

Description

BACKGROUND OF THE INVENTION

The present invention relates generally to paging systems and, more particularly, to paging terminal apparatus which, in cooperation with paging receivers with acknowledge back capability, provides an automatic or selective page forwarding service at the election of the pager user.

Present day paging systems are efficient, sophisticated in technology and serve well large numbers of users. As a result, such systems are relied upon more and more to reach particular individuals wearing such paging receivers and deliver critical and urgent messages. Unfortunately, it cannot always be guaranteed that such messages for particular pagers will in fact be received when initially sent or intended. In the past, paging messages were sent without knowing whether users received them as intended or not. One way to overcome this, of course, is to request the pager wearer to call back the originator on the telephone to so advise him. One prior art system addressed the problem by simply periodically transmitting a message until the specific pager user called a particular telephone number to indicate receipt thereof so that the continuously transmitted message could be terminated. However, unless the particular pager user in fact calls the necessary telephone number, and even though it may have been received, the message continues to be periodically sent, expending, and most certainly wasting, valuable system capacity.

Another approach has been to provide the paging receivers themselves with an acknowledge back capability which is activated, either manually or automatically, whenever their particular address is received and properly decoded. This assures that the pager is working satisfactorily and that the originator may be notified with a good deal of confidence that the message was very probably received as intended. No specific action on the part of the pager is necessarily required.

The above, of course, provides a substantial step towards assuring confidence in the reliability of the paging system. However, it does not address the problem regarding those instances in which acknowledge back is not perfected. It will readily be understood that the pager may be inoperative, the user may be out of effective signal range, or the pager may have been, accidentally or intentionally, turned off. Nevertheless, there are instances in which it is deemed imperative that the intended pager user be reached in one way or another.

Where the user is roaming from system to system, WO85/05240 provides an improved store and forward paging system.

In many situations in the past emergencies or otherwise demanding situations have usually resulted in the paging originator being forced to find some other pager user to notify and request that he or she contact the non-responding user with some specific message. While this alternative plan of reaching the intended pager user may well be the only option available to the page originator, it has nevertheless been on a rather hit-and-miss basis and, in any event, has proven to be very inconvenient and time consuming for all concerned. The originator must find the identify of another pager user that can response, then find that person's pager ID, cause the page to be sent, and then wait for the hoped for response.

A more convenient and reliable arrangement is therefore needed to improve response time and alleviate the burden to system users.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to overcome the deficiencies of the prior art paging systems in reaching an intended pager user under certain operating conditions.

This object is achieved by the present invention as characterized in claim 1.

Accordingly the invention provides paging terminal apparatus, for use with paging receivers with acknowledge back capability ("pagers"), wherein paging messages for pagers initially failing to acknowledge back may be automatically forwarded to alternate pagers within a paging system, said paging terminal apparatus comprising: means for sending pager addresses and associated messages intended therefor to the system paging receivers; characterized by means, upon failure to receive back a prearranged acknowledgement from a called pager for sending the intended message to some other pager in the paging system; said other pager being determined by a set hierarchy listing of alternate pagers included within the paging terminal apparatus.

Accordingly automatic paging forwarding can be achieved in a paging system with paging receivers having acknowledge back capability in accordance with a predetermined paging hierarchy, without further action being required on the part of the pager users themselves or the paging originator.

In one embodiment of the invention, a paging terminal apparatus is provided for use with paging receivers having an acknowledge back capability, wherein a paging message initially intended for a particular called pager which fails to acknowledge back within a predetermined time period is automatically forwarded by the paging terminal apparatus to another pager within the system along with, if desired, an indication that the message was

forwarded from the initially called pager. The other pager to whom the message is redirected is determined by the terminal apparatus from a subscriber list into which has been entered a predetermined set hierarchy, of alternative pager addresses.

In another embodiment the system pagers are additionally equipped with manual controls and are capable of multiple acknowledge back responses. Accordingly, the received message may be caused to be selectively rerouted (forwarded) to some other system pager or pagers by the initially called pager simply selecting the appropriate acknowledge back reference with the push of a button.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, however, together with further objects and advantage thereof, may best be understood by reference to the accompanying drawings, in which:

FIG. 1 is a block diagram of a radio communication system in which one aspect of the present invention may be advantageously utilized;

FIG. 2 is a block diagram of a paging terminal and associated apparatus used to send addresses and messages to the system pagers and which include the automatic and/or selective call forwarding feature of the present invention;

FIG. 3 is a block diagram of a paging receiver with acknowledge back capability intended for operation in one embodiment of the present invention;

FIG. 4 is a flow chart which describes the operation of the paging receiver of FIG. 3;

FIG. 5 is a graphic representation of the timing diagram showing the relation between the "outbound" pages of the paging terminal and the "inbound" acknowledgments of the various system pagers;

FIG. 6 is a flow diagram that describes the operation of the paging terminal including the handling and automatic forwarding of paging messages in accordance with one embodiment of the present invention;

FIG. 7 is a partial block diagram of a paging receiver with acknowledge back capability differing from the receiver shown in FIG. 4 for use with another embodiment of the invention;

FIG. 8 is a flow chart which describes the difference in operation of the paging receiver of FIG. 7;

FIG. 9 is a flow chart which describes the differences in the operation of the terminal apparatus to provide another embodiment of the invention;

FIG. 10 is a graphic representation of the timing diagram showing the relationship between "out-

bound" pager of the paging terminal and the "inbound acknowledgment of the pagers regarding the second embodiment of the invention.

