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(11) Publication number:

0 646 900 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **93115501.4**(51) Int. Cl.⁶: **G08B 5/22**(22) Date of filing: **25.09.93**(43) Date of publication of application:
05.04.95 Bulletin 95/14(84) Designated Contracting States:
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CH-8044 Zürich (CH)(54) **Radio pager with customizable display.**

(57) The pager comprises a radio receiver (1), a control unit (2), a liquid crystal display (3), control elements (4) and a battery operated power supply (5). A pattern memory (6) and a pattern control (7) are used for generating the bitmap pattern for each symbol that can be displayed. The pattern memory (6) can be modified to allow a user to select preferred patterns and sizes for the displayed symbols. Furthermore, the pattern memory (6) holds the patterns for a plurality of character sizes for the alphanumeric symbols. The pattern control can be set to select the character size of a message to be displayed automatically. In this case, the message is displayed as large as possible while still fitting into the display.

In this way it becomes possible to optimize the use of the limited size of the display of a pager.

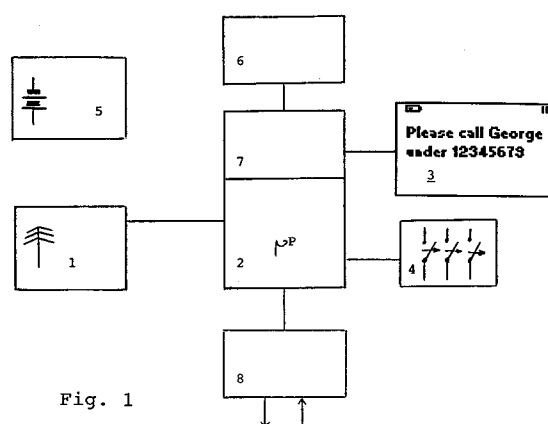


Fig. 1

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The invention relates to a radio pager having a matrix display for displaying patterns corresponding to symbols from a set of symbols and a pattern generating means for generating said patterns for displaying said symbols on said display. The invention also relates to a method for displaying a message on such a radio pager.

Modern radio pagers are equipped with a matrix display, usually a liquid-crystal display (LCD) or a VDU, for displaying received messages, information on the internal status of the device, etc. Since pagers are portable devices that should fit in a pocket, size is a critical parameter and the area of the display is limited. However, they should be able to display about 100 characters at a time. Therefore, the size of each character is in the order of 5mm x 4mm. A normally sighted user reading the pager's display from a distance of approximately 30 cm in a well lit place will usually be able to recognize the displayed characters easily. However, problems occur for users with a poor sight or in difficult conditions.

Therefore, it is a goal of the present invention to provide a radio pager with a display that is easily readable and a method for operating such a pager.

This goal is achieved by the characterizing portions of the independent claims.

The inventive apparatus and method provide a possibility to make the best use of the limited display space available in a radio pager. Conventional pagers generate one fixed pattern for each symbol. In the inventive pager, the pattern generated for a symbol can vary. It can e.g. be possible to modify the patterns stored in the pager, or more than one single pattern can be provided for each symbol. Since the patterns of the displayed symbols are variable, each symbol can be represented using an optimum size and shape.

In a preferred embodiment, the size of the patterns is chosen such that a message to be displayed fills the display. Short messages will therefore appear in a larger character size and be much easier to read. Also, the minimum character or symbol size can be chosen by the user. Users with a poor eye sight can choose larger patterns.

If a writable memory for storing the symbol patterns and a suitable interface or controls are provided, the patterns of the symbols can be customized. In this way it becomes possible to use patterns (characters, icons, pictures) that are familiar to the user and are compatible with his or her cultural background and experience.

More objects and advantages of the present invention will become apparent from the following description of the preferred embodiments. This description makes reference to the drawings, wherein

Fig. 1 shows a simplified block diagram of an embodiment of a pager according to the invention;

Fig. 2 is a flow chart showing the method for selecting a character size;

Fig. 3 shows an icon for displaying the battery state of a pager;

Fig. 4 shows a second icon for displaying the battery state of a pager; and

Fig. 5 is the flow chart of an alternative method for selecting the character size of a message.

Figure 1 shows a schematic block diagram of a preferred embodiment of a pager according to the invention. The pager includes a radio receiver 1 for receiving messages from a network, a microprocessor control 2, a liquid crystal matrix 3 for displaying messages and status information, suitable user controls 4 (buttons) allowing the user to select a desired function of the pager, and a battery powered voltage supply 5. These elements are also found in conventional pagers and are known to a person skilled in the art.

