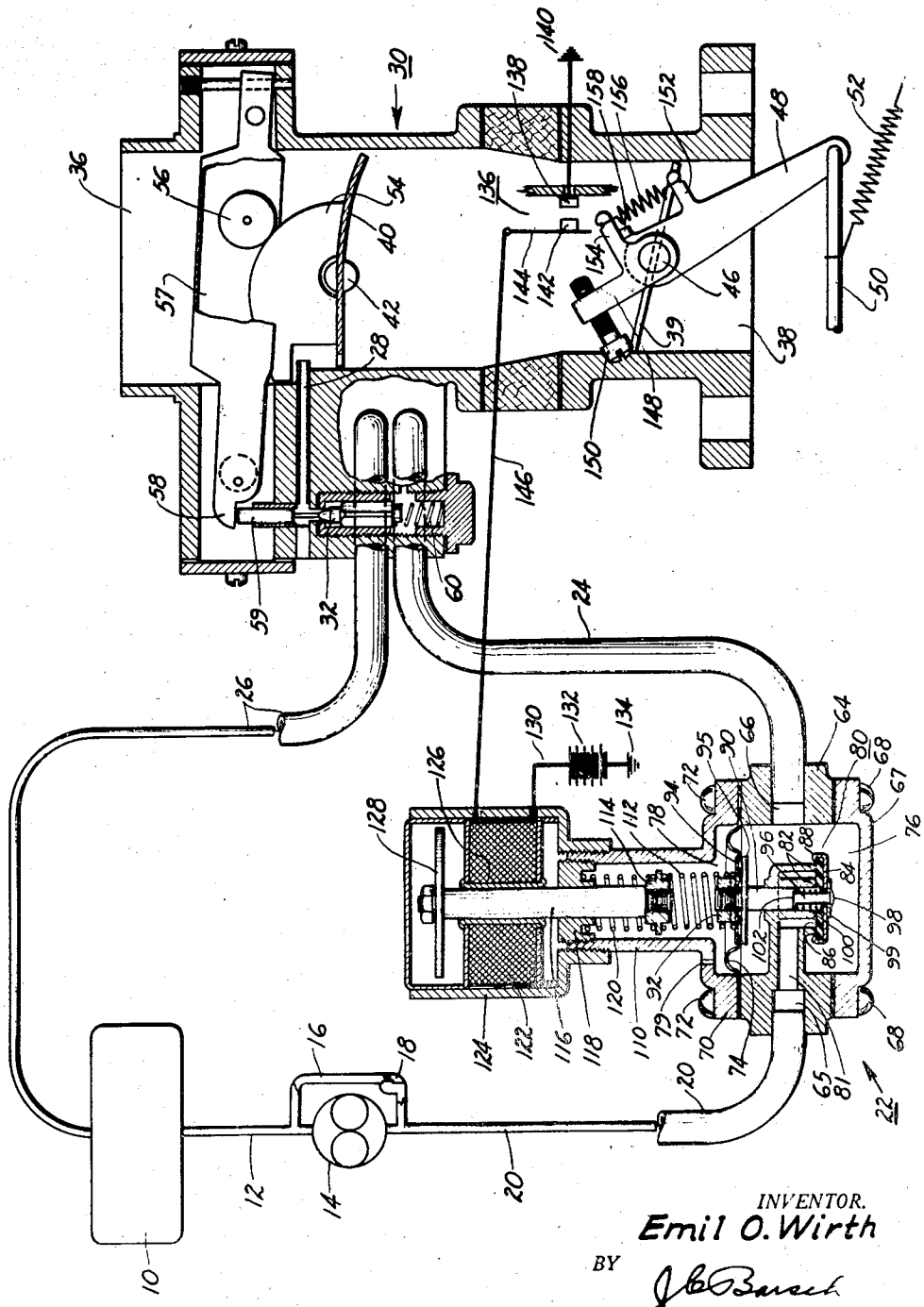
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FUEL SYSTEM

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FUEL SYSTEM

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1

This invention relates to fuel systems for internal combustion engines and the like and more particularly to pressure fuel systems wherein the fuel is delivered to the carburetor or engine under superatmospheric pressure and contains subject matter in common with the following applications: Leibing and Fageol, Serial No. 533,848, filed May 3, 1944; Wirth, Serial No. 555,077, filed September 21, 1944, now abandoned.

