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Smith, Jr.

[11] **4,398,174**

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[54] **FUEL CONSUMPTION SIGNALLING SYSTEM**

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Related U.S. Application Data

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[51] **Int. Cl.**[3] **F01D 21/02;** B60Q 1/00

[52] **U.S. Cl.** ..... **340/53;** 180/171; 180/282; 340/52 D; 340/60; 340/669

[58] **Field of Search** ..... 340/52 R, 52 D, 53, 340/60, 669; 180/170, 171, 174, 282

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,666,197	9/1949	Polymeros .	
2,683,782	8/1952	Corssen .	
2,692,980	3/1952	Platt .	
2,738,404	11/1952	Fitzsimmons .	
2,834,953	3/1975	Bechberger et al. .	
2,870,753	7/1954	Shuck et al. .	
3,647,016	8/1969	Fitzsimmons et al. .	
3,909,778	9/1975	Maria et al.	340/52 R
3,925,753	2/1975	Auman et al. .	
3,938,074	2/1976	Fox	340/52 R
4,025,897	5/1977	Kisuna et al.	340/52 D
4,065,961	1/1977	Crew	340/60
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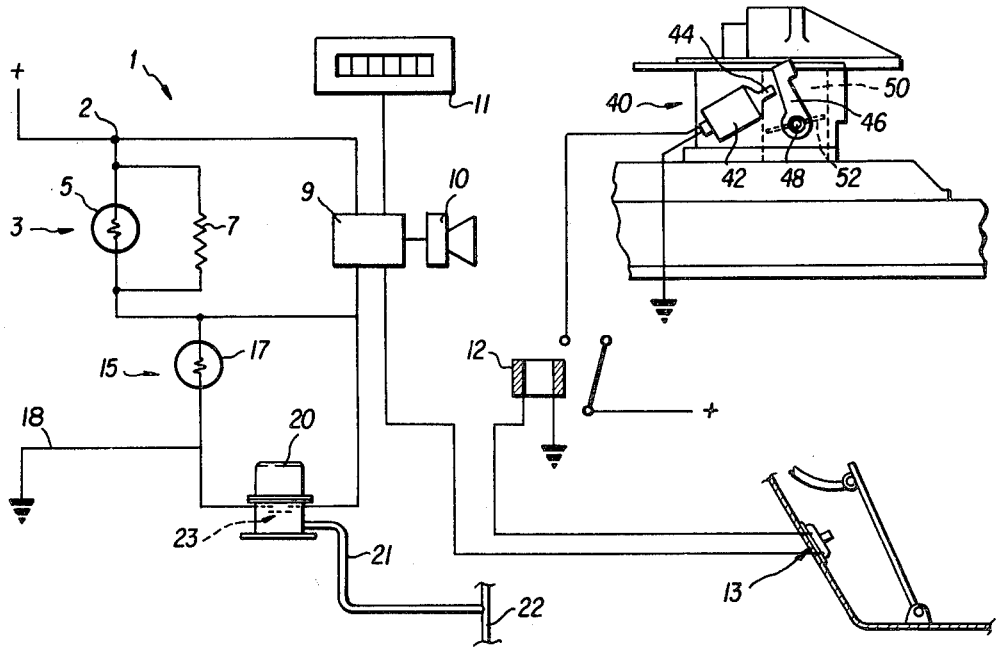
Attorney, Agent, or Firm—Irons and Sears

[57] **ABSTRACT**

A fuel consumption signalling system for signalling both efficient and inefficient fuel consumption conditions in the engine of a motor vehicle is herein disclosed. The system comprises an alarm circuit connected in series with an indicator circuit including an indicator light connected in parallel with a vacuum operated switch pneumatically connected to the engine manifold. An electric potential sufficient to actuate the alarm circuit, but insufficient to actuate both the indicator light and the alarm circuit is applied across the series connected indicator and alarm circuits. When the engine is consuming fuel efficiently, the vacuum switch is open, and the electric potential is divided between the indicator circuit and the alarm circuit. The divided potential is sufficient to illuminate the indicator light, but insufficient to actuate the alarm circuit. However, when the engine consumes fuel inefficiently, the vacuum switch closes, shunting the entire electric potential across the alarm circuit, thereby actuating it. The signalling system may also include an automatic throttle plate control.

