

Description

BACKGROUND OF THE INVENTION

The present invention relates to a paging system, and in particular to a receiver having a microprocessor-based control unit which decodes a transmitted radio frequency paging signal for providing a display on a linear array of elements and scrolling the displayed characters through the array.

In conventional radio frequency paging systems, individual portable receivers have a linear array of display elements on which the message is displayed upon detection of a match between a received address code and the subscriber's own code which is assigned to the receiver. The word-length of the message is usually exceeds the capacity of the display elements due to the small space available. The current practice is to display a portion of the received message at a time and then scroll it on a per character basis from one end of the array toward the other. However, this type of scrolling demands rapid eye movements and renders the message less intelligible since written information is usually perceived on a per word or word-group basis. Such a paging receiver according to the preamble of claim 1 is known from GB-A-2062320.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a radio paging receiver which is capable of scrolling a received message on a word or word-group basis. This object is solved with a paging receiver according to claims 1 and 13.

In a preferred embodiment of the invention, the data processing means is arranged to introduce a time interval between the times the first and second sequences are read into the display elements. This allows the user a sufficient time to perceive the displayed word or words which are automatically scrolled to the next word or words at the end of the time.

In a further preferred embodiment, the data processing means is arranged to introduce a first, longer interval in response to the first sequence being read into the display elements and successively read a sequence of characters from a position displaced by one character position from the first sequence at a second, shorter interval until the blank is detected. In this mode of operation, each sequence of characters remains displayed for a long interval to allow the user a sufficient time for perception and then the message is scrolled on a per character basis at short intervals until the next sequence appears.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described in further detail with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of a radio paging receiver embodying the present invention;

Fig. 2 is a block diagram illustrating the detail of the microprocessor-based decoder of Fig. 1;

Fig. 3 is an illustration of the format of received codewords;

Fig. 4 is a flowchart describing the instructions of the microprocessor of Fig. 2 programmed according to a first embodiment of the invention;

Fig. 5 is an illustration of a received message stored in a memory location of the data memory of Fig. 2;

Figs. 6a to 6f are illustrations associated with the flowchart of Fig. 3;

Fig. 7 is a flowchart of the instructions programmed according to a second embodiment of the invention;

Fig. 8 is a flowchart of the instructions programmed according to an alternative embodiment of the invention;

Figs. 9a and 9b are a flowchart of the instructions programmed according to a third embodiment of the invention; and

Figs. 10a to 10d are illustrations of characters displayed according to the third embodiment.

DETAILED DESCRIPTION

Referring now to Fig. 1, there is shown a paging receiver embodying the present invention. The paging receiver comprises a tuner 2 having one or more radio frequency amplifier stages, a local oscillator and a mixer for receiving a radio frequency signal intercepted by an antenna 1 and converts the radio frequency to an intermediate frequency. The output of the tuner 2 is applied to a waveshaper 3 wherein the signal is shaped into a waveform having sharply defined edges and distinguishable voltage levels suitable for it to be processed in a microprocessor-based decoder 4. The tuner 2 and waveshaper 3 receive power from a battery 11. Since the tuner and waveshaper are constructed of discrete components, these circuits account for a greater part of the total power consumption of the system. For power saving purposes an electronic switching circuit 10 is provided in a power line to these components to periodically cut it off during idle periods in response to a signal from the decoder 4.

A DC-DC converter 12 steps up the battery voltage to a level sufficient to operate the decoder 4. The microprocessor-based decoder 4 is in receipt of clock pulses from a clock source 13 to

perform decoding operations on the signal received from the waveshaper 3 in synchronized fashion with associated external circuits which include a drive circuit 6, an 8-digit liquid crystal display panel 5, and a programmable read only memory (PROM) 14.

In the PROM 14 is stored a subscriber's own address codeword with which the received address codewords are each checked to detect a match therebetween. When this occurs, the decoder 4 activates an audio frequency oscillator 7 to apply a tone signal to a loudspeaker 8 to alert the user that he is being paged. A manual key 15 is provided to terminate the alarm sound. In one embodiment, the user is further urged to operate the key 15 each time a predetermined amount of characters is displayed on the panel 5.

As illustrated in Fig. 2, the decoder 4 comprises an instruction decoder 20 which translates the instructions it receives from a program memory 21 when addressed by a program counter 22. A multi-timer 23 which provides timing signals to various parts of the system. An arithmetic logic unit 25 executes arithmetic and logic operations in accordance with instructions issued from the decoder 20. The signal from the waveshaper 3 is applied to an input port 26.

The code format of the paging system, shown in Fig. 3, starts with a preamble P followed by a word synchronization codeword SC to attain word synchronization for a sequence of subscriber data including address codewords A and message codewords I. The end of the format is indicated by an end-of-transmission codeword E.

During idle periods the power saving operation is effected to open the electronic switch 10 at intervals to reduce the amount of power dissipated in the tuner and waveshaper. When the input signal is received from the waveshaper 3 through input port 26 and a preamble P is detected, the power saving operation is discontinued by the decoder. The microprocessor 20 proceeds to detect a word synchronization codeword SC to establish word synchronization and then to compare the succeeding address codeword A₁ against the address data stored in the PROM 14 by successively addressing it through an output port 27 and reading the addressed data through an input port 28.

If the address codeword A₁ is matched with the user's own address codeword, the tone oscillator 7 is energized to generate a sound alarm. A succeeding message codeword I₁ is then loaded into a storage location d₁ of a data memory 30. Upon the operation of key 15, the message codeword I₁ is read out of the memory 30 in a manner as will be detailed hereinbelow and transmitted from an interface 24 on a line 24a to the driver 6 and thence to

the display panel 5 with an associated synchronization code on a line 24b. In response to the receipt of an end-of-transmission codeword E, the microprocessor 20 places an enabling signal to the electronic switch 10 to reinitiate the power saving operation.

Fig. 4 is a flowchart describing a display operation according to a first preferred embodiment of the present invention. In this embodiment, the display panel 5 comprises an eight-segment liquid crystal display. Under certain circumstances where a lengthy word contains more than eight characters, only the eight most significant digit characters are displayed. However, the loss of one or two least significant digit codes does not materially affect on the intelligibility of the word.