The above Wirth application teaches the varying of the fuel to air ratio of the fuel mixture by varying the effective pump delivery pressure of the fuel to the carburetor, the pump being of the constant delivery type and the present invention provides improved control means for varying said effective fuel pressure.

An object of the present invention is to provide a fuel system of this character of simple construction and having improved performance and economy.

A further object of the invention is to provide a device of this character so constructed and arranged as to provide the engine with a lean mixture for maximum economy throughout the lower speed and power range and an enriched mixture for maximum speed and power ranges above said lower speed range.

The characteristics and advantages of the invention are further sufficiently referred to in connection with the following detailed description of the accompanying drawings which represents a preferred embodiment thereof. After considering the example, skilled persons will understand that many variations may be made without departing from the principles disclosed, and I contemplate the employment of any structures, arrangements, or modes of operation that are properly within the scope of the appended claims.

The accompanying drawing is a diagrammatical view showing a fuel system as a whole wherein the present invention is embodied.

While the present invention is shown and described in connection with a downdraft carburetor having a movable flow responsive member in the induction passage for controlling the inflow of fuel to said passage, it is to be understood that the present invention may be used in many other types of fuel systems, such as those employing other flow responsive means and said means may include diaphragms or the like for controlling the metering of the fuel, and in connection with carburetors of the updraft or horizontal delivery type.

The fuel system, as shown, comprises the usual

2

fuel tank 10 connected by a conduit 12 to a fuel pump 14 of known construction. The pump may be of the diaphragm type commonly used on present day automobiles, but for simplicity is shown as a centrifugal pump having a by-pass 16 controlled by a pressure responsive valve 18 set for a predetermined pressure. Whatever the type of pump, it should supply fuel to the carburetor at a substantially constant pressure and should preferably prevent flow through the line when the engine is not operating. An outlet line 20 leads from the pump to a pressure regulator indicated generally at 22, and thence is conveyed by a conduit 24 to a separating chamber not shown herein but preferably of the character of that shown and described in the above Leibing and Fageol application, there being a return line 26 which conveys excess fuel, together with any vapor which may be present in the line, back to the tank 10. The return line 26 is preferably provided, at its point of connection with the chamber, with a restriction (shown in said Leibing and Fageol application) of such size as to permit pressure to be built up in the chamber. From the separating chamber fuel is conveyed to a nozzle 28 of the carburetor, indicated generally at 30, the discharge of fuel into the induction passage being controlled by a fuel valve 32.

The carburetor generally

The carburetor 30, as illustrated in the drawings, is substantially the same in construction and operation as that shown in the Leibing-Fageol application above referred to and comprises an induction passage including an air inlet portion 36 and a mixture outlet 38 controlled by a throttle valve 39. Within the inlet portion 36, and anterior to the throttle, is a vane or valve 40 fixed to an offcenter shaft 42 so that flow of the air into the carburetor tends to rotate the vane and shaft in a clockwise direction. A spring, not shown herein, yieldingly urges the vane in the closing direction. The throttle valve 39 is mounted on a throttle shaft 46 to which is attached a throttle lever 48 having a link connection 50 with the usual accelerator mechanism, not shown. The usual throttle return spring 52 urges the throttle valve closed. Fuel is delivered into the induction passage from the fuel nozzle 28 and the flow of said fuel is controlled by the valve 32 which is connected with and controlled by said vane, the connection between said valve and vane comprising a cam 54 secured to the vane and operably engaging a

roller 56 mounted on a lever 57 which has an end 58 adapted to engage the stem 59 of said valve 32. The valve 32 is adapted to be moved in the opening direction by said lever and is urged in the closing direction by a spring 60, it being noted that the pressure of fuel on the valve has a negligible effect on the action of said valve, that is the valve is operable substantially independent of fuel pressure thereon.