14 Claims, 4 Drawing Figures



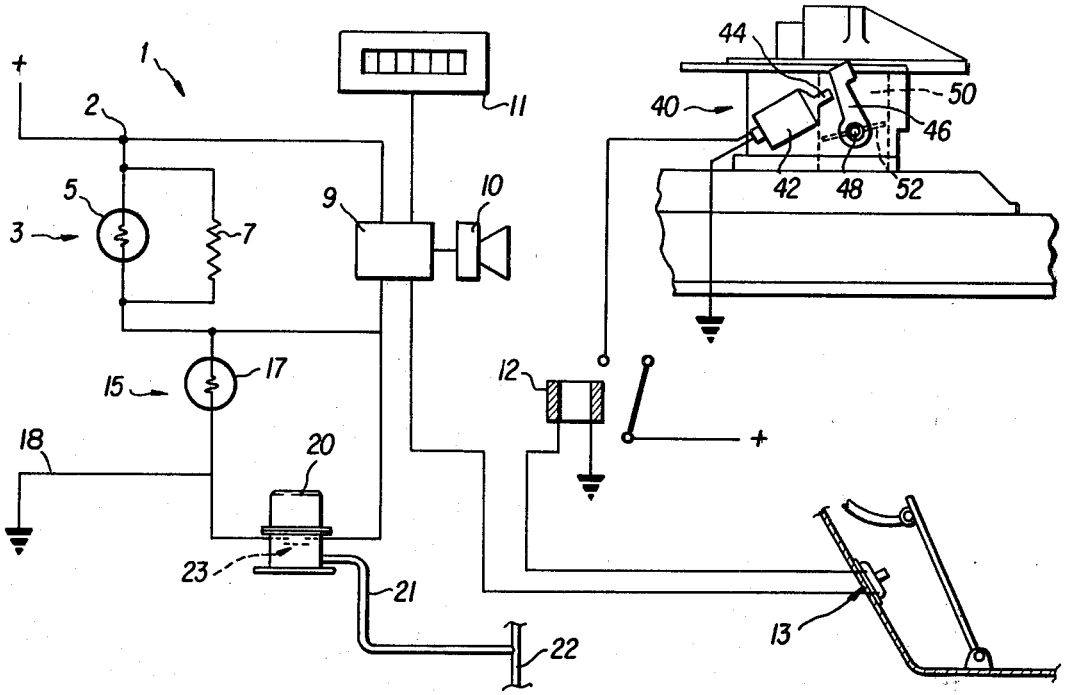


FIG. 1

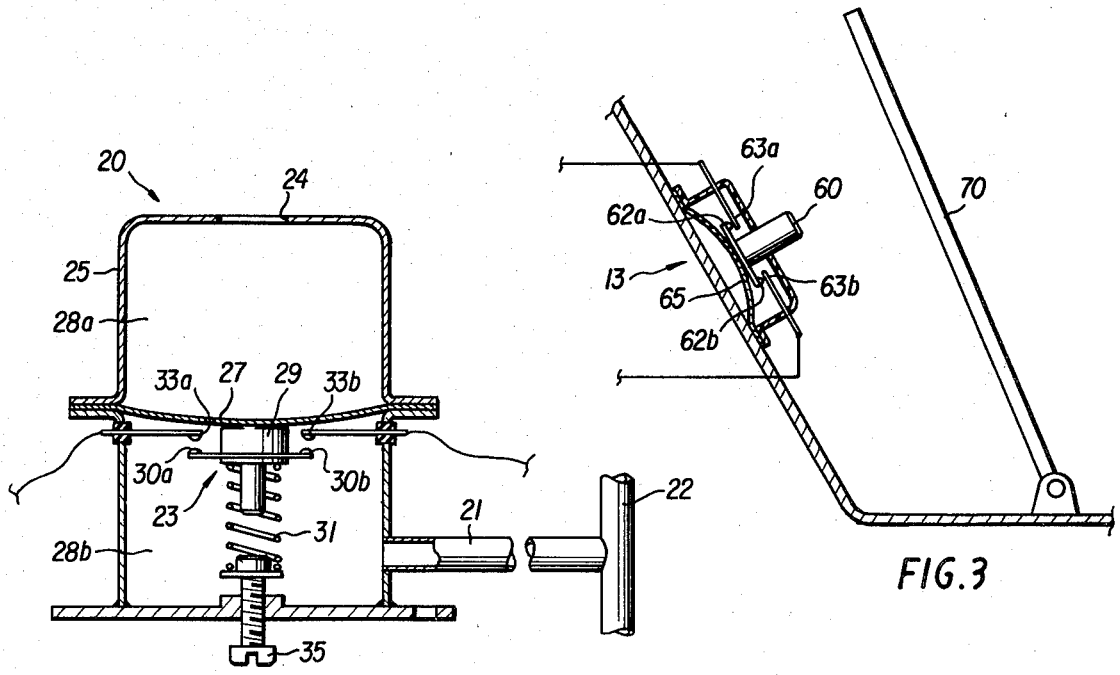


FIG. 2

FIG. 3

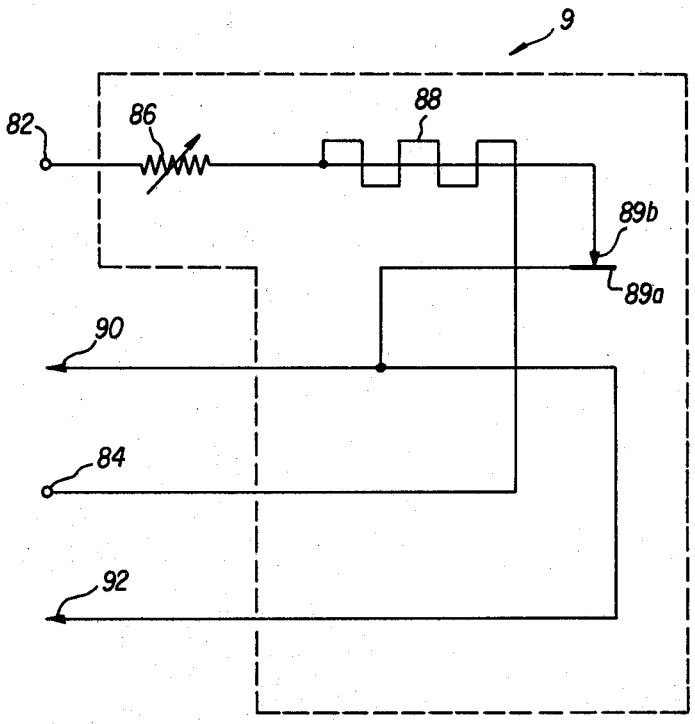


FIG. 4

FUEL CONSUMPTION SIGNALLING SYSTEM

This is a continuation, of application Ser. No. 027,614, filed Apr. 5, 1979.

BACKGROUND OF THE INVENTION

In recent years, the rising cost of fuel has sharply increased the need for more efficient consumption of fuel. One well known, but little used method of efficient fuel consumption in a motor vehicle lies in the conscientious use of fuel saving driving techniques. In fact, a 1978 United States government publication entitled "Driver Aid and Education Test Project" (DOE/CS-0043) and prepared for the U.S. Department of Energy states, on page 1, that it is ". . . not unusual to find a variation of 30 to 50 percent in fuel economy among a group of non-professional drivers operating under identical and controlled test conditions . . . ", the difference being attributable solely to individual driving techniques. Thus, it is clear that significant amounts of fuel could be saved by the widespread adoption of fuel efficient driving techniques by the motor vehicle operators of this country.

To encourage the use of such efficient driving techniques, a variety of fuel consumption gauges and indicators have been provided by the prior art. Such prior art fuel consumption gauges have typically utilized a vacuum operated sensor to monitor the manifold pressure of the engine, as the manifold pressure is one of the best over all indicators of efficient fuel use. A high vacuum pressure in the engine manifold indicates that the fuel is being burned in a fuel to air ratio which