FIG. 11 is a block diagram of a paging receiver with automatic acknowledge back capability intended for operation in another embodiment of the present invention;

FIG. 12 is a flow chart which describes the operation of the paging receiver of FIG. 11;

FIG. 13 is a graphic representation of the timing diagram showing the relation between the "outbound" pages of the paging terminal and the "inbound" automatic acknowledgments of the various system pagers; and

FIG. 14 is a flow diagram that describes the operation of the paging terminal including the handling and automatic forwarding of paging messages in accordance with another embodiment of the present invention.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, a radio communications paging system 10 is shown in FIG. 1 in which the present invention may be advantageously utilized. The paging system includes terminal apparatus, shown generally at reference 20, and a plurality of paging receivers, indicated at 12, as illustrated. It is intended that the associated paging receivers be capable of and provide an acknowledge back feature upon receiving and recognizing certain transmitted information. Pagers of this character are, of course, known in the art and include an acknowledge back encoder 14 as indicated for activation, manually or automatically, when the paging receiver 12 receives and recognizes at least its particular address. A more detailed description will be set forth in connection with FIG. 3 for the system pager function and operation.

The terminal apparatus 20 of FIG. 1 is illustrated in greater detail in FIG. 2 together with the associated auxiliary equipment and the paging files intended to be generated and maintained to effect the advantages of the present invention. As therein shown, terminal apparatus 20 includes a paging controller 22 which also includes an address and data encoder 24 and an acknowledge back decoder 26. Associated with the paging controller is an entry device 30, a real time clock 32 as well as a transmitter 34 and receiver 36 operating in connection with an antenna 38 and an antenna switch 40. Although a switch is shown as 40, a duplexer may also be used. A duplexer is a transmission line device which permits the use of a single antenna for simultaneous transmission and reception. The use of a duplexer for simultaneous transmission and reception of information is well known to

those of ordinary skill in the art.

Entry device 30 is used to access the paging controller 22 to enter pager ID's (identification numbers) and messages intended therefor for subsequent transmission. The entry device 30 as shown is a video display terminal which is useful for entering alphanumeric messages, and for accessing and updating a subscriber list 42. Subscriber list 42 is a list of all the pagers ID's that are valid in the system 10. Filed under each pager ID in the subscriber list 42 are several items that will be needed by the paging controller 22 to send, or transmit, a page, including such information as pager type (acknowledge back or non-acknowledge back), the particular pager address which corresponds to the pager ID, as well as a particular forwarding address hierarchy, details of which will be described in more detail subsequently.

As may be appreciated, paging controller 22 is the essential heart of the system 10 and controls the operation of the other associated elements of the paging terminal apparatus. In addition to subscriber list 42, maintained by controller 22, an active page file 44 is also maintained and comprises a temporary file containing information about the pages being processed by the terminal apparatus 20. The active page file 44 includes at least the pager identification or ID, address, message, time, and may include whether the originator is notified of the received acknowledgment. A real time clock 32 is used to supply timing information to the paging controller and for time stamping of the messages in active page file 44.

The address and data encoder 24 accepts addresses and messages supplied to the paging controller 22 by the entry device 30. Address and data encoder 22 then converts this supplied information to the actual transmitted bit patterns in a manner well understood by those skilled in the art. These bit patterns are subsequently transmitted by transmitter 34 through antenna switch 40 and to antenna 38 which radiates the signal energy to the system pagers 12. The "Ack-Back" decoder 26 then detects and processes any acknowledgments returned by the system pagers 12 and provides this information to the paging controller 22. While transmitter 34 modulates an RF carrier frequency with outbound addresses and messages, the receiver 36 demodulates the inbound modulated RF carrier frequency and supplies recovered data to decoder 26.

Upon transmitting an address and an intended message for a particular pager 12, an acknowledgment is sent back by that pager and received by paging controller 22. If an address message for a particular paging receiver 12 is transmitted and an acknowledgment back is not received within a predetermined period of time, the message intended

for that particular receiver 12, in one embodiment of the present invention, is forwarded to another pager within the system. The identity of that other pager is determined by the terminal apparatus from a set hierarchy of alternate pagers as entered into the subscriber list 42 as associated with the initial pager failing to acknowledge back.

The block diagram of the paging receiver 12 is shown in FIG. 3 and a flow diagram that describes this operation is illustrated in FIG. 4. The pager 12 with acknowledge back capability (hereinafter "Ack-Back"), as illustrated, consists of an RF section 50 and a transmitter section 52. RF signals are coupled to and from the receiver and transmitter sections 50/52 via an antenna 54 and antenna switch 56. Normally, ack-back pager 12 is operated in the receive mode, and the demodulated data output of the pager receiver section 50 is coupled to an included paging address decoder 58. In addition, an ack-back latch 64 is included, coupled to the address decoder 58 at Q and R, with a manual push button 66 between S and ground, as shown.

As indicated in the flow chart of FIG. 4, following the initialize step 70 the address decoder 58 initially holds the ack-back latch 64 in the reset condition while address decoder 58 examines the recovered data looking for a unique selective calling signal or address at steps 72 and 73 that is assigned to pager 12. This unique address is a precursor for any alphanumeric or voice messages that may be directed to the pager. Once the address has been detected at step 73, the paging address decoder 58 performs appropriate message decoding on the data that follows the address.

The message decoding itself is performed in program flow steps 74 through 76 in the conventional manner understood by those skilled in the art and it is deemed unnecessary to describe the same in further detail at this point for that reason and, further, because it is not a critical matter to an understanding of the present invention. Once a complete message has been received, the paging decoder 58 generates an alert tone and routes this alert tone to the receiver transducer 60. The paging decoder 58 also stores the messages in memory so that a page wearer can recall these messages later for viewing on display 62 in the usual manner.

Paging decoder 58 holds the ack-back latch 64 in the reset condition until the alert tone is generated and then releases the latch at step 78. The pager user at step 79 is then given the opportunity to acknowledge back the message by pressing the ack-back response button 66, which will then set the latch. The decoder 58, after a short delay, looks for a query signal transmitted by terminal apparatus 20.

If the pager user presses ack-back response button 66 before the query signal, sent by terminal

apparatus 20, is detected, the paging decoder 58 will upon such detection at step 82, key the transmitter 52, modulate it with the ack-back response signal, and direct the transmit output signal to the antenna 54 through antenna switch 56. It is to be understood that if the message is not received by the pager user or such user elects not to acknowledge back, no ack-back response will be generated and the message will be forwarded by the terminal apparatus 20 as will be described subsequently in accordance with the present invention.