While the discharge of fuel from the nozzle 28 is herein shown and described as being controlled by the action of air flow on the vane 40, such control may be by means of other air flow means or in accordance with other engine operating conditions. In any event, the control of fuel discharged into the induction passage should be such as to proportion said fuel in accordance with the mass air flow through said induction passage, particularly during normal operation of the engine.

The carburetor may also include other elements not shown herein but fully disclosed in said Leibing and Fageol application, and referred to hereinabove, which are compatible with the present arrangement.

Fuel regulator

Suitable means for regulating or controlling the pressure of the fuel delivered to the carburetor induction passage is provided. The regulator is interposed in the fuel line between the pump 14 and carburetor and comprises a body having a central casing member 64 which includes an inlet 65 connected with the conduit 24 to the carburetor. A hollow end member 67 is secured to one side of the central member 64 by any suitable means such as screws 68, and a second hollow member 70 secured to the opposite side of the central member 64 by screws 72. A flexible diaphragm 74 is secured between the casing members 70 and 64 thereby separating the interior of the regulator into two chambers 76 and 78. The former chamber is a fuel chamber and fuel therein exerts upward pressure on the diaphragm 74, and the latter chamber is vented to atmosphere by a vent 79 to prevent undesirable pressures therein such as might interfere with the proper action of the diaphragm. Within the chamber 76 there is a valve, indicated generally at 80, which is connected with the inlet 65 by a conduit 81. The valve includes a seat 82 adapted to be engaged by a movable valve member which comprises a body member 84 having a recess in which a gasket 86 is secured by the overturning at 88 of the edges of said body member 84. The gasket 86 is preferably of some resilient material which is resistant to gasoline or the like, such as neoprene, although it may be of other material having the requisite qualities. The valve 80 includes a stem 90 secured to the diaphragm 74 by a nut 92 on a threaded reduced diameter portion. Washers 94 and 95 on the stem 90 are also secured by the nut 92 and are disposed on opposite sides of the diaphragm for reinforcing the central portion thereof. The opposite end of the stem 90 has a reduced diameter portion 96 which extends loosely through an opening in the body member 84 of the movable valve member and the outer end of the reduced diameter portion is overturned or riveted at 98, there being a washer 99 disposed between the overturned portion 98 and the body portion 84. A spring 100 disposed about the reduced diameter portion 96 reacts between a shoulder 102 and the body portion 84 for urging the movable valve member against the washer 99. With this arrangement the valve may be effectively closed despite misalignments between the stem and movable valve member such as may occur from manufacturing variations and the like.

The casing member 70 has a hollow extension 110 having the interior thereof in open communication with the chamber 78 and forming a part thereof. A spring 112 is provided in the chamber 78 and is adapted to react between the diaphragm washer 94 and a spring retaining head 114 of a plunger 116 which is slidable in a bearing 118 threaded into the upper end, as shown in the drawing, of the extension 110. A second spring 120, reacts between the bearing 118 and the head 114 with a force counterbalancing that of spring 112 on the head 114. A solenoid 122 is mounted in a casing 124 screwed onto the free end of the extension 110 and is so arranged that the plunger 116 is slidably received in the core 126 of the solenoid coil. The upper end of the plunger 116 carries the disk like member 128 which is adapted to be drawn toward the solenoid for increasing the tension of spring 112 on the diaphragm 74. Fuel under substantially constant pump pressure, entering the regulator by way of the inlet 65, passes through valve 80 and into the chamber 76 and urges the diaphragm upwardly, as shown in Figure 1, in opposition to the downwardly exerted force of spring 112, so that the valve 80 is controlled primarily by the pressures on opposite sides of the diaphragm and the effective force urging the valve 80 closed determines the fuel pressure posterior to the regulator. Further, with the above arrangement the pressure of fuel to the carburetor may be varied by varying one of the above pressures on the diaphragm 74. It is to be noted that by using the counterbalancing spring 120 a slight force only is required to actuate the plunger. Thus a relatively small solenoid may be used.