After detecting the address codeword A₁, the microprocessor starts executing the programmed instructions at Step 31 by loading the succeeding message codeword I₁, which typically comprises a sequence of 7-bit ASCII codes, for example "PLEASE TELEPHONE TO YOUR OFFICE", into the location d₁ of memory 30 as illustrated in Fig. 5. The microprocessor 20 goes to a Step 32 to check if the manual key 15 has been operated, and if so, executes a Step 33 by reading eight 7-bit codes "PLEASE T" from the MSD to MSD-7 digit positions of memory location d₁ and executes a Step 34 by putting the data on display as shown in Fig. 6a. The Step 32 will be repeatedly executed until the key 15 is operated.

At Step 35, the microprocessor checks if there is a blank in the MSD position of memory location d₁, and if not, executes a Step 36 to decrement a "variable" stored in an MSD position by one and returns through a Step 38 to the Step 35. The Steps 35, 36 and 38 are executed seven times until a blank is detected in the MSD-6 position. When this occurs, the microprocessor moves to a Step 37 to decrement the MSD variable by one so that the current status of the MSD variable is MSD-7, or the eighth MSD position where the character "T" is stored. The microprocessor now returns to the Step 32 to check if the key 15 is again operated, and if so, the Step 33 is executed to read the next eight 7-bit codes from the MSD-7 to MSD-14 positions using the current MSD variable, so that the codes "TELEPHON" are retrieved, and subsequently displayed in Step 34 (see Fig. 6b).

The above process is repeated to provide display as shown in Figs. 6c to 6e until an asterisk "*" which is located at the end of the message is detected in Step 38. The Step 38 is followed by a Step 39 to detect if the key 15 is operated, and if so, the display panel 5 is cleared (Fig. 6f) in Step 40 to permit the microprocessor to return to the Step 32 to repeat the above process. If the switch 15 is not detected as being operated in Step 39, a

delay time of 8 second is set in a memory in Step 41 and counted in Step 42. After the 8-second pause lapses, the program returns to Step 39, so that the status of the switch 15 is checked at 8-second intervals until it is operated. It is seen therefore that according to the first embodiment of the invention, the message is scrolled manually on a per word group basis.

According to a second embodiment of the invention, the message is scrolled automatically on a per wordgroup basis. Fig. 7 is an illustration of a flowchart according to this embodiment. Similar to the Step 31 of Fig. 4, a message codeword is loaded into memory location d_1 in Step 41, and followed by a Step 42 to check if the key 15 is operated, and if so, Steps 43 and 44 are successively executed to display the first eight characters "PLEASE T". At Step 45, a "1-second" delay time flag is set up in a memory location d_2 . Clock is counted in Step 46 to check if 1 second has lapsed. A Step 47 is executed to check if a blank is present in the MSD position of the memory location d_1 . A Step 48 is then executed if no blank is detected in Step 47 to decrement the MSD variable by one. The microprocessor goes to a Step 50 to detect the asterisk and if not, returns to the Step 47 to successively decrement the MSD variable until the blank in the MSD-6 position is detected at Step 47. If a blank is detected in Step 47 the microprocessor exits to a Step 49 to further decrement the MSD variable by one so that the current status of the MSD variable is MSD-7. The microprocessor returns to the Step 43 to reset the display panel 5 and read out the next eight characters "TELEPHON". When the asterisk is detected in Step 50, an 8-second delay is introduced by Steps 51 and 52 before the microprocessor clears the display panel 5 at Step 53. After execution of Step 53, the program returns to Step 42. Therefore, the message is scrolled automatically at 1-second intervals on a per wordgroup basis.

The flowchart of Fig. 7 is modified as shown in Fig. 8 which differs from the Fig. 7 embodiment by the inclusion of a string of Steps 52 to 55 interposed between the Steps 48 and 50 of Fig. 7. After decrementing the MSD variable by one at Step 48 so that its current value is MSD-1, the eight characters of the MSD-1 to MSD-8 ("ELEPHONE") are read out of memory location d_1 at Step 52 and displayed at Step 53. A 0.3-second delay time flag is set up in a memory location d_3 at Step 54 and this time interval is checked at Step 55. After the introduction of a 0.3-second interval, the microprocessor returns through Step 50 to the Step 47 to repeat the string of Steps 47, 48, 52 to 55, 50 and 47 again to scroll the message at 0.3 intervals on a per character basis until a blank is detected in Step 47.

It is seen therefore that the first eight characters "PLEASE T" remain displayed for a 1-second period and are then scrolled at 0.3 intervals so that one character disappears from the display and another appears until the blank between E and T moves to the leftmost segment of the display panel and subsequently the next eight characters "TELEPHON" remains displayed for a 1-second period. In this embodiment, all the characters of a word having more than 8 characters are made to appear on the display panel during the 0.3-second interval scroll.

Figs. 9a and 9b are a flowchart of a further preferred embodiment of the present invention. In the previous embodiments the last word of any sequence is partially displayed if this word spills over the end of the display panel.

In the present embodiment, the previously used MSD variable is divided into a first variable WN which represents the number of characters counted before a blank is detected, a second variable DS which is updated with and accumulate the first variable, and a third variable or display pointer DP which is updated each time a sequence of characters is displayed to accumulate the second variable. These variables are stored in WN, DS and DP registers, respectively. The total count of the DP and DS registers are used to determine the characters to be displayed when the total count of the WN and DS registers exceeds the maximum number of display elements.

For purposes of illustration a 16-element display panel is used and a sentence "PLEASE GO TO 19TH HOLE AT 3 PM" is stored in a memory location d_5 . As illustrated in Fig. 10a, the characters stored in location d_5 are each identified by an address code corresponding to the total value of DP, DS and WN registers, which is expressed in the flowchart as a function $f(DP + DS + WN)$. On the other hand, the characters to be displayed are addressed by a code corresponding to the total count of the DP and DS registers which is expressed in the flowchart as a function $f(DP + DS)$.

