

KEYLESS PORTABLE CELLULAR PHONE SYSTEM HAVING REMOTE VOICE RECOGNITION

FIELD OF THE INVENTION

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The invention relates to the field of portable telephone systems. More particularly, the invention relates to a keyless portable cellular phone system having remote voice recognition.

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BACKGROUND OF THE INVENTION

Portable cellular phones have been used with increasing popularity worldwide for a variety of personal and business uses. These systems typically require a subscription contract with a telephone service or company, which allow the cellular
15 phone to access a cellular phone exchange, for the assignment of a communication line. The establishment of a subscription contract typically requires a good credit standing for the assigned user, as well as a long-term commitment to a cellular carrier(e.g. one year service contracts are common).

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Subscription contracts for conventional cellular networks are typically based on two types of customer billing. The first billing architecture is a per call system, which is based upon a service plan for the customer. The second common billing architecture is a pay in advance system, which is based upon a unique credit
25 identifier (i.e. drop number) for the customer.

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There are commonly different contracted services for different types of communication, based on the location of the cellular phone, and the location of other connected parties. For example, one service rate may apply to outgoing or incoming local calls, such as within a local area code, or within a cellular calling
30 region. A different service rate may apply to outgoing or incoming calls for long distance telecommunication connections. This complicated arrangement of service contracts typically requires the use of personal identification numbers (PIN) to identify the caller or to access different services, and frequently burdens the user with roaming charges (as the mobile user moves through different cellular
35 regions).

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Payment of a monthly charge based on an average maximum use of prepaid minutes may often be more costly than the amount needed by a particular user. No single billing plan can be optimized for any specific user, since plans are based on average users. For example, "minimal use" users, who may only carry portable phones for emergency use (e.g. such as for roadside assistance or "911" services), commonly establish and pay for service charges which far exceed the actual communication services used.

Common cellular phones are typically purchased by the user, or are provided, frequently at a discount, by a service provider upon the establishment of a long-term service contract. Conventional cellular phones are commonly purchased with several required accessories which allow them to be reused, such as a AC/DC recharger module, removable and rechargeable batteries, a phone stand, and flexible DC power cords for mobile power and/or recharging. There is commonly a significant cost in accessories alone. As well, the accessories commonly become damaged through use, are lost or misplaced (particularly for business people who travel frequently), or become outdated through use, or through normal wear and tear and time. Such phones and accessories are commonly impractical during international travel, frequently requiring a large variety of chargers and power converters.

Some recent, specialized portable phones and communication networks, such as multi-mode (e.g. IRIDIUM™, manufactured by Motorola, Inc.) phones, while designed for use while traveling, are prohibitively expensive.

As well, existing portable phones typically include complex dial pads, memory, batteries, functions, and displays, all of which are commonly expensive, take up space, and are prone to failure.

Another drawback of conventional cellular phone services is the need for the user to dial, in order to call any destination. Even for destination numbers which the user may place into memory, the user is required to manually enter a series of keystrokes, such as to convert from keystroke signals to voice signals. The physical action of dialing is often inconvenient and difficult, and can even be dangerous in various circumstances, such as while driving, or even while walking down a street. The action requires precision, and is time consuming, and to some extent even complicated. The smaller the phone, the harder it becomes for the user to dial, sometimes even requiring a pen or pointer to hit the correct buttons.

In low light conditions, such as at night, in an automobile, or in a restaurant or bar, it is often difficult for the user to see and correctly operate the dial pad.

5 Conventional cell phones are each unique to the world, having both a serial number (which is typically stamped on the housing), as well as an installed electronic serial number (ESN) (*i.e.* a drop number), which is established upon initial activation by a service provider (*e.g.* such as by authorized personnel at a phone retail outlet). Ongoing use of the cell phone is associated with the electronic drop number, in which the registered user of the conventional cellular
10 phone is billed for the ongoing use. The installed electronic drop number is transmitted whenever the phone is powered. Therefore, incoming and outgoing calls are routed to the location of the cell phone, and billing for the cell phone is correctly logged to registered user of the conventional cellular phone, based upon the transmitted electronic drop number.

15 However, since the installed electronic drop number is transmitted whenever a conventional phone is powered, an unauthorized user (*i.e.* a pirate) can intercept and receive a phone signal, capture the electronic drop number, and use the captured electronic drop number to enable unauthorized communication from an
20 unauthorized, using a process called cloning. Unauthorized use of the electronic drop number enables unauthorized access to the phone system, wherein charges for unauthorized calls are billed to the original authorized user.

25 While some cellular phone system signals are encrypted, there is continuous encryption of the same electronic drop number. Unauthorized decryption of the encrypted signal, while it may require some processing power, yields valuable access to the electronic drop number (again enabling unauthorized access to a phone system, while the original, authorized user is billed for the unauthorized access).

30 When a conventional cell phone is powered off, the cell phone is not able to receive calls. Therefore, as a mobile user uses a cell phone throughout the day, the user moves between one or more cell sites, and powers the phone, typically in a standby mode, to be able to receive incoming calls. When the cell phone is
35 moved, from cell to cell, the cell phone talks to the closest cell site, and can be used to send or receive calls. In a powered state, a conventional cell phone is in

constant communication with a base station, and requires a substantial amount of stored battery power.

Some recent conventional cell phones can receive calls, without being fully powered, or powered in a "standby" mode. Such conventional cellular phones include an internal paging circuitry, and can receive paging signals through the cell phone antenna. Upon receiving a paging signal from a paging transmitter, the paging circuitry activates an internal trip switch, which automatically turns on the cell phone RF circuitry. Once the pager/cell phone is fully activated, the incoming call is routed through the mobile Telephone Switching Office (MTSO) to the cell phone, and the phone rings. The mobile user then selectively chooses accept the call. Such operation presently allows some conventional cell phones, having integrated paging assistance, to operate on limited pager power for up to eight days, with an energy storage capacity of about three hours of talk time.

D. Gaulke, T. Hanson, and R. Moleres, *Pager-Controlled Wireless Telephone*, U.S. 5,737,707 (07 April 1998) disclose an integrated pager and cellular phone which includes "circuitry that responds to receipt by the pager of an incoming-call-indicative paging signal by connecting the cellular phone to a battery power source. This activates the cellular phone, whereupon it registers with a base station and thus becomes able to receive the incoming call. The circuitry further responds to receipt by the pager of a second paging signal by disconnecting the cellular phone from the battery power source. This allows the cellular phone to be kept in a deactivated condition and not draining battery power at times when the cellular phone is not in use, without missing incoming calls, and does so automatically, without intervention of the user of the cellular phone". While Gaulke et al. disclose combined cellular phone and pager circuitry, call completion occurs at the handset level, after registration and hand off from the mobile telephone switch operator (MTSO), as opposed to a connection at the server level. As well, call completion includes automatic activation of the cellular phone circuitry. Furthermore, the disclosed phones can have generic identifies, such that querying the Network Control Point before transmitting a page is inefficient.

Breeden, P. Mupiddi, and R. Bessom, *Method and Apparatus for Providing Telepoint Calling Between Pager Equipped Handsets*, U.S. 5,202,912 (13 April 1993) disclose communication between "first and second portable radiotelephone transceivers"..."in a radiotelephone communication system by

generating a paging message in response to the first transceiver registering with a first telepoint base station. The paging message is directed to the second transceiver for which communication is requested, and identifies the first telepoint base station and the first transceiver. Upon receiving the paging message, the second transceiver registers with a second telepoint base station, downloading the information identifying the first telepoint base station and the first transceiver. The second telepoint base station establishes communication with the first telepoint base station, after which the first telepoint base station requests registration of the first transceiver to complete the communication between first and second transceivers". While Breeden et al. disclose telepoint communication between pager equipped handsets, call completion occurs at the handset. Two distinct signals are sent to the handset, a first pager activation signal, and a second phone signal. The first pager signal powers the phone circuitry, whether or not the user wished to receive calls, and then the second phone signal is received by the self-powered phone circuitry, notifying the user of an incoming call (e.g. the phone rings).

J. Wohl, E. Naugler Jr., J. Hendershot, G. Lloyd, and E. Adams, *Cellular Telephone with Pager*, U.S. 5,247,700 (21 September 1993) disclose a "compact and unitary cellular/pager. The cellular/pager includes a cellular antenna for receiving UHF cellular and paging signals. The cellular/pager also includes a VHF paging antenna. Every paging signal is sent to a paging receiver. The paging receiver uses the same circuitry to process either the UHF or VHF page. Cellular location information is utilized by the cellular/pager to form an internally updated roaming pager. That is, the cellular location information is automatically conveyed by the cellular block, under the control of the microprocessor, to a paging service. The paging service then knows the location of the paging receiver, consequently the paging service can direct the pager to await for a page at a single frequency, thereby eliminating frequency scanning by the pager or manual updates by the user".

D. Gaulke, T. Hanson, and R. Moler, *Automated Wireless-Call Completion Using a Paging Network*, U.S. 5,802,470 (01 September 1998) disclose a cellular telephone system, in which a "pager is associated with a cellular phone that is normally kept turned off and thus not drawing power from its battery. When an incoming call for the cellular phone arrives at a cellular exchange and the exchange determines that the cellular phone is not registered with a base station,

a paging system is caused to transmit an incoming-call-indicative paging signal to the pager. Receipt of this paging signal at the pager either causes the user of the pager and the cellular phone to turn on the cellular phone, or causes the pager to turn on the cellular phone automatically via associated circuitry. Activation causes the cellular phone to register with a base station, whereupon the cellular exchange extends the incoming call to the cellular phone through that base station. If the incoming call is not answered, or when the incoming call is completed, the paging system is caused to transmit a second paging signal to the pager. Receipt of the second paging signal at the pager leads to the cellular phone being turned off again. The cellular phone can therefore normally be turned off without fear of missing incoming calls. Battery power of the cellular phone is thus conserved".

In addition, some cell phones having integrated paging assistance also include an alphanumeric display, such that a remote user may receive alphanumeric messages from their cell phone. Longer messages are typically scrollable through the display, using conventional "next" and "back" keypad controls.

The metering of phone usage, as well as the establishment of system security has been an ongoing challenge for conventional cellular phone systems.

G. Hansen, D. Riley, D. Lee, F. Ryan Jr., Nathan Rosenberg, A. Violante and R. Sansone, *Metered Payment Cellular Telephone Communication System*, U.S. 5,812,945 (22 September 1998) disclose "a cellular telephone metering system that allows phone calls to be made as long as sufficient funds or call units reside in the phone. The apparatus of this invention also utilize encryption and employ seed numbers for the addition of funds or call units to the cellular phone".

R. Osmani, and M. Metroka, *Disposable Wireless Communication Device Adapted to Prevent Fraud*, U.S. 5,815,807 (29 September 1998) disclose "A disposable portable radiotelephone subscriber unit comprises a power supply, a transceiver and a controller. The power supply has stored therein a predetermined measure of power capacity. The transceiver is permitted to operate for a predetermined period of time responsive to the predetermined measure of the power capacity. The controller monitors a rate of depletion of the predetermined measure of the power capacity. The controller permits operation of the transceiver when the power capacity is being depleted at a desirable rate, thereby decreasing the predetermined period of time that the transceiver is

permitted to operate. The controller prevents operation of the transceiver when the power capacity is being depleted at an undesirable rate, thereby prolonging the predetermined period of time that the transceiver is permitted to operate. Alternatively, the power supply may be a memory unit and the power capacity may be calling time or a future electronic date". While Osmani et al. disclose a portable radio telephone, phone usage is monitored in terms of battery drainage, and disablement is monitored within the phone".

10 A. Wise, and T. Rich, *Cellular Phone System Wherein the Air time Use is Predetermined*, U.S. 5,826,185 (20 October 1998) disclose "A cellular phone system in which a cellular phone user (CPU) has a cellular phone with a predetermined amount of available airtime. The CPU prepays for a particular number of airtime units. When a cell site receives a call from the CPU, the cell site communicates with a mobile telecommunications switching office (MTSO), which
15 recognizes a unique serial number from the cellular phone. The MTSO directs the call to a prepaid airtime transaction tracking interface (PATTI). The PATTI then checks whether the CPU's account has any available airtime units and may indicate the number of units to the CPU. If none, the PATTI does not answer the call; otherwise, the PATTI connects the call and deducts airtime units until the call is
20 disconnected".

V. Hill, *Prepaid Long-Distance Telephone Service System with Flexible Operating Parameters*, U.S. 5,719,926 (17 February 1998) disclose "A long-distance telephone service system provides for accounting and flexible,
25 customizable control of long-distance telephone usage by customers, especially prepaid long-distance service customers. The system maintains a set of global operating parameters associated with each access number. It further maintains a database of user accounts or card numbers, and a set of card processing parameters associated with each card number. Both the global parameters and
30 the individual card processing parameters are applied in completing a long-distance call to a destination number so as to provide highly flexible control over individual accounts as well as groups of accounts. Establishment of new accounts, and "recharging" the prepaid balance of existing accounts is accomplished automatically from remote locations".

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Some telephonic systems have attempted to use voice activated dialing. However, most systems require a high level of internal intelligence and processing power to distinguish even simple voice commands.

5 G. Engelbeck, and M. Marics, *Method of Voice Activated Telephone Dialing*, U.S. 5,452,340 (19 September 1995) disclose "a user interface which can add a name and corresponding telephone number to a directory during the process of initiating a telephone call. In addition, the present invention provides the user the opportunity to select which element of a directory listing should be changed,
10 using a single integrated review, erase and change functionality accessible while in a directory mode".

