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FUEL INJECTION ENGINE

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Fig.1.

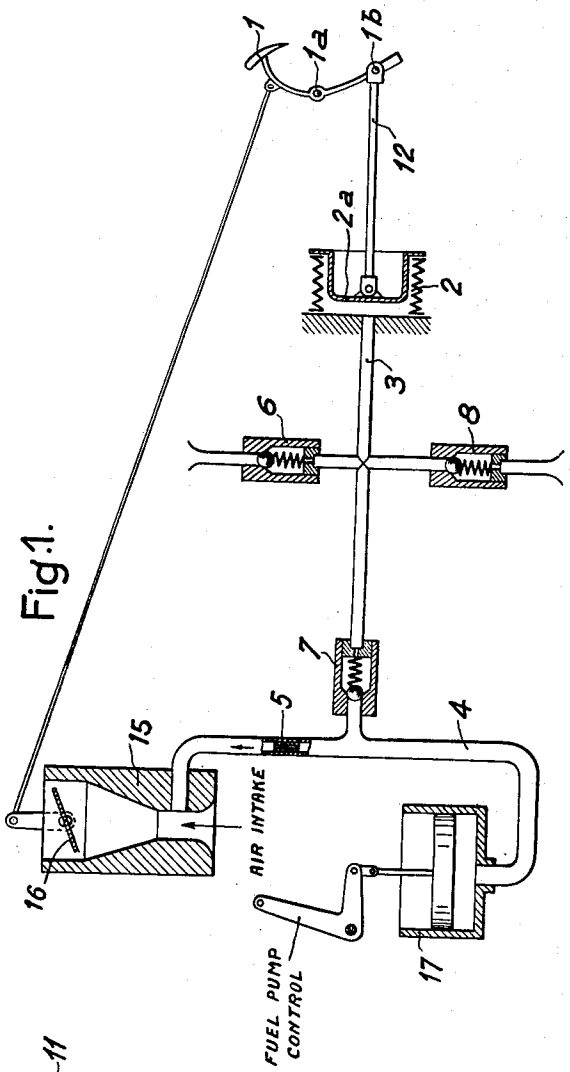
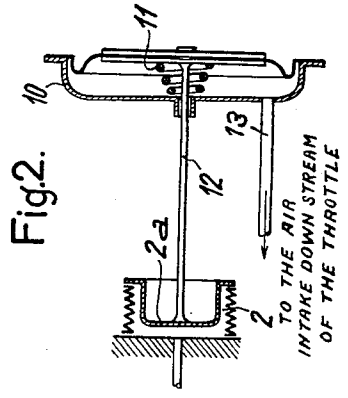


Fig.2.



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FUEL INJECTION ENGINE

Edmond Henry-Biabaud, Paris, France, assignor to Societe Anonyme Andre Citroen, Paris, France

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4 Claims. (Cl. 123—140)

The present application is a continuation-in-part of the prior application Serial No. 28,601, filed on May 12, 1960 and entitled: "Fuel Injection Engine," now abandoned.

This invention relates to an improvement in the control system for the admission of fuel in internal combustion engines of the kind defined in specification G. L. du Rostu 2,621,674 and in which the fuel output control member is operated by a vacuum prevailing in a passage of the system for admission of air disposed upstream of the throttle and formed as a venturi in the air induction pipe.

This control system has the disadvantage of only being responsive to the sudden depressions of the accelerator pedal with a certain time-lag in the increase of the fuel output.

An object of the invention is to avoid this time-lag in the increase of the fuel output in response to a sudden acceleration of the pedal. Another object of the invention is to provide a chamber of variable volume controlled in the sense of the increase of volume in a manner concomitant with the operations of the accelerator pedal, a pipe for communicating this chamber of variable volume with a connection between the vacuum passage conformed as a venturi in the air induction pipe and a pneumatic member controlling the fuel output and means in this connection limiting by a narrow passage communication of this connection with the air induction pipe.

A further object of the invention is the provision of means for preventing this auxiliary vacuum from increasing above a maximum value over which there would be a risk of flooding the engine with an excess fuel, other means being provided for limiting the momentary overpressure likely to occur during the return stroke of the accelerator pedal subsequent to a sudden depression thereof, to a maximum value above which the delivery of fuel would be cut off.

These objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawing in which:

FIGURE 1 shows diagrammatically a first form of embodiment of the invention wherein the action of the accelerator pedal is used directly; and

FIGURE 2 shows as a part of FIGURE 1 another form of embodiment wherein the action of the accelerator pedal is utilized indirectly.

In the two figures of the drawing the same reference numerals designate the same or equivalent members.

The accelerator pedal 1 or other manual control member pivoted at 1*a* controls, through a link or rod 12 attached at 1*b*, a movable wall 2*a* of a deformable capsule, in this case a bellows 2 serving as a chamber of variable volume, in which a vacuum is produced when the pedal 1 is depressed. This bellows 2 is connected through a pipe line 3 to the duct 4 whereby the vacuum passage formed as a venturi 15 in the air induction pipe upstream of the throttle 16 communicates with a pneumatic member 17 controlling the fuel output which is thus responsive to the vacuum prevailing at this point and consequently to the air output. A narrow orifice is mounted in a conduit 5, at the side of the air induction pipe.

