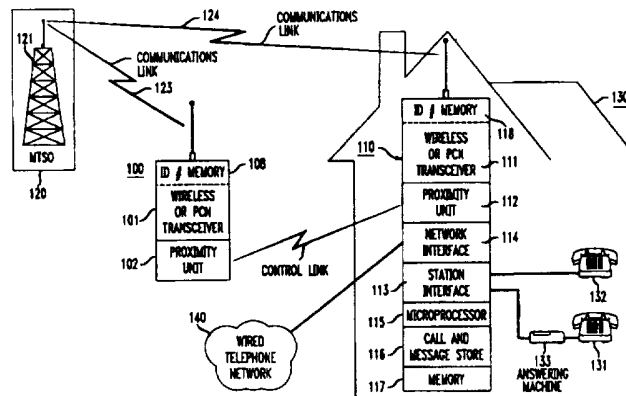




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(54) Title: MOBILE TELEPHONE CALL HANDOVER AND IMPERSONATION



(57) Abstract

One communications device (called the "impersonating" device) (110) can selectively impersonate another communications device (called the "impersonated" device) (100) by arranging the impersonating device (110) to take over and/or use the same network identification number (typically stored in an identification number (108) memory and used to control selection of incoming calls to which the device responds) normally associated with the impersonated device (100). As a result of impersonation, there is a hand-off between the devices, with the impersonated device (100) becoming dormant and the impersonating device (110) becoming active, such that calls normally received by the impersonated device (100) are received by the impersonating device (110), and such that calls originating in the impersonating device (110) get the identical network treatment as would be accorded to calls originated by the impersonated device (100), all of this without any need to adjust or update profiles stored in a network database. Impersonation can be triggered automatically, as by the physical proximity (102, 112) of one terminal device to the other, or manually, such as by pushing a button on one of the devices.

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MOBILE TELEPHONE CALL HANDOVER AND IMPERSONATION

Technical Field

This invention relates generally to an apparatus and method for
5 originating or completing mobile (e.g. cellular or wireless) telephone calls, and,
in particular, to origination or completion of such calls through impersonation
wherein one terminal device (such as a transceiver in a base station) takes over
and/or uses the network identification number normally associated with another
device (such as a car phone or personal cellular communication device) as a
10 result of a hand-off between the devices.

Background Of the Invention

Various schemes have been devised to allow telephone calls directed to a
called party's personal telephone number to be completed to one of several
telephones, depending upon the current location of the person. The notion of a
15 personal number, not associated with a fixed location, but rather with an
individual, is explained in Patent 4,313,035 issued to D.S. Jordan et al. on
January 26, 1982, and generally requires that calls to the personal number be
routed to a database, where the person's profile is retrieved. The call is then
completed to the "then current" number in the profile. Updating of the profile
20 can be accomplished in various ways, such as explained, in Patent 5,243,645
issued to E. P. Bissell et al. on September 7, 1993. AT&T's Easy Reach[®]
telecommunications service also makes use of individual profiles to assist in call
completion.

The updating of profiles stored in a central database so that calls can be
25 rerouted can be inefficient, because of the expense of maintaining the database
and the delay associated with formulating and transmitting an update message
to the database before rerouting becomes effective, and the further delay
resulting from the need to consult the database for each incoming call before
routing can be completed.

30 Additionally, with respect to outgoing calls, the notion of a personal
telephone number would conflict with sharing of terminals, typically wireless or
cellular telephony devices, that self-identify themselves to communication
networks.

Summary of the Invention

The problems experienced in the prior art are overcome in accordance with the present invention by arranging one communications device, called the "impersonating" device, to selectively impersonate another communications
5 device, called the "impersonated" device. Impersonation is accomplished by arranging the impersonating device to take over and/or use the same network identification number normally associated with the impersonated device; the network identification number is typically stored in an identification number
10 memory in the impersonating device and controls selection of incoming calls to which the impersonating device responds, as well as the handling of outgoing calls made through the impersonating device. As a result of this impersonation, there is a hand-off between the devices, with the impersonated device becoming dormant and the impersonating device becoming active, such that calls normally received by or initiated by the impersonated device are received by or initiated
15 by the impersonating device, all of this without any need to adjust or update profiles stored in a network database. Impersonation can be triggered automatically, as by the physical proximity of one terminal device to the other, or manually, such as by pushing a button on one of the devices.

Impersonation accomplishes two principal functions: first, with respect to
20 incoming calls, calls destined for the impersonated communications device (e.g., a mobile cellular telephone), which is rendered dormant during impersonation, can then be received by the impersonating communications device itself, or by terminal equipment connected to the impersonating communications device. This effectuates a type of call forwarding that does not depend upon any changes
25 being made within the telephone network. Second, calls originating in terminal equipment (e.g., home telephones) connected to the impersonating communications device can advantageously be routed via alternative networks, i.e., either the conventional wired network, or via a wireless network, based upon a choice made by the call originator. This permits calls from stationary
30 equipment to be billed as, and to enjoy, the rate structure and customer profiles of calls made on the wireless network. Additionally, because wireless systems routinely use self-identifying terminals, while traditional wireline systems do not, wireless terminals using impersonation naturally and easily accommodate personal communications for multiple users sharing a common impersonating
35 terminal or base station device.

In accordance with one embodiment of the present invention, a first communications device is "stationary" and a second communications device is "mobile". The stationary device, sometimes called a "base station", includes a transceiver that impersonates or assumes the network identity of a mobile
5 transceiver (such as a cellular car phone or personal communications terminal) when the mobile transceiver travels to within a predetermined distance from the base station. Impersonation occurs by duplicating the network identification numbers contained in the identification number memories of the devices, so that both devices would respond to the same telephone calls, when in an active state.
10 Impersonation is triggered when control signals are transmitted between proximity units contained in both devices, rendering one device dormant and the other active. While impersonation is in effect, incoming wireless telephone calls or messages addressed to or destined for the mobile transceiver are instead received in the base station transceiver, and are routed to terminal equipment
15 that may also be connected to the conventional (i.e., wired) telephone network. Accordingly, the same terminal equipment can receive both conventional calls as well as wireless calls that are received by virtue of impersonation.

With respect to outgoing telephone calls, when impersonation has been effected between the mobile transceiver and the base station, calls originated in
20 the terminal equipment connected to the base station can be routed (a) conventionally, via the wired telephone network, or (b) alternatively, via the transceiver in the base station directly to facilities of a mobile telephone network provider. In this way, a user of the present invention is provided with a means of obtaining "alternate access" in making outgoing calls, so that the wired
25 telephone network can be bypassed and a wireless network used instead. Even when impersonation has not been effected, originated calls can be routed through the base station transceiver (and not the wired network), provided that an additional network identification number is available for use; this avoids the possibility that outgoing calls will interfere with other calls being handled in the
30 mobile transceiver at the same time.

Optionally, in accordance with one aspect of the present invention, if calls made to the impersonating device are not answered, such calls can be
(a) stored in a message storage facility contained in the base station itself, or (b)
35 forwarded through the base station to another stand-alone device with answering and storage capability.

In accordance with yet another aspect of the present invention, outgoing calls can be made using the identification number, and thus the "personality" of the mobile device, or, alternatively, can be based upon other stored identification numbers, so that the transceiver can be controlled to appear to the network as a
5 distinct or separate device with respect to outgoing calls. This functionality is particularly useful in associating network based profiles and classes of service that might ordinarily pertain to the mobile device, with the stationary device when it is impersonating the mobile device.

In accordance with yet another aspect of the present invention, a set of
10 mobile devices may impersonate each other for use, for example, by a group of people that share them in the course of their normal work activities.

In accordance with yet another aspect of the invention, the impersonation functionality is automatically suspended when the mobile device is removed
15 from proximity to the stationary device, such as when the person moves away from the home.

Brief Description of the Drawing

The present invention will be more fully appreciated by consideration of the following Detailed Description, which should be read in light of the accompanying drawing in which:

20 Fig. 1 is a block diagram illustrating one embodiment of the present invention in which a first communications device located within a building is made to impersonate a second communications device that is mobile;

Fig. 2 is a block diagram illustrating the arrangement of base station 110 of Fig 1;

25 Fig. 3 illustrates the process performed in microprocessor 115 in base station 110 by which impersonation is accomplished;

Fig. 4 is a block diagram illustrating the arrangement that may be used in transceiver 111 of Figs. 1 and 2 when more than one portable device is impersonated;

30 Fig. 5 is a block diagram illustrating an application of the present invention in the context of a hotel or office building in which a plurality of devices are impersonated, and calls are selectively routed to appropriate terminal devices in response to calls placed to the impersonated devices;

35 Fig. 6 is a diagram illustrating an arrangement in which multiple communications devices can selectively impersonate one another; and

Fig. 7 illustrates one embodiment of a process by which calls can be originated using the system of Figs. 1 and 2, such that the caller is given a choice with respect to the method of network access that is used, i.e., routing via wired network 140 or via the wireless network.

