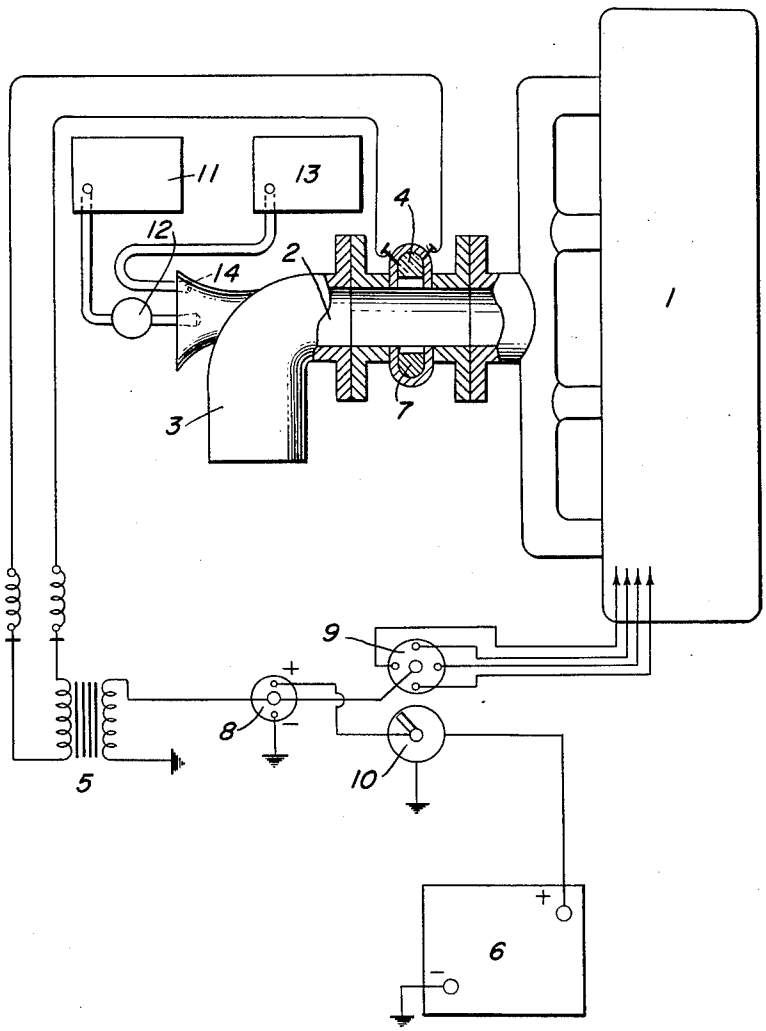
March 22, 1955 B. MAGUI ET AL 2,704,535

METHOD OF AND DEVICE FOR IMPROVING CARBURETION IN INTERNAL COMBUSTION ENGINES

Filed Jan. 29, 1951



INVENTORS
BERNARD MAGUI AND
ANDRE GIRARD

BY Wenderoth, Lind & Ponack

ATTORNEY

United States Patent Office 2,704,535 Patented Mar. 22, 1955

2,704,535

METHOD OF AND DEVICE FOR IMPROVING CARBURETION IN INTERNAL COMBUSTION ENGINES

Bernard Magui, Paris, and André Girard, Oyonnax, France

Application January 29, 1951, Serial No. 208,410

Claims priority, application France January 31, 1950

5 Claims. (Cl. 123—25)

This invention relates to the carburetion of internal combustion engines and more particularly to a novel method of and means for improving the carburetion in internal combustion engines.

It is known that the functional efficiency of an engine, or in other words its sound and economical operation, is governed essentially by the quality of the air/fuel mixture fed thereto.

The mixture, consisting essentially of air and more or less volatile hydrocarbons, has to meet two requirements.

(I) It must be suitably metered so that the combustion, that is to say the combination of the hydrocarbon with the oxygen component of atmospheric air, may take place completely.

(II) It must be homogeneous throughout in order to avoid any condensation of the hydrocarbon, before or during the explosion, likely to promote incomplete combustion, carbon deposits and above all fuel extravagance, because the ideal mixture should behave like a perfect gas.