The timing diagram of FIG. 5 illustrates the relationship between the "outbound" signals transmitted from paging terminal apparatus 20 to the various system pagers 12, and the "inbound" signals from the pagers 12 acknowledging back to the terminal apparatus. By way of example, in FIG. 5, pager "No. 1" does not acknowledge back after receiving its address following the message intended therefor. As a consequence, the message for pager no. 1 is then forwarded to pager no. 2, who is a member of pager no. 1's hierarchy as set forth and entered into the subscriber list 42. It will be noted that the time period, or gap, 88 is provided between the sending of the message and the transmission of the reference query which is intended specifically for pager user action, i.e. activation of manual push-button 66. It is to be understood that other addresses and/or messages could, of course, be sent during this time frame (gap 88), if so desired.

FIG. 5 also illustrates that, upon sending the address for pager no. 2, followed by the message for pager no. 1, that the sequence is completed upon pager no. 2 acknowledging back after the query signal is transmitted to indicate pager no. 2 received the message. FIG. 5 also illustrates a normal page intended for pager no. 2, which also acknowledges back its reception.

The means and the procedure for effecting the signalling procedure, as illustrated and described in FIG. 5 are accomplished within, and by means of, the paging controller 22 of terminal apparatus 20, as previously described. The procedure/protocol for accomplishing this is set forth with particularity in the flow diagram comprising FIG. 6. The operation begins with an initialize step 90, normally needed only at power up. Step 90 is used to perform functions such as setting up the I/O ports as inputs and outputs, clearing certain memory locations, and perhaps running a self-test.

After completing the initial power up routine, paging controller 22 then prompts the page originator at step 91 for a pager ID and message which may be entered by way of entry device 30, and then hitting a designated key (such as enter) on device 30. Paging controller 22 then reads the originator's response at step 92 and looks for a

matching pager ID in the subscriber list 42 at step 93. If there is no matching ID, the controller 22 sends a message to entry device 30 at step 94 notifying the originator that the pager ID entered is invalid and the input session is terminated at step 95, whereupon paging controller 22 is returned to step 91 as illustrated. If a matching ID is found at step 93, a message is sent to entry device 30 notifying the page originator that the page has in fact been accepted, at step 96.

Once the page has been accepted by controller 22, it then sets up active page file 44 at step 97 which contains the pagers ID, the address to which the page will be sent, and the message attached to the page. The address corresponding to a particular pager's ID is located in subscriber list 42. A pager's address and ID may be identical, but generally they are not. Typically a pager has a three-digit pager ID but an address is perhaps six or seven digits in length. The time, of course, is obtained from real time clock 32.

Next, the controller 22 consults subscriber list 42 at step 98 to determine if the pager being addressed is capable of an acknowledge back feature. If the pager being addressed is not one capable of such, the page is sent immediately at step 99, whereupon the active page file entry 44 is deleted at step 100, and paging controller 22 is returned to step 91 in the flow diagram, as illustrated.

If the pager being addressed is capable of acknowledging back, the address and message are transmitted at step 101. In performing the operations indicated at steps 99 and 101, paging controller 22 may, for example, send information in the form of ASCII characters to the address and data encoder 24 where it is converted to the required binary digits and parity information is added before being applied to transmitter 34 for transmission.

Following step 101, controller 22 waits for a minimum length of time at step 102 to allow the pager user to read the message and acknowledge back by activating push button 66. The response signal is not sent immediately by the pager, as mentioned previously, but waits until a query signal is received from the terminal apparatus 22 at step 103. After the query signal is sent by pager controller 22, it turns transmitter 34 off, enables receiver 36, connects antenna 38 to receiver 36 via antenna switch 40 and enables ack-back decoder 26 for a brief window. If the pager acknowledgment is received, indicated at step 104, a message is sent to the entry device 30 notifying the page originator that the page was in fact acknowledged and the Active File 44 may then be deleted for that page at step 100. As indicated, the entry input session is terminated at step 95 and a new input prompt cycle may be initiated.

If the appropriate acknowledge back is not detected, paging controller 22 consults the subscriber list 42 to ascertain a new forwarding address under the particular called, but unacknowledging, pager's ID maintained in the active file 44. If a forwarding address can be found at step 106, the address to which it was sent initially will be changed to the new, forwarding address at step 107. Accordingly, the transmit cycle is reinitiated at step 98.

If no acknowledgment back is appropriately received the process is repeated to determine if there is still a further forwarding address for yet another pager in the system hierarchal listing referenced in the subscriber list 42. In the event one is found, the transmit cycle is again reinitiated as before.

If there is no forwarding address found at step 106, a message will be sent to the entry device 30 at step 108, notifying the page originator that the page was in fact not acknowledged, the active page file 44 will be purged of the relevant information with regard thereto, at step 100, and the entry session deleted at step 95 as indicated. A new input prompt cycle may then be initiated as before.

Another embodiment of the invention is set forth in FIGS. 7 through 10, wherein the pager user upon receipt thereof may further selectively transfer the same to another pager user without further action, such as making a telephone call to reenter the message. An example, a busy executive may receive a message he deems significant and wishes to share with a colleague, superior, subordinate or the like. It may also be a message that requires immediate action and he wishes to alert other members of his staff. A provision is made in this embodiment of the invention to add the signature of the forwarding party to the forwarded messages.

In this embodiment, the pager receiver is the same as for the receiver shown in FIG. 3, except that it includes a provision for multiple ack-back responses. This is shown in FIG. 7 in which a multiple Latch 64' includes S₁, S₂, and S₃, set positions controlled by manual push buttons 66'a, 66'b, and 66'c.

The operation of the paging receiver 12 is the same as referenced in the flowchart of FIG. 4 up through step 84. As depicted in FIG. 8, assuming that the query signal has been received from terminal apparatus 20, and that ack-back latch 64' has been set, at step 84, then the address decoder/acknowledge back controller 58 selects the appropriate ack-back code at step 86, in accordance with what push-button 66a', 66b' or 66c' has been manipulated, and then transmitted back at step 87.

