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United States Patent [19]

Cullen et al.

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[45] **Date of Patent:** Jan. 2, 1996

[54] **METHOD AND APPARATUS FOR CONTROLLING ENGINE TORQUE** 5,333,109 7/1994 Oo et al. 364/426.04
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[75] Inventors: **Michael J. Cullen**, Northville; **Louis R. Christensen**, Canton; **Peter J. Grutter**, Plymouth; **Michael A. Weyburne**, Northville, all of Mich.; **Joseph N. Ulrey**, Hiroshima, Japan; **David G. Farmer**, Plymouth, Mich.

Primary Examiner—Raymond A. Nelli
Attorney, Agent, or Firm—Allan J. Lipppa; Roger L. May

[57] ABSTRACT

A method for reducing the engine torque being produced by an internal combustion engine to a desired engine torque through coordinated control of spark retard, cylinder cut-out and air/fuel scheduling. The method is for use with a vehicle including a multi-cylinder internal combustion engine capable of generating torque, each cylinder having an associated fuel injector for providing fuel to the cylinder and an associated spark timing control for providing a spark for combustion of the fuel with fresh air during engine operation. The method includes identifying the desired engine torque to which the engine torque being produced is to be reduced, and determining a first torque reduction to be achieved by defueling at least one of the engine cylinders. The method also includes determining a second torque reduction to be achieved by lean air/fuel scheduling, the second torque reduction being adjusted for the number of cylinders defueled, and determining a third torque reduction to be achieved by spark retardation, the third torque reduction being adjusted for the number of cylinders defueled and for the lean air/fuel scheduling.

[73] Assignee: **Ford Motor Company**, Dearborn, Mich.

[21] Appl. No.: **270,963**

[22] Filed: **Jul. 5, 1994**

[51] Int. Cl.⁶ **F02D 41/00**

[52] U.S. Cl. **123/350; 364/431.07**

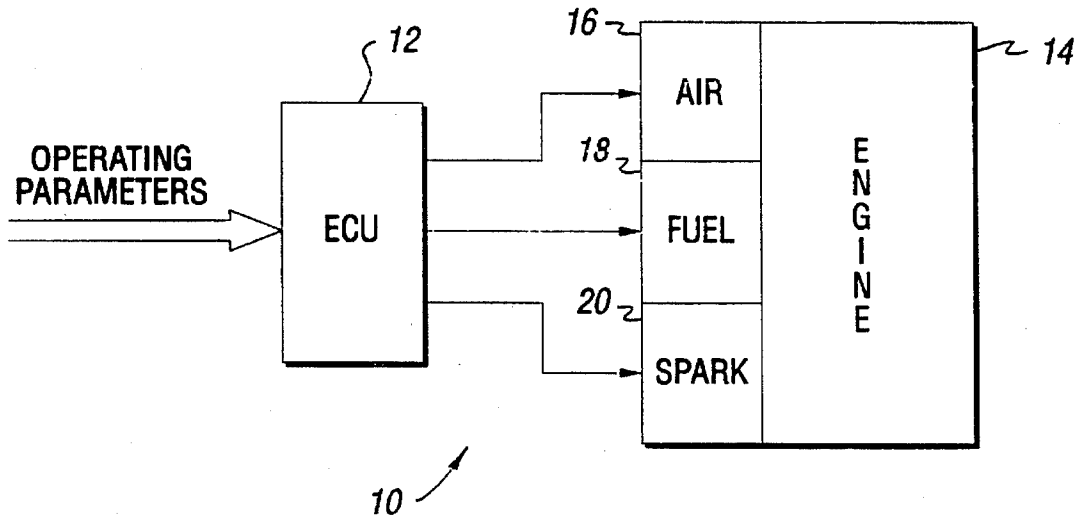
[58] **Field of Search** 123/350, 349, 123/352, 361, 340; 73/117.3; 477/110; 364/426.04, 431.07; 60/277