K. Kaneuchi, T. Kawamoto, and T. Nakatani, *Voice Activated Dialing Apparatus*, U.S. 4,945,557 (31 July 1990) disclose an automatic dialing apparatus for use in
15 a telephone or facsimile machine, which "sends out a dial signal to an external network automatically. A detachable telephone number memory, which stores a telephone number together with an area code, is detachably mounted on a telephone unit which includes a memory storing an area code of the district in which the telephone unit is located. The area code of the telephone number data
20 supplied from the telephone number memory is deleted if that area code agrees with the area code stored in the memory of the telephone unit. An automatic dialing apparatus is preferably constructed to carry out dialing automatically responsive to a voice. In the preferred embodiment of such a voice activated dialing apparatus, a telephone number is input through a keyboard and a
25 corresponding identifier, typically the name of a subscriber, is voiced and its voice signal is stored in association with the telephone number".

M. Sakanishi, H. Yoshida, T. Ishii, H. Sato, and M. Hoshino, *Telephone Apparatus with Voice Activated Dialing Function*, U.S. 5,042,063 (20 August
30 1991) disclose telephone, in which a call "may be made in response to utterances of a user by speech recognition without manually dialing a telephone number. The telephone apparatus includes a storage device for storing a set of parameters corresponding to an expected speech signal, which are used for recognizing the user's subsequent utterance and/or for indicating differences
35 between the utterance and the stored signal. The telephone apparatus further includes a storage device for storing the speech signal so that the stored speech signal can be reproduced. The reproduced speech signal is used to confirm the

stored speech signal. The stored speech signal may be reproduced in response to a user's key operation when the telephone apparatus is in a confirmation mode and in response to a user's utterance when the telephone apparatus is in a registration or voice calling mode".

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T. Hormann and G. Rozinaj, *Start/End Point Detection for Word Recognition*, U.S. 5,794,195 (11 August 1998) disclose "detection of start/end points of words". "Use of a feature with noise-resistant properties is shown wherein for a feature vector, a function of the signal energy is formed as the first feature and a function of the quadratic difference of an LPC (Linear-Predictive-Coding) cepstrum coefficient as a second feature. A check quantity or a maximum function of a distribution function is calculated, which detects the start/end points by comparison with a threshold".

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B. Bareis, P. Foster, and T. Schalk, *Speech Recognition System for Electronic Switches in a Non-Wireline Communications Network*, U.S. 5,659,597 (19 August 1997) disclose a telecommunications system which recognizes spoken commands over a cellular telephone, satellite telephone, or personal communications network. In the cellular application, for example, a Speech Recognition System interconnects either internally with or as an external peripheral to a cellular telecommunications switch. The Speech Recognition System includes an administrative subsystem, a call processing subsystem, a speaker-dependent recognition subsystem, a speaker-independent recognition subsystem, and a data storage subsystem".

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L. Eting, and Y. Gelfer, *Apparatus and Methods for Conveying Telephone Numbers and Other Information via Communication Devices*, U.S. 5,651,056 (22 July 1997) disclose an "accessory device for a telephone system, the device including a spoken telephone number recorder serving a local communicant, the recorder including a spoken telephone number recognizer operative to recognize a telephone number spoken in the course of a telephone conversation between a remote communicant and the local communicant, and a telephone number memory operative to store at least one telephone number received from said telephone number recognizer".

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Other voice recognition systems have been disclosed for control systems.

B. Bareis, *Speech Controlled Vehicle Alarm System*, U.S. 5,706,399 (06 January 1998) discloses an electronic vehicle alarm system which "allows control of alarm functions to be accomplished using specific spoken commands. A microphone converts speech into time-variant voltage levels which are amplified and sent to an analog-to-digital converter and digitized. The digitized data is then processed by a speech recognition subsystem. The speech recognition subsystem separates extraneous speech from words and provides corresponding output signals when control words are recognized". "The response indicator provides verbal responses to confirm spoken commands. A speaker verification capability is also included in the speech recognition subsystem to allow for secured operation of the vehicle alarm system".

T. Schalk, *Voice-Controlled Account Access Over a Telephone Network*, U.S. 5,517,558 (14 May 1996) discloses "a system and method for enabling a caller to obtain access to services via a telephone network by entering a spoken first character string having a plurality of digits. Preferably, the method includes the steps of prompting the caller to speak the first character string beginning with a first digit and ending with a last digit thereof, recognizing each spoken digit of the first character string using a speaker-independent voice recognition algorithm, and then following entry of the last digit of the first string, initially verifying the caller's identity using a voice verification algorithm. After initial verification, the caller is again prompted to enter a second character string, which must also be recognized before access is effected". Schalk therefore discloses a system wherein the caller is required to input voice commands to gain authorized access to the telephone network. The resulting complicated system access is therefore voice and character string dependent, requiring a user learning/experience curve.

A. Hunt and T. Schalk, *Simultaneous Voice Recognition and Verification to Allow Access to Telephone Network Services*, U.S. 5,499,288 (12 March 1996) disclose "a system and method for enabling a caller to obtain access to services via a telephone network by entering a spoken password having a plurality of digits. Preferably, the method includes the steps of: (1) prompting the caller to speak the password beginning with a first digit and ending with a last digit thereof, recognizing each spoken digit of the password using a speaker-independent voice recognition algorithm, (3) following entry of the last digit of the password, determining whether the password is valid, and (4) if the password is valid, verifying the caller's identity using a voice verification algorithm".

5 T. Schalk and F. Kaake, *Method for Recognizing a Spoken Word in the Presence of Interfering Speech*, U.S. 5,475,791 (12 December 1995) disclose "A method for recognizing a spoken word in the presence of interfering speech, such as a system-generated voice prompt, begins by echo canceling the voice prompt and any detected speech signal to produce a residual signal. Portions of the residual signal that have been most recently echo-canceled are then continuously stored in a buffer. The energy in the residual signal is also continuously processed to determine onset of the spoken word. Upon detection of word
10 onset, the portion of the residual signal then currently in the buffer is retained, the voice prompt is terminated, and the recognizer begins real-time recognition of subsequent portions of the residual signal. Upon detection of word completion, the method retrieves the portion of the residual signal that was retained in the buffer upon detection of word onset and performs recognition of that portion.
15 The recognized portions of the word are then reconstructed to determine the spoken word".

20 P. Foster and B. Bareis, *Intelligent Call Processing Platform for Home Telephone System*, U.S. 5,881,134 (09 March 1999) disclose "an intelligent call processing platform for use with a home telephone system. The system consists of a processing unit interfaced with a variety of memory storage areas, a switching central office providing local telephone service and a plurality of telephone handsets. Using a variety of voice and/or pushbutton commands, a user is able to access a variety of telephone services from any telephone interfaced with the
25 platform. Services provided include identification of incoming callers, automatic speed dialing of user-stored telephone numbers, storage of new numbers to the user-stored list of telephone numbers, and control of peripheral systems interconnected with the intelligent call processing platform". While Foster et al. disclose a call processing platform, system intelligence is associated with a
30 specific station, and is not transportable, either from station to station, or from user to user.

35 T. Schalk, *Method for Reducing Database Requirements for Speech Recognition Systems*, U.S. 5,845,246 (01 December 1998) discloses "a method for reducing the database requirements necessary for use in speaker independent recognition systems", which involves "digital processing of a plurality of recorded utterances from a first database of digitally recorded spoken

utterances. The previously recorded utterances are digitally processed to create a second database of modified utterances and then the first and second databases are combined to form an expanded database from which recognition vocabulary tables may be generated".

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There has also been work on connectable power supplies, and development of activatable, conventional cellular phones.

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N. Mischneko, *Multiposition Detenting Hinge Apparatus*, U.S. 5,185,790 (09 February 1993) discloses "A hinge apparatus for a foldable telephone includes a body portion and a flip element. The flip element is held in a closed and an open position relative to the body portion by an enclosed follower which follows recesses in two hinge shafts integral to the hinge portion of the flip element. The apparatus is assembled along a common axis from a single direction. The flip element is held tight against a keypad of the body portion in its closed position. The flip element is secured in its open position with no excessive play".

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S. Beutler, H. Estates, and J. Barber, *Multipurpose Hinge Apparatus for Foldable Telephones*, U.S. 4,897,873 (30 January 1990) disclose "A multipurpose hinge apparatus for a foldable telephone includes a flip element and a hookswitch. The flip element is held in the closed and open positions by an enclosed cam element which follows recesses in one shaft securing the hinge elements. The hookswitch is activated by another enclosed cam which follows a recess in a second shaft".

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M. Metroka, S. Davis, and P. Gargulak, *Portable Radio Telephone with Control Switching Disabling*, U.S. 4,845,772 (04 July 1989) disclose "A portable radiotelephone with control switch disabling is disclosed. A flip element which contains a microphone and covers a keypad and other control buttons when in a closed position also activates a hookswitch. When the hookswitch and microprocessor indicate that the flip element is in a closed position, the on/off switch cannot be activated to turn the portable radiotelephone on or off and switches which control volume level are deactivated".

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G. Kaye, *Battery Connector*, U.S. 4,186,983 (05 February 1980) discloses "A connector for use in electrically connecting a battery, having substantially planar terminals on a wall thereof, to an electrical device. The connector comprises a

housing partially containing conductive means which extend from the housing to contact the battery terminals and the electrical device. The connector further includes resilient gripping means on the housing which cooperatively engages holding means on the battery with a snap on connection".

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As described above, the acquisition of conventional cellular phones requires the establishment of a billing system, wherein telephone communication is billed to a registered user.

- 10 R. Bishop, D. McClure, and J. Storch, *Automated Vending of Cellular Handheld Telephones and Cellular Telephone Services*, U.S. 4,951,308 (21 August 1990) disclose the automated vending of conventional cellular phone, wherein "a microprocessor controlled vending machine which inventories a plurality of mobile cellular telephones and selectively delivers one of the phones after reading a credit card number from a customer and obtaining credit card approval. The mobile cellular telephone is dispensed and later returned by the customer. When returned by the customer, the mobile cellular telephone is disposed within a receiving unit which uniquely verifies the mobile cellular telephone through its phone number, reads the usage made by the customer of the mobile telephone, and senses the charged condition of the battery within the mobile telephone. The customer's credit card is again read and the bill for rental of the mobile cellular telephone unit, including all telephone usage charges, is computed and directly billed to the credit card number. The vending unit then produces a printed record of the credit card billing and returns the mobile telephone unit to inventory to be fully recharged and reinitialized for revending". While Bishop et al. disclose a vending machine for cellular phones, the automated vending machine is required to deal with the billing complexities of conventional cellular phones, whereby the vending machine requires the user's credit card to be read twice, and wherein the machine computes the billing for system use. The disclosed system usage and billing is associated with a conventional cellular phone (i.e. having a conventional electronic service number).

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The disclosed prior art systems and methodologies thus provide basic portable cellular phone systems, mechanical component design, and basic voice recognition and control technologies, but fail to provide a keyless portable cellular phone system that does not require a long term service contract to be established with the user. As well, conventional systems fail to provide a pre-

paid communication system that provides remote voice recognition, as well as high levels of system security from unauthorized use. The development of such a portable phone system would constitute a major technological advance.

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SUMMARY OF THE INVENTION

A keyless portable cellular phone system is provided, wherein matched sets of algorithmically generated communication units are generated, each communication unit pair defining a discrete time increment of authorized communication. One set is stored on a system server (*i.e.* a service provider), and the pre-paid set is available for use within a keyless portable cellular phone. The phone, normally non-activated, automatically contacts the system server upon selective activation by the user, to initiate a call (outgoing or incoming). A voice recognition system allows the user to place calls and/or receive calls. During a call, the keyless portable cellular phone periodically sends the sequential discrete airtime communication units, having unique identifiers (*i.e.* encryption), whereby the system server allows pre-paid authorized access to time increments of system services, such as communication, based upon the receipt of the matching, uniquely identified, sequential discrete airtime communication units. The phone typically has either an internal energy supply and storage for pre-paid communication units, or a removable airtime cartridge, typically containing an energy supply and either the ability to store or to generate a set of pre-paid single use airtime communication units.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a functional block diagram of for a keyless portable cellular phone system with a voice recognition operating system;

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Figure 2 is a functional block diagram of a system server for a keyless portable cellular phone system with a voice recognition operating system;

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Figure 3 is a block diagram of a keyless portable cellular phone having an airtime cartridge;

Figure 4 is a block diagram showing the defined time value of a set of pre-paid single use communication units;

5 Figure 5 is a block diagram of hardware components for a keyless portable cellular phone;

Figure 6 is a front view of an activateable keyless portable cellular phone;

10 Figure 7 is a side view of an activateable keyless portable cellular phone;

Figure 8 is a front view of a microphone activateable keyless portable cellular phone having pager circuitry within an airtime cartridge;

15 Figure 9 is a upper view of a microphone activateable keyless portable cellular phone;

Figure 10 is a lower view of a microphone activateable keyless portable cellular phone;

20 Figure 11 is a right side view of a microphone activateable keyless portable cellular phone;

Figure 12 is a left side view of a microphone activateable keyless portable cellular phone;

25 Figure 13 is a rear view of a microphone activateable keyless portable cellular phone;

30 Figure 14 is a partial front cross-sectional view of the microphone activateable keyless portable cellular phone shown in Figure 8;

Figure 15 is a partial left cutaway view of the microphone activateable keyless portable cellular phone shown in Figure 8;

35 Figure 16 is an upper cross-sectional view of the microphone activateable keyless portable cellular phone shown in Figure 8;

Figure 17 is a center cross-sectional view of the microphone activateable keyless portable cellular phone shown in Figure 8;

5 Figure 18 is a lower cross-sectional view of the microphone activateable keyless portable cellular phone shown in Figure 8;

Figure 19 is a partial expanded assembly view of an alternate embodiment of a microphone activateable keyless portable cellular phone;

10 Figure 20 is a functional block diagram of algorithmic generation of server information and airtime cartridge information;

Figure 21 is a functional block diagram of an alternate embodiment of algorithmic generation of server information and airtime cartridge information;

15 Figure 22 is a block diagram of an authentication information packet;

Figure 23 is a schematic diagram showing the sequential transmission and debiting of encrypted airtime communication units;

20 Figure 24 is a functional block diagram showing communication between a keyless portable cell phone and the system server during the establishment of a call;

25 Figure 25 is a flow chart for call placement of an outgoing call using a cellular service having voice recognition and virtual operators;

30 Figure 26 is a block diagram for an incoming call in a preferred keyless portable cellular phone system, in which the keyless portable cellular phone includes pager circuitry;

35 Figure 27 is a keyless portable cellular phone having a rechargeable airtime cartridge, being recharged for both stored energy and acquired pre-paid airtime communication units;

Figure 28 is a keyless portable cellular phone having a plurality of replaceable airtime cartridges;

Figure 29 is a functional block diagram for a keyless portable cellular phone system with a voice recognition operating system, wherein information is available from a plurality of external sources;

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Figure 30 is an airtime cartridge vending machine in communication with a system server, which remotely establishes sets of pre-paid single use airtime communication units in one or more airtime cartridges at the time of sale;

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Figure 31 shows recycling and reuse of keyless portable cellular phones and airtime cartridges at a remote location;

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Figure 32 shows a keyless portable cellular phone having an airtime cartridge which includes a modem, through which a user may establish an Internet connection;

Figure 33 shows a miniature keyless portable cellular phone having a headset; and

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Figure 34 shows a automobile dash-mounted miniature keyless portable cellular phone having a headset.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 is a functional block diagram of for a keyless portable cellular phone system 10a with a voice recognition operating system. Conventional telephones 12a-12n are connected, through a public switched telephone network (PSTN) 14 to a system network 13, which is connected to a network control point (NCP) 20, which provides routing decisions. A mobile phone infrastructure 23 includes a mobile telephone switching office (MTSO) 22, which is connected to network 13, and to one or more base stations 24. A paging exchange 26 is also preferably connected to network 13, and is connected to one or more paging transmitters 28.

