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LIQUID FUEL CONTROL MEANS

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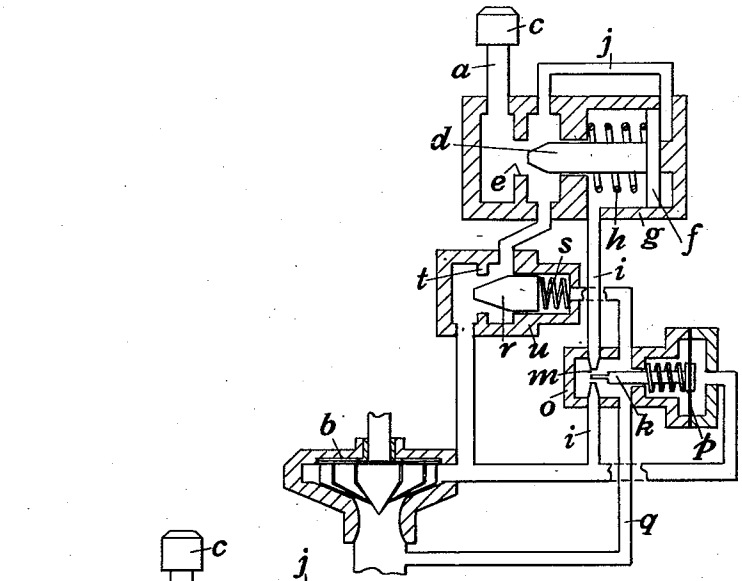


Fig.1

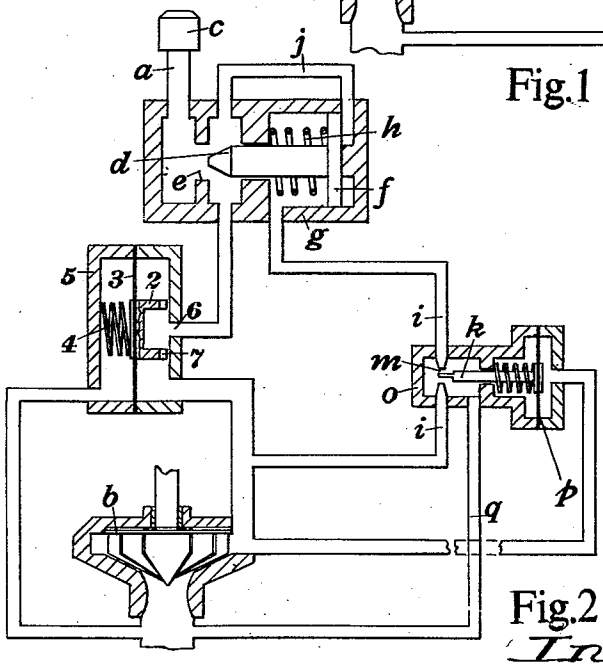


Fig.2

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LIQUID FUEL CONTROL MEANS

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1 Claim. (Cl. 158—36.4)

This invention relates to means for controlling the supply of liquid fuel from a rotary pump to a jet-engine or gas turbine.

The object of the invention is to obviate excessive fuel supply during acceleration.

The invention comprises the combination of a main throttle for controlling the rate of flow of fuel in a fuel-supply pipe between the pump and a burner, a liquid-actuated means for actuating the throttle, a governor for controlling the pressure of liquid on the throttle-actuating means, and a second spring-loaded throttle in the fuel-supply pipe responsive to the pressure in the said pipe.

In the accompanying drawings:

Figures 1 and 2 are diagrammatic representations of two embodiments of the invention.