5 **Detailed Description**

Referring first to Fig. 1, there is shown a block diagram illustrating the overall arrangement of one embodiment of the present invention by which a first communications device, namely a wireless or PCN transceiver 111 in a base station 110 is made to impersonate a second communications device, namely a
10 wireless or PCN transceiver 101 that is part of a mobile cellular telephone 100. Each transceiver includes an identification number memory, which contains an identification number that is used by the transceiver to select or identify incoming calls or other communications intended for that transceiver, and to also identify outgoing calls or other communications originated from that transceiver.
15 For the purposes of the ensuing discussion, it is assumed, unless otherwise stated, that the identification number stored in the identification number memory 108 within transceiver 101 is the same as the identification number stored in the identification number memory 118 within transceiver 111, so that
20 both transceivers would respond to the same incoming telephone calls, if both transceivers were active at the same time and both were within range of the transmitter that broadcasted the calls and accompanying identification number. The duplication of identification numbers can be accomplished in various ways, such as by manufacturing and distributing transceivers 101 and 111 as "matched sets", by providing transceivers with the capability of storing and selectively
25 using one of several identification numbers, as discussed in connection with Fig. 4, by allowing for the remote entry of identification numbers in the identification number memories through signaling via control links between the transceivers, or in many other ways that will be apparent to those skilled in the art.

When a person using mobile cellular telephone 100 is within a
30 predetermined distance from building 130 in which base station 110 is located, and therefore wishes to receive incoming calls placed to mobile cellular telephone 100 on telecommunications terminals such as terminals 131 or 132 in building 130, a proximity unit 112 in base station 110 is arranged, in accordance with our invention, to communicate with an associated proximity unit 102 in
35 mobile cellular telephone 100, so as to trigger or begin the impersonation

process. The communications between proximity units 102 and 112 can be carried on a control link, which may be a relatively short range radio channel that is separate from the channel used for cellular or wireless communication itself, such as the radio channel currently used in wireless telephones to enable
5 the exchange of control information (paging, on-hook and off-hook signaling) between a wireless telephone handset and the wireless telephone base unit. Proximity may be determined simply by comparing the strength of the signals received on this control link to a preset threshold, or in other ways such as by computing the time delay between transmission of a control signal by one
10 proximity unit and receipt of an acknowledgment from the other proximity unit.

When impersonation is triggered by the proximity of mobile cellular telephone 100 to base station 110, transceiver 101 becomes dormant and transceiver 111 becomes active. Voice calls or data messages transmitted from a conventional mobile telephone switching office (MTSO) 120 via an associated
15 transmitting antenna 121 that contain the identification number of, and thus are addressed to, mobile cellular telephone 100, can be received via over-the-air communications links 123 and 124 both by transceiver 101 as well as by transceiver 111 in the base station 110, since both transceivers are near each other and thus will receive the same signals. However, because impersonation is in
20 effect, and transceiver 101 is thus dormant, the ringer or paging unit contained therein is not triggered. Concurrently, upon receipt of the same call in transceiver 111, the control program in base station 110 is activated, so that the call can be routed through a station interface 113 in base station 110 to one of the telecommunications terminals 131 or 132 (which may be ordinary telephones) in
25 building 130. Communication from transceiver 111 to the terminals 131 and 132 can be either by a wired or wireless connection, using conventionally available equipment. If desired, a terminal may be "built in" to base station 110. Base station 110, which is described in more detail below in conjunction with Fig. 2, is also arranged to perform various call distribution functions, under the overall
30 control of a microprocessor 115.

With respect to incoming calls, it is seen from the foregoing description that even though a caller (in a voice call) or a sender (in a data call) placed a call or addressed a message to the number assigned to mobile cellular telephone 100, the call is ultimately received by terminals 131 or 132, which, if they are
35 telephones, are arranged to simply ring and be answered normally. If certain calls placed through base station 110 to these telephones is not answered, those

calls can be delivered and either held in a call/message storage facility 116 optionally built into base station 110, or be forwarded through base station 110 to answering machine 133 having conventional answering and message storage capability.

5 In the embodiment of Fig. 1, outgoing calls made from terminals 131 or 132 may be routed from base station 110 through network interface 114 to the wired telephone network 140 as conventional calls. Alternatively, since
10 transceiver 101 in mobile cellular telephone 100 is dormant (and thus not in use), outgoing calls can be transmitted as cellular calls by transceiver 111 in base station 110. These outgoing calls can be made using the identification number and thus the "personality" of mobile cellular telephone 100, or, alternatively, can be based upon other identification numbers that can be (a) stored in
15 identification number memory 118 in transceiver 111, or (b) stored in a memory unit 117 in base station 110, and downloaded to memory 118 as appropriate. In this way, transceiver 111 can be controlled to appear to the cellular telephone network and MTSO 120 as a distinct or separate device with respect to outgoing calls. This functionality is particularly useful in associating network based profiles and classes of service that might ordinarily pertain to one mobile device, with stationary transceiver 111 when it is impersonating transceiver 101.

20 When mobile cellular telephone 100 is removed from proximity to base station 110, the impersonation functionality may be automatically suspended, by the transmission of, or interruption of, suitable signals on the control link between proximity units 102 and 112. At that point, mobile cellular telephone 100 would recover full functionality. Alternatively, a user of the system may
25 disable transceiver 111 and re-enable transceiver 101 manually, by using suitable over-ride switches provided on the devices themselves.

It is to be noted here that transceivers 101 and 111 can include conventional components found in (a) a cellular telephone that is in a vehicle or is designed and intended to be transported by an individual, (b) a personal
30 digital assistant, such as Apple Computer Company's "Newton" or (c) a wireless (PCN) terminal such as has been described in many publications, such as Moving Toward a Wireless InfraStructure, Computer World, October 11, 1993, page 51; Why Wait of PCS? Personalized Portable Telephone Services are Here Today, Telecommunications, March, 1994, page 41; Wireless Data: Closing the Gap
35 Between Promise and Reality, Telecommunications, March, 1994, page 25. The transceiver interacts with the associated proximity unit such that the transceiver

can be turned off (made dormant) or turned on (made active) remotely, i.e., on command from the proximity unit. The details of the control provided by proximity units 102 and 112 over respective transceivers 101 and 111 will be apparent to those skilled in the art. Furthermore, it is to be understood that
5 manual "ON" and "OFF" controls may be provided, as an over-ride of the automatic control provided by the proximity units, or as an alternative thereto.

Referring now to Fig. 2, there is shown a block diagram illustrating the arrangement of base station 110 of Fig 1. At the heart of base station 110 is microprocessor 115, which operates in accordance with program instructions
10 stored in an associated memory 117. The principal operating process performed in microprocessor 115 is illustrated in Fig. 3, which is discussed below.

Various call distribution functions are performed in base station 110 under the overall control of microprocessor 115. The functions include (a) directing calls received in transceiver 111 to terminal equipment (e.g., terminals 131, 132 of
15 Fig. 1) ; (b) directing conventional telephone calls to and from wired telephone network 140 to the terminal equipment; (c) and directing certain calls made in the terminal equipment (e.g. terminals 131, 132) to transceiver 111 rather than to wired telephone network 140, so as to achieve an alternative access arrangement. These functions are performed in a switch 200, which receives control inputs
20 from microprocessor 115 on control line 250. Switch 200 can be thought of as a "mini-PBX", since it provides both the switching and call control functionality normally provided by a private branch exchange, but only in the context of several lines, rather than a large number of lines. It may be implemented using one of AT&T's small office key-telephone systems, such as the Merlin[®]
25 electronic key telephone system, or the AT&T Home Network Controller available from AT&T Paradyne.

Integral to switch 200 are station interface 113 and network interface 114, which respectively interconnect switch 200 to the terminal equipment (such as terminals 131,132) and the wired network 140, respectively. The functions
30 performed by these interfaces are largely conventional, and include assuring that (a) incoming calls delivered via network 140 are connected, through the switching fabric of switch 200, to available terminal equipment, or otherwise to a call and message store 116 that is connected to switch 200, and (b) outgoing calls originated in terminal equipment are connected through the switching fabric to
35 an available circuit connection to network 140. In addition to the foregoing, switch 200 further includes a communication interface 201, that interconnects

switch 200 and its switching fabric, via communications line 220, with transceiver 111, so that (a) incoming wireless calls received "over the air" when transceiver 111 is active can be connected, through the switching fabric of switch 200, to available terminal equipment, or otherwise to a call and message store 116 that is connected to switch 200, and (b) outgoing calls originated in terminal equipment can be, if desired, connected through the switching fabric to transceiver 111, so that these calls can be transmitted as wireless calls, rather than wired calls.

It is to be noted here that station interface 113 can implement wired or wireless communication, or a combination thereof, between switch 200 and terminals 131,132, depending upon the capabilities of the terminal equipment itself. For example, station interface 113 can include the capabilities of a conventional cordless base station, and one or more of the terminals 131, 132 can include the capabilities of a conventional cordless handset that can communicate with the base station. Furthermore, other communications devices, such as portable computers, facsimile machines, modems, set top boxes, cordless telephones, etc., may be similarly connected, via appropriate station interfaces, to base station 110, and can be used singly or in combination as terminals 131,132. It is also to be noted that network interface 114 can be arranged to not only connect switch 200 to wired network 140, but also to interconnect switch 200 with (a) a cable communication network, such as a described in Patent 5,343,240 issued to C. Yu on August 30, 1994, (b) an optical communication network, or (c) any other type of commercially available communication network. These diverse networks can be used singly or in combination with each other.

In addition to providing control signals to switch 200 via control line 250, microprocessor 115 also controls various native functionalities associated with transceiver 111 via a control signal provided on control line 240. These functionalities are typically present in a conventional cellular telephone, and the details of their implementation will be understood by those skilled in the art. The functions are accordingly diagrammatically represented in Fig. 2 as an activate/deactivate function 211, a detect call function 216, an answer call function 212, a make busy function 213, a hang-up function 214, and a dial call function 215, each of which is used in the process illustrated in Fig. 3.

