

change the drive waveform for providing a slight change in vibration feeling for an operator.

[0124] Because the piezoelectric substrate **2** can have a single layer structure, and the thickness can be thinner, it is manufactured at a low cost. Because a low drive voltage provides a large bend, a large-amplitude vibration is efficiently generated on the movable plate **3** and on the support substrate **4**.

[0125] Because the piezoelectric substrate to which the pair of drive electrodes are fixed is installed in an installation space required for the spacer member for slightly separating the movable plate and the support substrate, additional independent space for a structure for applying the vibration action according to the second aspect of the invention is not required.

[0126] A leader electrode electrically connected to the peripheral edge of the conductor layer serves as one drive electrode of the piezoelectric substrate. It is not necessary to form that drive electrode independently according to the third aspect of the invention. Also, the lead for connecting the leader electrode with the external circuits is also shared. It is thus not necessary to provide independent wiring for supplying drive voltage to that drive electrode.

[0127] Because the piezoelectric substrate is simply fixed on the rear surface of the support substrate through a drive electrode according to the fourth aspect of the invention, a conventional touch panel input device may be modified by simply adding the vibration feature.

[0128] Because the drive electrodes shield the high frequency noise received from the rear surface of the support substrate according to the fifth aspect of the invention, errors in detecting a pressed position caused by the high frequency noise superimposed on the leader electrodes is prevented.

[0129] Because an oscillation circuit for generating a continuous vibration, and the like are not necessary according to the sixth aspect of the invention, a simple drive circuit for the piezoelectric substrate generates vibration sensitive to an operator.

[0130] Input operation feeling is provided for an operator using an operation sound without providing an independent sound source such as a speaker according to the seventh aspect of the invention.

[0131] Having described preferred embodiments of the invention with reference to the accompanying drawings, it is to be understood that the invention 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 spirit of the invention as defined in the appended claims.

What is claimed is:

1. A touch panel input device comprising:

a movable plate;

an input operation surface on a surface of said movable plate;

a support substrate facing said movable plate across an insulating gap;

a first conductor layer on a first surface of said movable plate facing said support substrate;

a second conductor layer on a second surface of said support substrate facing said movable plate;

pressure detecting means for detecting a pressure and a pressed position on said input operation surface based on a contact between said first and second conductor layers;

means for providing pressed position data indicating a position of said pressure;

a piezoelectric substrate mechanically fixed to one of said movable plate and said support substrate; and

means for applying a drive voltage to said piezoelectric substrate responsive to said pressure, whereby contracting and expanding of said piezoelectric substrate in response to said drive voltage vibrates the one of said movable plate and said support substrate to generate an input operation feeling.

2. A touch panel input device according to claim 1, wherein said piezoelectric substrate includes a pair of drive electrodes fixed on opposed surfaces thereof.

3. A touch panel input device according to claim 2, wherein said means for detecting pressure is connected through at least one of said drive electrodes.

4. The touch panel input device according to claim 1 further comprising:

a spacer member placed at peripheral frames between inner surfaces of said movable plate and said support substrate for laminating and spacing said movable plate and said support substrate facing each other over a slight gap;

a drive electrode for applying said drive voltage to said piezoelectric substrate;

said piezoelectric substrate is fixed directly or through said drive electrode on an inner surface of one of said movable plate and said support substrate; and

said piezoelectric substrate is installed in a space where said spacer member is placed.

5. The touch panel input device according to claim 4, wherein:

said pressure detecting means impresses a detecting voltage on, or detects a voltage of any leader electrode electrically connected with a peripheral edge of the individual conductor layers of said movable plate or said support substrate to detect said pressure and said pressed position on said input operation surface,

said leader electrode fixed on said inner surface of said frame of said movable plate or said support substrate serves as one of said drive electrodes of said piezoelectric substrate; and

said piezoelectric substrate is fixed through said leader electrode.

6. The touch panel input device according to claim 1, wherein said piezoelectric substrate is fixed directly on a rear surface of said support substrate.

7. The touch panel input device according to claim 1, wherein said piezoelectric substrate is fixed through a drive electrode on a rear surface of said support substrate.