The lower extremity of the sensing rod **26** (see FIG. **5**) is counterbored at **27** to slideably receive therewithin in a telescoping manner a rod extender insert **28**. The insert **28** includes a dowel portion **29** which slides within the counterbore **27** in the main body of the rod **26**. The dowel portion makes a tight interference fit with the internal walls of the bore **27** so that by adjusting the degree of penetration of the dowel **29** the axial length of the composite rod structure **26** is determined.

The sensing rods **26** rest at their lower extremity upon the free end portions of the respective piezoelectric reeds **17**. The reeds **17** are cantilevered about the fulcrum support **18** with the free end portions thereof supporting their respective sensing rods **26**. The reeds are arranged in a stair step fashion in pairs. The upper most reed of each pair is apertured to allow passage therethrough of the sensing rod resting upon the lower most reed of each pair. The aperture is conveniently formed by a notch which notches out one of the corners of the respective reed. Such a notched corner is shown at **31** in FIG. **3**. The sensing rod **26** associated with the upper most reed of each stair step pair rests upon the corner of the reed at the free end of the reed **17**. The sensing rods **26** associated with the successively lower pairs or steps of the stack of reeds **17** pass by the ends of the reeds above that pair in the stack of reeds **17**.

Referring now to FIG. **4**, the piezoelectric reeds **17** each comprise a sandwich structure of piezoelectric material in which two layers of electrically polarized piezoelectric material **32** and **33** sandwich therebetween a leaf of conductive material **34**, as of brass. The outer surfaces of the piezoelectric layer **32** and **33** are covered with a thin layer of electrically conductive material **35** as of gold or nickel. In a typical example, the reeds are approximately a ¼ inch wide, 2 inches in length and the brass leaf **34** has a thickness as of 0.001 to 0.002 inch and piezoelectric layers **32** and **33** have thicknesses as of 0.007 to 0.008 inch. The conductive layer **35** has a thickness, as of 50 micro inches. Such reeds are commercially available from NGK of Nagoya, Japan as model MT-114H bimorphous elements.

The reeds utilized herein are electrically polarized for parallel operation at the factory by the application of a high voltage across conductive layer **35**. A polarization mark **36** indicates the positive terminal during the polarizing process.

The operating potentials are applied to the respective reeds **17** by means of a circuit schematically indicated in FIG. **4**. More particularly, a source of relatively high voltage, as of +160 volts is applied to terminal **37** which is connected to the upper layer **35** of the bimorphous piezoelectric reed **17**. The central leaf **34** is connected to one terminal of a double pole-double throw switch **38** which is preferably a transistor switch. The lower face electrode **35** of the reed **17** is connected to ground. The switch **38** selectively couples the central leaf **34** either to the high positive potential or to ground potential which either places the full 160 volts across the lower piezoelectric layer **33**, or across the upper piezoelectric layer **32** as determined by the position of switch **38**.

When positive potential is applied across the upper piezoelectric layer **32**, it deflects the reed upwardly about the fulcrum **18** and conversely when the positive potential is applied across the lower piezoelectric layer **33** it deflects the reed **17** downwardly about the fulcrum **18**. The bending moment selectively applied to the reed causes the sensing rod **26** associated with that reed to be either fully elevated as determined by the shoulder of the rod being stopped by the marginal edge of the respective bore **24** in the sensing plate **19** or conversely when the bending moment is downward, the reed deflects downward and gravity operating on the respective sensing rod **26** causes the rod to be fully retracted so that the degree to which the sensing rod protrudes if any from the sensing surface **23** is greatly reduced relative to the amount of protrusion when the rod is fully elevated. The operator senses the pattern of protruding rods **26** to define a given braille character.

Electrical connection is made to the root ends of the respective reeds by means of a printed circuit board, mating with the recessed web **15** not shown, and leads which connect the circuit on the printed circuit board to the respective terminals of each of the respective reeds **17** in a manner as indicated in FIG. **4**.

In a typical example, the sensing rod **26** is made of ABS plastic, has a diameter of 0.082 inch and a length for the neck portion 25 of 0.328 inch. The rods are conveniently made by injection molding and their length from the shoulder to the base varies from 0.095 inch to 0.845 inch.

An advantage to the manner in which the electrical potentials are applied to the reeds **17** as shown in FIG. **4** is that the piezoelectric layers **32** and **33** are permanently electrically polarized in the same sense as that of the applied operating electric field. More particularly, the electric vector of layer **32** is perpendicular to and directed toward the plane of the central leaf **34**, whereas the permanent electric polarization vector of the lower piezoelectric layer **33** is normal to the leaf **34** and directed away from the leaf. The applied voltage for actuation of the reed **17** is thus always applied in the direction of the electric field polarization of the layers **32** and **33**. In this manner, depolarization of the reeds with useage does not occur.

The inner ends of the respective top plates **19** are recessed at **39** for mounting to a stringer, not shown, extending laterally of the individual electromechanical braille cells **11**. The recessed portion **39** includes a vertical bore **41** to receive a screw passing into a tapped bore in the stringer. Similarly, a tapped bore **42** is provided in the centrally recessed portion **21** of the top plate to receive a screw passing through the central stringer and threadably mating with the threads of the bore **42**.

The advantages of the braille cell of the present invention include its simplified construction utilizing reeds **17** all of the same dimension with certain of the reeds being notched at **31**. By cantilevering the reeds **17**, the braille cells **11** may be arranged in a pair of rows, as shown in FIG. **6**, thereby providing two relatively closely spaced lines of braille text.

What is claimed is:

1. In an electromechanical braille cell having a plurality of braille indicia:

reed means comprising a stack of piezoelectric reeds cantilevered from a support structure for bending movement about a fulcrum at the support structure in response to the application of an operating voltage to respective ones of said piezoelectric reeds;

sensing rod means for mechanical operative association with respective ones of said reed means for selective movement of respective ones of said rod means along the direction of elongation of said rod means in response to bending movement of respective ones of said reed means;