When the activate function 211 is used, transceiver 111 is "turned on", so that incoming calls addressed to a device with an identification number that matches the identification number then being used in the transceiver will be detected and received. The deactivate function is used to turn off transceiver

111, so that it no longer responds to calls, even those normally intended for that device. Typically, the activate function is invoked when signaling between proximity units 102 and 112 indicates that mobile cellular telephone 100 is within a predetermined distance with respect to base station 110, and the deactivate function is invoked when signaling between proximity units 102 and 112 indicates that, after being invoked, mobile cellular telephone 100 is thereafter further than the predetermined distance with respect to base station 110. In base station 110, proximity, or lack thereof, is communicated from proximity unit 112 to microprocessor 115 via a signal on control line 230.

Alternatively, as previously explained, a manual over-ride may be provided to invoke the activate and/or deactivate functions in response, for example, to actuation of a control button. Those skilled in the art will appreciate that other criteria and methods may be used for triggering proximity units.

Answer call function 212, when activated, causes transceiver 111, when in the activated state, to answer an incoming wireless call and couple it to communications interface 201 of switch 200, so that the call can be extended to the appropriate terminal equipment, which will then begin to alert or ring. Until an incoming call is answered in transceiver 111 by receipt of a signal invoking the answer call function, the call is held in transceiver 111 such that the caller is aware that the call has not yet been answered. When an ongoing call is completed, and the terminal equipment to which the call was connected hangs up or otherwise terminates the call, this condition is sensed in microprocessor 115, invoking hang-up function 214 in transceiver 111.

Detect call function 216 is performed in transceiver 111 when in the activated state, and allows microprocessor 115 to begin a timing process if unanswered calls are to be routed to call and message store 116. At the appropriate time, after receipt of an incoming call is detected, microprocessor 115 may signal transceiver 111 to invoke answer call function 212, and concurrently signal switch 200 to forward the call to call and message store 116 rather than to the terminal equipment. As previously stated, similar functionality can alternatively be achieved using a conventional answering machine 133.

Make busy function 213 is provided in transceiver 111 in the event that all of the terminal equipment is otherwise in use, as might be the case when outgoing calls have been placed using wired network 140, and it is not desired to offer the caller the opportunity to leave a message. In this event, transceiver 111 will provide a suitable signal to the calling party indicating a busy condition.

Note here that in the just described circumstances, the calling party may desirably be unaware that impersonation has occurred, but rather may believe that a call to transceiver 101 could not be completed because that device was already in use. Alternatively, base station 110 may be arranged to provide "call
5 waiting" functionality with respect to both wired and wireless telephone calls, such that, when all terminal equipment is busy, an incoming call is held in switch 200 and the persons currently engaged in communication are advised that another call has arrived and is waiting to be answered.

Dial call function 215 is used with respect to outgoing calls made from
10 terminal equipment connected to base station 110 when such calls are placed through transceiver 111. In this event, the terminal equipment signals microprocessor 115 through a signal communicated via station interface 113 and control line 250, and microprocessor invokes dial call function 215 through a
15 signal communicated via control line 240. Dialed number information is passed to transceiver 111 as needed, and a call is initiated. The communications path for such an outbound call extends from the terminal equipment through station
interface 113 and switch 200 to transceiver 111 via communications line 220.

As mentioned previously, memory 117 may be used to store program
instructions that control the operation of microprocessor 115. In addition, it may
20 also store one or a plurality of network identification numbers that are used by transceiver 111 when it makes and receives calls. Summarizing what has already been described, in accordance with one aspect of the present invention, impersonation may be achieved by storing the SAME identification number in
identification number memories 108 and 118 in both transceiver 101 and in
25 transceiver 111, respectively, and by activating only one transceiver while rendering the other dormant or inactive. This impersonation is particularly well suited in dealing with incoming calls, because the impersonation capability allows calls addressed to a particular physical device (e.g., a portable cellular
telephone) to be received and answered in other physical devices (e.g., terminals
30 131,132). However, several physical devices may be impersonated by a single base station, if desired, and this arrangement is discussed in more detail in connection with Fig. 4.

With respect to outgoing calls, impersonation may also be particularly
useful when such calls can be made using any one of several different
35 identification numbers. This is because each of the different numbers can be associated with a different caller profile maintained for example, by the wireless

H. Aldermeshian 1-3-3-1

service provider in a database accessed from MTSO 120 of Fig. 1, so that different and customized functions can be offered to callers using the various profiles. For example, each profile may have a different speed dialing list for outgoing calls; each profile may have different billing treatment; and each profile may require
5 inter-exchange calls to be carried by different long distance carriers. If desired, each identification number may correspond to a particular user's own personal telephone number.

To accommodate the multiple impersonation capability just described, stored identification numbers contained in memory 117 may be accessed by
10 microprocessor 115 at appropriate points in the control process. This is discussed more fully in connection with Figs. 4 and 5.

From the foregoing description, it can be seen that base station 110 of Fig. 2 can be thought of as a hub for a centralized narrow band communication system within the building 130, and a hub for connecting that narrow band
15 system with several different access systems, including copper-based, cable-based, and wireless cellular and/or personal communication networks.

The process performed in microprocessor 115 in base station 110 by which impersonation is accomplished is illustrated in Fig. 3. Once the process is started in step 300, a determination is first made, in step 301, as to whether or
20 not "proximity exists", typically meaning that mobile cellular telephone 100 is within a predetermined distance from base station 110, or that a user of the system has entered an over-ride command causing impersonation to occur. As stated previously, proximity units 102 and 112, by cooperating with each other and exchanging control signals, will normally make the proximity
25 determination. Note here that various other hand-off protocols can be used, depending upon the specific implementation of the present invention. For example, if mobile cellular telephone 100 is a cellular car telephone, proximity may be detected simply by the fact that the car in which mobile cellular telephone 100 is located is turned off; if mobile cellular telephone 100 is a
30 portable unit, proximity may be detected only when mobile cellular telephone 100 is carried into the user's home.

If proximity is found to exist, and a positive result is thus obtained in step 301, a series of steps is next performed to assure that impersonation does not occur if mobile cellular telephone 100 is currently in use on a call. This is
35 advantageous, since when impersonation is invoked, transceiver 101 becomes dormant or inactive, and any ongoing calls may be interrupted. Specifically, in

step 305, a status request message is transmitted from base station 110 to mobile cellular telephone 100, requesting a return message, received in step 307, indicating whether or not transceiver 101 is presently in use. If a positive result is detected in step 309, the impersonation is deferred by causing the process to wait for a predetermined time in step 311 before repeating steps 305, 307 and 309. When the status message received in step 307 indicates that transceiver 101 is not in use, a negative result occurs in step 309, and the process advances to step 313. Note here that the exchange of status request and status reply messages can be performed in accordance with numerous specific different implementations which will be apparent to those skilled in the art. For example, signaling such as that found between a cordless telephone base and cordless telephone handset can easily be used to transmit messages between base station 110 and mobile cellular telephone 100.

If a negative result is reached in step 301, this may indicate that impersonation, if previously activated, should be suspended, since transceiver 101 is no longer near transceiver 111. In this event, a signal is communicated to base station 110 in step 303, to invoke deactivation function 211. Thereafter, the process returns to step 301.

Continuing with the previous explanation, following a negative result in step 309, impersonation of transceiver 101 by transceiver 111 is caused to occur in step 313, by de-activating transceiver 101 and activating transceiver 111, using activate function 211. Transceiver 111 remains thereafter in a ready status in step 315, awaiting the receipt of an incoming call addressed to the identification number contained in memory, which, as stated previously, is the same as the identification number contained in identification number memory 108. Until an incoming call is detected in step 317, a negative result occurs in that step, and therefore step 315 is periodically repeated.

When a call to transceiver 111 is detected in step 317, call detect function 216 is invoked in step 318, so that, as stated previously, a timing process, not shown, can be started. This timing process is useful in determining how to process an incoming call if it is not answered within a predetermined time period. If desired, when the predetermined time period expires without an answer, the call may be routed by 200 to call and message store.

Assuming that the timing process is continuing, a determination is next made, in step 319, as to whether terminal equipment is available to "answer" the incoming call. This is necessary because the terminal equipment may already

be busy in connection with calls on other lines. If a negative result occurs in step 319, a determination is next made in step 320 as to whether call storage is desired. A call and message storage option may be selected by a user during the process by which microprocessor 115 is programmed, and requires that call and message store 116 is available. If a positive result occurs in step 320, then the call is connected by switch 200 to call and message store 116 in step 322, and the answer call function 212 is invoked, so that the call received in transceiver 111 is connected through communications interface 201 and switch 200 to call and message store. On the other hand, if a negative result occurs in step 320, then the call cannot be answered, so that make busy function 213 is invoked, alerting the caller that the call should be tried again at a later time.

If the result in step 319 is positive, indicating that the incoming call can be completed to available terminal equipment, answer call function 212 is invoked in step 323, and the call is routed from transceiver 111 through 210 and switch 200 to the available terminal equipment, which rings and is answered normally. Monitoring is then performed, in steps 325 and 327, to determine if the ongoing call is complete. If not, a time delay is introduced in step 327, and the process is repeated. When a positive result occurs in step 325, hang-up function 214 is invoked in step 329.

It is to be noted here that the process of Fig. 3 is illustrative only, and that persons skilled in the art will appreciate that various different functions pertaining to call control can be added and/or enhanced, as desired. These additions and/or enhancements are made depending upon the specific configuration and capabilities of switch 200 and the capabilities of the terminal equipment being used.

