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**Severinsky et al.**

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(54) **HYBRID VEHICLES**

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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 0 days.

This patent is subject to a terminal disclaimer.

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(65) **Prior Publication Data**

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**Related U.S. Application Data**

(60) Division of application No. 13/065,708, filed on Mar. 29, 2011, which is a division of application No. 12/320,600, filed on Jan. 29, 2009, now abandoned, which is a division of application No. 11/459,458, filed on May 8, 2006, now Pat. No. 7,520,353, which is a division of application No. 10/382,577, filed on Mar. 7, 2003, now Pat. No. 7,104,347, which is a division of application No. 09/822,866, filed on Apr. 2, 2001, now Pat. No. 6,554,088, which is a continuation-in-part of application No. 09/264,817, filed on Mar. 9, 1999, now Pat. No. 6,209,672.

(60) Provisional application No. 60/100,095, filed on Sep. 14, 1998, provisional application No. 60/122,296, filed on Mar. 1, 1999.

(51) **Int. Cl.**  
**B60L 9/00** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **701/22; 318/139**

(58) **Field of Classification Search**  
USPC ..... 701/22; 318/139  
See application file for complete search history.

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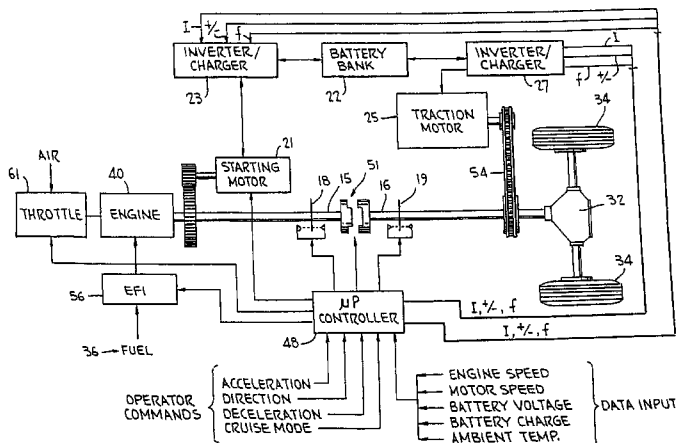
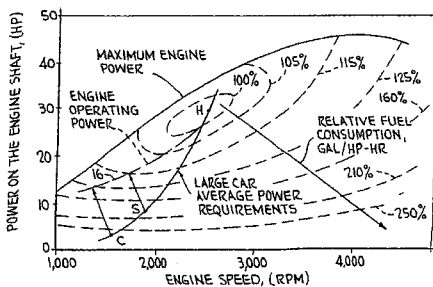
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(57) **ABSTRACT**

A hybrid vehicle comprises an internal combustion engine, a traction motor, a starter motor, and a battery bank, all controlled by a microprocessor in accordance with the vehicle's instantaneous torque demands so that the engine is run only under conditions of high efficiency, typically only when the load is at least equal to 30% of the engine's maximum torque output. In some embodiments, a turbocharger may be provided, activated only when the load exceeds the engine's maximum torque output for an extended period; a two-speed transmission may further be provided, to further broaden the vehicle's load range. A hybrid brake system provides regenerative braking, with mechanical braking available in the event the battery bank is fully charged, in emergencies, or at rest; a control mechanism is provided to control the brake system to provide linear brake feel under varying circumstances.

