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Gray, Jr. et al.

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- [54] **HYBRID POWERTRAIN VEHICLE**
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- [73] Assignee: **The United States of America as represented by the Administrator of the U.S. Environmental Protection Agency**, Washington, D.C.

- [21] Appl. No.: **253,944**
- [22] Filed: **Jun. 3, 1994**
- [51] Int. Cl.⁶ **B60K 26/00**
- [52] U.S. Cl. **180/165; 180/65.4; 180/307; 60/414**
- [58] Field of Search **180/165, 305, 180/306, 307, 308, 65.1, 65.2, 65.3, 65.4; 60/413, 414, 418, 420; 364/424.1, 426.01; 74/665 A, 665 B**

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Primary Examiner—Richard M. Camby
Attorney, Agent, or Firm—Lorusso & Loud

[57] **ABSTRACT**

Engine output speed is controlled for optimum efficiency by

adjustment of input speed of a continuously variable transmission (CVT). Where power in excess of that provided by the engine is required, additional power is input to the drivetrain from a fluidic motor driven by fluid pressure stored in an accumulator. In driving conditions where the engine, operating at optimum efficiency, produces power in excess of that demanded by the vehicle, the fluidic motor is reversed for operation as a pump and excess engine power is utilized to drive the pump and store energy in the accumulator in the form of fluid pressure. A CPU determines power output required of the engine as a sum of that indicated by a sensor which senses power demanded of the vehicle by a driver and an increment of power required to maintain the pressure of the accumulator above a threshold amount. An engine speed controller controls the rotary speed of the engine output, to produce the required total power output, by changing the input speed of the CVT. In order to maintain optimum engine efficiency, a memory associated with the CPU is stored with maps correlating values for optimum engine speed with values for engine output power and the optimum engine speed is read from the map by reference to the determined total requirement for engine output power. Optionally, the vehicle may include first and second engines with the second engine providing a power assist under driving conditions demanding power in excess of that available from the primary engine in combination with the fluidic motor. The invention also includes a method of operating the system in order to achieve the objective of optimum engine efficiency.

