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Saiki et al.

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(54) **DRIVING CIRCUIT,
ELECTRO-MECHANICAL-ACOUSTIC
TRANSDUCER, AND PORTABLE TERMINAL
APPARATUS**

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patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

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Apr. 27, 1999	(JP)	11-119443
Nov. 22, 1999	(JP)	11-331216

(51) **Int. Cl.**
H03G 5/00 (2006.01)

(52) **U.S. Cl.** **381/98; 340/7.2; 340/7.6;
340/384.72**

(58) **Field of Classification Search** **381/162,
381/164, 151, 98; 340/384.72, 7.6, 7.58,
340/407.1, 384.5, 384.7, 384.73, 384.6, 384.71,
340/7.2**

See application file for complete search history.

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Primary Examiner—Vivian Chin

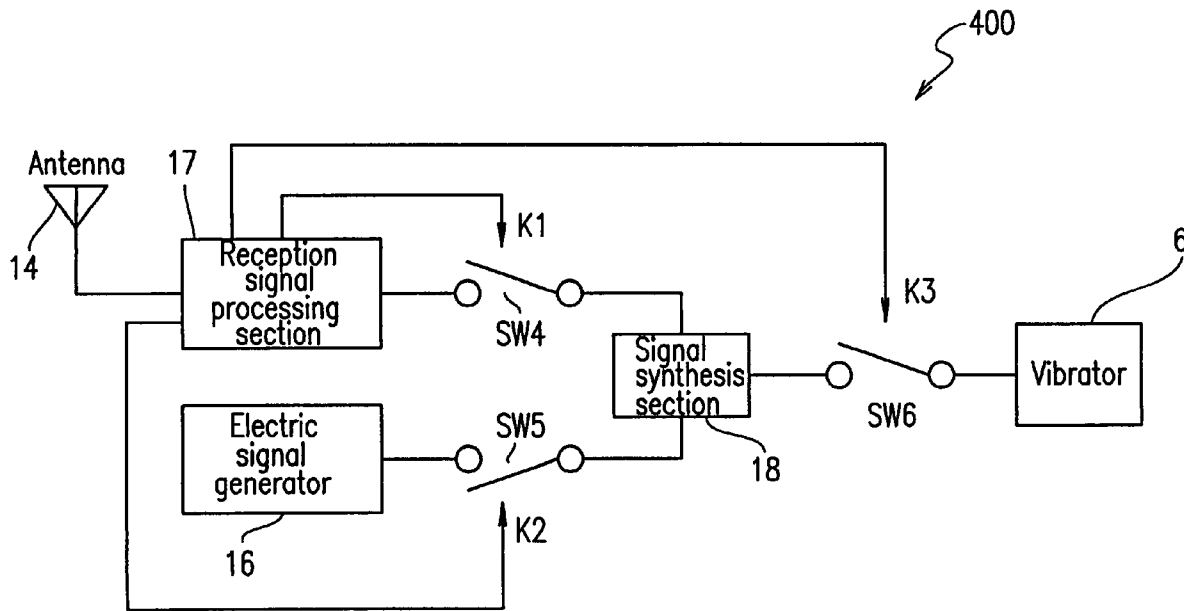
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(57) **ABSTRACT**

A circuit of the present invention is a driving circuit for driving a vibrator having a mechanical vibration system which resonates at a resonance frequency. The driving circuit outputs to the vibrator at least two signals of different frequencies which are included in a frequency range including the resonance frequency. The vibrator has a function of converting an electric signal into at least one of a sound and a vibration.

