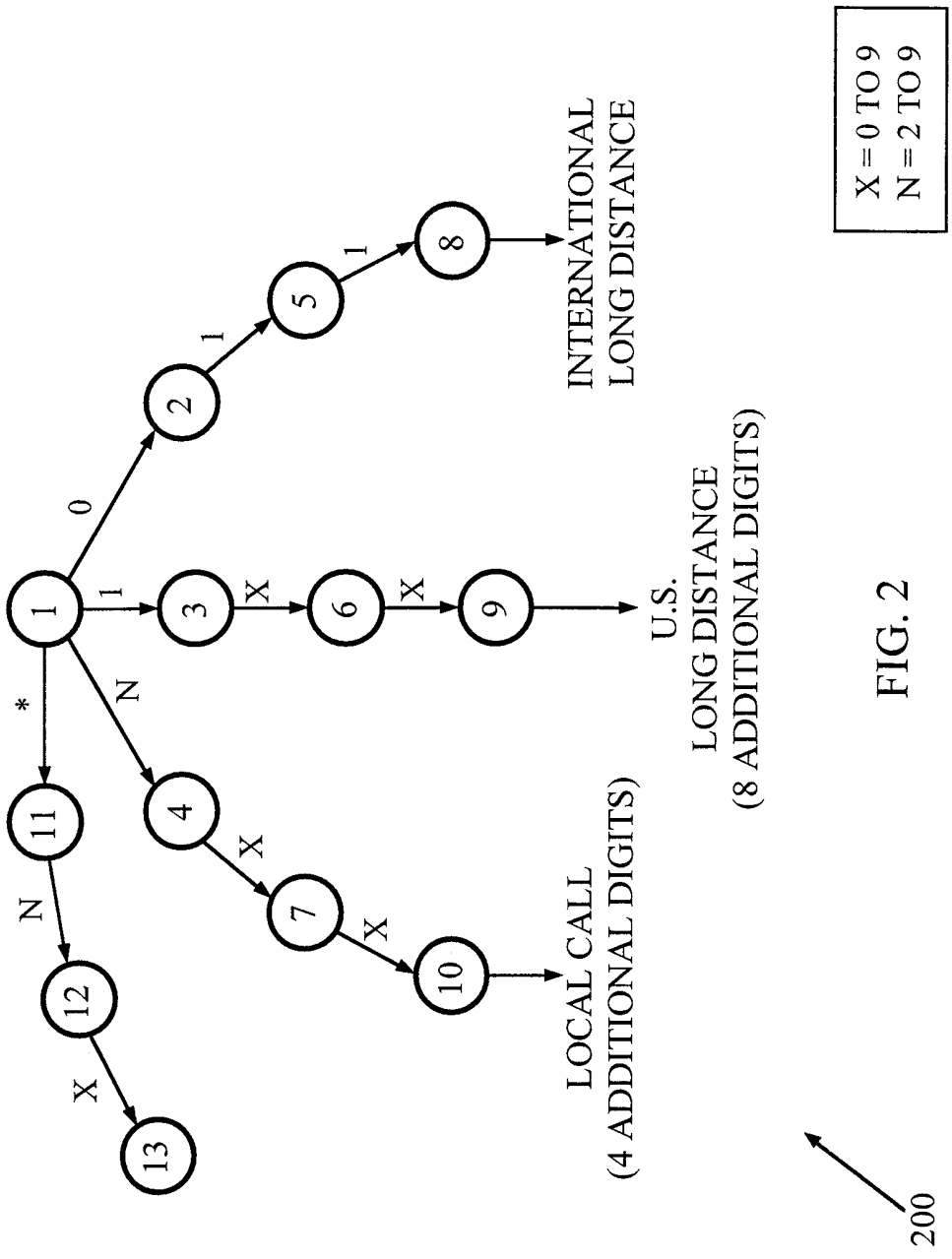
1
2
3
4
5
6
7
8
9
10
11
12
13
0
1
*
N
1
X
X
X
1
X
X
N
X
INTERNATIONAL
LONG DISTANCE
U.S.
LONG DISTANCE
(8 ADDITIONAL DIGITS)
LOCAL CALL
(4 ADDITIONAL DIGITS)
X = 0 TO 9
N = 2 TO 9
200