A keyless portable cellular phone system server 30 is also connected to the system network 13. A keyless portable cellular phone 34, when activated, is in communication with the system server 30, through a base station 24, the mobile telephone switching office 22, and the system network 13 (*i.e.* the mobile telephone, switching office 22 and one or more base stations 24 are located between the system server 30 and the keyless portable cellular phone 34). Therefore, communication between the system server 30 and the keyless portable cellular phone 34 goes through the mobile telephone switching office 22, and the closest base station 24 to the remote keyless portable cellular phone 34.

While the system server 30 is shown as a discrete component in communication with the mobile telephone switching office 22, the system server 30 can alternately be a module within a mobile telephone switching office 22.

In a preferred embodiment, one or more external information sources 38 are able to send information to the system server 30, either directly 40, or indirectly 41, such as through the public switched telephone network 14 or an internet connection).

The keyless cellular telephone system 10a provides communication between the keyless portable cellular phone 34 and other devices in the system 10a, such as with conventional telephones 12-12n, conventional cell phones, conventional pagers, or other keyless portable cellular phones 34.

In a preferred embodiment, wherein the keyless portable cellular phone 34 includes paging circuitry 107 (FIG. 11), the keyless portable cellular phone 34 receives incoming calls, by receiving a paging signal 36 from the system server 30, paging exchange 26 and a paging transmitter 28. By selective activation of the phone 34, the user is routed through the system server 30 to the incoming phone call.

Figure 2 is a functional block diagram of a keyless portable cellular phone system server 30, which includes an authentication server 42, a voice recognition server 44, and a billing server 46. The authentication server 42 authorizes the system connection for a keyless portable cellular phone 34, and controls communication for the keyless portable cellular phone 34, based on the receipt of authorized pre-paid tokens (airtime communication units 57). The voice recognition system 44 allows a user to operate a keyless portable cellular phone 34, whereby a user entering voice commands into the keyless portable cellular phone 34, which are remotely interpreted by the voice recognition system 44 (such as to dial out to a phone 12, or to access remote information). The voice recognition system 44 also typically provides voice prompts to the user, such as through the recall and transmission of stored system messages, or the transmission of synthesized voice signals. The billing server 46 decrements received authorized pre-paid airtime communication units 57 (FIG. 3) from the keyless portable cellular phone 34.

Since the system server 30 includes the functionality of an authentication server 42, a voice recognition server 44, and a billing server 46, most of the intelligence for the system 10a is located externally from the keyless portable cellular phone 34. The distributed intelligence offered by the system server 30 allows the portable cellular phone 34 to operate with a minimal amount of processing power or stored intelligence, and without a keypad.

The voice recognition server 44 interactively communicates with the remote user. For example, the remote user, upon being prompted by the voice recognition server 44, may input a local phone number "415-555-1234". The voice recognition server 44, upon confirmation that of the user's choice for an outgoing call, typically notifies the user that a connection will now be made, such as with a message (e.g. "415-555-1234 confirmed. Making connection"), and allows the

system server 30 to direct the call from the keyless portable cellular phone 34 to the destination phone 12.

While the voice recognition server 44 is shown within system server 30, the voice recognition server 44 may be located at one or more locations throughout the network 18.

Figure 3 is a block diagram for a keyless portable cellular phone 34 with a voice recognition operating system. The keyless portable cellular phone 34 houses RF circuitry 48, and in a preferred embodiment, there is a unique communicatable phone ID 50 associated with the keyless portable cellular phone 34.

The keyless portable cellular phone 34 also includes an airtime cartridge 52. The airtime cartridge 52 comprises energy storage 54, an airtime cartridge identifier (ATC ID) 58, and an authentication module 56 having a set 55 of single use communication units 57a-57n, wherein each of the communication units has a separate, unique associated ID 59a-59n. For example, in Figure 3, communication unit 57a includes a unique identifier 59a. The use of unique identifiers 59 provides unique encryption, as well as secure transmission for each communication unit 57 that is transmitted from the keyless portable cellular phone 34 to the system server 30.

The keyless portable cellular phone 34 typically uses either an internal airtime cartridge 52, or a replaceable airtime cartridge 52. Airtime cartridges 52 are typically preloaded (FIG. 20) with a stored set 55 of single use airtime communication units 57a-57n. In alternate embodiments, airtime cartridges 52 contain a stored algorithm 123 and a unique unit key 132 (FIG. 21), by which a set 55 of pre-paid single use airtime communication units 57a-57n is produced within the airtime cartridge 52 (FIG. 21).

In contrast to a conventional cell phone, there is no requirement for a unique drop number for locating the keyless portable cellular phone 34, or for attributing service to a registered user for billing purposes. For basic calling services within the system, such as for an outgoing local call, the system 10 is prepaid, and the billing server 46 allows communication, based upon the ongoing receipt of valid communication units 57 having valid unique identifiers 59, at the system server 30.

Figure 4 is a block diagram showing the defined time value 65 of a set 55 of pre-paid single use communication units 57a-57n. Each of the pre-paid single use communication units 57a-57n has a time value increment 63, which can be used to acquire services from the system server 30 for a time equal to the time value increment 63. Therefore, the entire defined time value 65 for a set 55 of pre-paid single use communication units 57a-57n is equal to the number of pre-paid single use communication units 57a-57n, times the time value increment 63 of each pre-paid single use communication unit 57. Timed usage of the keyless portable phone 34 is credited against the remaining credit value within an airtime cartridge 52, until the credit value 65 is entirely depleted.

System use is limited to the total value 65 of prepaid communication units 57a-57n within the authentication module 56 of the airtime cartridge 52 (i.e. the maximum duration of service is equivalent to the prepaid airtime, which is the sum of all the prepaid communication units 57a-57n).

In contrast to conventional cellular phones, where service is sold separately, the pre-paid airtime cartridge 52 provides the user with increments of system access, and does not require a separate personal subscription contract with a telephone communication entity. The user therefore may gain further system access by simply purchasing another airtime cartridge 52 (not by purchasing another keyless portable phone 34, or by establishing a personal subscription contract).

While a basic keyless portable cellular phone 34 does not require a unique phone ID 50, either to route communication to the remote keyless portable cellular phone 34, or for billing purposes, preferred embodiments do include a unique phone ID 50, typically for accessing preferred services. However, payment for such preferred services is still associated with the transmission of pre-paid single use airtime communication units 57 from the keyless portable cellular phone 34 to the system server 30.

Figure 5 is a block diagram 60 of hardware components and circuitry 48 for a keyless portable cellular phone 34. The components include a microprocessor 66 capable of receiving 64 an incoming RF signal 32a, and transmitting 82 an output RF signal 32b. The received signals 32a arriving at the antenna 62 are demodulated and processed by the microprocessor 66. The received,

processed signals 68 and are then converted to audio signals 72 by a digital to analog (D/A) converter 70, and are then emitted through a speaker earphone 74.

5 For transmission, the user's voice is input into a microphone 76 to produce an input audio signal 78, which is then converted 80, processed 66, and transmitted 82 from the antenna 62 as an outgoing RF signal 32b. The keyless portable cellular phone 34 contains internal logic 52, preferably with a preprogrammed unique phone identifier 50, as well as additional required information, such as service provider information. Memory 86 is preferably used to store pre-
10 recorded messages 87a-87n, such as "No Service" 88 (FIG. 22), "No Credit Remaining" 98 (FIG. 22), or "Low Battery" (FIG. 22). The system is powered from energy source 54 within the airtime cartridge 52.

15 The keyless portable cellular phone 34 is operated by a voice recognition system 44 located at the system server 30, and by internal operating logic 84 and memory 86, which is automatically activated when the keyless portable cellular phone 34 is powered on. Since the keyless portable cellular phone 34 is controlled and operated by the user's voice, the phone 34 has no key pad, as on a conventional wired or cellular phone.

20 In a basic embodiment of the keyless portable cellular phone 34, the phone logic 84 includes a simple time counter, with which the phone sequentially sends single use prepaid airtime communication units 57 while the phone is activated and talking with the system server 30, and decrements the remaining communication
25 units 57, by marking the transmitted single use prepaid airtime communication units 57 as "used" 149 (FIG. 23). The phone logic 84 also knows the last communication unit 57 it has sent and marked as used 149, and which communication unit 57 within a set 55 to transmit and decrement next. When the user deactivates the keyless portable cellular phone 34, such as to terminate a
30 call, the keyless portable cellular phone 34 stops transmitting communication units 57 (and stops decrementing the remaining internal airtime communication units 57).

35 The keyless portable cellular phone 34 preferably contains a small amount of stored information, such as simple acoustic messages (e.g. beeps, rings, or recorded voice messages). Simple beeps can be used to indicate many system functions. For example, since the keyless portable cellular phone 34

counts how much pre-paid time remains (corresponding to the number of remaining airtime communication units 57), the keyless portable cellular phone 34 may provide a series of audible beeps that is a function of remaining pre-paid time (e.g. five beeps for five minutes of pre-paid service remaining). While simple audio signals may offer only rudimentary information, a keyless portable cellular phone 34 having less stored intelligence and processing power provides adequate and affordable system access for many users.

The keyless portable cellular phone 34 may alternately provide the recall of simple stored voice messages, such as "Five minutes remain". In preferred system embodiments, more extensive messages are stored on the phone, more detailed messages are provided by the system server 30, or more extensive virtual assistance is provided by the voice recognition server 44. Detailed stored messages may notify the user of operating conditions (e.g. "No service in the area"). Keyless portable cellular phones 34 offering a wide range of services and ease of use are often preferred by sophisticated users, such as business travelers. While such preferred embodiments of the keyless portable cellular phone 34 may require more memory and/or processing power, the increased functionality and ease of use is advantageous for many users. As well, no airtime is used (i.e. spent) to transmit these voice messages to the user.

Figure 6 is a front view of a keyless portable cellular phone 34a. Figure 7 is a side view of a keyless portable cellular phone 34a shown in Figure 6. The phone body 90 is comprised of a first lower housing 92a and a second upper housing 92b, connected by a hinge mechanism 94. The first lower housing 92a includes a microphone 76, while the second housing includes an earphone 74, and an antenna 62.

The keyless portable cellular phone 34a shown in Figure 6 and Figure 7 is foldable, whereby the first lower housing 92a and the second upper housing 92b are controllably moved about the hinge 94, between a first, closed unactivated storage position 96a and a second, open activated position 96b. In contrast to conventional cell phones, the keyless voice recognition phone 34 is unactivated (i.e. powered off) in its natural state. In an alternate embodiment of the keyless portable cellular phone 34, an on/off activation switch is used for selective activation. In other alternate embodiments of the keyless portable cellular phone 34, a slidable or rotatable microphone boom is used for selective

activation. As a mobile user travels throughout the day, an unactivated phone 34 does not relay any information to base stations 24.

5 In Figure 6 and Figure 7, the rotatable antenna 62 is movable from a first closed antenna position 98a to a second open antenna position 98b. While a rotatable antenna 62 is shown, several varieties of antennas 62 may be used, such as short flexible stationary antennas, telescoping antennas, or imbedded internal antennas 62.

10 In the embodiment shown in Figure 6 and Figure 7, the keyless portable cellular phone 34a comprises a simple, small, foldable unit, having a width 97 of 1.29 inches, and an open height 95 of 3.2 inches. The keyless portable phone 34a shown in Figure 6 and Figure 7 is a sealed limited service time unit, and does not provide access to internal components for service. The airtime cartridge 52 and
15 energy storage 54 are located within the phone body 90.

Since the portable cellular phone 34 does not have a keypad, some embodiments of the portable phone 34 may be extremely small (e.g. a lapel phone). The sizes of different current portable cellular phones 34 are currently
20 limited by the size of energy storage 56. For example, a portable cellular phone 34 designed for short duration may be very small, while a portable cellular phone 34 having a larger energy capacity 56 typically requires a larger enclosure 90.

Keyless portable cellular phones 34 are typically powered on by first opening
25 the phone to the open position 96b (FIGS. 6,7), by pulling out or rotating a microphone 76 (FIGS 11-19), or by manually toggling an on/off button, which triggers a switch 116 (FIG. 19). When a keyless portable cellular phone 34 is powered on, the internal logic 86 is activated, and attempts to establish an authorized connection with the system server 30. The keyless portable phone
30 34 then preferably indicates the number of minutes of service airtime which remain (such as by an audio message 172 (FIG. 25)), and then requires voice operated dialing to place an outgoing call. Therefore, the keyless portable cellular phone 34 is automatically activated, when the user opens the device to a calling position 18b.

