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Ferroelectric Storage Read-Write Memory

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(12) **United States Patent**
Wickramasinghe et al.

(10) **Patent No.:** **US 6,548,843 B2**
(45) **Date of Patent:** ***Apr. 15, 2003**

(54) **FERROELECTRIC STORAGE READ-WRITE MEMORY**

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **09/190,131**

(22) Filed: **Nov. 12, 1998**

(65) **Prior Publication Data**

US 2002/0089005 A1 Jul. 11, 2002

(51) **Int. Cl.**⁷ **H01L 29/76**

(52) **U.S. Cl.** **257/295; 257/298; 365/145**

(58) **Field of Search** **257/295, 298, 257/310; 365/145**

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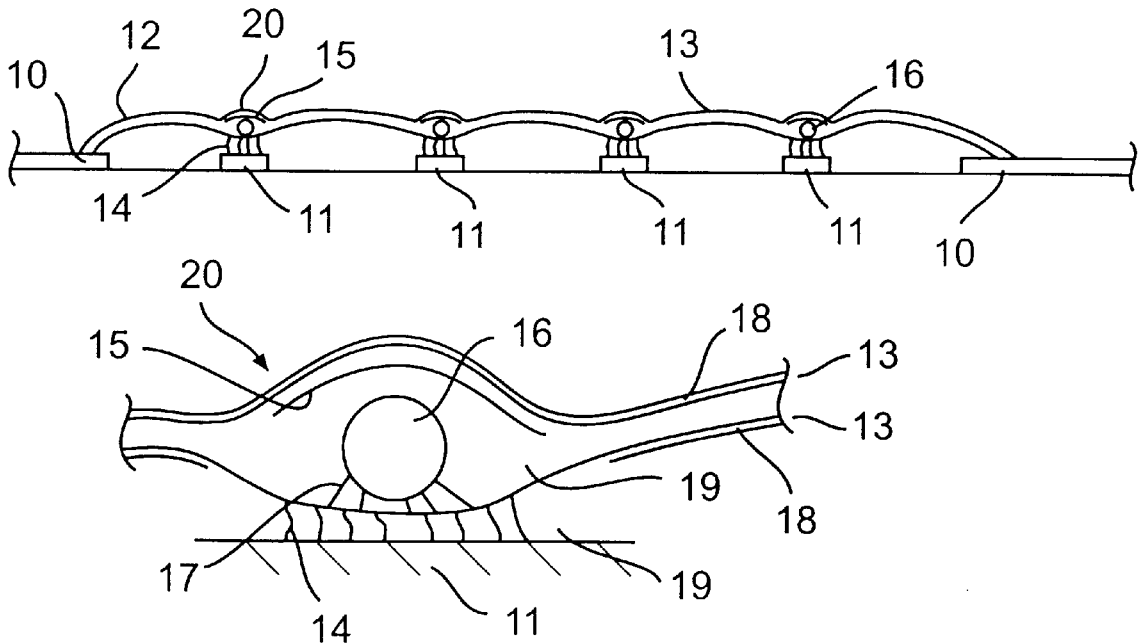
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Primary Examiner—George Eckert
(74) *Attorney, Agent, or Firm*—Connolly Bove Lodge & Hutz, LLP; Robert M. Trepp, Esq.

(57) **ABSTRACT**

A memory device including at least one pair of spaced apart conductors and a ferroelectric material between the pair of conductors. The pair of conductors is spaced apart a distance sufficient to permit a tunneling current therebetween.

91 Claims, 4 Drawing Sheets



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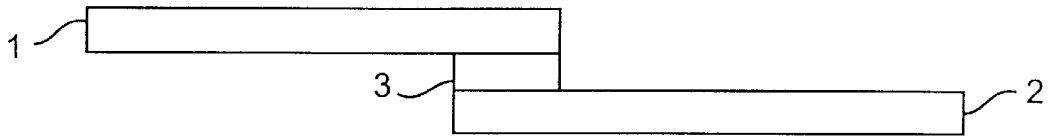


FIG. 1

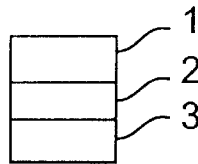


FIG. 1(a)

