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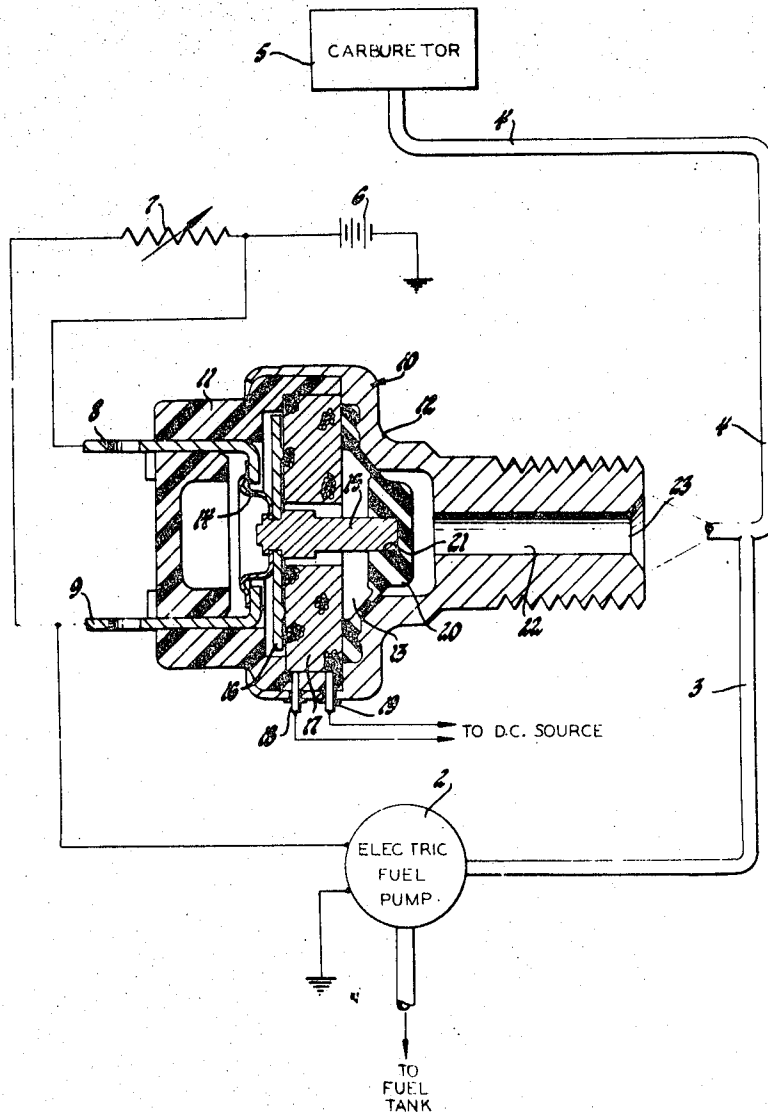
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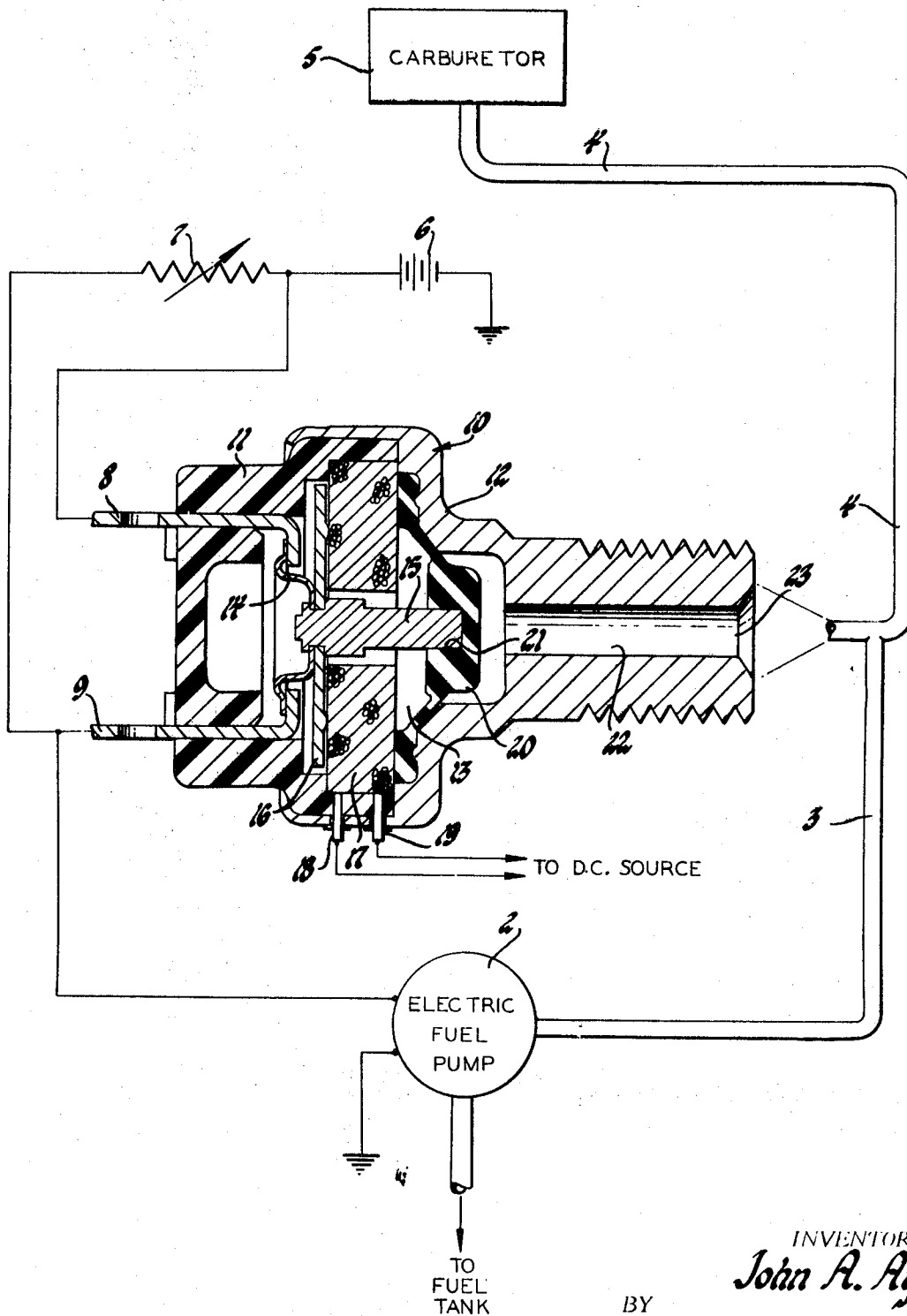
[54] **PRESSURE MODULATOR SWITCH FOR
 ELECTRIC FUEL PUMP**
 3 Claims, 1 Drawing Fig.

