[0078] The first electrode **410** and the second electrode film **440**, each of which is an optically transparent conductive thin film made of ITO, are of an example of "a pair of electrodes" according to the present invention.

[0079] The photoconductive layer **420**, which is a photoconductive layer made of organic materials having a stack structure in which a CGL (Carrier Generation Layer) of BZP (benzimidazole perylene), a CTL (Carrier Transfer Layer) of PVK (polyvinyl carbazole) and another layer of BZP are formed in this order, is of an example of the "photoconductive layer" which is a kind of the "characteristic change layer" according to the present invention. The photoconductive layer **420** exhibits higher conductivity as stronger the intensity of the irradiation light is, and exhibits lower conductivity as weaker the intensity of the irradiation light is.

[0080] In this embodiment, the photoconductive layer **420** is adapted to use the visual information displayed on the display device **200** as the irradiation light source. As mentioned above, since the display device **200** is adapted in such a manner that each pixel displays either while or black, the intensity of the irradiation light irradiated onto the photoconductive layer **420** has a binary value corresponding to white or black as well.

[0081] Incidentally, in this embodiment, a material or materials for the photoconductive layer is not or are not limited to any special material or materials, insofar as it has a light transmissive property and can change the conductivity in response to the intensity of the irradiation light. For example, it may be an inorganic material such as hydrogenated amorphous silicon. Furthermore, in the case that the photoconductive layer is made of organic material or materials, the aforementioned stack structure of the CGL and the CTL is typically employed. In this case, CuPc (cupperphthalocyanine) may be used as the CGL, and TPD (triphenyldiamine) may be used as the CTL.

[0082] The electrorheological fluid layer **430**, which has dielectric solid fine particles dispersed in an insulation fluid and which has a light transmissive property and another property or characteristic of changing the viscosity in response to the applied voltage, is an example of the "electrorheological fluid layer" according to the present invention. The electrorheological fluid layer **430** becomes harder as higher the applied voltage is, and becomes softer as lower the applied voltage is. Incidentally, an electrorheological fluid for the electrorheological fluid layer **430** may be determined without any limitation, insofar as the viscosity changes in response to the applied voltage.

[0083] The plastic film **450**, which may be a protection film made of PET, is an example of the "flexible substrate" according to the present invention. Beneath the plastic film **450**, the aforementioned second electrode film **440** is formed. The plastic film **450** and the second electrode film **440** are adapted to deform reversibly downwardly in the figure due to the operation of the operator. Incidentally, predetermined voltage is applied to the tactile display device **400**, by means of a power supply circuit (not shown).

[0084] (Operation of Touch Panel Apparatus **10** with Tactile Display Function)

[0085] In the touch panel apparatus **10** with tactile display function having the aforementioned structure, the operator refers to the visual information displayed on the display device **200**, and performs the information input by operating the touch panel device **300**. Namely, the operator performs the operation as seen in operating a usual touch panel apparatus. However, since the touch panel apparatus **10** according to this embodiment is provide with the tactile display device **400**, it is possible to add the tactile information to the usual touch panel operation. Now, the operation of the touch panel apparatus **10** will be discussed, focusing on the operation of the tactile display device **400**.

[0086] First of all, an explanation will be made on a basic operation of the tactile display device **400**, with reference to **FIG. 4**. **FIG. 4** illustrates equivalent circuits of the tactile display device **400**. Incidentally, in **FIG. 4**, the same elements or components as in **FIG. 2** carry the same numerals, and the explanation of them are omitted.

[0087] In **FIG. 4**, the tactile display device **400** has a structure in which the photoconductive layer **420** and the electrorheological fluid layer **430** are disposed in series, each of which is shown as a parallel circuit made of a resistance part and a capacity part, between the first electrode film **410** and the second electrode film **440**.

[0088] The parallel circuit for the photoconductive layer **420** is made of a resistance part **421** and a capacity part **422**, while the parallel circuit for the electrorheological fluid layer **430** is made of a resistance part **431** and a capacity part **432**. The resistance part **421** of the photoconductive layer **420** can be shown as a variable resistance, since the conductivity of the layer changes in response to the intensity of the irradiation light.

[0089] Once a resistance value of the resistance part **421** changes (i.e. the conductivity of the photoconductive layer **420** changes), a partial pressure ratio changes between the photoconductive layer **420** and the electrorheological fluid layer **430**. That is, in the tactile display device **400**, a relative level of the voltage applied to the electrorheological fluid layer **430** is determined, in response to the intensity of the irradiation light irradiated onto the photoconductive layer **420**. As mentioned above, since the intensity of the irradiation light can take a binary value, the applied voltage applied to the electrorheological fluid layer **430** can also take a relative binary value.

[0090] In particular, at a part displayed as white on the display device **200**, as well as at the corresponding part of the photoconductive layer **420**, the resistance value of the resistance part **421** decreases, the partial pressure of the electrorheological fluid layer **430** increases, and the applied voltage to the electrorheological fluid layer **430** relatively increases. On the contrary, at a part displayed as black on the display device **200**, as well as at the corresponding part of the photoconductive layer **420**, the resistance value of the resistance part **421** does not change, and the applied voltage to the electrorheological fluid layer **430** relatively decreases. In the case that yield stress is employed as an indicator of the viscosity, the electrorheological fluid layer **430** is adapted in such a manner that the yield stress of the electrorheological fluid layer **430** becomes 130 kPa and 10 kPa, in response to the increased voltage and the decreased voltage, respectively.

[0091] Now, an explanation will be made on a specific operation of the tactile display device **400**, with reference to