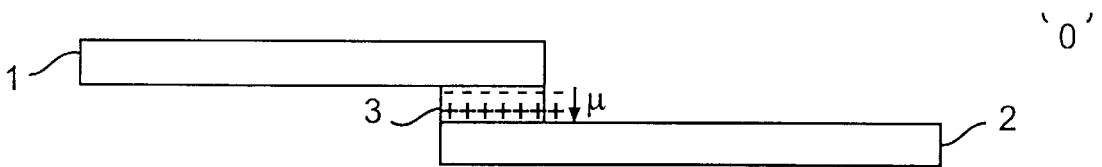


FIG. 2(a)

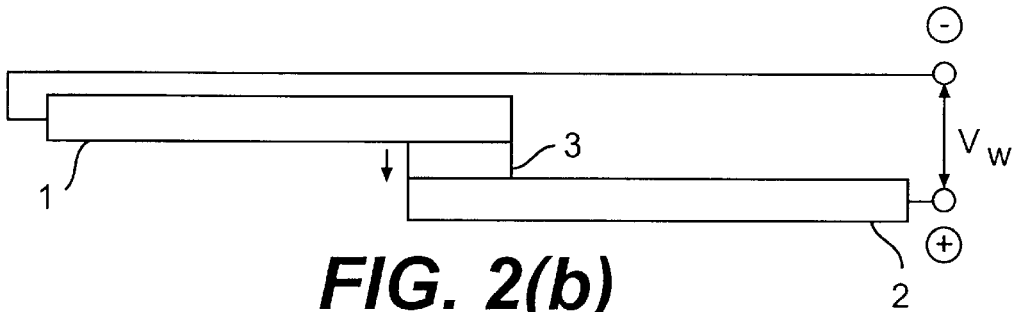


FIG. 2(b)

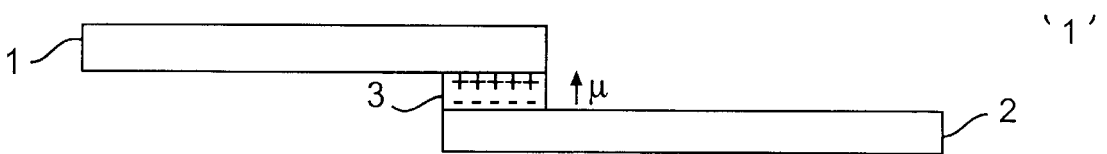


FIG. 2(c)

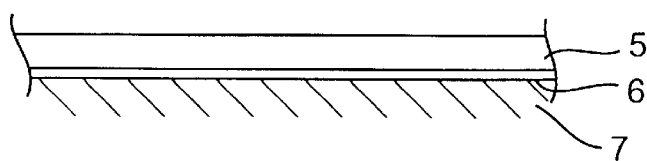


FIG. 3(a)

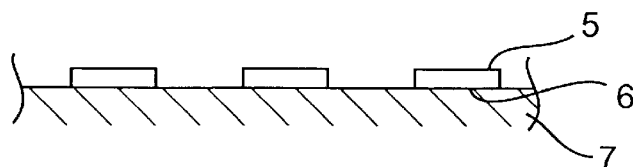


FIG. 3(b)

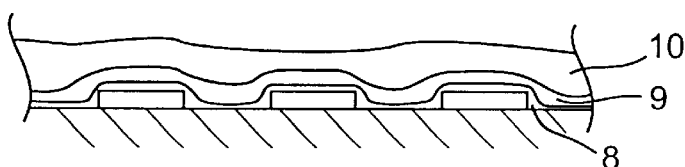


FIG. 3(c)

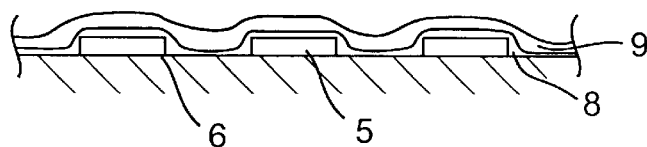


FIG. 3(d)