35 The keyless portable cellular phone 34 can either be unidirectional (dial-out only) or can be multidirectional (dial in as well as dial out). A basic unidirectional keyless

dial-out portable phone 34 is automatically powered down when not in active use, to conserve the active life of the battery 28.

5 The keyless portable cellular phone 34a shown in Figure 6 and Figure 7 is activated by means of opening the phone (*i.e.* flipping or pulling open), and is deactivated by closing the phone at the end of the communication period. The opening of the keyless portable cellular phone 34 typically includes the simultaneous transmission of an identification code and connection to the service provider or system server 30 of a telephone company, which enables
10 authorized prepaid access to a PSTN line.

As described above, a conventional cell phone operates as a single entity, having a transmitted ID (*i.e.* the drop number), by which services are provided to the user, and by which the registered user is billed for services received. In
15 contrast, the keyless phone 34 preferably has two identities, the phone ID 50 (which is used to access preferred services), and the ATC ID 58 (which is used to make payments to the system server 30 by transmitting discrete pre-paid airtime communication units 57a-57n for increments of service).

20 For example, in a preferred embodiment, a user may download external information 38 (FIGS. 1, 29) to the system server 30, such as a personal electronic address book database (*e.g.* such as created using OUTLOOK™ software, from MicroSoft, Inc., of Redmond, WA), and may preferably link database records (*i.e.* such as commonly called phone numbers) to speed-dial
25 numbers within the system server. In this example, it is preferred that the established address book and speed-dial codes be linked with the keyless portable cellular phone 34, having a phone ID 50, so that the user may retrieve the address book information, or use the programmed speed-dial numbers, while using the keyless portable cellular phone 34, even when a new pre-paid
30 airtime cartridge 52 is installed.

Preferred Phone Embodiments. Figure 8 is a front view of a preferred microphone activateable keyless portable cellular phone 34b, which includes a removable airtime cartridge 52, which forms part of the external body 90. The
35 microphone activateable keyless portable cellular phone 34b comprises three main subassemblies, which include the main phone body 90, the removable airtime cartridge 52, and the microphone boom 101(FIG. 13). The main phone

body includes the phone electronic circuitry 48 (including an internal antenna 62), power contacts 114 (FIG. 19), earphone 74, and an activation on/off switch 116 (FIG. 19) defined between the phone body 90 and the moveable microphone boom 101. The earphone 74 is located in the upper region of the front of the phone body 90.

The airtime cartridge 52 includes pager circuitry 107 and a pager ID 109. In one embodiment, internal energy storage 54 includes four size "AAA" cell batteries. Means for attaching 108 (FIG. 10) the airtime cartridge 52 to the phone body 90 are also included, such as integral tabs or snaps, which allow the airtime cartridge to be easily attached and detached from the phone body 90. The removable airtime cartridge 52, with integral energy storage 54, preferably fits within the design form of the phone body itself, such that when in place, the phone body 90 fits securely and comfortably in the hand of a user.

Figure 9 is a upper view of a microphone activateable keyless portable cellular phone 34b, which shows a microphone movement switch 100. Figure 10 is a lower view of a microphone activateable keyless portable cellular phone 34b, showing the microphone 76, as well as airtime cartridge release latch 108. Figure 11 and Figure 12 provide respective right and left side views of a microphone activateable keyless portable cellular phone 34b, which show the relative thickness of the airtime cartridge 52 (based on the use of standard "AAA" cell batteries). In alternate embodiments of the airtime cartridge 52, using different energy storage 34, the relative thickness of the airtime cartridge 52 may be different. The phone body also preferably includes an attachment loop 110, whereby a user can attach the phone to a strap or keychain (not shown). Figure 13 is a rear view of a microphone activateable keyless portable cellular phone 34b. The microphone movement switch tab 100 on the microphone boom 101 is movable from a first closed position 104a (wherein the microphone 76 is in a closed position 106a), to a second open position 104b (wherein the microphone 76 is in an open position 106b) within a switch channel 102. When the microphone is in the closed position 106a, the keyless portable cellular phone 34b is unactivated, and when the microphone is in the open position 106b, the keyless portable cellular phone 34b is activated, and establishes contact, or maintains contact, with the system server 30.

The microphone 76 is preferably assembled in a thermoplastic elastomeric boom 101, that is soft to the touch, and flexible, but sufficiently rigid to allow the boom to be extended (*i.e.* telescoped) from the phone body 90, to project closer to the mouth of the user, when the phone is in use.

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When the keyless portable cellular phone 34b is off (not in use), the microphone boom 101 is deployed within the phone body 90. To use the keyless portable cellular phone 34b (to make an outgoing call, or to receive a call), the microphone boom 101 is extended, either by pushing the microphone movement switch tab 100 located on the top of a spine ridge 103, or by pulling on the end of the microphone boom 101. As the microphone boom 101 is extended to open position 106b, the internal activation switch 116 is closed, activating the keyless portable cellular phone 34b. To end a call, the microphone boom 101 is slid back into the phone body 90. The microphone 76 is electrically connected to the electronic circuitry 48 by a flexible service loop 113 (FIG. 19), which ensures that electrical contact between the microphone 76 and the electronic circuitry 48 is maintained, whether the boom is deployed 106b or recessed 106a.

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Figure 14 is a partial front cross-sectional view of a microphone activateable keyless portable cellular phone 34b. Figure 15 is a partial left cutaway view of a microphone activateable keyless portable cellular phone 34b. Figure 16 is an upper cross-sectional view of a microphone activateable keyless portable cellular phone 34b. Figure 17 is a center cross-sectional view of a microphone activateable keyless portable cellular phone 34b. Figure 18 is a lower cross-sectional view of a microphone activateable keyless portable cellular phone 34b.

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Figure 19 is a partial expanded assembly view of an alternate embodiment of a microphone activateable keyless portable cellular phone 34c. The microphone activateable keyless portable cellular phone 34c includes a slidable activation switch 116, comprising switch contact 116a and swipe contact 116b. When the microphone 76 is moved from a first closed position 106a to a second open position 106b, switch contact 116a and swipe contact 116b come into electrical contact with each other, to activate the portable cellular phone 34c. The microphone activateable keyless portable cellular phone 34c also includes a top closure panel 112 which connects to phone body 90. The RF circuitry includes battery contacts 114, which extend through contact holes 119 define through the top closure panel 112, to make contact with stored energy 54 within a connected

airtime cartridge 52. The earphone 74 is electrically attached to the RF circuitry 48 by speaker leads 115, and the microphone 76 is attached to the RF circuitry 48 by a flexible microphone lead 113 and microphone interconnects 117a, 117b.

5 **Matched Algorithmic Generation and Storage of Information.** Figure 20 is a functional block diagram 120a showing matched algorithmic generation 122 of server communication unit information 124 and airtime cartridge communication unit information 126. In Figure 20, the algorithmically generated server communication unit information 124 includes a set 128 of single use server communication units
10 130a-130n with an associated unit key 132. Also in Figure 20, the algorithmically generated airtime cartridge communication unit information 126 includes a set 55 of single use airtime communication units 57a-57n, wherein each of the single-use communication units has a separate, unique associated ID 59a-59n. Furthermore, the algorithmically generated unique identifiers 59a-59n, for the set 55 of single
15 use airtime communication units 57a-57n, is also matched to the unit key 132 within the system server, such that each transmitted encrypted unique ID 59 may be decrypted correctly by the unit key 132 within the system server 30, allowing a match between corresponding airtime communication units 57 and server communication units 130.

20 Through matched algorithmic generation 122, the algorithmically generated set 128 of single use server communication units 130a-130n matches the algorithmically generated set 55 of single use airtime communication units 57a-57n. Therefore, each algorithmically generated single use communication unit 130
25 corresponds to a matching algorithmically generated single use airtime communication unit 57. For example, single use communication unit 130a matches single use airtime communication unit 57a (*i.e.* CU-1 equals CU-1), and single use communication unit 130b matches single use airtime communication unit 57b (*i.e.* CU-2 equals CU-2).

30 As well, the total number of single use server communication units 130a-130n within server set 128 matches the total number of single use airtime communication units 57a-57n in the ATC set 22. Also, the defined time interval of service 63 (FIG. 4) (*e.g.* one minute of local communication) is the same for
35 each generated single use server communication unit 130 and single use airtime communication units 57.

Different airtime cartridges 52 can vary in the defined pre-paid time allotment 65 (FIG. 4) for the set 55 of single use airtime communication units 57a-57n. For example, one set 55 may provide 30 minutes total service of local calls, while another set 55 provides 60 minutes total service of long distance calls.

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The matched algorithmic generation 122 of server communication unit information 124 and airtime cartridge communication unit information 126 can be performed at several locations, such as at the point of manufacture of the airtime cartridges 52. Alternatively, airtime cartridges 52 may be loaded with sets 55 of communication units 57a-57n at a remote location, such as at a point of purchase of the airtime cartridge 52. In a preferred embodiment, new sets 55 of communication units 57a-57n may be installed in an airtime cartridge 52.

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Figure 21 is a functional block diagram of an alternate embodiment 120b for matched algorithmic generation of server communication unit information 124 and airtime cartridge communication unit information 126. In Figure 21, a shared algorithm 123, such as a unit key 132m is supplied to both the system server 30 and the airtime cartridge 52. Using the supplied algorithm 123, the algorithmic generation of server communication unit information 124 is performed within the system server 30, and the algorithmic generation of airtime cartridge communication unit information 126 is performed within the airtime cartridge 52. Sets 128 of single use server communication units 130a-130n may be established all at once, and then stored within the system server 30, or may alternately be produced, as needed by the system server 30. As well, sets 55 of single use airtime communication units 57a-57n may be established all at once by a processor within the airtime cartridge 52, and then stored to memory, or may alternately be produced, as needed, by the airtime cartridge 52.

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For a simple shared authentication algorithm 123, the processing required for algorithmic generation of server communication unit information 124 or airtime cartridge communication unit information 126 may not be significant, as compared to the cost of memory within the system server 30 or airtime cartridge 52, suggesting that internally generated information 120b may be feasible for either or both units. In alternate embodiments, the use of challenge response systems may be used to establish matched server communication unit information 124 and airtime cartridge communication unit information 126.

Activation and Shelf Life of Airtime Cartridges. As described above, airtime cartridges include energy storage 54, such as a battery supply 54. For airtime cartridges 52 that include a single use energy storage 54, each airtime cartridge 52 inherently has an energy shelf life, due to inherent loss of stored energy from the batteries 54. An energy shelf life expiration date 232 (FIG. 28) is therefore preferably included for airtime cartridges 52 having single use energy storage 54, such that vendors may rotate airtime cartridges 52 to be sold and used while there is sufficient stored energy 54, and such that unsold airtime cartridges which have potentially lost adequate energy are not distributed (*i.e.* sold) to portable phone users.

In addition, as shown in Figure 20 and Figure 21, the generated server communication unit information 124 preferably includes the establishment of an expiration date designator 134a for the set 128 of server communication units 130a-130n, while the generated airtime cartridge communication unit information 126 preferably includes the establishment of an expiration date designator 134b for the set 55 of single-use airtime communication units 57.

The first time an airtime cartridge 52 is activated, the phone 34 transmits the first single use airtime communication unit 57a, having a unique associated ID 59a, for a set 55 of single use airtime communication units 57a-57n. When the authentication server 42 receives the first single use airtime communication unit 57a, having a unique associated ID 59a, and matches the first single use airtime communication unit 57a to the first single use server communication units 130a with an associated unit key 132, the authentication server 42 activates the matching set 128 of single use server communication units 130a. In addition, the phone 34 activates the set 55 of single-use airtime communication units 57.

As well, in a preferred embodiment, an expiration date is then applied to each set 55, 128 of communication units, typically corresponding to a time span (*i.e.* the shelf life 134a, 134b) for which the airtime cartridge 52 is expected to be used (*e.g.* from thirty to sixty days from the date of first use), and beginning when the airtime cartridge 52 is first used (*i.e.* when the sets 55, 128 are activated). For example, if an airtime cartridge 52, having a designated ATC expiration 134 of 30 days was first activated on June 1, 1998, the authentication server 42 allows the pre-paid airtime communication units 57 for that airtime

cartridge 52 to be used within 30 days (e.g. an expiration date corresponding to July 1, 1998 is established), both at the system server 30, and at the phone 34.

5 The established expiration date 134a,134b of an airtime cartridge 52 is independent of the energy shelf life expiration date 232. For example, an airtime cartridge 52 manufactured on January 1, 1998, with a two year energy shelf life expiration date 232, is expected to provide sufficient stored energy 34 until January 1, 1998. However, if the airtime cartridge 52 includes an
10 established expiration date 134a,134b of sixty days from first use, and the airtime cartridge 52 is first used on June 1, 1999, the airtime cartridge 52 therefore expires on August 1, 1999 (or even before, though usage of all the pre-paid single use airtime communication units 57a-57n).

System Security. Figure 22 shows an authentication information packet 140,
15 which is transmitted from a keyless portable phone 34, and is received by the system server 30, to be authenticated by the authentication server 42. An authentication information packet 140 typically contains the airtime cartridge ID 58 for an installed airtime cartridge 52 within the keyless portable phone 34. In a preferred embodiment, wherein the keyless portable phone 34 includes a
20 phone ID 50, the phone ID is also included within the authentication information packet 140. The authentication information packet 140 also includes the transmitted pre-paid airtime communication unit 57, and an ATC-ID Hash 142. While the ATC ID 58 and the phone ID 50 are typically transmitted as clear text (i.e. unencrypted) within the packet 140, the transmitted pre-paid airtime
25 communication unit 57, and the ATC-ID Hash 142 are preferably sent with encryption 144. In one embodiment, the encryption 144 is 3DES (Data Encryption Standard) or similar encryption. The encryption of transmitted pre-paid airtime communication unit 57 provides protection against malicious attacks to the system 10 by unauthorized users or entities.