16 Claims, 5 Drawing Sheets

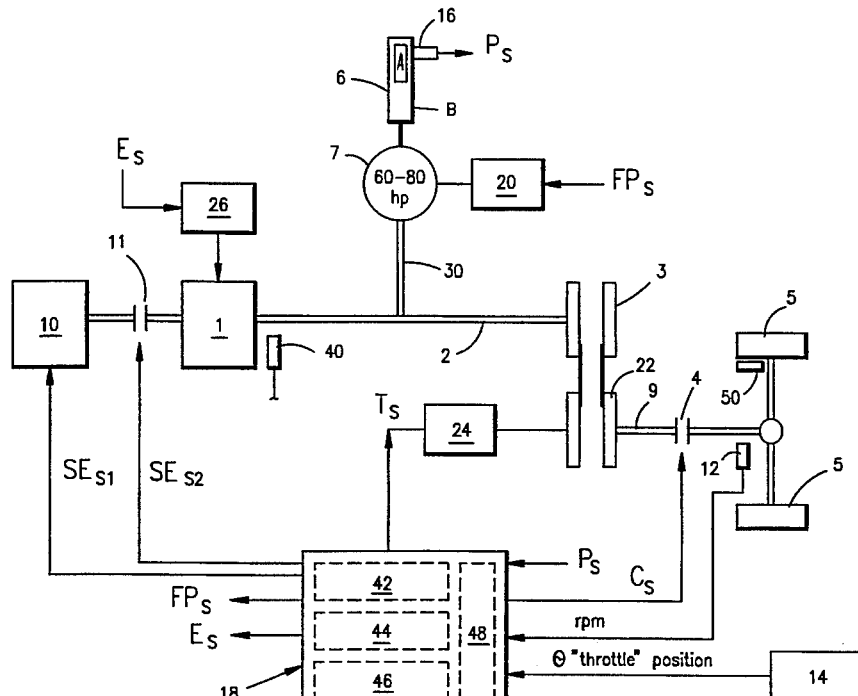
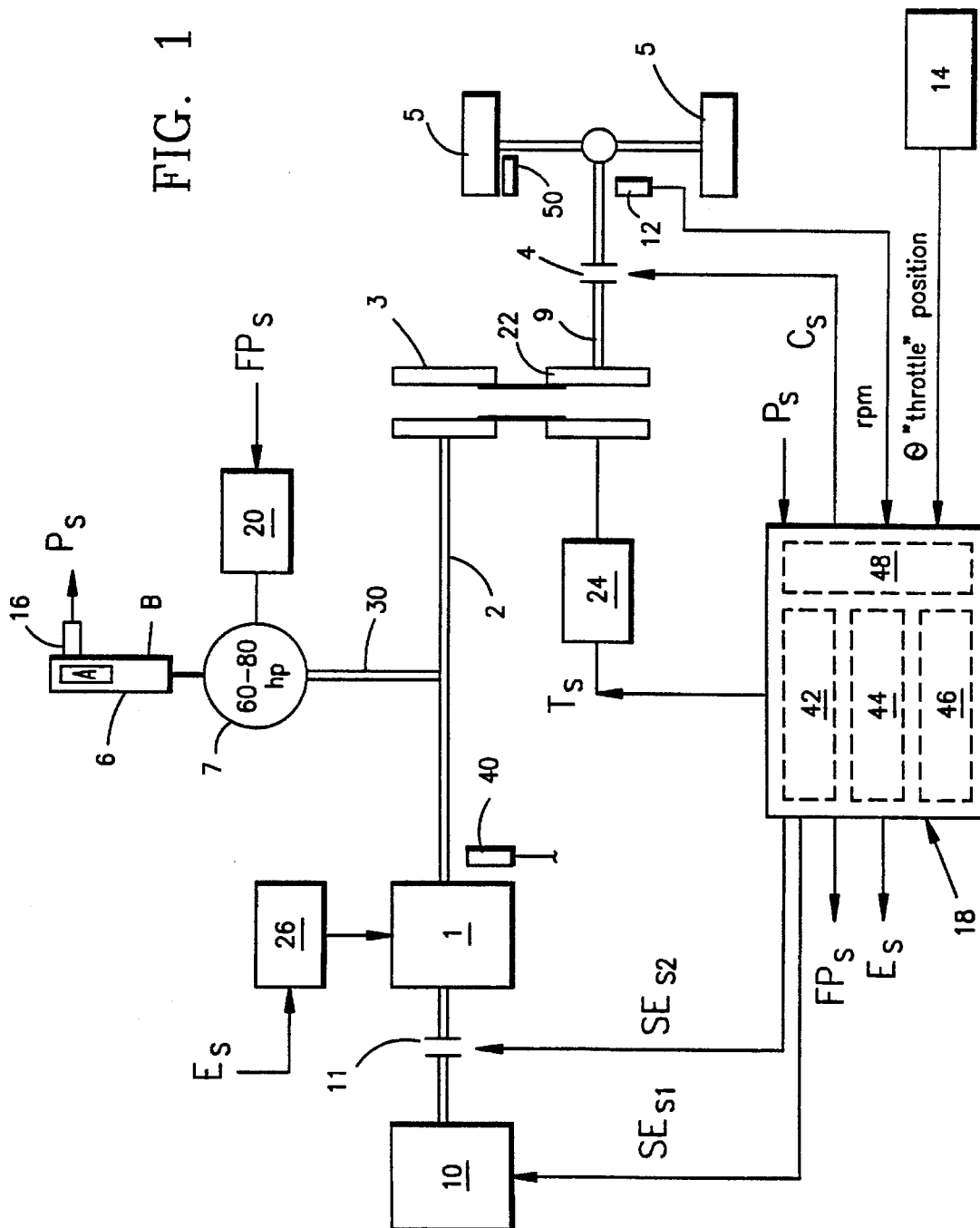