results in complete, and hence efficient, combustion. By contrast, a low vacuum pressure in the manifold indicates that the fuel is being burned in an overly rich fuel to air ratio which results in incomplete, and hence inefficient, combustion. In operation, the vacuum operated sensor of typical prior art devices senses whether the pressure of the engine manifold is in a high or low vacuum state, and transmits this information to an indicator which in turn indicates to the driver whether or not the motor vehicle is being driven in a fuel efficient fashion.

Unfortunately, each of the prior art fuel consumption indicators has, thus far, been attended by a variety of technical drawbacks which in turn has discouraged its general use among the motor vehicle operators of this country. For example, Polymeros U.S. Pat. No. 2,666,197 discloses a vacuum operated signal device having a vacuum operated switch adapted to be mounted on the instrument panel of an automobile. However, the single pilot light of Polymeros' invention only gives a visual indication of an inefficient fuel consumption condition in the engine which is easily overlooked by a driver observing the road. Further, the suggested location of the single pilot light of this invention between other lights and indicators on the instrument panel of the automobile makes installation difficult, and renders the single pilot light less perceptible to the driver than if the signal light were mounted away from the other lights and dials of the instrument panel. Finally, because the pilot light is actuated only during a fuel wastage condition in the engine, it is difficult to tell at any given time whether or not the invention is operative.