Referring to Figure 1 there is provided in the fuel supply pipe *a* between a centrifugal pump *b* and burner *c*, an axially slidable throttle *d* having a conical or like part adapted to co-operate with an orifice *e* for controlling the rate of flow in the pipe *a*. The pump *b* is driven at a speed related to that of the engine (not shown). The throttle is formed on or secured to a piston *f* slidable in a cylinder *g* which at one end contains a spring *h* the latter acting on the piston in the direction for moving the throttle to its fully open position. Also this end of the cylinder is connected by a pipe *i* to a point in the system adjacent to the pump outlet, and the other end of the cylinder is connected to the throttle inlet by a passage *j*. Further, in the pipe *i* is arranged any convenient governor for controlling the pressure of the fuel in the said pipe *i*. The governor may comprise a valve for controlling a by-pass and responsive to a fluid pressure related to speed, or other factor associated with the system. Or (and as shown) it may consist of a shutter *k* movable across a gap *m* in the pipe. The gap is enclosed in a chamber *o*, and the shutter is operable by a spring loaded diaphragm *p* which at one side is subjected to the pressure of a liquid supplied by the pump *b* along a pipe *p*, or by a separate pump. At low pressure the shutter is fully retracted, thereby allowing liquid at full pressure to pass to the cylinder *g*. In this condition the throttle *d* is moved to its fully open position by the spring *h*, the liquid pressures acting on opposite sides of the piston *f* being substantially balanced. When the shutter obstructs flow across the gap *m*, the pressure in the pipe *i* is correspondingly reduced. The preponderating liquid pressure then acting on the right hand side of the piston *f* moves the throttle *d* in the direction for reducing the flow of fuel to the burner. Excess liquid entering the chamber *o* is returned to the pump inlet by the pipe *q*.

In addition there is provided in the fuel-supply pipe *a*, and preferably between the pump and the above mentioned throttle, an additional axially movable throttle *r* which is loaded by a spring *s* tending to move this throttle

towards an orifice formed by an annular seating *t*. The throttle *r* is supported in a cylinder *u* which at one end is connected to the chamber *o* of the governor.

The mode of action is as follows:

When starting, the throttle *r* restricts the rate of flow of fuel to the burner, allowing only sufficient to pass to enable the desired acceleration to occur. Meanwhile the main throttle *d* is fully open. With increasing fuel pressure corresponding to increased speed of the pump, the throttle *r* is opened to an increasing extent by the fuel pressure acting on it in opposition to its spring. At full speed, a full supply of fuel passes the throttle *r*, and the rate of flow to the burner is then controlled only by the throttle *d* in response to the governing means.

As an alternative to the throttle *r* above described, there may be used the device shown in Figure 2. This consists of an annular barrier **2** carried by a diaphragm **3**, loaded by a spring **4** contained in a chamber **5** connected to the main fuel supply pipe *a*, the barrier being arranged to bear against a wall of the chamber in which is formed an outlet orifice **6**. In one position a restricted flow can pass through notches **7** in the free edge of the barrier. When, by pressure of the fuel on the diaphragm the barrier is moved away from the wall, a full flow of fuel can pass. In other respects, the arrangement shown in Figure 2 is similar to that shown in Figure 1.

The invention is not, however, restricted to any particular construction of either of the throttles, or of the servomechanism for actuating one of the throttles, or of the governing means, as these may be varied to suit different requirements. Also, whilst for most purposes it is usually more convenient to employ the fuel for actuating the main throttle, motive liquid from any other source may be utilised.

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

A liquid fuel supply system comprising in combination a centrifugal pump having an inlet and an outlet for liquid fuel, a fuel delivery pipe communicating with said outlet, a normally-open main throttle arranged to provide a variable fuel-flow restriction in said pipe, a liquid-operated device connected to said main throttle for effecting actuation thereof, and thereby varying fuel flow through said pipe, means for controlling the action of said device on said main throttle, said means including a pressure liquid supply passage connected to said device and a governor responsive to the speed of said pump arranged in association with said passage to control the pressure of the liquid supplied by said passage to said device, and a spring-loaded subsidiary throttle arranged to provide a second variable fuel-flow restriction in said pipe at a position between said pump and main throttle, said subsidiary throttle being exposed to and movable against its spring loading by the delivery pressure of said pump for reducing said second variable fuel-flow restriction until said subsidiary throttle reaches its fully open position as a result of the delivery pressure of said pump attaining a predetermined value due to increasing speed of said pump, whereupon the fuel flow through said pipe is controlled by said main throttle only.

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