Referring to Figs. 9a and 9b, the program starts when the input data are stored in memory location d_5 and the key 15 operated. At Step 61 the display pointer register DP is set to "1", at Step 62 the DS register is set to "0", and at Step 63 the WN register and a flag are both set to "0". At Step 64, the microprocessor checks if the digit position identified by the total count of the DP, DS and WN registers is a blank, and if not, goes to a Step 65 to check if that digit position is an asterisk, and if not, goes to a Step 66 to set up the flag and thence to a Step 67 to increment the WN register by one and returns to the Step 64. The microprocessor passes through Steps 64, 65, 66 and 67 back to Step 64 repeatedly to scan the characters

"PLEASE" to detect a blank that follows when $DP = 1$, $DS = 0$, $WN = 6$, and passes through a Step 68 to a Step 69. The total of DS and WN registers, which indicates the number of digit positions scanned up to this moment, is checked if it is still smaller than the maximum number of the available display segments to allow the microprocessor to increment the DS register by an amount equal to the first variable WN in Step 70 and return to Step 63 to reset the WN register and flag to "0". With the blank at the 7th digit position being detected and the flag being reset to zero, the microprocessor now passes through Steps 64 and 68 and increments the WN register by one at Step 67 to shift the scanning point to the 8th digit position to detect the character "G". Thus, Steps 64, 65, 66, 67 and back to 64 are repeatedly looped to scan the next word "GO". Step 68 is then executed when the scanning point reaches the tenth digit position where a second blank is stored to permit the microprocessor to check if the number of scanned characters is still smaller than 16. Therefore, the first variable WN is reset each time a blank is detected, while the second variable DS is incremented by an amount equal to the first variable before the first variable is reset to zero.

The above process is repeated until the scanning point reaches the 17th digit position. The total count of DS and WN registers is now 17 and the microprocessor exits from Step 69 to a Step 71 to put an arrow head on a separate display element 100 located above the 16th digit position of the display panel 5 (see Fig. 10b). This arrow head indicates that there is still at least one word to follow. At this moment, the total count of the DP and DS registers equals 13 ($= 1 + 12$).

The microprocessor advances to a Step 72 to address the characters as a function of variables from $DP=1$ to $DP=1 + 12$ to display the characters "PLEASE GO TO" (Fig. 10b) in a first display cycle.

These characters remain on display for a period of 1 second by setting 1-second pause data into a memory location d_5 in Step 73 and checking the elapse of this period in Step 74. The Steps 73 and 74 may be replaced with a step which detects the operating condition of the manual key 15 so that the display cycle continues as long as the user desires.

At the end of a display cycle, the display pointer DP is incremented by an amount equal to the second variable DS in Step 75. At Step 76, a digit position addressable by the updated display pointer DP is checked if it is filled with an asterisk, and if not, Steps 77 and 78 are repeatedly executed to increment the variable DP by one until the first character of the next word "19TH" is detected in Step 77. The microprocessor now re-

turns to the Step 62 to reinitiate the second display cycle by repeating the above process to display "19TH HOLE AT 3".

During the second display cycle the display pointer DP remains set to 14. The first, WN variable is incremented to 4 by the characters "19TH", reset to zero, and then incremented to 5 by the characters "HOLE" plus a blank that follows, then reset to zero and incremented to 3 by the characters "AT" plus a following blank, reset to zero by that blank and incremented to 2 by the character "3" plus a following blank, reset again by the last-mentioned blank and incremented to 3 by the characters "PM". Therefore, the DS variable is incremented to 14 by the time all the digit positions are scanned. An asterisk is now detected in Step 65 and the microprocessor goes to a Step 79 to increment the WN variable by one and goes to a Step 80 to check if the total of DS and WN variables exceeds 16 to allow the microprocessor to exit to the Step 71 to put an arrow head on display at the 16th digit position (Fig. 10c). Since the DP and DS variables are both 14, the characters stored in the 14th to 28th digit positions are addressed in Step 72 for display as a function of variables from $DP=14$ to $DP=14 + 14$. Upon the elapse of a 1-second interval, the DP variable is again incremented by an amount equal to DS which is now 14, so that DP is now 28. In Step 76, the digit position corresponding to $DP=28$ is checked if it contains an asterisk and control exits to Step 77 to increment WN by one in Step 78 to return to Step 63.

During the third display cycle, the DP variable is incremented to 29 by execution of Steps 64, 68 and 67 and the DS variable is incremented to 2 by the time the characters "PM" are scanned. The asterisk is again detected in Step 65 to follow the Steps 79 and 80. Since the total of DS and WN variables is smaller than 16 this time, the arrow head display step 71 is bypassed to allow only the last word "PM" to be displayed in Step 72. After a 1-second interval, the DP variable is set to 31 ($= 29 + 2$) corresponding to the digit position of the asterisk which is detected in Step 76 to terminate the program.

Claims

1. A paging receiver adapted to receive a radio frequency paging signal containing a preamble, a subscriber address code and a message code representing a plurality of blocks of characters and blanks, comprising:
 - a) a linear array of display elements;
 - b) a memory having a plurality of storage locations for storing said message code therein; and

"PLEASE" to detect a blank that follows when DP = 1, DS = 0, WN = 6, and passes through a Step 68 to a Step 69. The total of DS and WN registers, which indicates the number of digit positions scanned up to this moment, is checked if it is still smaller than the maximum number of the available display segments to allow the microprocessor to increment the DS register by an amount equal to the first variable WN in Step 70 and return to Step 63 to reset the WN register and flag to "0". With the blank at the 7th digit position being detected and the flag being reset to zero, the microprocessor now passes through Steps 64 and 68 and increments the WN register by one at Step 67 to shift the scanning point to the 8th digit position to detect the character "G". Thus, Steps 64, 65, 66, 67 and back to 64 are repeatedly looped to scan the next word "GO". Step 68 is then executed when the scanning point reaches the tenth digit position where a second blank is stored to permit the microprocessor to check if the number of scanned characters is still smaller than 16. Therefore, the first variable WN is reset each time a blank is detected, while the second variable DS is incremented by an amount equal to the first variable before the first variable is reset to zero.

The above process is repeated until the scanning point reaches the 17th digit position. The total count of DS and WN registers is now 17 and the microprocessor exits from Step 69 to a Step 71 to put an arrow head on a separate display element 100 located above the 16th digit position of the display panel 5 (see Fig. 10b). This arrow head indicates that there is still at least one word to follow. At this moment, the total count of the DP and DS registers equals 13 (= 1 + 12).

