



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

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- (54) **FUEL INJECTION SYSTEM METHOD AND APPARATUS USING OXYGEN SENSOR SIGNAL CONDITIONING TO MODIFY AIR/FUEL RATIO**
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- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(57) **ABSTRACT**

A method and apparatus for externally modifying the operation of a closed loop electronic fuel injection control system that is normally used with a standard oxygen sensor, which method and apparatus includes replacing the standard oxygen sensor with a wide band oxygen sensor. The signal from the wide band oxygen sensor is processed in a first signal-conditioning module and coupled to the input of the electronic fuel injection control system. The first signal-conditioning module simulates the appearance of a standard oxygen sensor to the electronic fuel injection control system. In a second embodiment, a method and apparatus for externally modifying the operation of a closed loop electronic fuel injection control system that is normally used with a wide band oxygen sensor, includes intercepting the signal from the wide band oxygen sensor in a second signal-conditioning module. The second signal-conditioning module receives a first current from the wide band oxygen sensor and provides a second current to the electronic fuel injection control system.

- (21) Appl. No.: **10/212,475**
- (22) Filed: **Aug. 5, 2002**
- (51) **Int. Cl.**⁷ **F02D 41/00**
- (52) **U.S. Cl.** **123/683; 123/687**
- (58) **Field of Search** 123/683, 687, 123/674, 672

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19 Claims, 6 Drawing Sheets

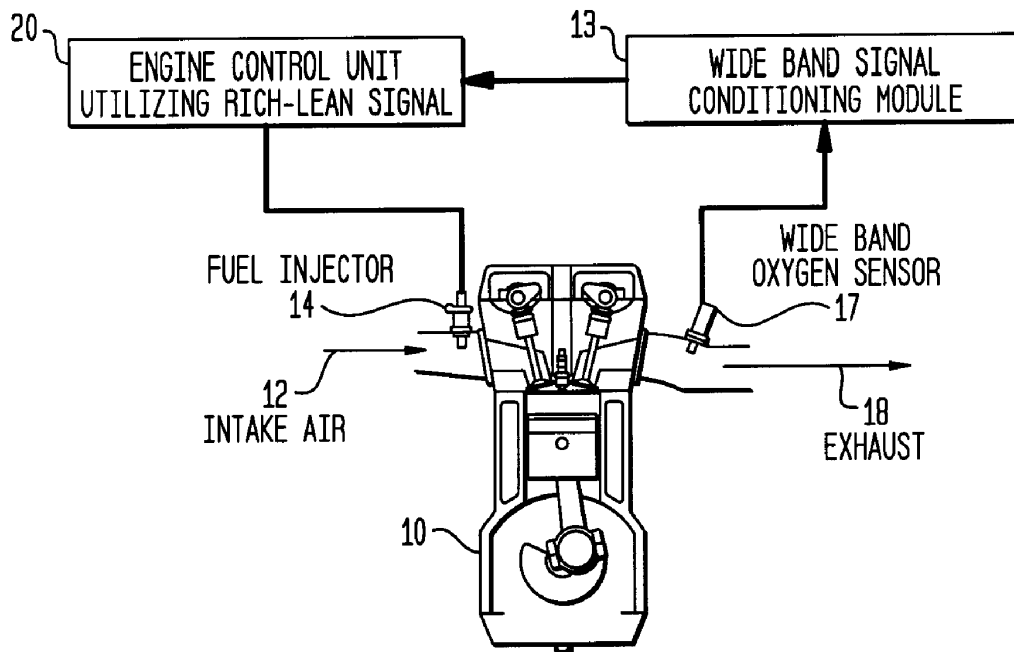


FIG. 1

(PRIOR ART)

