serial to parallel integrated circuit may be used to receive the input from the computer and provide the output to the piezoelectric elements as required.

As shown in FIG. **4**, the electromechanical tactile cells **40**, employed as Braille cells, of the present invention are shown as assembled in a refreshable Braille display **100**. As shown, the cells are positioned within the frame and held in place utilizing receiving connectors **42**. Refreshable Braille displays often include a router button that allows control over the position of the text cursor. Pressing the router button of a particular cell will move the cursor over that particular letter of the text. The receiving connectors **42** provide electrical communication between the Braille cells **40** and the cursor routing buttons **102** through a backplane. Prior art devices require that lead wires be run from the button switches to the printed circuit board of the Braille cell to provide operation of the cursor controls.

The Braille cell of the present invention does not include an individual tactile pin cap for each cell. As shown in FIG. **4**, a monolithic cell cap **90** is provided to replace the individual tactile pin caps. The cell cap **90** provides a smooth tactile surface for the user, eliminating the spaces between adjacent individual tactile pin caps. The use of a monolithic cell cap also eliminates that need for alignment hardware and fixing plates associated with the individual tactile pin caps. The cell cap provides for self-alignment of the Braille cells.

As shown with reference to FIGS. **5**A and **5**B, in an additional embodiment, the electromechanical tactile cell includes a removable downward stop **110**. In accordance with the present invention, the negative stop is provided by a removable, nonconductive stop. The removable negative stop assembly further comprises a plurality of negative stop elements corresponding to each of a plurality of piezoelectric elements, the plurality of negative stop elements integral with the removable negative stop assembly **110**. The negative stop assembly is fabricated of an insulative material and positioned proximate to the elongated end portion of the plurality of piezoelectric element reeds as shown in FIG. **5**B. As illustrated in FIG. **5**A, the negative stop assembly is characterized as having a thin cylindrical portion **115**, followed by a disc shaped portion **120**, followed by another cylindrical portion **115** and an additional disc shaped portion **120**, and continuing to provide a disc shape portion positioned between each of the piezoelectric element reeds. The negative stop assembly is removable, thereby eliminating the additional manufacturing cost of molding the downward stop into a plastic assembly. The downward stop is additionally effective in controlling the piezoelectric element reeds not to be displaced by impact or the like to such an extent that the piezoelectric element reeds are broken by their own displacement.

It will be seen that the advantages set forth above, and those made apparent from the foregoing description, are efficiently attained and since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matters contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween. Now that the invention has been described,

What is claimed is:

1. An electromechanical tactile cell assembly comprising:

a plurality of piezoelectric element reeds, each one of the piezoelectric element reeds being bendable at an elongated end portion when a voltage is applied to the reed;

a plurality of conductive fulcrum pins secured to a printed circuit board; and

a plurality of multiple element conductive supports secured to a printed circuit board, each multiple element conductive support, in combination with the plurality of conductive fulcrum pins, adapted to secure a plurality of piezoelectric reeds, corresponding to the plurality of conductive fulcrum pins, to the printed circuit board.

2. The electromechanical tactile cell assembly of claim **1**, wherein the piezoelectric element reed is a bimorph.

3. The electromechanical tactile cell assembly of claim **1**, wherein the piezoelectric element reed is a parallel polled bimorph.

4. The electromechanical tactile cell assembly of claim **1**, wherein the piezoelectric element reed is a series polled bimorph.

5. The electromechanical tactile cell assembly of claim **1**, wherein the piezoelectric element reed further comprises a top piezoelectric plate, a bottom piezoelectric plate, and a conductive strip positioned between the top plate and the bottom plate and insulated therefrom, the conductive strip extending beyond the top plate and the bottom plate at a first end of the reed.

6. The electromechanical tactile cell assembly of claim **5**, wherein the piezoelectric element reed is conductively secured to the printed circuit board at a first end of the reed.

7. The electromechanical tactile cell assembly of claim **1**, wherein the piezoelectric element reeds are of substantially equal length, and wherein the piezoelectric element reeds are secured to the printed circuit board in a stepped pattern in a common bending plane.

8. The electromechanical tactile cell assembly of claim **1**, wherein the plurality of multiple element conductive supports further comprises:

a conductive base; and

a plurality of conductive flexion members integral to the conductive base.

9. The electromechanical tactile cell assembly of claim **8**, wherein the plurality of conductive flexion members further comprises an arm including a substantially convex portion, the convex portion biased in a direction to contact the piezoelectric element reed.

10. The electromechanical tactile assembly of claim **8**, wherein the plurality of conductive flexion members are arranged in a stepped pattern relative to the conductive base.

11. The electromechanical tactile cell assembly of claim **5**, further comprising a first electrical contact surface coincident with the top plate and a second electrical contact surface coincident with the bottom plate.

12. The electromechanical tactile cell assembly of claim **11**, wherein each multiple element conductive support is in contact with the first electrical contact surface and each of the plurality of conductive fulcrum pins is in contact with the second electrical contact surface, such that the piezoelectric reed is secured to the printed circuit board.

13. The electromechanical tactile cell assembly of claim **11**, wherein each multiple element conductive support is in contact with the second electrical contact surface and each of the plurality of conductive fulcrum pins is in contact with the first electrical contact surface, such that the piezoelectric reed is secured to the printed circuit board.

14. The electromechanical tactile cell assembly of claim **1**, further comprising:

the plurality of conductive fulcrum pins includes a first plurality of fulcrum pins secured to a first side of the