The microprocessor advances to a Step 72 to address the characters as a function of variables from DP=1 to DP= 1 + 12 to display the characters "PLEASE GO TO" (Fig. 10b) in a first display cycle.

These characters remain on display for a period of 1 second by setting 1-second pause data into a memory location d₅ in Step 73 and checking the elapse of this period in Step 74. The Steps 73 and 74 may be replaced with a step which detects the operating condition of the manual key 15 so that the display cycle continues as long as the user desires.

At the end of a display cycle, the display pointer DP is incremented by an amount equal to the second variable DS in Step 75. At Step 76, a digit position addressible by the updated display pointer DP is checked if it is filled with an asterisk, and if not, Steps 77 and 78 are repeatedly executed to increment the variable DP by one until the first character of the next word "19TH" is detected in Step 77. The microprocessor now re-

turns to the Step 62 to reinitiate the second display cycle by repeating the above process to display "19TH HOLE AT 3".

During the second display cycle the display pointer DP remains set to 14. The first, WN variable is incremented to 4 by the characters "19TH", reset to zero, and then incremented to 5 by the characters "HOLE" plus a blank that follows, then reset to zero and incremented to 3 by the characters "AT" plus a following blank, reset to zero by that blank and incremented to 2 by the character "3" plus a following blank, reset again by the last-mentioned blank and incremented to 3 by the characters "PM". Therefore, the DS variable is incremented to 14 by the time all the digit positions are scanned. An asterisk is now detected in Step 65 and the microprocessor goes to a Step 79 to increment the WN variable by one and goes to a Step 80 to check if the total of DS and WN variables exceeds 16 to allow the microprocessor to exit to the Step 71 to put an arrow head on display at the 16th digit position (Fig. 10c). Since the DP and DS variables are both 14, the characters stored in the 14th to 28th digit positions are addressed in Step 72 for display as a function of variables from DP=14 to DP=14 + 14. Upon the elapse of a 1-second interval, the DP variable is again incremented by an amount equal to DS which is now 14, so that DP is now 28. In Step 76, the digit position corresponding to DP=28 is checked if it contains an asterisk and control exits to Step 77 to increment WN by one in Step 78 to return to Step 63.

During the third display cycle, the DP variable is incremented to 29 by execution of Steps 64, 68 and 67 and the DS variable is incremented to 2 by the time the characters "PM" are scanned. The asterisk is again detected in Step 65 to follow the Steps 79 and 80. Since the total of DS and WN variables is smaller than 16 this time, the arrow head display step 71 is bypassed to allow only the last word "PM" to be displayed in Step 72. After a 1-second interval, the DP variable is set to 31 (= 29 + 2) corresponding to the digit position of the asterisk which is detected in Step 76 to terminate the program.

Claims

1. A paging receiver adapted to receive a radio frequency paging signal containing a preamble, a subscriber address code and a message code representing a plurality of blocks of characters and blanks, comprising:
 - a) a linear array of display elements;
 - b) a memory having a plurality of storage locations for storing said message code therein; and



c) data processing means responsive to said preamble for

c₁) detecting a match between the received address code and a predetermined code,

c₂) storing said message code into said memory in response to the detection of said match,

c₃) reading a first sequence of characters from predetermined storage locations of said memory and displaying same on said display elements,

c₄) detecting the position of a blank immediately following said first sequence to read a second sequence of characters from the positions immediately following the detected position of the blank into said display elements instead of said first sequence,

characterized in that the data processing means

d) scans a predetermined number of storage locations of said memory prior to the reading of each one of said first and second sequences to detect when a block of characters therein partially spills over a position corresponding to one end of said display elements and

e) forms said first and second sequences with one or more blocks of characters which precede said partially spilled block.

2. A paging receiver as claimed in claim 1, further comprising a manually operated key, and wherein said data processing means is arranged to introduce a pause in response to said first sequence being read into said display elements until said key is operated.

3. A paging receiver as claimed in claim 1, wherein said data processing means is arranged to introduce a pause between the times during which said first and second sequences are read into said display elements.

4. A paging receiver as claimed in claim 1, wherein said data processing means is arranged to introduce a first, longer interval in response to said first sequence being read into said display elements and is further arranged to successively read a sequence of characters from a position displaced by one character position from said first sequence at a second, shorter interval until said blank is detected.

5. A paging receiver as claimed in any of claims 1 to 4, wherein said data processing means comprises a microcomputer programmed to

execute the following steps:

a) reading a sequence of characters out of storage locations of said memory which are specified by a variable and displaying same on said display elements;

b) detecting a blank in a storage location which immediately follows said sequence;

c) if said blank is not detected, varying a variable by one and repeating the steps (b) and (c) until said blank is detected;

d) if said blank is detected, varying said variable by one; and

e) repeating the steps (a) to (d) until all the characters are displayed.

6. A paging receiver as claimed in claim 5, wherein said microcomputer is further programmed to execute the step of introducing a pause between the steps (a) and (b).

7. A paging receiver as claimed in any of claims 1 to 4, wherein said data processing means comprises a microcomputer programmed to execute the following steps:

a) reading a sequence of characters out of storage locations of said memory which are specified by a variable and displaying same on said display elements;

b) introducing a first, longer pause;

c) detecting a blank in a storage location which immediately follows said sequence;

d) if said blank is not detected, varying a variable by one;

e) reading a sequence of characters out of storage locations of said memory which are specified by said variable and displaying same on said display elements;

f) introducing a second, shorter pause;

g) repeating the steps (c) to (f) until said blank is detected in the step (c);

h) varying said variable by one to repeat the steps (a) to (g).