Referring to FIG. 9, in the paging controller 22, the operation is essentially the same up through step 103 which is described in FIG. 6. Specifically

in FIG. 9, at step 109, if the ack-back response is not detected, the active page file is consulted at step 110 to see if an ack to originator is required. This step is necessary since the page originator has no control over whether a page will be selectively forwarded, and he is normally only interested to know that the page was received by the original addressee. If the page originator is to be notified, a message is sent to the entry device at step 111 notifying the page originator that the page was not acknowledged, and then the active page file is deleted at step 100, and the input session is terminated at step 95. If the originator is not to be notified (in the case of a forwarded page), the active page file is deleted at step 100, and the program flow returns to the input prompt state.

If the page is acknowledged at step 109, the active page file is consulted at step 112 to see if the originator should be notified. If the originator is to be notified, a message is sent to the entry device at step 113 notifying the originator that the message was acknowledged. If this is a forwarded page, the program branches around step 113 to step 114.

After a page acknowledgment has been received and proper notification has been made to the originator, the nature of the acknowledgment is determined at step 114. Ack's can be simple acknowledgments as well as forwarding requests. If the acknowledgment is only a simple ack, the active page file will be deleted at step 100 and the program flow returned to the input prompt state. However, if there is a forwarding request contained in the acknowledgment, the paging controller selects a forwarding address based upon this request from the subscriber list at step 115, and at step 116, the controller updates the active page file with a new pager ID, a new address, and a signature is added to the message indicating that the message was forwarded from the original addressee. This signature could be the name associated with the pager's ID contained in the subscriber list. In addition, a no ack to the originator is specified. After updating of the active page file, the program returns to step 98. A forwarded message is essentially just another page to the paging controller; however, a signature is added to the message each time it is forwarded.

FIG. 10 references the various relationships that may be expected between "outbound" terminal signals and "inbound" signals from the system pagers. Illustrated is an example of these messages sent to those pagers which all duly acknowledged back. Push-button 66'a of FIG. 7, when activated, results in response A, arbitrarily chosen to represent a simple acknowledge back with no call forwarding request. Similarly, response B, associated with push-button 66'b, is chosen to mean

a request to forward the message to some additional predetermined pager user, and response C to mean a forwarding request to still a different but predetermined pager user.

In the example given, the acknowledge back from pager no. 1 contains a request to forward the referenced message to some other pager user (Response "B" being indicated). The address of such pager is determined and the message for pager no. 1 is also sent to pager no. 2, who acknowledges back and also requests the referenced message to also be call forwarded to still another pager user (Response "C" being indicated). The controller 20 then determines the address of that still other pager user and sends out that address and the message for pager no. 1 to pager no. 3, who, in the example given, makes a simple acknowledge back (Response "A" being indicated).

In this manner, then, a procedure is established whereby the normal paging operations proceeds in the manner well known in prior systems. However, for those pages which are initially unacknowledged, the messages intended therefor may be forwarded automatically to another pager in the system as determined by a set page forwarding hierarchy entered into the associated paging controller and associated with the initially called pager user.

Further, this page forward operation may be effected selectively if the system pagers include a multiple response provision. In this case, it will be necessary for the pager user to manually select which acknowledge back response is utilized. In this way an entirely new and added dimension is provided for paging systems to effectively and efficiently prevent messages from being lost, by retaining and later retransmitting them, requiring no further action on the part of the pager user himself.

Another embodiment of the present invention is shown in FIGS. 11-14. A block diagram of paging receiver 12 is shown in FIG. 11, and a flow diagram that describes this operation is illustrated in FIG. 12. The pager 12 with acknowledge back capability, as illustrated, includes an RF section 50 and a transmitter section 52. RF signals are coupled to and from the receiver and transmitter section 50/52 via an antenna 54 and an antenna switch 56. Referring back to FIG. 11, normally, ack back pager 12 is operated in the receive mode and the demodulated data output of the pager receiver section 50 is coupled to an included paging address decoder 58.

Paging address decoder 58 examines the recovered data looking for a unique selective calling signal or address that is assigned to pager 12, as illustrated in steps 201 and 202 of the pager flow diagram shown in FIG. 12. This unique address is a precursor for any alphanumeric or voice messages that may be directed to the pager. Once the ad-

dress has been detected at step 202, the paging address decoder 58 at step 203 generates an appropriate pager automatic acknowledge back response (hereinafter "PACK") consisting of particular coded words, which then keys the transmitter 52 which is modulated with the PACK response signal, and the output signal from antenna 54 is transmitted to and is received by the paging controller 20. Following the PACK response, pager 12 returns to its normal receive mode and looks for an activation code (see AC in FIG. 13). However, before beginning to search for this activation code, a window counter (not specifically shown) is initialized at step 204. Then, after each attempt to decode the activation code at step 206, the AC window counter is decremented at step 207. At step 208, the count is compared to zero. If the count has decremented to zero, the pager returns to the address decode state. If the count has not decremented to zero, the pager decoder 58 continues to look for the activation code detect. The activation code is used to resynchronize the pager for data message decoding.

The message decoding itself is performed in program flow steps 209-212. In step 209, the message block following the activation code is decoded and stored in appropriate memory of the pager 12. Eventually, the end of message is detected by the pager, step 210. When the end of message is detected, the pager stores an end of message block in memory, step 211. Finally, the pager generates a short alert tone to alert the user of the reception of a message, step 212.