The pager is further equipped with a pattern generating means comprising a pattern memory 6 and a pattern control 7. The pattern generating means generates the bitmap pattern of each symbol that can be displayed on the LCD. The set of symbols that is supported by the pager includes alphanumeric characters and a plurality of icons. Alphanumeric characters are used for written messages (e.g. "Meet George at 10:00"). The icons can e.g. be used to display internal status information of the pager (e.g. the condition "Battery low" is represented by the picture of a small battery, see below) or abbreviated messages (e.g. the picture of a phone preceding a number can tell the user to call a certain phone number).

The pattern memory 6 is a non-volatile RAM, EEPROM or some similar device. It stores the bit patterns used for displaying the symbols. In the present embodiment one pattern is stored for each icon symbol and two patterns are stored for each alphanumeric symbol. Each of the two patterns provided for an alphanumeric symbol represents the symbol in one of two possible character (font) sizes. In the smaller character size, all character symbols are displayed in an area of 7x5 bits, in the larger character size 14x10 bits are used.

The pattern control 7 is used for selecting and transferring the symbol patterns from the pattern memory 6 to the display 3. It can be implemented in hardware or, as in the present embodiment, it can be part of the microprocessor pager control and its software.

Figure 2 shows the operations that occur in the pattern control when the pager receives a message to be displayed (Step 100). First, the length L of the message (the number of symbols required for

displaying the message) is determined in step 110. Then, L is compared to a predefined value L_{short} . If $L < L_{\text{short}}$, the larger character size is selected to display the message (step 140), else the smaller character size is selected (step 130). Then the message is displayed using the selected character size (Step 150).

In the above procedure, L_{short} is defined such that a message of $L_{\text{short}}-1$ symbols just fills the available display area when using the larger character size. A message with a length above $L_{\text{short}}-1$ is displayed using the smaller character size. If it is too long to fit in the display even in the smaller character size, the display can be scrolled by operating the user controls 4 in a known way.

The user can also switch off the character size selection feature shown in Fig. 2 and select a preferred character size for displaying all messages. A user with a poor sight can select the larger character size, forcing all messages to appear in large characters. Messages too large to be displayed at one time can be scrolled.

A manual selection of the character size can e.g. occur in the following way: When the pager is switched on and a predetermined combination of switches or buttons is operated, the pager enters a programming mode. Here, the user can choose the desired character size or tell the pager to determine the character size automatically.

In the shown embodiment, the patterns are stored in RAM 6. They can therefore be modified. Even though modification could occur locally, e.g. by operating the controls 4 of the pager, it is easier to provide the pager with an interface 8 that allows to transfer data between the pager and a personal computer or some other suitable programming device.

Such a personal computer can comprise a graphic editor allowing to select and modify each pattern. This is especially useful for optimizing the readability of the information displayed on the pager. Depending on his or her background, a user may prefer to read messages in a serif or non-serif font. It is also possible to load a non-Latin (e.g. a Cyrillic) font to the pager.

Also, icons used by the pager can be customized. A user may e.g. be used to a certain set of status icons from an earlier equipment. This earlier equipment might have used the icon shown in Fig. 3 to indicate a well charged battery and the icon shown in Fig. 4 to indicate "low battery". However, the new pager's default settings might display the symbol of Fig. 3 to indicate "low battery".

In this situation, the inventive pager offers the possibility to modify the icons for "charged battery" and "low battery". Using a programming device or a computer, the user would edit the desired

icons for "charged battery" and "low battery" (or select them from a predefined list of icons) and transfer them via interface 8 into the pattern memory 6.

Another feature of the described pager is that when an icon is switched on, an explanation of its meaning is also displayed in a language of the user's choice. The explanation will stay on the display for a predefined time and disappear thereafter for saving battery power. When the user is modifying the icon as described above, he/she will also be able to modify its description as well.

The icons are displayed on the matrix of the LCD 3. In conventional pagers, these icons are usually displayed in a separate part of the display having a fixed mask for each icon. They can therefore not be modified. In the present pager, the icons can have any pattern and size. They can be displayed in a reserved area of the display simultaneously with a message (as shown in Fig. 1), or they can be placed anywhere in the display as long as no message appears.

The pattern memory of the present pager holds two bitmap patterns for each character symbol corresponding to the two possible character sizes. It is, however, possible to store only one bitmap pattern or a general contour information per character and to calculate the pattern for a given character size in the pattern control 7.