FIG. 1



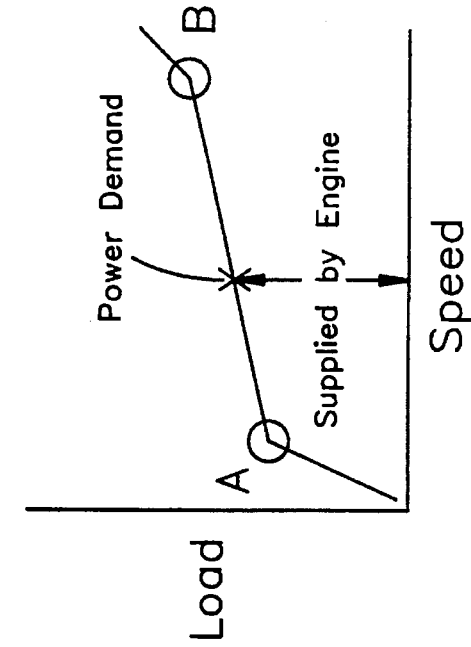


FIG. 2A

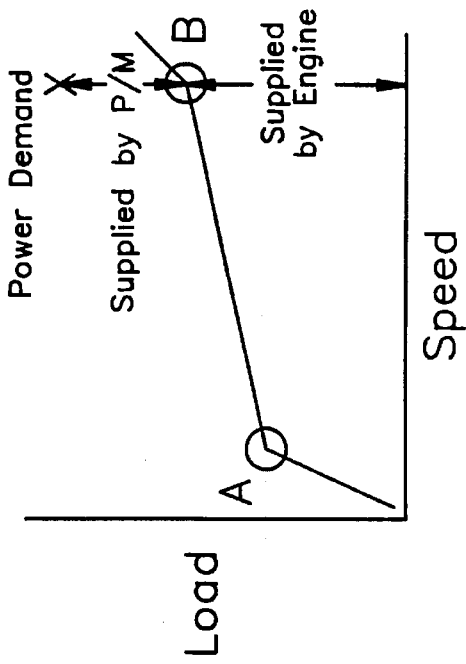


FIG. 2B

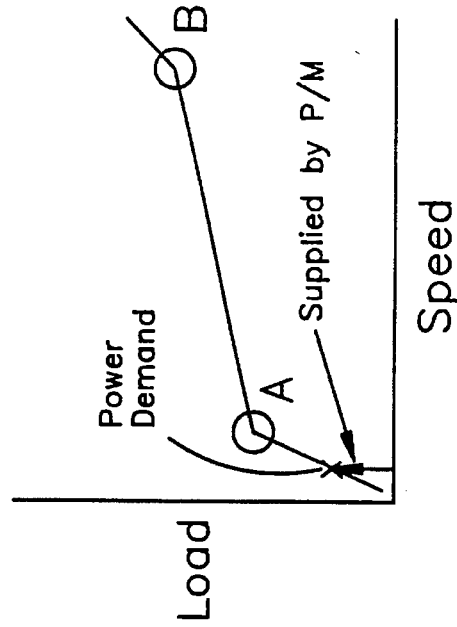


