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**United States Patent** [19]  
**Caldwell et al.**

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[54] **DETECTION CIRCUIT FOR MATRIX TOUCH PAD**

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[73] **Assignee:** **Donnelly Corporation, Holland, Mich.**

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[51] **Int. Cl.<sup>5</sup>** ..... **H03M 11/20**

[52] **U.S. Cl.** ..... **341/26; 341/34; 364/189**

[58] **Field of Search** ..... **341/33, 34, 26, 22, 341/24; 200/600; 400/479.1; 364/189; 379/368**

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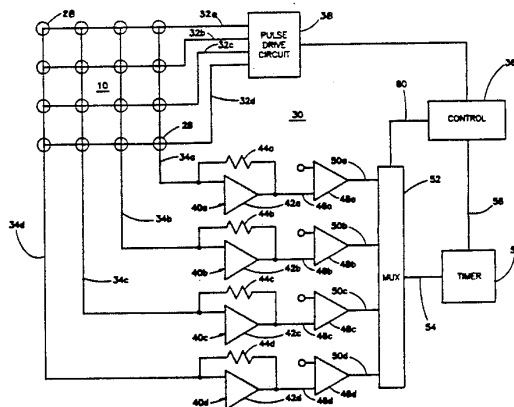
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[57] **ABSTRACT**

A circuit for detecting user contact of one of a plurality of touch pads includes a plurality of drive lines and a plurality of sense lines coupled with the touch pads. A sense circuit responsive to the signals on the sense lines produces a pulse having a width that is proportional to the amplitude of each of the sense signals. A control circuit measures the width of the pulses produced by the sense circuit and compares each measured pulse width to a reference pulse width to distinguish between a touch and no-touch condition for each touch pad. The sense circuit is illustrated in the form of a comparator having a threshold input that is always exceeded by the sense signal to produce the variable width pulse. Separate amplifiers may be provided for each sense line.

**24 Claims, 5 Drawing Sheets**



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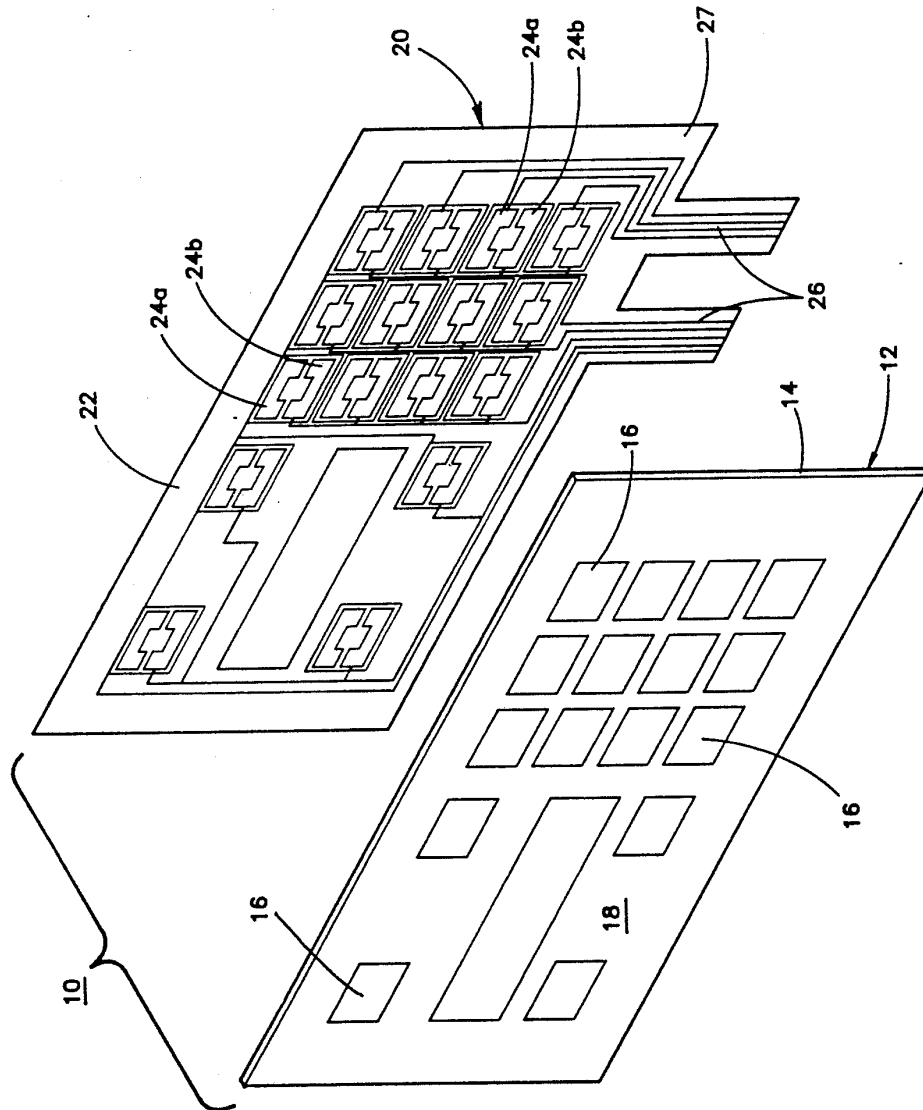


