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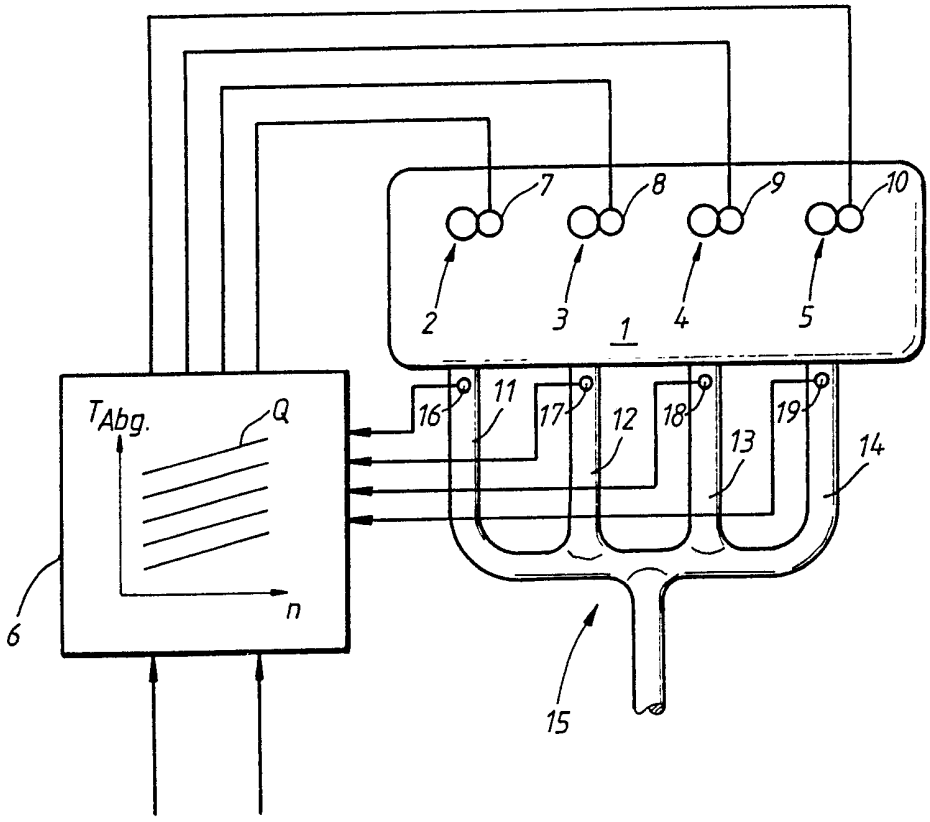
(54) Regulating the injection quantity of a fuel-injection device

(57) To regulate the injection quantity of solenoid-valve-controlled fuel-injection devices each consisting of a pump and nozzle 2, 3, 4, and 5 for respective cylinders of an internal-combustion engine, in order to eliminate the irregular running of the internal combustion engine, the exhaust-gas temperature of each cylinder is measured by sensors 16, 17, 18, 19. the actual value of exhaust-gas temperature is compared with a desired value, filed in a characteristics store in a control unit 6, and in the event of a deviation the injection quantity is regulated to the desired value by changing the activation time of the solenoid valve, 7, 8, 9 and 10.



