

**TACTILE PIN HOLDING APPARATUS, TACTILE  
PIN DISPLAY APPARATUS AND BRAILLE  
DISPLAY MEMBER**

**BACKGROUND OF THE INVENTION**

**[0001]** 1. Field of the Invention

**[0002]** The present invention relates to a tactile pin holding apparatus for holding plural pins such as 6 pins, 8 pins or more, and to a tactile pin display apparatus for continuously displaying desired characters and/or graphics, either braille or general (for e.g. the non-handicapped), two-dimensionally or three-dimensionally. More particularly, it relates to a tactile pin holding and moving mechanism by which the pins are moved up-and-down from and to a tactile surface, and held at desired positions or heights from the tactile surface. The present invention furthermore relates to a braille display member capable of decomposing contaminants deposited on the pins or their peripheral portions.

**[0003]** 2. Background Art

**[0004]** In a conventional braille display apparatus, which is usually a tactile pin display apparatus, a plurality of braille cells, i.e. display cells, in a given number are arranged in one (braille) line. The tactile pins (hereinafter frequently referred to as pins simply) in the braille or display cells in one (braille) line are electromagnetically moved up-and-down for tactile pin display. After a user (visually handicapped) touches and read the tactile pins in the one braille line, a next braille line is displayed. By sequentially displaying such braille lines of display cells, the user reads the braille information line by line.

**[0005]** Japanese Laid-open Patent Publication 2000-122526 discloses a continuous braille display or tactile pin display apparatus comprising the following six elements. A first element comprises a rotational display drum having a plurality of braille cells, each being composed of 6 pins, wherein the 6 pins in each braille cell are raised and lowered in various ways to display one braille character. A second element comprises a display cover, which covers the display drum, and which exposes a part of the display drum at a braille display window thereof, i.e. braille display location. A third element comprises a display command input unit for inputting display commands. A fourth element comprises a display setting unit for selectively moving up-and-down, relative to a tactile surface, 6 pins in a braille cell at a non-display location of braille cells, thereby preliminarily setting the combination of the positions (heights relative to the tactile surface) of the 6 pins to display a braille character in correspondence with a character signal input to the display command input unit.

**[0006]** A fifth element comprises a display drum rotation driving unit for rotating the display drum relative to the display cover in response to a braille display command, such that the braille cell having been preliminarily set with respect to the combination of the positions of the 6 pins is brought to the place of the braille display window for being exposed outside thereat, and that the braille cell having been exposed outside at the braille display window is brought to a non-display location of braille cells. A sixth element comprises a display holding unit for holding the combination of the pins of the braille cell at the display location, namely at the braille display window.

**[0007]** Japanese Laid-open patent publication 2000-206873 proposes another continuous braille display apparatus comprising: a rotational display drum having a plurality of braille cells, each being composed of 6 pins to be raised and lowered in various ways to display one braille character, each pin being made of permanent magnet; a first arrangement for selectively raising or lowering the pins, using electromagnets; and a second arrangement for holding the pins at the raised and the lowered positions by two kinds of shape-memory alloy springs and heating means.

**[0008]** Japanese Laid-open Patent Publication Hei 09-127859 discloses an arrangement, using an elastic cantilever made of a flat spring, for holding pins at certain positions (heights) of the pins from a tactile surface.

**[0009]** Furthermore, Japanese Laid-open Patent Publication Hei 09-311622 discloses an arrangement, using frictional force of rubber sheet, for holding the pins to be movable up-and-down relative to the tactile surface.

**[0010]** However, the conventional braille display apparatuses according to e.g. Japanese Laid-open Patent Publications 2000-122526 and 2000-206873 have drawbacks, such that pin moving means and pin holding means have complicated structures, making it difficult to reduce in size, weight and cost. In addition, none of the four Japanese Laid-open Patent Publications teach any arrangements for keeping clean the pins and/or the rotational drums, constituting the braille display apparatuses, against odor, bacteria, sweat, oil of the hand, food particles and so on.

**[0011]** The conventional braille display or tactile pin display apparatuses will be more specifically described hereinafter.

**[0012]** Firstly, Japanese Laid-open Patent Publication 2000-122526 requires a very complicated structure comprising: slippage prevention members (reference numeral 15 in FIGS. 5 and 6 of the Publication) for preventing the pins at the non-display place from slipping in an unintentional direction, either raising or lowering; and a display holding unit (reference numeral 9 in FIG. 2 there), i.e. hooking portions (reference numeral 22 in FIGS. 4, 8 and 9 there) of latching members (reference numeral 22a in FIGS. 8 and 9 there), for holding the pins against strong force of pressing the pins downward by e.g. a finger of a user.

**[0013]** Furthermore, for preventing the pin from pivoting or turning, it is required to bend an end of each pin (reference numeral 7b in FIG. 6 there), and to provide pivoting prevention slits (reference numeral 4e in FIGS. 5 and 6 there) Additionally, three pins (reference numeral 7 there) of each column of each braille cell (reference numeral 6 there) are moved up-and-down by three actuators (reference numeral 17 in FIG. 7 there) that are arranged at one place and are driven simultaneously. Moreover, at an abnormal condition such that a foreign article, such as a paper clip, falls onto the braille cells at the braille display window exposed to outside, and is stuck between the rotational display drum (reference numeral 4 there) and some other element of the apparatus, the rotation of the rotation driving motor is disturbed or stopped. Thereby, an overload or abnormal load is undesirably applied to the motor. This may undesirably cause the apparatus to overheat, emit smoke or even catch fire in the absence of any means to prevent the apparatus therefrom.