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Mayega et al.

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(54) **SINGLE INDUCTOR DUAL OUTPUT BUCK CONVERTER WITH FREQUENCY AND TIME VARYING OFFSET CONTROL**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 191 days.

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(22) Filed: **Nov. 25, 2003**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
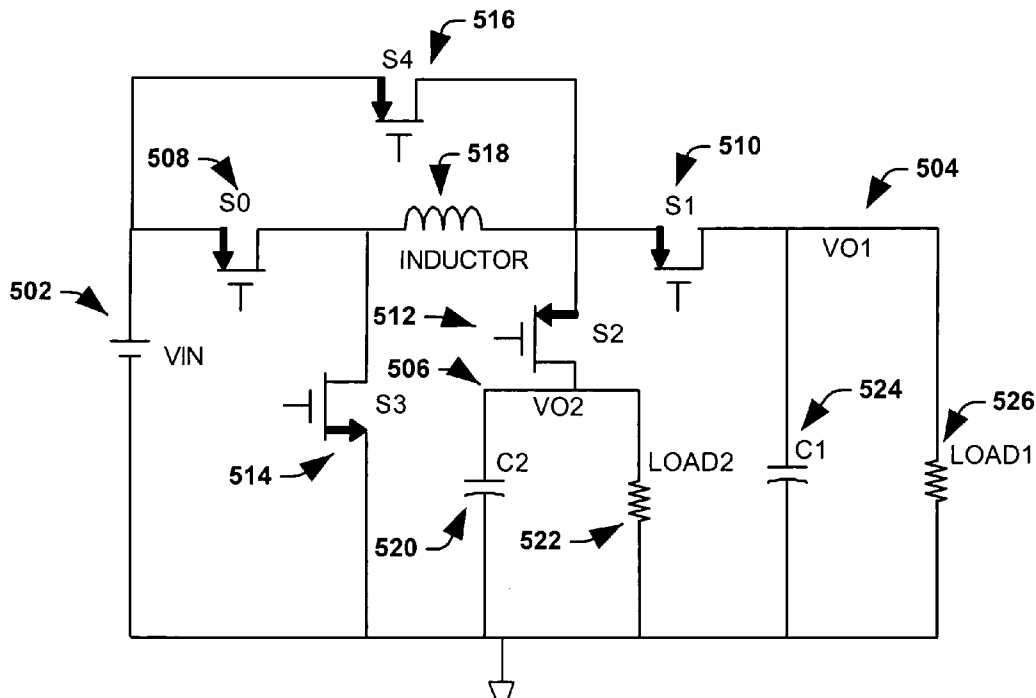**G05F 1/577** (2006.01)
(52) **U.S. Cl.** **323/267**
(58) **Field of Classification Search** 323/265, 323/267, 282
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,038,264 A * 8/1991 Steigerwald 363/21.02

6,075,295 A * 6/2000 Li 307/39
6,222,352 B1 4/2001 Lenk
6,522,110 B1 2/2003 Ivanov
2005/0105227 A1* 5/2005 Chen et al. 361/82

* cited by examiner

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(74) *Attorney, Agent, or Firm*—J. Dennis Moore; W. James Brady, III; Frederick J. Telecky, Jr.

