GRAPHIC TACTILE CELL

BACKGROUND OF THE INVENTION

The present invention relates to the technique of a graphic tactile cell for indicating a graphic pattern, a braille pattern and the like to a visually handicapped person and, more particularly, to the technique of a graphic tactile cell in which the tactile surface can be enlarged easily and the operability in the manufacture and maintenance is improved.

As a means that readily transmits graphic information or the like dealt with by a computer to a visually handicapped person, a graphic tactile apparatus is known which indicates the graphic information as an original two-dimensional expression in the form of dots and transmits the graphic information through tactile reading.

Conventionally, as a graphic tactile apparatus of this type, for example, U.S. Pat. No. 3,229,387 discloses an apparatus in which a large number of piezoelectric operation segments are densely arranged on a printed circuit board to be inclined by a predetermined angle. These piezoelectric operation segments are vibrated in accordance with graphic information to be indicated. The indicated content is read when a finger touches the distal ends of the piezoelectric operation segments, i.e., through a finger touch. Since this graphic tactile apparatus has an integral arrangement in which the number of dots constituting the tactile surface is limited to, e.g., 10×11, it is difficult to arbitrarily increase or decrease the number of dots constituting the tactile surface. Accordingly, if the tactile surface must be enlarged in order to increase the number of dots of the tactile surface, a tactile surface meeting each condition must be fabricated for apparatus by apparatus, leading to a high manufacturing cost.

As another technique, Jpn. Pat. Appln. KOKOKU Publication No. 1-54712 discloses a graphic tactile apparatus in which interdigital piezoelectric operation segments are arranged at a predetermined distance from each other and to be inclined at a predetermined angle. The piezoelectric operation segments are stationarily displaced in accordance with the graphic information to project tactile pins from the surface of a tactile plate. The graphic information is read when a finger touches the distal ends of the tactile pins. In this graphic tactile apparatus, since the constituent components must be prepared in accordance with the number of image dots, it is difficult to assemble. Regarding the structure, since the piezoelectric operation segments are interdigitally connected, the maintenance of the individual piezoelectric operation segments is difficult to perform. In addition, as the position adjustment of the individual tactile pins is difficult to perform due to their structure, the assembling efficiency is poor, leading to a high cost.

A graphic tactile apparatus also needs a technique that enables a visually handicapped person to recognize the finger touch position of indicated graphic information. As a means for informing the visually handicapped person of a finger touch position, German Patent No. DE 37 33 612 proposes ones that utilize light, e.g., one that uses a capacitance sensor, one that uses a combination of an optical fiber, a light-emitting diode, and an optical sensor, one that uses a combination of a light-emitting diode and a phototube, and the like. However, the technique which is disclosed in this reference and which detects a change in capacitance has many uncertain factors and thus lacks reliability. Also, the technique that utilizes light tends to be influenced by external light. In addition, these methods require complicated arrangements and their maintenance is difficult to perform, leading to a higher cost.

BRIEF SUMMARY OF THE INVENTION

The present invention has been made to solve the problems described above, and has as its object to provide a graphic tactile cell in which the graphic tactile surface can be enlarged with a large degree of freedom and manufactured and maintained easily.

According to the first characteristic feature of the graphic tactile cell of the present invention, a plurality of cell units each comprising the unit number of tactile pins, piezoelectric element segments corresponding to them, and a unit base for holding the unit number of tactile pins and the piezoelectric element segments are coupled to each other in the vertical and horizontal directions. The tactile pins are arranged at an equal interval in the vertical and horizontal directions. With this arrangement, the degree of freedom in enlargement of the graphic tactile surface is increased remarkably. Also, unit bases constitute the cell units, so that an economical tactile graphic cell can be formed.

The proximal end portions of the piezoelectric element segments are held by the unit base through plastically deformable members. With this arrangement, even if the bending characteristics of the individual piezoelectric element segments may somewhat vary in the manufacturing process, these variations can be easily corrected by deforming adjusting members after assembly.

In the graphic tactile cell according to the present invention, the bending displacement surface at one end of each piezoelectric element segment is arranged at a predetermined angle with respect to the graphic tactile surface, and the abutting surface of a tactile pin that abuts against this bending displacement surface is formed to be substantially parallel to the bending displacement surface. Each tactile pin is placed on the bending displacement surface of the corresponding piezoelectric element segment through the abutting surface and is supported to be vertically movable. In this arrangement, since the tactile pins and the piezoelectric element segments are not fixed to each other, the tactile pins can move vertically freely. Since the abutting surfaces of the piezoelectric element segments and those of the corresponding tactile pins are substantially parallel to each other, the movement of the piezoelectric element segments can be smoothly transmitted to the tactile pins. Since the tactile pins and the piezoelectric element segments are independent of each other, the assembly and maintenance are easily performed.

It is another characteristic feature of the present invention that the unit base that holds the piezoelectric element segments has groove portions for independently mounting and holding the piezoelectric element segments therein. With this arrangement, the respective piezoelectric element segments can be held independently and reliably stably, leading to an easy manufacturing process.

It is still another characteristic feature of the present invention that a strain sensor for detecting a finger touch is provided at the required position of each piezoelectric element segment, or a finger touch sensor is provided at the required position of the graphic tactile surface. With this arrangement, a low-cost graphic tactile cell capable of detecting a finger touch position reliably can be provided.

Furthermore, an arithmetic drive unit that applies a voltage to the respective piezoelectric element segments may be integrally formed with the unit base, or may be connected through a housing connection. With this arrangement, the manufacturing process or the inspection process is systemized to decrease the manufacturing cost.

According to the present invention, a graphic tactile cell is fabricated with a combination of cell units. Therefore, a