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17 Claims, 6 Drawing Sheets



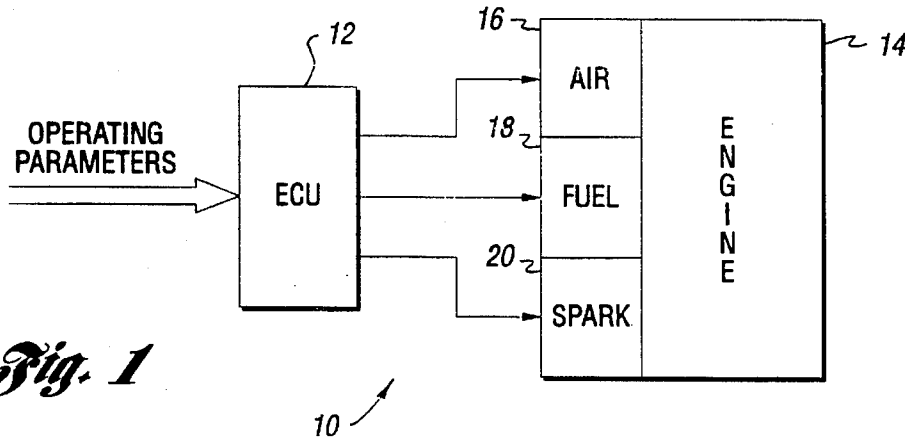


Fig. 1

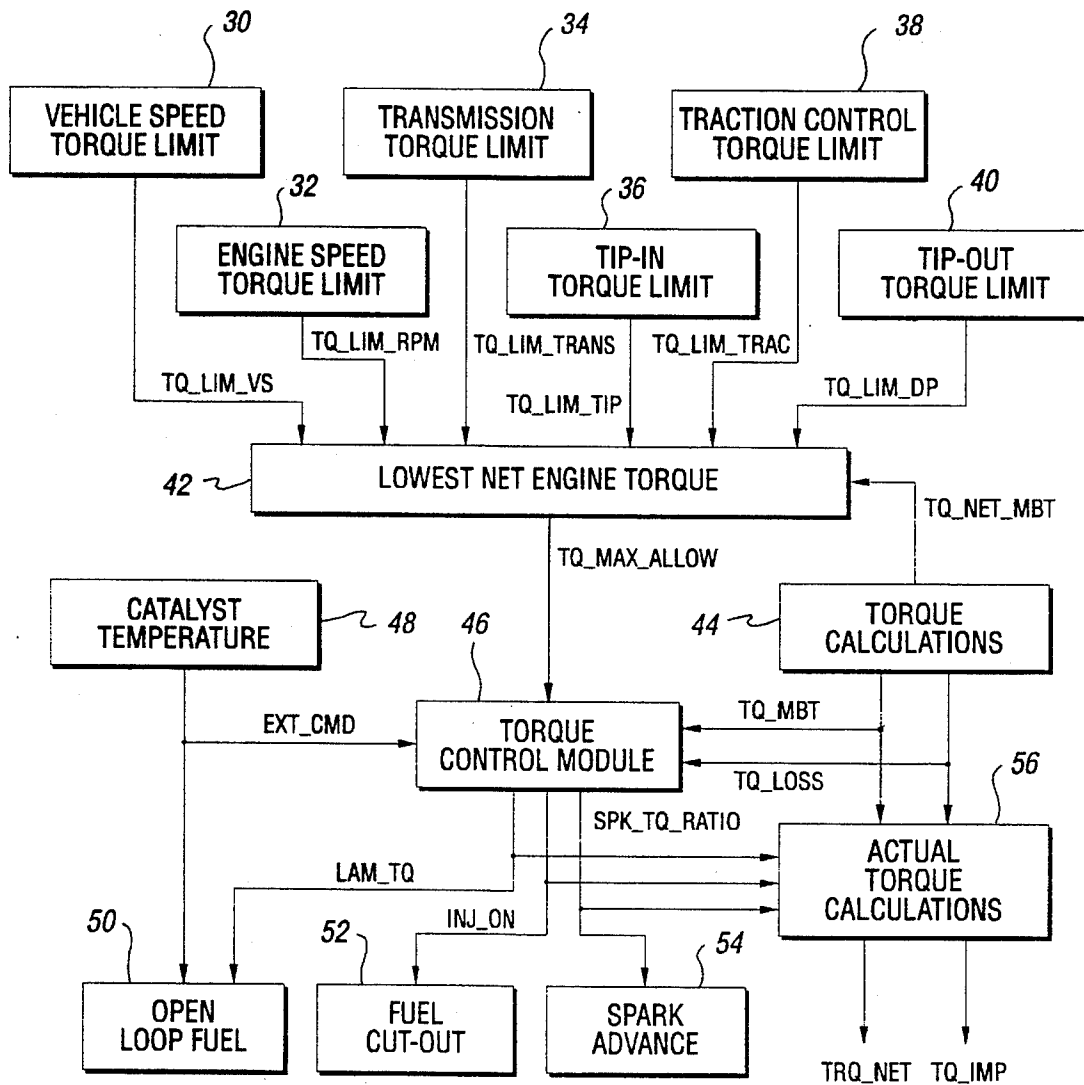


Fig. 2