One embodiment of a process by which calls can be originated using the system of Figs. 1 and 2, such that the caller is given a choice with respect to the method of network access that is used (i.e., routing via wired network 140 or via the wireless network), is illustrated in Fig. 7. The process begins in step 701, when terminal interface 113 detects an off hook condition in any of the terminal equipment connected thereto. In step 703, the caller is prompted for (or otherwise provides) the called number, and optionally, information indicating the type of access that the caller desires. This information is received by terminal interface 113 and transmitted, in step 705, to microprocessor 115. If the access type was given explicitly, that information is passed to the appropriate interfaces and switch 200 in base station 110, in step 707. Alternatively, the access type can

be determined by a database look-up, by consideration, for example, of the called number in conjunction with stored information in memory 117, in order to determine which type of access is preferable at the time that the call is being made, for that particular called number. In yet another alternative, the access
5 decision-making may involve direct signaling that queries database and processing facilities reachable through the wireless access network.

In any event, after the access mechanism is selected in step 707, a determination is made in step 709 as to whether wireless access was selected. If not, the call is completed in the conventional manner in step 711, such that the
10 call is routed over wired network 140 using network interface 114. If wireless access was selected, dial call function 215 is invoked in step 713, and the dialed number, collected in step 703, is forwarded to transceiver 111 in step 715, so that the call may be initiated as a wireless call.

While the present invention has generally heretofore been described in
15 connection with a telephone call, which is one example of a "narrow band" application, it is to be understood that impersonation, as contemplated in accordance with the present invention, can be also applied in the context of a multi-mode and/or a "broad band" application, such as applications involving video and data devices. In a multi-mode embodiment, devices capable of
20 handling several types of calls (i.e., devices that permit both voice and data operation) might switch from one mode to another in step 313, instead of becoming dormant or inactive.

Referring now to Fig. 4, there is illustrated an arrangement that may be used in transceiver 111 when more than one other device is impersonated. In
25 Fig. 4, identification number memory 118 stores the identification numbers of several portable devices (such as cellular telephones). When any call is received in transceiver 111, the identification number of the device being called is captured, in a conventional fashion, in identification number receiver 401 and coupled, on a temporary basis, to buffer 403 until processing is complete. The contents of buffer 403 are applied to a first input of comparator 405 for a
30 predetermined time interval, and then cleared, in anticipation of receipt of the next identification number representing a different call.

The second input to comparator 405 is provided by identification number memory, which is controlled by a sequencer 409 so that the individual
35 identification numbers stored therein are output, one at a time. If any one of the numbers stored in memory 118 matches the number in buffer 403, a positive

output from comparator 405 provides a signal to control actuator 407, indicating that the incoming call was directed on one of the portable devices being impersonated. The output of actuator 407, together with information from sequencer 409, can then be used to answer the call and route it to appropriate terminal equipment intended to impersonate the particular portable device to which the call was originally addressed.

The arrangement illustrated in Fig. 4 is particularly useful in the context illustrated in Fig. 5, which is a block diagram of an application of the present invention in multiple unit building, such as a hotel or office building. In this embodiment, a plurality of portable devices 501, such as portable cellular telephones, are impersonated, and calls to any of the impersonated devices are selectively routed to appropriate terminal devices 531, such as telephones in different rooms, in response to calls placed to the impersonated devices 501. In this embodiment, base station 510, which includes the capabilities of a PBX that might normally be found in a hotel or office complex, is interconnected with a conventional computer-based processor 520 that contains information (a) relating to the arrangement of the terminal devices in the hotel or office building, and (b) information that associates particular users and their mobile device identification numbers to particular units (rooms) within the building. The transceiver in base station 510 is provided with a multi-channel capability, and contains an identification number memory into which have been loaded the identification numbers for the plurality of portable devices 501 whose users desire to have calls received through impersonation when the users are in the hotel or office building.

Impersonation, with respect to any particular one of the devices 501 may be triggered by proximity, as previously described, or alternatively by entering information into 520, such as when a guest having a portable phone checks into or returns to a hotel. When impersonation is in effect, and a call is received in base station 510, all of the then active identification numbers in the identification number memory are checked, in sequence, in the manner described in connection with Fig. 4. If an actuation signal is generated by control actuator 407, indicating a positive match, information from 520 may be obtained, in order to determine, for example, in which room a particular guest is registered. This information is passed to 510, allowing the incoming call to be routed to the appropriate terminal equipment.

By virtue of this embodiment of the present invention, a hotel can, for example, offer its guest the ability to continue to receive calls placed to their portable cellular telephones, while the guests are located in their rooms. This avoids the need to use a personal communication device within the hotel, since that device might be unable to function properly because of interference by the building structure. It also makes personal profile information pertaining to each user of mobile devices 501 available with respect to calls originated from their terminal devices 531. In the arrangement of Fig. 5, the hotel needs no special services bought from communication networks, but needs only to install a base station 510 arranged, in accordance with the invention, with multiple channel capability for simultaneously impersonating several mobile communication devices. Because base station 510 handles multiple calls concurrently, it cooperates with processor 520, thereby providing the ability to look up the room number of the called device's owner by means of a table in its data processing system. Note that a similar arrangement to that depicted in Fig. 5 can be used in a hospital, shopping center, theater, office building, etc.

The embodiment illustrated in Fig. 5, as well as other arrangements utilizing the present invention, can raise issues regarding security, since it is contemplated that one transceiver will use the identification number normally associated with another transceiver, and that the impersonating transceiver can abuse or misuse the intended capabilities. This can be prevented in a number of ways. First, in the arrangement of Fig. 5, portable devices 501 may have to be surrendered or plugged into base station 510, in order to render impersonation effective. If a physical connection was required, the identification number residing in a portable device could be automatically transferred to and stored in the identification number memory contained in the base station, and there would be no requirement for a proximity unit. Alternatively, or in addition, a separate authenticator, possibly in the form of a credit card or "smart card" device, would supplement or substitute for the mobile communication device itself.

Second, as with present cellular telephone equipment, the identification numbers could be entered and stored in such a way that they are not accessible by the average user, and require special equipment that can be accessed and programmed only by professionals (e.g., dealers) having the appropriate security clearance as well as the appropriate programming system.

Finally, it is to be noted that the unauthorized proliferation of identification numbers must be prevented by users themselves, in the same manner as credit card numbers and other valuable information is guarded today.

Referring now to Fig. 6, there is shown an arrangement in which multiple communications devices 600, 610 and 620, which can all be portable, can selectively impersonate one another. Each of the devices 600, 610, 620 is located in an area 640 in which wireless communications is provided by an MTSO 650 that, for example, broadcasts via an over-the-air link 652 using antenna 651. Each of the devices 600, 610, 620 includes a respective wireless transceiver portion, 602, 612 and 622, which enables two-way communication between the device and remote parties via communications routed to and from the device using MTSO 650. Each of the devices 600, 610, 620 includes a respective identification number memory 601, 611, 621 in which can be stored either (a) a different identification number, uniquely identifying each particular device, or (b) selectively, the same identification number as that ordinary used by another device, so that, in the latter event, one device can impersonate another. Control of the identification number contained in identification number memory 601, 611, 621 is maintained by respective control/proximity units 603, 613 and 623 in each device, which may be arranged to perform functions similar to those described above in connection with proximity units 102 and 112. Additional control functionality is described below.

Using the arrangement of Fig. 6, one of the communications devices 600, 610 and 620 can be "paired" with another one of the devices, so that either one of the devices can impersonate the other. Impersonation can be triggered by physical proximity of the devices, when they are within a predetermined distance from each other, as heretofore explained. Additionally, control functionality incorporated into control/proximity units 603, 613 and 623 can provide for signaling between devices, via control links, to enable entry of selected pre-stored identification numbers into the appropriate identification number memory 601, 611, 621. This will, for example, allow a user of one device to relinquish call receiving ability to another device. Alternatively, one device may relinquish control to the "next" device in a pre-fixed sequence. This functionality would be useful when, for example, the leader of a group of field repair personnel is incapacitated or busy. The leader might then effectively transfer incoming communications on her or his device to another person's

device, if it is nearby. If no other devices are located in area 640 to accept the transfer, an incoming call is simply not answered.

Persons skilled in the art will appreciate that various modification and adaptations may be made of the present invention. Accordingly, the invention
5 should be limited only by the appended claims.

What is claimed is:

1 1. A system for completing wireless telephone calls, comprising
2 first and second transceivers arranged to originate and receive wireless
3 telephone calls,
4 means for determining that said first transceiver is in close proximity to
5 said second transceiver; and
6 means responsive to said determining means for altering the operation of
7 each of said first and second transceivers so that calls directed to and normally
8 answered by said first transceiver are completed to said second transceiver.

1 2. A system for originating wireless telephone calls, comprising
2 first and second transceivers arranged to originate and receive wireless
3 telephone calls,
4 means for determining that said first transceiver is in close proximity to
5 said second transceiver; and
6 means responsive to said determining means for altering the operation of
7 each of said first and second transceivers so that calls normally originated by
8 said first transceiver are originated by said second transceiver as though they
9 were made by said first transceiver.

1 3. The system defined in claim 1 or claim 2 wherein
2 each of said transceivers has an active state and a dormant state; and
3 said altering means is arranged to switch said first transceiver from said
4 active state to said dormant state and to switch said second transceiver from said
5 dormant state to said active state.

1 4. The system defined in claim 1 or claim 2 wherein each of said
2 transceivers includes an identification number memory for processing calls
3 originated or received by said transceivers when in said active state in
4 accordance with a stored identification number; and
5 wherein an identification number stored in said identification number
6 memory in each of said transceivers is the same.