8. A paging receiver as claimed in any of claims 1 to 4, wherein said data processing means comprises a microcomputer programmed to execute the following steps:

a) resetting a first variable to zero;

b) addressing each of said storage locations from a position specified by a total of said first variable and a second variable to detect a blank;

c) varying said first variable by one;

d) checking if the number of said addressed locations exceeds a predetermined number;

e) if said predetermined number is not exceeded, varying said second variable by an amount equal to said first variable to repeat





- the steps (a) to (d) until said predetermined number is exceeded;
- f) reading the characters out of the storage locations as a function of said second variable and displaying same on said display elements;
- g) introducing a pause; and
- h) repeating the steps (a) to (g).
9. A paging receiver as claimed in claim 8, further comprising a separate display element located adjacent one end of said linear array, wherein said microcomputer is further programmed to execute a step (i) of displaying a mark in said separate display element in response to the step (e) to indicate that there is still a message code to be displayed.
10. A paging receiver as claimed in claim 8 or 9, wherein said message code include an end of message code, and wherein said microcomputer is further programmed to execute the steps of detecting the end of message code in response to the step (b), varying said first variable by one, checking if the number of said addressed locations exceeds a predetermined number; and skipping a step (i) to execute the step (f) if said predetermined number is exceeded and executing a step (i) if said predetermined number is not exceeded.
11. A paging receiver as claimed in any of claims 1 to 4, wherein said data processing means comprises a microcomputer having first, second and third variables, said microcomputer being programmed to execute the following steps:
- A) initializing said third variable;
 - B) initializing said second variable;
 - C) initializing said first variable;
 - D) addressing each of said storage locations from a position specified by a total of said first and second variables to detect a blank;
 - E) varying said first variable by one;
 - F) checking if the number of said addressed locations exceeds a predetermined number;
 - G) if said predetermined number is not exceeded, varying said second variable by an amount equal to said first variable to repeat the steps (C) to (F) until said predetermined number is exceeded;
 - H) reading the characters out of the storage locations as a function of said second and third variables and displaying same on said display elements;
 - I) introducing a pause; and
 - J) varying said third variable by an amount equal to said second variable;
 - K) addressing said storage locations as a function of said third variable;
 - L) varying said third variable by one; and
 - M) repeating the steps (B) to (L).
12. A paging receiver as claimed in claim 11, further comprising a separate display element adjacent to one end of said linear array, wherein said microcomputer is further programmed to execute a step (N) of displaying a mark in said separate display element in response to the step (G) to indicate that there is still a message code to be displayed.
13. A method for displaying a message code received from a transmitting station on a linear array of display elements, said message code representing a plurality of series of characters and blanks, comprising:
- a) storing said message code into a memory;
 - b) reading a first sequence of characters from predetermined storage locations of said memory and displaying same on said display elements;
 - c) detecting the position of a blank immediately following said first sequence;
 - d) reading a second sequence of characters from the positions immediately following the detected position of the blank and displaying same on said display elements instead of said first sequence ;
- characterized by
- e) scanning a predetermined number of storage locations of said memory prior to the reading of each one of said first and second sequences to detect when a block of characters therein partially spills over a position corresponding to one end of said display elements and
 - f) forming said first and second sequences with one or more blocks of characters which precede said partially spilled block.
14. A method as claimed in claim 13, further comprising introducing a pause between the times during which said first and second sequences are displayed on said display elements.
15. A method as claimed in claim 13 or 14, further comprising introducing a first, longer interval in response to said first sequence being displayed on said display elements, successively reading a sequence of characters from a position dis-



placed by one character position from said first sequence at a second, shorter interval until said blank is detected.

Revendications

1. Récepteur d'appel de personne adapté à recevoir un signal d'appel de personne radio-fréquence contenant un préambule, un code d'adresse d'abonné et un code de message représentant une pluralité de blocs de caractères et d'espaces, comprenant :
 - a) un réseau linéaire d'éléments d'affichage;
 - b) une mémoire ayant une pluralité d'emplacements de stockage pour y stocker le dit code de message et
 - c) un moyen de traitement des données sensible audit préambule pour
 - c₁) détecter une correspondance entre le code d'adresse reçu et un code prédéterminé,
 - c₂) stocker ledit code de message dans ladite mémoire en réponse à la détection de ladite correspondance,
 - c₃) lire une première séquence de caractères à partir des emplacements de stockage prédéterminés de ladite mémoire et les afficher sur lesdits éléments d'affichage,
 - c₄) détecter la position d'un espace suivant immédiatement ladite première séquence pour lire une seconde séquence de caractères à partir des positions suivant immédiatement la position détectée de l'espace dans lesdits éléments d'affichage, au lieu de ladite première séquence,

caractérisé en ce que ledit moyen de traitement des données:

 - d) analyse un nombre prédéterminé d'emplacements de stockage de ladite mémoire avant de lire chacune desdites première et seconde séquences afin de détecter l'instant où un bloc de caractères qu'elle contient dépasse partiellement une position correspondant à une extrémité desdits éléments d'affichage, et
 - e) forme lesdites première et seconde séquences avec un ou plusieurs blocs de caractères qui précèdent ledit bloc dépassant partiellement.
2. Récepteur d'appel de personne selon la revendication 1, comprenant en outre une touche actionnée manuellement et caractérisé en ce que ledit moyen de traitement de données est conçu pour introduire une pause en réponse à ladite première séquence qui est lue dans les-

dit éléments d'affichage jusqu'à ce que ladite touche soit actionnée.

3. Récepteur d'appel de personne selon la revendication 1, caractérisé en ce que ledit moyen de traitement des données est conçu pour introduire une pause entre les instants où lesdites première et seconde séquences sont lues dans lesdits éléments d'affichage.
4. Récepteur d'appel de personne selon la revendication 1, caractérisé en ce que ledit moyen de traitement des données est conçu pour introduire un premier intervalle de temps long en réponse à ladite première séquence lue dans lesdits éléments d'affichage, et est en outre conçu pour lire successivement une séquence de caractères à partir d'une position décalée d'une position de caractère par rapport à ladite première séquence, au bout d'un second intervalle de temps court, jusqu'à ce que ledit espace soit détecté.
5. Récepteur d'appel de personne selon l'une quelconque des revendications 1 à 4, caractérisé en ce que ledit moyen de traitement des données comprend un micro-calculateur programmé pour exécuter les étapes suivantes :
 - a) lire une séquence de caractères dans des emplacements de stockage de ladite mémoire qui sont spécifiés par une variable et les afficher sur lesdits éléments d'affichage;
 - b) détecter dans un emplacement de stockage un espace qui suit immédiatement ladite séquence;
 - c) si ledit espace n'est pas détecté, faire varier d'une unité une variable et répéter les étapes (b) et (c) jusqu'à ce que ledit espace soit détecté;
 - d) si ledit espace est détecté, faire varier d'une unité ladite variable, et
 - e) répéter les étapes (a) à (d) jusqu'à ce que tous les caractères soient affichés.
6. Récepteur d'appel de personne selon la revendication 5, caractérisé en ce que ledit micro-calculateur est en outre programmé pour exécuter l'étape consistant à introduire une pause entre les étapes (a) et (b).
7. Récepteur d'appel de personne selon l'une quelconque des revendications 1 à 4, caractérisé en ce que ledit moyen de traitement des données comprend un micro-calculateur programmé pour exécuter les étapes suivantes :
 - a) lire une séquence de caractères dans des emplacements de stockage de ladite