The timing diagram of FIG. 13 illustrates the relationship between the "outbound" signals transmitted from paging terminal apparatus 20 to various system pagers 12, and "inbound" signals from the pagers 12 acknowledging back to the terminal apparatus (the PACK response). By way of example, in FIG. 13, pager "number 1" immediately and automatically acknowledges back after receiving its address, following detection of such response by the terminal apparatus, the message intended for that pager may then be transmitted by the terminal shown as message for pager 1. In contrast, pager "number 2" for some reason has not sent back an acknowledge and, consequently, paging terminal apparatus 20 does not send the message intended for pager "number 2." Since the paging terminal apparatus did not receive the expected PACK response from pager number 2 within a predetermined period of time, the paging terminal apparatus scans pager number 2's forwarding hierarchy as set forth and entered into subscriber list 42 to determine which pager to know send the message that was intended for pager "number 2." By way of example, FIG. 13 illustrates that the message intended for pager "number 2" is sent to pager

"number N", where N is determined by pager number 2's forwarding hierarchy contained in the subscriber list in the paging terminal apparatus. Subsequently, after the message for pager 2 has been successfully sent to pager "number N", the message intended for pager "number 2" is deleted from the active page file included in the paging terminal apparatus.

The apparatus and the procedure for effecting the signalling procedure and sequence in terms of sending or forwarding messages, as illustrated and described in FIG. 13, are effecting within, and by means of, the paging controller 22 of terminal apparatus 20, as previously described. The procedure for accomplishing this is set forth with particularity in the flow diagram comprising FIG. 14. The operation begins with an initialization step 220, normally needed only at power up. Step 220 is used to perform functions such as setting up the I/O ports as inputs and outputs, clearing certain memory locations, and perhaps running a self-test.

After completing the initial power up routine, paging controller 22 then prompts the page originator at step 221 for pager I.D. and message which may be entered by way of entry device 30 and then hitting a designated key (such as ENTER) on the device 30. Paging controller 22 then reads the originator's response at step 222 and looks for a matching pager I.D. in the subscriber list 42 at step 223. If there is no matching I.D., the controller 22 sends a message to entry device 30 at step 224 notifying the originator that the pager I.D. entered is invalid and the input session is terminated at step 225, whereupon paging controller 22 is returned to step 221 as illustrated. If a matching I.D. is found at step 223, a message is sent to entry device 30 notifying the paging originator that the page has in fact been accepted, at step 226.

Once the page has been accepted by controller 22, it then sets up active page file 44 at step 227 which contains the pager's I.D., the address to which the pager will be sent, and the message attached to the page. The address corresponding to a particular pager's I.D. is located in subscriber list 42. The pager's address and I.D. may be identical but generally are not. Typically, a pager has a three-digit pager I.D., but an address are perhaps six or seven digits in length.

Next, the controller 22 consults subscriber list 42 at step 228 to determine if the pager being addressed is capable of an automatic acknowledge back feature. If the pager being addressed is not one capable of such, the page is sent immediately at step 229, whereupon the active page file entry 44 is deleted at step 230, and paging controller 22 is returned to step 221 in the flow diagram, as illustrated.

If the pager being addressed is capable of automatic acknowledge back, the address is transmitted at step 231. In performing the operations indicated at steps 229 and 231, paging controller 22 may, for example, send information in the form of ASCII characters to the address and data encoder 24 where it is converted to the required binary digits and parity information is added before being applied to transmitter 34 for transmission. Following step 231, the paging controller looks for the PACK response at step 232. The PACK response is sent immediately and automatically by pager 12 having successfully detected its transmitted address.

To perform step 232, the paging controller 22 turns transmitter 34 off, enables receiver 36, connects antenna 38 to receiver 36 via antenna switch 40 and enables ack back decoder 26 for a brief window.

If the automatic pager acknowledgment is received, indicated at step 232, an activation code and data message is sent to the selected paging receiver, step 233. After the message is sent to the paging receiver, another message is sent to the entry device 30 notifying the pager originator that the page was in fact acknowledged, step 236, an active file 44 may then be deleted for that page at step 230. As indicated, the entry input session is terminated at step 225 and a new input prompt cycle may be initiated.

If the appropriate acknowledgment back is not detected, pager controller 22 consults the subscriber list to ascertain a new forwarding address under the particular called, but unacknowledged, pagers I.D. maintained in the active file 44. If a forwarding address can be found at step 234, the address to which it was sent initially will be changed to the new forwarding address and, accordingly, the transmit cycle is reinitiated at step 228.

If no acknowledgment back is appropriately received, the process is repeated to determine if there is still a further forwarding address for yet another pager in the system hierarchal listing reference in the subscriber list 42. In the event one is found, the transmit cycle is again reinitiated as before.

If there is no forward address found at step 234, a message will be sent to the entry device 30, step 237, notifying the page originator that the page was in fact not acknowledged, the active page file 44 will be purged of the relevant information with regard thereto at step 230, and the entry session deleted at step 225 is indicated. A new input prompt cycle may then be initiated as before.



