image to be displayed, and thereby leading out it externally. It should be especially remarked that the information for at least one of proximately discernible senses can be obtained from both the front and the back of the information display plane.

According to the third aspect of the invention, there is provided an information receiving/display apparatus configured to receive sensory information other than visual information and audio information, in addition to visual information and/or audio information, and display it on an information display plane.

According to the fourth aspect of the invention, there is provided an information receiving/display method characterized in receiving sensory information other than visual information and audio information, in addition to visual information and/or audio information, and displaying it on an information display plane.

In the third and fourth aspects of the invention, the visual information, audio information other sensory information are given as functions of positions on the information display plane. The other sensory information is tactual information, relative temperature information or olfactory information. The other sensory information is typically composed of image information. More specifically, the other sensory information is tactual information, for example, and the tactual information is composed of image information. Alternatively, the other sensory information is relative surface temperature information or relative surface humidity information, and the relative surface temperature information or relative surface humidity information is composed of image information. Typically, the information display plane is made by using an optical fiber or optical waveguide having a liquid core, and a fiber having a liquid core. The image information is typically displayed by scattering light introduced into the core from one end or opposite ends of the optical fiber or waveguide by means of light scattering elements in the core at a portion selected in response to an image to be displayed, and thereby leading out it externally.

According to the fifth aspect of the invention, there is provided an information receiving/display apparatus configured to receive sensory information other than visual information and audio information, in addition to visual information and/or audio information, and display it on an information display plane, wherein the information display plane comprises:

an optical fiber or an optical waveguide having a liquid core for visual information; and

a fiber for information for another sensory information having a liquid core,

image information being displayed by scattering light introduced into the core from one end or opposite ends of the optical fiber or waveguide by means of light scattering elements in the core at a portion selected in response to an image to be displayed, and thereby leading out it externally,

a projection being formed or a temperature change being produced on a surface of the fiber at a portion selected in response to image information to be displayed, and/or, a liquid forming the liquid core or molecules of a substance contained in the liquid being emanated from a surface of the fiber at a portion selected in response to image information to be displayed.

According to the sixth aspect of the invention, there is provided an information receiving/display apparatus characterized in receiving sensory information other than visual information and audio information, in addition to visual information and/or audio information, and displaying it on an information display plane, wherein the information display plane comprises:

an optical fiber or an optical waveguide having a liquid core for visual information; and

a fiber for information for another sensory information having a liquid core,

image information being displayed by scattering light introduced into the core from one end or opposite ends of the optical fiber or waveguide by means of light scattering elements in the core at a portion selected in response to an image to be displayed, and thereby leading out it externally,

a projection being formed or a temperature change being produced on a surface of the fiber at a portion selected in response to image information to be displayed, and/or, a liquid forming the liquid core or molecules of a substance contained in the liquid being emanated from a surface of the fiber at a portion selected in response to image information to be displayed.

In the fifth and sixth aspects of the invention, typical light scattering elements are bubbles. Explanation is made here about generation of the bubbles by a piezoelectric element. That is, in general, when ultrasonic waves generated by a piezoelectric element are propagated, a liquid swings and begins to perform its power of scattering light due to local variance in density. However, this local variance in density is a continuous change, and its light scattering power is not high. In order to enhance the light scattering power, it will be effective to introduce dissolved gas as a guest into a host liquid, evaporate it with ultrasonic waves and thereby bring about multi-refraction along the well-defined (and therefore producing a large discontinuity in refractive index) boundary between the gas and the liquid. In this case, however, since generated bubbles do not disappear soon (which results in early loosing the dissolved gas), this technique cannot be used in the display apparatus.

To overcome the problem, it is effective to use cavitation for generating bubbles. By using a host liquid having an appropriate vapor pressure and ultrasonic waves of an appropriate intensity, bubbles are generated by cavitation. This is a critical process, and bubbles are made of molecules of the host liquid. Therefore, the process can be repeated quickly.

In response to the saturation vapor pressure of the liquid, sound pressure on the outer circumferential surface of the optical fiber or optical waveguide given from the piezoelectric element, and the distance from the core center axis, cavitation is brought about near the core center axis, bubbles of vapor of the liquid can be generated. Refractive index of a liquid, in general, is about 1.3 through 1.9, and that of the bubbles is approximately 1. Therefore, light can be scattered very efficiently by bubbles.

When the cavitation number is C_n (dimensionless number), it can be expressed as:

$$C_n=(p_0-p')/(\rho v^2/2) \quad (1)$$

where p_0 is the pressure in a still liquid, p' is the saturation vapor pressure of the liquid, ρ is the density of the liquid, and v is the velocity of an object. Near an object moving sufficiently fast in a liquid, the pressure drops according to the Bernoulli's law to a value smaller than the saturation vapor pressure of the liquid, it may occurs that C_n becomes negative. That is, the following inequality

$$C_n \propto p_0-p'<0 \quad (2)$$

is the criterion about whether cavitation occurs or not. In a state where cavitation has occurred, a liquid vaporizes and