

horizontal direction in turn smoothly even when the timing of the vertical movement is not strictly set.

[0086] The display board portion **3**, penetrated and supported by the tactile pins **10**, is obtained by assembling the upper and the lower plates **11**, **12** and the friction member **13**, which is like a sheet firmly held in an airtight manner between the upper and the lower plates **11**, **12**, in a laminated manner. This maintains the friction member **13** in a state of tension, securely holds the tactile pins **10** at the upper movable positions and the lower movable positions, and finishes the display board portion **3** like a compact kit which is the item between the top and the bottom.

[0087] Further, the display board portion **3** is attached to the case body **2** in such a manner that the display board portion **3** alone can be freely attached and detached from outside the case body **2**. Hence, it is easy to attach and detach the display board portion **3**, which contributes to an improvement in the ease of assembly and maintainability.

[0088] The tactile display apparatus allows a visually handicapped person to recognize image information, such as a photograph, a graphic and/or a letter, using his tactile sense at the fingertips. The apparatus is particularly effective as the number of components is reduced, because the crisscross adjacent gaps are shortened without any restriction imposed by actuators, the display board portion is compact, the ease of assembly, maintainability and the like are improved, and image information fed to the control part is accurately displayed as difference in elevation among the tactile pins, etc.

1. A tactile display apparatus in which tactile pins disposed in a matrix arrangement on a display board portion are capable of freely projecting or retracting and information is displayed in accordance with concavities and convexities formed as the tactile pins project or retract, comprising:

a movable unit which is capable of freely moving in the vertical direction and the horizontal direction relative to the display board portion;

actuators disposed at the movable unit so as to control projected or retracted position of each tactile pin of the tactile pins;

a control part which controls driving of the actuators in accordance with an information signal; and

movement mechanisms which move the movable unit in the vertical direction and the horizontal direction,

wherein the display board portion comprises an upper plate and a lower plate, a pin holding member which is like a sheet firmly held airtightly between the upper plate and the lower plate, and the tactile pins penetrating and supported in through holes which are formed in a matrix arrangement in the upper plate and the lower plate and the pin holding member.

2. The tactile display apparatus according to claim 1, wherein the actuators which control projected or retracted positions of each tactile pin of the tactile pins are provided to the movable unit so as to be disposed in a vertical row and/or horizontal row, one for every preset number of the tactile pins lined up in at least one of the vertical direction and the horizontal direction.

3. (canceled)

4. The tactile display apparatus according to claim 1, wherein the pin holding member is formed by cloth which has a friction force.

5. The tactile display apparatus according to claim 1, wherein the display board portion is attached to a top surface portion of a case body of the tactile display apparatus in such a manner that the display board portion by itself can be freely attached to and detached from the case body from outside.

6. The tactile display apparatus according to claim 1, wherein the tactile pins are formed by attaching tactile dot parts, which are formed by spring pins, to the tip end portions of main pin parts.

7. The tactile display apparatus according to claim 1, wherein the actuation pins which move forward or backward as the actuators operate are disposed at said movable unit, the tactile pins protrude as the actuation pins move forward, the actuation pins move away from the tactile pins when retracting, and the actuation pins move forward or backward while the movable unit moves.

8. The tactile display apparatus according to claim 7, wherein the movable unit moves while avoiding any contact or connection with the display board portion except for the actuation pins contacting the tactile pins.

9. The tactile display apparatus according to claim 1, wherein the movable unit is supported for free vertical movements via a vertical movement mechanism by a cradle which is supported for free horizontal movements via a horizontal movement mechanism by the case body of the tactile display apparatus.

10. The tactile display apparatus according to claim 1, wherein the movable unit moves horizontally beyond the range in which the actuators control the projected or retracted position of each tactile pin of said tactile pins, and the movable unit moves vertically while moving horizontally beyond the range in which the projected or retracted positions of the tactile pins are controlled.

11. The tactile display apparatus according to claim 1, wherein the vertical movement mechanism of the movable unit comprises an actuating member which moves horizontally and integrally with the movable unit, a fixed member which is fixed to the case body side of the tactile display apparatus, and a one-way clutch mechanism which moves the movable unit vertically in association with interference of the actuating member moving horizontally with the fixed member.

12. The tactile display apparatus according to claim 11, wherein the fixed member is disposed at the both end sides of the range in which the movable unit moves horizontally, the movable unit is caused to move vertically in association with interference of the actuating member with the fixed member which is caused as the movable unit moves horizontally toward one side, whereas the movable unit does not move vertically during interference of the actuating member with the fixed member which is caused as the movable unit moves horizontally toward the other side.

13. (canceled)

14. A control method for a tactile display apparatus in which tactile pins are on a display board portion, using a movable unit mounting actuators thereon, a control part, and movement mechanisms to move the movable unit, the display board portion having an upper plate, a lower plate, and a pin holding member, the tactile pins penetrating and