**12 Claims, 17 Drawing Sheets**



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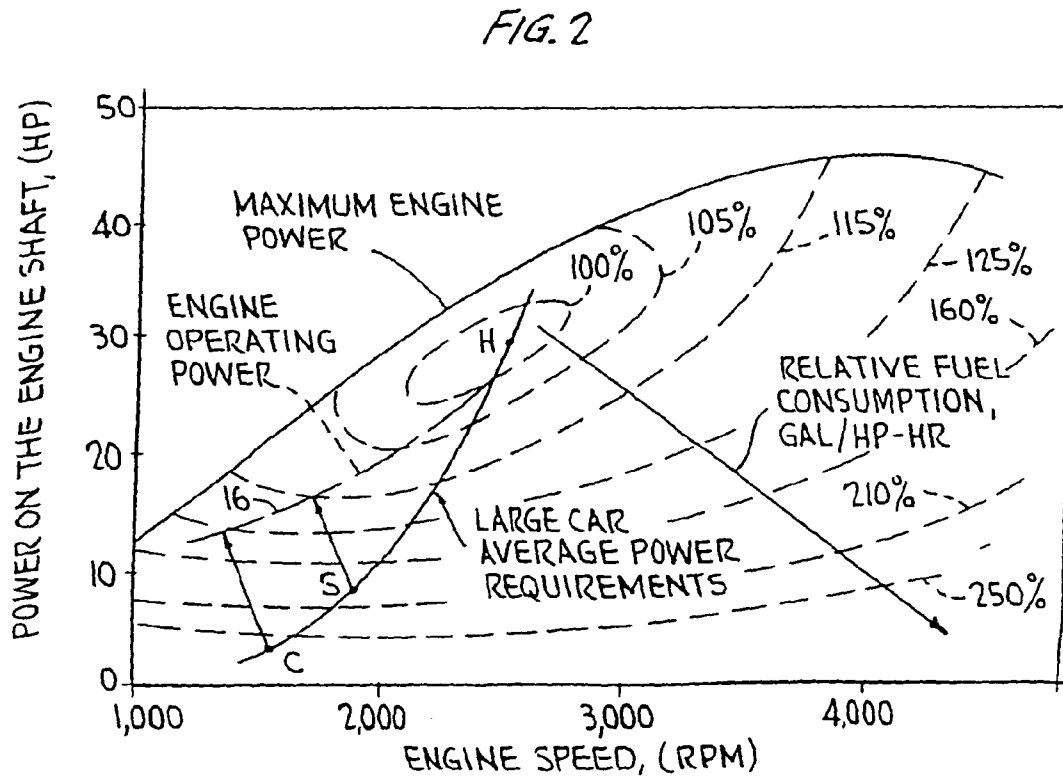
