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# United States Patent [19]

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Caldwell et al.

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[54] **TOUCH CONTROL SYSTEM**

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[73] Assignee: **Donnelly Technology, Inc.**, Holland, Mich.

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[51] Int. Cl.<sup>6</sup> ..... **H03K 17/955**

[52] U.S. Cl. .... **341/33; 341/26; 345/168; 200/600; 361/181; 219/451**

[58] Field of Search ..... 341/20, 22, 26, 341/33; 200/600; 345/168, 173; 331/65; 361/181; 291/451, 464

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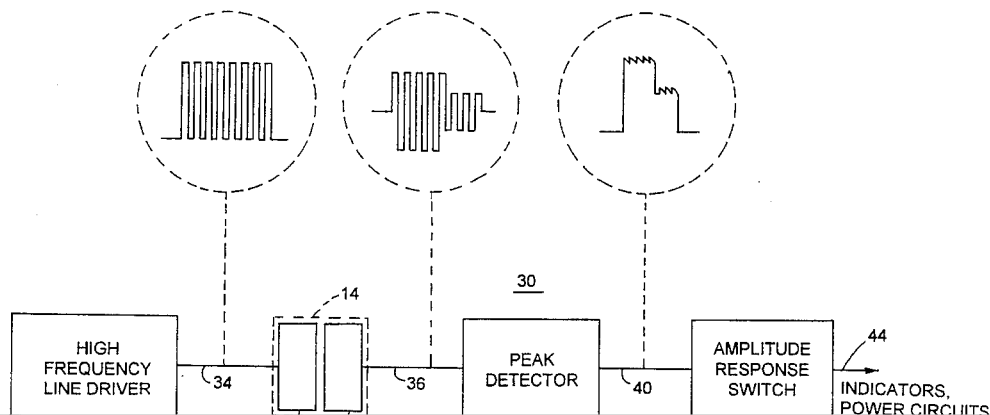
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[57] **ABSTRACT**

A touch control system that is responsive to a user input selection includes an electrically non-conducting substrate, such as glass ceramic, and at least one capacitive-responsive touch pad on the substrate. A source signal having a primary frequency that is greater than 150 kHz, and preferably in the range of between 150 kHz and 500 kHz, is applied to one portion of the touch pad. The touch pad couples the electrical signal to another portion of the touch pad in order to develop a detection signal, which is decoded in order to determine the presence of the capacitance of a user. The decoder preferably includes a peak detector composed of a low gain circuit in order to avoid distortion of the detection signal. Greatly improved performance in the presence of liquids, such as water, on the touch pad is provided. This is especially useful when the touch pad is applied to a horizontal surface, such as a cook top, upon which liquid spills may occur. A display is juxtaposed with the glass ceramic substrate and an optical correction material is provided between the display and the underlying modulated surface that imparts mechanical strength to the substrate. The optical correction material corrects optical distortion of the visual indications of the display caused by the modulated surface.