- mémoire qui sont spécifiés par une variable et les afficher sur lesdits éléments d'affichage;
- b) introduire une première pause longue;
- c) détecter un espace à l'emplacement de stockage qui suit immédiatement ladite séquence;
- d) si ledit espace n'est pas détecté, faire varier d'une unité ladite variable;
- e) lire une séquence de caractères aux emplacements de stockage de ladite mémoire qui sont spécifiés par ladite variable et les afficher sur lesdits éléments d'affichage;
- f) introduire une seconde pause courte;
- g) répéter les étapes (c) à (f) jusqu'à ce que ledit espace soit détecté à l'étape (c);
- h) faire varier d'une unité ladite variable pour répéter les étapes (a) à (g).
8. Récepteur d'appel de personne selon l'une quelconque des revendications 1 à 4, caractérisé en ce que ledit moyen de traitement des données comprend un micro-calculateur programmé pour exécuter les étapes suivantes :
- a) réinitialiser à zéro une première variable;
- b) adresser chacun des emplacements de stockage à partir d'une position spécifiée par un total de ladite première variable et de ladite seconde variable afin de détecter un espace;
- c) faire varier d'une unité ladite première variable;
- d) vérifier si le nombre desdits emplacements adressés dépasse un nombre prédéterminé;
- e) si ledit nombre prédéterminé n'est pas dépassé, faire varier ladite seconde variable d'une quantité égale à ladite première variable pour répéter les étapes (a) à (d) jusqu'à ce que ledit nombre prédéterminé soit dépassé;
- f) lire les caractères aux emplacements de stockage en fonction de ladite seconde variable et les afficher sur lesdits éléments d'affichage;
- g) introduire une pause; et
- h) répéter les étapes (a) à (g).
9. Récepteur d'appel de personne selon la revendication 8, comprenant en outre un élément d'affichage séparé situé au voisinage d'une extrémité dudit réseau linéaire, caractérisé en ce que ce micro-calculateur est en outre programmé pour exécuter une étape (I) d'affichage d'une marque dans ledit élément d'affichage séparé en réponse à l'étape (e) pour indiquer qu'il reste un code de message à afficher.
10. Récepteur d'appel de personne selon la revendication 8 ou 9, caractérisé en ce que ledit code de message comporte un code de fin de message et en ce que ledit micro-calculateur est en outre programmé pour exécuter l'étape de détection du code de fin de message en réponse à l'étape (b), faire varier d'une unité la première variable, vérifier si le nombre desdits emplacements adressés dépasse un nombre prédéterminé; et sauter une étape (I) pour exécuter l'étape (f) si ledit nombre prédéterminé est dépassé et exécuter une étape (I) si ledit nombre prédéterminé n'est pas dépassé.
11. Récepteur d'appel de personne selon l'une quelconque des revendications 1 à 4, caractérisé en ce que ledit moyen de traitement des données comprend un micro-calculateur ayant une première, une seconde et une troisième variables, ledit micro-calculateur étant programmé pour exécuter les étapes suivantes :
- A) initialiser ladite troisième variable;
- B) initialiser ladite seconde variable;
- C) initialiser ladite première variable;
- D) adresser chacun desdits emplacements de stockage à partir d'une position spécifiée par un total desdites première et seconde variables afin de détecter un espace;
- E) faire varier d'une unité ladite première variable;
- F) vérifier si le nombre desdits emplacements dépasse un nombre prédéterminé;
- G) si ledit nombre prédéterminé n'est pas dépassé, faire varier ladite seconde variable d'une quantité égale à ladite première variable pour répéter les étapes (C) à (F) jusqu'à ce que ledit nombre prédéterminé soit dépassé;
- H) lire les caractères aux emplacements de stockage en fonction desdites seconde et troisième variables et les afficher sur lesdits éléments d'affichage;
- I) introduire une pause; et
- J) faire varier la troisième variable d'une quantité égale à ladite seconde variable;
- K) adresser lesdits emplacements de stockage en fonction de ladite troisième variable;
- L) faire varier d'une unité ladite troisième variable; et
- M) répéter les étapes (B) à (L).
12. Récepteur d'appel de personne selon la revendication 11, comprenant en outre un élément d'affichage séparé au voisinage d'une extrémité dudit réseau linéaire, caractérisé en ce que ledit micro-calculateur est en outre programmé pour exécuter une étape (N) d'affichage d'une



marque dans ledit élément d'affichage séparé en réponse à l'étape (G) pour indiquer qu'il reste un code de message à afficher.

13. Procédé d'affichage d'un code de message reçu d'une station d'émission sur un réseau linéaire d'éléments d'affichage, ledit code de message représentant une pluralité de séries de caractères et d'espaces comprenant :
- a) le stockage dudit code de message dans une mémoire;
 - b) la lecture d'une première séquence de caractères à partir d'emplacements de stockage prédéterminés de ladite mémoire et leur affichage sur lesdits éléments d'affichage;
 - c) la détection de la position d'un espace suivant immédiatement ladite première séquence;
 - d) la lecture d'une seconde séquence de caractères à partir des positions suivant immédiatement la position détectée de l'espace et leur affichage sur lesdits éléments d'affichage, au lieu de ladite première séquence;
- caractérisé par :
- e) l'analyse d'un nombre prédéterminé d'emplacements de stockage de ladite mémoire avant la lecture de chacune desdites première et seconde séquences pour détecter l'instant où un bloc de caractères qu'elle contiennent dépassent partiellement une position correspondant à une extrémité desdits éléments d'affichage, et
 - f) former lesdites première et seconde séquences avec un ou plusieurs blocs de caractères qui précèdent ledit bloc dépassant partiellement.

