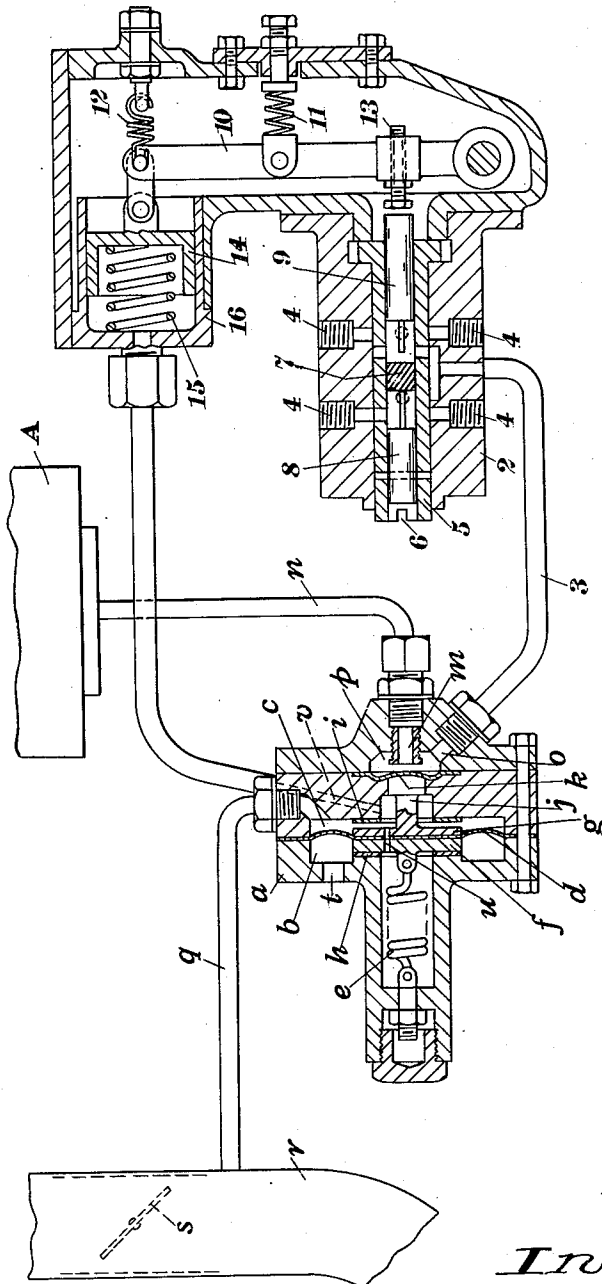


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APPARATUS FOR CONTROLLING THE INJECTION OF
LIQUID FUEL TO INTERNAL-COMBUSTION ENGINES
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APPARATUS FOR CONTROLLING THE INJECTION OF LIQUID FUEL TO INTERNAL-COMBUSTION ENGINES

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For the injection of liquid fuel, and particularly a light fuel such as petrol, to the cylinders of an internal combustion engine, it is known to employ a pump and a distributor, the latter being of the kind provided with means responsive to the depression of pressure in the air manifold of the engine for varying the rate of supply of fuel from the distributor to the engine cylinders, and the air flow through the manifold being under the control of a throttle. It is desired that an unduly weak fuel-air mixture shall not be supplied to the engine when the throttle is suddenly opened from a closed or nearly closed position.

The object of the present invention is to enable the above mentioned requirement to be met in a simple and satisfactory manner.

The invention comprises means whereby when the depression of pressure in the manifold exceeds a predetermined limit, the means which controls the rate of supply of fuel is temporarily put out of action so that it can automatically assume a condition approaching full delivery, and the supply of fuel is temporarily interrupted.

In particular, the invention comprises the combination of a hollow body part, a spring-loaded and movable diaphragm or piston dividing the said part into two compartments, one of which is adapted for connection to the engine manifold, the other being in communication with the outer atmosphere, a closure member operable by the diaphragm or piston for controlling communication between the pump and distributor, and means operable by the diaphragm or piston for establishing communication between the distributor controlling means and either the engine manifold or the outer atmosphere.

The accompanying drawing illustrates one embodiment of the invention.

Referring to the drawing, a hollow body part *a* is divided into two compartments *b*, *c* by a movable diaphragm *d* which is loaded by a spring *e* and which at its centre has secured to its opposite sides a pair of rigid discs *f*, *g* which co-operate with a pair of annular seatings *h*, *i*. At the centre of one of the discs is formed or secured a plunger *j* slidable in a bore in the body part, and the free end of the plunger acts on another diaphragm *k* which serves as a closure member for closing a fuel inlet *m*, the latter being adapted for connection by a pipe *n* to a constant pressure pump *A*. Adjacent to the said inlet there is provided an outlet *o* which is adapted for connection by a pipe to the distributor, a sub-chamber *p* in the body part extending across the fuel inlet

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and outlet being bounded on one side by the second diaphragm *k*.