FIG. 2C

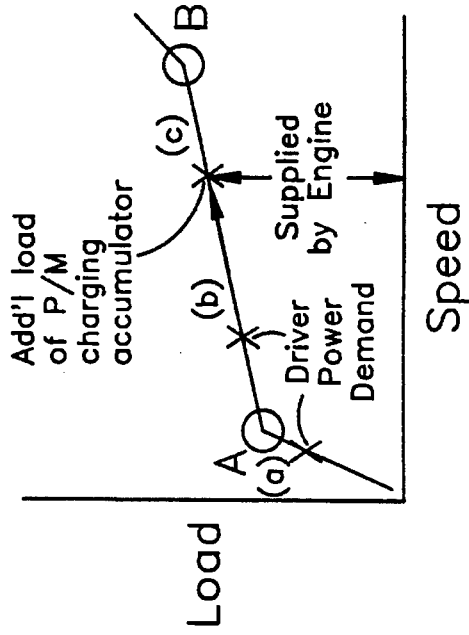


FIG. 2D

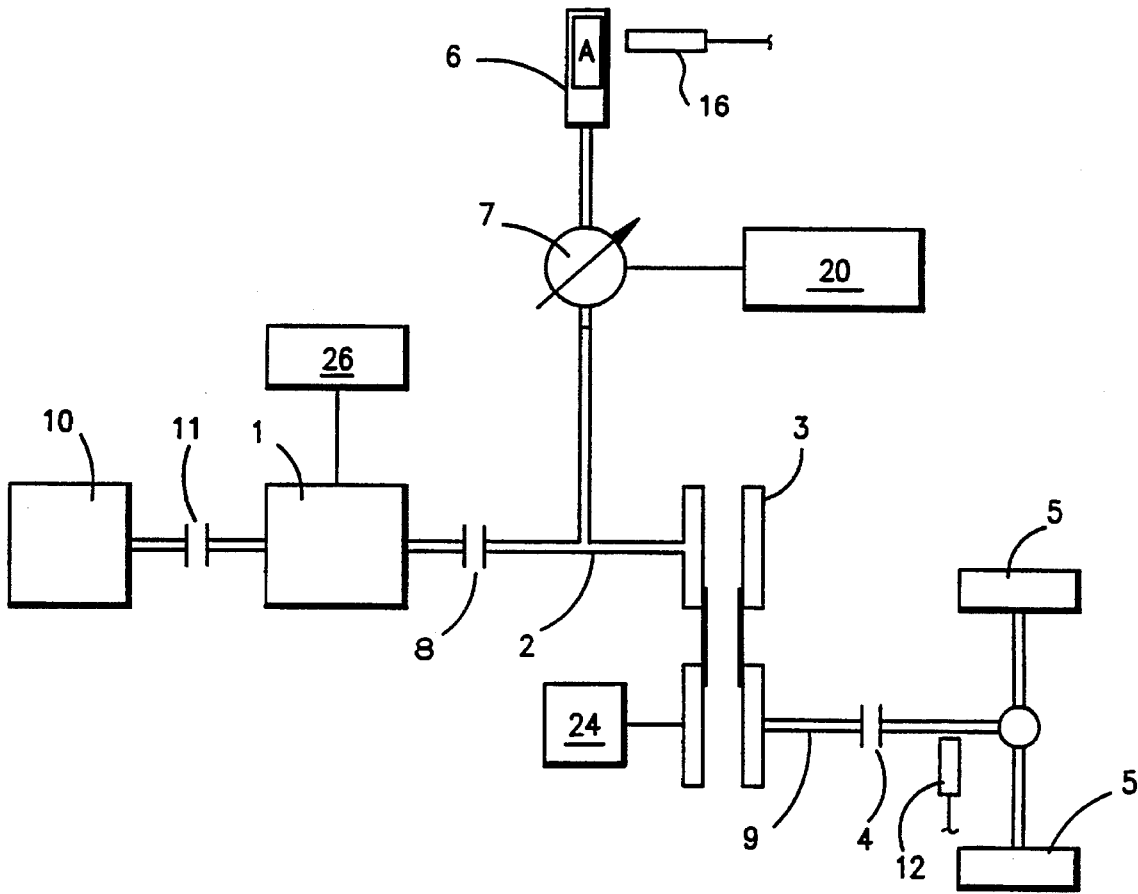


FIG. 3

FIG. 4

