BRAILLE MODULE WITH COMPRESSIBLE PIN ARRAYS

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

The present invention was developed, at least in part, under NSF SBIR Phase I proposal #0539464, funded on Jan. 3, 2006.

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable.

THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

Not applicable.

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

Not applicable.

REFERENCE TO A "MICROFICHE APPENDIX"

Not applicable.

BACKGROUND OF THE INVENTION

1. Field of the Present Disclosure

This disclosure relates generally to refreshable tactile displays for Braille text and graphics for the blind, and, more particularly, relates to an easily cleaned Braille module utilizing tactile pins that can absorb strong downward forces without damage to the pins or the actuation mechanism.

2. Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 1.98

Hannen et al., U.S. Pat. No. 4,191,945 discloses an electromechanical apparatus for setting up and erasing alphanumeric characters or other symbols in Braille by means of a tactile display. Dot pins simulating Braille are supported for movement within holes in a display plate to a position protruding therefrom to form tactile characters and for retraction to a withdrawn position flush with the surface of the display plate. Solenoid-operated plungers are arranged to selectively project the dot pins. Latch elements are movable by energizing the solenoid to a position to support the plungers in their operative position, a common support for the latch elements movable in a plane perpendicular to the axis of the support plungers to remove the latch elements, and spring means for restoring the support plate to its initial position.

Tetzlaff, U.S. Pat. No. 4,283,178 An electromechanical braille cell is disclosed wherein each cell includes six braille indicia formed by the free ends of a vertical stack of cantilever supported piezoelectric reeds. Applying an operating potential to a respective reed causes the reed to bend about a fulcrum at the supported root end of the reed causing the free end to deflect in such a manner as to cause the indicia rod to protrude through an opening in the reading surface of the braille cell. Simultaneous energization of one or more of the reeds in the respective stack defines a given braille character sensed by the operator. The free ends of the reeds are tiered in pairs in a stair step configuration so that the sensing rods from a lower pair of reeds pass by the free end portions of the reeds of a higher step. The upper reed of each pair of reeds is notched to allow passage of the sensing rod associated with the lower reed of that pair of reeds.

Petersen, U.S. Pat. No. 4,871,992 discloses a tactile display according to which a touch pin is selectively movable relative to a reference surface. An electromagnet distant from the reference surface has spaced poles of opposite, selectively reversible, polarity. A cam rotatable about an axis transverse to the reference surface has an integral permanent magnet with similarly spaced poles of opposite polarity equidistant from the axis of rotation. The cam is rotatable between an active position at which its respective poles are attached to and positioned adjacent the poles of the electromagnet and an inactive position at which the reversed poles of the permanent magnet are attracted to and positioned adjacent the opposite poles of the electromagnet. A touch pin has a longitudinal axis transverse to the reference surface and includes a follower end engagable with the cam and a tip end distant from the follower end. The pin is movable on the cam between a first position raised above the reference surface when the cam is in the active position and a second position not projecting beyond the reference surface then the cam is in the inactive position. A plurality of touch pins and associated mechanisms can be combined into a matrix to form a tactile display unit and a plurality of such units can be provided in a console and electronically driven in an intelligent fashion to provide the user with various forms of tactile information.

Tani et al., U.S. Pat. No. 5,449,292 discloses a tactile reading device including sensing rods that are supported to be vertically movable, piezo-electric actuating elements disposed in the vertical direction such that their free end portions are directed upward, and pushing-up cams having first levers which are axially and pivotally supported on support rods provided at an upper position of the free end portions of the piezo-electric actuating elements, extending downward from the support rods, and having side surfaces at distal end portions thereof which are freely abutted against the free end portions of the piezo-electric actuating elements, and second levers extending horizontally from the support rods and freely mounting, on their mounting planes, lower end portions of the sensing rods corresponding to the piezo-electric actuating elements.

Gilkes et al., U.S. Pat. No. 5,580,251 discloses a Braille display device which comprises: a plurality of cavities; and circuitry to individually excite the plurality of cavities. The plurality of cavities contain a positive and a negative electrode and are filled with a quantity of polar organic gel sensitive to electric fields. The cavities are sealed by an elastomeric film. The elastomeric film is held generally flat, by its own tension, in the absence of any voltage applied to the electrodes in the plurality of cavities. The display device can also include circuitry to determine whether the cavity has been touched by a person who is reading the display. The display device can also include circuitry to individually vibrate each cavity. Other devices, systems and methods are also disclosed.

Decker, U.S. Pat. No. 5,685,721 discloses a refreshable Braille cell display using a single moving part per tactile element. Tactile elements, formed from stainless steel tubing, are assembled in densely arranged modules. Lower ends of the tactile elements extend beneath the modules and are in contact with a pressurized medium. Shape memory alloy actuators are positioned in the tactile elements, isolated from any motion or flow in the pressurized medium. When a pressurized medium is delivered through a port in a tactile element, the actuator extends upward, thereby forcing the upper portion of the tactile element through a hole in the user contact surface. In that state the tactile element indicates information. When the tactile element is activated, current flows