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# United States Patent [19]

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Ibaraki et al.

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[54] **VEHICLE CONTROL APPARATUS ADAPTED TO SELECT ENGINE-OR MOTOR-DRIVE MODE BASED ON PHYSICAL QUANTITY REFLECTING ENERGY CONVERSION EFFICIENCIES IN MOTOR-DRIVE MODE**

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[73] Assignee: **Toyota Jidosha Kabushiki Kaisha**, Toyota, Japan

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[21] Appl. No.: **685,102**

[22] Filed: **Jul. 22, 1996**

### [30] Foreign Application Priority Data

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Dec. 18, 1995 [JP] Japan ..... 7-328444

Primary Examiner—John W. Cabeca  
Attorney, Agent, or Firm—Oliff & Berridge, PLC

[51] Int. Cl.<sup>6</sup> ..... **H02P 7/66**

[52] U.S. Cl. .... **318/148**; 318/146; 180/65.3; 180/65.4; 290/40 C; 322/14

[58] Field of Search ..... 180/65.1, 65.2, 180/65.3, 65.4; 290/40 C, 40 R, 40 F, 36 R; 318/140, 141, 143, 146, 148, 151, 802, 799, 806; 322/14, 38, 39

### [57] ABSTRACT

A drive control apparatus for an automotive vehicle having an electric motor and an engine operated by combustion of a fuel, the drive control apparatus including a drive source selecting device for selecting an engine drive mode or a motor drive mode on the basis of a first value in the engine drive mode of a physical quantity relating to a condition of the engine and a second value of the same physical quantity reflecting energy conversion efficiencies of the electric motor, an electric generator and an electric energy storage device during an electricity generating mode. The physical quantity is preferably a fuel consumption amount by the engine. The drive control apparatus may also include an engine output determining device that optimizes the efficiency of the system by determining the output of the engine so as to power the vehicle and also provide surplus power to operate the electric generator and charge the electric energy storage device. An enlarging device may also be included to increase the output of the electric motor to prevent excessive charging of the electric energy storage device.

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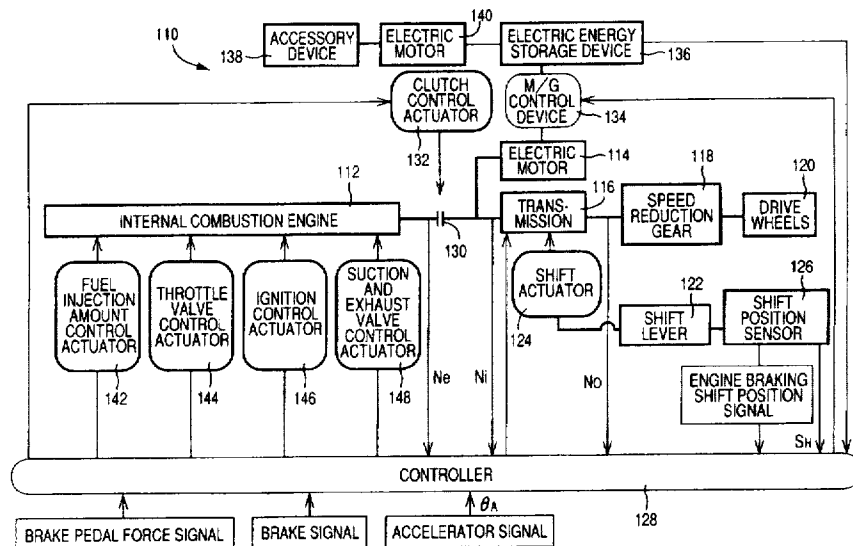
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**19 Claims, 9 Drawing Sheets**