Instead of using only two sizes for each character as described above, it is also possible to provide a larger set of available sizes for characters and/or icons and to use proportional character spacing. In this case, the method of Fig. 2 would be replaced by a more elaborate method such as shown in Fig. 5: After receiving the message (step 200) the search for a suitable character size starts by selecting the smallest allowed character size (step 210). The total length of the message as displayed in this size is calculated in step 220. In step 230 it is tested if the displayed message would fill the display sufficiently. Sufficiently can e.g. mean that it should fill more than 50% of the display or that the message displayed in a next larger character size would be too large to fit in the display. If the message does not fill the display sufficiently, a next larger character size is chosen from a set of possible character sizes (step 240) and operation continues with step 220. Once that the answer of condition 230 is "yes" or all possible character sizes have been tested, the message is displayed (step 250).

As it has been described above, the patterns of the symbols are stored in RAM so that they can be modified. They are usually edited and selected in a personal computer and transferred to the pager via interface 8. It may, however, be possible to include a pixel editor in the pager allowing to modify the

patterns locally. The pager can also be designed to modify the patterns according to radio instructions received by the receiver 1. A user could e.g. order a new font to be downloaded to his device or a network operator might provide an icon with his company logo.

If editing of individual icons or characters is not required, the patterns or other information for displaying the icons and the characters can also be stored in ROM.

While there are shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

Claims

1. Radio pager having a matrix display (3) for displaying patterns, corresponding to symbols from a set of symbols and a pattern generating means (6, 7) for generating said patterns for displaying said symbols on said display (3), wherein said pattern generating means (6, 7) is designed to allow a plurality of possible patterns for at least some of said symbols. 20
2. Radio pager of claim 1 wherein said pattern generating means (6, 7) comprises a pattern memory (6) for storing at least one pattern for at least some of said symbols. 25
3. Radio pager of claim 2, comprising a means for modifying the contents of said pattern memory (6). 30
4. Radio pager of claim 3, wherein said means for modifying the contents of said pattern memory (6) comprises an interface (8) for connecting said radio pager to external programming unit. 35
5. Radio pager of one of the preceding claims, wherein said pattern generating means (6, 7) is adapted to generate patterns in a plurality of sizes for at least some of said symbols. 40
6. Radio pager of claim 5, comprising a user control means (4) for selecting a default size of said patterns. 45
7. Method for displaying a message on the radio pager of one of the preceding claims, said message being expressed by a sequence of symbols from said set of symbols, said method comprising a selection step for finding a largest character size from a set of character 50

sizes for the patterns of the symbols of said message such that said message still fits in said display.

8. Method of claim 7, wherein. if no largest character size is found in said selection step, a default character size is used for the display patterns of the symbols of said message. 5
9. Method of one of the claims 7 or 8, wherein said largest character size is determined from the number of symbols required for expressing said message. 10

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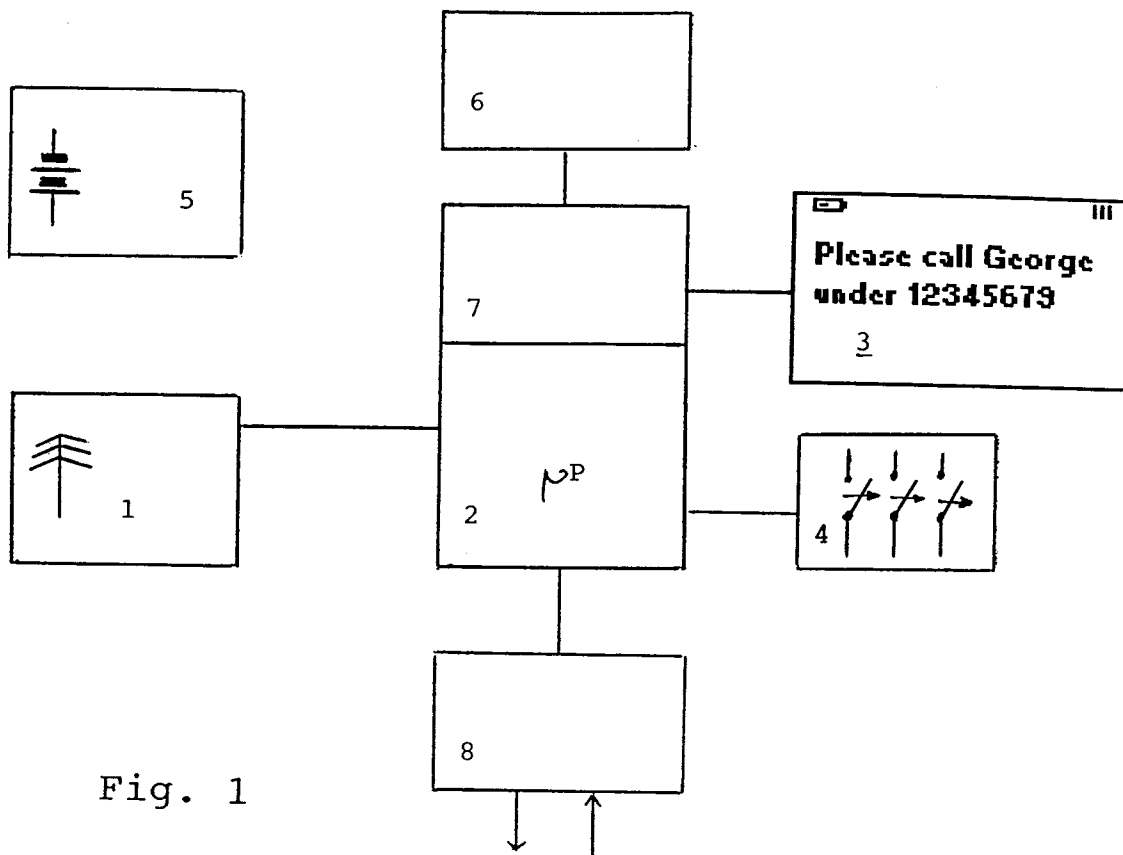