54 Claims, 27 Drawing Sheets



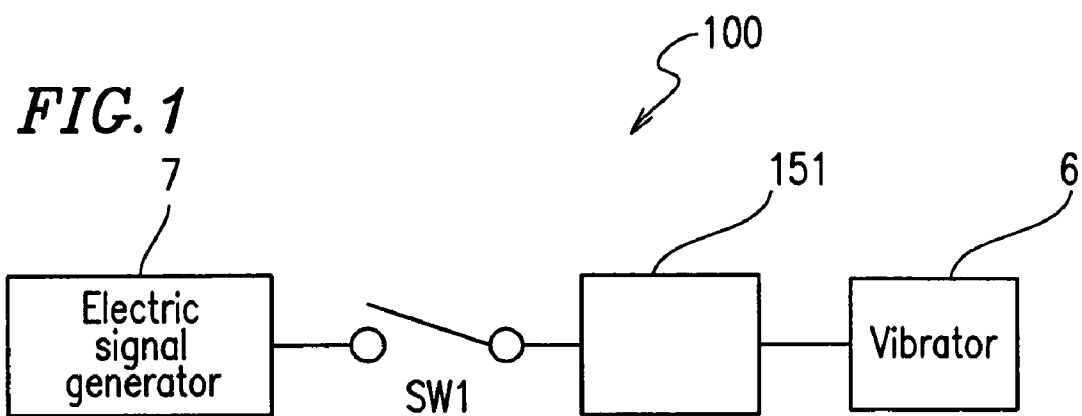


FIG. 2

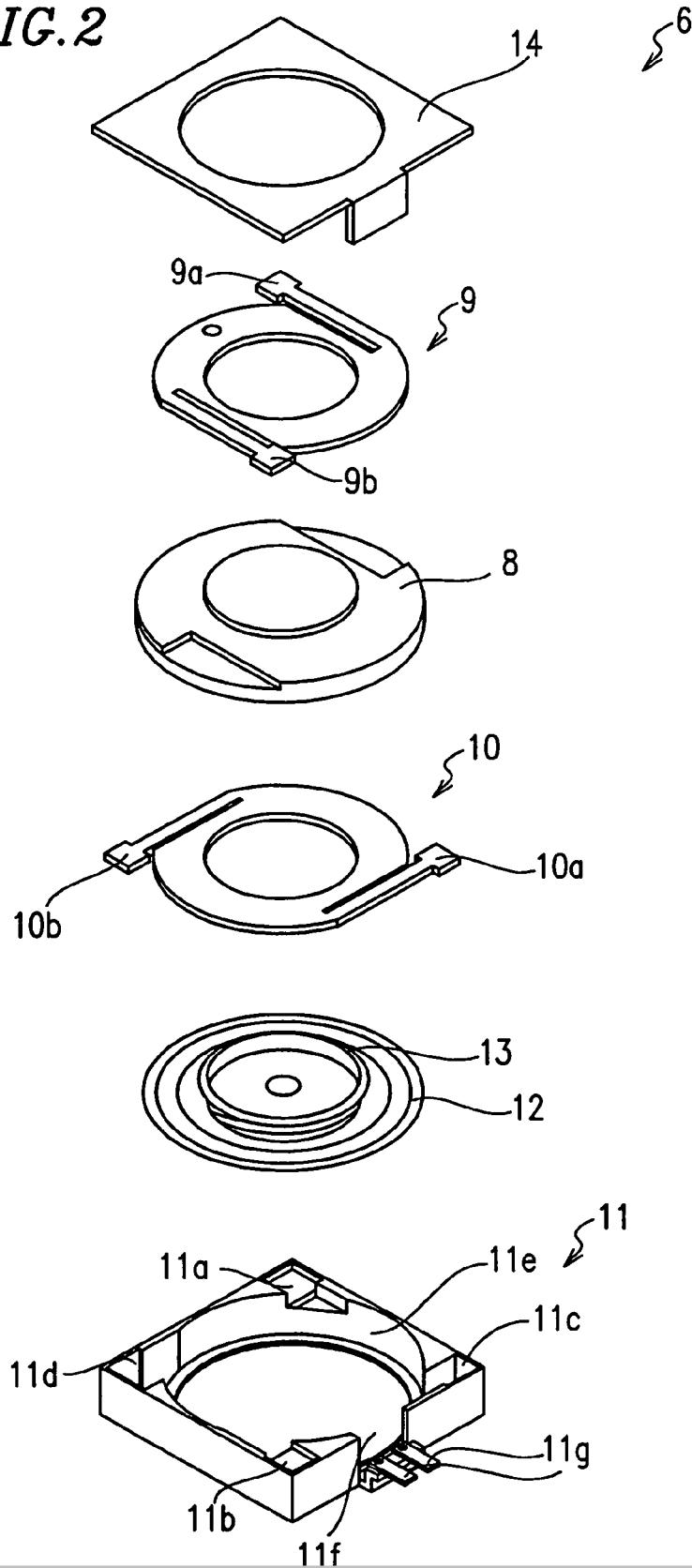