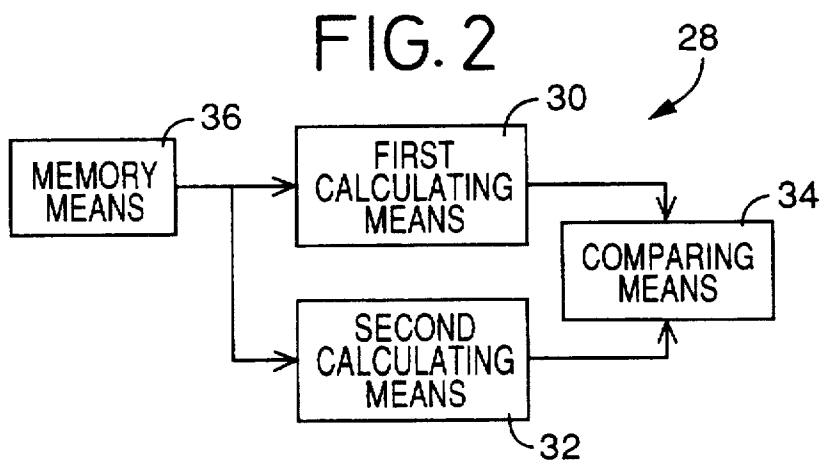
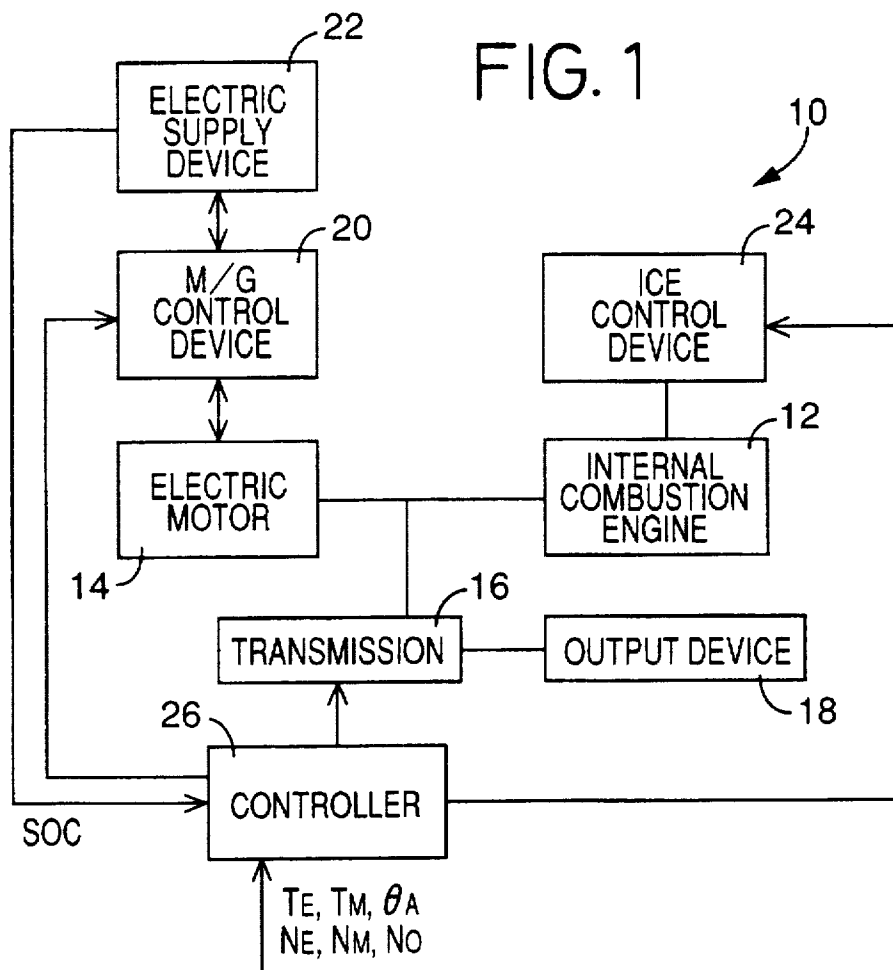


