obvious to those of ordinary skill in this field that the identified improvements should be made nor would it have been obvious as to how to make the improvements if the need for such improvements had been perceived.

[0019] The longstanding but heretofore unfulfilled need for an improved Braille cell and Braille cell cap assembly is now met by a new, useful, and non-obvious invention. The electromechanical Braille cell assembly of the present invention and the improved Braille cell cap of this invention provides manufacturing cost reductions and substantial improvements in utility and reliability over prior art Braille cell and Braille cell cap assemblies. The present invention also reduces the labor required to manufacture the Braille cell and Braille cell cap assemblies, thereby further reducing the cost of the device.

[0020] More particularly, the present invention obviates the need for thirty-two (32) hand-soldered joints and for the routing of sixteen (16) jumper wires, thereby facilitating the manufacturing process and improving the reliability of the product. Additional manufacturing improvements are realized through improved alignment between the Braille pins and the bimorph reeds, also known as bimorph strips or bimorph actuators or simply bimorphs.

[0021] The novel Braille cell assembly includes a universal mounting means forming a part of an Original Electronic Manufacturer (OEM) solution. The novel Braille assembly therefore defines a standard for interfacing with the assembly.

[0022] More particularly, the novel Braille cell assembly includes a plurality of parallel polled bimorph reeds. Each bimorph reed or strip includes a top plate, a bottom plate, and a center conductor strip sandwiched therebetween. A virtual bimorph ground is provided by grounding the center conductor, by electrically isolating the top and bottom plate from each other, and by applying a high voltage to both the top and bottom plates so that neither plate is a mechanical drag on the other as in prior art bimorph strips.

[0023] A novel clip mounts each bimorph reed to a printed circuit board. Each clip includes a horizontal top wall soldered to the printed circuit board and a horizontal bottom wall soldered to the PCB. A top arm formed integrally with the horizontal top wall has a linear contact area formed by a part that extends downwardly to the linear contact area and upwardly therefrom. A bottom arm formed integrally with the horizontal bottom wall has a linear contact area formed by a part that extends upwardly to the linear contact area and downwardly therefrom. The linear contact areas are spaced apart from one another by a distance that is slightly less than a thickness of a bimorph reed. A bimorph reed is slid between the two linear contact areas and is clampingly engaged by the inherent bias of the top and bottom arms.

[0024] Each clip, including its horizontal top and bottom walls and its top and bottom arms, is formed of an electrically conductive flexible and resilient material. The arms are inherently biased toward one another so that a bimorph when disposed in sandwiched relation therebetween, is clampingly engaged thereby.

[0025] The clips are positioned about mid-length of their associated PCB. Each bimorph reed is engaged near its trailing end by its associated clip. The respective leading ends of the bimorph reeds extend beyond the leading ends associated PCBs.

[0026] The Braille cell assembly of this invention includes a plurality of Braille cells, each of which preferably includes eight (8) Braille pins in a housing. Each pin is actuated to extend out of the housing by a bimorph reed. Thus, there are eight (8) bimorph reeds for each Braille cell. A first set of four (4) bimorphs are clippingly engaged to a first side of a printed circuit board to actuate a first column of four (4) Braille pins and a second set of four (4) bimorphs are clippingly engaged to a second side of the printed circuit board to actuate a second column of four (4) Braille pins.

[0027] In a preferred embodiment, twenty (20) printed circuit boards are mounted in a hollow frame structure, more particularly known as a chassis or backplane. As above-mentioned, each printed circuit board provides a mount for eight (8) bimorph reeds. Accordingly, each PCB drives one (1) Braille cell. In a preferred embodiment, known as a double decade, there are two (2) sets of ten (10) Braille cells mounted on the novel frame structure. Thus, there are twenty (20) PCBs and one hundred sixty (160) bimorph reeds mounted in the chassis/backplane. In a preferred embodiment, such collection of twenty (20) PCBs is considered a module. Each module is interconnectable with another module. Thus, a user may purchase one (1) module or any multiple thereof when purchasing a Braille display case. Advantageously, repairs are easily made by exchanging a good module for a broken or malfunctioning module so that a user need not purchase an entire Braille display case when a problem arises.

[0028] The chassis/backplane has a top wall, a bottom wall, a first, leading sidewall in the form of an angle wall and a second, trailing sidewall in the form of a flat wall. A horizontal section of the angle wall is disposed in abutting and coplanar relation to a leading edge of the frame top wall and the vertical section of the angle wall is disposed in abutting relation to the leading end of the frame bottom wall. The longitudinal extent of the frame top wall is thus less than the longitudinal extent of the frame bottom wall, the difference in longitudinal extents being equal to the longitudinal extent of the horizontal section of the angle wall.

[0029] The flat wall is disposed in abutting relation to the trailing edge of the top wall and the trailing edge of the bottom wall.

[0030] A plurality of sockets is mounted on the top wall of the frame, in depending relation thereto, with each socket having a trailing end disposed near a trailing edge of the top wall. Each socket is adapted to receive an upper, trailing longitudinal edge of an upstanding PCB.

[0031] A plurality of slots is also formed in the top wall to receive the respective leading ends of the PCBs.

[0032] Each PCB has a protuberance formed in its lowermost, trailing end. A corresponding plurality of slots is formed in the bottom edge of the flat wall of the frame to respectively receive the protuberances to thereby enhance the mounting of the PCBs within the frame.

[0033] A first plurality of clips is soldered to a first side of each printed circuit board and a second plurality of clips is soldered to on a second side of each printed circuit board as aforesaid. Each clip holds a bimorph reed in substantially parallel relation to the top and bottom walls of the frame and each center conductor of each bimorph reed is soldered to its associated PCB.

[0034] A plurality of sets of pinholes is formed in the horizontal section of the angle wall and each pinhole is adapted to slideably receive a Braille pin.

[0035] A first set of bimorph reeds clipped to a first side of a first PCB includes four (4) bimorph reeds having a common length. The bimorph reeds are staggered with respect to one another so that a leading end of a first, uppermost bimorph