While Corsseu U.S. Pat. No. 2,683,782, Shuck U.S. Pat. No. 2,870,753, and Platt U.S. Pat. No. 2,692,980 each disclose manifold pressure indicators utilizing two

separate signalling devices for signalling both efficient and inefficient fuel consumption conditions in an internal combustion engine, they suffer from the drawback of utilizing relatively intricate and expensive single pole, double throw or double pole vacuum operated switches. Additionally, each of these devices utilizes only a pilot light for indicating an inefficient fuel consumption condition which again can be easily overlooked by an operator with his full attention on the road.

Finally, although the manifold pressure indicator disclosed in Australian Pat. No. 114,535 suggests the use of an audio signal to signal an inefficient fuel condition, this device, like the Polymeros invention, is capable of signalling only an inefficient fuel consumption condition. Additionally, no suggestion is made as to how to conveniently mount this device in the cockpit of a conventional motor vehicle.

Clearly the need exists for a conveniently installable, simple, effective and inexpensive fuel consumption signalling system which has at least two separate signalling devices for positively signalling both efficient and inefficient fuel consumption conditions.

SUMMARY OF THE INVENTION

The invention relates to a fuel consumption signalling system which is conveniently installable within a conventional motor vehicle and which has two separate signalling devices for signalling both efficient and inefficient fuel consumption conditions in the engine of a motor vehicle without any of the drawbacks associated with prior art devices of this type. Basically, the signalling system comprises an alarm circuit for indicating an inefficient fuel consumption condition which is connected in series with an indicator circuit for indicating an efficient fuel consumption condition. The alarm circuit includes an alarm light, a resistor, and a time delay circuit having an audio alarm generator, each of which is connected to the other in parallel. The indicator circuit includes an indicator light and a normally open vacuum operated switch connected together in parallel. The vacuum operated switch is pneumatically connected to the engine manifold of the motor vehicle. A source of electrical potential sufficient enough to actuate the alarm circuit, but insufficient to actuate both the alarm circuit and the indicator light of the indicator circuit is applied across the series connected alarm and indicator circuits.

In operation, the vacuum operated switch closes when the manifold pressure attains a value indicative of inefficient fuel consumption, thereby shunting the entire electrical potential around the indicator light and across the alarm circuit. Thus, the indicator light is extinguished and the alarm circuit is actuated, perceptibly illuminating the alarm light and triggering the time delay circuit. If the inefficient fuel consumption condition lasts beyond a preset amount of time, the time delay circuit then actuates an audio alarm generator.

Both the series circuit and the vacuum operated switch are mounted in a box-like housing which is conveniently installable either above or below the instrument panel of a conventional motor vehicle by means of simple brackets.

Thus, the invention provides an easily installable, simple, effective and inexpensive fuel consumption signalling device having two separate indicators for positively signalling both efficient and inefficient fuel consumption conditions in an engine. The use of a simple,

single pole, vacuum operated switch in a dual signalling system instead of the intricate and more expensive multipole vacuum switches frequently associated with the prior art devices significantly reduces costs while increasing reliability. More particularly, the use of a simple, single pole vacuum switch in combination with an indicator light which serves the dual function of indicating a fuel efficient condition while providing a voltage divider along the series circuit constitutes a significant improvement over the prior art, providing maximum performance with a minimum of parts.

Finally, the use of a time delay circuit between the alarm circuit and the audio signal generator prevents the audio alarm from being prematurely actuated during necessary periods of inefficient fuel usage, such as those which occur during the emergency handling of the motor vehicle.

The fuel consumption signalling system may also include an automatic throttle control for automatically eliminating inefficient fuel consumption condition. The automatic throttle control basically comprises a lever connected to the carburetor throttle blade rod of the motor vehicle engine, and a solenoid having an extensible plunger for limiting the movement of this lever. The solenoid is actuated by a relay connected to the time delay circuit of the alarm circuit, so that the throttle control, like the audio alarm generator, becomes actuated only if the inefficient fuel consumption condition lasts beyond a preset amount of time.