Fig. 3a

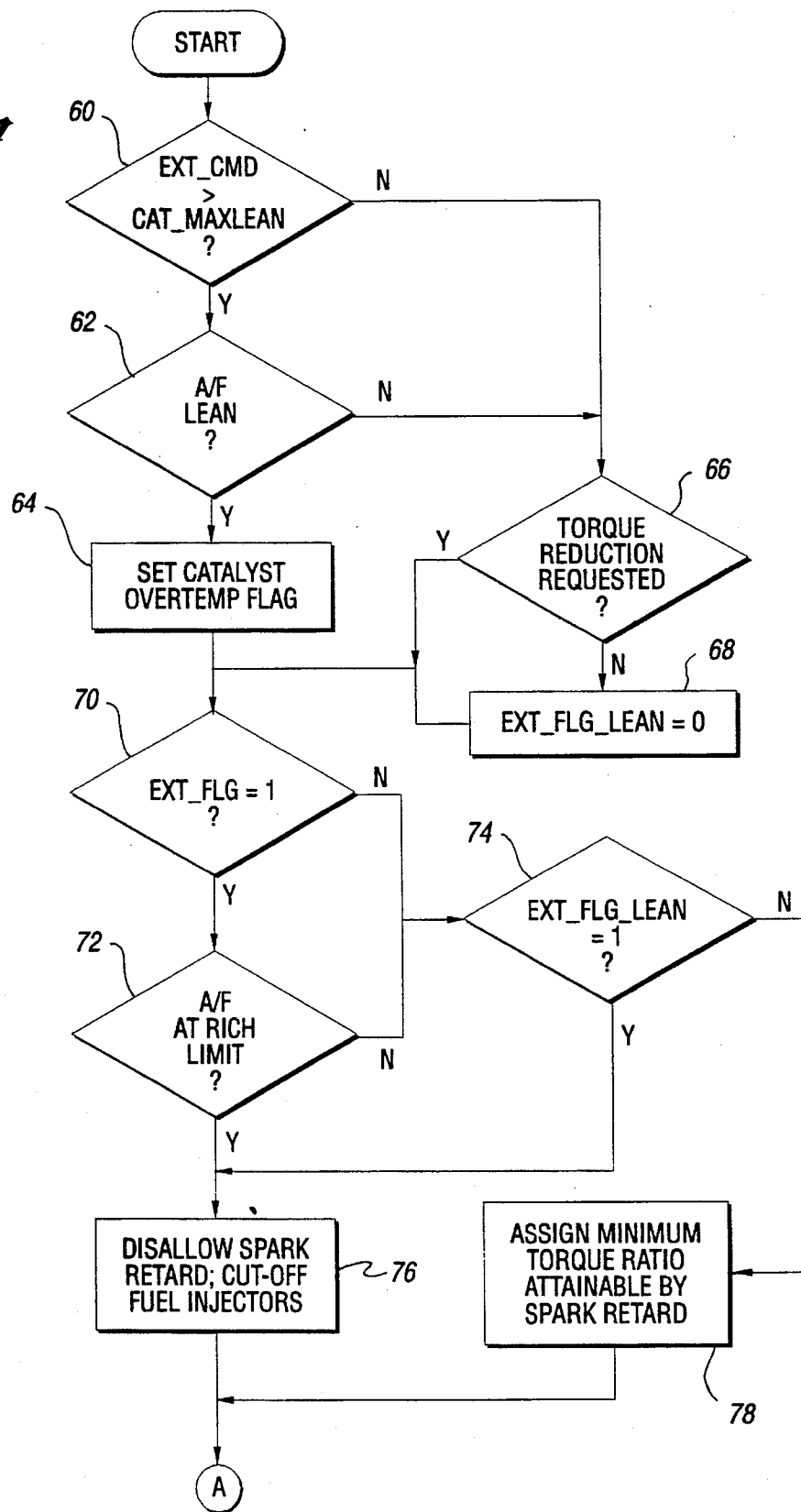
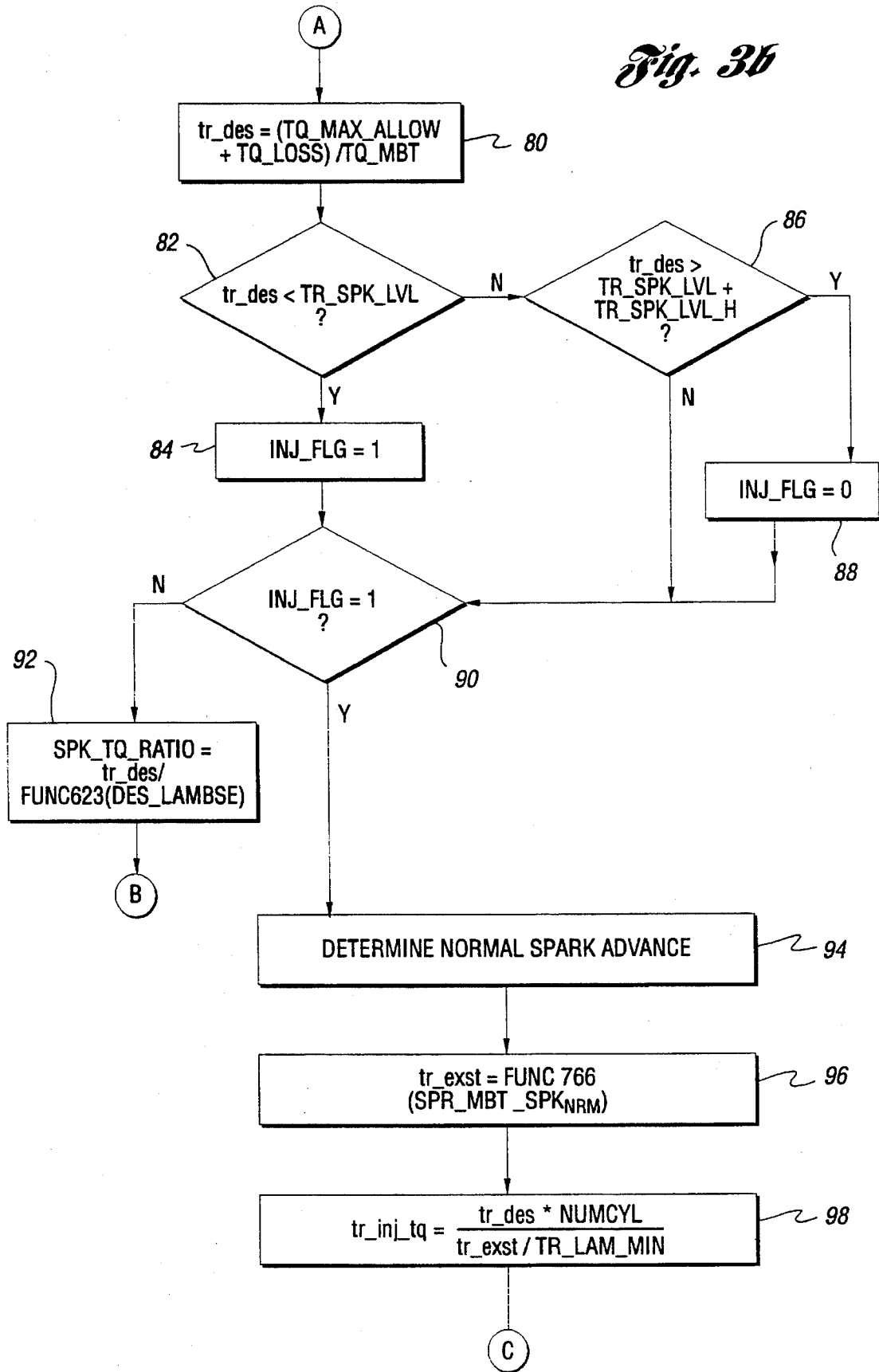


