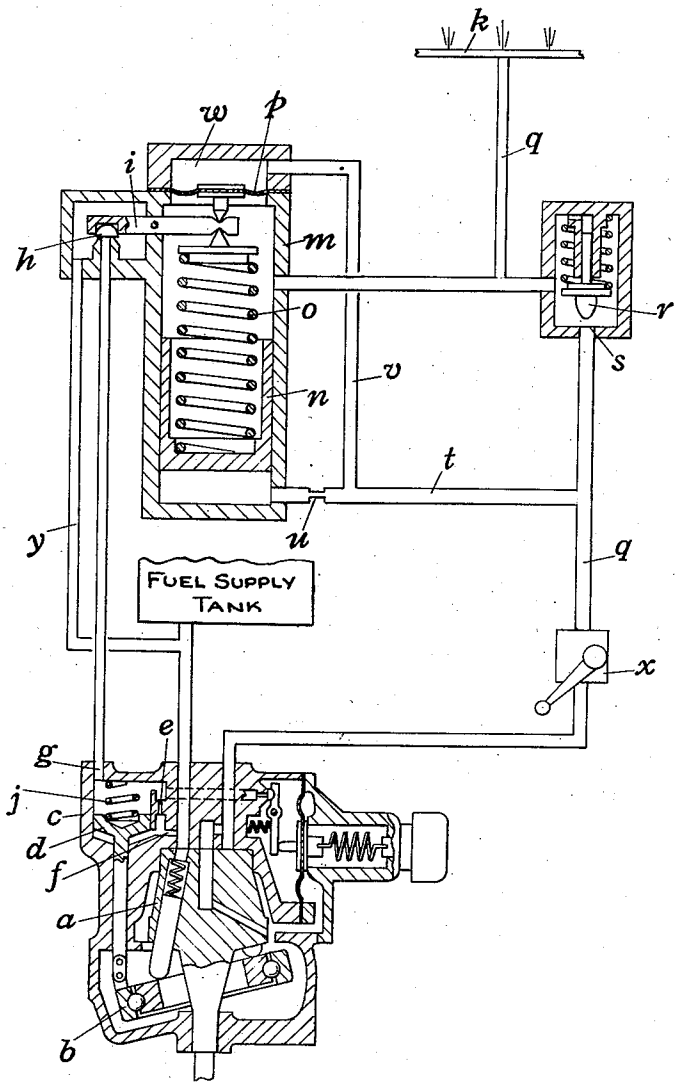
July 13, 1954 T. A. HARRIS 2,683,485

LIQUID FUEL CONTROLLING MEANS FOR JET-ENGINES, GAS TURBINES, OR LIKE PRIME MOVERS

Filed Dec. 11, 1950



Inventor
T. A. Harris
By Glascock Downing Seebold
Attys.

Patented July 13, 1954 2,683,485

UNITED STATES PATENT OFFICE

2,683,485

LIQUID FUEL CONTROLLING MEANS FOR JET-ENGINES, GAS TURBINES, OR LIKE PRIME MOVERS

Thomas Alfred Harris, Edgbaston, Birmingham, England, assignor to Joseph Lucas Limited, Birmingham, England

Application December 11, 1950, Serial No. 200,278

Claims priority, application Great Britain December 19, 1949

1 Claim. (Cl. 158—36.3)

1

This invention relates to the liquid fuel controlling means employed on jet engines, gas turbines or like prime movers, of the kind which include a liquid-operated servo-mechanism for automatically varying the rate of supply of fuel to the combustion chamber or chambers, and also a control means operable by the driver.

In some such systems it is possible to obtain a temporary but undesirable excess of fuel supply to the combustion chamber when the throttle is opened suddenly, and the object of the present invention is to obviate this condition.

The invention comprises the combination with a valve for controlling the servo-mechanism, of valve actuating means responsive to a pressure difference set up in the system in response to a change of pressure accompanying a change in the rate of flow of the liquid fuel, the said means including a piston slidable in a cylinder and loaded by a spring which at one end is supported by one side of a valve-actuating lever, and a diaphragm (or piston) of smaller effective diameter acting on the opposite side of the lever, the first mentioned piston and the diaphragm (or piston) being responsive to the said pressure difference.

The accompanying diagram illustrates one mode of carrying the invention into effect.

