US009410453B2

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

(10) **Patent No.: US 9,410,453 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **METHOD AND SYSTEM FOR VARIABLE CAM TIMING DEVICE**

(71) Applicant: **Ford Global Technologies, LLC**, Dearborn, MI (US)

(72) Inventors: **John Eric Rollinger**, Sterling Heights, MI (US); **Paul A. Pietrzyk**, Beverly Hills, MI (US); **Ed Badillo**, Flat Rock, MI (US); **Jamie Charles Hanshaw**, South Lyon, MI (US)

(73) Assignee: **Ford Global Technologies, LLC**, Dearborn, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 141 days.

(21) Appl. No.: **14/520,194**

(22) Filed: **Oct. 21, 2014**

(65) **Prior Publication Data**

US 2016/0108768 A1 Apr. 21, 2016

(51) **Int. Cl.**
F01L 1/34 (2006.01)
F01L 1/344 (2006.01)

(52) **U.S. Cl.**
CPC ***F01L 1/344*** (2013.01)

(58) **Field of Classification Search**
CPC F01L 1/344
USPC 123/90.17
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,172,659	A	12/1992	Butterfield et al.
5,184,578	A	2/1993	Quinn, Jr. et al.
5,937,806	A	8/1999	Lyko et al.
6,807,931	B2	10/2004	Taylor et al.
6,810,843	B2	11/2004	Quinn, Jr.
7,137,369	B2	11/2006	Jiang
7,214,153	B2	5/2007	Simpson
7,584,044	B2	9/2009	Mladenovic et al.
8,356,583	B2	1/2013	Smith
8,380,423	B2	2/2013	Cowgill et al.
8,495,981	B2	7/2013	Stewart et al.
2010/0280739	A1 *	11/2010	Rollinger F01L 1/34 701/102

FOREIGN PATENT DOCUMENTS

EP	1653056 A2	5/2006
EP	1914395 A1	4/2008

OTHER PUBLICATIONS

Pietrzyk, Paul A. et al., "Method and System for Variable Cam Timing Device," U.S. Appl. No. 144/520,174, filed Oct. 21, 2014, 98 pages.

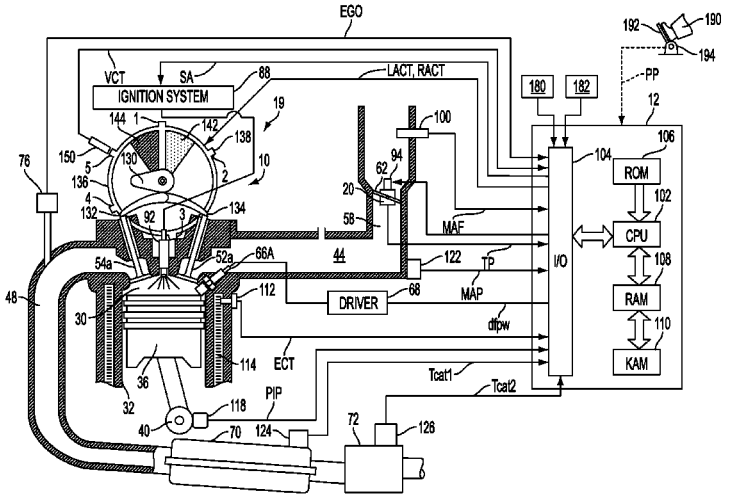
Rollinger, John E. et al., "Method and System for Variable Cam Timing Device," U.S. Appl. No. 14/520,179, filed Oct. 21, 2014, 98 pages.

(Continued)

Primary Examiner — Zelalem Eshete

(74) *Attorney, Agent, or Firm* — Julia Voutyras; Alleman Hall McCoy Russell & Tuttle LLP

(57) **ABSTRACT**

Methods and systems are described for an engine with a cam torque actuated variable cam timing phaser. Phaser positioning control is improved by reducing inaccuracies resulting from inadvertent spool valve and/or phaser movement when the spool valve is commanded between regions. In addition, improved spool valve mapping is used to render phaser commands more consistent and robust.

20 Claims, 18 Drawing Sheets