The compartment *c* is provided with a connection for a pipe *q* leading to the manifold *r* at a position between the throttle *s* and the engine cylinders. The other compartment *b* is in communication with the outer atmosphere through an orifice *t*. Also a restricted passage *u* is formed through the diaphragm *d* and discs *f*, *g* whereby in one position of the diaphragm communication is provided between the compartment *b* and that part of the compartment *c* lying within the seating *i*. Further the portion of the compartment *c* lying within the seating *i* is provided with a passage *v* leading to a pipe *w* connected to the distributor controlling means.

The arrangement is such that so long as the depression of pressure in the manifold does not exceed a predetermined limit the spring *e* acting on the diaphragm *d* holds the disc *f* against its seating *h*. In this condition the pump is in communication with the distributor, and the distributor controlling means is in communication with the manifold by way of the passage *v*. While this condition prevails, the ratio of supply of fuel to the engine depends on the depression of pressure in the manifold. But in the event of the depression of pressure exceeding the predetermined amount (which may be varied by adjustment of the spring) the diaphragm *d* is caused thereby to move to its other position, in which the other disc *g* by co-operation with its seating *i* isolates the pipe *w* from the pipe *q*. At the same time the plunger *j* is caused to close the liquid fuel inlet *m* and so isolate the pump. In this condition, the inflow of atmospheric air to the passage *v* from the compartment *b* through the hole *u* causes the distributor controlling means to move towards the position in which a full supply of fuel can be supplied to the engine when communication with the pump is restored. If desired this movement of the diaphragm may also open an air-bleed (which is normally closed) so that atmospheric air can pass to the manifold for reducing the depression of pressure. When a normal depression is restored in the manifold, the diaphragm *d* returns to its initial position, and the connection with the pump is restored. As the distributor can now discharge fuel at a full rate or approximately full rate, an effective fuel-air mixture is supplied to the engine, and the normal control of the distributor by the manifold depression of pressure is resumed.

Instead of a diaphragm as above described a spring loaded piston slidable in a bore between

the two compartments may be used, the opposite ends of the piston being adapted to co-operate with the said seatings.

One form of distributor and its controlling means (which form no part of the present invention) are shown at the right hand side of the drawing. The distributor comprises a body part 2 which is connected by a pipe 3 to the outlet o of the apparatus above described. Also in the body part 2 are formed a plurality of delivery passages 4 for connection to the engine. In the said body part is formed a cylindrical bore containing a hollow rotary and suitably ported valve 5 which is driven by connection of its end 6 with a suitable source of motion. In the valve is contained a shuttle piston 7 which is movable alternately in opposite directions by pressure of the fuel within limits determined by a fixed stop 8 and an axially adjustable stop 9. The extent of movement of the shuttle piston determines the quantity of fuel delivered at each of the successive stages in the rotation of the valve.

For controlling the extent of movement of the shuttle piston, there is provided a lever 10 loaded by springs 11, 12. On this lever is carried an adjustable abutment 13 which determines the position of the stop 9. The lever is also connected to a controlling piston 14 loaded by a spring 15 and contained in a cylinder 16 connected by the pipe w to the apparatus above described. It will be evident from examination of the drawing that the position of the piston 14 and consequently the position of the stop 9 is normally variable in response to variations of pressure in the manifold r at the engine side of the throttle s. When the cylinder 16 is isolated from the manifold by the action of the diaphragm d, atmospheric air can enter the cylinder through the pipe v from the air inlets t, u, and so cause the piston 14 to move to the right under the pressure of the spring 15, so enabling the stop 9 to move towards the position in which the maximum amount of fuel can temporarily be supplied to the engine.

By this invention excessive reduction of the

rate of fuel supply to the engine during the transition from an excessive to the normal depression of pressure in the manifold is obviated in a convenient and satisfactory manner.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for controlling the injection of liquid fuel to an internal combustion engine from a pump having a communication with a distributor of the kind including means responsive to the depression of pressure in the air manifold of the engine for varying the rate of supply of fuel from the distributor to the engine cylinders, comprising means responsive to a depression of pressure in the engine manifold which exceeds a predetermined limit for temporarily putting out of action the means for varying the rate of fuel supply to the engine cylinders and thereby interrupting the supply of fuel thereto, and means causing said fuel supply varying means to automatically assume a condition approaching full delivery when said latter means is temporarily put out of action.

2. Apparatus according to claim 1, comprising a hollow body part, spring-loaded and movable fluid-actuatable means dividing said part into two compartments, one of which is adapted for connection to the engine manifold and the other of which is in communication with the outer atmosphere, a closure member and co-operating seating controlling the communication between the pump and the distributor, an operative connection between said closure member and said movable fluid-actuatable means, a distributor controlling means normally in communication with the engine manifold, and means operable by said movable fluid-actuatable means for establishing communication between said distributor controlling means and the outer atmosphere.

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No references cited.