14. Procédé suivant la revendication 13, comprenant en outre l'introduction d'une pause entre lesdits instants où lesdites première et seconde séquences sont affichées sur lesdits éléments d'affichage.

15. Procédé selon la revendication 13 ou 14, comprenant en outre l'introduction d'un premier intervalle long en réponse à ladite première séquence affichée sur lesdits éléments d'affichage, la lecture successive d'une séquence de caractères à partir d'une position décalée d'une position de caractère par rapport ladite première séquence au bout d'un second intervalle court, jusqu'à ce que ledit espace soit détecté.

Ansprüche

1. Seitenwechselempfänger zum Empfangen eines Funkfrequenzseitenwechselsignals mit einer Präambel, einem Teilnehmeradressencode und einem Nachrichtencode, der mehrere Blöcke von Zeichen und Leerstellen darstellt, mit:

- a) einer linearen Anordnung von Anzeigeelementen;
- b) einem Speicher mit mehreren Speicherplätzen zum Speichern des Nachrichtencodes; und
- c) einer Datenverarbeitungseinrichtung, die auf die Präambel anspricht, um

- c₁) eine Übereinstimmung zwischen dem empfangenen Adressencode und einem vorbestimmten Code festzustellen,
- c₂) den Nachrichtencode in dem Speicher als Reaktion auf die Feststellung der Übereinstimmung zu speichern,
- c₃) eine erste Zeichenfolge aus den vorbestimmten Speicherplätzen des Speichers zu lesen und sie auf den Anzeigeelementen anzuzeigen, und
- c₄) die Position einer Leerstelle, die unmittelbar nach der ersten Folge auftritt, festzustellen, um eine zweite Zeichenfolge aus den Positionen, die unmittelbar auf die festgestellte Position der Leerstelle folgen, in die Anzeigeelemente anstelle der ersten Folge einzulesen,

dadurch gekennzeichnet, daß die Datenverarbeitungseinrichtung

- d) eine vorbestimmte Zahl von Speicherzellen des Speichers vor dem Lesen jeder der ersten und zweiten Folgen abtastet, um festzustellen, ob ein Block von Zeichen darin teilweise über eine Position, die einem Ende der Anzeigeelemente entspricht, hinausläuft, und

- e) die erste und die zweite Folge mit einem oder mehreren Zeichenblöcken ausbildet, die dem teilweise übergelaufenen Block vorhergehen.

2. Seitenwechselempfänger nach Anspruch 1, ferner mit einer manuell betätigten Taste, und wobei die Datenverarbeitungseinrichtung angeordnet ist, um als Reaktion auf die erste Folge, die in die Anzeigeelemente eingelesen wird, eine Pause einzuführen, bis die Taste betätigt wird.

3. Seitenwechselempfänger nach Anspruch 1, wobei die Datenverarbeitungseinrichtung angeordnet ist, um eine Pause zwischen den Zeiten einzulegen, währenddessen die erste und die zweite Folge in die Anzeigeelemente eingelesen werden.



4. Seitenwechselempfänger nach Anspruch 1, wobei die Datenverarbeitungseinrichtung angeordnet ist, um ein erstes, längeres Intervall als Reaktion auf die erste Folge, die in die Anzeigeelemente eingelesen wird, einzuführen und ferner angeordnet ist, um nacheinander eine Zeichenfolge aus einer Position, die durch eine Zeichenposition aus der ersten Folge verlagert wurde, in einem zweiten, kürzeren Intervall zu lesen, bis die Leerstelle festgestellt ist. 5
5. Seitenwechselempfänger nach einem der Ansprüche 1 bis 4, wobei die Datenverarbeitungseinrichtung einen Mikrocomputer aufweist, der zum Ausführen der folgenden Schritte programmiert ist: 10
 - a) Lesen einer Zeichenfolge aus den Speicherplätzen des Speichers, die durch eine Variable spezifiziert sind, und Anzeigen derselben auf den Anzeigeelementen; 15
 - b) Feststellen einer Leerstelle in einem Speicherplatz, die unmittelbar auf die Folge folgt; 20
 - c) wenn die Leerstelle nicht festgestellt wird, Verändern einer Variablen um eins und Wiederholen der Schritte (b) und (c), bis die Leerstelle festgestellt ist; 25
 - d) wenn die Leerstelle festgestellt ist, Verändern der Variablen um eins; und 30
 - e) Wiederholen der Schritte (a) bis (d), bis alle Zeichen angezeigt sind.
6. Seitenwechselempfänger nach Anspruch 5, wobei der Mikrocomputer ferner zum Ausführen des Schrittes Einführen einer Pause zwischen den Schritten (a) und (b) programmiert ist. 35
7. Seitenwechselempfänger nach einem der Ansprüche 1 bis 4, wobei die Datenverarbeitungseinrichtung einen Mikrocomputer aufweist, der zum Ausführen der folgenden Schritte programmiert ist: 40
 - a) Lesen einer Zeichenfolge aus den Speicherplätzen des Speichers, die durch eine Variable spezifiziert sind, und Anzeigen derselben auf den Anzeigeelementen; 45
 - b) Einführen einer ersten, längeren Pause;
 - c) Feststellen einer Leerstelle in einem Speicherplatz, die unmittelbar auf die Folge folgt; 50
 - d) wenn die Leerstelle nicht festgestellt wird, Verändern einer Variablen um eins;
 - e) Lesen einer Zeichenfolge aus den Speicherplätzen des Speichers, die durch die Variable spezifiziert sind, und Anzeigen derselben auf den Anzeigeelementen; 55
 - f) Einführen einer zweiten, kürzeren Pause;
 - g) Wiederholen der Schritte (c) bis (f), bis die Leerstelle in dem Schritt (c) festgestellt ist;
 - h) Verändern der Variablen um eins, um die Schritte (a) bis (g) zu wiederholen.
8. Seitenwechselempfänger nach einem der Ansprüche 1 bis 4, wobei die Datenverarbeitungseinrichtung einen Mikrocomputer aufweist, der zum Ausführen der folgenden Schritte programmiert ist:
 - a) Zurückstellen einer ersten Variablen auf Null;
 - b) Adressieren jedes der Speicherplätze aus einer Position, die durch die Gesamtheit der ersten und einer zweiten Variablen spezifiziert ist, um eine Leerstelle festzustellen;
 - c) Verändern der ersten Variablen um eins;
 - d) Prüfen, ob die Zahl der adressierten Plätze eine vorbestimmte Zahl überschreitet;
 - e) wenn die vorbestimmte Zahl nicht überschritten ist, Verändern der zweiten Variablen um einen Betrag, der gleich der ersten Variablen ist, um die Schritte (a) bis (d) zu wiederholen, bis die vorbestimmte Zahl überschritten ist;
 - f) Lesen der Zeichen aus den Speicherplätzen als eine Funktion der zweiten Variablen und Anzeigen derselben auf den Anzeigeelementen;
 - g) Einführen einer Pause; und
 - h) Wiederholen der Schritte (a) bis (g).
9. Seitenwechselempfänger nach Anspruch 8, ferner mit einem separaten Anzeigeelement, das angrenzend an das eine Ende der linearen Anordnung angeordnet ist, wobei der Mikrocomputer ferner programmiert ist, einen Schritt (i) zum Anzeigen einer Marke in dem separaten Anzeigeelement als Reaktion auf den Schritt (e) auszuführen, um darzustellen, daß noch ein Nachrichtencode, der abgebildet wird, vorhanden ist.
10. Seitenwechselempfänger nach Anspruch 8 oder 9, wobei der Nachrichtencode ein Ende des Nachrichtencodes aufweist, und der Mikrocomputer ferner programmiert ist, um folgende Schritte auszuführen: Feststellen des Endes des Nachrichtencodes als Reaktion auf den Schritt (b), Verändern der ersten Variablen um eins, Prüfen, ob die Zahl der adressierten Plätze eine vorbestimmte Zahl überschreitet; und Überspringen eines Schrittes (i), um den Schritt (f) auszuführen, wenn die vorbestimmte Zahl überschritten ist und Ausführen eines Schrittes (i), wenn die vorbestimmte Zahl nicht überschritten ist.



