

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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FORD MOTOR COMPANY,  
Petitioner,

v.

PAICE LLC & THE ABELL FOUNDATION, INC.,  
Patent Owner.

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Case IPR2014-00579  
Patent 7,104,347 B2

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Before SALLY C. MEDLEY, KALYAN K. DESHPANDE, and  
CARL M. DEFRANCO, *Administrative Patent Judges*.

DEFRANCO, *Administrative Patent Judge*.

FINAL WRITTEN DECISION  
*35 U.S.C. § 318(a) and 37 C.F.R. § 42.73*

## I. INTRODUCTION

Ford Motor Company (“Ford”) filed a Petition (“Pet.”) for *inter partes* review of claims 1, 7, 8, 18, 21, 23, and 37 of U.S. Patent No. 7,104,347 B2 (“the ’347 patent”), which is owned by Paice LLC & The Abell Foundation, Inc. (collectively, “Paice”). In a preliminary proceeding, we determined there is a reasonable likelihood that the challenged claims are unpatentable under 35 U.S.C. § 103, and instituted trial (“Dec. to Inst.”). In support of patentability, Paice filed a Patent Owner Response (“PO Resp.”), and Ford followed with a Reply (“Reply”). After hearing oral argument from both parties,<sup>1</sup> and pursuant to our jurisdiction under 35 U.S.C. § 6(c), we conclude Ford has proven, by a preponderance of the evidence, that all of the challenged claims are unpatentable.

## II. BACKGROUND

### A. *The ’347 patent*<sup>2</sup>

The ’347 patent describes a hybrid vehicle with an internal combustion engine, two electric motors (a starter motor and a traction motor), and a battery bank, all controlled by a microprocessor that directs the transfer of torque from the engine and traction motor to the drive wheels of the vehicle. Ex. 1101, 17:5–45, Fig. 4. The microprocessor features an engine control strategy that runs the engine only under conditions of high efficiency, typically when the vehicle’s instantaneous torque requirements (i.e., the amount of torque required to propel the vehicle, or “road load”) is

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<sup>1</sup> A transcript (“Tr.”) has been entered into the record. Paper 44.

<sup>2</sup> The ’347 patent is also the subject of several co-pending cases, including *Paice LLC v. Ford Motor Co.*, No. 1:14-cv-00492 (D. Md.), filed Feb. 19, 2014 (Pet. 1), and *Paice LLC v. Hyundai Motor Co.*, No. 1:12-cv-00499 (D. Md.), filed Feb. 16, 2012 (PO Resp. 6).

at least equal to 30% of the engine's maximum torque output ("MTO") capability. *Id.* at 20:52–60, 35:5–14; *see also id.* at 13:47–61 ("the engine is never operated at less than 30% of MTO, and is thus never operated inefficiently").

Running the engine only when it is efficient to do so leads to improved fuel economy and reduced emissions. *Id.* at 13:47–51. To achieve such efficiency, the hybrid vehicle includes various operating modes that depend on the vehicle's torque requirements, the battery's state of charge, and other operating parameters. *Id.* at 19:53–55. For example, the hybrid vehicle may operate in: (1) an all-electric mode, where only the traction motor provides the torque to propel the vehicle and operation of the engine would be inefficient (i.e., stop-and-go city driving); (2) an engine-only mode, where only the engine provides the torque to propel the vehicle and the engine would run at an efficient level (i.e., highway cruising); (3) a dual-operation mode, where the traction motor provides additional torque to propel the vehicle beyond that already provided by the engine and the torque required to propel the vehicle exceeds the maximum torque output of the engine (i.e., while accelerating, passing, and climbing hills); and (4) a battery recharge mode where the engine operates a generator to recharge the battery while the traction motor drives the vehicle. *Id.* at 35:66–36:58, 37:26–38:55.

