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C. H. NYSTROM ET AL

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FUEL INJECTION APPARATUS FOR SPARK IGNITION ENGINES

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2 Sheets-Sheet 1

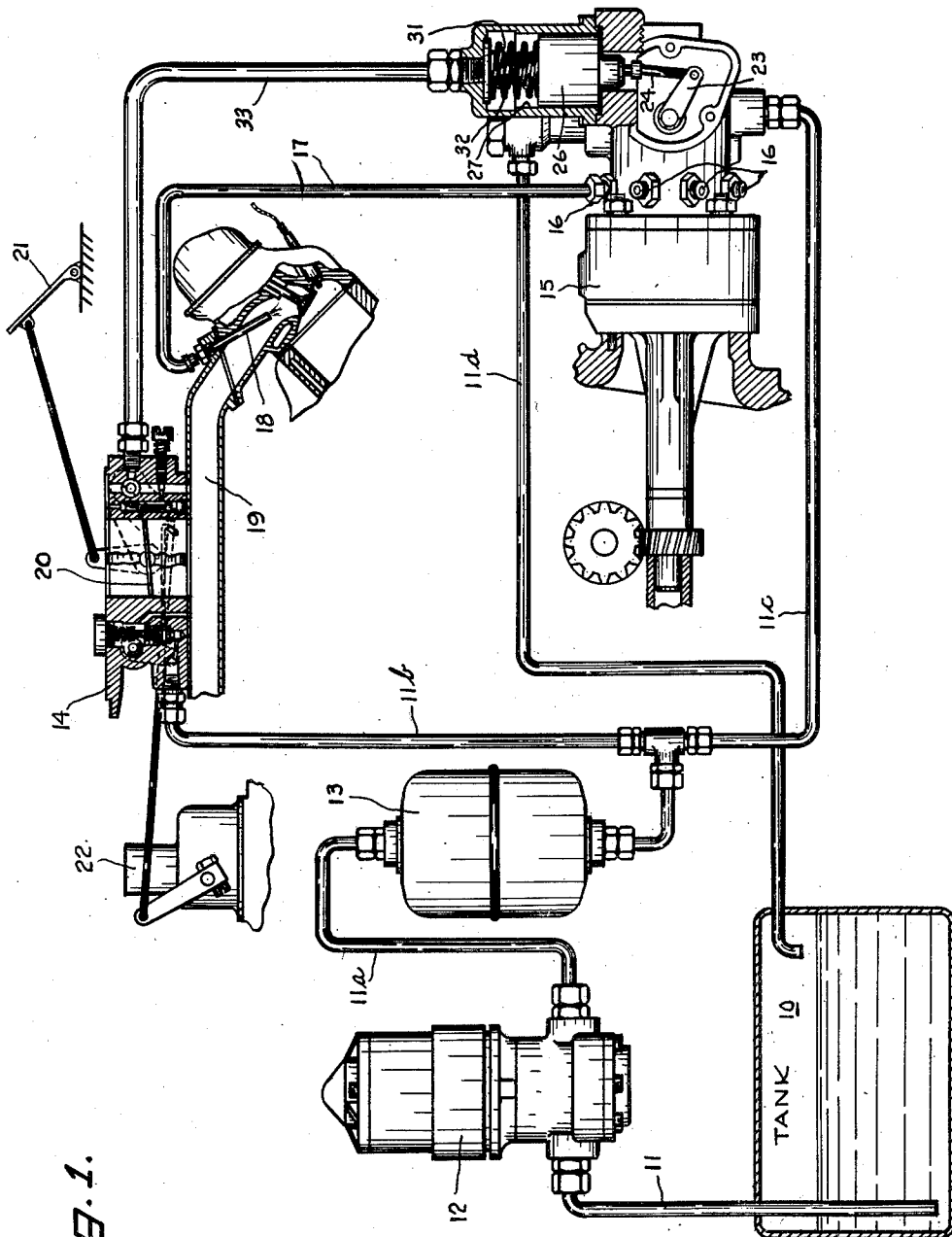


Fig. 1.

INVENTORS.
CARL H. NYSTROM
ARTHUR E. HUSE
JOHN H. HUMBER
BY *Raymond A. Laguerre*
ATTORNEY.

