

set, that can be operated using conventional electromechanical actuators each operatively associated with plural stimulus points, and that can be adapted for multi-level (relief) display.

The apparatus includes a display surface having a pin array of at least hundreds of movable pins maintained. A pin retention mechanism (or mechanisms) is established adjacent to the display surface for holding pins in a position when moved. An actuating means selectively moves selected pins in the pin array between at least first and second positions, with a single actuator of the actuating means able to establish movement of multiple pins in the pin array.

Each pin in the array preferably includes a shaft between an enlarged head and an end. The display surface and pin retention mechanism(s) are preferably established by elements in a matrix of stacked elements, the display surface element having a user accessible display surface and an array of openings each having one of the movable pins maintained therein with the enlarged heads of the pins above the display surface and the pin ends below the display surface element. The actuating means is positioned to selectively contact the pin ends for moving pins maintained at the array of openings.

The method of this invention includes the steps of maintaining an array of at least hundreds of movable pins at a display surface and using a single actuator to move multiple pins in the array between at least first and second positions. Movement of the pins is continued until a desired configuration is attained at the display surface, pins being retained in a position when moved without continued influence from the actuator. When desired, the pins are again moved to attain a different configuration at the display surface.

It is therefore an object of this invention to provide improved apparatus and methods for extended, refreshable display of graphics.

It is another object of this invention to provide improved an extended refreshable tactile graphic array for scanned tactile displays.

It is another object of this invention to provide an extended refreshable tactile graphic array for scanned tactile displays that accommodates both a Braille matrix and a closely spaced matrix for graphics.

It is another object of this invention to provide an extended refreshable tactile graphic array for scanned tactile displays that does not require the application of power to maintain the displayed image once the stimulus points, or pins, have been set.

It is still another object of this invention to provide an extended refreshable tactile graphic array for scanned tactile displays that can be operated using conventional electromechanical actuators each operatively associated with plural stimulus point.

It is still another object of this invention to provide an extended refreshable tactile graphic array for scanned tactile displays and that can be adapted for multi-level (relief) display.

It is yet another object of this invention to provide an extended refreshable tactile graphic array apparatus for tactile display that includes a display surface having a pin array of at least hundreds of movable pins maintained thereat, pin retention means for holding pins in a position when moved, and actuating means for selectively moving pins in the pin array between at least first and second positions, a single actuator of the actuating means for moving multiple pins in the pin array.

It is yet another object of this invention to provide an extended refreshable tactile graphic array apparatus for scanned tactile display including a multiplicity of movable pins, each pin including a shaft between an enlarged head and an end, a matrix of stacked elements including a display surface element and a pin retention element for holding pins in a position when moved, the display surface element having a user accessible display surface and an array of openings each having one of the movable pins maintained therein with the enlarged heads of the pins above the display surface and the pin ends below the display surface element, and actuating means for selectively contacting the pin ends for moving pins maintained at the array of openings at the display surface element between at least first and second positions, a single actuator in the actuating means for moving a number of the pins.

It is yet another object of this invention to provide a method for extended refreshable tactile graphic display that includes the steps of maintaining an array of at least hundreds of movable pins at a display surface, using a single actuator to move multiple pins in the array between at least first and second positions, continuing to move the pins until a desired configuration is attained at the display surface, retaining pins in a position when moved without continued influence from the actuator, and moving the pins when desired to attain a different configuration at the display surface.

With these and other objects in view, which will become apparent to one skilled in the art as the description proceeds, this invention resides in the novel construction, combination, and arrangement of parts and method substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that changes in the precise embodiment of the herein disclosed invention are meant to be included as come within the scope of the claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate a complete embodiment of the invention according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is an illustration of a pin used in the tactile graphic array of this invention;

FIG. 2 is a diagrammatic illustration of a portion of a first embodiment of an extended pin array used in the tactile graphic array of this invention;

FIG. 3 is a diagrammatic illustration of a portion of a second embodiment of an extended pin array used in the tactile graphic array of this invention;

FIG. 4 is a diagrammatic illustration of a portion of a third embodiment of an extended pin array used in the tactile graphic array of this invention;

FIG. 5 is a diagrammatic illustration of a portion of a pair of plates in a stacked configuration of the tactile graphic array of this invention;

FIG. 6 is a top view illustration of a single plate of the stacked configuration of the tactile graphic array of this invention;

FIG. 7 is a schematic illustration showing one method of pin position retention for use with the tactile graphic array of this invention;

FIG. 8 is a schematic illustration showing a second method of pin position retention for use with the tactile graphic array of this invention;