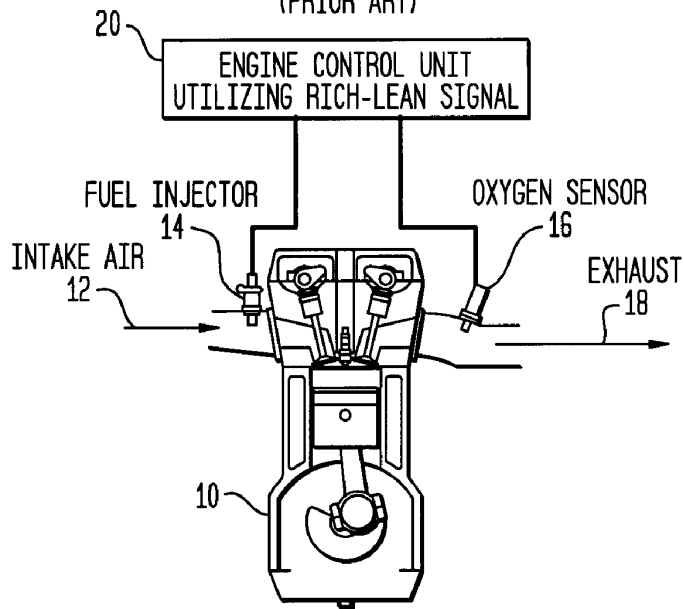


FIG. 1A

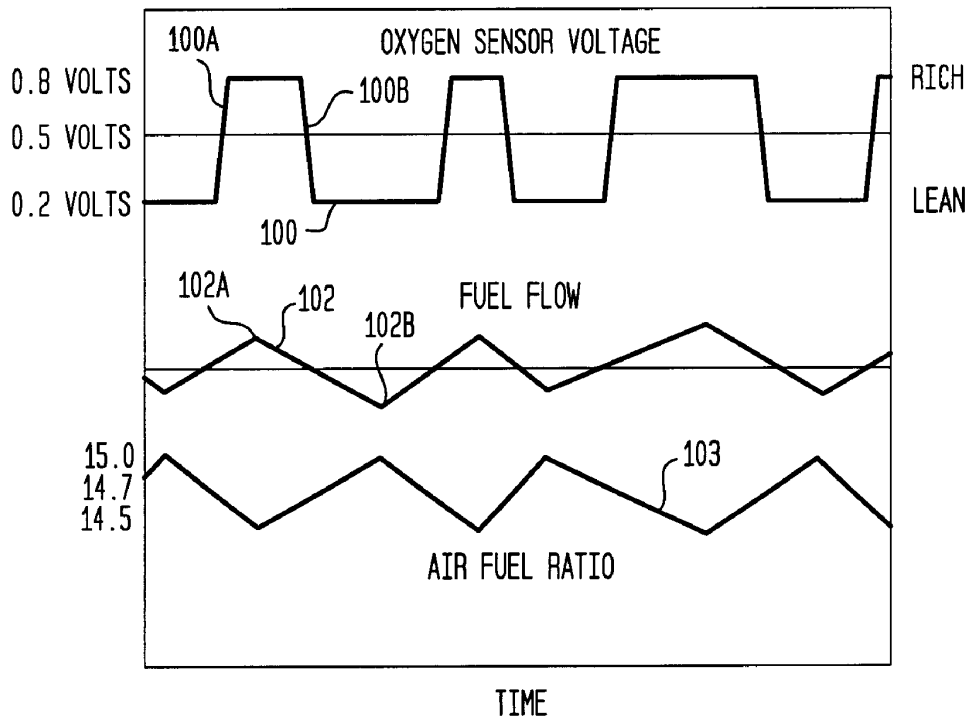


FIG. 2

(PRIOR ART)

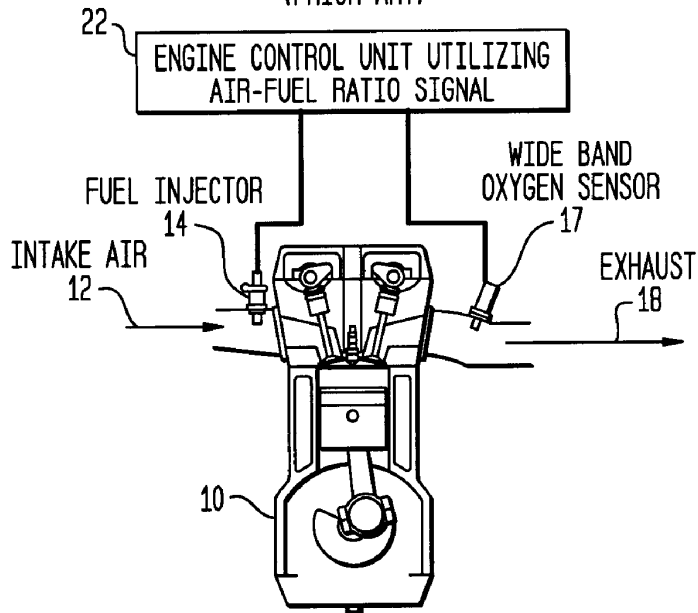


FIG. 2A

(PRIOR ART)