Claims

1. Paging terminal apparatus, (20) for use with paging receivers (12) with acknowledge back capability ("pagers"), wherein paging messages for pagers initially failing to acknowledge back may be automatically forwarded to alternative pagers within a paging system (10), said paging terminal apparatus (20) comprising:
 - means (22, 34) for sending pager addresses and associated messages (44) intended therefor to the paging receivers (12) within said paging system; characterized by
 - means, (22 & FIG. 6 or FIG 8) upon failure to receive back a prearranged acknowledgement from a called pager, for sending the intended message to some other pager in the paging system (10);
 - said other pager being determined by a set hierarchy listing (42) of alternative pagers included within the paging terminal apparatus (20).
2. Paging terminal apparatus according to claim 1 wherein said means for sending the intended message to the other pager are arranged to do so upon failure to receive the prearranged acknowledgement within a predetermined time period.
3. Paging terminal apparatus (20) according to claim 1 or 2, wherein the means (22) for sending pager addresses and associated messages comprise means (22, 42) for sending pager addresses and means (22, 44) for sending a directed message to a particular pager upon receiving back an acknowledgement from said pager.
4. Paging terminal apparatus (20) according to claim 1, 2 or 3 wherein the means for sending pager addresses and associated messages comprise:
 - paging controller means; (22)
 - entry means (30) for entering information into said paging controller means (22); and
 - said other pager is determined by a set hierarchy listing (42) of alternative pagers entered into said paging controller means (22) by said entry device (30).
5. Paging terminal apparatus (20) in accordance with any one of the preceding claims wherein said means (22) for sending the intended message to said other pager, upon failure to receive the acknowledgement therefrom, sends said intended message to the next pager on said set hierarchy listing (42).
6. Paging terminal apparatus (20) in accordance with claim 5, wherein additional alternative pagers are selected in sequential fashion from said set hierarchical listing (42) until either an acknowledgement is received from an alternative pager or the list of alternative pagers is exhausted.
7. Paging terminal apparatus (20) in accordance with any one of the preceding claims wherein said means (22) for sending addresses and messages to pagers (12) within said paging system include means (22, FIG. 6) for establishing an Active Page File (44) into which addresses of particular pagers are placed, along with the messages intended therefor, as well as the particular pager's ID and the time of placing such in the file.
8. Paging terminal apparatus (20) in accordance with any one of the preceding claims, wherein said means (22, 34) for sending the intended message to alternative pagers within said paging system and determining the identity of said alternative pager includes means (22, 30) for establishing a Subscriber Page List into which, along with pager's ID, type and address, the paging hierarchy associated therewith may be included in the form of forwarding address information.
9. Paging terminal apparatus (20) according to claim 1, wherein,
 - pagers (12) within said paging system have multiple acknowledge back response capability; (66a', 66b', 66c') and wherein the means for sending the intended message to some other pager are arranged to do so responsive to particular ones of an initially called pager's acknowledge back responses.
10. Paging terminal apparatus (20) in accordance with claim 9, wherein said means (22, 34) for sending addresses and messages to pagers (12) within said paging system include means (22) for establishing an Active Page File (44) into which addresses of particular pagers are placed, along with the messages intended therefor, as well as the particular pager ID's and the times of placing such in the file.
11. Paging terminal apparatus (20) in accordance with claim 9, wherein said means (22, 34) for further sending the message for an initially called pager to at least one other pager (12) within said paging system includes means (22, 30) for establishing a Subscriber Page List (42) into which the forwarding address of alternative



pagern are included, one of which is selected based on the particular acknowledge back response received from the initially called and acknowledging back pager.

12. Paging terminal apparatus (20) in accordance with claim 11, wherein after the address of said other alternative pager for sending the message to is selected, means (22, FIG. 6) are included to update said Active Page File (44) to include the new ID of said other pager and its address, along with a signature added to the message being call forwarded to indicate origin, and the time of such updating.

13. Paging terminal apparatus (20) in accordance with claim 9, wherein one of the multiple acknowledge back responses from the initially called pager represents a single acknowledgement with no request for further call forwarding of the message and wherein another response represents an acknowledgement together with a request to call forward such message to at least one other particular pager in the paging system (20).

14. Paging terminal apparatus according to any one of the preceding claims wherein the other pager is determined by the set hierarchy listing as being associated with the initially called pager.

Patentansprüche

1. Personenrufendgerät (20) zur Verwendung mit Personenrufempfängern (12) mit Rückbestätigungsfähigkeit ("Rufgeräte"), worin Rufnachrichten für Rufgeräte, die zu Anfang nicht rückbestätigen, automatisch zu anderen Rufgeräten innerhalb eines Personenrufsystems (10) weitergeleitet werden können. Das Personenrufendgerät (20) umfaßt:

eine Einrichtung (22, 34) zum Senden von Rufgeräteadressen und dafür bestimmter zugehöriger Nachrichten (44) an die Rufempfänger (12) innerhalb des Personenrufsystems; gekennzeichnet durch

eine Einrichtung (22 & Fig. 6 oder Fig. 8), um bei Ausbleiben des Rückempfangs einer vorvereinbarten Bestätigung von einem gerufenen Rufgerät die beabsichtigte Nachricht an ein anderes Rufgerät in dem Personenrufsystem (10) zu senden;

wobei das andere Rufgerät durch eine Geräterangordnungsliste (42) alternativer Rufgeräte bestimmt wird, die in dem Personenrufendgerät (20) enthalten ist.

2. Personenrufendgerät nach Anspruch 1, worin die Einrichtung zum Senden der beabsichtigten Nachricht an das andere Rufgerät eingerichtet ist, so zu verfahren, wenn die vorvereinbarte Bestätigung nicht innerhalb einer vorbestimmten Zeitdauer empfangen wird.

3. Personenrufendgerät (20) nach Anspruch 1 oder 2, worin die Einrichtung (22) zum Senden von Rufgeräteadressen und zugehöriger Nachrichten eine Einrichtung (22, 42) zum Senden von Rufgeräteadressen und eine Einrichtung (22, 44) zum Senden einer gezielten Nachricht an ein bestimmtes Rufgerät bei Rückempfang einer Bestätigung von diesem Rufgerät umfaßt.

4. Personenrufendgerät (20) nach Anspruch 1, 2 oder 3, worin die Einrichtung zum Senden von Rufgeräteadressen und zugehöriger Nachrichten umfaßt:

eine Rufsteuereinrichtung (22);

eine Eingabeeinrichtung (30) zur Eingabe von Informationen in die Rufsteuereinrichtung (22); und

das andere Rufgerät durch eine Geräterangordnungsliste (42) alternativer Rufgeräte ermittelt wird, die in die Rufsteuereinrichtung (22) durch das Eingabegerät (30) eingegeben wird.

5. Personenrufendgerät (20) nach einem der vorangehenden Ansprüche, worin die Einrichtung (22) zum Senden der beabsichtigten Nachricht an das andere Rufgerät, wenn der Empfang der Bestätigung davon ausbleibt, die beabsichtigte Nachricht an das nächste Rufgerät auf der Geräterangordnungsliste (42) sendet.

6. Personenrufendgerät (20) nach Anspruch 5, worin zusätzliche alternative Rufgeräte der Reihe nach aus der Geräterangordnungsliste (42) ausgewählt werden, bis entweder eine Bestätigung von einem alternativen Rufgerät empfangen wird, oder die Liste alternativer Rufgeräte erschöpft ist.