30 In some embodiments, the authentication information packet 140 is transmitted from the keyless portable phone 34 at the start of any call, while subsequent transmission of unique encrypted identifiers 59a-59n is used during an ongoing call (FIG. 23). In alternate embodiments, the authentication information packet
35 140 is repeatedly transmitted from the keyless portable phone 34 during a call. Repeated transmission of authentication information packets 140 protects the system 10 from "bait and switch" attacks by unauthorized users.

5 The stronger the encryption 146 used for a transmitted authentication information packet 140, the longer the authentication server 42 typically takes to authenticate a user. For extremely strong encryptions 146, there may be a slight delay between the initial activation of a keyless portable cellular phone 34 by a user, and the beginning of voice-activated operation from the voice recognition server 44 within the system server 30.

10 In an alternate embodiment, authentication information packets 140 are repeatedly transmitted from the keyless portable phone 34 during a call, whereby sequential airtime communication units 57 are sent in sequential authentication information packets 140. In such an embodiment, each communication unit 57 includes unique encryption, as created by an associated unit key 132, which can be performed at the time of transmission (thus avoiding
15 the cost of storing encrypted unique identifiers 59.

In addition, there is no requirement to pre-compute server communication units 130, such as within the system server 30. For every ATC ID 58, the authentication server 42 reserves a matching associated unit key 132 (e.g. a 168-bit 3DES key). When the authentication server 42 receives each authentication
20 packet 140, the authentication server 42 reads the ATC ID 58 within the authentication information packet 140, and uses the unit key 132 associated with the ATC ID 58 to decrypt the single-use airtime communication unit 57. The decrypted single-use airtime communication unit 57 is then decremented from the
25 remaining time value 65 for the airtime cartridge 52 (FIG. 23).

The encryption 144 is different for each authentication information packet 140, while a single ATC ID 58, matched to a single unit key 132, is associated with the airtime cartridge 52. Therefore, what is transmitted is a discrete authorization for a
30 single communication unit 57, which is time dependent. If an unauthorized user manages to receive a transmitted communication unit 57, the unauthorized user cannot reuse the communication unit 57 to gain communication service, since the transmitted communication unit 57 is marked at the system server 30 as "Used" 149 (FIG. 23), and cannot be reused.

35 If an unauthorized user breaks the encoding mechanism (i.e. the unit key 132) for a single airtime cartridge 52, the unauthorized user only gains a limited access to

the remaining communication units 57 for that single airtime cartridge 52 (typically a small portion of communication). Since each airtime cartridge 52 has a unique unit key 132, an unauthorized user must break the encoding mechanism (*i.e.* the unit key 132) for each single airtime cartridge 52.

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In this manner, fraudulent use of the system 10 by unauthorized users is impractical. Since services are pre-paid through the use of pre-paid airtime cartridges 52, unauthorized users cannot gain access to a billing account for a user. Hence, for individual authorized users, the potential financial loss is limited to the cost of remaining communication units 57 within a single airtime cartridge 52.

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For the system 10, wide based fraud is prevented, since unauthorized users cannot gain open access to the system network 10. If an unauthorized user listens to the transmitted communication units 57 (*i.e.* intercepts and duplicates a transmitted communication unit 57), they cannot emulate a portable phone 34, because whenever a communication unit 57 is transmitted, it expires. Even if an unauthorized user breaks the unit key 132 for an airtime cartridge 52, they only gain access to the remaining communication units 57 for a particular airtime cartridge.

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As well, blank airtime cartridges 52 cannot be used to provide unauthorized communication, since blank airtime cartridges 52 are not matched to a set 128 of server communication units 130. Therefore, even if an unauthorized user steals blank airtime cartridges 52, they cannot use the airtime cartridges 52 to gain access to the system server 30. Even if an unauthorized user manages to program an airtime cartridge with a set 55 of airtime communication units, there is no corresponding set 128 of server communication units 130 located at a system server 30 with which the user can be authorized to receive communication.

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Transmittal and Authentication of Single Use Communication Units. Figure 23 is a schematic diagram 145 showing the sequential transmission of encrypted airtime communication units 57, which are each authenticated at a system server 30 and debited against corresponding stored communication units 130, such as within billing server 46.

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As a call progresses, the billing server 46 consumes server communication units 130, as airtime communication units 57 are transmitted to the system server 30

from the phone 34. The billing server 46 marks the corresponding server communication units 130 on the billing server 46 as "used" 149, thus debiting the discrete units of service. As well, the keyless phone 34 marks the transmitted airtime communication units 57 as "used" 147, thus also debiting the discrete units of service.

If the transmitted, received, and matched server communication units 130 are entirely depleted 147,149 during the call (*i.e.* the ATC 52 expires), the billing server 46 typically disconnects the phone communication. In an alternate embodiment, the system server 30 preferably places the call on hold for a period of time (*e.g.* thirty seconds), such as within a conference server 210 (FIG. 26), while the user replaces the expired airtime cartridge 52 on the fly, with a new or valid airtime cartridge 52. If the call is terminated while there are still server communication units 130 available, the billing server 46 retains the remaining stored communication units 130 within the server database, such that the mobile user can use the phone for subsequent calls.

While in the process of an ongoing phone conversation, the phone 34 repeatedly transmits a unique identifier 59 corresponding to a sequential communication unit 57 within a set 55 of airtime communication units 57, to the system server 30. For example, in a system wherein each communication unit 57,130 allows connected phone service for one minute, the portable phone 34 transmits a unique identifier 59 for each airtime communication unit 57, in a sequential fashion, for each minute of service. The unique identifiers 59 are typically transmitted in an embedded fashion within output signal 32b (FIG. 5) during the communication session (*i.e.* during the phone call). For instance, during a particular phone conversation, the keyless phone 34 transmits a unique identifier 59 for the ninth of a series 55 of twenty sequential communication units 57a-57n. The authentication server 42 checks the ninth unique identifier 57i for authenticity, by matching the ninth unique identifier 59i in the transmitted series 55 to the stored series 128 of server communication units 130. If the authentication server 42 determines that the received communication unit identifier 59 is valid, the system marks the matching server communication unit (*e.g.* 130i), as "used" 149, and allows the user of the keyless phone 34 another time increment 63 (FIG. 4) of service.

At the end of another minute, the phone 34 transmits the next unique identifier 59j (corresponding to the tenth of a series 55 of twenty sequential communication units 57a-57n), which the authentication server 42 checks for authenticity against the stored tenth server communication unit 130j in the stored set 128 of server communication units 130a-130n.

If the keyless caller terminates the communication session before the remaining communication units 57 are sent, the remaining communication units 57 can be used for subsequent communication. However, if all the communication units 57 are used before the end of the communication session, the system (i.e. both the system server 30 and the portable phone 34) typically terminates the session, while preferably warning the user, such as with an audio signal or message 192 (FIG. 25), before time expires.

Therefore, each airtime communication unit 57, having a unique identifier 59, is sent only once, and is debited against a matching stored identifier at the authentication server 42. Once a communication unit 57 is sent and matched, such as to pay for a time increment 63 of phone service, the unique identifier 59 is useless for further communication. Within a set 55 of communication units 57a-57n, each unique identifier 59 corresponds to a subsequent time increment 63 of service, such that the portable phone 34 repeatedly sends different unique identifiers 59 for subsequent time periods 63.

Since authentication identifiers 59 are only transmitted once, even if they are captured, they cannot be used again to receive communication services. Therefore, the system 10 provides efficient communication services, which are paid upon the receipt of services, and the system 10 is secure against unauthorized use.

In most embodiments of the system, each communication unit 57,130 corresponds to an allotted time increment 63 of service. In alternate embodiments, one or more communication units (CU) 57,130 may be required to initiate a communication session, or to initiate the first determined time period of a conversation (e.g. five CUs for the first three minutes, and one CU per minute thereafter). In other alternate embodiments, the billing server 46, and the keyless phone 34, may debit communication units 57,130 based upon different services,

such as local calling, long distance calling, roaming charges, or other service provider charges.

Debiting of Communication Units at Both Phone and Server. As a call proceeds, the series of communication units are sequentially "spent", and are counted as used by both the phone 34, and the billing server 46. Debiting of airtime communication units 57 is performed by the keyless portable phone 34, since as a call progresses, the keyless portable phone 34 needs to know which airtime communication units 57 are depleted, and which airtime communication units 57 to send next. In addition, debiting of matching server communication units 130 is performed by the system server 30, since as a call progresses, the system server 30 controls authorized communication, and sequentially debits matching server communication units 130, providing appropriate information to the user (e.g. such as providing a message that the ATC 52 is about to be depleted).

If a transmitted airtime communication unit identifier 59 is properly sent from a keyless portable phone 34, but is not accepted by the system server 30 (such as from a single communication unit identifier 59 that is sent and accepted first from an unauthorized user), the keyless portable phone 34 preferably attempts to send the next sequential unused airtime communication unit identifier 59. For example, if a second airtime communication unit identifier 59b is not accepted, it may mean that the second airtime communication unit identifier 59b has already arrived at the system server 30, such as from an unauthorized source. Therefore, the keyless portable phone 34 preferably sends the next airtime communication unit identifier 59c.

Establishment of a Call. When a keyless portable cellular phone 34 is authenticated (i.e. authorized) by the authentication server 42, the authentication server 42 allows a voice communication link to be established between the keyless portable cellular phone 34 and the voice recognition server 44. Figure 24 is a functional block diagram 146 for the establishment of a call, between a keyless portable cellular phone 34, the system server 30, and a connected device (e.g. a conventional phone 12 connected to PSTN 14). Once activated by a user, the keyless portable cellular phone 34 establishes contact 32 with the system server 30 utilizing mobile communication equipment 23, such as through mobile exchange base station 24 and mobile telephone switching office 22.

Upon reception of the transmitted unique identifier 59 at the authentication server 42, typically located at either a private branch exchange (PBX), or on the premises of a PSTN operator, the authentication server 42 confirms validity of the keyless portable cellular phone 34. Once the signal 32 is validated, the
5 billing server 46 checks the remaining stored credit allotment 128,130 for the airtime cartridge 52 of the keyless portable cellular phone 34.

A call initiated at the keyless portable cellular phone 34 is then connected to the destination receiver, via the system server 30, which typically completes the call,
10 such as through the public switched telephone network (PSTN) 14 to the specified location (e.g. a destination telephone 12) anywhere on Earth E.

Outgoing Calls. For an outgoing call, a user first activates the keyless portable phone 34 (e.g. by opening phone 34a or sliding microphone 76 in phone 34b).
15 The keyless portable phone 34 makes a connection to the system server 30, and waits for authorization. Once authorization is achieved, the voice recognition server, preferably automated, prompts the user for the phone number to be dialed (or alternately connects the caller to a 411 look up service). If the call is long distance (e.g. outside the coverage area), the call is either debited against
20 the airtime cartridge 52 (if the airtime cartridge 52 allows long distance service), or is alternately billed, as communicated by the user to the voice recognition server. Billing is typically accomplished as a collect call to the recipient, or as a debit to a credit card or pre-paid phone card.

For an outgoing call, the voice recognition server 44 prompts the user to input the desired destination identification, such as the phone number of a phone 12. For example, a user may input the desired destination phone number "I want to talk to 212-555-1212". The voice recognition server 44 then preferably confirms the number that the user wishes to dial. Upon confirmation, the system server 30
25 forwards the call to the designated land line, such as through the land-based network PSTN 14.
30

Figure 25 provides a flow chart 150 for an outgoing call using a cellular service with voice recognition and virtual operators. Upon activation 152 (e.g. such as
35 sliding a microphone 76 of a keyless portable phone 34b to an activated position 106b), the keyless portable cellular phone 34 is engaged, and automatically attempts to contact a designated service provider 30. If no service

provider 30 is currently available 156, such as if the user is currently located out of range, or if the system server 30 is not currently functioning (i.e. "down"), a pre-programmed "No Service" message is played 158, thus communicating the fact to the user. If service is available 160, the connection is made 162. The ATC ID 58 is checked 164, both for validity, and for credit 57 available. If no credit 57 remains 166, a message code 168 is transmitted back to the user. If the credit (debit units) counter shows a positive balance 170, a remaining credit message 172 relays the number of units available to the user.

10 Connection is then passed 174 to the voice recognition server 44 (i.e. a virtual operator). Voice recognition is attempted 176 with user confirmation before the call is processed. If the user confirmation is denied 178, the user is preferably directed to a human operator 180. Once a user connection is confirmed, either through voice recognition 182 or by the human operator 180, a connection 184 is attempted via the public switched telephone network (PSTN) 14 (FIG. 1). 15 Regular PSTN error messages apply, such as a busy signal, a wrong number, or an invalid number dialed. Certain debit charges may also be made 186 for the connection attempt, such as for the airtime used, or applicable services, such as operator assistance.

20 If the call is successfully completed, the credit allocation is monitored 188 for the duration of the call. Should the credit allocation expire 190 before the end of the call, the call is interrupted 194, and an appropriate message 192 is typically sent to the user. The ATC ID 58 is then invalidated 196, disabling further calls from a keyless portable cellular phone 34 using the depleted airtime cartridge 52. The 25 billing record is expunged, thus invalidating further use of the depleted airtime cartridge 52. As discussed above, in a preferred system embodiment, the system server 30 does not immediately disconnect calls when an airtime cartridge 52 expires, thus allowing the user to change out a depleted airtime cartridge 52 on the fly, while the incoming call is placed on hold. For calls 30 terminated 198 by the user, the system debits the credit allocation 200, upon termination 202.

