Aug. 12, 1969 E. W. DOWNING ETAL 3,460,521

ELECTRICAL SPEED CONTROL FOR AN INTERNAL COMBUSTION ENGINE

Filed March 29, 1967

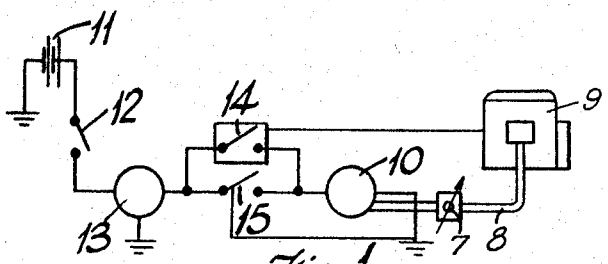


Fig. 1.

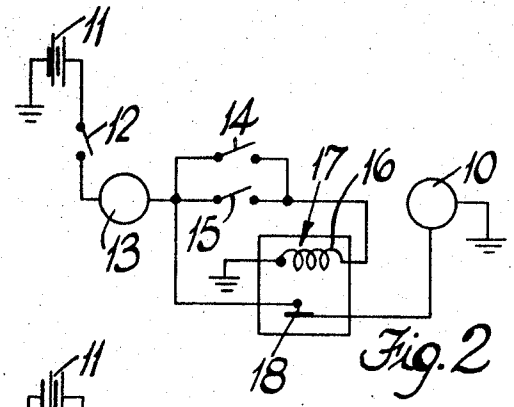


Fig. 2

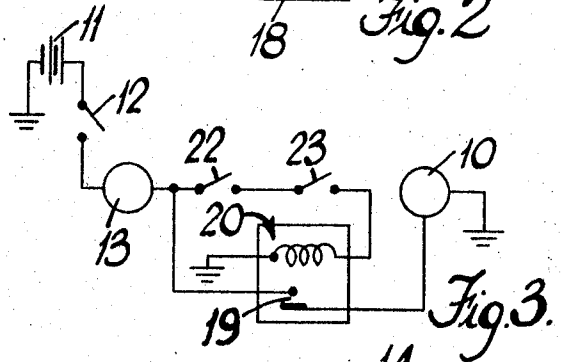


Fig. 3.

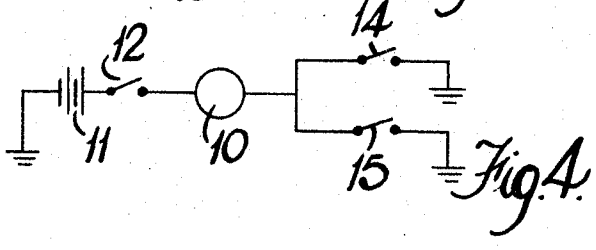


Fig. 4.

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ELECTRICAL SPEED CONTROL FOR AN INTERNAL COMBUSTION ENGINE

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Int. Cl. F02d 5/00, 9/08
U.S. Cl. 123—102 2 Claims

ABSTRACT OF THE DISCLOSURE

An electrical control circuit for use with a fuel injection system for an internal combustion engine comprises a pump or a relay for operation of a pump, and a pair of switches one responsive to engine speed and the other operable with throttle closure, the switches being so connected that the pump or relay is de-energized to interrupt fuel supply to the engine when the speed of the engine is above a predetermined value but the throttle is shut.

This invention relates to fuel injection systems for internal combustion engines and of the kind wherein liquid fuel (usually petrol) is injected into the inlet manifold of the engine adjacent the inlet valves thereof.

The object of the invention is to provide in, or for such systems means whereby the supply of fuel to the engine is automatically cut off when the throttle is closed and the engine is operating at a speed above a predetermined value.

According to the invention an electrical control circuit for use with a fuel injection system for an internal combustion engine comprises electromagnetic means for controlling the supply of fuel to the associated engine, and a pair of switches controlling the supply of current to said electromagnetic means, one of said switches being operable when the engine speed is above a predetermined value and the other switch operating with closure of the throttle, the switches being so arranged that when the throttle is closed but engine speed is above said predetermined value, the supply of fuel to the engine is interrupted.

The electromagnetic means may be an electromagnetically driven pump for supplying fuel to the engine in which case the two switches may be arranged to break the circuit to the pump or its electric motor under appropriate circumstances.

Alternatively, where a mechanically driven pump is used an electromagnetically operable valve may be provided in the fuel supply line to the engine, this valve being arranged to close under the control of the two switches when the throttle is closed with the engine operating above the predetermined speed.