FIG. 3A

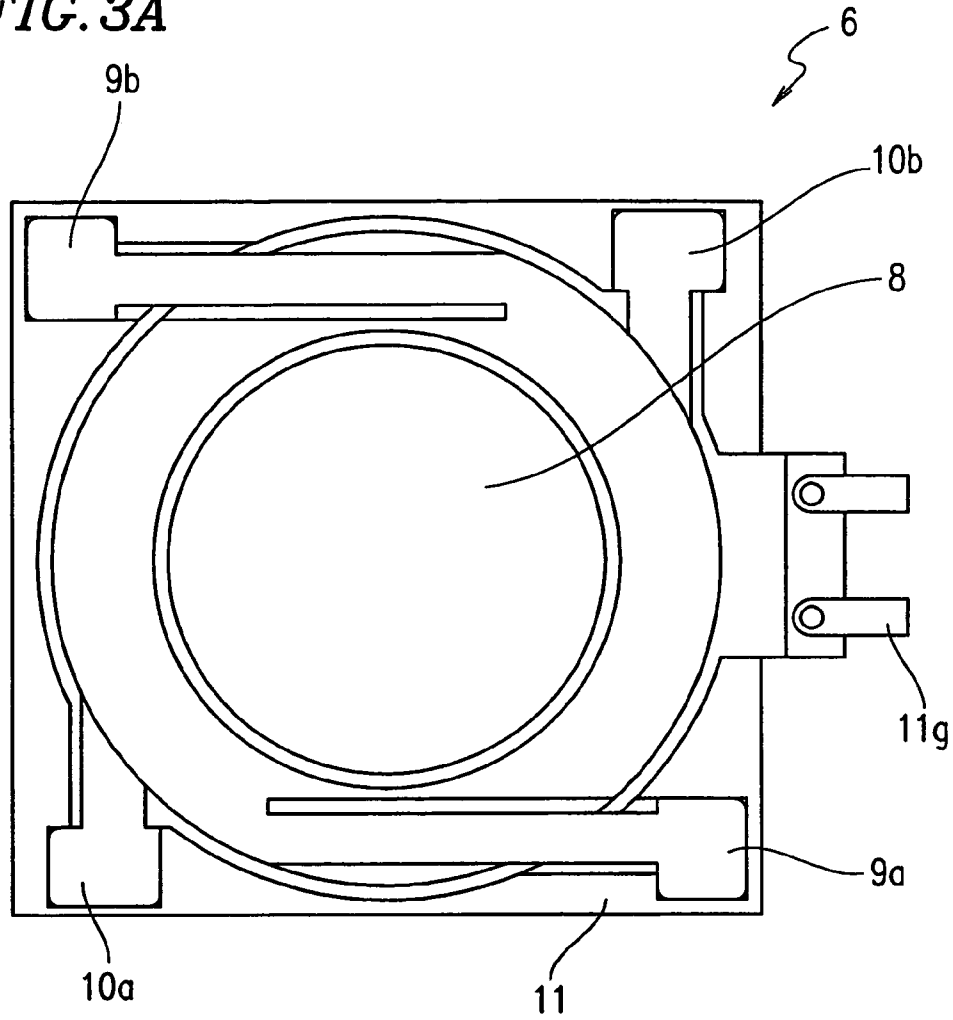


FIG. 3B

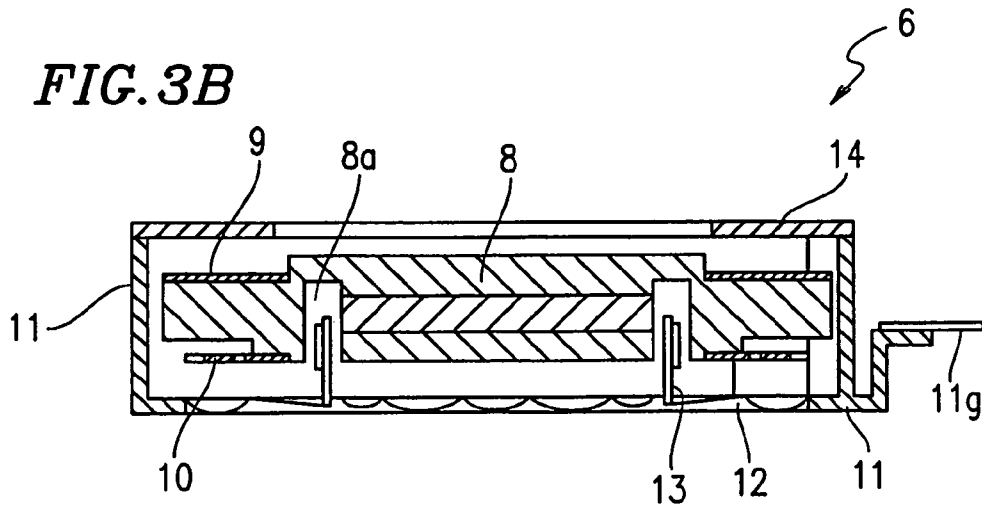


FIG. 4