35 **Incoming Calls.** While Figure 25 describes the use of a the keyless portable phone 34 for the transmission of outgoing calls, a basic keyless portable phone 34 can also be used to receive calls. For a keyless portable phone 34 used to receive incoming calls, the user gives calling parties a pager ID 107, associated

with the keyless portable phone 34, which allows calling parties to reach to user, through the system 10.

5 A caller wishing to call a user of a basic portable phone 34 first dials an access number 208 (FIG. 26), which connects the caller to the system server 30. Upon entry of a number identifier (e.g. typically four to six digits long) for the destination keyless portable phone 34, the system server 30 routes the caller to the desired portable phone 34. A basic keyless portable phone 34 indicates incoming calls, such as by an audio signal (e.g. a beep or ring), or by a visual signal, such as a
10 flashing light emitting diode, visible through the phone body 30. Upon turning on the keyless portable phone 34, a communication connection is then made.

While a basic keyless cellular phone 34, having only RF circuitry 48, may be used for the receipt of incoming calls, a basic keyless cellular phone 34 is
15 normally in an unpowered state. When in an activated state, the RF circuitry is powered, and the keyless cellular phone 34 establishes and maintains contact with a system server 30, typically requiring the ongoing transmission and usage of prepaid single use airtime communication units.

20 **Incoming Calls for Keyless Portable Phone Having Pager Circuitry.** Figure 26 is a block diagram for a preferred keyless portable cellular phone system 10b, in which the keyless portable cellular phone 34 includes pager circuitry 107 (FIGS. 8,11), such as within an airtime cartridge 52. For a portable phone 34 having pager circuitry 107, the internal pager circuitry 107 is typically
25 always on, upon initial activation of the portable phone 34. The paging circuitry 107 typically uses a small amount of power, and can be run for a extended time period. When a paging signal 36 is received, the power draw is selectably transferred from the pager circuitry 109 to the phone RF circuitry 48, thus drawing more power, while enabling the call 32.

30 The pager circuitry 107 is associated with a pager identification 109 (FIG. 11). Since the keyless portable cellular phone 34 typically has replaceable airtime cartridges 52, which are used to identify and locate the phone 34, as well as to allow access to the system server 30, throughout the life of a keyless portable
35 cellular phone 34, there are typically many airtime cartridges 52 associated with a keyless portable cellular phone 34.

5 The pager circuitry 107 therefore includes a unique pager identification 109, so that the system server 30 can locate the remote keyless portable cellular phone 34, and correctly route calls to the keyless portable cellular phone 34. An airtime cartridge 52 having pager circuitry 109 therefore includes either an identification label 111 (FIG. 10) that lists the pager identification 109, or includes other means for notifying the user of the pager identification 107, such as an accessible stored voice-synthesized message which communicates the identification 109 to the user, or to a connected calling party upon prompt by the remote user (e.g. "This ATC number is 6472").

10 Pager identifications 109 are temporary, and are only good for the either life of the energy storage 54, or the installed credit 55 of the airtime cartridge 52 (e.g. 60 days or 60 minutes of use, whichever runs out first). Therefore, pager identifications 109 (or ATC connection numbers for a basic airtime cartridge) may be reused for a plurality of airtime cartridges 52 over time. The pager identification 109 for an airtime cartridge 52 is preferably selected from a pool of pager identifications 109 allotted for the system server 30. Reuse of pager identifications 109 minimizes crowding of the phone network 13.

15 In one embodiment, the pager number 109 would typically be associated with a call in number 208 for a system server 30 (i.e. similar to an extension number). The pager number 109 may be dialed, along with the server call-in number 208, or may be entered by voice, after dialing the call-in number 208, such as to the voice recognition server 44 (e.g. "Please connect me to pager "5555"").

25 In another embodiment, the user is able to associate a pager ID number 109 and a phone ID number 50, such as through secure password protected web access. The user may then reuse a previously established contact database and/or a previously used pager ID number 109. This is advantageous, particularly for lost or misplaced handsets 34, whereby a user may reuse previously established and stored information, such as an electronic address book database 38a.

30 The ATC pager identification 109 is not necessarily a phone number, but simply a routing number to the remote user of the airtime cartridge 52, through the system server 30 (e.g. "6472"). The system call in number 208 associated with the pager number 107 is typically a local or national connection. As well, the call

in number 208 is not necessarily a phone number. For example, the system may preferably reserve a phone prefix (e.g. XXX) within an area code (e.g. 415), whereby a calling party may simply call the area code, the prefix, followed by the pager identification 109 (e.g. for a pager identification 109 "6472", the
5 diald number is "1-415-XXX-6472").

The system call in number 208 associated with the pager number 107 may alternately be an Internet connection. For an Internet connection, a calling party may preferably send in a text-based message, which can be stored within the
10 system server 30, and read to the user, through a voice synthesis module.

The user of the keyless portable cellular phone 34 typically selectably provides the pager identification 109 to other people, so that the user may be called. For example, a user may call out, and leave the pager identification 109 as part of a
15 voice mail on an answering machine (e.g. "Call me back by paging 6472").

When an incoming caller, such as from a conventional phone 12, relays the pager number 109 to the system server 30, the server sends the calling session to conference storage 210. While conference storage 210 may be a connected
20 server, it may alternately be located within the system server 30. The system server 30 then sends a paging signal 36 to the cell phone 34b, through a paging exchange 26 and paging transmitter 28, while the calling party sits on "hold" within conference storage 210.

The paging circuitry 109, upon receiving a page signal 36, provides a paging signal 212 (e.g. a ring, beep, chime, indicator light, or vibration). As the user of the portable phone 34 has probably distributed the pager identifier 107 to a limited number of people, the portable phone user knows that the incoming call is probably from a desired caller, and is expecting the incoming call.
30

To connect to an incoming call, the portable user selectably activates the keyless portable cell phone 34, such as by pulling the microphone 76 down to an activated position 106b. While the paging circuitry 109 notifies the user, such as with a beep or a ring 212, the phone circuitry 48 remains unactivated, until
35 selectively activated by the user. Incoming calls are held at the system server 30, until the user activates the keyless portable cell phone 34.

Since the phone circuitry 48 remains unactivated, the user has a choice to activate the phone 34b or not. Since connection time is "charged" against pre-paid airtime communication units 57a-57n within the airtime cartridge 52, the user may choose not to activate the phone 34b, particularly if no call is expected, or if the caller is busy. If the keyless portable cell phone 34 is not activated, the caller may preferably leave a verbal voice mail message at the server 30. The user may then, at a later time, retrieve the stored voice mail from the system server 30.

If the cell phone user activates the phone 34, the phone 34 automatically connects to the system server 30, as described above, and the authentication server 42 authenticates the user, in a similar manner to an outgoing call placed from the keyless cell phone 34. Once the user is authenticated, the system server 30, identifies the ATC ID 58, and knows that there is a pending call associated to that ATC ID 58 on "hold" within conference server 210. The system server 30 thus routes the user to the pending call, and the calling parties are connected.

While the conference server 210 typically holds an active caller in a hold cue, the conference server 210 can also store information, such as voice-mail, or text-based mail. In preferred embodiments, when a mobile user calls in, the system server notifies the server of one or more messages, which the user can selectably choose to listen or retrieve. For voice mail, the system server retrieves the stored voice mail message, and plays the message back to the mobile user. The user may repeat the playback of the message, save the message for later retrieval, or delete the message. For voice mail that includes a callback number, the voice recognition server 44 may preferably detect and store the number, such that the remote caller may call the stored number, such as with a voice command "Call back".

In alternate embodiments, a calling party can leave a voice-mail message within the system server 30 or conference 210, such as for a user who does not activate the keyless cell phone 34 to receive the incoming call. Alternatively, a calling party, upon calling in to the system server 30, may be provided with choices, such as a phone connection to the cell phone user, or to leave a voice-mail message (e.g. if they know the cell phone user is in a meeting).

Rechargeable Airtime Cartridges. Figure 27 is a side view 218 of a keyless portable cellular phone 34b having a rechargeable airtime cartridge 52a, being recharged for both stored energy 54 and an acquired set 55 of pre-paid airtime communication units 57a-57n. While airtime cartridges 52 are often single use cartridges (*i.e.* non-rechargeable), in some preferred embodiments the stored energy 54 is rechargeable. In other preferred embodiments, new sets 55 of communication units 57a-57n may be installed within the airtime cartridge 52, such as through an acquisition connection 226 (*e.g.* an authorized Internet connection) at work or at home, or at another remote location, such as at a vending machine.

Figure 27 shows an airtime cartridge recharging unit 220, which includes an airtime cartridge port 221. The airtime cartridge port 221 accepts a rechargeable airtime cartridge 52a, which has battery contacts 224, and authentication module contacts 228. When a user installs a depleted rechargeable airtime cartridge 52a in the airtime cartridge port 221, battery contacts 224 come into contact with energy input connection 222, and authentication module contacts 228 come into contact with pre-paid acquisition connection 222.

For a home based acquisition Internet connection 226, the user may be required to establish a secure authorized connection (*e.g.* a secure socket layer SSL), such as to system server 30, while providing payment (*e.g.* billing to a credit card) for a new acquired set 55 of airtime communication units 57a-57n.

For a vending machine based acquisition connection 226, the user may only be required to slide or swipe a credit card to provide payment for a new acquired set 55 of airtime communication units 57a-57n. The user may also be required to provide a PIN number associated with the card (such as for an ATM card).

As described above, when new algorithmically generated sets 55 of airtime communication units 57a-57n are sold to a user, thereby providing generation of ATC information 124 to a recharger 220, the selling party must also provide matching generation of server information 124 to system server 30.

In an alternate embodiment of the airtime cartridge, the energy storage is removable (*i.e.* replaceable batteries), while the set 55 of pre-paid single use airtime communication units 57 is rechargeable.

Replaceable Airtime Cartridges. Figure 28 is a keyless portable cellular phone 34b having a plurality of removable and replaceable airtime cartridges 52a,52b. The airtime cartridges 52a,52b also preferably include an energy expiration storage label 232, such as for airtime cartridges 52a,52b which have a single use energy source (e.g. non-rechargeable batteries). In this embodiment, the phone body 90 is reusable, and includes a receptacle 231 for receiving removable and replaceable airtime cartridges 52a,52b. As the prepaid airtime credit 55 is depleted from a first airtime cartridge 52a, the user may remove the first airtime cartridge 52a, and install a second airtime cartridge 52a, thus reactivating the phone.

Replaceable airtime cartridges 52 can be distributed or sold in a wide variety of ways, since the provided service is internally supplied with each airtime cartridges 52 (i.e. there is no activation required from a specialty store). For example, keyless portable phones 34, or replaceable airtime cartridges 52, may be purchased from a wide variety of vending machines or commercial locations.

In preferred embodiments, airtime cartridges 52 may be used for promotional advertising, whereby airtime cartridges 52 are distributed or sold, and may include supplementary information, such as advertising text or logos.

Different service providers 30 preferably sell different replaceable airtime cartridges 52, selectively providing different levels of service, such as for national coverage, local coverage, or overseas service, depending on the operator, copolicy, and target market. As long as the RF circuitry 48 for a keyless portable cellular phone 34 matches different regional system servers 30, the consumer can optionally use different carriers 30 with different services to match their current communication needs. For example, a business user, while traveling, may use an airtime cartridge 52 offering regional use on the west coast, while located in California. Upon traveling to New York, the business traveler may quickly replace the first airtime cartridge 52 with a second airtime cartridge 52, offering regional service for the east coast.

Information Input from External Sources. Figure 29 is a functional block diagram for a keyless portable cellular phone system 10c with a voice recognition 33 operating system, wherein information is preferably transferred to the system server 30, either directly 40, or indirectly 41, from a plurality of external information

sources 38a-38n. The transferred information is then typically stored within the system server 30, and is then preferably accessible to one or more keyless portable cellular phones 34.

5 Transferred information is available from a variety of external information sources 38a-38n, such as downloaded data from an external computer, a personal digital assistant (e.g. a PalmPilot™), manufactured by 3Com Corporation, of Sunnyvale, CA), a regular phone (e.g. by keying in commonly dialed numbers and associating them with speed dial numbers, by voice through voice
10 recognition system 44, or by an internet connection), or through premium external services, such as stock information sources 38b or music channels 38n.

For stored, text-based messages, the voice recognition system 46 preferably includes a voice synthesis module, which reads the stored text, and provides a
15 synthesized play back for the mobile user. In this manner, peripheral devices, such as computers can be used to send messages to a remote user, such as by e-mail to the system server 30, whereby the remote user may readily have access to text-based messages.

20 For example, as described above, a user may download a personal electronic address book database 38a to the system server 30, and may preferably link the database records (i.e. commonly called people and phone numbers) to speed-dial numbers within the system server 30. In this example, it is preferred that the established address book and speed-dial codes be linked with the
25 keyless portable cellular phone 34, having a phone ID 50, so that the user may retrieve the address book information, or use the programmed speed-dial numbers, while using the keyless portable cellular phone 34, even when a new pre-paid airtime cartridge 52 is installed. The use of speed-dial numbers from a keyless portable cellular phone 34 is preferred, since a user may quickly provide
30 a simple speed-dial code to the voice recognition server 44 to place a call, which is more accurately detected by the voice recognition software, and confirmed by the virtual operator. The user database is password protected and secured, such that only the authorized user may access the data.

35 In Figure 29, an alternate external information source 38b provides a download of updated information regarding a stock portfolio for a user. For example, a user may track a portfolio from an external computer, and have updated information

sent to the system server 30, to be updated. Alternately, a user may define a portfolio of stocks at the system server 30, or through another external source, and the system server 30 may retrieve updated information from an external source, so that the user has access to updated information from the keyless portable cellular phone 34.

Therefore, a user of a keyless portable cellular phone 34 preferably has available information from a number of sources. In the examples above, a user may reserve speed dial numbers One through Ten for phone numbers (which the voice recognition server 44 can use to make calls), and speed dial numbers Eleven through Twenty for Stock Portfolio information (which the system server may download and cite to the user, such as through voice synthesis software).

