main frame part **18***a* as one integrated unit. The eight solenoids **4** are equidistantly disposed vertically in a row between the bottom side **18***d* and the middle side **18***c*. A plunger **4***a* of each solenoid **4** penetrates and protrudes upwardly beyond the middle side **18***c*, and is set so as to move upward when the solenoid is ON and downward when the solenoid is OFF. The actuation pins **16** penetrate through the top side **18***b* and are accordingly supported by the top side **18***b* through the springs **19** such that the actuation pins **16** are located above the plungers **4***a*. Plunger receiving parts **16***a* are formed as integrated, lower sections of the actuation pins **16**.

[**0043**] When the solenoids **4** are OFF, the plungers **4***a* which are moved down, or retracted, do not push the actuation pins **16**. In this condition, the top ends of the actuation pins **16** are slightly away from the abutting parts **10***c* of the tactile pins **10** which are at the lower movable positions described above.

[**0044**] On the other hand, when the solenoids **4** are ON, the plungers **4***a* move up to push the plunger receiving parts **16***a* of the actuation pins **16** from below thereby moving the actuation pins **16** upward. The actuation pins **16** which have thus moved upward push the abutting parts **10***c* of the tactile pins **10** from below, and the tactile pins **10** move to the upper movable positions as described above.

[**0045**] The solenoids **4** used have small inertia. The control part **8** controls the turning on and off of the solenoids **4** is described later. To improve a start-up characteristic of the solenoids **4**, a capacitor which compensates for a voltage drop is used in an output circuit of the control part **8**. Further, when the actuation pins **16**, which have moved upward, are to be moved downward, the solenoids **4** are switched from ON to OFF immediately before the plungers **4***a* arrive at the top end positions and the repulsive force and the spring force of the springs **19** move the actuation pins **16** down. Thus, the actuation pins **16** can quickly move downward. The actuation pins **16**, treated with hard alumite, are light yet ensure necessary hardness. The actuation pins **16** move upward or downward at a high speed in this manner as the plungers **4***a* of the solenoids **4** move upward or downward. Therefore, the actuation pins **16** can move up or down smoothly while the movable unit **5** moves horizontally as described later in detail. In addition, the movable unit **5** will not contact or become connected (linked, engaged) with the display board portion **3** except for pushing of the abutting parts **10***c* of the tactile pins **10** by the actuation pins **16**, which allows movement of the movable unit **5** in the horizontal direction and the vertical direction at a high speed which will be described later.

[**0046**] Eight of the actuation pins **16** are equidistantly disposed in the vertical direction in a single row. Thus, the actuation pins **16** can therefore respond to the respective solenoids **4**. The interval between adjacent actuation pins **16** is one actuation pin **16** is disposed for every six, i.e. with five intervening, tactile pins **10** which are disposed in the vertical direction in the display board portion **3**.

[**0047**] In other words, when the movable unit **5** is located at the origin, as shown in the explanatory operation diagram of **FIG. 7**(A), the first actuation pin **16** is at a location which corresponds to the first tactile pin **10** in the first column, the second actuation pin **16** is at a location which corresponds to the seventh tactile pin **10** in the first column, and the n-th actuation pin **16** (n=1 through 8) is at a location which corresponds to the {(n−1)×6+1}-th tactile pin **10** in the first column.

[**0048**] In the explanatory operation diagrams in FIGS. **7**(A)-**7**(E), the right-most column is the first column, the columns arranged to the left are the second, the third and subsequent columns, and the left-most column is the 64-th column. The bottom row is the first row, the rows above are the second, the third and subsequent rows, and the top row is the 48-th row. Further, although the actuation pins **16** can move horizontally beyond the tactile pins **10** which are in the first and the 64-th columns as described later, for the purpose of description below, the range of horizontal movements of the actuation pins **16** will be from the first to the 64-th columns of the tactile pins **10**.

[**0049**] In response to a start-up command from the control part **8**, the movable unit **5** located at the origin moves horizontally toward the left-hand side from the first column of the tactile pins **10** to the 64-th column of the tactile pins **10** as shown in **FIG. 7**(B). After the actuation pins **16** have arrived at the 64-th column of the tactile pins **10**, the movable unit **5** moves vertically for one row at the back of the tactile pins **10** as shown in **FIG. 7**(C). As a result, the first actuation pin **16** is at the location which corresponds to the tactile pins **10** in the second row, the second actuation pin **16** is at a location which corresponds to the tactile pins **10** in the eighth row, and the n-th actuation pin **16** (n=1 through 8) is at a location which corresponds to the tactile pins **10** in the {(n−1)×6+2}-th row. Following this, the movable unit **5** moves horizontally toward the right-hand side from the 64-th column of the tactile pins **10** to the first column of the tactile pins **10** as shown in **FIG. 7**(D) after reaching the first column of the tactile pins **10**, the movable unit **5** again moves vertically one row at the back of the tactile pins **10** as shown in **FIG. 7**(E). This horizontal and vertical movement is repeated for three reciprocal movements in the horizontal direction, whereby eight actuation pins **16** are located at locations which correspond to all 3072 tactile pins **10**. Thus, the eight solenoids **4** can move all tactile pins **10** upward as required by the image data.

[**0050**] With respect to the horizontal movement mechanism **6** which moves the movable unit **5** in the horizontal direction, the movable unit **5** is supported by a first cradle **20** (**FIG. 6**) which will be described later in such a manner that the movable unit **5** can move vertically but not horizontally and therefore the movable unit **5** moves together with the first cradle **20** in the horizontal direction when the first cradle **20** moves in the horizontal direction. Horizontal movements of the first cradle **20** will now be described.

[**0051**] Horizontal guide members **21**, **21***a* elongated in the left/right direction (in **FIG. 6**, the right side of the figure is the back of the tactile display apparatus **1**) are fixed to the front and the back end portions of the first cradle **20**. Meanwhile, the side surfaces **2***c*, **2***d* on the front and the back of the case body **2** mount, through support members **23**, horizontal rails **22**, **22***a* elongated in the left/right direction. The horizontal rails **22**, **22***a* at the front and the back receive, via bearings **24**, the front and the back horizontal guide members **21**, **21***a* in such a manner that the horizontal guide members **21**, **21***a* can freely move along the left/right direction (horizontal direction).

[**0052**] A motor **25** (**FIG. 8**) is disposed in a back right portion inside the case body **2**. Rotational drive in the