

[54] MEANS AND METHOD FOR REGULATING
FUEL COMBUSTION IN AN EXTERNAL
COMBUSTION ENGINE

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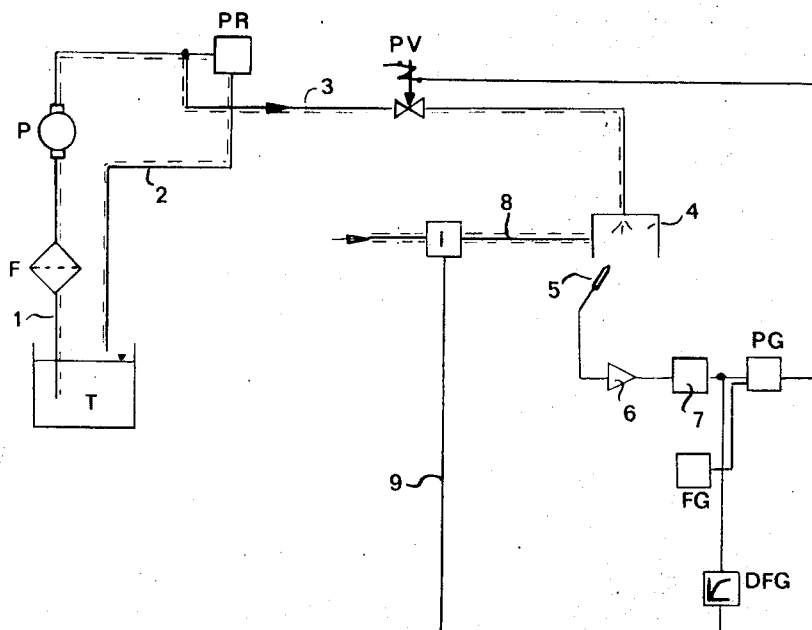
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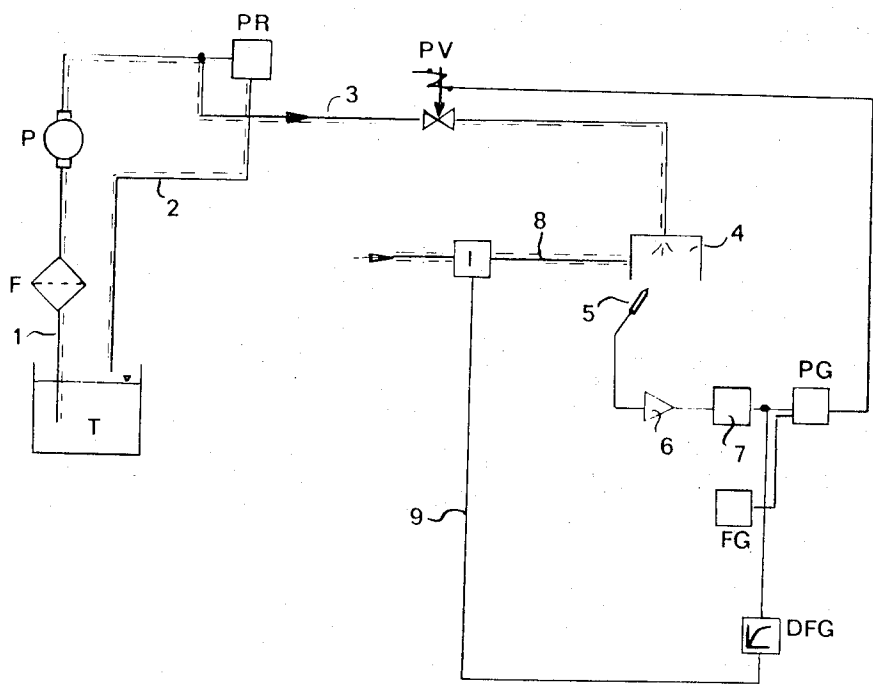
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[57] ABSTRACT

To regulate fuel for maintaining a continuous combustion of fuel at a known and constant temperature a fuel valve under constant pressure is opened and closed periodically at known time intervals which can be varied to regulate the mean rate of fuel supply. A temperature responsive element in the combustion chamber is connected with control means to regulate said intervals.

9 Claims, 1 Drawing Figure





MEANS AND METHOD FOR REGULATING FUEL COMBUSTION IN AN EXTERNAL COMBUSTION ENGINE

This invention relates to a method of and device for maintaining and regulating a continuous combustion of fuel in an external combustion engine.

Modern external combustion engines are based upon the principle of supplying thermal energy to a medium which is subsequently allowed to cool and thereby develop an amount of mechanical work. Such engines have a high degree of efficiency and use a drop in temperature from a high level. Therefore maintaining a high temperature at a constant level is a desirable feature in the engine in spite of varying outputs and thus varying rates of combustion.

Hitherto the rate of supplying fluid fuel to such an engine has been governed by a valve having a varying degree of opening of a fluid passage for the fuel.