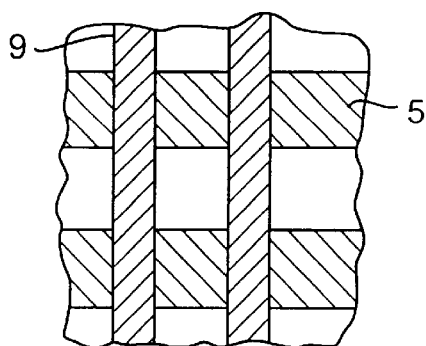


FIG. 4

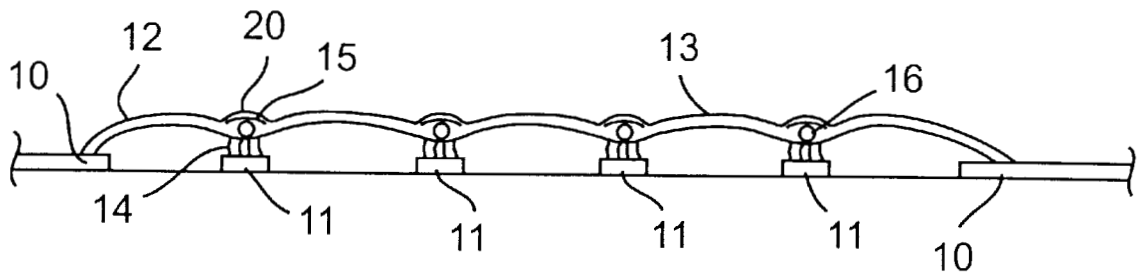


FIG. 5

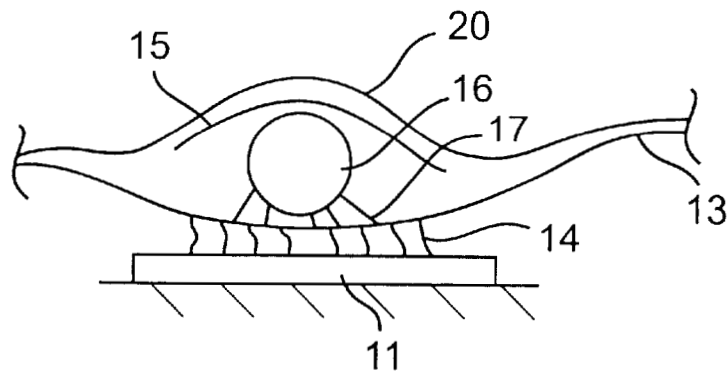


FIG. 6

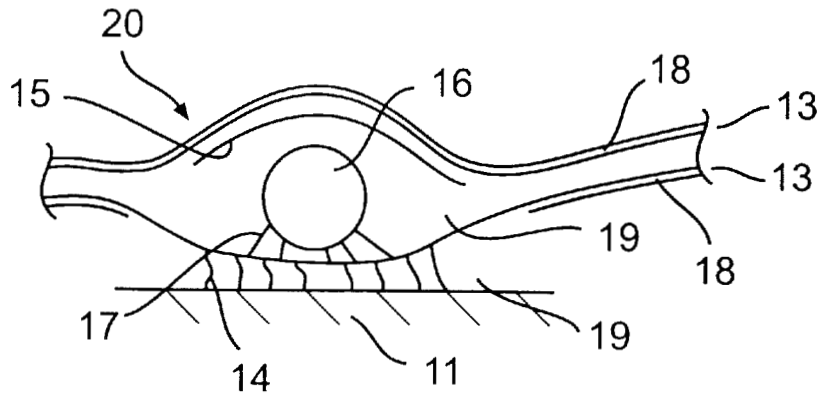


FIG. 7

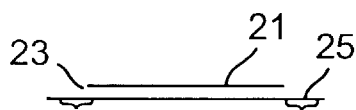


FIG. 8

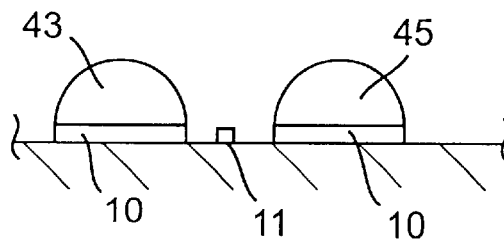


FIG. 9