

and the locking pawls 11e are engaged with the recessed locking portions 1u, thereby fixing the cassette 11 on the frame body 1. In this embodiment, four coupling holes 1g are formed in each frame body 1 in order to reinforce coupling with adjacent frame bodies 1, and projections 1r for coupling the adjacent frame bodies 1 with each other and recessed portions 1s to be fitted in these projections 1r are provided. In this embodiment, as shown in FIG. 13, projections 1v are formed on the front and rear surfaces of each side surface 1c in order to mount two housings 7 on the frame body 1. Therefore, fitting holes 7e to be fitted on the projections 1v are formed in two sides of each housing 7. Finally, as shown in FIG. 14, the two frame bodies 1 including the corresponding housings 7 and two control drive circuits 8 are soldered to a bottom plate 10 together with a connector 10a, thereby completing assembly. According to this embodiment, since the pushing-up cams 5 can be easily assembled in the cassette 11, assembly of the entire tactile reading device is facilitated, and strength after assembly can be increased.

The present invention is not limited to the embodiments described above, but can be modified without departing from the spirit and scope of the invention. For example, the structure and assembly method of the pushing-up cams 5 described in the first embodiment, and the structure and assembly method of the housing 7 of the piezo-electric actuating elements 6, the control drive circuits 8, the bottom plate 10, and the like can naturally be practiced in the second, third, and fourth embodiments.

The following effects can be obtained by the present invention.

The displacing movement of the piezo-electric actuating elements can be readily and efficiently converted to the vertical movement of the sensing rods by the pushing-up cams axially and pivotally supported on the support rods. Therefore, the piezo-electric actuating elements can be downsized.

When a predetermined angle or predetermined curved surface is formed on the upper side surface at the distal end of the second lever of each pushing-up cam, an optimum depression force can be applied to the sensing rod throughout strokes of a wide range.

When projections are formed at portions of the first levers of the pushing-up cams which are abutted against the free end portions of the piezo-electric actuating elements, contact between the first levers and the free end portions of the piezo-electric actuating members becomes smooth, and the displacement of the piezo-electric actuating elements can be efficiently converted to the vertical movement of the sensing rods.

When a rotational moment is imparted to the pushing-up cams so that the side surfaces at the distal end portions of the first levers are always abutted against the free end portions of the piezo-electric actuating elements, the sensing rods are reliably returned to the reset position in the reset state.

When the piezo-electric actuating elements of the sensing rods on one side are provided below the sensing rods of the other side, the limited space is effectively utilized to obtain an optimum depression force.

When the cassette that integrally houses the pushing-up cams and the support rods is detachably mounted on the frame body, assembly and maintenance of the braille type cell module are facilitated. When the piezo-electric actuating elements are directly connected to the lead terminals of the housing, and the housing is detachably

mounted on the frame body, lead wires of the piezo-electric actuating elements become unnecessary, and assembly of the braille type cell module is facilitated.

When the control drive circuits are housed in the module, replacement and maintenance of the tactile reading device are facilitated, and the braille type system can be downsized.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, and representative devices shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

What is claimed is:

1. A tactile reading device comprising:

- a frame body;
- a plurality of sensing rods, provided on an upper portion of a frame body and supported so as to be vertically movable, for serving as braille type display units;
- a plurality of piezo-electric actuating elements provided on a lower portion of said frame body to respectively correspond to said sensing rods and disposed vertically such that free end portions thereof extend in an upward direction;
- said frame body including a module having said sensing rods and said piezo-electric actuating elements mounted thereon;
- a plurality of pushing-up cams disposed between said sensing rods and said piezo-electric actuating elements to transmit tactile reading information from said piezo-electric actuating elements to said sensing rods;
- support rods for axially and pivotally supporting said pushing-up cams; and
- each of said pushing-up cams has first and second levers, said first lever extending downward from a respective said support rod and having a lower end portion which freely contacts with said free end portion of a respective said piezo-electric actuating element, and said second lever extending laterally to a lower portion of a respective said sensing rod and having an upper portion which freely contacts with a lower portion of said respective sensing rod, and said pushing-up cam rotates on said support rod to transmit a force applied to said lower portion of said first lever of said pushing-up cam from said piezo-electric actuating element to said lower portion of said sensing rod.

2. The device according to claim 1, wherein lower end portions of said first levers of said pushing-up cams which contact said free end portions of said piezo-electric elements are provided with projections.

3. The device according to claim 1, further comprising a cassette, detachably mounted on said frame body, for integrally housing a predetermined number of pushing-up cams and said support rods supporting said pushing-up cams.

4. The device according to claim 1, wherein said pushing-up cams are imparted with a rotational moment on said support rods so that said lower end portions of said first levers always contact said free end portions of said piezo-electric actuating elements.

5. The device according to claim 1, further comprising a housing, detachably mounted on said frame body, and having a plurality of lead terminals, for directly