Referring to the diagram there is employed a known form of liquid operated servo-mechanism adapted to control the fuel pump output, or a throttle valve, or a by-pass valve in the fuel supply system. In the example shown, the servo-mechanism controls the output of a variable delivery pump *a* of the swash plate type, the said mechanism serving to vary the obliquity of an adjustable swash plate *b*. The servo-mechanism comprises a cylinder *c* containing a spring loaded piston *d*. Both ends of the cylinder are in communication through a restricted orifice *e*, and pressure fluid is admitted to one end of the cylinder at *f*. An outlet *g* at the other end of the cylinder is controlled by a valve *h* operable by a lever *i*. The arrangement is such that when the valve is closed the spring *j* moves the piston in the direction for increasing the rate of fuel supply to the burner *k* in the combustion chamber of the prime mover, and when the valve is opened the pressure of the liquid moves the piston in the direction for reducing the rate of fuel supply.

In association with the said valve lever *i* there is provided in accordance with the present invention, a cylinder *m* containing a piston *n* which is loaded by a suitable spring *o*, the end of the spring remote from the piston being supported

2

by one side of the lever. The end of the cylinder adjacent to the lever is divided by a diaphragm *p* to form an antechamber *w*, the diaphragm being of smaller effective diameter than the piston. Instead of a diaphragm an equivalent piston may be used. This diaphragm (or piston) acts on the other side of the lever.

In series with the fuel supply pipe *q* there may be provided if desired a spring loaded valve *r* co-operating with a seating *s*, and such that the extent of opening of the valve depends on the difference of pressure in the liquid fuel between the entrance and exit sides of the valve. The approach side of the valve *r* is connected by a pipe *t* and a restricted orifice *u* to the end of the cylinder *m* containing the piston *n*, and is also connected to the antechamber *w* by a pipe *v*. The intermediate part of the cylinder containing the spring is, in this example, connected to the discharge side of the valve *r*. The valve *r* is, however, not essential, and may be replaced by a restrictive orifice of fixed diameter. Alternatively neither of these devices may be necessary in some cases, the pipe *q* being then connected directly to the burner *k*, and the intermediate part of the cylinder *m* being then connected to a sump or the inlet side of the fuel pump.

The arrangement is such that in the event of an increase of pressure in the pipe *q* due to an increase in the rate of flow in the said pipe, following a sudden opening of the driver's throttle valve *x*, a temporary pressure difference will result across the restricted orifice *u*, and when the pressures which consequently act on the mechanism above described are such that the force exerted on the valve lever *i* by the diaphragm *p* (or piston) is greater than that exerted on the piston *n*, the lever will be moved in the direction for causing the servo-mechanism to reduce the fuel. And when the pressure difference is subsequently reduced, the mechanism resumes its previous condition. Spillage through the valve *h* may be returned to a sump, or to the inlet side of the pump, by way of a pipe *y*.

It will be understood that the action above described is only a temporary one, and its effect is to obviate an undesirable sudden increase of rate of fuel supply, with risk of temporary overfueling of the prime mover, when the driver's throttle valve is opened suddenly. In other words the effect is to make the rate of increase of fuel supply independent of the rate at which the driver actuates the throttle valve under his direct control when he desires to accelerate the prime mover.

The invention is not, however, restricted to the

example above described. Thus the restricted orifice u and the connection with the antechamber w may be arranged in any part of the fuel supply system in which an appropriate change of pressure accompanies a change in the rate of flow. Moreover, and as already stated, the servomechanism may be adapted to actuate any other means than the pump control means for varying the rate of supply of fuel to the burner k. Also the part above described as the throttle x may be any other manually controllable means for varying the rate of supply of fuel to the burner.

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

A liquid fuel supply system comprising in combination a liquid fuel pump, at least one liquid fuel burner, means connected to and providing a passageway between the discharge side of said pump and said burner, a throttle in said passageway, a liquid-operated servo-mechanism for controlling the rate of fuel flow from said pump to said passageway, a valve controlling said servomechanism and having an actuating lever, a cylinder, a piston slidable in said cylinder, a spring arranged between said piston and one side of said lever, a pressure responsive member of smaller effective area than said piston acting on

the opposite side of said lever, means for creating a temporary liquid pressure difference in response to a sudden change in the rate of flow of liquid fuel through said passageway, and means for exposing said piston and pressure responsive member at the sides remote from said lever to opposing liquid pressures which vary relatively to each other with said liquid pressure difference, so that said actuating lever is movable in one direction through the medium of said pressure responsive member by said liquid pressure difference, and is thereafter moved in the opposite direction through the medium of said piston and spring as said liquid pressure difference is reduced.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,474,033	Chamberlin et al.	June 21, 1949
2,523,214	Ifield	Sept. 19, 1950
2,536,556	Lawrence	Jan. 2, 1951
2,537,681	Lawrence	Jan. 9, 1951
2,562,615	Huber	July 31, 1951
2,564,263	Ifield	Aug. 14, 1951
2,605,709	Jubb	Aug. 5, 1952