7. Personenrufendgerät (20) nach einem der vorangehenden Ansprüche, worin die Einrichtung (22) zum Senden von Adressen und Nachrichten an Rufgeräte (12) in dem Personenrufsystem eine Einrichtung (22, Fig. 6) enthält, um eine aktive Rufdatei (44) einzurichten, in die sowohl Adressen bestimmter Rufgeräte zusammen mit den dafür bestimmten Nachrichten, als auch die ID des bestimmten Rufgeräts und die Zeit des Eintragens derselben in die Datei eingetragen werden.



8. Personenrufendgerät (20) nach einem der vorangehenden Ansprüche, worin die Einrichtung (22, 34) zum Senden der beabsichtigten Nachricht an alternative Rufgeräte innerhalb des Personenrufsystems und zum Bestimmen der Identität des alternativen Rufgeräts eine Einrichtung (22, 30) umfaßt, um eine Teilnehmer-
ruffliste einzurichten, in die zusammen mit der ID, dem Typ und der Adresse des Rufgeräts die damit verbundene Ruf Rangordnung in der Form von Weiterleitungsadreßinformationen eingeschlossen werden kann.

9. Personenrufendgerät (20) nach Anspruch 1, worin

die Rufgeräte (12) innerhalb des Personenrufsystems eine Mehrfachrückmelde-Antwortfähigkeit haben (66a', 66b', 66c'), und worin die Einrichtung zum Senden der beabsichtigten Nachricht an ein anderes Rufgerät eingerichtet ist, ansprechend auf bestimmte von Rückmeldeantworten eines anfangs gerufenen Rufgeräts, so zu verfahren.

10. Personenrufendgerät (20) nach Anspruch 9, worin die Einrichtung (22, 34) zum Senden von Adresen und Nachrichten an Rufgeräte (12) innerhalb des Personenrufsystems eine Einrichtung (22) enthält, um eine aktive Rufdatei (44) einzurichten, in die sowohl Adressen bestimmter Rufgeräte zusammen mit den dafür bestimmten Nachrichten, als auch die bestimmten Rufgeräte-IDs und die Zeiten des Eintragens derselben in die Datei eingetragen werden.

11. Personenrufendgerät (20) nach Anspruch 9, worin die Einrichtung (22, 34) zum weiteren Senden der Nachricht für ein anfangs gerufenes Rufgerät an mindestens ein anderes Rufgerät (12) innerhalb des Personenrufsystems eine Einrichtung (22, 30) enthält, um eine Teilnehmerruffliste (42) einzurichten, in die die Weiterleitungsadressen alternativer Rufgeräte eingeschlossen sind, von denen eine auf der Basis der von dem anfangs gerufenen und rückmeldenden Rufgerät empfangenen bestimmten Rückmeldeantwort ausgewählt wird.

12. Personenrufendgerät (20) nach Anspruch 11, worin, nachdem die Adresse des anderen alternativen Rufgeräts, dem die Nachricht zu senden ist, ausgewählt ist, eine Einrichtung (22, Fig. 6) enthalten ist, um die aktive Rufdatei (44) zu aktualisieren, um die neue ID des anderen Rufgeräts und dessen Adresse zusammen mit einer der Nachricht, die weitergeleitet wird, hinzugefügten Zeichen, um den

Ursprung anzuzeigen, und die Zeit einer solchen Aktualisierung zu enthalten.

13. Personenrufendgerät (20) nach Anspruch 9, worin eine der Mehrfachrückmeldeantworten von dem anfangs gerufenen Rufgerät eine einzelne Bestätigung ohne Anforderung für eine weitere Rufweiterleitung der Nachricht darstellt, und worin eine andere Antwort eine Bestätigung zusammen mit einer Anforderung, eine solche Nachricht an wenigstens ein anderes bestimmtes Rufgerät in dem Rufsystem (10) weiterzuleiten, darstellt.

14. Personenrufendgerät nach einem der vorangehenden Ansprüche, worin das andere Rufgerät durch die Geräterangordnungsliste als dem anfangs gerufenen Rufgerät zugehörig ermittelt wird.

Revendications

1. Appareil de terminal de recherche de personne (20) destiné à être utilisé avec des récepteurs de recherche de personne (12) présentant une capacité de retour d'accusé de réception ("récepteurs de recherche de personne"), dans lequel des messages de recherche de personne pour récepteurs de recherche de personne qui échouent initialement à retourner un accusé de réception peuvent être automatiquement envoyés à d'autres récepteurs de recherche de personne contenus dans un système de recherche de personne (10), ledit appareil de terminal de recherche de personne (20) comprenant :

un moyen (22, 34) pour envoyer des adresses de récepteurs de recherche de personne et des messages associés (44) qui leur sont destinés jusqu'aux récepteurs de recherche de personne (12) contenus dans ledit système de recherche de personne,

caractérisé par :

un moyen (22 figure 6 ou figure 8) pour, suite à une défaillance quant à un retour de réception d'un accusé de réception préagencé à partir d'un récepteur de recherche de personne appelé, envoyer le message concerné jusqu'à un quelconque autre récepteur de recherche de personne contenu dans le système de recherche de personne (10) ;

ledit autre récepteur de recherche de personne étant déterminé au moyen d'une liste hiérarchique établie (42) d'autres récepteurs de recherche de personne inclus dans l'appareil de terminal de recherche de personne (20).



2. Appareil de terminal de recherche de personne selon la revendication 1, dans lequel ledit moyen pour envoyer le message considéré jusqu'à l'autre récepteur de recherche de personne est agencé pour réaliser cet envoi suite à une défaillance à recevoir l'accusé de réception préagencé en une période temporelle prédéterminée.