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[51] Int. Cl..... H02g 3/00

ABSTRACT: An electric fuel pump for a motor vehicle is provided with two modes of operation such that the pump will provide a high pressure at high flow rates in one mode of operation and a lower pressure at low flow rates in a second mode of operation.





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PRESSURE MODULATOR SWITCH FOR ELECTRIC FUEL PUMP

The present invention relates generally to fuel pumps for automotive vehicles and more particularly to means for controlling the output pressure of the fuel pump under different conditions of operation of the motor vehicle.

In present automotive fuel systems, fuel is supplied to the vehicle carburetor under pressure produced by the fuel transfer pump. One of the important considerations is that the pressure of the fuel at the inlet of the carburetor may be too high and can cause overrich fuel-air mixture with poor performance or stalling of the engine, or may cause too low pressure resulting in poor performance or damage to the engine.

The electric fuel pump, similar to other common types of pumps, has the characteristic of a decreasing output pressure with increasing fuel flow. This is opposite to the requirements of the conventional engine carburetor system. During periods of high engine load, as during rapid acceleration, high fuel flow rates are required for the engine but at the same time reasonable minimum pressure is required at the carburetor. In the other mode of operation, low engine loads, as during idling and deceleration, low fuel flow rates are required by the engine but at the same time the pressure at the carburetor should not be too high.

These opposing requirements can be met with the electric fuel pump by having two modes of operation of the pump. The pump can be designed for high output (good pressure at high flow rates) to accomplish the upper mode. A resistor can then be inserted in the circuit of the pump to accomplish a second mode of operation (lower pressure at low flow rates).

It is accordingly an object of the present invention to provide an automotive fuel pump with two modes of operation.

It is a further object of the present invention to provide a fuel pump circuit which senses the engine requirements at the carburetor and corrects pump pressure according to carburetor needs.

A further object of the present invention is to provide a fuel pump circuit which senses the high engine requirements at the carburetor, corrects pump pressure according to carburetor needs and returns to the normal operating condition when the high demand is passed.

