ABSTRACT

A carburetor for spark-ignition internal combustion engines in which the desired fuel-air mixture is maintained by electronically comparing the temperatures of combustion of two sampling burning jets. One sample is enriched with pure fuel vapor, while the other sample is diluted with pure air. The combustion temperatures of both jets are sensed by electronic means and a constant temperature difference between them is maintained by regulating the fuel-air mixture. The mixture regulation is accomplished by electro-mechanical means.

7 Claims, 1 Drawing Figure
SPARK-IGNITION INTERNAL COMBUSTION ENGINE CARBURETORS

This invention relates to carburetors for internal combustion engines and more particularly to carburetors which utilize the response of electronic devices to the heat of combustion of the air-fuel mixture to control the rate of flow of gasoline or other fuel into the engine.

An internal combustion engine derives its power from the heat from a burning air-fuel mixture. There is a certain proportioned mixture which will result in complete combustion of the fuel and yield maximum heat from the fuel and therefore maximum power, greatest economy of operation, best engine performance, with minimum pollution of the air from the exhaust gases. This mixture will hereafter be called the optimum mixture.

In a conventional carburetor the mixture is controlled by the difference in pressure in the throat of the carburetor, called the venturi, and the outside atmosphere. As more air is drawn through the venturi, this pressure difference increases. Jets spray the fuel into the air stream in the venturi in proportion to this difference of pressure.

As is well known in the art, the air-fuel mixture changes as the pressure difference changes, becoming richer with greater pressure differences, and various methods are used to compensate for this variation. Other factors affect the mixture proportions and those most prevalent are: (a) engine speed, (b) acceleration, (c) deceleration (d) temperature of air and fuel, (e) altitude or barometric pressure, (f) relative humidity of the air, and (g) variations in the quality of the fuel. Other factors may be present to a greater or lesser extent, including choke and throttle valve positions respectively controlling the inflow rate of air and the outflow rate of the fuel mixture fed to the intake manifold.

It is the primary purpose of this invention to provide the optimum mixture to the engine under all operating conditions by regulating the air-fuel mixture to produce the maximum heat of combustion instead of maintaining some predetermined proportion. This is accomplished by burning a small sample of the mixture in an analyzer, sensing the heat produced, and adjusting the mixture by electronic means until maximum heat is obtained.

It is a further object of this invention to provide a means of obtaining greater fuel efficiency, improving engine performance, and reducing air pollution from the exhaust gases over long periods of time with a minimum of maintenance.

Other objects, advantages, and novel features of the invention will become apparent from the detailed description of the invention when considered in conjunction with the accompanying drawing wherein the figure is a cross sectional view of the carburetor with a schematic diagram of the electric circuitry embodying this invention.

Referring now to the FIGURE, carburetor 1 consists of a barrel 2 mounted on engine manifold 3, a choke valve 4, a fuel bowl 5, a fuel nozzle 6, a rich analyzer 7, and a lean analyzer 8. The conventional structural features and components are associated with the carburetor, such as the venturi throat profile structure and the accelerator pedal operated throttle valve 27. The electric current to operate the electronic components comes from battery 9 and is controlled by switch 10. When the switch is turned off, a spring in servo-motor 11 closes choke valve 4. When the switch is turned on, current is supplied to all components including vacuum pump 12, which may be combined with the fuel pump (not shown), amplifiers 13 and 14, ignitors 15, and heat-sensitive photo-electric cells 16 and 17. Choke valve 4 will remain closed until actuated by servo-motor 11 in response to currents from amplifiers 13 and 14. Fuel regulating valve 18 is coupled to choke valve 4, opening when the choke valve closes and closing when the choke valve opens. Thus both fuel and air are regulated.

When the engine is turned, a vacuum is produced in barrel 2 causing fuel nozzle 6 to spray a rich mixture into barrel 2. Small samples of this mixture are drawn by vacuum pump 12 into rich analyzer 7 and lean analyzer 8 through safety screen 19. The purpose of the safety screen is to eliminate the possibility of a fire in the carburetor barrel.

The sample to rich analyzer 7 is further enriched by pure fuel vapor from fuel bowl 5 through tube 20 and is passed through jet 21 where it is ignited by ignitor 15. The heat from the burning jet is reflected by reflector 22 into heat-sensitive photo-electric cell 16 where it is converted into an electric current in proportion to the heat from the burning jet. This current is amplified by amplifier 13 and is fed into differential wound servo-motor 11. This tends to open choke valve 4 and close fuel regulating valve 18 to make the mixture leaner.

The sample to lean analyzer 8 is further diluted by pure air through tube 23 and is passed through jet 24 where it is ignited by ignitor 15. The heat from the burning jet is reflected by reflector 25 into heat-sensitive photo-electric cell 17 where it is converted into electric current in proportion to the heat from the burning jet. This current is amplified by amplifier 14 and is fed into differential wound servo-motor 11. This tends to close the choke valve 4 and to open fuel regulating valve 18 to make the mixture richer. Thus a balance is reached between the rich and lean analyzers by corrective operation of the choke valve 4 and fuel valve 18 to obtain the desired fuel mixture. Cooling fins 26 are provided on the analyzers.

Since the regulation is accomplished by electronic means, adjustments to keep the mixture at optimum are made at a very high speed. Modern electronic devices are notably reliable and accurate metering should be maintained over long periods of time with a minimum of inspection and maintenance.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claim, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In combination with a carburetor having a barrel from which a fuel mixture is supplied to an intake manifold and valve means for selectively varying the air-fuel ratio of the fuel mixture, means for automatically adjusting the air-fuel ratio of the fuel mixture conducted to the manifold, comprising means connected to the barrel for sampling the fuel mixture, means connected to the sampling means for measuring the heat of combustion of the sampled fuel mixture, and servo means connecting the measuring means to the valve means for...
3,825,239

correctively adjusting the air-fuel ratio, said sampling means comprising a pair of analyzer chambers, passage means connecting the barrel to said chambers downstream of the fuel nozzle, vacuum pump means connected to said chambers for drawing in the sampled fuel mixture, and means connected to the passage means for enriching one of the chambers with fuel vapor and diluting the other of the chambers with air.

2. The combination of claim 1 wherein said servo means comprises signal amplifier means connected to said sensing means and balancing motor means differentially energized by signals from the amplifier means for displacement of the valve means.

3. The combination of claim 1 wherein said measuring means comprises means for igniting the sampled fuel mixture to produce combustion, sensing means for detecting heat generated by said combustion and reflector means for directing the heat toward the sensing means.

4. The combination of claim 3 wherein said servo means comprises signal amplifier means connected to said sensing means and balancing motor means differentially energized by signals from the amplifier means for displacement of the valve means.

5. The combination of claim 1 wherein said valve means includes a choke valve and a liquid fuel valve drivingly connected to the servo means, and a fuel nozzle conducting liquid fuel from the fuel valve into the barrel upstream of the sampling means.

6. The combination of claim 5 wherein said measuring means comprises means for igniting the sampled fuel mixture to produce combustion, sensing means for detecting heat generated by said combustion and reflector means for directing the heat toward the sensing means.

7. The combination of claim 6 wherein said servo means comprises signal amplifier means connected to said sensing means and balancing motor means differentially energized by signals from the amplifier means for displacement of the valve means.