



US007559388B2

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

(10) **Patent No.:** **US 7,559,388 B2**
(45) **Date of Patent:** **Jul. 14, 2009**

(54) **HYBRID VEHICLES**

(56) **References Cited**

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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 481 days.

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(21) **Appl. No.:** 11/429,408

(22) **Filed:** May 8, 2006

(65) **Prior Publication Data**
US 2006/0231304 A1 Oct. 19, 2006

Related U.S. Application Data

(60) 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, said application No. 10/382,577 is a continuation-in-part of application No. 09/392,743, filed on Sep. 9, 1999, now Pat. No. 6,338,391.

(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.**
B60W 10/06 (2006.01)

(52) **U.S. Cl.** 180/65.28; 180/65.21

(58) **Field of Classification Search** 180/65.2, 180/65.3, 65.8, 233, 65.21, 65.22, 65.225, 180/65.26, 65.265, 65.28; 903/930, 941

See application file for complete search history.

(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.

74 Claims, 17 Drawing Sheets

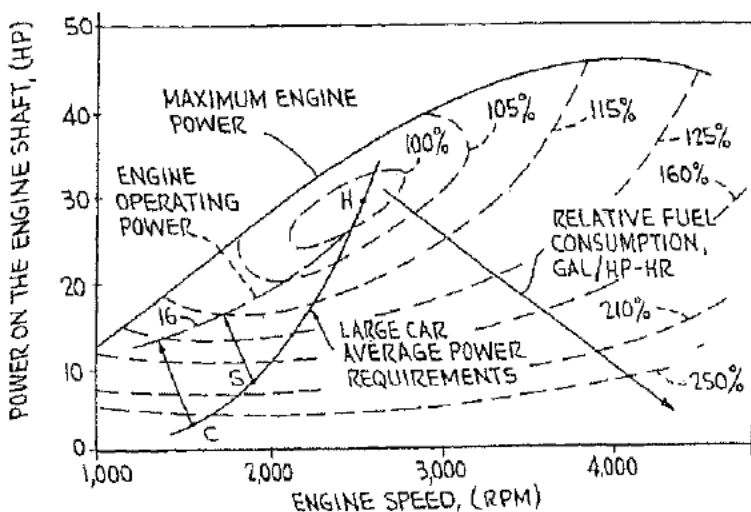


EXHIBIT 2
 WIT: *N. Hanneman*
 DATE: *4-30-2005*
 JANET A. HAMILTON, RDR

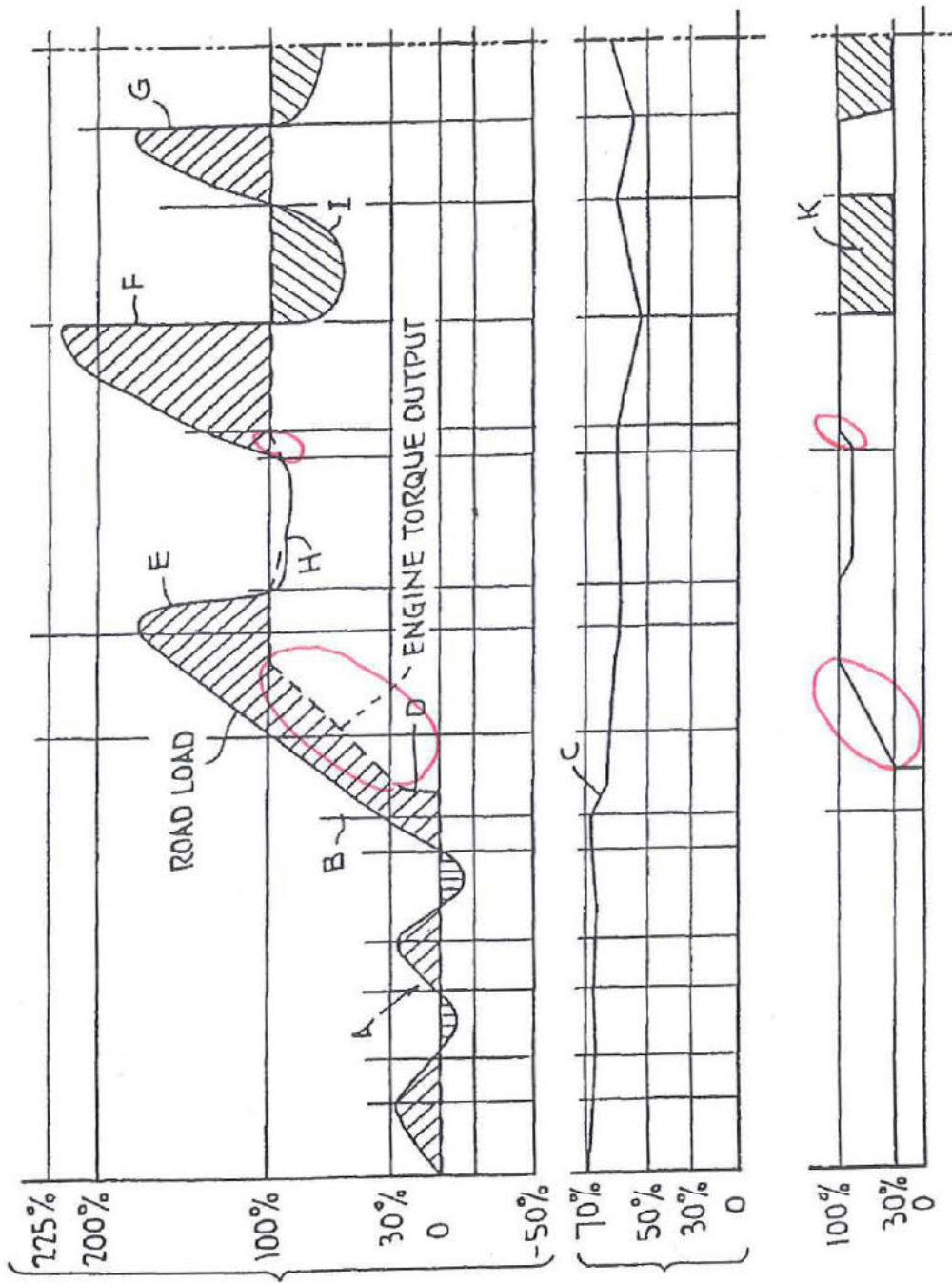


FIG. 7(a)
ROAD LOAD AS %
OF MAX. ENGINE
TORQUE OUTPUT
(% MTO)

FIG. 7(b)
BATTERY BANK
STATE OF CHARGE
(BSC)

FIG. 7(c)
ENGINE TORQUE
OUTPUT