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Hibino et al.

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[54] **METHOD FOR INDICATING A VEHICLE OPERATION IN A FUEL ECONOMY RANGE FOR A VEHICLE WITH A MANUAL TRANSMISSION**

[75] Inventors: **Yoshitaka Hibino**, Utsunomiya; **Hiroshi Kogure**, Tokorozawa, both of Japan

[73] Assignee: **Honda Giken Kogyo Kabushiki Kaisha**, Tokyo, Japan

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[52] **U.S. Cl.** ..... **364/442**; 340/52 D; 364/424.1

[58] **Field of Search** ..... 364/424.1, 442; 434/71; 74/866; 340/52 D

[56] **References Cited**

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Primary Examiner—Felix D. Gruber
Attorney, Agent, or Firm—Pollock, VandeSande & Priddy

[57] **ABSTRACT**

A method for indicating a vehicle operation in a fuel economy range, for a vehicle with a manual transmission, indicates that the vehicle is operating in a fuel economy range when both of an up-shifting condition and a down-shifting condition are not satisfied. The method further detects a non-regular state of the vehicle operation and stops the indication of the vehicle operation under the fuel economy range when the non-regular state of the vehicle operation is detected even though both of the up-shifting and down-shifting conditions are not satisfied.

4 Claims, 3 Drawing Figures

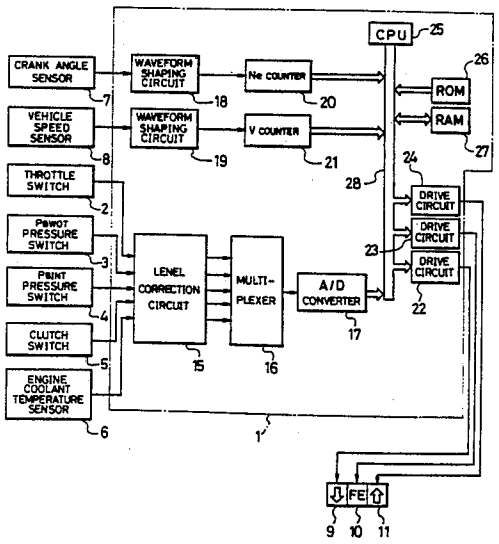


FIG.1

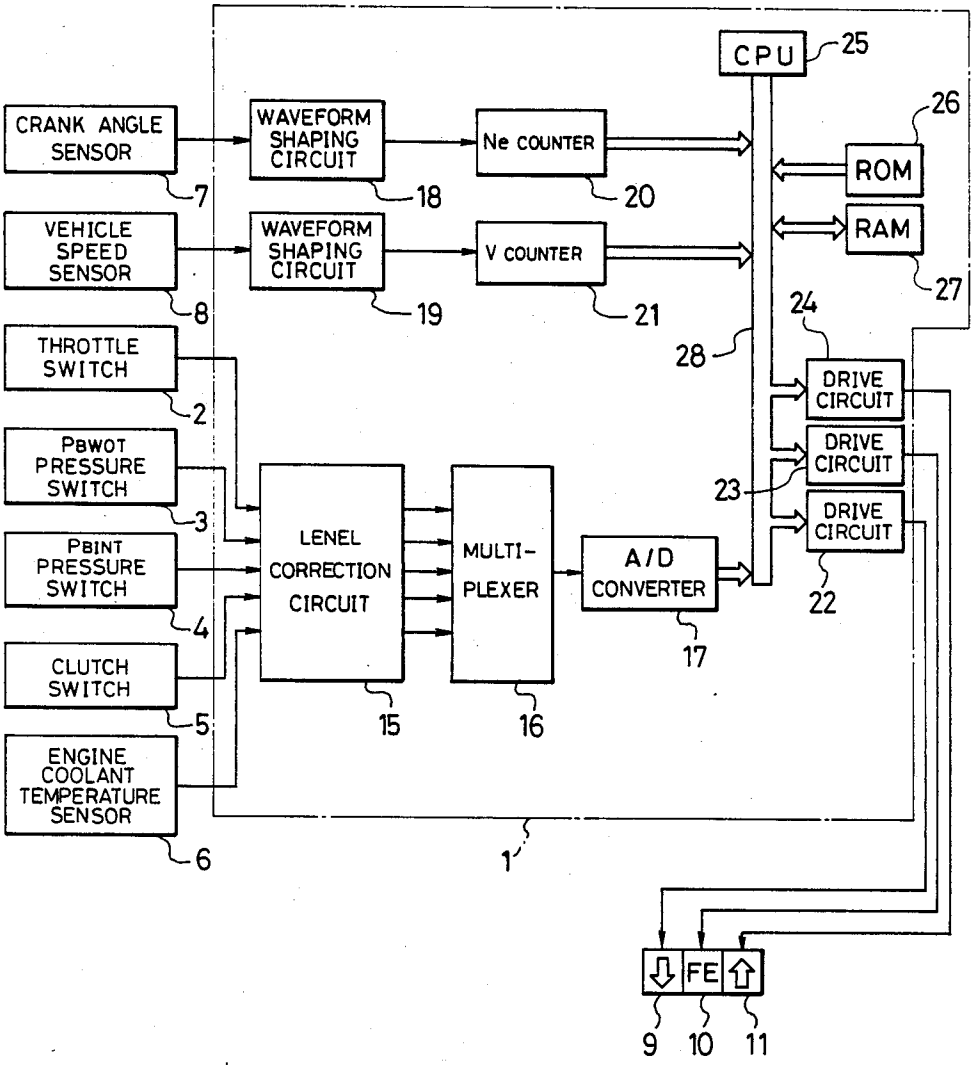


FIG. 2

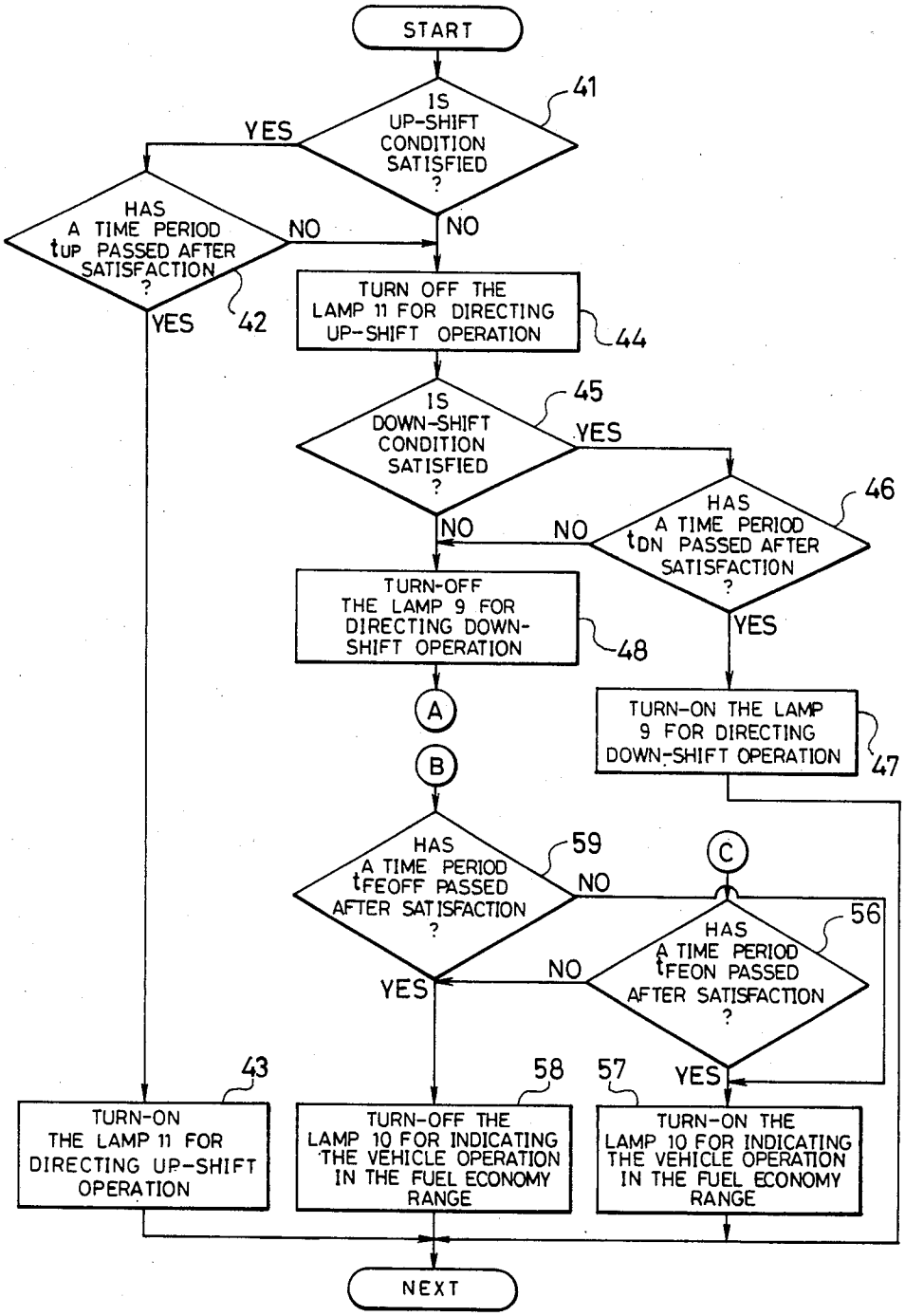
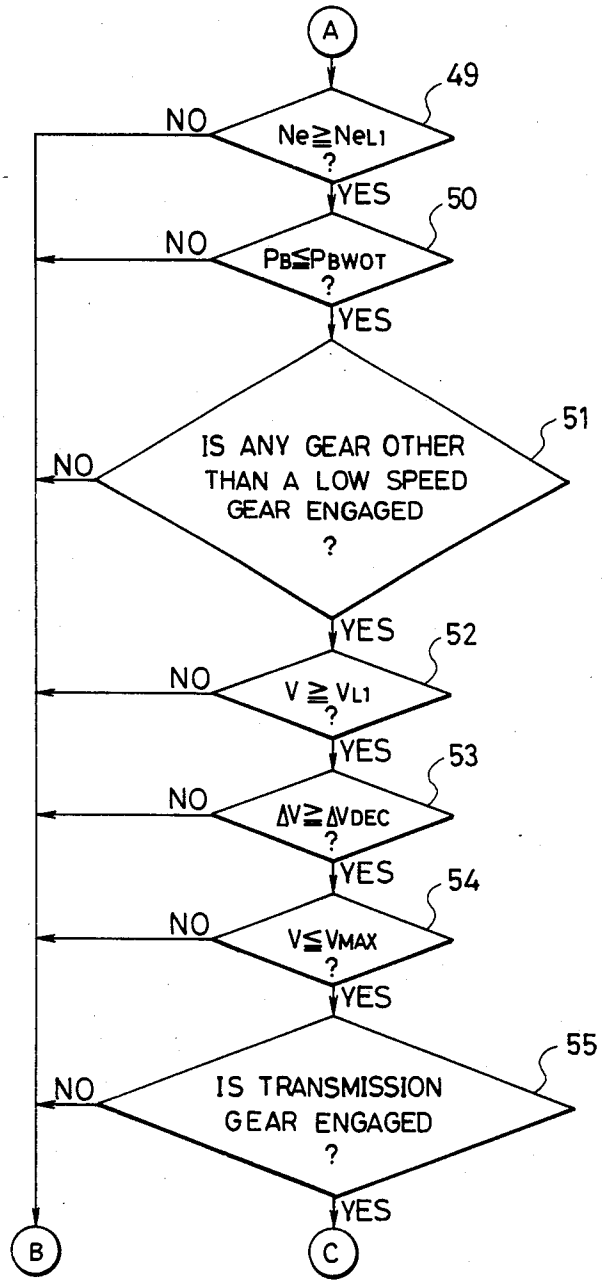


FIG. 3



METHOD FOR INDICATING A VEHICLE OPERATION IN A FUEL ECONOMY RANGE FOR A VEHICLE WITH A MANUAL TRANSMISSION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method for a vehicle having an engine and a manual transmission, for indicating that the vehicle, including its engine, is operating in a fuel economy range.

2. Description of Background Information

For vehicles having a manual transmission, various techniques for indicating an appropriate gear position have been proposed so as to promote fuel savings. For instance, Japanese patent application laid open No. 55-31669 discloses a technique in which the fuel economy range of the vehicle operation is derived as a state where both an up-shifting operation and a down-shifting operation are not required. When such a state is detected, an indication device such as an indication lamp is driven to show that the vehicle is operating in a fuel economy range.