The accompanying drawings illustrate the invention, and

FIGURE 1 shows an electrical circuit arranged in accordance with the invention and

FIGURES 2, 3 and 4 illustrate alternative circuits.

In the example shown in FIGURE 1 there is shown an engine **9** to which fuel is supplied into a manifold **8** through nozzles (not shown) from a pump **10** with is either electromagnetically operated or is driven by an electric motor. The fuel supply is controlled by a mechanism including a throttle **7**.

The pump **10** or the combined pump and electric motor, as the case may be, is connected to an electric storage battery **11** through an engine ignition switch **12**, which is arranged to actuate an electrical ignition system indicated diagrammatically at **13**. In series with the pump **10** and switch **12** are two switches **14**, **15** which are themselves connected in parallel. One of the switches **14** is a centrifugal or other engine speed responsive switch which is normally closed but opens when the engine speed reaches a predetermined value.

The other switch **15** is a normally closed switch which is open only when the engine throttle **7** is closed. Thus, when the ignition switch **12** is closed, the pump **10** or its motor will always be energised except when the throttle **7** is closed but with the engine operating above the predetermined speed, which may be approximately 1000 r.p.m. This arrangement will cut off the fuel supply under "overrun" conditions when the throttle is shut, but since idling speed is below the predetermined speed, the pump or its motor will be energised to provide a supply of fuel when the throttle is shut and the engine speed is below the predetermined speed.

In the example illustrated in FIGURE 2, the switches **14**, **15** control the supply of current to the coil **16** of a relay **17** the contacts **18** of which are closed when the coil **16** is energised and are in series with the ignition switch **12** and pump **10** or its motor but in parallel with the two switches **14**, **15** and the coil **16**.

In the example shown in FIGURE 3 the pump **10**, or its motor is connected to the ignition switch **12** through the contacts **19** of a relay **20**, these contacts **20** however being open when energised. The coil **21** of this relay **20** is connected to the ignition switch **12** through a parallel circuit including an engine speed responsive switch **22** and a throttle operated switch **23** arranged in series. The throttle operated switch **23** is closed only when the throttle is closed, and the speed responsive switch **22** is normally open but closes above a predetermined engine speed. Thus, only when the throttle is closed above the predetermined speed will the pump, or its motor, be stepped to interrupt the fuel supply.

In the arrangement in FIGURE 4, the switches **14**, **15** are arranged in parallel and when either of them is closed the pump is actuated. The speed sensitive switch **14** is closed below the predetermined speed and the other switch **15** is closed when the accelerator is open.

It will be understood that if a mechanically operated pump is used the switch and/or relay can be used to actuate a solenoid operated valve for controlling the fuel supply to achieve a similar result.

By the present invention it is envisaged that, not only will there be a saving in fuel consumption, but overfueling on "overrun" will be minimized thereby reducing the production of objectional exhaust gases due to incomplete combustion in the engine.

In still further alternative arrangements, the speed responsive switch **14** in either of FIGURES 1 and 2 or the switch **23** in FIGURE 3 is operated by changes in the depression in the engine inlet manifold. This switch opens, in the circuit of FIGURES 1 and 2 and closes in the circuit of FIGURE 3 when the pressure in the manifold falls below a predetermined pressure.

Conveniently this predetermined pressure is an absolute pressure which is less than that existing in the manifold at idling but is greater than the minimum pressure obtainable in the manifold during use.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. An electrical control circuit for a fuel injection system for an internal combustion engine, electrical power supply means, electromagnetic means for the supply of fuel to the engine, and a pair of switches controlling the supply of current from the power supply means to said electromagnetic means, one of said switches being operatively connected to the engine to operate when the engine speed is above a predetermined value and the other switch being operatively connected to the throttle to operate with closure of the throttle, the switches being so connected that when the throttle is closed but engine speed is above

said predetermined value, the supply of fuel to the engine is interrupted, the two switches being arranged in parallel, between the power supply means and the electromagnetic means, said one switch being closed below the predetermined speed and open above it, the said other switch being open only when the throttle is closed, and opening of both switches preventing energization of the electromagnetic means to interrupt the supply of fuel to the engine.

2. An electrical control circuit as claimed in claim 1 in which the electromagnetic means comprises an electromagnetically driven pump for supplying fuel to the engine.

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WILLIAM E. WAYNER, Primary Examiner

U.S. Cl. X.R.

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