FIG. 1

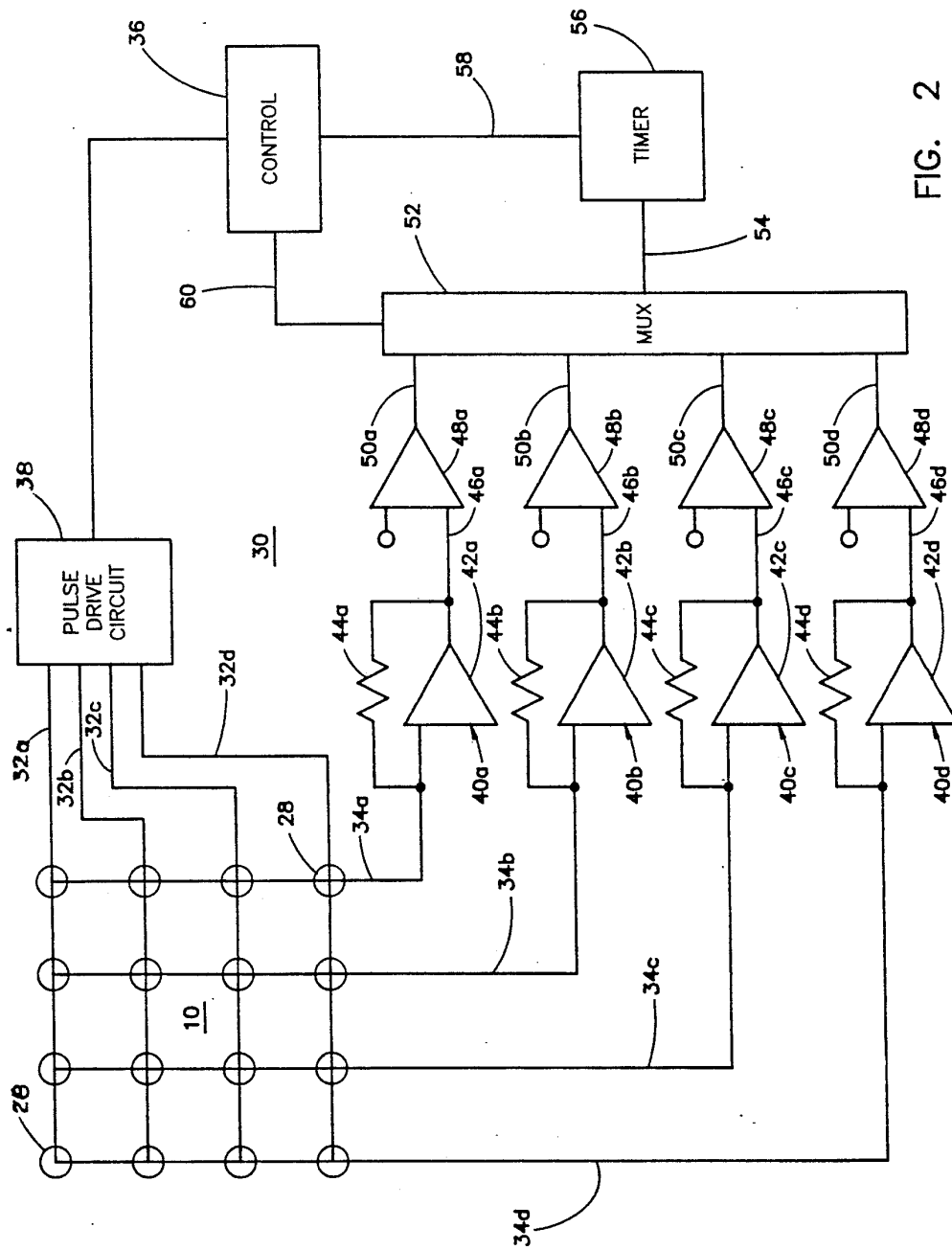


FIG. 2

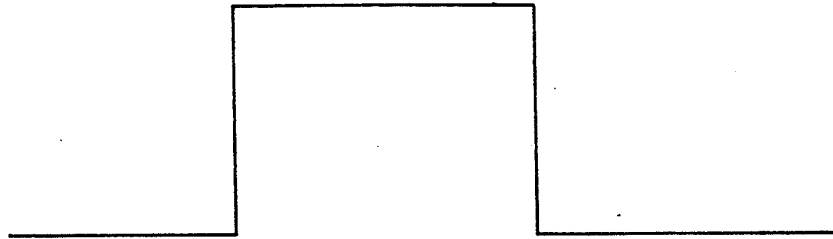


FIG. 3a

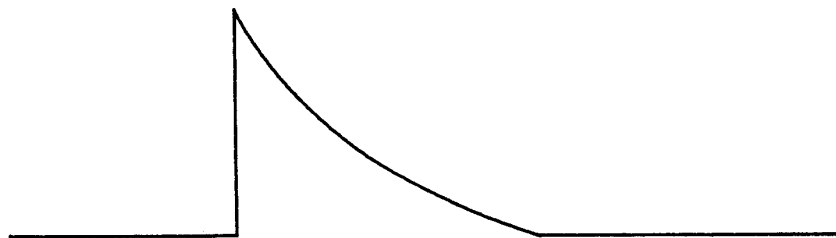


FIG. 3b