FIG. 3

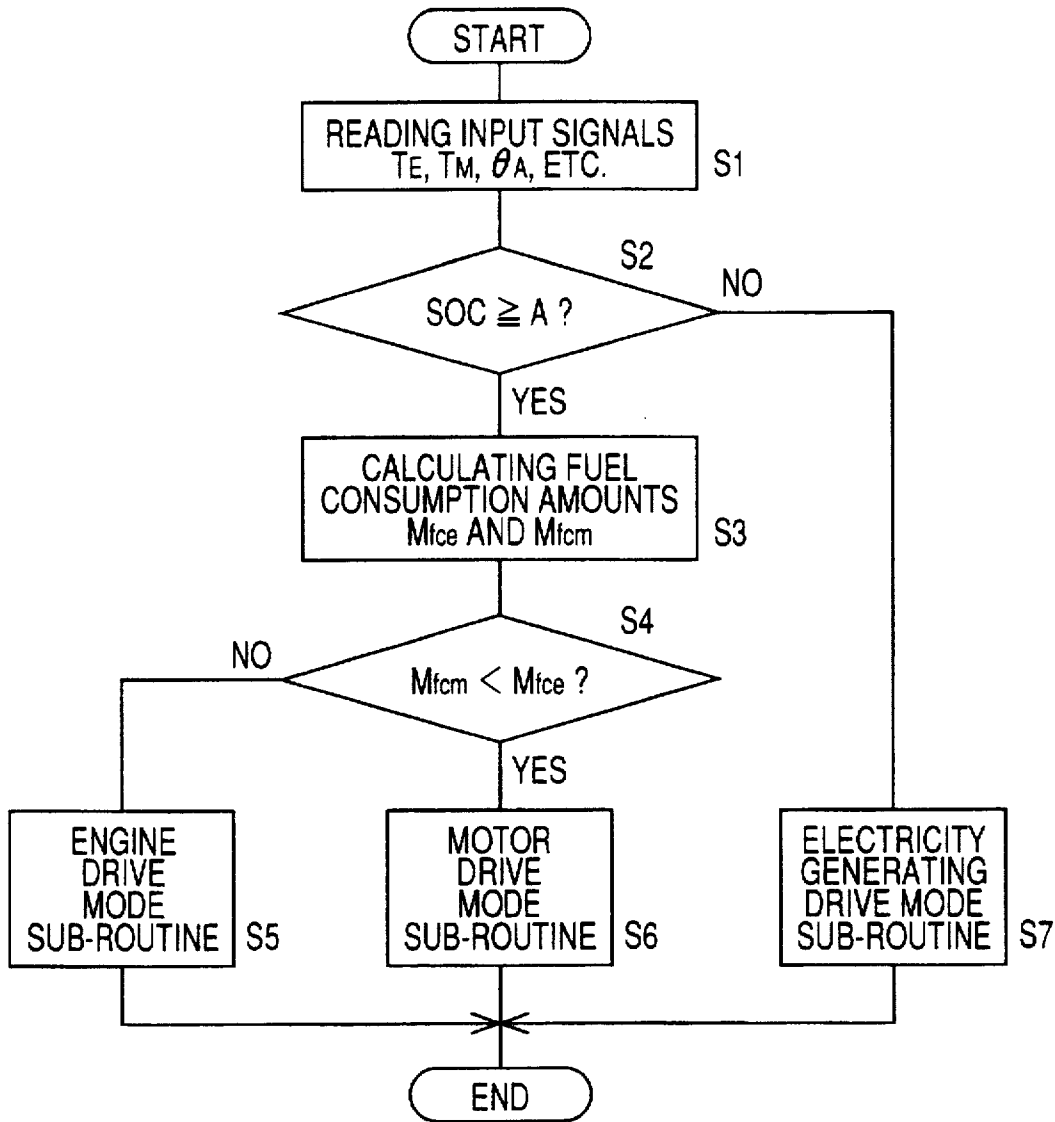


FIG. 4

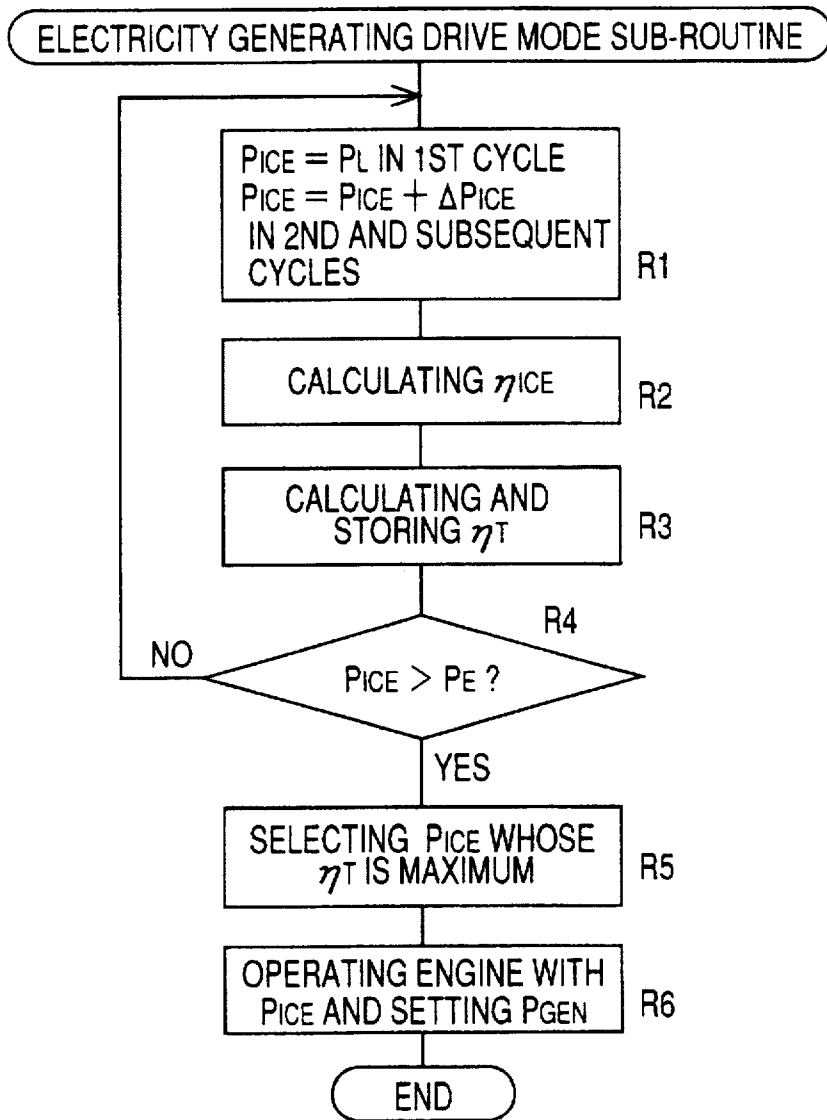


FIG. 5