Fig. 3b



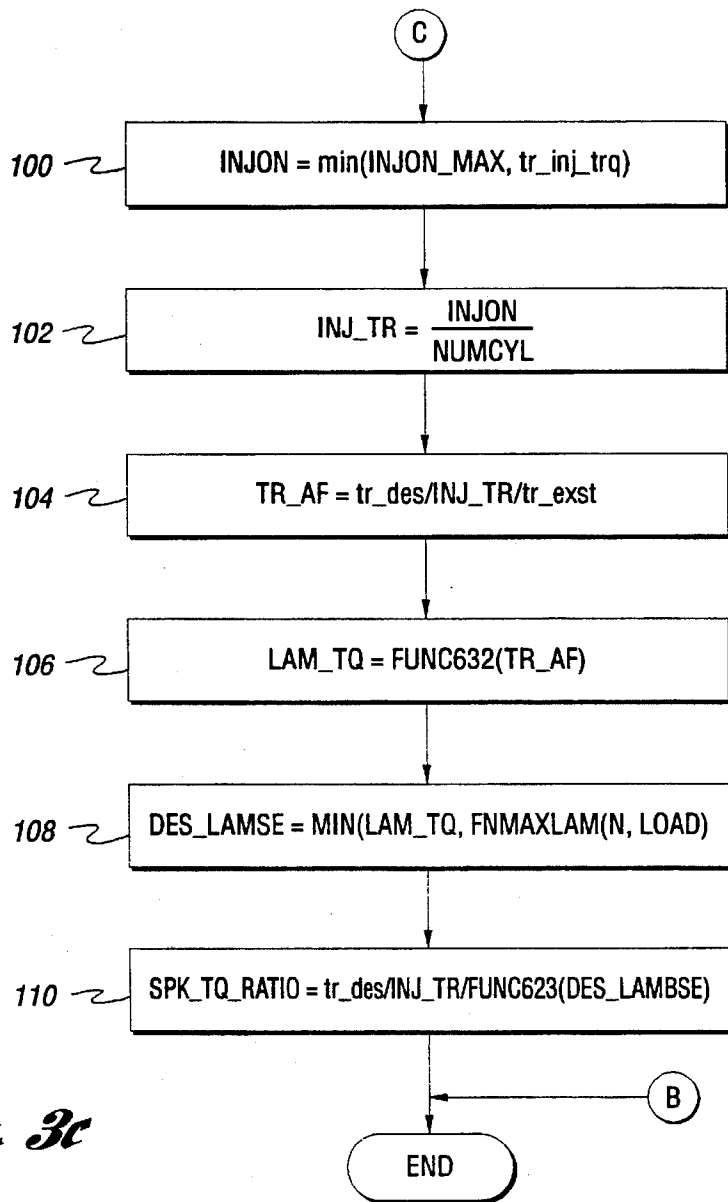


Fig. 3c

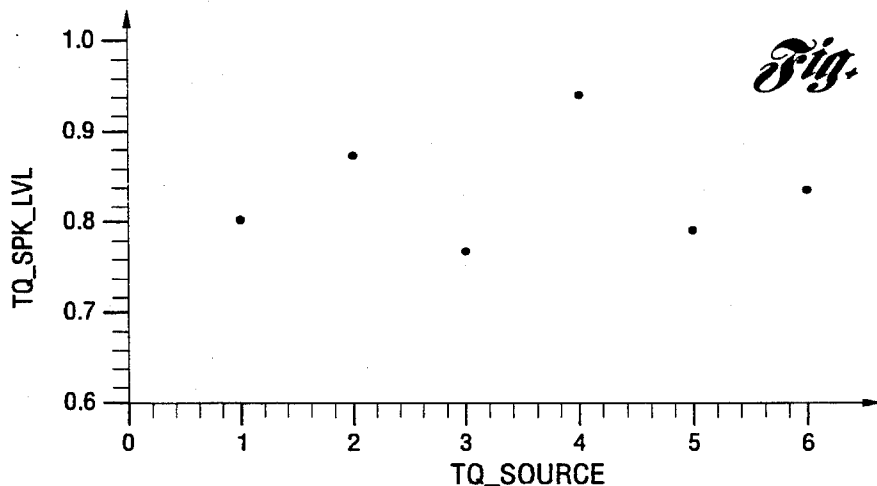


Fig. 4

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