External downloadable music source 38n is also shown in Figure 29. Downloadable music may be available to a keyless portable cellular phone 34, such as accessed through a preferred replaceable airtime cartridge 52. Downloadable music, such as transferred in MPS format, may be played through the system server 30, or may be downloaded to a preferred airtime cartridge having an internal MP3 player, which plays the music signal as it receives the signal, or preferably stores it to internal airtime cartridge memory, such as for later playback.

For example, a user may activate the keyless portable cellular phone 34 for a limited time, to download music 38n, and may store the music internally to a preferred airtime cartridge, allowing the user to play back the music one or more times, such as when the keyless portable cellular phone 34 is not activated (and unconnected to the system server 30), thus avoiding the cost of debited airtime communication units 57 while listening to the stored music.

While external information source 38n is described as music, the transferred data 38 may include numerous other acoustic information, such as news reports, conferences, or audio books, which the user may access, either on the fly, or on a store and play basis.

Different services, such as local, regional or foreign calling services, or the receipt of external information 38a-38n, is typically available to the user, such as through the use of different replaceable airtime cartridges 52. As described above,

some external information 38, such as a user's address book 38a or stock portfolio information 38b, is linked to a phone ID 50. Such stored intelligence is typically related to a unique phone ID 50, so that a user can have continuing access to stored information, even when airtime cartridges 52 are changed. Such stored information within the server 30 is not typically associated with an airtime cartridge ID for a removable single-use airtime cartridge 52, because such an airtime cartridge 52 is inherently used for a limited period.

However, the pre-paid access to the different services is typically available to different preferred airtime cartridges 52. Therefore, while the phone ID can be linked to some preferred services, the ATC ID 58 is used to allow pre-paid access to preferred services. The user of a particular keyless portable cellular phone 34 will have pre-paid access to the preferred services, depending on the paid capabilities of the airtime cartridge 52, (e.g. a premium for having access to stock quotes 38b). Therefore, an airtime cartridge 52 providing premium services may be priced differently from a basic airtime cartridge 52. A user may have a plurality of airtime cartridges, therefore, to provide pre-paid access to different calling services or preferred services.

Establishment of Communication Units. Figure 30 is a schematic block diagram 234 of an airtime cartridge vending machine 236. The airtime cartridge vending machine 236 typically includes a network connection 238 to a system server 30, such as by a connection 240 through the public switched telephone network 14. The airtime cartridge vending machine 236 includes a processor 237, and one or more airtime cartridge vending stacks 242a-242n for holding and dispensing one or more airtime cartridges 52. A plurality of stacks 242a-242n are preferably used, such as to sell and dispense airtime cartridges 52 having different included hardware (e.g. paging circuitry 107), or having different services (e.g. local calling, long distance, address books, music downloading), or pre-paid service access (e.g. such as thirty minutes of call time, 30 day ATC shelf life).

There are three main modes of operation for alternate embodiments of the airtime cartridge vending machine 236, wherein:

- i) pre-burned (pre-programmed) (and enabled) airtime cartridges 52 are stocked within the vending machine 236;

ii) pre-burned (pre-programmed) airtime cartridges 52 are stocked within the vending machine 236, while the vending machine 236 communicates the sale of airtime cartridges 52, such that network access is enabled at the point of sale; or

iii) blank airtime cartridges 52 are stocked within the vending machine 236, and are burned-in (programmed) on the fly, in conjunction to the transmission of data between the vending machine 236 and the system server 30, to enable service access.

In the preferred vending machine embodiment 234 shown, the stored airtime cartridges 52 are initially produced with storage capacity (*i.e.* a blank authentication module 56 (FIG. 3)) to receive a set 55 of communication units 57a-57n, but are distributed as blanks, whereby a set 55 of single-use pre-paid airtime communication units 57a-57n are controllably established, or "burned in", by a burn-in device 244, within the vending machine 236.

The vending machine also includes a payment and control interface 246, typically including a cash input 248, a credit/ATM card input 250, an interface screen 252, a keypad 254, a speaker 256, and a microphone 258.

Either before burn-in 244, or as a set 55 of single-use pre-paid airtime communication units 57a-57n is established, the processor 237 within the ATC vending machine 236 communicates with the system server 30 through connection 238,240, such that a matching set 128 of server communication units 130 is established (whereby a user may use the new airtime within a keyless portable cellular phone 134, and wherein corresponding communication unit pairs 57,130 may be matched and marked as used 147, 149 (FIG. 23), between the keyless portable cellular phone 134 and the system server 30. In this embodiment of the ATC vending machine 236, wherein blank airtime cartridges are programmed in-situ, the ATC vending machine 236 is secured by password/dongle, for authorization of authorized use. As well, the ATC vending machine 236 is required to log and communicate all unit sales of airtime cartridges 52. At the time of sale, the ATC vending machine 236 may preferably print a sales receipt, preferably containing a user password, by which the user may later configure the purchased airtime cartridge (*e.g.* such as through web configuration).

Since a user may commonly install and use a new airtime cartridge 52 in a keyless portable cellular phone 34 soon after purchasing the airtime cartridge 52, it is important that the corresponding set 128 of server communication units 130 is established promptly (otherwise, the keyless portable cellular phone 34 is not able to make an authorized connection to system server 30, for communication services). In a preferred embodiment, the established expiration date 134a, 134b (e.g. sixty days) is set at the point of purchase.

An airtime cartridge vending machine 236 preferably contacts system server 30, before the point of sale of airtime cartridges 52, whereby matched algorithmic generation 122 (FIGS. 20, 21) of server communication unit information 124 and airtime cartridge communication unit information 126, or a plurality of shared algorithms 123 (FIG. 21) are used to establish a plurality of matched sets 55, 128 (i.e. an inventory of pre-paid airtime) between the system server 30 and the vending machine 236.

To purchase an airtime cartridge, a user inserts money 262 into cash input 248, or a credit card or ATM bank card 264 into credit/ATM card input 250. The payment and control interface 246 preferably guides the user through the airtime cartridge selection and payment process, such as by visual prompts through interface screen 252, or audio prompts through speaker 256. The user enters information, such as airtime cartridge selection, payment type, or credit card PIN codes, such as through keypad 254, or by voice commands into microphone 258.

In a preferred embodiment, the ATC vending machine 236 provides access to the voice recognition server 44 at the system server 30 during the airtime cartridge procurement process 234. The voice recognition server 44 guides the user through the process, such as through playback of audio prompts, as well as through voice recognition of the user's voice commands.

When the user provides payment for the desired prepaid airtime cartridge (i.e. the point of sale), the burn in device 244 installs either a set 55 of pre-paid single use airtime communication units 57, or a shared algorithm 123 (which allows a processor within the airtime cartridge 52 to produce the equivalent set 55 of pre-paid single use airtime communication units 57), within the authentication module 56 of the purchased airtime cartridge 52. The user-selected airtime cartridge

vending stack 242 then dispenses the purchased and loaded airtime cartridge through dispensing access 260.

5 **Reusability and Recycling of System Hardware.** A significant advantage of keyless portable cellular phones 34 and airtime cartridges 52 is the ease by which a person may establish portable pre-paid communication, wherever they may be located.

10 As described above, conventional cellular phone hardware requires the establishment of complicated service provider agreements, as well as the establishment of an electronic serial number (*i.e.* a drop number) for billing purposes. For conventional cellular phones, such services require that a person visit a specialty store, typically having trained personnel to perform phone registration functions.

15 In contrast to conventional cellular phones, the purchase of a keyless portable cellular phone 34 does not require registration for the user, nor is there any requirement to visit a specialty store, or any requirement for the user to submit private information, such as a social security number and/or credit history
20 information. Instead, the keyless portable cellular phone system 10 provides discrete time units 63 of communication, through the paid acquisition and secure transmission of sets 55 of pre-paid single use airtime communication units 57.

25 As described above, the keyless portable cellular phone 34 can either have a fixed internally loaded pre-paid airtime cartridge (such as a "disposable" keyless portable cellular phone 34), or can have rechargeable or replaceable pre-paid airtime cartridges 52. Even for rechargeable airtime cartridges 52, the establishment of new sets 55 of pre-paid single use airtime communication units 57 does not require a visit to a specialty store.

30 While airtime cartridges 52 have an ATC ID 58, and while preferred keyless portable cellular phones 34 have a phone ID 50, neither ATC ID's 58 nor phone are linked to a user for billing purposes. Therefore, a user may readily dispose of a keyless portable cellular phone 34 or airtime cartridge 52, without fear of great
35 financial risk (such as the financial risk of unrestricted access by unauthorized users for a conventional cellular phone). Even if a keyless portable cellular phone 34 is

lost or stolen, the financial loss is limited, at most, to the cost of hardware and residual pre-paid single use airtime communication units 57.

5 Also, as described above, keyless portable cellular phones 34 inherently have very few internal components, such as key pads, or complicated internal intelligence. Most system processing intelligence (e.g. such as authentication and voice recognition) is located within a remote system server 30. Furthermore, most system memory (e.g. such as preferred speed-dial and address book information) is located within a remote system server 30.

10 As keyless portable cellular phones 34 provide limited financial risk to the user, are inherently simple to manufacture, and do not require user billing registration at a point of sale, they may be readily disposed, recycled and reused between multiple users. Figure 31 shows disposal 262,278 and reuse 264,280 of
15 keyless portable cellular phones 34 and airtime cartridges 52 at a remote location RL.

A user, arriving at a remote location RL, such as by plane AV, may readily purchase a keyless portable cellular phone 34, either having an internal airtime
20 cartridge 52, or one or more replaceable airtime cartridges 52. The user is not required to establish a billing contract with a service provider, and can use the keyless portable cellular phone 34 immediately for portable communication as they go about their local business travel MV.

25 Even if the user, upon arriving in a remote location RL, has no idea how the local phone system operates, the user may readily purchase a set 55 of single use airtime communication units 57 for a keyless portable phone 34 or for an airtime cartridge 52, for local communication in the remote location RL, and may readily make calls.

30 In Figure 31, keyless portable cellular phone reuse center 266 includes a phone drop off bin 268, and a phone dispensing bin 270. In a preferred embodiment, the phone reuse center 266 includes a vending interface 272, by which a user may purchase, or even "borrow", a keyless portable cellular phone 34 (having
35 either no loaded communication units 57, or residual airtime communication units 57 from a prior user), or may purchase a keyless portable cellular phone 34

preloaded, or reloaded, with a set 55 of pre-paid single use airtime communication units 57.

5 At the end of an extended stay, a user may readily dispose 268 the keyless portable cellular phone 34 at any convenient phone reuse center 266. In a preferred embodiment, the reuse center 266 may include a deposit fee return 274, as compensation for return of a keyless portable cellular phone 34.

10 In a similar manner, the user may readily purchase one or more replaceable airtime cartridges 52. Just as for the keyless portable cellular phone 34, the user is not required to establish a billing contract with a service provider, and can use the pre-paid airtime cartridge 52 with a compatibly housed keyless portable cellular phone 34 immediately for communication.

15 In Figure 31, the keyless portable cellular phone reuse center 266 also includes an ATC reuse module 276, which includes an airtime cartridge drop off bin 282, and an airtime cartridge dispensing bin 284. In a preferred embodiment, the ATC reuse module 276 includes an ATC reuse vending interface 286, by which a user may purchase or "borrow" a blank airtime cartridge 54, to be charged
20 (having no loaded, or residual airtime communication units 57 from a prior user), or may purchase an airtime cartridge 52 preloaded with a set 55 of pre-paid single use airtime communication units 57. In a preferred embodiment, the ATC reuse module 276 may include an ATC deposit return 288, as compensation for return of an airtime cartridge 52.

25 At the end of an extended stay, therefore, a user may readily dispose of and recycle the airtime cartridge 52. For airtime cartridges 52 which can be recharged, such as for a rechargeable energy supply 54 and a set of pre-paid single use airtime communication units 57, the reuse center 266 preferably includes a
30 recharger 220.

As shown in Figure 31, therefore, keyless portable cellular phones 34 may readily be dropped off at the end of use, and recycled to provide instant pre-paid communication for a number of users.

35 In a preferred embodiment, as described above, information from an external source 38 is preferably stored on a system server 30, and is then preferably

accessible to a user, even in a remote location RL. For example, for a business user who spends an extended period of time (e.g. two months) in a remote location (e.g. France), the user may prefer to establish or retrieve a personal electronic address book 38a, and link it to the keyless portable cellular phone 34 (i.e. the phone ID 50), for the duration of the stay.

For external information 38 that has been linked to a keyless portable cellular phone 34 (i.e. linked to a phone ID 50), such as a personal electronic address book 38a (FIG. 29), a user wishing to recycle the keyless portable cellular phone 34, such as at the end of a business trip, may want to avoid access to the linked information 38 by a future user of the keyless portable cellular phone 34.

In one preferred embodiment, therefore, a user may readily contact the system server 30, and direct the system server 30 to either unlink remote information 38, or erase stored information 38 that is linked to the phone ID 50.

In an alternate embodiment, the user may establish an expiration date for the linked information 38, such as to coincide with the user's business itinerary (e.g. if the user is returning home the remote location by a certain date).

In another alternate embodiment, the airtime cartridge 52 includes an internal memory (such as within the authentication module 56), which allows the downloading and short term storage of information (e.g. address books, speed-dial numbers), which the phone logic 84 (FIG. 5) may access. At the end of the memory expiration date, or by the airtime cartridge expiration date 134, the memory expires.

Keyless Portable Phone with Modem. While typical embodiments of the keyless portable cellular phone 34 and system server 30 communicate voice-based signals 32 (i.e. acoustic data), the preferred embodiments of the system 10 can be modified to communicate other data as well. For example, Figure 32 shows a preferred system data application 290, wherein the airtime cartridge 52 within the keyless portable cellular phone 34 includes a modem 292, through which a user may establish an Internet connection 32. The preferred airtime cartridge 52 includes a modem attachment 294 (e.g. such as a serial port connector), which can be connected to a computer 296, such as a portable laptop computer 296, having an Internet browser application 298. The preferred

airtime cartridge 52 includes a set of pre-paid single use communication units 57, with which the user may initiate a dial-in login and receive time increments of connection to the Internet (e.g. a pre-paid hour of worldwide web "surfing") from an Internet service provider (ISP).