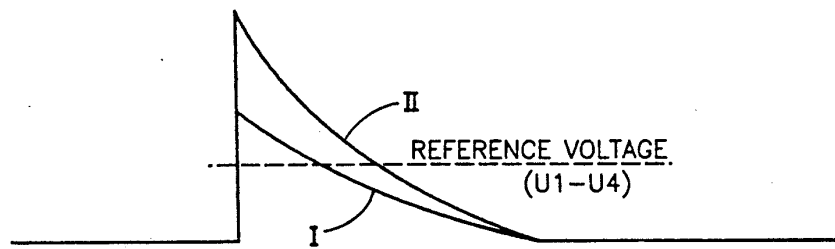


FIG. 3c

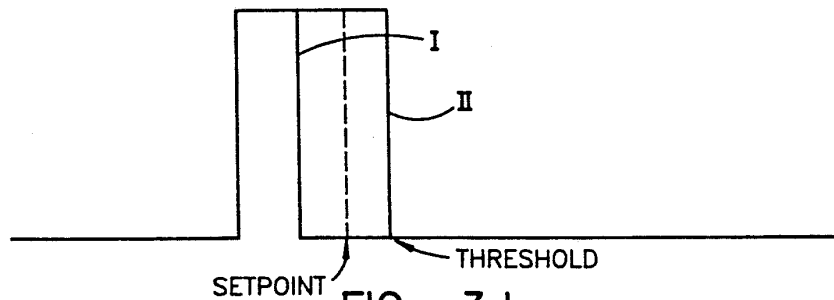


FIG. 3d

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