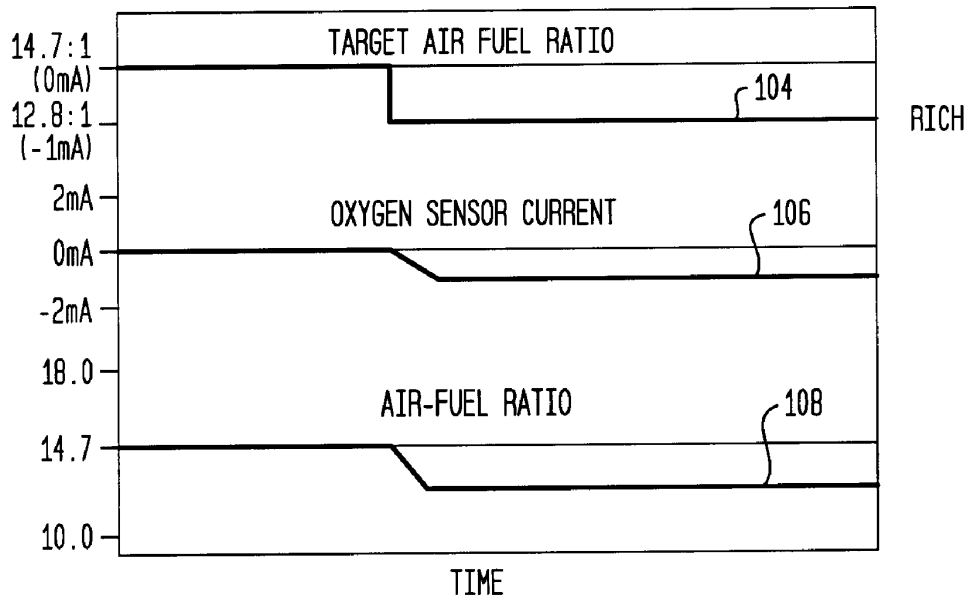


FIG. 3

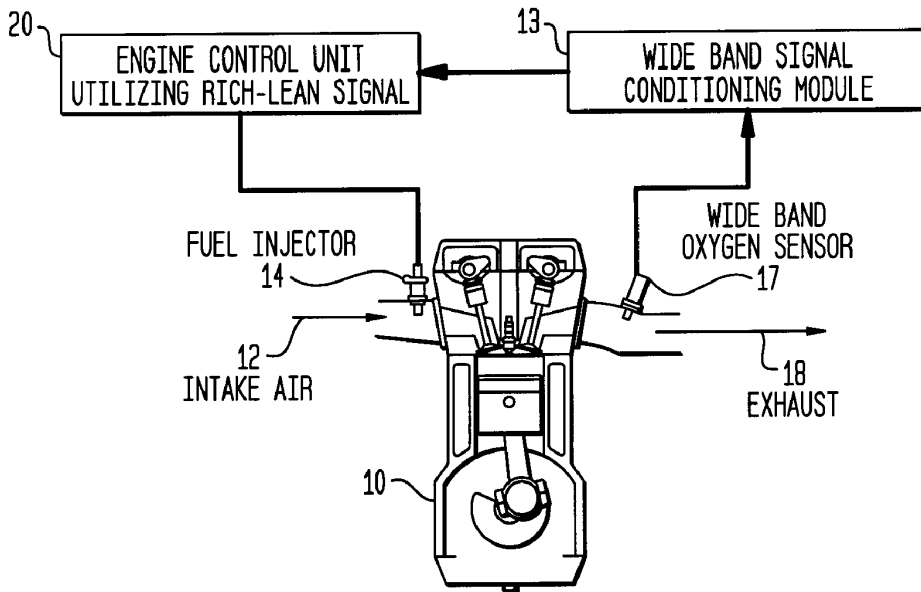


FIG. 3A

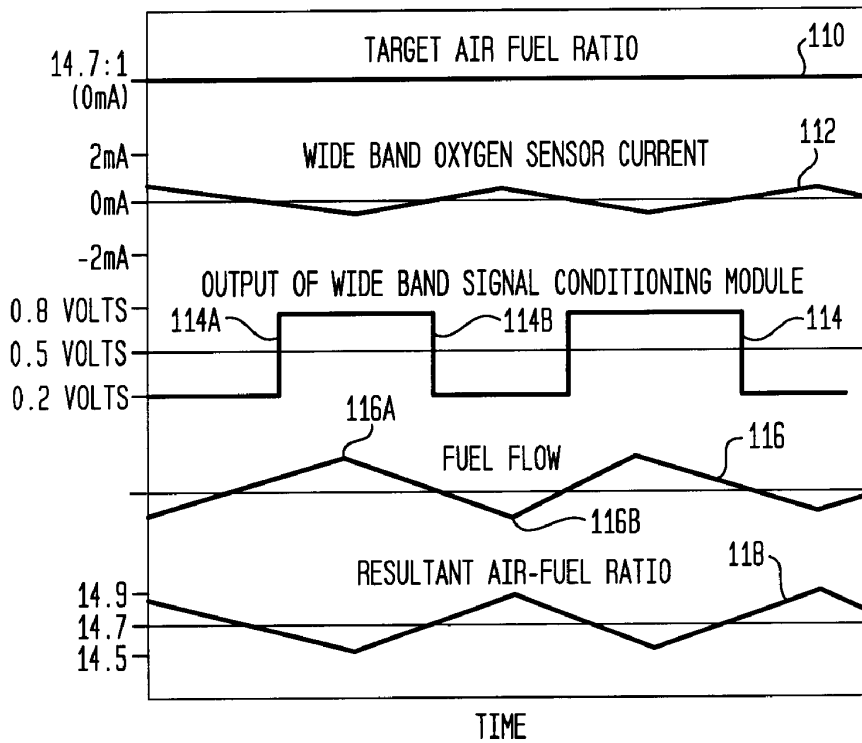
