control fibers **16** each associated with three optical fibers **1** forming one pixel in the lengthwise direction of the control signal lines **3** and **4** to the flat color display having the tactual representation function according to the first embodiment. Although this fiber has a structure similar to that of the fiber **16** in the third embodiment, the liquid forming the core **16***a* is water.

In the fourth embodiment, similarly to the third embodiment, when ultrasonic waves are generated by driving the piezoelectric element at the intersection point between the control signal line **17** and the control signal line **4**, the ultrasonic waves causes cavitation in the liquid core **16***a* of the fiber **16** because of the principle already explained before, and bubbles are produced. In other words, ultrasonic waves generated by the piezoelectric element function to evaporate the liquid, i.e. water, forming the core **2***a* or a substance contained in the liquid. The vapor is released externally through the cladding **16***b*. By using this mechanism, information about surface humidity of a subject of transmission can be transmitted and demonstrated on a display plane as information on relative surface temperature.

Next explained is a flat color display having a tactual representation function according to the fifth embodiment of the invention.

The flat color display having a tactual representation function is different from the first embodiment in structure of the intersection of each optical fiber **1** and the control signal line **3**. More specifically, in the fifth embodiment, as shown in FIG. **27**, at each intersection point of the control signal line with the optical fiber **1**, the control signal line **3** made of a piezoelectric element defines a concave plane in contact with the outer circumferential surface of the optical fiber **1** excluding a part of the circumference facing the display plane of the display. In this case, the control signal line **3** as the piezoelectric element is made of a transparent material such that light scattered in the core **1***a* can be efficiently led out externally through the control signal line **3**. As the transparent piezoelectric material **3***c* of the piezoelectric element, a transparent polymer, such as PVDF, for example, may be used, and ITO, for example, can be used as the transparent electrode.

In the other respects, the fifth embodiment is the same as the first embodiment, and explanation thereof is omitted here.

The fifth embodiment ensures the same advantages as those of the first embodiment.

Next explained is a flat color display having a tactual representation function according to the sixth embodiment of the invention.

As shown in FIG. **28**, in the flat color display having the tactual representation function, the control signal line made up of a piezoelectric element is divided into stripes **3***d*, **3***e*, **3***f*, **3***g* and **3***h* each having the width W and aligned at intervals Λ in their width direction. Stripes **3***d*, **3***f* and **3***h* of the piezoelectric element are supplied with a voltage opposite in phase from a voltage applied to the stripes **3***e* and **3***g*.

In the other respects, the sixth embodiment is the same as the first embodiment, and explanation thereof is omitted here.

The sixth embodiment ensures the same advantages as those of the first embodiment. Additionally, the following advantage can be obtained as well.

FIG. **29** shows an aspect of propagation of ultrasonic waves upon driving the piezoelectric element by applying voltages opposite in phase to the group of the stripes **3***d*, **3***f*, **3***h* of the piezoelectric element and the group of the stripes **3***e*, **3***g* of the piezoelectric element and thereby generating ultrasonic waves. At that time, since every adjacent stripes of the piezoelectric element among the stripes **3***d*, **3***d*, **3***f*, **3***g* and **3***h* are driven by voltages opposite in phase, propagation of ultrasonic waves in the lengthwise direction of the optical fiber **1** can be prevented. Therefore, ultrasonic waves can be locally limited to the portions of the stripes **3***d*, **3***e*, **3***f*, **3***g* and **3***h*, and cavitation by ultrasonic waves can be limited inside each single pixel. In other words, cross talk between pixels adjacent in the lengthwise direction of the optical fiber **1** can be prevented. Additionally, since the stripes **3***d*, **3***e*, **3***f*, **3***g* and **3***h* periodically aligned at intervals Λ in the lengthwise direction of the optical fiber **1** function as diffraction gratings, scattering of light in the lengthwise direction by bubbles generated in the core **1***a* of the optical fiber **1** can be enhanced, and light can be efficiently led out externally.

Next explained is a flat color display having a tactual representation function according to the seventh embodiment of the invention.

As shown in FIG. **30**, in the flat color display having the tactual representation function, the core **1***a* of each optical fiber **1** is made of a liquid containing fine particles **18** dispersed therein as light scattering elements (a kind of sol). Each signal line **3** is an optical control element made up of an optical waveguide **3***i* and a cladding **3***j* covering it, and it intersects with each optical fiber **1** and contact with a part of its outer circumferential surface.

In the flat color display having the tactual representation function, a control photon flow is generated in the optical waveguide **3***i* of each control signal line **3** as shown in FIG. **30**. As a result, evanescent light is generated in a part of the optical fiber **1** in contact with the optical waveguide **3***i*, and the evanescent light functions to move the fine particles dispersed in the liquid forming the core **1***a* of the optical fiber **1** to positions corresponding to the positions of photons traveling through the optical waveguide **3***i*. Especially when the fine particles **18** are those of a polar organic compound having a dipole moment, for example, it is also possible to change orientation of the fine particles **18** under a function of the electric field of the evanescent light. Using these mechanisms, it is possible to efficiently scatter the laser beams introduced into the optical fiber **1** and efficiently lead out the light externally.

In the other respects, the seventh embodiment is the same as the first embodiment, and explanation thereof is omitted here.

The seventh embodiment ensures the same advantages as those of the first embodiment.

FIG. **31** shows a flat color display having a tactual representation function according to the eighth embodiment of the invention.

As shown in FIG. **31**, in the eighth embodiment, the flat color display **19** having a tactual representation function is shaped in form of a vase as a whole, using its flexibility.

With the flat color-display **19** having the tactual representation function, in case an image of an apple **20** is displayed on the bottom of the vase, for example, an observer **21** looking into the inside of the vase can not only observe the apple **20** as a three-dimensional object but also touch the peel of the apple as a two-dimensional object.

Having described specific preferred embodiments of the present invention with reference to the accompanying drawings, it is to be understood that the inventions is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or the spirit of the invention as defined in the appended claims.

For example, numerical values, structures, materials, source materials, processes and others proposed in the