(57) **ABSTRACT**

A single-inductor dual-output buck converter and control method that facilitates power conversion by converting a single DC power source/supply into two separate DC outputs, each of which can be configured to provide a selected/desired voltage by selection of respective duty cycles. The topology of the inverter includes a pair of diodes or switches that can selectively re-circulate inductor current. The converter is generally operated at a fixed frequency with four stages of operation. A first and third stage of operation provide power to a first and second output, respectively. A second and fourth stage of operation re-circulate inductor current and can partially recharge a battery type power source. The power output for each stage (voltage and current) can be selectively obtained by computing and employing appropriate time periods for the stages of operation that correspond to appropriate duty cycles.
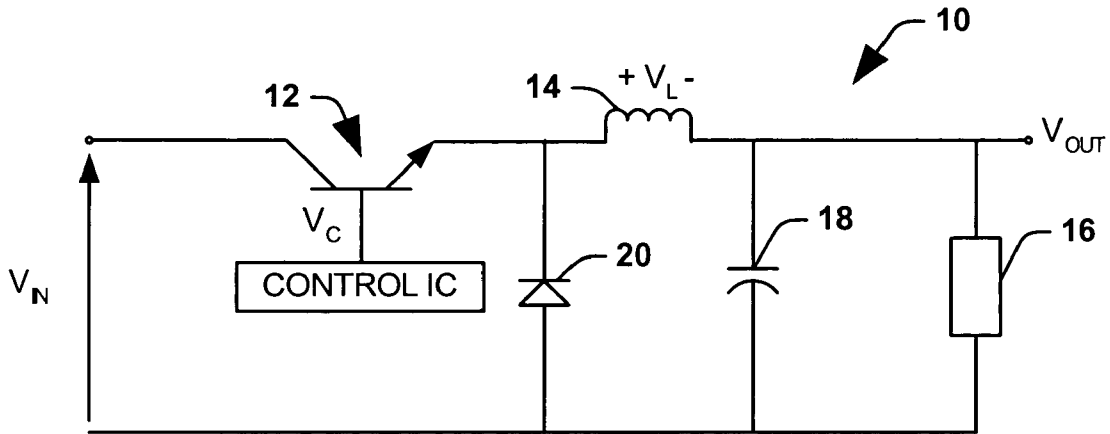
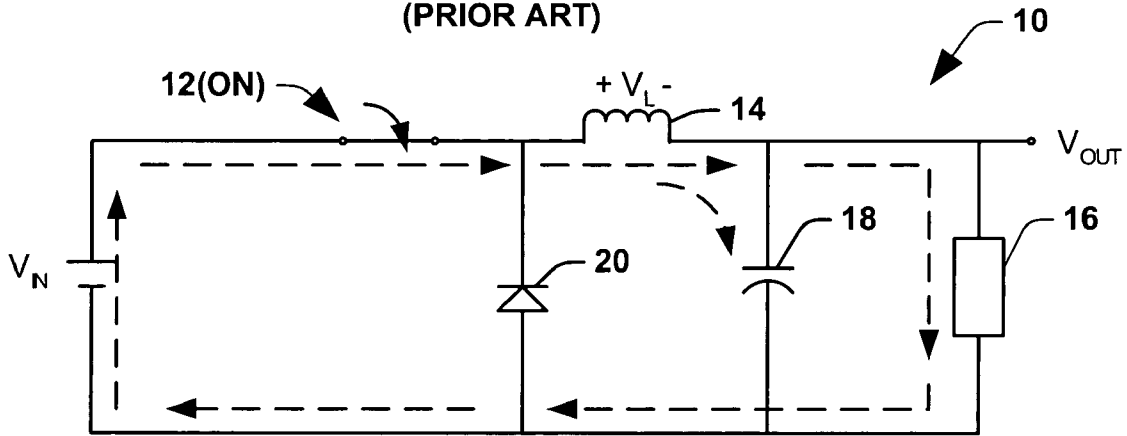**23 Claims, 17 Drawing Sheets**
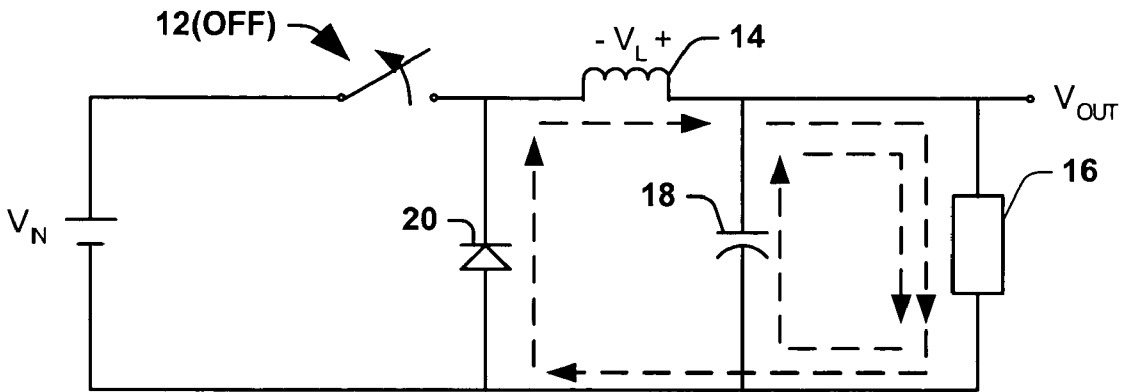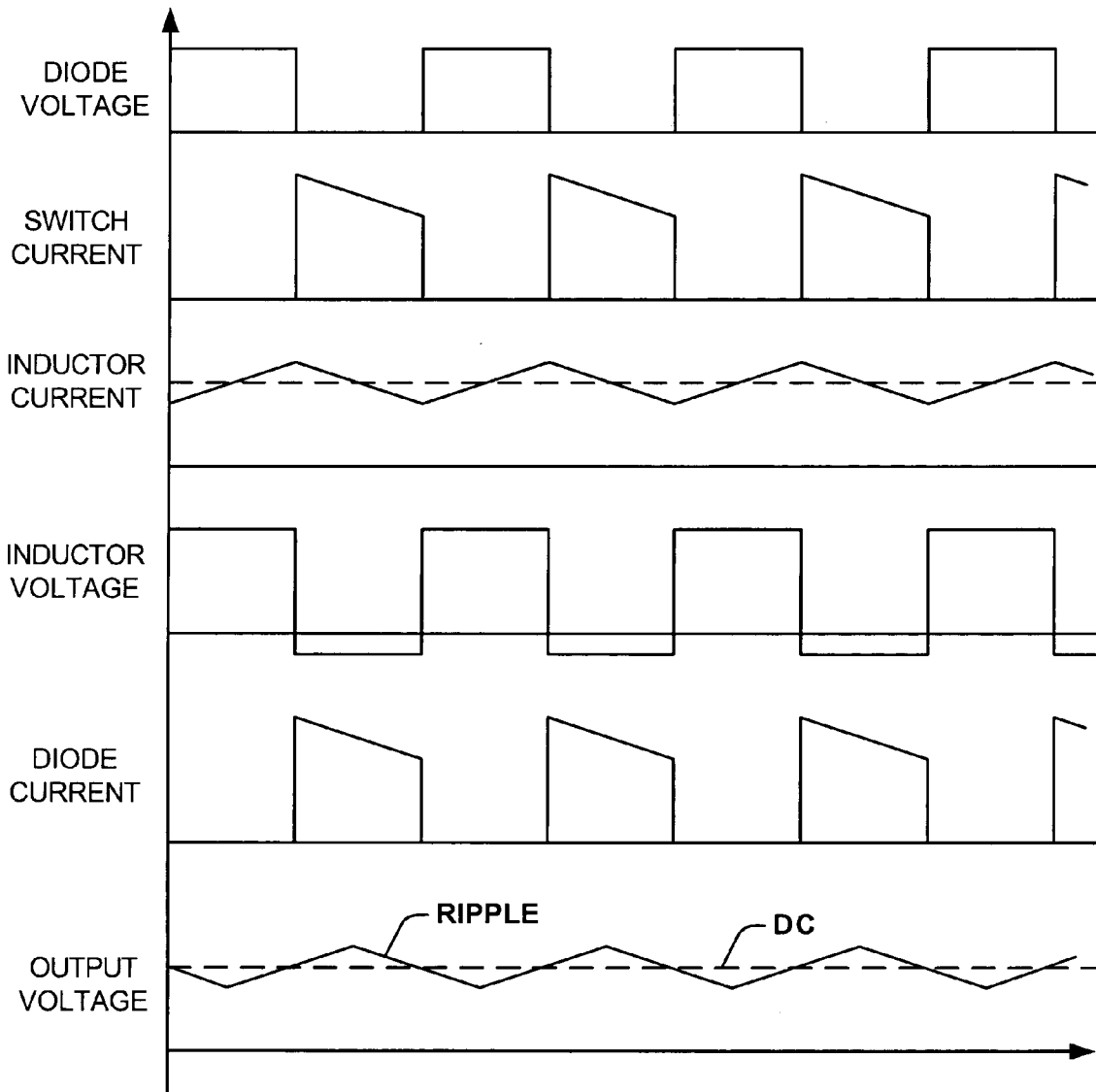
FIG. 1A
(PRIOR ART)