FIG. 2

KEYPAD INPUT DATA

STATE	0	1	2	3	4	5	6	7	8	9	*	FEEDBACK
1	2	3	4	4	4	4	4	4	4	4	11	0
2	I	5										0
3	I	I										0
4	7	7	7	7	7	7	7	7	7	7	I	0
5												
10												
11			12	12	12	12	12	12	12	12	I	0
12	13	13	13	13	13	13	13	13	13	13	I	0
13	2	3	4	4	4	4	4	4	4	4	I	1
⋮												
⋮												
⋮												
⋮												

FIG. 3

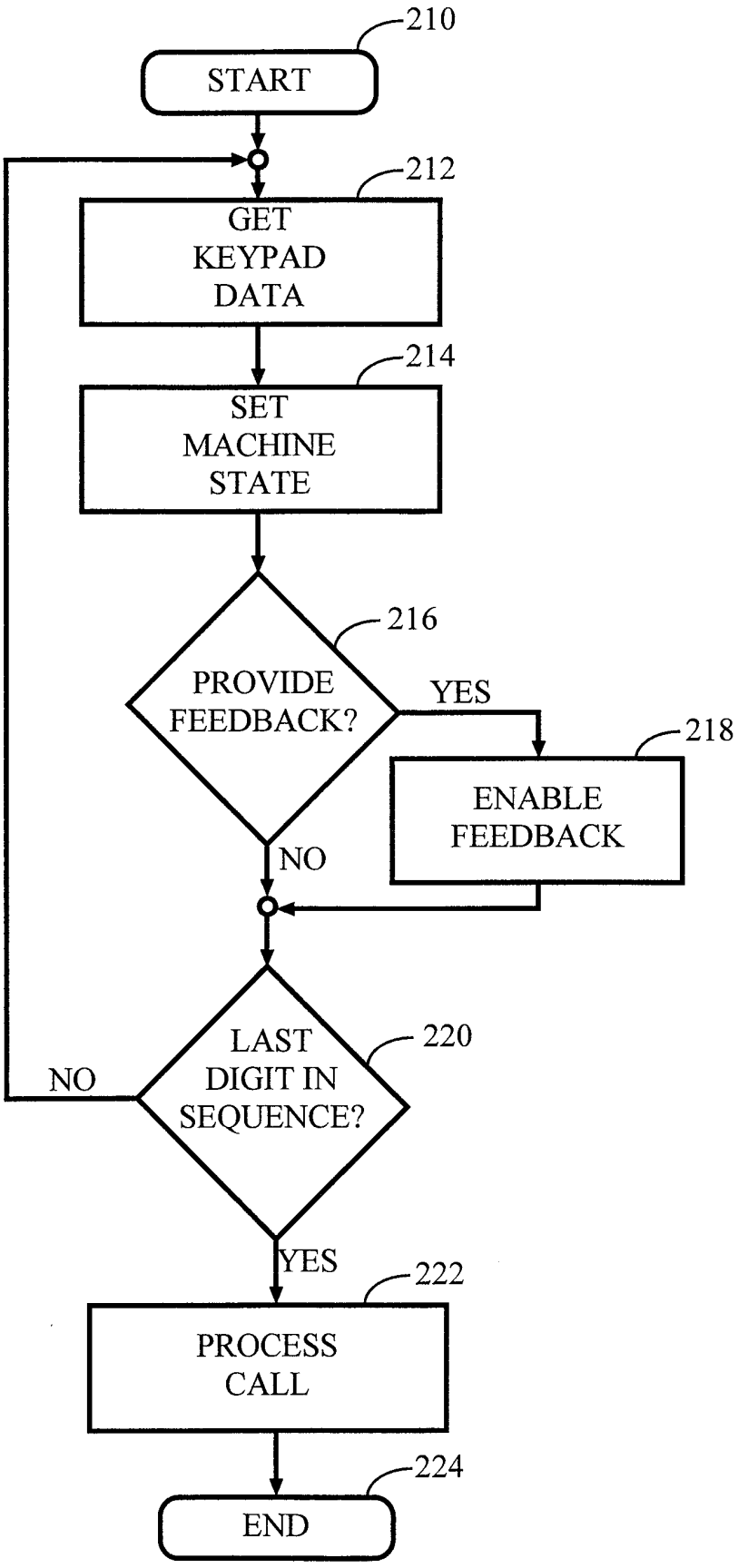
210
START
212
GET KEYPAD DATA
214
SET MACHINE STATE
216
PROVIDE FEEDBACK?
YES
218
ENABLE FEEDBACK
NO
220
LAST DIGIT IN SEQUENCE?
NO
YES
222
PROCESS CALL
224
END

FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/11540

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/32 H04M1/72

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 117 450 A (JOGLEKAR MANOHAR A ET AL) 26 May 1992 (1992-05-26) column 4, line 21 - line 46 column 4, line 64 - column 5, line 46 ---	1,5,7,9, 10,17, 19,22
X	US 5 247 565 A (JOGLEKAR MANOHAR A ET AL) 21 September 1993 (1993-09-21) column 2, line 34 - column 7, line 17 ---	1,17,19, 20
X	WO 98 01988 A (OMNIPOINT CORP) 15 January 1998 (1998-01-15) page 28, line 21 - page 29, line 18; figure 12 ---	1,17,19
A	US 5 535 260 A (DION JOHN K ET AL) 9 July 1996 (1996-07-09) column 7, line 9 - column 11, line 13 --- -/--	1,7,17

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 September 1999	16/09/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Baas, G

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/11540

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 959 851 A (TOBOLSKI JR FRANCIS P ET AL) 25 September 1990 (1990-09-25) column 1, line 59 - column 8, line 49	1,7,17
P,X	US 5 812 651 A (KAPLAN DIEGO) 22 September 1998 (1998-09-22) cited in the application column 5, line 61 - column 11, line 65	1,7,9, 13,14, 17,19,22

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/11540

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5117450 A	26-05-1992	US 5247565 A	21-09-1993
		AU 621752 B	19-03-1992
		AU 5569590 A	18-12-1990
		CA 2032163 A,C	11-11-1990
		CN 1047181 A	21-11-1990
		EP 0431096 A	12-06-1991
		JP 3506109 T	26-12-1991
		KR 9409476 B	13-10-1994
		MX 173350 B	22-02-1994
		WO 9014729 A	29-11-1990
US 5247565 A	21-09-1993	US 5117450 A	26-05-1992
		BR 9205507 A	05-04-1994
		CA 2097808 A,C	22-04-1993
		GB 2266211 A,B	20-10-1993
		KR 9616367 B	09-12-1996
		MX 9205994 A	01-05-1993
		WO 9308615 A	29-04-1993
		AU 621752 B	19-03-1992
		AU 5569590 A	18-12-1990
		CA 2032163 A,C	11-11-1990
		CN 1047181 A	21-11-1990
		EP 0431096 A	12-06-1991
		JP 3506109 T	26-12-1991
		KR 9409476 B	13-10-1994
		MX 173350 B	22-02-1994
		WO 9014729 A	29-11-1992
WO 9801988 A	15-01-1998	US 5884148 A	16-03-1999
		AU 3486897 A	02-02-1998
US 5535260 A	09-07-1996	US 5594782 A	14-01-1997
		AU 686742 B	12-02-1998
		AU 1695995 A	11-09-1995
		BR 9506895 A	09-09-1997
		CN 1141709 A	29-01-1997
		EP 0746953 A	11-12-1996
		JP 9509542 T	22-09-1997
		NZ 279729 A	25-03-1998
		WO 9523486 A	31-08-1995
		AU 689215 B	26-03-1998
		AU 1698995 A	11-09-1995
		AU 687996 B	05-03-1998
		AU 1737995 A	11-09-1995
		AU 706261 B	10-06-1999
		AU 7319598 A	27-08-1998
		BR 9506893 A	09-09-1997
		BR 9506894 A	09-09-1997
		CN 1142306 A	05-02-1997
		CN 1151237 A	04-06-1997
		EP 0746954 A	11-12-1996
		EP 0746955 A	11-12-1996
		JP 9509543 T	22-09-1997
		JP 9509544 T	22-09-1997
		NZ 279750 A	19-12-1997
		NZ 281061 A	19-12-1997
		NZ 329077 A	29-04-1999
		US 5878344 A	02-03-1999

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/11540

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5535260 A		US 5878339 A	02-03-1999
		WO 9523487 A	31-08-1995
		WO 9523488 A	31-08-1995
		US 5887259 A	23-03-1999
		US 5787354 A	28-07-1998
		US 5873037 A	16-02-1999
		US 5832378 A	03-11-1998
		US 5862475 A	19-01-1999
US 4959851 A	25-09-1990	AU 618196 B	12-12-1991
		AU 5634190 A	29-11-1990
		CA 2032162 A,C	11-11-1990
		CN 1047182 A,B	21-11-1990
		EP 0424508 A	02-05-1991
		JP 4502392 T	23-04-1992
		KR 9400706 B	27-01-1994
		WO 9013962 A	15-11-1990
US 5812651 A	22-09-1998	NONE	