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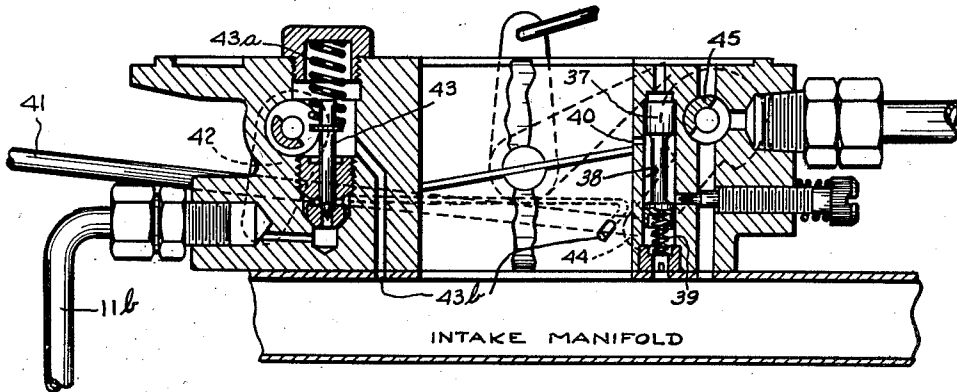


Fig. 2.

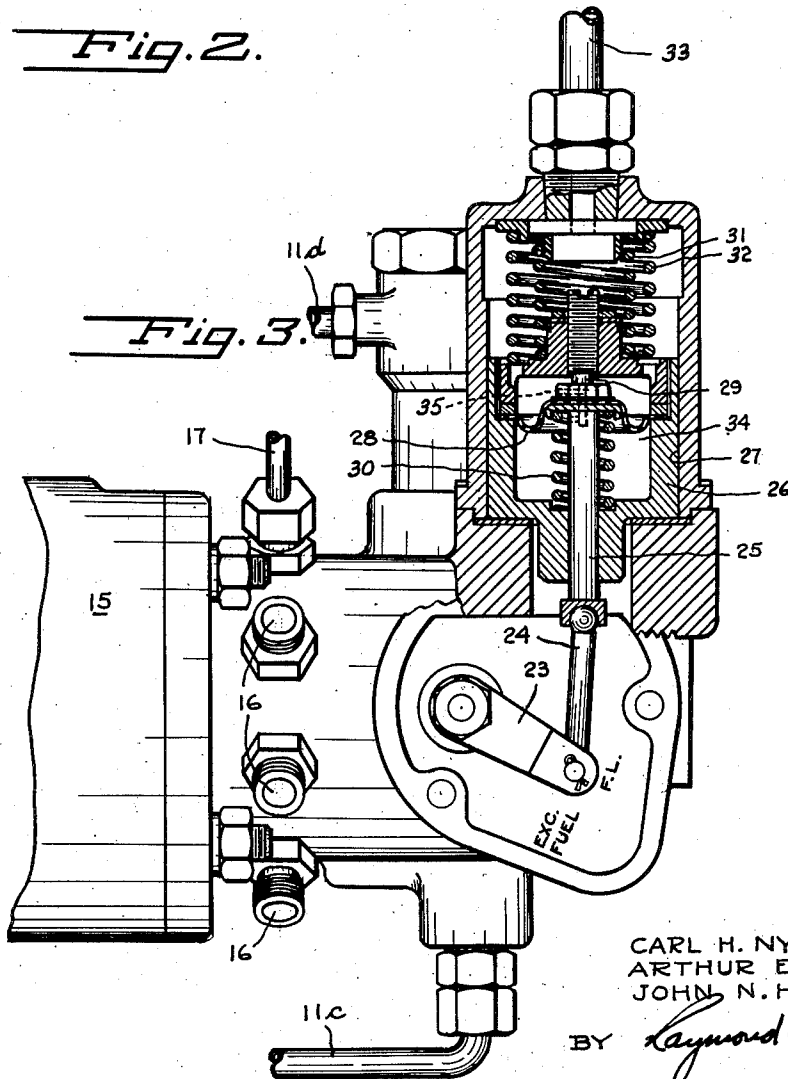


Fig. 3.

INVENTORS.
CARL H. NYSTROM
ARTHUR E. HUSE
JOHN N. HUMBER

BY

Raymond A. Raguin
ATTORNEY.