1 5. The system defined in claims 1 or 2 wherein each of said transceivers
2 includes means for storing a plurality of network identification numbers and
3 control means for selectively using particular ones of said identification numbers
4 in said identification number memory.

1 6. The system defined in claim 5 wherein said control means is arranged
2 so that only one of said transceivers is allowed to use any of said identification
3 numbers at any time.

1 7. The system defined in claims 1 or 2, wherein said first transceiver is
2 portable and said second transceiver is stationary.

1 8. The system defined in claim 7 wherein said second transceiver is
2 connected to terminal equipment arranged to receive calls placed over a wired
3 telephone network.

1 9. The system defined in claim 1 or claim 2 wherein
2 said first and second transceivers are cellular telephones,
3 each of said cellular telephones include a memory for storing an
4 identification number to which said cellular telephone responds, and
5 the identification numbers in each of said memories is the same.

1 10. The system defined in claim 1 or claim 2 wherein said system further
2 includes means for coupling the output of said second transceiver to at least one
3 stationary terminal device.

1 11. The invention defined in claim 10 wherein said coupling means is
2 arranged to provide private branch exchange (PBX) functionality.

1 12. A system for originating wireless telephone calls comprising
2 a telecommunications network;

3 first and second transceivers arranged to originate and receive wireless
4 telephone calls,
5 means for controlling said first transceiver to hand over its functionality to
6 said second transceiver based upon the proximity of said transceivers to each
7 other; and
8 means responsive to said controlling means for altering the operation of
9 each of said first and second transceivers, so that calls originated in said second
10 transceiver are processed in said communications network in a manner that is
11 identical to the manner in which calls originating in said first transceiver are
12 processed.

1 13. A system for selectively receiving telephone calls addressed to a first
2 transceiver, in a second transceiver, comprising
3 respective first and second identification number memories in each of said
4 first and second transceivers for controlling the selection of incoming calls to
5 which said transceivers respond,
6 means for causing said second transceiver to impersonate said first
7 transceiver by storing the same identification numbers in said first and second
8 identification number memories, and
9 means for rendering one of said transceivers dormant and the other of
10 said transceivers active.

1 14. A system for selectively originating telephone calls from a second
2 transceiver using the outgoing call characteristics of a first transceiver,
3 comprising
4 respective first and second identification number memories in each of said
5 first and second transceivers for controlling the origination of outgoing calls and
6 for selecting the network-resident profiles with which said outgoing calls are
7 associated,
8 means for causing said second transceiver to impersonate said first
9 transceiver by storing the same identification numbers in said first and second
10 identification number memories, and
11 means for rendering one of said transceivers dormant and the other of
12 said transceivers active.

1 15. The invention defined in claim 14 wherein said last mentioned means
2 is arranged to operate when said first transceiver is within a predetermined
3 distance from said second transceiver.

1 16. A system for completing wireless telephone calls, comprising
2 first and second wireless communication devices, said first and second
3 devices adapted, when activated within the operating region of a cell site, to
4 receive selected calls based upon an identification number associated with each
5 call,
6 means for selecting calls received in said first and said second devices
7 each in response to the same identification number,
8 means for determining that said first wireless communication device is in
9 a particular portion a particular cell site that is in a predetermined location with
10 respect to said second wireless communication device; and
11 means responsive to said determining means for causing said first device
12 to become deactivated and said second device to become activated, so that
13 telephone calls made using said identification number are selected and directed
14 to said second device for a limited period of time.

1 17. A system for originating wireless telephone calls, comprising
2 first and second wireless communication devices, said first and second
3 devices adapted, when activated within the operating region of a cell site, to
4 originate outgoing calls based upon an identification number associated with
5 each device,
6 means for determining that said first wireless communication device is in
7 a predetermined location with respect to said second wireless communication
8 device; and
9 means responsive to said determining means for causing said first device
10 to become deactivated and said second device to become activated, so that
11 telephone calls are originated for a limited period of time in said second wireless
12 device, using said identification number normally used to originate calls in said
13 first wireless device.

1 **18.** A system for allowing one wireless communication device to
2 impersonate another wireless communication device, comprising
3 means in each communication device for storing an identification number
4 used to identify incoming communications messages to which said device
5 responds,
6 means for determining if said communication devices are in proximity to
7 each other, and
8 means responsive to said determining means for causing said one device
9 to assume the identification number of said other communication device.

1 **19.** The invention defined in claim 18 wherein said one communication
2 device is portable and said other communication device is stationary.

1 **20.** The invention defined in claim 18 wherein said system further
2 includes
3 a switch,
4 a plurality of terminals connected to said switch, and
5 means for routing calls from said one device through said switch to one of
6 said terminals.

1 **21.** The invention defined in claim 20 wherein said switch is connected to
2 the wired telecommunication network.

1 **22.** The invention defined in claim 21 wherein said wireless
2 communication devices are arranged to originate and receive calls using a
3 wireless communication network, and said system further includes
4 means for routing calls made from said terminals either through said
5 wired telecommunications network or through said wireless communication
6 network.

1 **23.** A system for competing calls, comprising

2 a first mobile cellular telephone and a second stationary cellular
3 telephone, each having the same cellular telephone number, and
4 means for controlling said cellular telephones so that only one of said
5 cellular telephones is active at any one time.

1 24. The invention defined in claim 23 wherein said control means includes
2 a proximity unit in each of said first and second transceivers, said
3 proximity units arranged to generate a control signal when one of said proximity
4 units is within a predetermined distance from the other, and
5 means responsive to said control signal for activating said mobile cellular
6 telephone and deactivating said stationary cellular telephone.

1 25. A communications system wherein one communications device
2 selectively impersonates another communications device, comprising
3 means in each device for storing a network identification number that
4 controls selection of incoming calls to which the device responds,
5 means for controlling one device to use the same network identification
6 number normally associated with the other device; and
7 means for activating said controlling means as a function of the proximity
8 of one device to the other.

1 26. A system for forwarding incoming calls from one device to another
2 device, comprising
3 first and second devices arranged to respond, when active, to the same set
4 of incoming calls, and
5 means for rendering one device dormant and the other device active for a
6 limited period of time.

1 27. A method of completing wireless telephone calls, comprising the steps
2 of
3

4 determining that a first transceiver arranged to originate and receive
5 wireless telephone calls is in close proximity to said second transceiver arranged
6 to originate and receive wireless telephone calls; and
7 responsive to said determining step, altering the operation of each of said
8 first and second transceivers so that calls directed to and normally answered by
9 said first transceiver are completed to said second transceiver.

1 28. A method of originating wireless telephone calls, comprising the steps
2 of
3 determining that a first transceiver arranged to originate and receive
4 wireless telephone calls is in close proximity to said second transceiver arranged
5 to originate and receive wireless telephone calls; and
6 responsive to said determining step, altering the operation of each of said
7 first and second transceivers so that calls normally originated by said first
8 transceiver are originated by said second transceiver as though they were made
9 by said first transceiver.

1 29. The method defined in claim 27 or claim 28 wherein
2 each of said transceivers has an active state and a dormant state; and
3 said altering step includes switching said first transceiver from said active
4 state to said dormant state and switching said second transceiver from said
5 dormant state to said active state.

1 30. The method defined in claim 27 or claim 28 wherein each of said
2 transceivers includes an identification number memory for processing calls
3 originated or received by said transceivers when in said active state in
4 accordance with a stored identification number; and
5 wherein said method further includes the steps of
6 storing a plurality of network identification numbers in each of said
7 transceivers, and
8 selectively using particular ones of said identification numbers in said
9 identification number memory.

1 31. The method defined in claim 27 or claim 28 wherein said method
2 further includes the step of coupling the output of said second transceiver to at
3 least one stationary terminal device.

1 32. A method for originating wireless telephone calls comprising the steps
2 of
3 arranging first and second transceivers to originate and receive wireless
4 telephone calls using a telecommunications network;
5 controlling said first transceiver to hand over its functionality to said
6 second transceiver based upon the proximity of said transceivers to each other;
7 and
8 altering the operation of each of said first and second transceivers, so that
9 calls originated in said second transceiver are processed in said communications
10 network in a manner that is identical to the manner in which calls originating in
11 said first transceiver are processed.

1 33. A method for selectively receiving telephone calls addressed to a first
2 transceiver, in a second transceiver, comprising the steps of
3 controlling the selection of incoming calls to which said transceivers
4 respond using respective first and second identification number memories in
5 each of said first and second transceivers,
6 causing said second transceiver to impersonate said first transceiver by
7 storing the same identification numbers in said first and second identification
8 number memories, and
9 rendering one of said transceivers dormant and the other of said
10 transceivers active.

1 34. A method of selectively originating telephone calls from a second
2 transceiver using the outgoing call characteristics of a first transceiver,
3 comprising the steps of
4 controlling the origination of outgoing calls and selecting the network-
5 resident profiles with which said outgoing calls are associated, using respective
6 first and second identification number memories in each of said first and second
7 transceivers,

8 causing said second transceiver to impersonate said first transceiver by
9 storing the same identification numbers in said first and second identification
10 number memories, and
11 rendering one of said transceivers dormant and the other of said
12 transceivers active.

1 35. The method defined in claim 34 wherein said rendering step is
2 performed when said first transceiver is within a predetermined distance from
3 said second transceiver.