**60 Claims, 4 Drawing Sheets**



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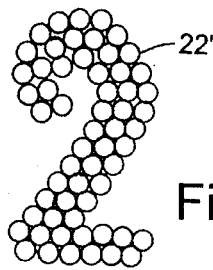
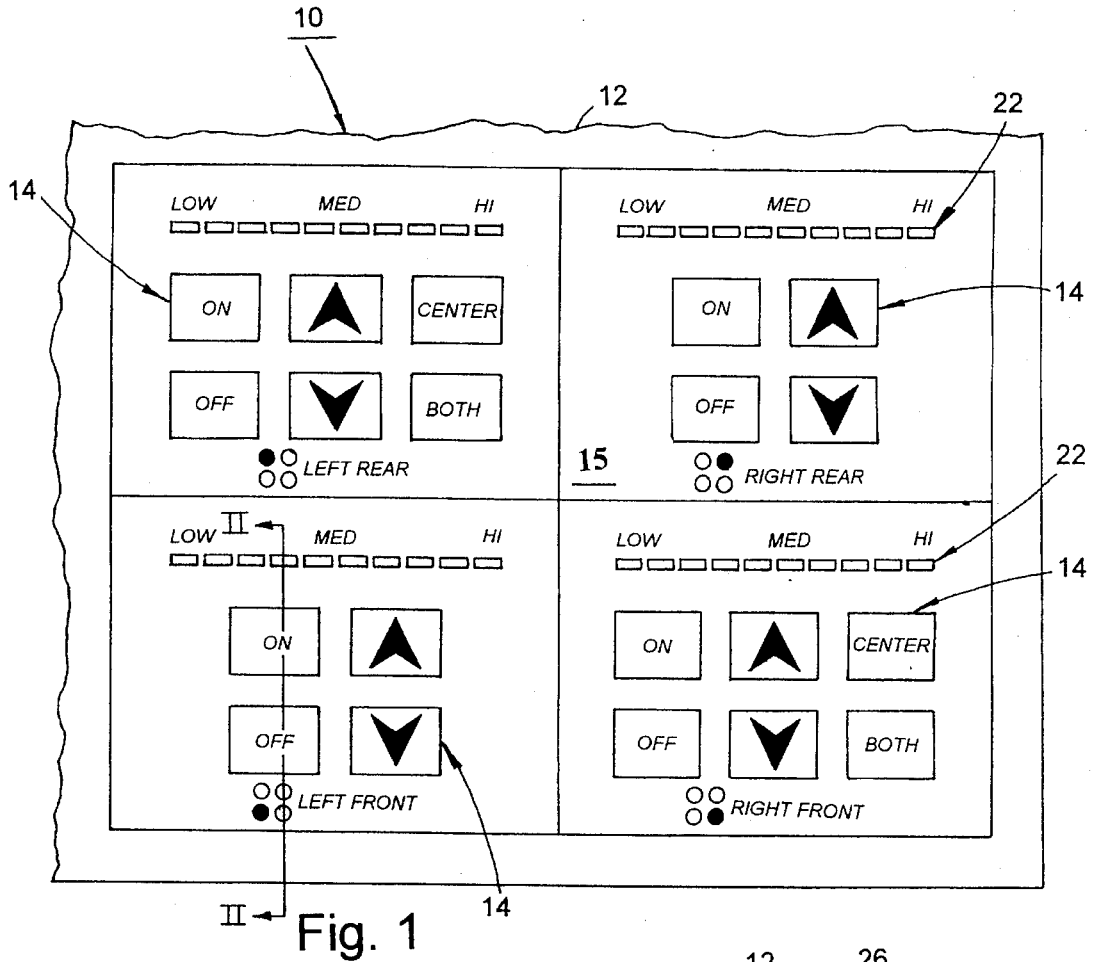