5

The keyless voice-activated portable phone 34 and system 10 provides affordable and convenient communication for a wide variety of users. Even for short term use, such as for work or for vacation, a user may quickly acquire and use a keyless voice activated portable phone 34, without a long-term capital commitment for a conventional cellular phone, and without establishing complicated activation or service contracts. Payment for communication is made in advance of the user's outgoing or incoming calls, allowing use of the keyless voice-activated portable phone 34 upon purchase, at any given time, anyplace in the world E.

10

15

The keyless portable phone 34 guarantees a fixed up-front fee for communication based upon a given amount of prepaid airtime communication units 57 a limited time of use (e.g. shelf life 134). Such a cellular phone 34 may be discarded without hesitation (or may optionally be recycled) upon end of use, without the need of paying further fees. The keyless voice-activated portable cellular phone 34 requires no dial pad and no function keys, since the functionality depends upon the system server 30, rather than the mechanical capabilities of the keyless portable phone 34.

20

25

As well, alternate embodiments of the keyless portable phone 34 can be extremely small. Figure 33 is a preferred hands-free application 300, wherein a wearable keyless portable cellular phone 34 is attached to an article of clothing. The wearable keyless portable cellular phone 34 includes a connected microphone activatable headset 302, by which the user may simply pull on the microphone 76 to activate the phone 34, and use the voice recognition server 44 to control the operation of the phone 34.

30

35

Figure 34 shows a mobile hands-free application 304, wherein an miniature keyless portable cellular phone 34d is removably mounted to the dashboard DB of an automobile MV. The miniature keyless portable cellular phone 34d includes a directable speaker 74, to direct the speaker 74 toward the user. The cellular phone 34d also includes an activateable directional input microphone 76,

by which the user may simply pull on the microphone 76 to activate the phone 34, and use the voice recognition server 44 to control the operation of the phone 34 in a hands-free fashion, such as when driving the automobile MV.

5 The keyless portable cellular phone 34 may easily be modified for other small applications, or integrated into other devices, such as within a watch or a portable radio. As well, a keyless portable phone may alternately house a plurality of pre-paid airtime cartridges 52, such as to provide access for different services, or
10 for midflight transfer of a pre-paid call from a first installed airtime cartridge 52 to a second installed airtime cartridge 52.

Although the keyless portable telephone system and its methods of use are described herein in connection with cellular telephone systems, the apparatus
15 and techniques can be implemented for other communication devices, or any combination thereof, as desired.

Accordingly, although the invention has been described in detail with reference to a particular preferred embodiment, persons possessing ordinary skill in the art to
20 which this invention pertains will appreciate that various modifications and enhancements may be made without departing from the spirit and scope of the claims that follow.



CLAIMS

What is claimed is:

- 5 1. A communication system, comprising:
 a system server, said system server having a plurality of algorithmically
 generated sequential single use server communication units, each of said plurality
 of algorithmically generated single use sequential server communication units
 defining a discrete time increment of authorized communication; and
10 a keyless portable wireless phone having wireless phone circuitry, an
 energy storage, and an airtime cartridge, said airtime cartridge having an airtime
 cartridge identifier, and a plurality of algorithmically generated sequential pre-paid
 single use airtime communication units, each of said plurality of algorithmically
 generated pre-paid single use communication units matching corresponding of
15 said each of said plurality of algorithmically generated sequential server
 communication units at said system server, each of said plurality of algorithmically
 generated pre-paid single use airtime communication units defining a discrete time
 increment of authorized communication, each of said plurality of algorithmically
 generated pre-paid single use communication units having a unique identifier;
20 whereby sequential transmission of each of said algorithmically generated
 pre-paid single use airtime communication units having said unique identifiers from
 said keyless portable wireless phone to said system server is matched to said
 corresponding of said each of said plurality of algorithmically generated sequential
 single use server communication units at said system server, in which said system
25 server allocates said defined discrete time increment of authorized communication
 for said keyless portable wireless phone based upon said matching of each of
 said corresponding algorithmically generated single use server communication
 units and said algorithmically generated pre-paid single use airtime communication
 units.
30 2. The communication system of Claim 1, wherein said airtime cartridge
 includes a memory, wherein a unit key and said plurality of algorithmically
 generated sequential pre-paid single use airtime communication units within said
 airtime cartridge is stored in said memory.
35 3. The communication system of Claim 1, wherein said airtime cartridge
 includes an airtime processor and an algorithm, and wherein said plurality of



algorithmically generated sequential pre-paid single use airtime communication units within said airtime cartridge are generated by said airtime processor using said algorithm.

5 4. The communication system of Claim 1, wherein said system server includes a server memory, and wherein said plurality of algorithmically generated sequential single use server communication units within said server is stored in said server memory.

10 5. The communication system of Claim 1, wherein said system server includes a server processor and an algorithm, and wherein said plurality of algorithmically generated sequential single use server communication units within said system server are generated by said server processor using said algorithm.

15 6. The communication system of Claim 1, wherein said system server is in communication with a public switched telephone network, and wherein said system server allocates said defined discrete time increment of authorized communication between said keyless portable wireless phone and said public switched telephone network.

20 7. The communication system of Claim 1, wherein said system server includes a voice recognition server, and wherein a voice command entered into said keyless portable wireless phone is interpreted by said voice recognition server.

25 8. The communication system of Claim 7, wherein said voice command is a phone number.

30 9. The communication system of Claim 7, wherein said voice command is a speed-dial number.

10. The communication system of Claim 7, wherein said voice command is a name.

35 11. The communication system of Claim 7, wherein said voice command is a voice mail identifier.



12. The communication system of Claim 7, wherein said voice command is a destination.

5 13. The communication system of Claim 1, wherein said system server includes a billing server.

10 14. The communication system of Claim 1, wherein each of said transmitted algorithmically generated pre-paid single use airtime communication units is generated by an encryption algorithm.

15 15. The communication system of Claim 16, wherein each of said encrypted transmitted algorithmically generated pre-paid single use airtime communication units having said unique identifiers is encrypted using 3DES.

16 16. The communication system of Claim 1, wherein said keyless portable wireless phone includes a phone identifier.

17 17. The communication system of Claim 1, wherein said keyless portable wireless phone is normally inactivated.

20 18. The communication system of Claim 17, wherein said keyless portable wireless phone includes paging circuitry, whereby an incoming call is stored at said system server, whereby said paging circuitry is activated to announce said incoming, stored call, and whereby said normally inactivated keyless portable
25 wireless phone is selectively activated by user to connect to said incoming, stored call at said system server.

30 19. The communication system of Claim 1, wherein said keyless portable wireless phone includes a microphone activation switch having a first open position and a second closed position, whereby movement of microphone from said first open position to said second closed position activates said phone, and whereby movement of microphone from said second closed position to said first open position deactivates said phone.

35 20. The communication system of Claim 1, wherein said keyless portable wireless phone automatically transmits information to said system server to establish communication when activated.



21. The communication system of Claim 1, wherein said keyless portable wireless phone includes pager circuitry having a pager identifier, whereby said pager circuitry is activated by said system server to alert user.
- 5 22. The communication system of Claim 21, wherein said server includes means for forwarding a communication connection between said keyless portable wireless phone to stored information.
- 10 23. The communication system of Claim 22, wherein said server includes means for forwarding a communication connection between said keyless portable wireless phone to an incoming call.
- 15 24. The communication system of Claim 22, wherein said pager circuitry functions independently of said cellular circuitry.
- 20 25. The communication system of Claim 1, wherein said energy storage is rechargeable.
26. The communication system of Claim 1, wherein said energy storage is a single use energy supply.
- 25 27. The communication system of Claim 1, wherein said airtime cartridge is replaceable, and wherein said energy storage is located within said replaceable airtime cartridge.
- 30 28. The communication system of Claim 1, wherein keyless portable wireless phone includes a phone identifier, and wherein said system server includes means for associating user of said keyless portable wireless phone with information, and means for user to associate said information with said phone identifier.
- 35 29. The communication system of Claim 1, wherein information is stored on said system server.
30. The communication system of Claim 29, wherein said information is an address book database.



31. The communication system of Claim 1, further comprising:
means for determining first activation for said airtime cartridge.

32. A process, comprising the steps of:

5 providing an algorithm;

generating a plurality of sequential single use server communication units
using said algorithm, each of said plurality of algorithmically generated single use
sequential server communication units defining a discrete time increment of
authorized communication;

10 supplying said plurality of sequential single use server communication units
to a system server;

generating a plurality of sequential single use airtime communication units
having unique identifiers using said algorithm, each of said plurality of
algorithmically generated sequential single use airtime communication units
15 defining a discrete time increment of authorized communication and matching
corresponding of each of said plurality of algorithmically generated single use
sequential server communication units;

20 providing a keyless portable wireless phone having wireless phone
circuitry, energy storage, and an airtime cartridge, said airtime cartridge having an
airtime cartridge identifier;

establishing said plurality of sequential single use airtime communication
units having said unique identifiers to said airtime cartridge within said keyless
portable wireless phone on a pre-paid basis;

25 authorizing access to said system server based upon a receipt of
transmitted airtime cartridge identifier from said keyless portable wireless phone;
and authorizing said discrete time increments of authorized communication for said
keyless portable wireless phone, based upon a receipt of one or more
sequentially transmitted sequential single use airtime communication units having
unique identifiers, using said algorithm to retrieve each of said sequential single
30 use airtime communication units from each of said unique identifiers, and matching
each of said transmitted sequential single use airtime communication units with
each of said corresponding sequential single use server communication units at
said system server.

35 33. The process of Claim 32, wherein said airtime cartridge includes an
authentication module memory, and wherein said step of establishing said
plurality of sequential single use airtime communication units having said unique



identifiers to said airtime cartridge consists of storing said plurality of sequential single use airtime communication units to said authentication module memory.

5 34. The process of Claim 32, wherein said airtime cartridge includes an airtime processor, and wherein said step of establishing said plurality of algorithmically generated sequential pre-paid single use airtime communication units within said airtime cartridge is performed by said airtime processor using said algorithm.

10 35. The process of Claim 32, wherein said system server includes a server memory, and wherein said plurality of algorithmically generated sequential single use server communication units within said server is stored in said server memory.

15 36. The process of Claim 32, wherein said system server includes a server processor and an algorithm, and wherein said plurality of algorithmically generated sequential single use server communication units within said system server are generated by said server processor using said algorithm.

20 37. The process of Claim 32, wherein said system server is in communication with a public switched telephone network, and wherein said step of allocating said defined discrete time increment of authorized communication allows communication between said keyless portable wireless phone and said public switched telephone network.

25 38. The process of Claim 32, further comprising the step of:
 interpreting a voice command entered into said keyless portable wireless phone at said system server.

30 39. The process of Claim 38, wherein said voice command is a phone number.

40. The process of Claim 38, wherein said voice command is a speed-dial number.

35 41. The process of Claim 38, wherein said voice command is a name.



42. The process of Claim 38, wherein said voice command is a voice mail identifier.

43. The process of Claim 38, wherein said voice command is a destination.

44. The process of Claim 32, wherein said system server includes a billing server.

45. The process of Claim 32, wherein each of said transmitted algorithmically generated pre-paid single use airtime communication units having said unique identifiers is encrypted.

46. The process of Claim 45, wherein each of said encrypted transmitted algorithmically generated pre-paid single use airtime communication units having said unique identifiers is encrypted using 3DES.

47. The process of Claim 32, wherein said keyless portable wireless phone includes a phone identifier.

48. The process of Claim 32, wherein said keyless portable wireless phone is normally inactivated.

49. The process of Claim 32, wherein said keyless portable wireless phone includes a microphone activation switch having a first open position and a second closed position, whereby movement of microphone from said first open position to said second closed position activates said phone, and whereby movement of microphone from said second closed position to said first open position deactivates said phone.

50. The process of Claim 32, further comprising the step of:

automatically transmitting said airtime identifier from said keyless portable wireless phone to said system server to establish communication when said keyless portable wireless phone is activated.

51. The process of Claim 43, wherein said keyless portable wireless phone includes pager circuitry having a pager identifier.



52. The process of Claim 51, further comprising the steps of:
storing incoming calls from a public switched telephone network in said
system server; and
5 sending an incoming call paging signal to said pager circuitry at said
keyless portable wireless phone.
53. The process of Claim 32, further comprising the steps of:
receiving an incoming call to said keyless portable wireless phone at said
10 system server;
controllably forwarding said received incoming call to one of a group of
appropriate receivers consisting of the group including a voice mail receiver, a call
back number receiver, and a call hold receiver;
upon connection of said keyless portable wireless phone to said system
15 server, prompting said keyless portable wireless phone regarding said
controllably forwarded said received incoming call; and
selectively forwarding said keyless portable wireless phone to said
appropriate receiver.
54. The process of Claim 52, wherein said pager circuitry includes an incoming
20 call signal.
55. The process of Claim 32, wherein said energy storage is rechargeable.
56. The process of Claim 32, wherein said energy storage is a single use
25 energy supply.
57. The process of Claim 32, wherein said energy storage is located within
said airtime cartridge.
30
58. The process of Claim 32, wherein said airtime cartridge is replaceable.
59. The process of Claim 32, further comprising the step of:
receiving information at said system server from an external source.
35
60. The process of Claim 59, wherein said received information is stored on
said system server.



61. The process of Claim 60, wherein said information is an address book database.

5 62. The process of Claim 32, further comprising the step of:
marking each of said transmitted algorithmically generated pre-paid single
use airtime communication units as used at said keyless portable phone.

10 63. The process of Claim 32, further comprising the step of:
determining first activation for said airtime cartridge.