In the case of rapid depression of pedal 1 controlling the aperture of the throttle 16, there is produced in the bellows 2 a sudden strong vacuum which tends to be transmitted, in greater part, to the pneumatic member 17 controlling the fuel output, without exercising in consequence of the narrowness of the conduit 5, any appreciable suction in the air venturi 15. To prevent this vacuum from being transmitted in an excessive manner to the pneumatic member 17 controlling the fuel output, attended by the inherent risk of flooding the engine, there is provided a gaged non-return ball-valve 6 in the line 3 to limit the vacuum to a suitable maximum value.

On the other hand, if the driver allows the accelerator pedal to resume rapidly its idling position, the deformable capacity 2, by returning to its initial condition, will produce a momentary overpressure that must be prevented from attaining the output control means, otherwise the fuel feed would be cut-off. To this end, a non-return ball valve 7 is provided in the pipe line 3 for preventing this line from communicating with the duct 4 in case of overpressure, another non-return ball valve 8 being branched off the line 3 to vent this overpressure to the atmosphere.

In the alternate form of embodiment shown diagrammatically in FIG. 2 the deformable capacity 2 is controlled indirectly by the accelerator pedal. To this end the piston 2*a* of capacity 2 is connected through a rod 12 to the diaphragm of a case 10 responsive to the vacuum prevailing behind the air intake control throttle the communication taking place through a line 13. Thus, when the air throttle is suddenly opened the vacuum drops in the pipe line 13 and, therefore, in the case 10. The spring 11 will then move the diaphragm away from the case and the rod 12 rigid with the central portion of the diaphragm will cause the deformation of the capacity 2 in the direction of its increasing volume.

The other components of the device are the same as those described in conjunction with the arrangement of FIG. 1.

Of course, the two forms of embodiment described hereinabove with reference to the accompanying drawing should not be construed as limiting the invention, as many modifications and alterations may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim is:

1. In an internal combustion engine having a venturi-shaped air intake wherein prevails a vacuum responsive to the air output, a throttle mounted downstream said air intake and a movable throttle pedal to control said throttle and to adjust said air output, a fuel injection system responsive to the air output, said fuel injection system comprising a suction line issuing from the venturi-shaped air intake, vacuum responsive means connected by said suction line to the venturi-shaped air intake, said vacuum responsive means controlling the output of the fuel injection, a deformable pneumatic chamber having a movable wall, means causing said movable wall to increase the volume of said chamber upon movement of the throttle pedal in the direction increasing the air output, conduit means issuing from said chamber to a point of connection with the suction line and a restriction in the suction line between said point of connection and the venturi-shaped air intake.

2. In an internal combustion engine having a venturi-shaped air intake wherein prevails a vacuum responsive to the air output, a throttle mounted downstream said air intake and a movable throttle pedal to control said throttle and to adjust said air output, a fuel injection system responsive to the air output, said fuel injection system comprising a suction line issuing from the venturi-shaped air intake, vacuum responsive means connected by said suction line to the venturi-shaped air intake, said vacuum responsive means controlling the output of the fuel injection, a deformable pneumatic chamber having a movable wall, means causing said movable wall to increase the volume of said chamber upon movement of the throttle pedal in the direction increasing the air output, conduit

means issuing from said chamber to a point of connection with the suction line, a restriction in the suction line between said point of connection and the venturi-shaped air intake, valve means for preventing each vacuum occuring in said conduit means from rising above a predetermined maximum value, other valve means for preventing each overpressure occurring in said conduit means from being transmitted to said suction line and further valve means to exhaust said each overpressure occurring in said conduit means.

3. In an internal combustion engine having a venturi-shaped air intake wherein prevails a vacuum responsive to the air output, a throttle mounted downstream said air intake and a movable throttle pedal to control said throttle and to adjust said air output, a fuel injection system responsive to the air output, said fuel injection system comprising a suction line issuing from the venturi-shaped air intake, vacuum responsive means connected by said suction line to the venturi-shaped air intake, said vacuum responsive means controlling the output of the fuel injection, a deformable pneumatic chamber having a movable wall, means mechanically connecting said movable wall to the throttle pedal and causing said movable wall to increase the volume of said chamber upon movement of the throttle pedal in the direction increasing the air output, and a restriction in the suction line between said point of connection and the venturi-shaped air intake.

4. In an internal combustion engine having a venturi-shaped air intake wherein prevails a vacuum responsive to the air output, a throttle mounted downstream said air intake and a movable throttle pedal to control said throttle and to adjust said air output, a fuel injection system

responsive to the air output, said fuel injection system comprising a suction line issuing from the venturi-shaped air intake, vacuum responsive means connected by said suction line to the venturi-shaped air intake, said vacuum responsive means controlling the output of the fuel injection, a deformable pneumatic chamber having a movable wall, another pneumatic chamber having a movable wall, a spring mounted in said other pneumatic chamber and connected to its wall to resiliently resist to movement of said wall in the direction increasing the volume of said other pneumatic chamber, other conduit means issuing from said other pneumatic chamber to a passage of the air intake downstream of the throttle and wherein prevails a pressure responsive to the air input, and means mechanically connecting the movable wall of said other pneumatic chamber to the movable wall of the first pneumatic chamber to increase the volume of said first pneumatic chamber upon movement of the wall of the other pneumatic chamber in the direction increasing the volume of said other pneumatic chamber and causing the movable wall of said first pneumatic chamber to increase the volume of said chamber upon movement of the throttle pedal in the direction increasing the air output.

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