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FUEL INJECTION APPARATUS FOR SPARK
IGNITION ENGINES

Carl H. Nystrom, West Springfield, Arthur E. Huse, Springfield, and John N. Humber, North Wilbraham, Mass., assignors to American Bosch Arma Corporation, a corporation of New York

Application October 12, 1955, Serial No. 539,987

4 Claims. (Cl. 261—37)

This invention relates to fuel injection apparatus for spark ignition internal combustion engines, or the like, and has particular reference to a new and improved arrangement wherein additional fuel is provided upon rapid acceleration, thereby improving the engine performance on such occasions.

An object of the invention is to provide relatively simple and economical means for temporarily furnishing additional fuel to the engine upon rapid acceleration thereof.

Another object is to provide new and improved means of the type set forth which improves the performance of the engine during acceleration thereof.

Another object is to provide new and improved means for furnishing additional fuel to the engine during the engine warm up period.

Another object is to provide new and improved means for minimizing the quantity of fuel injected during backtracking of the vehicle.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that changes may be made in the details of construction and arrangement of parts without departing from the scope of the invention as set forth in the accompanying claims, as the preferred form has been given by way of illustration only.

Referring to the drawings:

Fig. 1 is a schematic view of a fuel injection system embodying the invention;

Fig. 2 is a fragmentary view of the apparatus of Fig. 1, on an enlarged scale; and

Fig. 3 is a side view, partially in section, of the fuel injection pump and control shown in Fig. 1, taken on an enlarged scale.

It has been found desirable to furnish additional fuel beyond full load fuel quantity to the engine cylinders of an internal combustion engine upon rapid acceleration thereof in order to improve the performance of the engine under such conditions, and it is especially desirable that such additional fuel quantity be of only momentary duration after which the fuel control is automatically returned to normal position. The present invention provides a relatively simple and economical arrangement of obtaining this result.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout, there is shown in Fig. 1 a schematic view of a fuel injection system embodying the invention and which comprises a fuel tank 10 connected by a fuel line 11 to fuel supply pump 12 which may be of any suitable type and which is connected by line 11a to the fuel filter 13 from which fuel flows through branches 11b and 11c of line 11 to throttle body 14 and fuel injection pump 15 respectively.

Fuel injection pump 15 is of the type shown in application of Arthur E. Huse and Carl H. Nystrom, Serial Number 497,506, filed March 29, 1955, and is of the distributor type and is adapted to deliver fuel through each of the

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outlets 16 successively from which it flows through its respective fuel line 17 to its respective nozzle 18 by which fuel is delivered into intake manifold 19 adjacent the intake valve of each of the engine cylinders.

5 The bypass or return line 11d connects the injection pump 15 with fuel tank 10 whereby fuel bypassed by the pump is returned to the tank.

The throttle body 14 is provided with the air throttle controlled by butterfly valve 20 which is operatively connected to foot throttle 21 whereby the air quantity is controlled by the operator who thereby controls the fuel. The automatic choke 22 is connected to the operating lever 44 for valve 45.

The injection pump has the control lever 23 as described in the application referred to above and control lever 23 is connected to link 24 which in turn is connected to link 25, which in turn is connected to control piston 26 in cylinder 27, and piston 26 is provided with an acceleration device including diaphragm 28. Also secured to piston 26 is adjustable stop 29 for limiting the travel of link 25. Spring 30 tends to move link 25 and diaphragm 28 towards stop 29 which is adjustable to adjust the full load setting of the injection pump.

25 Springs 31 and 32 are positioned between piston 26 and the opposite wall of the housing.

In Fig. 3, the control lever 23 is shown in its normal full load position. In the drawing, "F. L." indicates this full load position and "Exc. Fuel" indicates the excess fuel position of control lever 23 of the injection pump.

30 The automatic choke 22 is connected by link 41 to operating lever 42 on primer valve 43 and to operating lever 44 on cold operation enrichment valve 45. When link 41 is moved to the right by the automatic choke 22 it forces primer valve 43 open against the force of spring 43a and fuel passes into the intake manifold through jets 43b. Simultaneously, cold operation enrichment valve 45 is adjusted to position whereby the pump control adjusts the pump to fast idle setting. When the engine starts, the solenoid element of the automatic choke is deenergized and link 41 returns valve 43 to closed position. As the bimetallic element of automatic choke 22 heats up, it moves the levers 42 and 44 to normal running position and the pump control is returned to normal low idle fuel setting.

