to be displayed using modular tactile units representing a cell of braille information.

It is a further object of the invention to provide a solenoid having a permanently magnetized actuating rod or an electromechanical transducer having a permanently magnetized dot pin to reduce the amount of current required to push the dot pin upwards with a sufficient force so as to be read.

It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top perspective view of the present invention with a portion thereof removed.

FIG. **2** is a partial view of the solenoid attached to the circuit board of the first embodiment of the present invention.

FIG. **3** is a partial cross-sectional view of one solenoid of the first embodiment of the present invention.

FIG. **4** is a partial view of the electromechanical transducers attached to the circuit board of the second embodiment of the present invention.

FIG. **5** is a block diagram of the control circuitry of the present invention driving each solenoid of each cell therein.

FIG. **6** discloses a third embodiment in which solenoid appear in cell modular units attachable to a circuit board.

FIG. **7** discloses a fourth embodiment in which electromechanical transducers appear in cell modular connectable to a circuit board.

FIG. **8** is a cross-sectional view of an electromechanical transducer used in the present invention.

FIG. **9** is a graph illustrating the electromagnetic force a solenoid could exert for a given amount of current passing therethrough.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. **1**, the braille board **1** of the present invention has a computer hook-up **3** identical to the standard serial or parallel port connections used for printers. The computer hookup **3** allows the computer (not shown) connected to the other end of the hook-up **3** to provide alphanumeric data to the braille board **1**. A conventional On/Off switch **5** is provided at the side of the braille board with braille letters **7** representing the word "On" and braille letters **9** representing the word "Off". The On/Off switch **5** would control the power from the power source (not shown) in the conventional manner. A page forward button **11** is pushed by the user to refresh the braille board with the next page of data to be displayed, while a page back button **13** is pushed by the user to refresh the braille board with the previous page of data displayed. The page forward button **11** has the braille representation "FWD" located thereon and the page back button **13** has the braille representation of "REV" located thereon. The braille board **1** has a reading surface **15** having an outer boarder **17** located therearound being constructed of the same material as the rest of the wall of the board **1**. The reading surface **15** is preferably constructed of a material offering a minimum abrasion of the user's finger as the user "reads" the text of braille. The page back button **13** and the page forward button **11** are located within the outer boarder **17**.

The reading surface **15** also has an inner boarder **16** in which no text is found so as to allow space for the user's fingers to extend beyond the end of a line of braille text and to be located in front of a line of braille text while still being located on the reading surface **15**. The inner boarder **16** also extends above and below the braille text and the outer boarder **17** extends all the way around the inner boarder **16**. As shown in FIG. **1**, in a right hand portion located above the braille text and inside the inner boarder **16**, a page number indicator display **19** is provided for allowing the user to determine the page number of the page presently displayed by the braille board **1**. The page number display has the braille representation of the number symbol "#" in front of three braille board cell locations representing the page number in braille.

As partially shown in FIG. **1**, a first row of cell locations **21** has **40** cell locations located thereacross. In the first embodiment of the present invention, each braille cell location **23** has six (6) dot pin locations **25** located thereon having an aperture **27** located thereat going through the braille board reading surface **15** as shown in FIG. **2**. As shown in FIG. **2**, each dot pin **29** is connected to the top of an actuating rod **31** of a solenoid **33**. Each solenoid **33** is soldered to a first circuit board **35**. A first lead **37** of each solenoid winding **39** of each solenoid **33** is connected to a first solder connection **41** having an electrical connection to a first prong lead **43** attached to the first circuit board **35** and leading down to a second circuit board **45** to form an electrical connection therewith. Each solenoid winding **39** also has a second lead **47** connected to a second solder connection **49** having an electrical connection to a second prong lead **51** attached to the first circuit board **35** and leading down to a third circuit board **53** forming an electrical connection therewith. The second prong leads **51** pass through the second circuit board **45** without making any connection therewith.

The second circuit board **45** would preferably contain the traces connecting each first lead **37** of each solenoid winding **39** for each solenoid **33** of the braille board **1** to ground. The third circuit board **53** would preferably contain traces individually connecting each second lead **47** of the solenoids **33** to separate solid state switches for selectively providing power to each of the solenoids **33** under the control of a microprocessor as discussed below.

As shown in FIG. **3**, each solenoid winding **39** of each solenoid **33** has a predetermined thickness and length for allowing a large number of turns therein, thereby increasing the amount of flux generated thereby per unit current passing therethrough. Further, each actuating rod **31** is permanently magnetized in order to provide an opposing flux as power is provide from the first lead **37** thereof to the second lead **47** thereof connected to ground. In this manner, the amount of magnetic force per unit current is increased with an increase in the strength of the permanently magnetized solenoid actuating rod **31**.

As shown in FIG. **3**, a flanged stop **55** is located at a bottom end of the permanently magnetized actuating rod **31** and passes through a hole **57** located through the first circuit board **35**. FIG. **3** shows dot pin **29** in its lowered position. With the dot pin **29** in its raised state a predetermined distance above the braille board reading surface **15**, the