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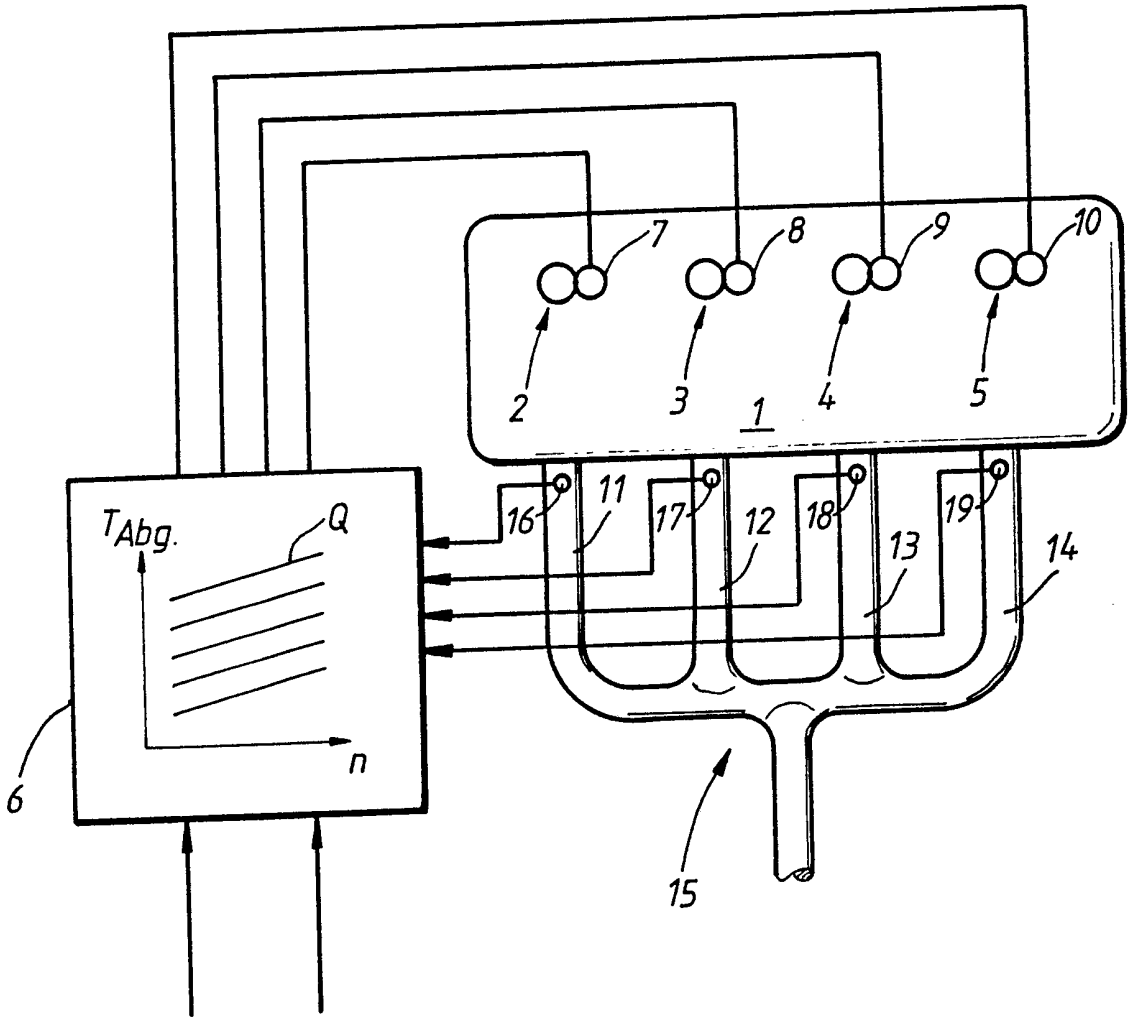
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Process for Regulating the Injection Quantity on a Fuel-Injection Device

The invention relates to a process for regulating the injection quantity of a solenoid valve-controlled fuel-injection device consisting of a pump and nozzle, for air-compression auto-ignition multi-cylinder internal-combustion engines, in which, in use, values for the engine speed, load and exhaust-gas temperature which are determined by sensors are obtained and in an electronic control unit are processed to form output signals for activating a solenoid valve connected operatively to the injection nozzle.

In a process known from German Offenlegungsschrift 1,916,167, by means of an electronic control unit detecting operating data of the internal-combustion engine any regulation desired can be carried out by adjusting the opening times of the control valves (inlet and outlet valves) and the fuel-injection timing, a solenoid valve switchable by the control unit being used as an actuating device for the fuel injection. The quality of combustion can be monitored and regulated by means of the data picked up from the internal-combustion engine, such as speed, load, smoke generation and temperatures in the combustion space and/or in the exhaust-gas line or the like.

However, with measures of this type, in practice it has been impossible to prevent irregularities in the engine running in particular speed ranges.

The present invention seeks to make it possible by simple means to ensure a uniform running of the internal-combustion engine over the entire speed range.