45 The normal setting of the fuel injection pump control lever 23 is controlled by the springs 31 and 32 and spring 30 on control piston 26 together with air or vacuum pressure on the piston and diaphragm normally balances the piston, thereby balancing the pump control. However, when the operator steps down on the accelerator rapidly for rapid acceleration, the vacuum in line 33 and in the space in cylinder 27 behind piston 26 drops and high vacuum in chamber 34 overcomes the force of spring 30, and diaphragm 28 and links 24 and 20 move quantity control lever to excess fuel position.

50 Because of hole 35, the vacuum leaks out of chamber 34 into the chamber on the opposite side of the diaphragm and when the pressure on the opposite side of the diaphragm are equal, the control lever is returned to its normally balanced position.

60 When backtracking, that is, when the vehicle momentum or inertia is such as to drive the engine when the engine is not receiving any fuel but idling quantity, the vacuum in the intake manifold increases and in order that such increased vacuum be applied to the pump control to minimize the quantity of fuel delivered by the pump, the piston 37 is provided in bore 38 and this piston is normally retained out of operative position by spring 39 but when the vacuum in the intake manifold is sufficient as during backtracking, as described above, this increased vacuum draws piston 37 downward against the force of spring 39 and shuts off idle bleed 40 which

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normally allows a slight amount of air to circumvent the butterflies.

When the idle bleed 40 is closed, true manifold vacuum is applied to the pump control to minimize the quantity of fuel delivered.

The operation of the apparatus is believed apparent from the foregoing description from which it will be seen that we have provided new and improved means for obtaining all of the objects and advantages of the invention.

We claim:

1. In a device of the character described, a fuel injection pump, a control operatively connected to said fuel injection pump for controlling the fuel delivered thereby and pressure actuated means associated with said control and adapted to be actuated by rapid changes in intake manifold vacuum whereby said pump will temporarily deliver more than normal full load fuel quantity, said control comprising a piston in a cylinder with said piston being operatively connected to said control for said fuel injection pump, and said pressure actuated means including a pressure actuated member in said cylinder and operatively connected to said piston and to said fuel injection pump control and stop means for limiting the movement of said pressure actuated member in one direction.

2. In a device of the character described, a fuel injection pump, a control operatively connected to said fuel injection pump for controlling the fuel delivered thereby and pressure actuated means associated with said control and adapted to be actuated by rapid changes in intake manifold vacuum whereby said pump will temporarily deliver more than normal full load fuel quantity, said control comprising a piston in a cylinder with said piston being operatively connected to said control for said fuel injection pump, and said pressure actuated means including a pressure actuated member in said cylinder and operatively connected to said piston and to said control for said fuel injection pump, and a relatively small passage allowing the passage of pneumatic pressure from one side of said pressure actuated member to the opposite side thereof.

3. In a device of the character described, a fuel injection

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pump, a control operatively connected to said fuel injection pump for controlling the fuel delivered thereby and pressure actuated means associated with said control and adapted to be actuated by rapid changes in intake manifold vacuum whereby said pump will temporarily deliver more than normal full load fuel quantity, said control comprising a cylinder, a line connecting said cylinder to the intake manifold of the engine, a piston in said cylinder with said piston being operatively connected to said fuel injection pump control, and said pressure actuated means including a pressure actuated member in said cylinder and operatively connected to said piston and to said fuel injection pump control and stop means for limiting the movement of said pressure actuated member in one direction, and a relatively small passage allowing the passage of pneumatic pressure from one side of said pressure actuated member to the opposite side thereof.

4. In a device of the character described, a fuel injection pump, a control operatively connected to said fuel injection pump for controlling the fuel delivered thereby and pressure actuated means associated with said control and adapted to be actuated by rapid changes in intake manifold vacuum whereby said pump will temporarily deliver more than normal full load fuel quantity, said control comprising a piston in a cylinder with said piston being operatively connected to said control for said fuel injection pump, and said pressure actuated means including a pressure actuated member in said cylinder and operatively connected to said piston and to said fuel injection pump control and an adjustable stop member for limiting the movement of said pressure actuated member in one direction.

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