March 30, 1954

O. N. LAWRENCE

MEANS FOR SUPPLYING LIQUID FUEL TO SPILL TYPE BURNERS IN PRIME MOVERS

Filed May 11, 1951

Inventor

O. N. Lawrence

Drawn By: Leonard Mooring, Jr.
This invention has for its object to provide means for supplying liquid fuel at a variable rate to the burner of such a prime mover as a jet-engine or gas turbine, the burner comprising one or more nozzles of the swirl-type, and having associated therewith a spill pipe for turning excess fuel supplied for maintaining an effective swirl condition.

The invention comprises the combination of a centrifugal fuel-supply pump, and adjustable means for connecting the discharge end of the burner spill pipe to a variable position between the pump inlet and outlet.

The invention also comprises means for automatically actuating the adjustable means.

The accompanying drawing represents diagrammatically one embodiment of the invention.

Referring to the diagram, a centrifugal pump of any convenient form is employed for supplying the liquid fuel to the burner or burners, the pump housing a being provided with a connection for a supply pipe b leading to the burner c. One side of the pump impeller d is open, and adjacent to this side there is formed in the housing a radial chamber e which at one side is exposed to the impeller. In this chamber is arranged a slidable plunger f having therein a radial port g facing the open side of the impeller, and the port communicates with one end of a longitudinal passage h, in the plunger, the other end being adapted for the connection thereto of a flexible end of the spill pipe i connected to the burner.

When the pump is in action a pressure gradient exists in the impeller, and by moving the plunger to bring the said port g to an appropriate position on the gradient, any desired pressure difference can be set up in the spill pipe for varying the rate of return flow of excess fuel from the burner to the pump.

To enable the return flow of excess fuel to be maintained substantially constant, or to be otherwise controlled, the plunger may conveniently be actuated by a liquid-operated servomechanism. Such a mechanism comprises a piston k attached to the plunger, the piston being sliding in a cylinder m the opposite ends of which are in communication by way of a restricted orifice n. One end of the cylinder is adapted for connection to the pump outlet by a pipe o, or the fuel-supply pipe leading to the burner. The other end is provided with an outlet which is connected by a pipe p to the seating q of a normally-closed valve r. The valve is operable by a lever s which in turn is operable by a stem t extending from a diaphragm u which divides into two compartments v, w from which passages lead to two points in the pump housing which are open at different radial positions to the open side of the impeller.

The two sides of the diaphragm are thus subject to a liquid pressure difference which depends on the rate of rotation of the impeller. When this difference exceeds a predetermined amount, the diaphragm causes the valve to be opened. The servomechanism thereupon moves the plunger f towards the axis of the impeller so increasing the pressure difference in the spill pipe and causing an increase in the return flow, with corresponding reduction of the supply of fuel to the burner until the previous condition is restored.

The diaphragm above mentioned is loaded by a spring x which is adjustable by a manually operable lever y for enabling the output of the pump to be varied to suit different working conditions.

By this invention the automatic control of a fuel supply system to a burner having a nozzle or nozzles of the swirl-type can be effected in a very simple manner.

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

1. A liquid fuel supply system comprising in combination a centrifugal pump having a fuel inlet and fuel discharge outlet, a burner communicating with said outlet and having at least one fuel discharge nozzle of the swirl-type, a spill pipe communicating at one end with said burner and at the opposite end with said pump at a position between said inlet and outlet so that excess liquid fuel supplied by said pump to said burner for maintaining an effective swirl condition at said nozzle returns to said pump through said spill pipe at a rate dependent on the fuel pressure in the part of said pump communicating with said spill pipe, and additionally-displaceable means for varying the position at which said pump communicates with said spill pipe, and thereby varying the rate of return fuel flow through said spill pipe.

2. A liquid fuel supply system according to claim 1 and having automatic means for moving said displaceable means.

3. A liquid fuel supply system comprising in combination a centrifugal pump formed by a rotary impeller in a housing having a fuel inlet and a fuel discharge outlet, a burner communicating with said outlet and having at least one fuel discharge nozzle of the swirl-type, a spill...
pipe communicating at one end with said burner, a chamber in said housing at one side of said impeller, a plunger slidably adjustable in said chamber and having there-in a passage through the medium of which the opposite end of said spill pipe communicates with the interior of said housing at a position between said inlet and outlet so that excess liquid fuel supplied by said pump to said burner for maintaining an effective swirl condition at said nozzle returns to said pump through said spill pipe at a rate dependent on the fuel pressure in the part of said pump communicating with said spill pipe, and means for actuating said plunger for varying the position at which said spill pipe communicates through said passage with said housing, and thereby varying the rate of return flow of fuel through said spill pipe.

4. A liquid fuel supply system according to claim 3, in which the means for actuating the plunger comprises a liquid-operated servo-mechanism having controlling means responsive to a liquid pressure difference in the impeller of said pump.

5. A liquid fuel supply system according to claim 4, in which the means for controlling the servo-mechanism comprises in combination a valve, a diaphragm for actuating said valve in response to a liquid pressure difference in the pump, a loading spring acting on said diaphragm, and manually operable means for adjusting said spring.

OWEN NAPIER LAWRENCE.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,407,139</td>
<td>Clothier</td>
<td>Sept. 3, 1946</td>
</tr>
<tr>
<td>2,528,214</td>
<td>Ifield</td>
<td>Sept. 19, 1950</td>
</tr>
<tr>
<td>2,616,507</td>
<td>Greenland</td>
<td>Nov. 4, 1952</td>
</tr>
<tr>
<td>2,619,163</td>
<td>Wynne et al.</td>
<td>Nov. 23, 1952</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Britain</td>
<td>Feb. 17, 1949</td>
</tr>
</tbody>
</table>