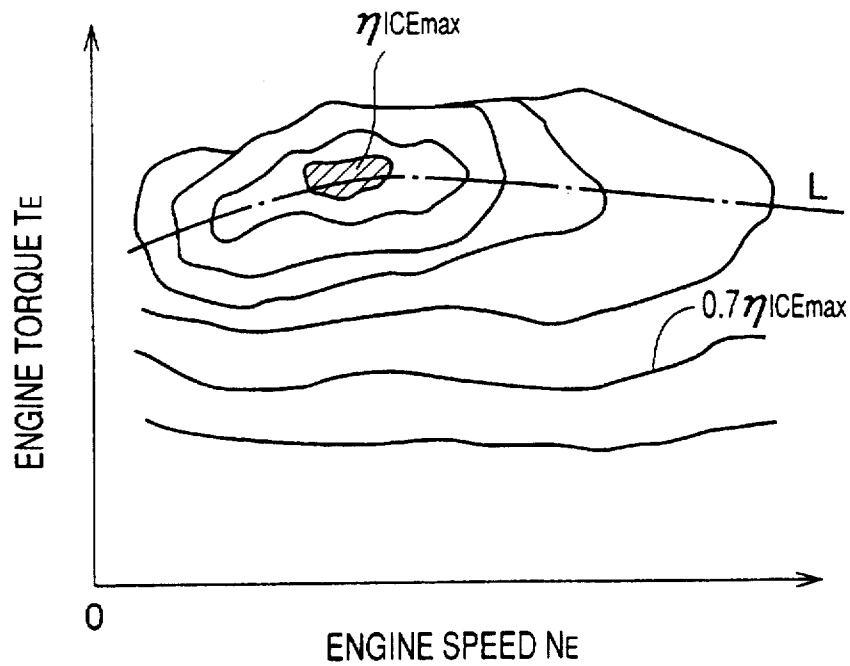
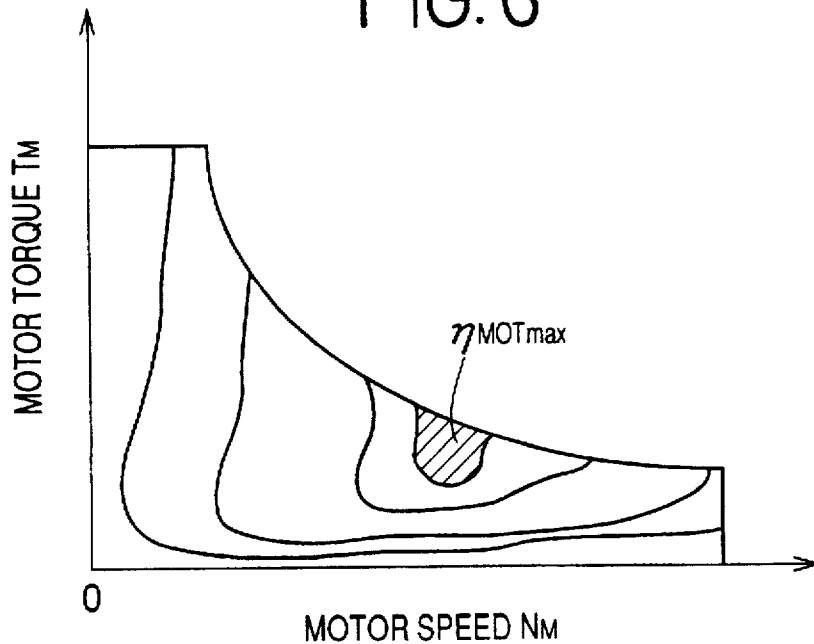


FIG. 6



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