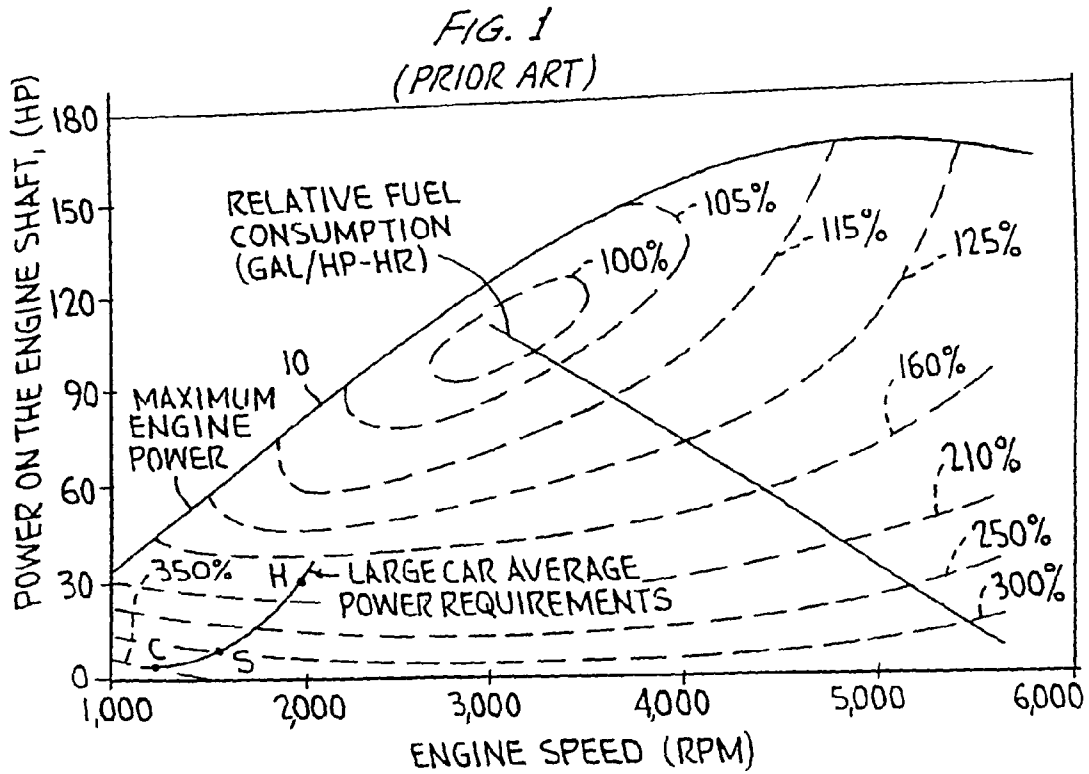
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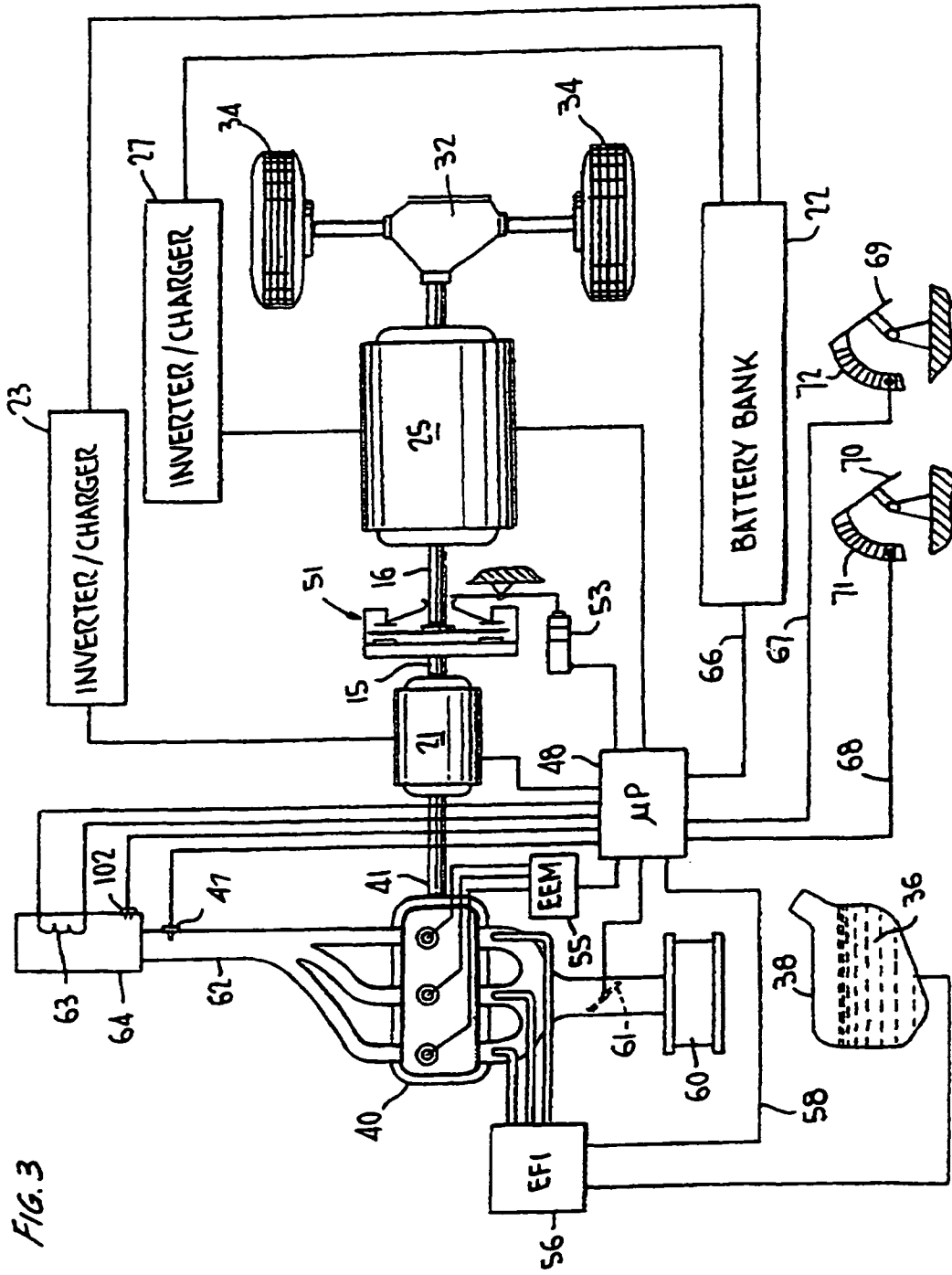