Fig. 6

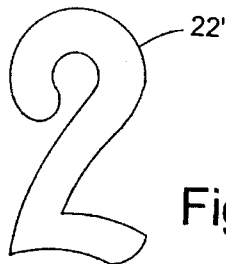


Fig. 7

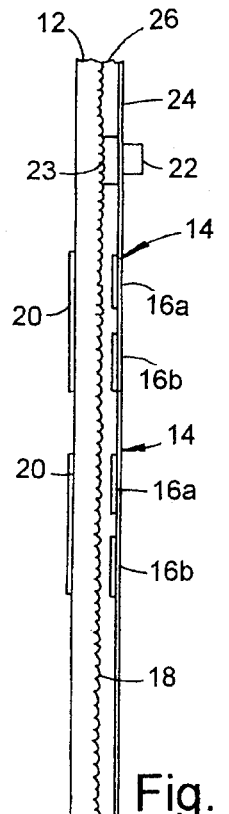


Fig. 2

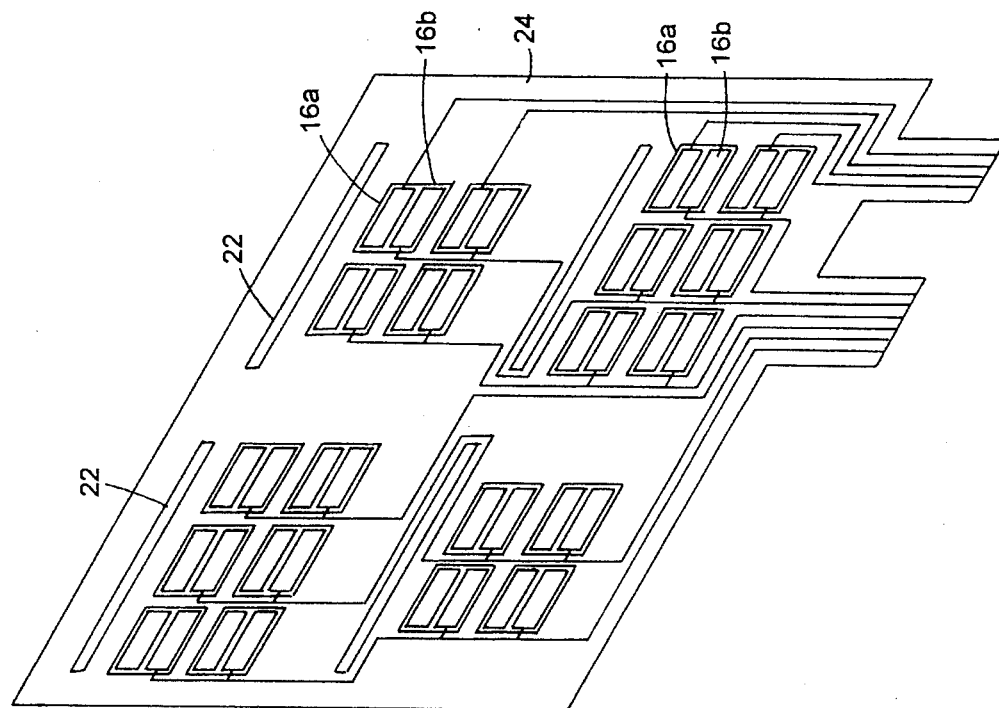
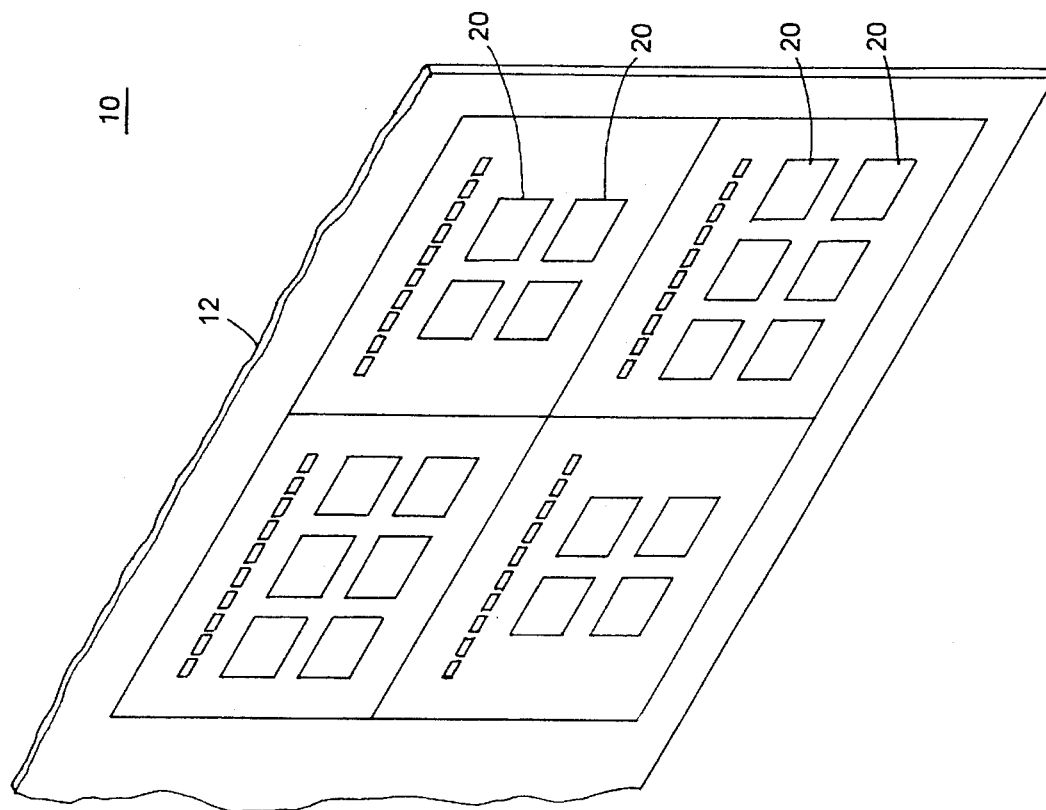