The system also includes a means for overriding the throttle control including a microswitch mounted under the gas pedal for breaking the connection between the relay and the time delay circuit when the gas pedal is pressed to the floor of the motor vehicle.

Additionally, an electronic counter may be connected to the time delay circuit of the alarm circuit for counting and displaying the number of times a gas wastage condition occured which lasted beyond the present delay period of the time delay circuit.

BRIEF DESCRIPTION OF THE SEVERAL DRAWINGS

FIG. **1** is an electromechanical diagram of the circuit of the fuel consumption signalling system installed in a conventional motor vehicle;

FIG. **2** illustrates a cross sectional side view of the vacuum operated switch of the fuel consumption signalling system;

FIG. **3** illustrates a cross sectional side view of the microswitch of the throttle control override means as it would appear mounted in a conventional motor vehicle; and

FIG. **4** is a schematic of the time delay circuit of the invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. **1**, the system **1** basically comprises an alarm circuit **3** connected in series with an indicator circuit.

The alarm circuit includes an alarm light **5**, a resistor **7** and a time delay circuit **9** including an audio alarm generator **10**, each of which is connected to the other in parallel as indicated. In the preferred embodiment, alarm light **5** comprises a red GE #18 miniature lamp having an electrical resistance of approximately 30 ohms, resistor **7** has a resistance of approximately 75 ohms, and time delay circuit **9** has a resistance of over 300 ohms, such that the entire alarm circuit has a resistance of about 20 ohms. Time delay circuit **9** serves as a time delay switch delaying the actuation of the audio alarm generator **10**, the counter **11** and the throttle plate control **40** for a period of about three seconds to allow for short, necessary periods of fuel wastage, such as might occur in emergency handling situations. Additionally, time delay circuit **9** is preferably adjustable so that drivers driving in hilly terrain or other conditions which regularly demand unusually long periods of gas wastage may adjust the time delay for a period over three seconds. Time delay circuit **9** is described more particularly hereafter. A variety of prior art audio signal generators may comprise the audio signal generator **10** of the invention, such as the Mallory "Son Alert" (part number SC 628) or Edwards "Lumatone" (part number E 101). Finally, a number of prior art electric counters and display devices may likewise comprise the counter **11** of the invention, such as AMP thumbwheel switch number 0.300 (7.62), which is connected to the time delay circuit **9** and counts and displays the number of fuel wastage occasions lasting longer than the time delay of the time delay circuit **9**.

The indicator circuit **15** includes an indicator light **17** connected in parallel to a normally open, vacuum operated switch **20**. In the preferred embodiment, indicator light **17** is a green, GE #73 light bulb having a resistance of approximately 30 ohms.

A 12 volt source of potential difference is connected at points **12** and **18** of the series circuit, as shown. In the preferred embodiment this source of potential difference comprises the ignition system of the vehicle, rather than the car battery, so that the system will automatically turn on and off with the engine of the vehicle.

With reference now to FIG. **2**, the normally open vacuum operated switch **20** of the system **1** includes a housing divided into two noncommunicating pneumatic chambers **28***a*, **28***b* by a resilient diaphram **27** as shown. The upper surface of diaphragm **27** is placed in pneumatic communication with the ambient atmosphere by aperture **24**. The bottom surface of diaphragm **27** is placed in pneumatic communication with the engine manifold (not shown) by means of a vacuum line **21** terminating in a "T" joint which is preferably conveniently connected to the pneumatic circuit powering the intake manifold of the vehicle, although any point will do. A plunger member **29** having a pair of bimetallic electrical contacts **30***a, b* is biased against the lower surface of diaphragm **27** by means of coil spring **31**. A complementary pair of contacts **33***a, b* connected in parallel with indicator light **17** is placed above the contacts **30***a, b*. Adjustment screw **35** balances the spring biasing force exerted on the underside of diaphragm **27** against the pneumatic force exerted on the top surface of diaphragm **27** by the atmosphere. More particularly, the adjustment screw **35** balances the spring and the pneumatic forces so that the contacts **30***a, b* and **33***a, b* remain out of conductive engagement when a fuel efficient, high vacuum is present in the manifold, but come together in conductive engagement when a fuel wasting low vacuum is present in the manifold. For a V-8 engine, adjustment screw **35** is adjusted so that the contacts **30***a, b* and **33***a, b* do not come into conducting engagement until the manifold pressure falls to about seven inches of mercury. For six and four cylinder cars, the screw is adjusted to a setting corresponding to about six and three and a half inches of mercury, respectively.

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