FIG. 1B
(PRIOR ART)

FIG. 1C
(PRIOR ART)

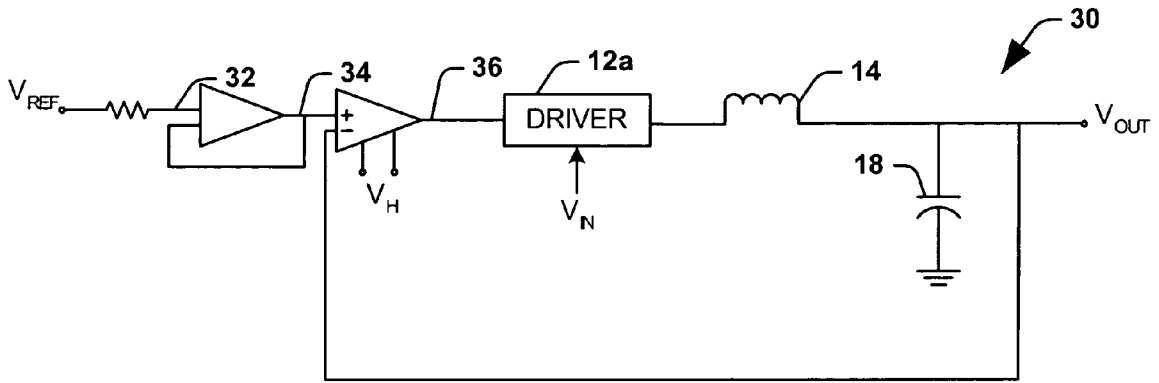**FIG. 2**
(PRIOR ART)
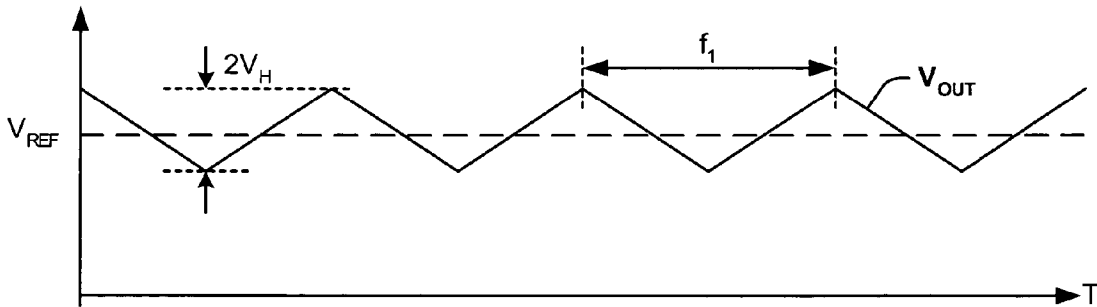
FIG. 3
(PRIOR ART)

FIG. 4
(PRIOR ART)

FIG. 5

DOCKET ALARM
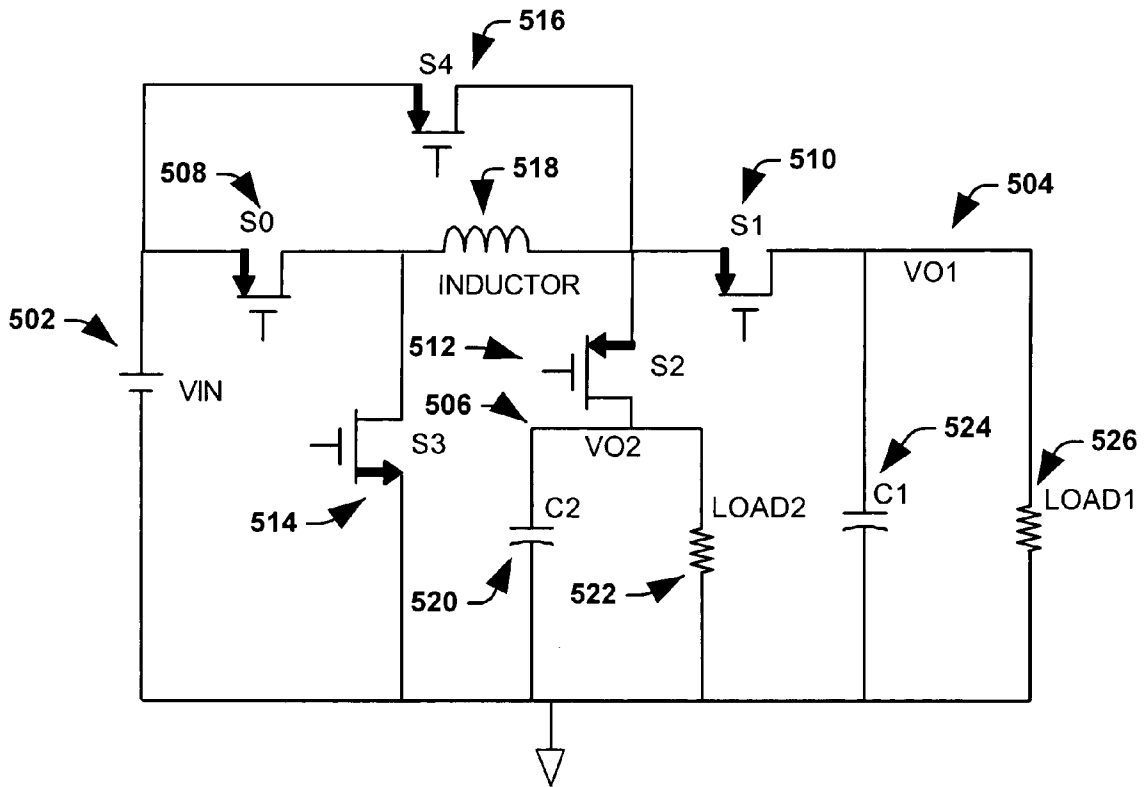
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