This last requirement is the most difficult to obtain owing to the dissimilar nature of the components and the striking difference between their respective densities. The surface-tension of the liquid drops in suspension in the air has to be overcome, since it acts against the bursting and gasification thereof.

It is generally admitted that all the devices heretofore tried have only given partially satisfactory results in this respect, whether in carburettors proper, in engines (high-turbulent heads for instance), or in fuel injection systems for engines using this method.

On the other hand it is known that ultrasonic frequencies, i. e. the inaudible frequencies from 30 kilocycles/sec. up, have specific properties whereby extremely intense physical and chemical phenomena are observed in the media through which they are passed.

It is the general principle of this invention to use some of these phenomena for influencing the process of forming air/fuel mixtures.

The object of this invention is to provide a method of improving the carburetion in internal combustion engines, consisting in submitting the air/fuel mixture to the action of ultra-sounds or supersonic waves. This improvement in the carburetion when supersonic waves are resorted to is probably due to their property of creating in the medium through which they are passed intense vibration fields as well as a local temperature rise on the surfaces separating heterogeneous bodies having different densities.

To illustrate this principle by an example, assuming a supersonic wave flux of 800 kc./s. passing across a suspension of liquid particles in air (case of mist, or air/fuel mixture), a local oscillation will be imparted to these particles which means a variation in pressure from 0 to 115 lbs. per sq. in. and an acceleration 100,000 times that of gravity, this effect occurring 800,000 times per second.

As a result of this action the effect of surface-tension is neutralized and the drops burst instantaneously which, combined with the intense stirring and self-heating action exerted on the mixture, will produce an atomized aerosol having the characteristics of an actual gas but not of a mist or saturated vapor.

The consequences are as follows:

The mixture delivered to the cylinders has a constant richness irrespective of the air or fuel temperature.

The optimum richness is obtained with a smaller proportion of fuel since the latter is completely gasified whereas in conventional carburetion a substantial fraction remains in the liquid state, is incompletely burnt, carried along by the exhaust gases and therefore wasted.

Condensations are suppressed in the inlet manifolds or pipes, particularly by cold weather.

Possibility of using low-grade, higher-evaporating fuels such as petroleum or gas oils, without neither auxiliary pre-heating not risk of sooting.

Elimination of knocking, a detrimental phenomenon caused by the explosive character assumed sometimes by the combustion. Now, this detonation is mainly caused by the partial oxidation of relatively large-sized fuel drops and the formation of instable peroxides.

Owing to the homogeneity of the gaseous mixture, the rate of combustion is accelerated, the "flame front" propagates uniformly and as a consequence the thermal losses on the walls are reduced and the thermodynamic efficiency increased.

Another object of this invention is to provide a supersonic carbureting device for carrying out the above-defined method and consisting essentially in:

A. A supersonic wave emitter comprising a small piezo-electric crystal set in a suitably shaped member fast with a tube element inserted between the carburettor and the engine. Thus the supersonic flux passes through the air/fuel mixture jet at right angles or obliquely thereto.

B. A frequency generator fed with primary current from the D. C. source available, for instance, in the case of an automotive vehicle, the storage battery supplying the ignition, lighting and radio systems thereof. This arrangement is trouble free and does not add any abnormal load to the battery, because the power requirement is very low, of the order of 6–12 watts per sq. in. of supersonic flux cross-section.

A modified embodiment may consist in connecting directly the ignition coil or an additional coil to the frequency generator for producing the high-tension current. With this method a discontinuous current supply and therefore supersonic wave trains are obtained the emission of which is synchronized with the engine ignition of each cylinder. As a result, the jet of air/fuel mixture delivered to the engine is subjected to series of vibrations which are superposed to the vibrations proper of the ultra-sounds, the turbulence of the mixture being increased accordingly.

It goes without saying that the details described above are given solely by way of example as any other device adapted to produce and apply supersonic waves may be resorted to without departing from the spirit and scope of the invention.