Fig. 3



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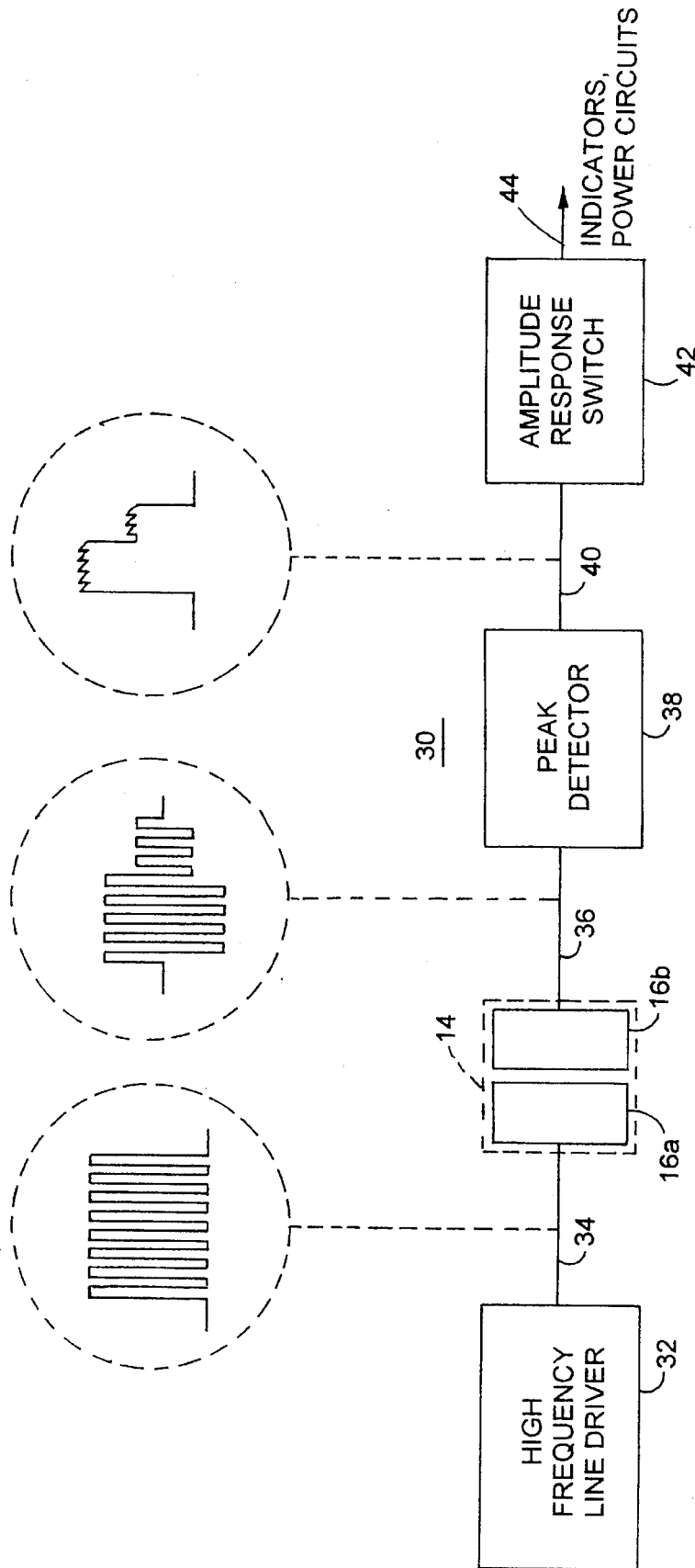


Fig. 4

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