*B. The challenged claims*

Ford challenges the patentability of claims 1, 7, 8, 18, 21, 23, and 37. Pet. 3. Of the challenged claims, claims 1 and 23 are independent. Claim 1 is directed to a "hybrid vehicle" (Ex. 1101, 58:13), while claim 23 is directed to a "method of control" of a hybrid vehicle (*id.* at 60:22). Each of

the independent claims recites that the engine is employed when it can produce torque “efficiently,” which claim 1 describes as when the torque required to propel the vehicle is “at least equal to a setpoint (SP) [but] substantially less than the maximum torque output (MTO)” of the engine (*id.* at 58:29–37), and claim 23 describes as when the torque required to propel the vehicle is “between a lower level SP and a maximum torque output MTO” (*id.* at 60:23–42).

Claim 1 is illustrative of the challenged claims:

1. A hybrid vehicle, comprising:

an internal combustion engine controllably coupled to road wheels of said vehicle;

a first electric motor connected to said engine [a]nd operable to start the engine responsive to a control signal;

a second electric motor connected to road wheels of said vehicle, and operable as a motor, to apply torque to said wheels to propel said vehicle, and as a generator, for accepting torque from at least said wheels for generating current;

a battery, for providing current to said motors and accepting charging current from at least said second motor; and

a controller for controlling the flow of electrical and mechanical power between said engine, first and second motors, and wheels,

*wherein said controller starts and operates said engine when torque require[d] to be produced by said engine to propel the vehicle and/or to drive either one or both said electric motor(s) to charge said battery is at least equal to a setpoint (SP) above which said engine torque is efficiently produced, and wherein the torque produced by said engine when operated at said setpoint (SP) is substantially less than the maximum torque output (MTO) of said engine.*

Ex. 1101, 58:13–37 (emphases added).

C. *The instituted grounds of unpatentability*

In a preliminary proceeding, we instituted trial because Ford made a threshold showing of a “reasonable likelihood” that the challenged claims were unpatentable as obvious over five publications that share a common author, Professor James R. Bumby, which are referred to individually as Bumby I,<sup>3</sup> Bumby II,<sup>4</sup> Bumby III,<sup>5</sup> Bumby IV,<sup>6</sup> and Bumby V,<sup>7</sup> and collectively as “the Bumby references” or “Bumby.” Dec. to Inst. 13. We now decide whether Ford has proven the unpatentability of the challenged claims by a “preponderance of the evidence.” 35 U.S.C. § 316(e).

III. ANALYSIS

A. *Claim construction*

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b). This standard involves determining the ordinary and customary meaning of the claim terms as understood by one of ordinary skill in the art reading the patent’s entire

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<sup>3</sup> J.R. Bumby, *Computer modelling of the automotive energy requirements for internal combustion engine and battery electric-powered vehicles*, IEE PROC., v. 132, pt. A, no. 5, 265–279 (Sep. 1985) (Ex. 1103).

<sup>4</sup> J.R. Bumby and I. Forster, *Optimisation and control of a hybrid electric car*, IEE PROC., v. 134, pt. D, no. 6, 373–387 Nov. 1987 (Ex. 1104).

<sup>5</sup> I. Forster and J.R. Bumby, *A hybrid internal combustion engine/battery electric passenger car for petroleum displacement*, PROC. INST. MECH. ENGRS., v. 202, no. D1, 51–64 Jan. 1988 (Ex. 1105).

<sup>6</sup> J.R. Bumby and P.W. Masding, *A Test-Bed Facility for Hybrid IC Engine-Battery Electric Road Vehicle Drive Trains*, TRANS. INST. MEAS. & CONT., v. 10, no. 2, 87–97 Apr. 1988 (Ex. 1106).

<sup>7</sup> P.W. Masding and J.R. Bumby, *Integrated microprocessor control of a hybrid i.c. engine/battery-electric automotive power train*, TRANS. INST. MEAS. & CONT., v. 12, no. 3, 128–146 Jan. 1990 (Ex. 1107).

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