In the arrangement shown the solenoid is connected by a wire 130 to a source of electric power which is shown as a battery 132 grounded at 134 and the solenoid circuit is controlled by a switch indicated generally at 136 located adjacent the throttle lever. The switch includes an insulated contact point 138 which is grounded at 140 and a second contact point 142 attached to a movable arm 144 and adapted to be moved therewith, said arm being connected by a wire 146 with the solenoid. A lever 148 is rotatably disposed on the throttle shaft 46 adjacent the throttle lever 48, said arm 148 being provided with an adjustable stop member or screw 150 which is adapted to move into engagement with the switch lever 144 and move the contact point 142 into engagement with the point 138 to thereby close the solenoid circuit and effect energization of the solenoid. Inasmuch as it is desirable to effect closing of the solenoid circuit at some predetermined partly open throttle position, less than the full open position, a yielding lost motion connection is provided adjacent the throttle lever 48 and the arm 148. This includes a lateral extension 152 on the throttle lever and a corresponding extension 154 on the arm 148, a spring 156 being attached to said extensions and adapted to yieldingly urge same toward each other. The throttle lever 148 carries a stop member 158 adapted to be engaged by the extension 154 of the arm 148 and to limit clockwise movement, as shown in the drawing, of the arm 148 with re-

spect to the throttle lever 48 and to normally maintain the throttle lever and arm in alignment.

Operation

The regulator 22 is normally set to provide a fuel pressure to the carburetor with an economical fuel mixture under normal driving conditions. That is throughout the cruising range the usual lean mixture is provided for the engine, the throttle valve range therefor being between idling position and a predetermined partly open position. When the throttle valve is opened beyond said predetermined position, for providing sufficient volume of fuel mixture for high engine output, it is desirable to increase the proportion of fuel to air in the mixture and this is effected in the present invention by the closing of the switch 136 whereby the solenoid is energized and the tension of spring 112 is increased. This results in lessening the force closing the valve 80 which in turn provides a higher fuel pressure to the carburetor and an increase in the ratio of fuel to air. It is to be noted that the throttle valve is only in a partly open position at the time the switch 136 is closed but due to the lost motion connection hereinabove described full opening of the throttle may be effected.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangements of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment.

I claim:

1. In a fuel system for an internal combustion engine: an induction passage having a throttle therein mounted on a shaft; a throttle lever for said throttle shaft; means for controlling the throttle; a fuel conduit having the metering orifice therein; a valve responsive to air flow in the induction passage for varying the effective size of said orifice; means for supplying fuel to the metering orifice at a substantially constant pressure; means so constructed and arranged as to vary the ratio of fuel to air for the engine by varying the pressure of the fuel supplied to said metering orifice; an electrical means for controlling the second mentioned means; a circuit for said electrical means; a switch for said circuit located adjacent the throttle shaft; and a means including an arm rotatable on the throttle shaft, yieldably connected to the throttle lever, and adapted to actuate the switch at a part open throttle position and permit the throttle lever to be moved beyond the switch actuating position.

2. In a fuel system for an internal combustion engine: an induction passage having a throttle therein; a throttle lever for actuating said throttle; a fuel conduit having an orifice therein; a valve for varying the flow of fuel through said orifice; means for supplying fuel to the orifice at a substantially constant pressure; means so constructed and arranged as to vary the ratio of the fuel to air for the engine by varying the pressure of the fuel supplied to said orifice; an electrical means for controlling the second mentioned means; a circuit for said electrical means; a switch for said circuit; and a means including a pivoted arm yieldably connected to the throttle lever and adapted to actuate the switch at a part open throttle position.

3. In a fuel system for an internal combustion engine: an induction passage having a throttle therein; a throttle lever; a fuel conduit having an orifice therein; a valve responsive to air flow in the induction passage for varying the effective size of said orifice; means for supplying fuel to the orifice at a substantially constant superatmospheric pressure, said means being so constructed and arranged as to vary the ratio of fuel to air for the engine by varying the pressure of the fuel supplied to said orifice; an electrical means for controlling said first mentioned means comprising an electrical circuit, a switch for said circuit, a pivoted arm yieldably connected to the throttle lever and adapted to actuate the switch as the throttle valve is moved toward open position.

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