microcapsules **371** received in the lower portion **311***a* of the reception groove **311** are charged.

[0035] The second electrode **335** is arranged above the electrorheological fluid **370** received in the reception groove **311** to move the particles **373** and **374** received in the lower portion **311***a* of the reception groove **311** together with the first electrode **330**. The second electrode protection film **336** is arranged between the second electrode **335** and the electrorheological fluid **370**. The second electrode protection film **336** protects the second electrode **335**, separates the lower portion **311***a* and an upper portion **311***b* of the reception groove **311**, and keeps the microcapsules **371** from being attached to the second electrode **335** when the microcapsules **371** received in the reception groove **311** are charged. The braille pin **340** is arranged above the upper portion **311***b* of the reception groove **311**, i.e., on the second electrode **335**, to move upward and downward. Preferably, the braille pin **340** is made of a polymer braille pin. The braille pin protection film **350** is arranged above the braille pin **340** and is preferably made of a polymer film for easy recognition of raised dots.

[0036] FIG. **4** shows a state that an electrical field is not applied to the electrorheological fluid **370** in the lower portion **311***a* of the reception groove **311**. That is, FIG. **4** shows movement of a general particle-dispersed suspension. The electrorheological fluid **370** of FIG. **4** is a suspension in which microcapsules **371** which surround the electrophoresis particles **373** and **374** are dispersed, and the electrophoresis particles **373** and **374** are between about 10 to 500 nm in size. In the present invention, nanosize polymer particles or inorganic particles coated with a polymer material are used as a physical/chemical means to adjust the charge density of the electrophoresis particles **373** and **374**.

[0037] The microcapsules **371** are microsized particles in a dispersion system in which an electrophoresis particle **373** (having a positive charge) and an electrophoresis particle **374** (having a negative charge) are dispersed in the electrorheological fluid **375** which is surrounded by a synthetic polymer or natural polymer film. Here, the electrophoresis particles **373** and **374** and the electrorheological fluid **375** are made of materials having the same specific gravity. The microcapsules **371** are between about 10 to 50 volume percent of a volume weight of the total electrorheological fluid **370**. A volume weight of the insulating dielectric fluid **372** which constitutes the electrorheological fluid **370** having the microcapsules **371** dispersed therein ranges from about 50 to about 90 volume percent of the total volume weight of the electrorheological fluid **370**. A thickness of the polymer film which constitutes the microcapsules **371** ranges from about 0.1 to about 0.3 μm. The polymer film adjusts transmittance according to a density of a crosslink agent when polymerized, and the thickness of the polymer film can be changed according to a polymerization reaction time. Mechanical strength of the polymer film and the size of the microcapsules **371** can be easily adjusted by adjusting a reaction condition.

[0038] FIG. **5** is a cross-sectional view illustrating a state of the braille display device when an electrical field is applied, according to one exemplary embodiment of the present invention.

[0039] Referring to FIG. **5**, an electrical power is applied to the first and second electrodes **330** and **335** to form an electric field, so that theological mechanical characteristics of the electrorheological fluid **370** containing the microcapsules **371** change. The electrophoresis particles **373** and **374** in the microcapsules **371** are arranged in a vertical direction due to an electrophoresis phenomenon (e.g., polarization phenomenon) to form a chain structure. A viscosity of the electrorheological fluid **370** is rapidly increased compared to when an electrical field is not applied, so that the electrorheological fluid **370** shows movement like a solid. Here, the electrophoresis phenomenon is a phenomenon that the electrophoresis particles **373** and **374** respectively move toward the electrodes having a charge of an opposite polarity through a medium when an electric field is applied to the dielectric fluid in which the electrophoresis particles **373** and **374** having charges are dispersed. Due to such a change of the electrorheological fluid **370**, the braille pins **340** in the upper portion **311***b* of the reception groove **311** move upward or downward, thereby expressing various information in the form of raised dots which blind people can feel. At this time, the speed at which the particles move depends on charge density, charge intensity, form and size of the electrophoresis particles **373** and **374**.

[0040] FIG. **6** is a cross-sectional view of a braille display device using an electrorheological fluid according to another exemplary embodiment of the present invention. For ease of description, like reference numerals denote like parts, and thus description of those is omitted.

[0041] Referring to FIG. **6**, a braille display device **600** according to another exemplary embodiment of the present invention comprises a first base body **610** having a plurality of first insulating reception grooves **611** formed therein, a substrate **320** arranged below the first base body **610**, a second base body having a plurality of second insulating reception grooves **616** which are arranged above the first base body **610** to communicate with the corresponding first reception grooves **611**, an electrorheological fluid **370** arranged in a lower portion of the first reception grooves **611**, first and second electrodes **330** and **335** respectively arranged above and below the electrorheological fluid **370**, and a plurality of braille pins **340** arranged on the second electrode **335**. Here, the first and second reception grooves **611** and **616** are different in size. Other components and operations therebetween are identical to those of another exemplary embodiment, and thus description of those omitted.

[0042] One exemplary embodiment of the present invention discloses the braille display device in which the electrorheological fluid and the braille pin are respectively received in the lower and upper portions of a single reception groove, but in another exemplary embodiment of the present invention, the upper base body having the reception groove for receiving the braille pin and the lower base body having the reception groove for receiving the electrorheological fluid are separately formed. Thus, since the base bodies can be separately formed, the reception grooves of a different size can be formed. For example, the reception groove formed in the upper base body can be smaller in size than that in the lower base body, or vice versa. Also, when the base bodies are separately formed, the second electrode arranged above the first base body may be arranged over the entire area as well as areas corresponding to the reception grooves. In one exemplary embodiment of the present invention, the first electrode protection film is formed over the entire surface of the substrate, but in another exemplary embodiment the first electrode protection film may be formed on portion of the first electrode corresponding to the reception grooves.

[0043] As described above, according to the braille display device using the electrorheological fluid of the present invention, the braille pins are installed to be moved vertically by the