However, in the case of this type of conventional technique, there has been a problem that the indication of the fuel economy range may sometimes become inappropriate. More specifically, the vehicle operation may become inappropriate, for example, due to a deterioration of the driveability even though it is indicated that the vehicle is operating in the fuel economy range. This is because the fuel economy range is simply derived as a state where both the up-shifting operation and the down-shifting operation are not required. Consequently, it is very likely that a driver may keep on driving the vehicle in a manner according to the indication of the fuel economy range in the indication device even though such manner of driving is not appropriate.

OBJECT AND SUMMARY OF THE INVENTION

An object of the present invention is therefore to provide a method for indicating a vehicle operation in a fuel economy range, in which inappropriate generation of an indication of a fuel economy running state, i.e. the indication that the vehicle is operating in the fuel economy range, is stopped so that the driver does not continue the inappropriate driving state.

According to the present invention, a method for indicating a vehicle operation in a fuel economy range is characterized in that the generation of the indication of the vehicle operation in a fuel economy range is stopped if predetermined non-regular running conditions are satisfied even under a state where the up-shift and down-shift conditions are not satisfied.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a system for indicating running conditions of the vehicle, in which the method for indicating the vehicle operation in a fuel economy range according to the present invention is suitably applied; and

FIGS. 2 and 3, when combined, are a flow chart showing steps of an embodiment of the method for indicating the vehicle operation in the fuel economy range according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is first made to FIG. 1, showing a device for indicating running states of the vehicle in which the method for indicating a vehicle operation in a fuel economy range according to the present invention is applied. This running states indication device includes a control circuit 1 which comprises a microcomputer. The control circuit 1 receives various sensor output signals, from a throttle switch 2, pressure switches 3 and 4, a clutch switch 5, an engine coolant temperature sensor 6, a crank angle sensor 7, and a vehicle speed sensor 8. Lamps 9 through 11 are also connected to the control circuit 1. The throttle switch 2 is adapted to turn on when a throttle valve of an internal combustion engine is closed. The pressure switch 3 turns on when a pressure P_B in an intake manifold downstream of the throttle valve is equal to or greater than a predetermined level P_{BWOT} (−85 mmHg for example), and the pressure switch 4 turns on when the pressure P_B in the intake manifold downstream of the throttle valve is equal to or greater than another predetermined level P_{BINT} (−370 mmHg for example) which is smaller than P_{BWOT}. The clutch switch 5 turns on when a clutch is disengaged to interrupt the transmission of engine power. These switches 2 through 5 produce a predetermined voltage when activated. The engine coolant temperature sensor 6 produces an output signal whose level varies with the temperature of the engine coolant. The crank angle sensor 7 generates an angular position signal whose period is inversely proportional to the rotational speed of the engine crankshaft. Similarly, the vehicle speed sensor 8 produces an angular position signal whose period is inversely proportional to the rotational speed of an output shaft of the manual transmission. The lamp 9 is provided to indicate that the vehicle is running under a state in which a down-shift of the manual transmission is required. On the other hand, the lamp 10 indicates that the vehicle is running under the fuel saving condition. In addition, the lamp 11 indicates that the vehicle is running under a state in which an up-shift of the manual transmission is required.

The control circuit 1 includes a level correction circuit 15 for correcting levels of signals from the throttle switch 2, the pressure switches 3 and 4, the clutch switch 5, and the engine coolant temperature sensor 6. Output signals of the level correction circuit 15 are then supplied to a multiplexer 16 which selectively transmits one of output signals of the switches 2 through 5 and the sensor 6 supplied through the level correction circuit 15. An analog output signal of the multiplexer 16 is in turn supplied to an A/D (analog to digital) converter 17 for converting the analog signal from the mutiplexer 16 to a digital signal. The control circuit 1 further includes waveform shaping circuits 18 and 19 respectively for shaping the waveform of the angular position signals from the crank angle sensor 7 and the vehicle speed sensor 8 to square wave pulse signals. An output pulse signal of the waveform shaping circuit 18 is in turn supplied to an N_e counter 20 where the intervals of pulses of the output signal of the waveform shaping circuit 18 are measured by counting the number of predetermined clock pulses for each interval and producing a digital signal indicative of a value inversely proportional to the rotational speed of the engine. On the other hand, an output signal of the waveform shaping circuit 19 is supplied to a V counter 21 which mea-

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