3. Appareil de terminal de recherche de personne (20) selon la revendication 1 ou 2, dans lequel le moyen (22) pour envoyer des adresses de récepteurs de recherche de personne et des messages associés comprend un moyen (22, 42) pour envoyer des adresses de récepteurs de recherche de personne et un moyen (22, 24) pour envoyer un message dirigé sur un récepteur de recherche de personne particulier suite à un retour de réception d'un accusé de réception en provenance dudit récepteur de recherche de personne.

4. Appareil de terminal de recherche de personne (20) selon la revendication 1, 2 ou 3, dans lequel le moyen pour envoyer des adresses de récepteurs de recherche de personne et des messages associés comprend :

un moyen de contrôleur de recherche de personne (22) ;

un moyen d'entrée (30) pour entrer une information dans ledit moyen de contrôleur de recherche de personne (22) ; et

ledit autre récepteur de recherche de personne est déterminé par une liste hiérarchique établie (42) d'autres récepteurs de recherche de personne entrée dans ledit moyen de contrôleur de recherche de personne (22) au moyen dudit dispositif d'entrée (30).

5. Appareil de terminal de recherche de personne (20) selon l'une quelconque des revendications précédentes, dans lequel ledit moyen (22) pour émettre le message considéré jusqu'au récepteur de recherche de personne suite à un échec à en recevoir l'accusé de réception, envoie ledit message considéré jusqu'au récepteur de recherche de personne suivant situé sur ladite liste hiérarchique établie (42).

6. Appareil de terminal de recherche de personne (20) selon la revendication 5, dans lequel d'autres récepteurs de recherche de personne supplémentaires sont sélectionnés séquentiellement dans ladite liste hiérarchique établie (42) soit jusqu'à ce qu'un accusé de réception soit reçu depuis un autre récepteur de recherche de personne soit jusqu'à ce que la liste des récepteurs de recherche de personne soit par-

courue de façon exhaustive.

7. Appareil de terminal de recherche de personne (20) selon l'une quelconque des revendications précédentes, dans lequel ledit moyen (22) pour envoyer des adresses et des messages jusqu'à des récepteurs de recherche de personne (12) contenus dans ledit système de recherche de personne inclut un moyen (22 figure 6) pour établir un fichier de recherche de personne actif (44) dans lequel des adresses de récepteurs de recherche de personne particuliers sont placées ainsi que les messages afférents ainsi que l'identification du récepteur de recherche de personne particulier et que l'instant de positionnement de ces éléments dans le fichier.

8. Appareil de terminal de recherche de personne (20) selon l'une quelconque des revendications précédentes, dans lequel ledit moyen (22, 34) pour envoyer le message considéré jusqu'à d'autres récepteurs de recherche de personne contenus dans ledit système de recherche de personne et pour déterminer l'identité dudit autre récepteur de recherche de personne inclut un moyen (22, 30) pour établir une liste de recherche de personne par abonné dans laquelle, en plus de l'ID de récepteur de recherche de personne, du type et de l'adresse, la hiérarchie de recherche de personne associée peut être incluse sous la forme d'une information d'adresse de renvoi automatique.

9. Appareil de terminal de recherche de personne (20) selon la revendication 1, dans lequel :

des récepteurs de recherche de personne (12) inclus dans ledit système de recherche de personne présentent une capacité de réponse de retour d'accusé de réception multiple (66a', 66b', 66c') et dans lequel le moyen pour envoyer le message considéré jusqu'à un quelconque autre récepteur de recherche de personne est agencé de manière à mettre en oeuvre cette capacité en réponse à certaines réponses particulières prises parmi des réponses de retour d'accusé de réception d'un récepteur de recherche de personne initialement appelé.

10. Appareil de terminal de recherche de personne (20) selon la revendication 9, dans lequel ledit moyen (22, 34) pour envoyer des adresses et des messages jusqu'à des récepteurs de recherche de personne (12) inclus dans ledit système de recherche de personne inclut un moyen (22) pour établir un fichier de recherche de personne actif (44) dans lequel des adres-



ses de récepteurs de recherche de personne particuliers sont placés ainsi que les messages afférents de même que les identificateurs de récepteurs de recherche de personne particuliers et que les instants de positionnement de ces éléments dans le fichier.

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hiérarchique établie qui est associée au récepteur de recherche de personne initialement appelé.

11. Appareil de terminal de recherche de personne (20) selon la revendication 9, dans lequel ledit moyen (22, 34) pour envoyer en outre le message concernant un récepteur de recherche de personne initialement appelé jusqu'à au moins un autre récepteur de recherche de personne (12) inclus dans ledit système de recherche de personne inclut un moyen (22, 30) pour établir une liste de recherche de personne par abonné (42) dans laquelle l'adresse de renvoi automatique d'autres récepteurs de recherche de personne est incluse, l'une d'elles étant sélectionnée sur la base de la réponse de retour d'accusé de réception particulière reçue depuis le récepteur de recherche de personne appelé initialement et de retour d'accusé de réception.

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12. Appareil de terminal de recherche de personne (20) selon la revendication 11, dans lequel après que l'adresse dudit autre récepteur de recherche de personne pour envoyer le message est sélectionnée, un moyen (22 figure 6) est inclus pour mettre à jour ledit fichier de recherche de personne actif (44) afin qu'il inclue le nouvel ID dudit autre récepteur de recherche de personne ainsi que son adresse de même qu'une signature ajoutée au message qui fait l'objet d'un renvoi automatique d'appel pour indiquer l'origine et l'instant de cette mise à jour.

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13. Appareil de terminal de recherche de personne (20) selon la revendication 9, dans lequel l'une des multiples réponses de retour d'accusé de réception en provenance du récepteur de recherche de personne appelé initialement représente un unique accusé de réception sans requête d'un autre renvoi automatique d'appel du message et dans lequel une autre réponse représente un accusé de réception ainsi qu'une requête de renvoi automatique d'appel de ce message sur au moins un autre récepteur de recherche de personne particulier contenu dans le système de recherche de personne (20).

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14. Appareil de terminal de recherche de personne selon l'une quelconque des revendications précédentes, dans lequel l'autre récepteur de recherche de personne est déterminé par la liste

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