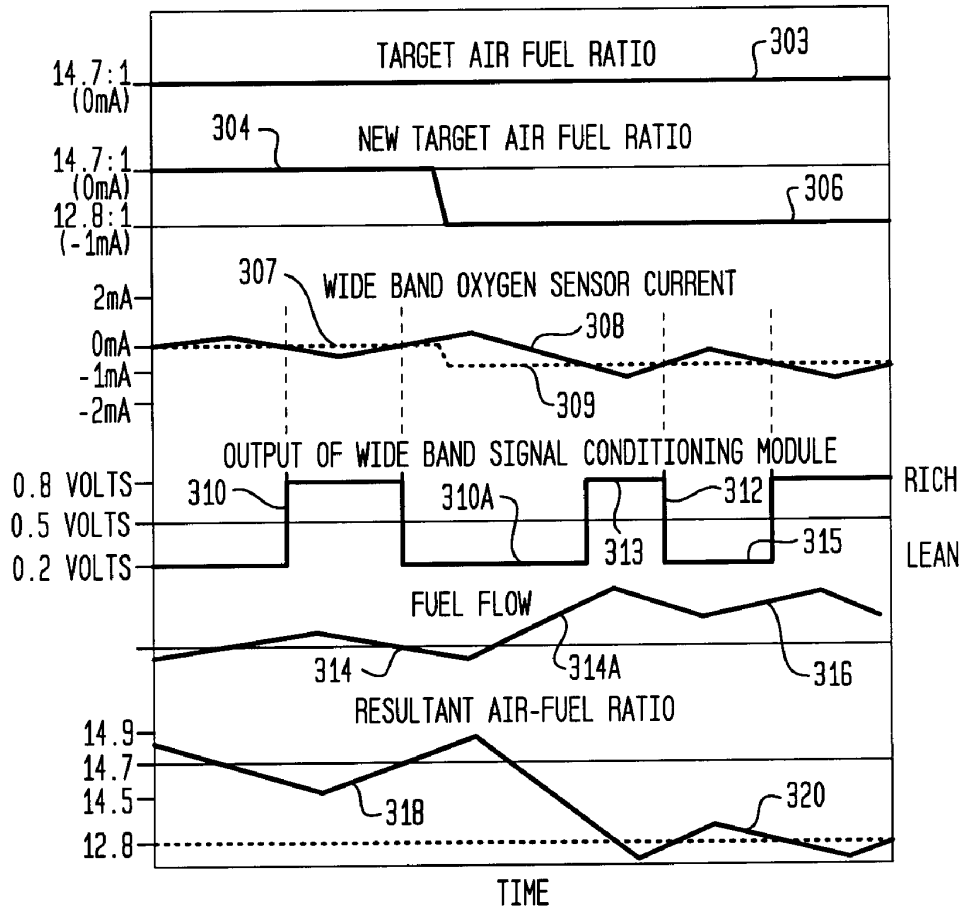


FIG. 3B



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