According to the present invention there is provided a process for regulating the injection quantity on a solenoid-valve-controlled fuel-injection device consisting of a pump and nozzle for use with air-compression multi-cylinder internal-combustion engines,

in which, in use, values for the engine speed, load and exhaust-gas temperature which are determined by sensors are obtained and in an electronic control unit are processed to form output signals for activating a solenoid valve connected operatively to the injection nozzle, wherein the exhaust-gas temperature of each cylinder of the internal-combustion engine is measured, the particular actual value of this exhaust-gas temperature is compared with the desired value, filed in a characteristics store, of the exhaust-gas temperature previously determined, and in the event of a deviation the injection quantity is regulated to the desired value by changing the activation time of the solenoid valve.

In a preferred embodiment, the exhaust-gas temperature is measured immediately downstream of the outlet valves assigned to the individual cylinders.

The advantage of the invention is that the injection quantity of each individual cylinder can be changed while the internal-combustion engine is in operation and consequently dispersals in quantity from cylinder to cylinder can be tuned out. It is possible for the injection quantity of the individual cylinder to be regulated up to high engine speeds. There is even no need to balance the pump and nozzle relative to one another on the pump test bench before the engine is installed, since irregularities occurring in the injection quantity which are caused by unavoidable production tolerances of the pump and nozzle in relation to one another can be tuned out.

An embodiment of the invention will now be described by way of example with reference to the drawing.

A solenoid valve-controlled fuel-injection device for a multi-cylinder internal-combustion engine 1 consists essentially of pump-nozzle assemblies 2, 3, 4, 5 which correspond to the number of cylinders and each of which is equipped with a solenoid valve 7, 8, 9, 10 activatable by an electronic control unit 6.

The control unit 6 with its characteristics store already contains a family of injection-quantity characteristics which is predetermined as ideal and of which variously illustrated injection-quantity characteristics "Q" are plotted as a function of the particular exhaust-gas temperature "T_{exh}" and speed "n". Each individual line 11, 12, 13, 14 flanged to the internal-combustion engine 1 and belonging to an exhaust manifold 15 is equipped with a sensor 16, 17, 18, 19 detecting the exhaust-gas temperature. The particular exhaust-gas temperature is advantageously measured immediately downstream of the outlet valves (not shown), is compared as instantaneous values or actual values, in the same way as the instantaneous values of the speed and load, with the desired values stored in the family of characteristics, and in the event of deviations as a result of irregularities from cylinder to cylinder, regulated by changing the activation time of the solenoid valve obtained from the control unit, until variations in the dispersals in quantity are reduced or eliminated.

Since a further influence on the exhaust-gas temperature is the start of injection, this should appropriately be kept constant if the exhaust-gas temperature is used as a measure of dispersals in the injection quantity. As a system expedient for this purpose, the closing of this solenoid valve is determined from the trend of the activation current of the solenoid valve and is used as feedback for the start of injection. The start of injection can consequently be set exactly, and a disturbing influence on the exhaust-gas temperature arising from this cannot even occur at all.

Claims

1. A process for regulating the injection quantity on a solenoid-valve-controlled fuel-injection device consisting of a pump and nozzle for use with air-compression multi-cylinder internal-combustion engines, in which, in use, values for the engine speed, load and exhaust-gas temperature which are determined by sensors are obtained and in an electronic control unit are processed to form output signals for activating a solenoid valve connected operatively to the injection nozzle, wherein the exhaust-gas temperature of each cylinder of the internal-combustion engine is measured, the particular actual value of this exhaust-gas temperature is compared with the desired value, filed in a characteristics store, of the exhaust-gas temperature previously determined, and in the event of a deviation the injection quantity is regulated to the desired value by changing the activation time of the solenoid valve.

2. A process according to Claim 1, wherein the exhaust-gas temperature is measured immediately downstream of the outlet valves assigned to the individual cylinders.

3. A process for regulating the injection quantity on a solenoid-valve-controlled fuel-injection device substantially as described herein with reference to, and as illustrated in, the accompanying drawings.

4. Apparatus adapted to carry out the process according to any one of claims 1 to 3.

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