Fig. 1

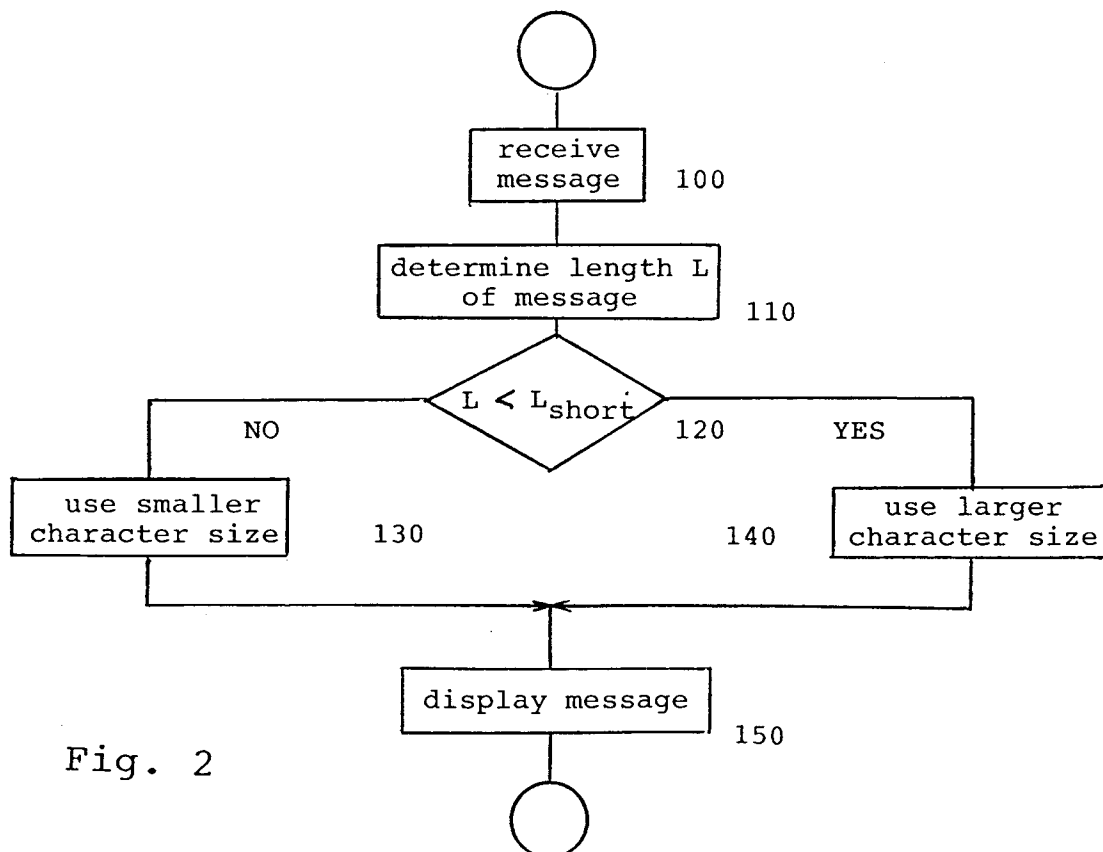


Fig. 2

Fig. 3



Fig. 4

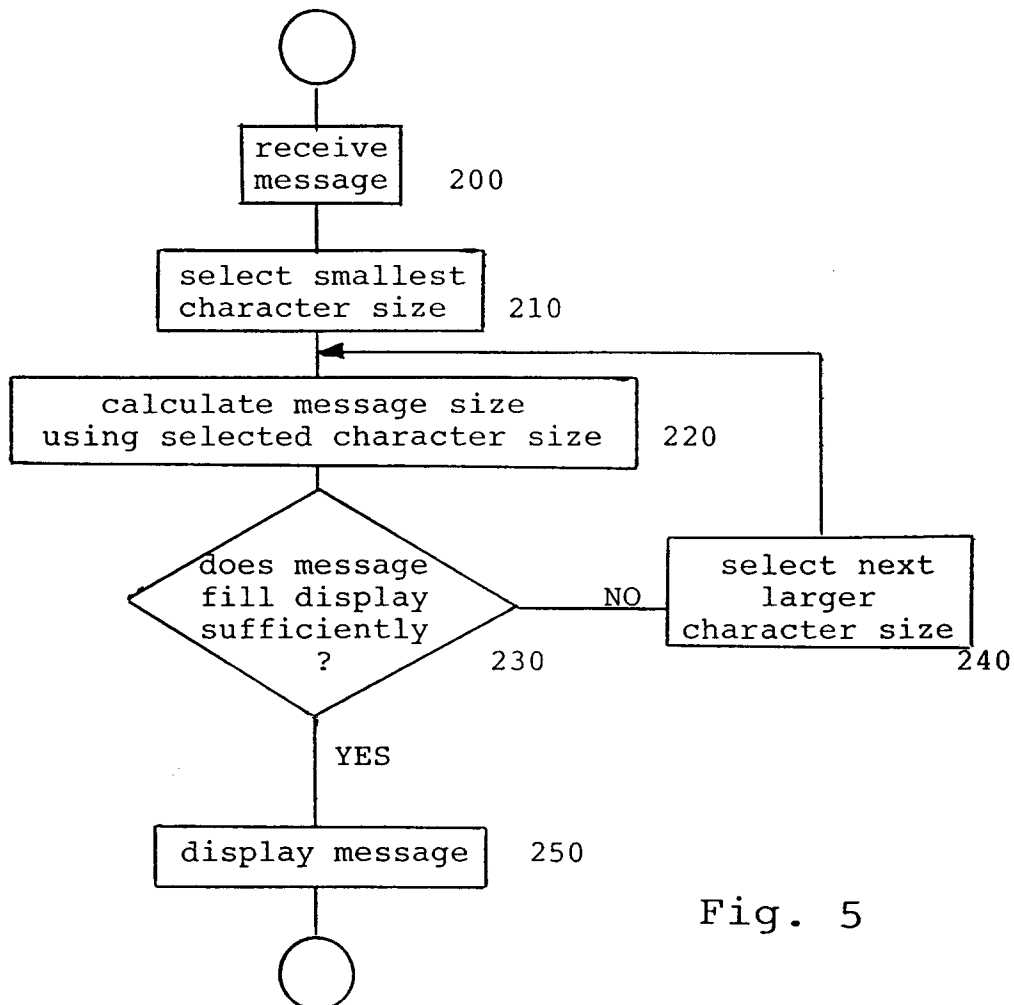
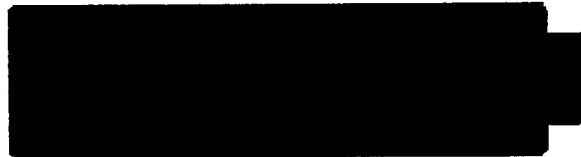


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 5501

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-5 212 477 (INDEKEU ET AL.)	1-3,5-9	G08B5/22
Y	* the whole document * ---	4	
Y	EP-A-0 529 798 (MITSUBISHI DENKI KABUSHIKI KAISHA) * page 2, column 2, line 24 - page 3, column 1, line 25 * ---	4	
X	WO-A-90 16052 (MOTOROLA, INC.) * the whole document * ---	1-3,5-9	
X	MOTOROLA INC. vol. 13 , July 1991 , SCHAUMBURG, ILLINOIS, US pages 116 - 117 KUZNICKI 'VISUAL PERSUASION DISPLAY PAGER' * the whole document * ---	1-3,5-9	
A	US-A-4 896 147 (FUTAKATA) * the whole document * -----	1-9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G08B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 March 1994	Examiner Reekmans, M
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