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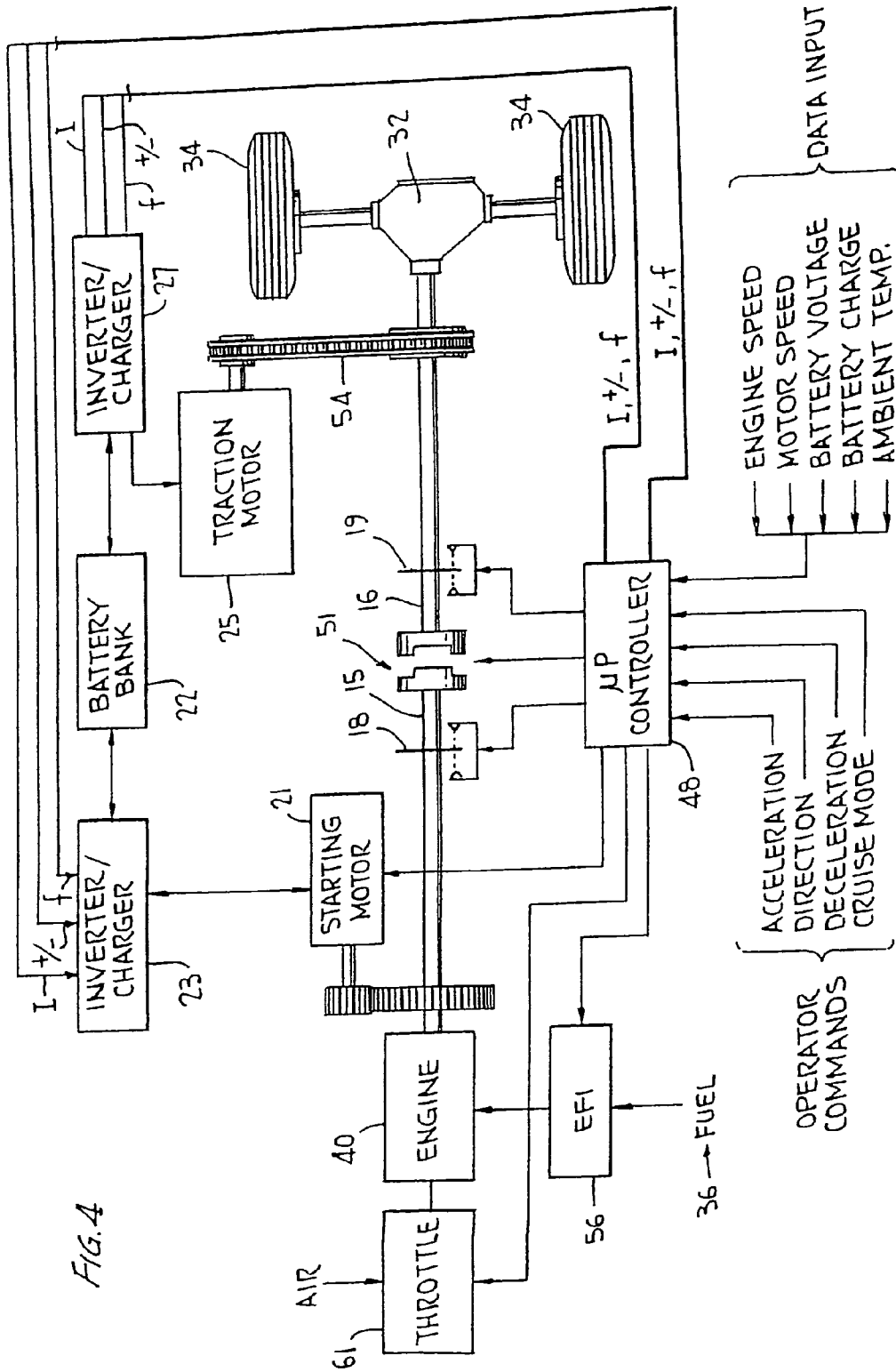


FIG. 4

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