1 36. A method of completing wireless telephone calls, comprising the steps
2 of
3 arranging first and second wireless communication devices, when
4 activated within the operating region of a cell site, to receive selected calls based
5 upon an identification number associated with each call,
6 selecting calls received in said first and said second devices each in
7 response to the same identification number,
8 determining that said first wireless communication device is in a
9 particular portion a particular cell site that is in a predetermined location with
10 respect to said second wireless communication device; and
11 responsive to said determining step, causing said first device to become
12 deactivated and said second device to become activated, so that telephone calls
13 made using said identification number are selected and directed to said second
14 device for a limited period of time.

1 37. A method of originating wireless telephone calls, comprising the steps
2 of
3 arranging first and second wireless communication devices, when
4 activated within the operating region of a cell site, to originate outgoing calls
5 based upon an identification number associated with each device,
6 determining that said first wireless communication device is in a
7 predetermined location with respect to said second wireless communication
8 device; and

9 responsive to said determining step, causing said first device to become
10 deactivated and said second device to become activated, so that telephone calls
11 are originated for a limited period of time in said second wireless device, using
12 said identification number normally used to originate calls in said first wireless
13 device.

1 38. A method for allowing one wireless communication device to
2 impersonate another wireless communication device, comprising the steps of
3 storing in each communication device an identification number used to
4 identify incoming communications messages to which said device responds,
5 determining if said communication devices are in proximity to each other,
6 and
7 responsive to said determining step, causing said one device to assume
8 the identification number of said other communication device.

1 39. The method defined in claim 38 wherein said one communication
2 device is portable and said other communication device is stationary.

1 40. The method defined in claim 38 wherein said method further includes
2 the step of routing calls from said one device through a switch to one of a
3 plurality of terminals connected to said switch.

1 41. The method defined in claim 38 wherein said wireless communication
2 devices are arranged to originate and receive calls using a wireless
3 communication network, and said method further includes the step of
4 routing calls made from said terminals either through said wired
5 telecommunications network or through said wireless communication network.

1 42. A method of competing calls, comprising the steps of
2 arranging a first mobile cellular telephone and a second stationary cellular
3 telephone so that each has the same cellular telephone number, and
4 controlling said cellular telephones so that only one of said cellular
5 telephones is active at any one time.

1 **43.** The method defined in claim 45 wherein said controlling step includes
2 arranging a proximity unit in each of said first and second transceivers,
3 said proximity units to generate a control signal when one of said proximity
4 units in within a predetermined distance from the other, and
5 responsive to said control signal, activating said mobile cellular telephone
6 and deactivating said stationary cellular telephone.

1 **44.** A communications method wherein one communications device
2 selectively impersonates another communications device, comprising the steps of
3 storing in each device a network identification number that controls
4 selection of incoming calls to which the device responds,
5 controlling one device to use the same network identification number
6 normally associated with the other device; and
7 activating said controlling step as a function of the proximity of one
8 device to the other.

1 **45.** A method of forwarding incoming calls from one device to another
2 device, comprising the steps of
3 arranging first and second devices to respond, when active, to the same
4 set of incoming calls, and
5 rendering one device dormant and the other device active for a limited
6 period of time.

1 **46.** A communication method including the steps of
2 allowing a second transceiver in a second stationary communications
3 device to impersonate the network identity of a first transceiver in a first device,
4 and
5 activating said impersonation when the first transceiver travels to within a
6 predetermined distance from said second transceiver.

1 47. The method defined in claim 46 wherein said method further includes
2 duplicating a network identification number in a network identification number
3 memory in said first and second transceivers, so that both devices respond to the
4 same telephone calls, when in an active state.