Thus, in direct-injection engines (using either low-volatile or volatile fuels) the effect of the supersonic flux may be applied either to the manifold through which fresh air is admitted or to the injector, or to both together.

Finally, the supersonic carburetion attachment ensures a last and substantial improvement in the carburetion.

The benefit derived from a water injection in carburetion has been known for many years (it regularizes the thermal efficiency owing to the high latent vaporization heat developed, it eliminates knocking, reduces carbon deposit, etc.) but none of the hitherto proposed devices has been completely satisfactory because water and fuel are incompatible, and water is not volatile. The proportions or air/fuel ratios are always irregular and condensations arise thus causing erratic operation of an internal corrosion in the engine.

With the supersonic device according to the invention these disadvantages are completely eliminated. It will be sufficient to provide a small auxiliary jet arranged in parallel with the main jet. The ternary air/water/fuel mixture after passing through the supersonic flux, will form a homogeneous and uncondensable mixture.

Furthermore, the additional water may be used without trouble as a vehicle for secondary products, for instance cylinder-head and valve lubricating oils, antiknock compounds, ionizing agents, etc.

In particular, it is extremely advantageous to use water containing a radiferous salt, or a salt irradiated in the carburettor proper by its passage in front of a radio-active cell. This cell may be located on the hollow section carrying the supersonic emitter.

The ionization of the gaseous mixture already homogenized by the action of the ultra-sounds will promote a still more accelerated propagation of the flame front and, therefore, the performance will be enhanced.

In addition, in the ionized medium the explosion will propagate even in mixtures that are much leaner than ordinary mixtures so that a constant-pressure carburetion will result together with a greater fuel economy, while constantly filling the cylinders at their full volumetric capacity, the regulation of engine operation being assured through variation of the richness of the mixture instead of throttling the gaseous stream.

This technique provides a diagram of operation very close to the theoretical thermodynamic cycle.

The appended drawing shows, by way of examplification, an embodiment of the present invention.

The motor **1** is supplied with the fuel mixture through the duct **2** connected to the carburettor **3**; the supersonic wave emitter **4** is set on this duct and consists of a piezo-electric crystal connected to the secondary circuit of a high-frequency generator **5**, fed by the secondary of coil **8** the primary of which is connected to the battery **6**, as diagrammatically shown in the drawing; a radio-active cell **7**, emitting rays, is provided in front of the supersonic wave emitter **4**, in the duct **2**.

When the motor turns and is supplied through the duct **2** with the fuel mixture, the mixture is subjected to to the action of trains of supersonic waves from the emitter **4**. This emission of waves is synchronized with the ignition in the cylinders and this mixture is ionized by rays from the radioactive cell **7**.

Water may be supplied to the engine simultaneously with steam from a small reservoir **11** and a small constant-level chamber **12**.

What we claim is:

1. A method of improving the combustion in internal combustion engines consisting in submitting the air/fuel mixture to the action of supersonic wave trains the emission of which is synchronized with the ignition of each cylinder.

2. A method of improving the combustion in internal combustion engines consisting in using a carburetted mixture containing water and radio-active salts and submitting said mixture to the action of supersonic waves.

3. A method of improving the combustion in internal combustion engines consisting in using a carburetted mixture containing water, ionizing said mixture and submitting it to the action of supersonic waves.

4. In a device for improving combustion in internal combustion engines, a supersonic wave emitter acting upon the stream of air/fuel mixture to the engine, an ignition coil, said supersonic wave emitter being fed by the secondary winding of said ignition coil.

5. In a device for improving combustion in internal combustion engines, a supersonic wave emitter acting upon the stream of air/fuel mixture to the engine, and a radio-active cell combined with said supersonic wave emitter adapted to ionize the carburetted mixture submitted to the action of the supersonic waves.

References Cited in the file of this patent

UNITED STATES PATENTS

1,939,302	Heaney	Dec. 12, 1933
2,436,570	Hancock	Feb. 24, 1948
2,453,595	Rosenthal	Nov. 9, 1948
2,454,900	Vang	Nov. 30, 1948
2,532,554	Joeck	Dec. 5, 1950