SPACER ELEMENTS FOR INTERACTIVE INFORMATION DEVICES AND METHOD FOR MAKING SAME

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority form U.S. Provisional Patent Application Serial No. 60/234,867, filed Sep. 22, 2000, the disclosure of which is hereby incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0002] This invention relates to an improved technology for the separation of a rigid, transparent, conductively coated substrate and a flexible, transparent, conductively coated top sheet as used in an interactive information device such as a computer touch panel, a digitizer panel, a personal digital assistant known as a PDA, or a computer pen input device.

[0003] In an interactive information device having opposing conductive surfaces on a flexible top sheet and a rigid bottom sheet, "spacer dots", or the like, are non-conductive insulating islands or spacer elements that separate the transparent conductively coated rigid substrate from the flexible transparent conductively coated top sheet in a touch input device when in its normal, untouched condition. When a user presses on the top sheet, such as with a finger or stylus, the flexible transparent conductive substrate is forced to make contact with the transparent conductively coated rigid substrate creating an electrical circuit for touch detection. When the device is not being touched, it is important that the flexible top sheet and the rigid back substrate do not come into contact so as to avoid creating a false touch. It is also desired that the spacer dots or elements be of minimal visibility for optimal optical performance of the information device.

SUMMARY OF THE INVENTION

[0004] The present invention includes an improved process and improved materials for producing uniformly dispersed, consistent, durable, essentially non-visible, fixed substrate-interpane-spacer elements (for example "spacer dots") for spacing the opposing conductive surfaces of the flexible top sheet and rigid bottom sheet of an interactive information device.

[0005] The invention is most effectively accomplished by the application of the non-conducting spacer dots or elements on the rigid substrate of the interactive information device using appropriately tall dots or elements separating the sheets well apart for optimum electrical performance (non false—touch) while minimizing visibility for optimum optical performance (such as by rendering the dots invisible such as by index matching the dot material to the surrounding interpane medium and/or by having a small dot diameter and/or by having few, well spaced dots). It is preferred that the performance be further improved by the use of spacer dot materials that are optically matched to the transparent conductors, typically indium tin oxide. It is preferred that the registration and/or orientation of the dots on the glass be matched to the particular touch screen design. It is preferred that the placement of the dots on the glass allow for manufacturability of more than one touch device per coated stock sheet, known as "stock sheet" or "stock lite" form substrates. It is also preferred that the spacer dots be durable to withstand post-processing requirements such as washing, cutting, baking, and the like, for the manufacturing of the touch devices.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] **FIG. 1** is a sectional, side elevation of an interactive information device incorporating the improved spacer elements of the present invention;

[0007] **FIG. 1A** is a sectional, side elevation of a second embodiment of the interactive information device of the present invention;

[0008] **FIG. 1B** is a sectional, side elevation of a third embodiment of the interactive information device of the present invention;

[0009] **FIG. 2** is a flow diagram of a preferred method for making the interactive information device of **FIG. 1** incorporating the present invention; and

[0010] **FIG. 3** is a photograph of exemplary spacer elements in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] More specifically, and as shown in **FIG. 1**, this invention relates to the improved process and materials resulting in an interactive information device such as a resistive touch device **60** comprising rigid substrate **10** such as soda lime glass with a transparent conductive thin film **20**. The spacer dots or elements **30** are deposited most preferably by silk screen methods on thin film **20**. The flexible substrate **40** with transparent conductive thin film **50** provides the top sheet of the resistive touch device **60**. Optionally, the transparent substrate **10** of the present invention may be an optical plastic comprising a conductively coated cyclic olefin copolymer plastic substrate as disclosed in U.S. patent application Serial No. _____ (DON03 P-910), filed Sep. 5, 2001, entitled IMPROVED PLASTIC SUBSTRATE FOR INFORMATION DEVICES AND METHOD FOR MAKING SAME, the disclosure of which is hereby incorporated by reference herein in its entirety. Such rigid plastic substrate may be formed from a cyclic olefin copolymer (COC) such as is available from Ticonca of Summit, New Jersey, under the trade name "Topas." Cyclic olefin-containing resins provide an improved material for a rigid, transparent conductively coated substrate suitable for use in an information display. The improved information display incorporating the improved plastic substrate is lightweight, durable, flex resistant, dimensionally stable and break resistant as compared to other, more conventional substrates. A rigid plastic substrate can be formed by extrusion, casting or injection molding. When injection molding is used such as when forming a substrate from a cyclic olefin copolymer (COC), a non-planar curved (spherical or multiradius) part can be formed, optionally with at least one surface roughened (such as by roughening/patterning a surface of the tool cavity used for injection molding) so as to have a light-diffusing, anti-glare property.

[0012] A transparent, plastic substrate such as one formed from cyclic olefin polymer resin can be used to form a rigid panel or back plate for use in a resistive membrane touch device where the cyclic olefin panel functions as a trans-