BRAILLE COMPUTER MONITOR

CROSS REFERENCES TO RELATED APPLICATION

This is a division of U.S. application Ser. No. 09/605,514, filed Jun. 28, 2000 U.S. Pat. No. 6,417,821, which claimed the benefit under 35 U.S.C. §119(e) of Provisional Patent Application No. 60/141,329, filed on Jun. 28, 1999.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to apparatus for displaying Braille characters and relates in particular to an economical Braille computer monitor which displays Braille characters using rectangular cells composed of eight tactile members arranged in two columns of four members each. Such cells are particularly compatible for use with ASCII 8 bit 256 symbol code.

2. Description of Prior Developments

Braille is a language of raised dots read by the fingers. In 1824, Louis Braille, a young blind teacher in Paris, perfected spelling in a sequence of dots, using a sharp stylus to punch indentations into paper fitted over a metal slate. Today, slate and stylus are available as lightweight portable tools, with Braille typewriters and electronic adaptions as well.

Braille, the tactual alphanumerics for the blind, is composed of "cells" with six tactile "dots" that are raised in various patterns. The cell is composed of two columns that have three dots each. By convention, the three dots in the first column are numbered top to bottom as dot 1, dot 2, and dot 3. Similarly, the dots in the second column of dots are numbered as dot 4, dot 5 and dot 6.

Braille is read by passing a finger lightly over the dot patterns, which are "seen" or perceived as letters and words in the same way the sighted perceive ink print.

Sixty-four different symbols, including a blank space, can be made from a cell's 6-dot binary dot-no-dot permutations. Many different alphabets have been coded from the cells and Braille is published in many different languages, 35 in the U.S. alone. Braille prose is written using one of two codes, Grade I or II. There are other codes for mathematics, music, and computers. Grade I is a written Braille letter code for respective ink print letters. Grade II Braille uses symbols, not used for letters and marks, to express common letter combinations such as: ss, tt, ough, th, and the like. Some symbols are used to express whole words, part words and symbols. Symbols include two cell combinations and double duty single cells, for a total of 157 symbols. Grade II Braille increases the reading rate of skilled users by reducing the number of characters needed.

Braille has no dedicated capital or numeric symbols. Capitals are shown by a "6" dot "conditional sign" before a given letter or word. Two position "6" dots are used to indicate the whole word is capitalized. Numbers use the first ten letters of the alphabet (a–j), preceded by the number sign dots 3, 4, 5, and 6. A period is represented by dots 2, 5, and 6 and a comma by a dot 5.

Current state of the art paperless Braille machines use discrete piezoelectric benders (bimorphs) to raise each and every dot. Because bimorph parts are expensive, number in the hundreds and their assembly is complex, the average retail price for such parts was estimated in 1993 to be $25.00 per dot.

Bimorphs have not yielded economies of scale and thus the $6,500 cost per 20 cell (120 dot) unit of 18 years ago, is still about the same today. The latest 80 cell display can cost $20,000 and the host computer software is not included.

Single lines of bimorphs must be read in jerky segments, which can slow reading rates by as much as 50%. This makes them virtually useless as "powerbooks". High costs have perpetuated awkward 6-dot "computer codes" instead of using easier 8-dot codes that are directly transliterable with ASCII's 8 bit 256 symbol codes.

SUMMARY OF THE INVENTION

The instant invention is directed to an 8-dot, multi-line, paperless Braille monitor that overcomes the above described disadvantages of single line bimorphs. Cell dots 1–6 are assigned the same row and column positions as before. Dots 7 and 8 are positioned in the first and second columns, respectively, just below dots 3 and 6. The 8-dot numbering scheme within a single cell is shown in FIG. **1A**. This numbering scheme allows an 8-dot tactual computer monitor to not only display legacy 6-dot Braille, but also facilitates the large ASCII 8 bit, 256 symbol code.

In accordance with the invention, an 8-dot tactual paperless Braille computer monitor (TCM) is constructed as a paperless computer-controlled, realtime, refreshable, electromechanical, multi-line, Braille display or "monitor" device that enables the bind to read, write, or edit Braille documents directly from a mechanical display monitor, rather than from paper, and to communicate simultaneously with sighted computer users. The TCM serves the blind in the same way visual display monitor units serve sighted computer users.

To operate the TCM, the user switches on a host computer. The host computer's automatic self check is displayed and the system's prompts then appear on the top line of the TCM. The user may then call up text on file, edit, or write new text via the host computer's keyboard. The text can be manipulated in the standard manner by the keyboard's directional pad.

To edit the text on screen, the text is highlighted by entering CONTROL/" on the computer keyboard. This is followed by a tap touch on the row and column cell coordinates on the TCM of the first letter of the word/passage to be edited. Next, a double tap touch is applied to the row and column cell coordinates on the TCM of the last letter of the word/passage to be edited. CONTROL/" is entered. At this point the word or passage from the computer keyboard is edited. Then SAVE, RETURN is entered and the program does the rest. Other commands, such as DELETE, INSERT, or MOVE, work in the usual way.

Reading documents with a TCM is done smoothly, in multi-line increments of text which are displayed in an enhanced 8-dot Braille format, read by feel, and then erased electro-mechanically, just prior to displaying the next increment of text. Of course, text can also be displayed on the TCM in the conventional 6-dot format. Thus, to read a given increment of a document, the user first prints the increment to the TCM display. Then, feeling the TCM display with one finger, or perhaps with a finger from each hand, the user is able to mentally translate into meaningful words and phrases the collective positions of the many individual dot pins comprising each line of text. Although the TCM can be made to display only a single line of Braille text, it is preferably made to be page size and therefor incorporate several lines, say six, twelve or more. The exact number of lines depends on customer or market preferences balanced by practical considerations for overall size. The instant TCM invention is described herein in terms of six lines each line having 40 tactual Braille cells per line.