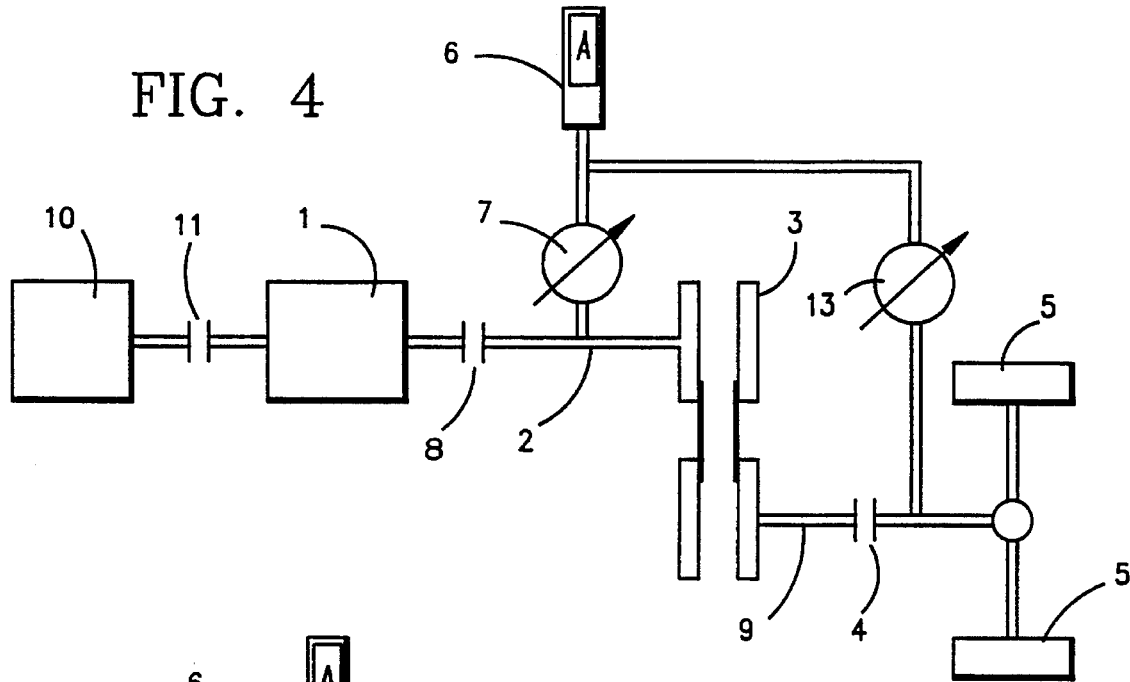
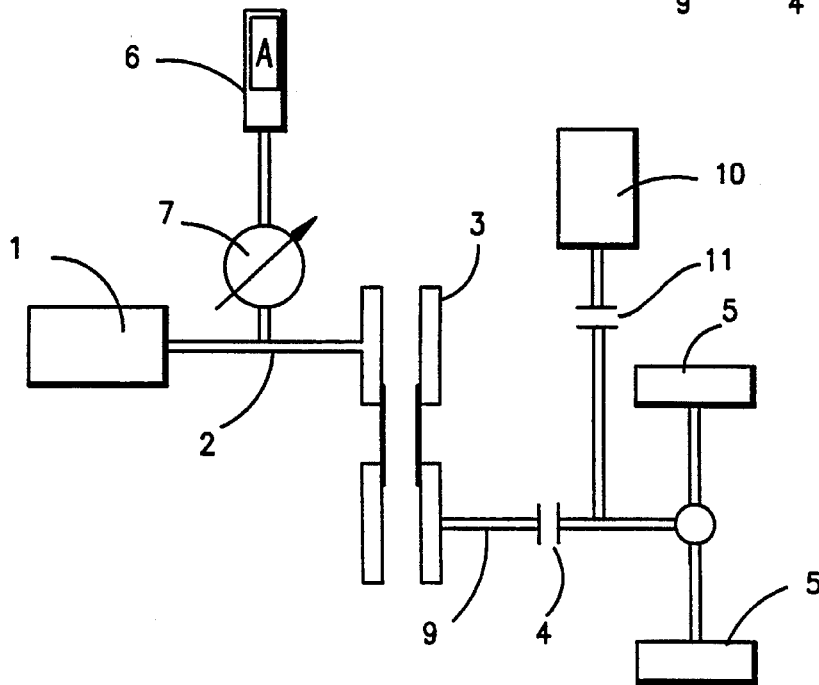


FIG. 5



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