BRAILLE BOARD WITH MOVABLE DOT PINS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electromechanical braille board display having solenoids or electromechanical transducers for moving the dot pins of the display. More particularly, the present invention pertains to those electromechanical braille board displays which provide a full page of braille information as defined by the National Library Service for the Blind and Physically Handicapped.

2. Description of the Prior Art

Electromechanical braille board displays using solenoids to place the dot pins of each cell of the board in either an upward or a downward position are disclosed in the prior art. A cell in the United States is two columns across and three rows down for a total of six dot locations for a cell, while the European braille cell has eight dot locations per cell. Each solenoid is associated with one of the dot pin, requiring six (6) solenoids for each cell using the U.S. braille cell configuration. Due to the number of solenoids required, various schemes have been implemented for tactile displays in order to reduce the number of solenoids required or the use an alternative to solenoids.

U.S. Pat. No. 5,195,894 issued Mar. 23, 1993 to Pieter W. C. J. le Blanc discloses a braille mouse having three cells to scan text on a computer screen. The dot pins are selectively raised from their normally lowered position by either a disc, belt, or drum having different character codes thereon. Once the proper code is accessed, a single solenoid is used to raise the pins.

U.S. Pat. No. 5,108,290 issued Apr. 28, 1992 to Bror A. Eriksson discloses a device for displaying braille characters by placing balls between two driven belts at different locations along the lengths of the belts as they are rotating.

U.S. Pat. No. 4,871,992 issued Oct. 3, 1989 to Robert C. Petersen discloses a tactile display utilizing an electromagnet to move a disk-shaped cam for positioning the dot pins of each cell in their raised or lowered states. A translator is used to convert the ASCII codes from a computer to a code for displaying the braille information by the tactile display board.

U.S. Pat. No. 4,194,190 issued Mar. 18, 1980 to Alain Bareau discloses a tactile display device utilizing solenoids to place the dot pins in either their raised or lowered states. Bareau also discloses a converter to translate alphanumeric information to a braille format.

U.S. Pat. No. 4,191,945 issued Mar. 18, 1980 to Martin R. Hannen et al disclose a braille board display in which each cell of the braille board may be individually accessed by a selector switch.

U.S. Pat. No. 5,065,434 issued Nov. 12, 1991 to Mikiharu Matsuoka et al discloses a controller including a microprocessor to control the flow of data to and from the storage memory. More specifically, RAM is used as a work space to store the scanned information provided by a camera once that information is converted into digital data and ROM is used to store the operating program.

U.S. Pat. No. 4,687,444 issued Aug. 18, 1987 to H. Douglas Garner discloses a tactile display using RAMto load a text information and to retrieve only a portion of that text information as needed.

U.S. Pat. No. 4,959,567 issued Sep. 25, 1990 to Mark A. Ealey et al discloses a solenoid using a permanent magnet.

U.S. Pat. No. 3,293,502 issued Dec. 20, 1966 to John D. Beierle discloses a cordwood circuit board design.

Braille Books and Pamphlets, National Library Service for the Blind and Physically Handicapped from the Library of Congress, Specification #800, August 1991, pages 1–14.

None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed.

SUMMARY OF THE INVENTION

The braille board designs in the prior art generally use few cells in their displays since each cell has six solenoids to selectively activate each dot pin to a raised or lowered state. The number of lead connections would become cumbersome to handle in the prior art since each solenoid is individually accessed. For example, Petersen discloses a modular tactile display unit representing one braille cell and having prong leads extending therefrom to allow each solenoid controlling the dot pins therein to have power selectively provided thereto. The modular design of Petersen allows for the placement of a plurality of cells in a single braille board device. However, the dual in-line package design of the individual cell tactile displays would make for a cumbersome, if not impossible, circuit board design to place these tactile displays on one circuit board if a complete page of braille were to be represented. More specifically, a full page of braille having forty (40) cells across and twenty-five (25) lines down would require forty (40) columns and twenty-five (25) rows of the tactile displays. This would require a circuit board with twelve thousand (40×25 cells and 12 leads per cell) traces.

The tactile displays of the prior art as represented by Petersen have few tactile cells in comparison to the full page of braille as set forth by the Library of Congress. A blind person using a tactile display with few characters would not be able to "read" a large volume of material quickly since the display would have to be refreshed often. A comparison for sighted individuals would be having to read a novel having no more than a few lines of print per page. The device of the present invention uses cordwood circuit board design for handling the logistics of having a full page of braille displayed at one time on a braille board display. With the cordwood circuit board design, fewer traces are needed for each circuit board than would be needed if only one circuit board were used.

In order to reduce the amount of electricity required to activate the six-thousand solenoids, each solenoid has a permanent magnet actuating rod so that flux of the solenoid winding will be in opposition to the actuating rod to push up a dot pin when activated. This provides a quick refreshing of the braille board as one page is "erased" and another page is "written" to the braille board. Further, less flux need be provided by the individual solenoid coils in order to provide a given amount of upwards push or downwards pull. Another embodiment uses electromechanical transducers, each including a permanently magnetized dot pin located above an electromagnet to provide a repulsive flux to push the dot pin up.

Accordingly, it is a principal object of the invention to provide a braille board display having a full page of braille displayed each time a new page is written to the display.

It is another object of the invention to provide a cordwood circuit board design which will allow a full page of braille