

TACTILE DISPLAY DEVICE AND METHOD OF CONTROLLING TACTILE DISPLAY DEVICE

[0001] This application is the national stage of PCT/JP03/05614, filed May 2, 2003 which claims priority from JP2002-132627, filed May 8, 2002, the disclosures of both documents being incorporated herein in their entireties by reference thereto.

FIELD OF THE INVENTION

[0002] The invention belongs to the technical field of a tactile display apparatus which one touches by hand to recognize screen information and a control method for the tactile display apparatus.

BACKGROUND ART

[0003] A tactile display apparatus having a structure which permits a visually handicapped person to recognize image information, such as a photograph, a graphic and/or a letter, by means of his/her (for the remainder of the application the male pronoun will be generically used for males and females) tactile sense at his fingertips has been proposed in recent years. Known as such an apparatus is one in which pins which are capable of freely projecting or retracting are disposed like a matrix on a display board portion, and as the pins are controlled to project and retract, a difference in elevation appears among the pins. Thereby, a visually handicapped person feels and senses the difference in elevation with his hand and recognizes image information, as described in Japanese Published Unexamined Patent Application No. 2000-221872 for instance. In a structure of such an apparatus, each one of the pins is controlled to project or retract by an actuator, such as a solenoid (electromagnet) or the like, corresponding to each such pin.

SUMMARY OF THE INVENTION

[0004] However, in the conventional apparatus described above, all pins are made to project or retract by corresponding solenoids. Hence, the adjacent gaps between the pins cannot be as narrow as or narrower than the widths of the solenoids. This not only increases the gaps between the pins and makes it hard to display a fine image, but also leads to a problem where the larger the number of pins is, the larger the number of components, including solenoids, required and the control and management of the increased number of solenoids becomes complex. These are the problems to be solved by the invention.

[0005] The invention has been made to solve the problems defined above. The invention provides 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 such as an image 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 projecting or retracting of each tactile pin of the tactile pins; a control part which controls driving of the actuators in accordance with an information signal, such as an image input, from outside; and movement mechanisms which move the movable unit in the vertical direction and the horizontal direction. This substantially reduces the num-

ber of actuators required to control projecting or retracting of the tactile pins, and hence, the number of components.

[0006] The actuators which control projecting or retracting of the tactile pins may be 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 the vertical direction and/or the horizontal direction, in which case, because this permits setting the adjacent gaps between the tactile pins narrowly without any restriction imposed upon the actuators, it is possible to even display fine information, such as an image, on the display board portion and obtain a sharp tactile display having a high resolution.

[0007] The display board portion may be formed by 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. This makes it possible to maintain the pin holding members in a state of tension, hold the tactile pins securely at projecting positions or retracting positions, and finish the display board portion like a compact kit which is thin between the top and the bottom.

[0008] When the pin holding member is formed by cloth, such as denim which has friction force, it is possible to securely hold the tactile pins and apply appropriate frictional force which will not hinder the projecting or retracting movements of the tactile pins.

[0009] The display board portion may be 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, in which case it is easy to attach and detach the display board portion, thus contributing to an improvement in the ease of assembling and maintainability.

[0010] Further, tactile pins are formed by attaching tactile dot parts, which are formed by spring pins, to the tip ends of main pin parts. Hence, the tactile pins are easily assembled and resistant to vibrations. The tactile pins allow the differences in elevation to be recognized and identified easily.

[0011] The actuation pins which move forward and backward as the actuators operate may be disposed at the movable unit. The tactile pins may protrude as the actuation pins move forward, the actuation pins may move away from the tactile pins when retracting, and the actuation pins may move forward and backward while the movable unit moves. Hence, it is possible to continuously and efficiently control projecting or retracting of the tactile pins.

[0012] The movable unit moves while avoiding any contact or connection with the display board portion except for the actuation pins contacting the tactile pins. The movable unit can therefore move vertically and horizontally at a high speed.

[0013] The movable unit is supported for free vertical movement via a vertical movement mechanism by a cradle which is supported for free horizontal movement via a horizontal movement mechanism by the case body of the tactile display apparatus. The movable unit can therefore move vertically and horizontally in a smooth manner.