FIG. 1

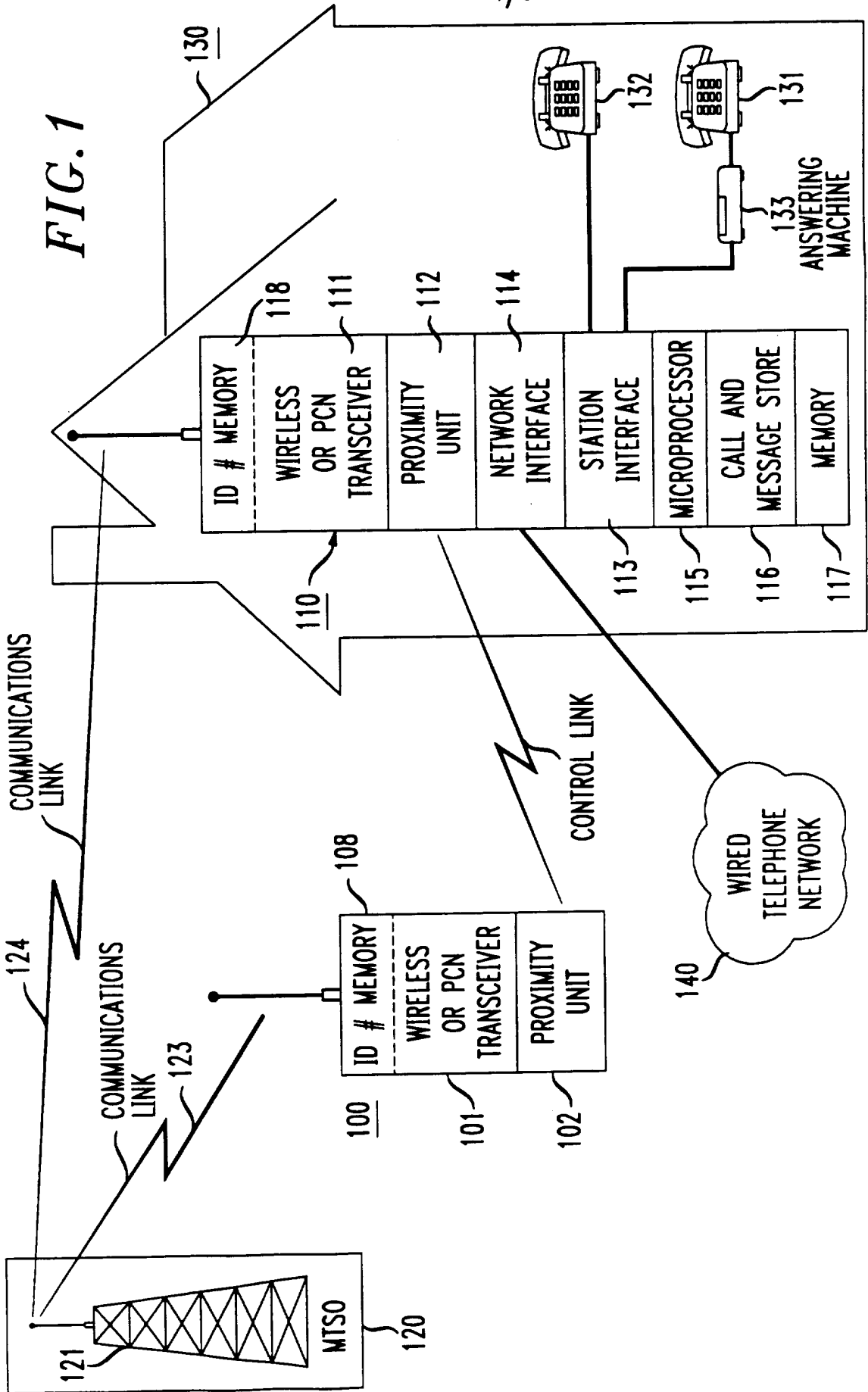


FIG. 2

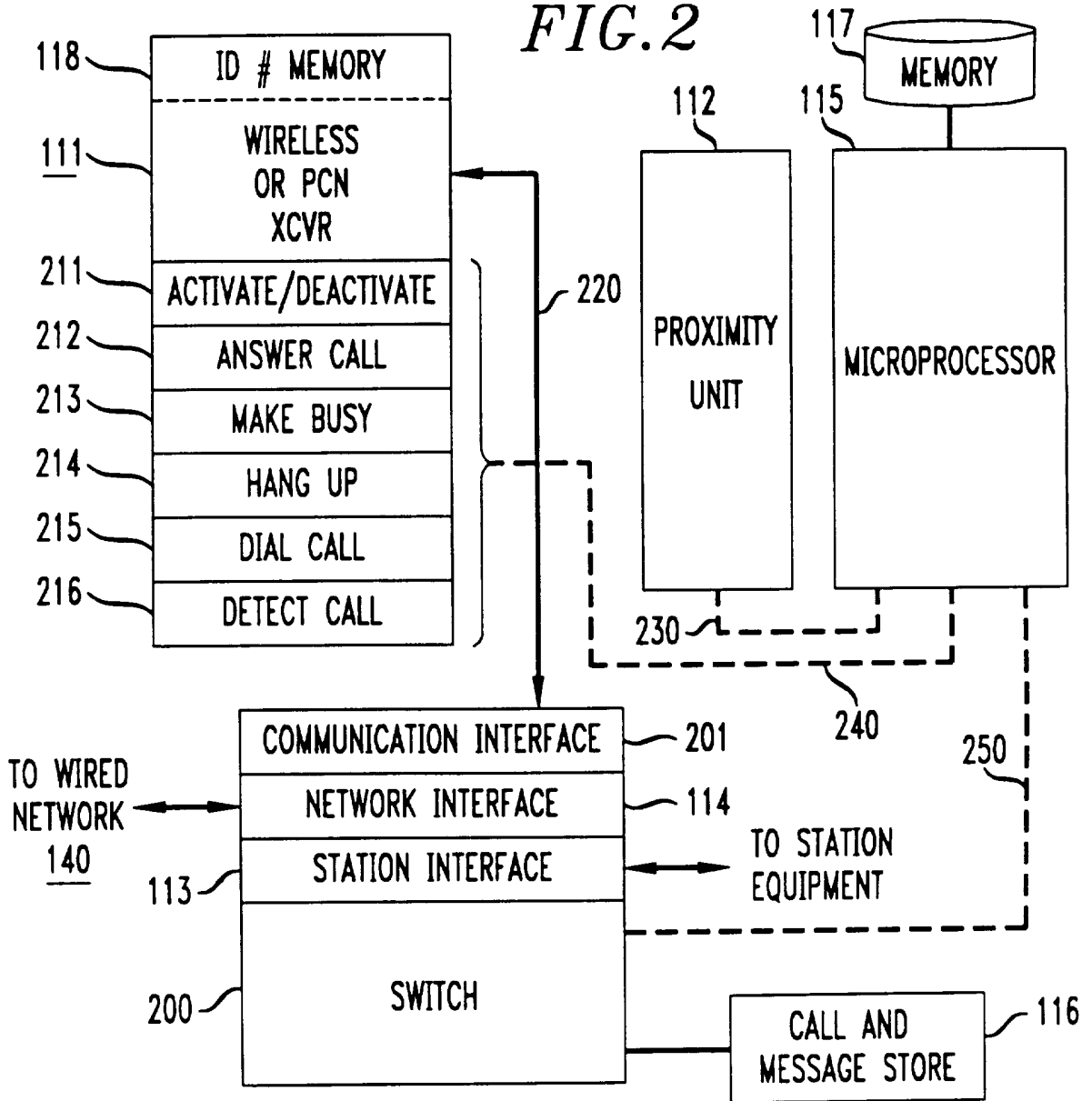
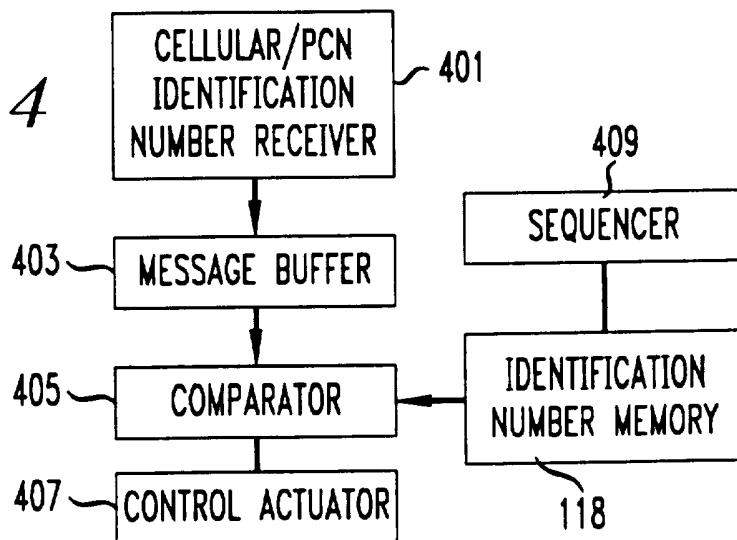
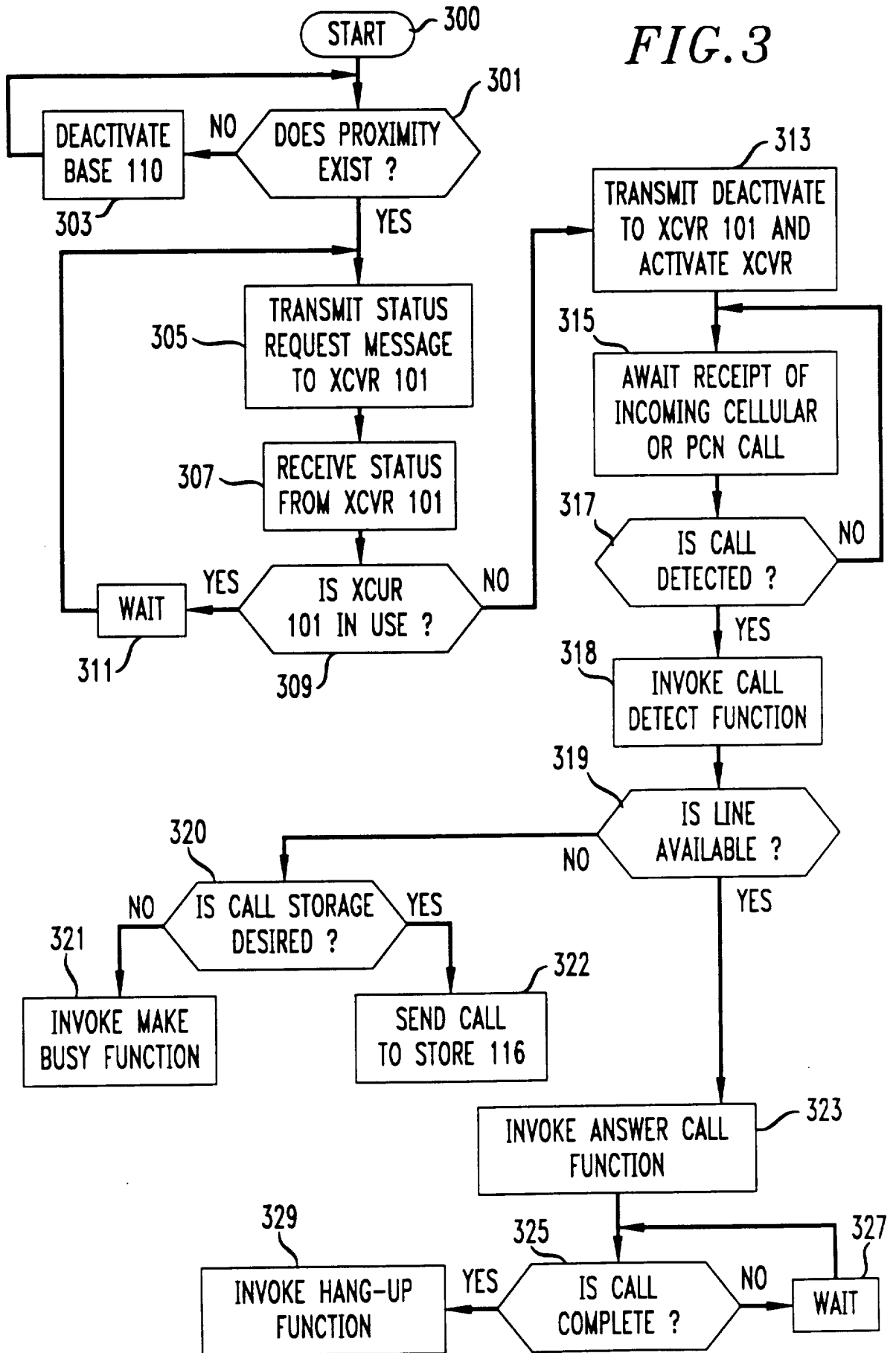