11. Seitenwechselempfänger nach einem der Ansprüche 1 bis 4, wobei die Datenverarbeitungseinrichtung einen Mikrocomputer mit ersten, zweiten und dritten Variablen aufweist und der Mikrocomputer zum Ausführen der folgenden Schritte programmiert ist:
- A) Initialisieren der dritten Variablen;
 - B) Initialisieren der zweiten Variablen;
 - C) Initialisieren der ersten Variablen;
 - D) Adressieren jeder der Speicherplätze aus einer Position, die durch eine Gesamtheit der ersten und zweiten Variablen spezifiziert ist, um eine Leerstelle festzustellen;
 - E) Verändern der ersten Variablen um eins;
 - F) Prüfen, ob die Zahl der adressierten Plätze eine vorbestimmte Zahl überschreitet;
 - G) wenn die vorbestimmte Zahl nicht überschritten ist, Verändern der zweiten Variablen um einen Betrag, der gleich der ersten Variablen ist, um die Schritte (C) bis (F) zu wiederholen, bis die vorbestimmte Zahl überschritten ist;
 - H) Lesen der Zeichen aus den Speicherplätzen als eine Funktion der zweiten und dritten Variablen und Anzeigen derselben auf den Anzeigeelementen;
 - I) Einführen einer Pause; und
 - J) Verändern der dritten Variablen um einen Betrag, der gleich der zweiten Variablen ist;
 - K) Adressieren der Speicherplätze als eine Funktion der dritten Variablen;
 - L) Verändern der dritten Variablen um eins;
 - M) Wiederholen der Schritte (B) bis (L).
12. Seitenwechselempfänger nach Anspruch 11, ferner mit einem separaten Anzeigeelement, das an ein Ende der linearen Anordnung angrenzt, wobei der Mikrocomputer ferner programmiert ist, um einen Schritt (N) des Anzeigens einer Marke in dem separaten Anzeigeelement als Reaktion auf den Schritt (G) auszuführen, um darzustellen, daß noch ein Nachrichtencode, der angezeigt wird, vorhanden ist.
13. Verfahren zum Anzeigen eines Nachrichtencodes, der von einer Sendestation empfangen wurde, auf einer linearen Anordnung von Anzeigeelementen, wobei der Nachrichtencode mehrere Reihen von Zeichen und Leerstellen darstellt, mit den Schritten:
- a) Speichern des Nachrichtencodes in einem Speicher;
 - b) Lesen einer ersten Zeichenfolge aus vorbestimmten Speicherplätzen des Speichers und Anzeigen derselben auf den Anzeigeelementen;
 - c) Feststellen der Position einer Leerstelle, die unmittelbar auf die erste Folge folgt;
 - d) Lesen einer zweiten Zeichenfolge aus den Positionen, die unmittelbar der festgestellten Position der Leerstelle folgen, und Anzeigen derselben auf den Anzeigeelementen anstelle der ersten Folge; gekennzeichnet durch die Schritte:
 - e) Abtasten einer vorbestimmten Zahl von Speicherplätzen des Speichers vor dem Lesen jeder der ersten und zweiten Folgen, um festzustellen, ob ein Zeichenblock darin teilweise über eine Position, die dem einen Ende der Anzeigeelemente entspricht, hinausläuft, und
 - f) Ausbilden der ersten und zweiten Folgen mit einem oder mehreren Zeichenblöcken, die dem teilweise übergelaufenen Block vorhergehen.
14. Verfahren nach Anspruch 13, das ferner den Schritt aufweist: Einführen einer Pause zwischen den Zeiten, währenddessen die erste und zweite Folge auf den Anzeigeelementen angezeigt werden.
15. Verfahren nach Anspruch 13 oder 14, das ferner die Schritte aufweist: Einführen eines ersten, längeren Intervalls als Reaktion auf die erste Folge, die auf den Anzeigeelementen angezeigt ist, und aufeinanderfolgendes Einlesen einer Zeichenfolge aus einer Position, die durch eine Zeichenposition aus der ersten Folge verlagert wurde, in einem zweiten, kürzeren Intervall, bis die Leerstelle festgestellt ist.