However, this method of governing the rate of supplying fluid fuel is often not sufficiently accurate, especially in a case when the engine is provided with a plurality of burning devices all of which should be supplied individually in order to maintain the same temperature. Also the accuracy of the known method of gradually opening a valve is dependent on a very pure fuel which is not always available or acceptable from an economic point of view.

The present invention is therefore intended to provide an improved method of and device for governing a flow of fuel for maintaining a continuous combustion in an external combustion engine, the said method being accurate but substantially unaffected by variations in fuel quality and easy to put into practice by a combination of substantially conventional elements.

According to the present invention there is provided a method of maintaining and regulating a continuous combustion of fuel in an external combustion engine, characterised in that a fluid fuel is continuously supplied to fuel valve means under a constant pressure and that said valve means alternately close and then open to allow fuel to pass to an atomizer at time intervals at a constant frequency and to a constant extent of valve opening but with the valve staying open for varying parts of the said time intervals in order to regulate the mean rate of fuel supply to the atomizer.

The invention also provides a device for carrying the method into effect, and the said device is characterised in that a temperature-responsive element is arranged in a combustion chamber of the engine and is connected through an amplifier to a temperature setting device the output signals of which are fed to a pulse train generator receiving signals from a frequency generator and giving signals for actuating the said fuel valve means.

The scope of the monopoly sought is defined in the claims hereinafter and how the invention can be put into practice is described in more detail with reference to the accompanying drawing which shows a diagram of a device according to the invention for maintaining and regulating a continuous combustion of fuel in a Stirling cycle hot gas engine.

Referring to the said diagram there is a fuel tank T from which liquid fuel passes through a pipe 1 to a filter F, the flow of fuel being caused by a pump P delivering fuel to an overflow pressure regulating device PR from which surplus fuel is returned to the tank T through a return pipe 2. Fuel under constant pressure — e.g. two

bars — is delivered through a pipe 3 to a pulse valve PV from which it is passed to an atomizer in a combustion chamber 4 in a Stirling cycle hot gas engine.

A temperature-responsive element 5 mounted in the combustion chamber 4 gives a signal corresponding to the temperature in the combustion chamber 4, and this signal is passed to a pre-amplifier 6 for actuating a temperature regulating device 7. Signals from the temperature regulating device 7 are fed to a pulse width generator PG which also receives signals from a frequency generator PG. The pulse train which is fed to the pulse valve PV has a constant frequency giving a pulse causing opening of the valve PV at a constant time interval t , but a pulse causing closing of the valve PV at a time Δt after each opening thereof. Δt will vary according to the difference between the desired and the actual temperature in the combustion chamber of the Stirling cycle hot gas engine.

Combustion air is fed to the combustion chamber 4 through a conduit 8, the air being driven by an impeller I having means for varying the rate of delivery. The said means are governed by signals fed through a lead 9 from a diode function generator DFG also receiving signals from the temperature regulating device 7. Thus the signals to the air impeller may be given a suitable characteristic in order to obtain the desired excess of air at any power output of the engine.

It will be understood that the delivery of fuel to the combustion chamber 4 of the engine may be varied by varying Δt from 0 to 100% of the time interval t . Said time interval t may be between 0 and 25 milliseconds, if 40 Hz frequency is used.

What we claim is:

1. Apparatus for maintaining and regulating a continuous combustion of fuel in an external combustion engine, comprising

1. means continuously supplying a fluid fuel under constant pressure to a valve, and

2. means alternately opening and closing said valve at a periodic rate to regulate the mean flow of said fuel.

2. Apparatus as defined in claim 1 including additional means sensing the temperature of combustion and controlling said rate to maintain a substantially constant combustion temperature.

3. A device for maintaining and regulating a continuous combustion of fuel in a combustion chamber of an external combustion engine comprising in combination,

means supplying liquid fuel for said engine under constant pressure,

a valve receiving the fuel under constant pressure, means delivering the fuel from said valve to said engine,

means to open and close said valve, and

means establishing a periodic rate of opening and closing said valve to provide a mean rate of fuel flow through said valve to said engine.

4. A device as defined in claim 3 having a temperature responsive element sensing the combustion temperature of said engine, and means responsive to said element controlling said periodic rate as a function of said temperature.

5. A device as defined in claim 4 wherein said means controlling said rate comprises a pulse train generator providing periodic pulses of a fixed frequency having

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the time interval between pulses controlled by said temperature.

6. A device as defined in claim 4 having means feeding air to said combustion chamber, and means responsive to said element controlling the feed rate of said air as a function of said temperature.

7. A device as defined in claim 4 wherein the last mentioned means comprises a diode function generator.

8. A device as defined in claim 3 wherein the means

for supplying liquid fuel under constant pressure comprises, a fuel tank, a pump passing fuel from said tank, a pressure regulating device receiving fuel from said pump and returning surplus fuel to the tank.

9. Apparatus as defined in claim 1 including constant frequency means operating said valve to open it and means responsive to the engine temperature to close it at a time increment after opening as a function of the temperature.

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