FIG. 4



3/6

FIG. 3



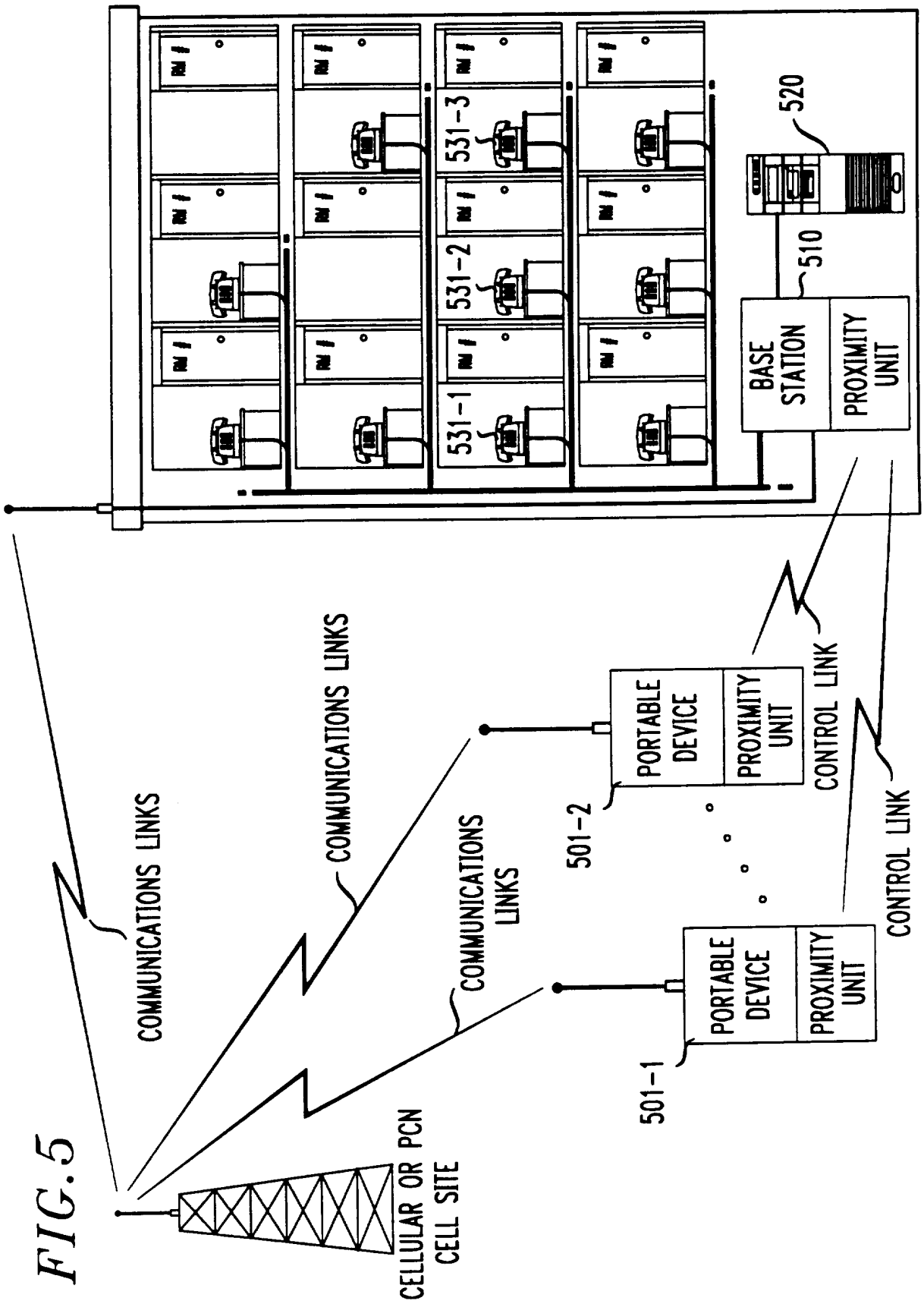


FIG. 6

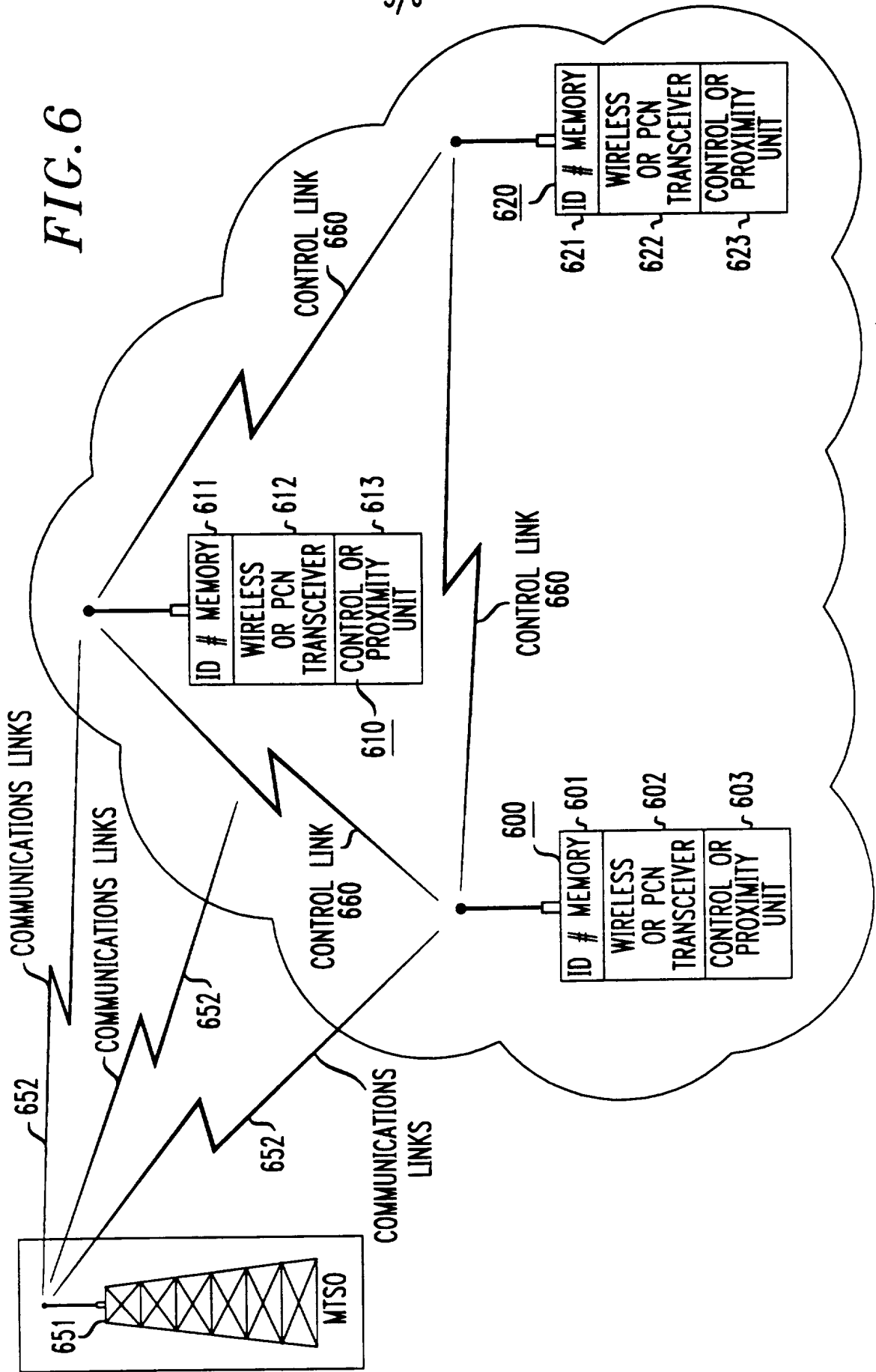
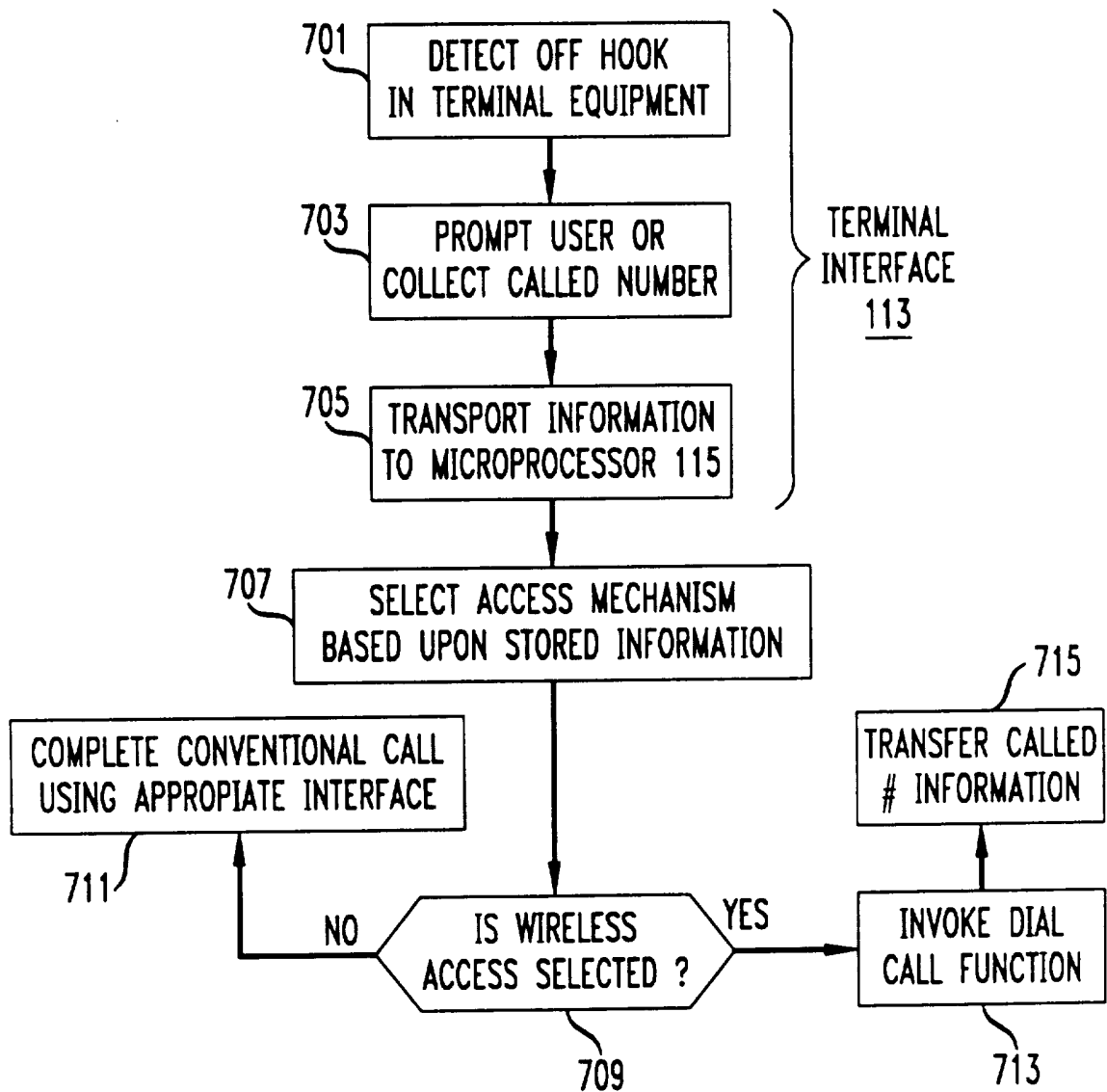


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/11605

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04M 11/00

US CL :379/58

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 379/58, 57, 59, 60, 61, 63; 455/33.1, 33.2, 54.1, 56.1

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,748,655 (THROWER ET AL) 31 May 1988, note figure 1 and col. 2, line 63 to col. 5, line 41.	1-47
A	US, A, 5,315,636 (PATEL) 24 May 1994, note abstract and fig. 1.	1-47

Further documents are listed in the continuation of Box C. See patent family annex.

<p>* Special categories of cited documents:</p> <p>*A* document defining the general state of the art which is not considered to be part of particular relevance</p> <p>*E* earlier document published on or after the international filing date</p> <p>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p>	<p>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>*Z* document member of the same patent family</p>
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