In accordance with the present invention the circuit for the fuel pump includes an additional series resistor. This resistor is bridged by a modulator switch which is hydraulically connected to the fuel line at the inlet of the carburetor. At a predetermined pressure in the line produced by the pump a switch is opened, causing a resistor to be electrically connected in the pump circuit. This condition causes the output pressure of the pump to be decreased according to the amount of resistance used. The switch will remain open until a lower pressure occurs in the fuel line, as from sudden acceleration or high power demand from the engine. The switch will then close, giving full power output from the pump. When the heavy demand for fuel has passed, the pressure will again rise above the predetermined point, the switch will again open and maintain the low-demand mode which is the condition for normal vehicle operation.

The above and other objects of the present invention will become more apparent when the following specification is read in connection with the accompanying drawing which is an electric circuit diagram incorporating a pressure modulator switch in accordance with the present invention.

Referring now to the drawing an electric fuel pump 2 is connected to a fuel tank (not shown) and through fuel conduit means 3 and 4 to the vehicle carburetor 5.

The fuel pump is provided with an electric circuit including a source of voltage 6, which may be the vehicle battery, and a variable resistance element 7 electrically connected in series. A pair of contacts 8 and 9 are connected in parallel with the resistor 7 and are adapted to short out the resistor at predetermined fuel pressures in conduits 3 and 4 as will be hereinafter described.

The shorting out of resistor 7 is controlled by a pressure modulator switch 10. The switch 10 includes a first closure member 11, preferably made of electric insulating material, and a second closure member 12 forming a housing or chamber 13 therebetween.

The contacts 8 and 9 extend into the housing and are spaced apart and supported by the first closure member 11. A contact cup or bridging member 14 is adapted to engage the contacts and complete an electrical circuit therethrough. The cup 14 is connected to a push rod 15 and an armature 16 of an electromagnet 17. Suitable terminals 18, 19 of electromagnet 17 are connected to a source of direct current (DC) voltage. It is understood that in lieu of an electromagnet, a permanent magnet can be employed and may be preferred.

Adjacent the electromagnet 17 and clamped between the magnet and the second closure member 12 is a pressure responsive diaphragm 20. The push rod 15 is secured to the diaphragm 20 at 21 so that the cup 14 is mechanically connected to the diaphragm. A passage 22 is provided in the second closure member 12 and terminates in an opening 23 that in turn is in communication with fuel conduits 3 and 4.

In operation the system provides lower fuel flow at high fuel pressures and a higher fuel flow at low fuel pressures. It is seen that at lower fuel pressures, the electromagnet acts on armature 16 to maintain contact cup 14 in engagement with contacts 8 and 9 to short out the resistor 7. The pump then operates in its high mode and increases the flow of fuel to the carburetor. This occurs during periods of high engine load, as during rapid acceleration, when high fuel flow rates are required but at the same time reasonable minimum pressure is required at the carburetor.

As high pressure is demanded, the pressure buildup in conduits 3 and 4 acts upon the diaphragm 20 to urge the diaphragm 20 and the contact cup 14 to the left. The contacts 8 and 9 are no longer bridged and the resistor 7 is in circuit with fuel pump 2 which now operates in a low mode.

One advantage of utilizing the electromagnet 17 is the hysteresis effect, i.e., the attractive force between the electromagnet 17 and the armature 16 varies inversely as the distance between them. Therefore, a greater pressure is required to force the armature 16 away from the electromagnet 17 than the pressure which will allow the armature 16 to return to the electromagnet 17. This difference in the operating pressure between opening and closing of the modulator switch allows the electric fuel pump 2 to operate in the low-demand mode during all normal operating conditions of the vehicle.

While a preferred embodiment of the invention has been disclosed it will be obvious to one skilled in the art that minor changes can be made to the system without departing from the spirit or scope of the invention as defined by the following claims.

What I claim is:

1. A system for controlling the flow of fuel from a vehicle fuel tank to a carburetor including an electric fuel pump, a source of fuel, a carburetor, conduit means connecting said fuel pump between said source of fuel and said carburetor, an electric circuit for said fuel pump including a source of power and a resistance element electrically connected in series with said fuel pump, and a pressure actuated switch responsive to pressure in said conduit means for electrically shorting said resistor when the fuel pressure in said conduit means is below a predetermined value.

2. A system for controlling the flow of fuel as defined by claim 1 wherein said pressure actuated switch is provided with a pair of spaced electrical contacts, magnetizable conductive bridging means adapted to bridge said contacts and complete an electrical circuit therethrough, and a magnet positioned adjacent said bridging means to maintain said contacts closed when the fuel pressure in said conduit means is below a predetermined value.

3. A system for controlling the flow of fuel as defined by claim 2 wherein a pressure actuated diaphragm is positioned

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adjacent said magnet and means are provided to mechanically connect said bridging member to said diaphragm such that

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said contacts are opened when the pressure in said fuel conduit means is above a predetermined value.

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