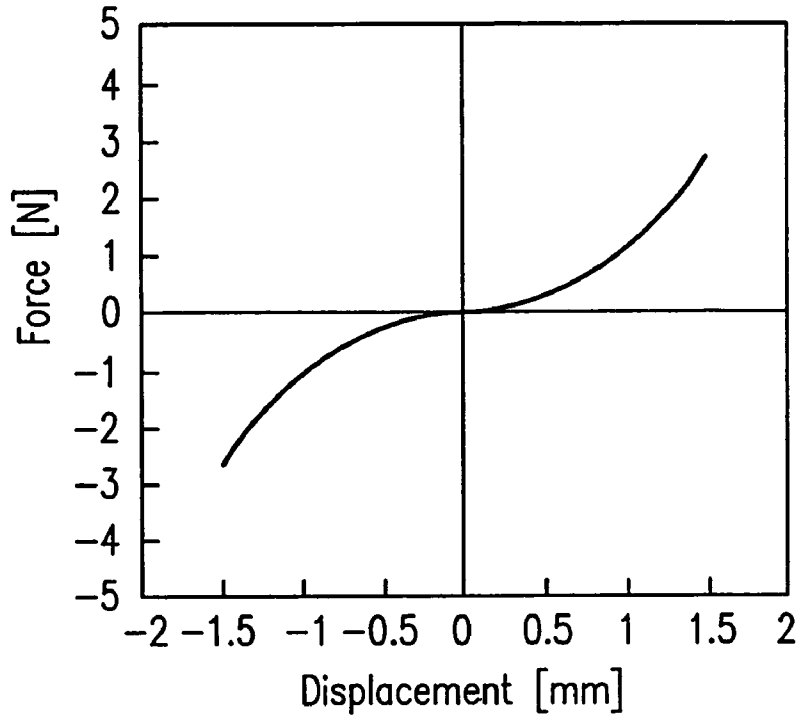
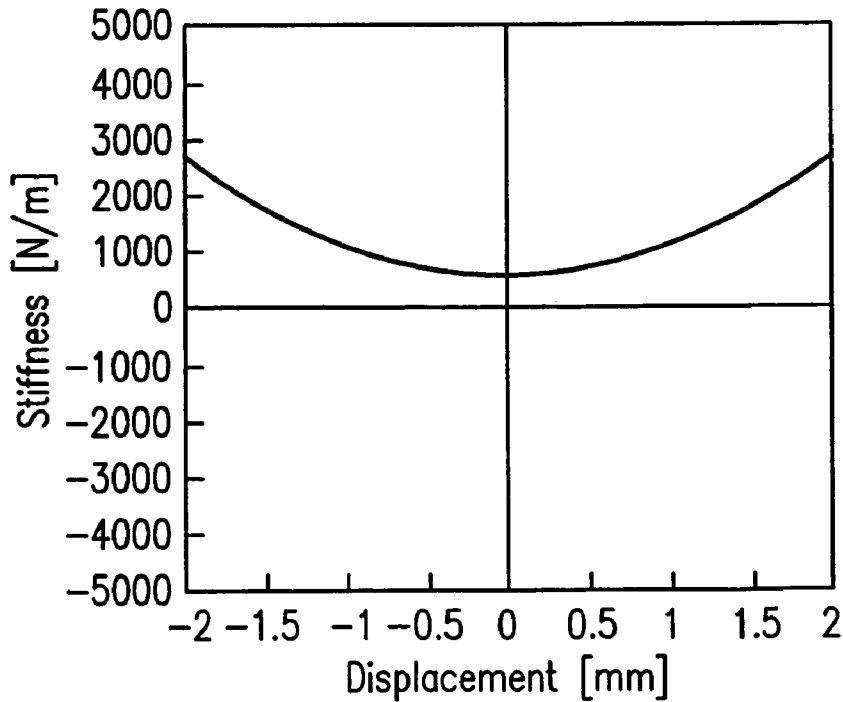


FIG. 5



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