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COMBUSTION ENHANCING APPARATUS

FIELD OF INVENTION

The present invention relates to Combustion Enhancing apparatus producing negatively charged Make-Weight Substances more particularly, but not exclusively, for use with an internal combustion engine.

BACKGROUND OF INVENTION

Gaseous hydrocarbons are present in the fuel tank and engine crankcase of petrol engines. These hydrocarbons have in the prior art been used for combustion in the engine. Two methods have been proposed and these are shown in Fig. 1.

In the first method, hydrocarbon vapour from the fuel tank 10 flows over pressed charcoal in a carbon canister 12 and is mixed with air before introduction at an inlet manifold 16 to the engine 14 for combustion. However, this process reduces the oxygen to nitrogen ratio of the air fed into the combustion chamber thereby causing pyrolysis and resulting in a high amount of unburnt exhaust hydrocarbons.

In the second method, the blow-by gases from the crankcase, composed of gaseous hydrocarbons, radical hydrogen and oil residue, are fed via outlet 18 through the air filter 20, through the air induction system 22 of the engine or directly to the engine inlet manifold 24, where the gases are mixed with air to the engine for recombustion. This process, however, also results in burning of the oil, pyrolysis and inefficient combustion.

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SUMMARY OF THE INVENTION

According to the invention, there is provided an apparatus producing negatively charge

Make-Weight Substances for an internal combustion engine comprising:

a gas inlet connectable to one of a petrol tank vent and an engine crankcase vent:

means for mixing gases from the inlet with an alcohol solution to form a gaseous mixture;

an ionizer for ionizing the gas mixture; and

a mixture outlet connectable to an air intake of the engine.

Preferably the alcohol solution is ethanol or methanol or alternatively turpentine with an alcohol concentration in the range 5% to 30%.

Preferably the mixing means comprises a mixing chamber or several chambers to which the inlets are connected and includes means for spraying the solution into contact with the gases or means for bubbling the gases through the solution, the mixing means further including a pump for circulating the solution from the liquid outlet to the spraying means.

The apparatus is further include a gas and vapour filter connected to the inlet where this is for connection to the petrol tank vent and an oil separator filter connected to the inlet where this is for connections to the engine crankcase vent. Preferably two inlets are provided, one for connection to each vent.

BRIEF DESCRIPTION OF DRAWINGS

An embodiment of the invention will now be described by way of example, with reference to the accompanying drawing, in which:

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Figure 1 is a schematic diagram illustrating prior art methods for utilising gaseous hydrocarbons present in the engine crankcase and fuel tank of internal combustion engine.

Figure 2 is a schematic diagram of the apparatus being an embodiment of the invention.

Figure 3 is a part sectional perspective view of the apparatus of Figure 2.

Figure 4 is a sectional perspective view of the carbon canister of the embodiment of Figure 2.

Figure 5 is a sectional view of an oil separator filter of the embodiment of Figure 2.

Figure 6 is a cross sectional view of a second embodiment of the mixing chamber of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the invention is schematically shown in Figure 2 in which an internal combustion engine 100 is provided with a carburettor 110 for combining air from air intake 120 and fuel from fuel tank 130 and providing the mixture to the cylinders of the engine 100 for combustion.

Blow-by gases from the engine crankcase are vented under positive crankcase pressure through engine crankcase opening 150 and petrol vapour gases are vented from petrol tank 130 through opening 152. The blow-by gases are fed via an oil separator filter 160 and the petrol tank gases are fed via a carbon canister 170 to the apparatus 140, being an embodiment of the invention, 140.

Figure 3 shows the apparatus 140 in more detail.

The apparatus 140 comprises a casing 200 provided with a first inlet pipe 202 from oil

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separator filter 160, a second inlet pipe 204 from carbon canister 170, and third inlet pipe 206 from a circulating pump 210, a first outlet pipe 208 to the pump 210 and a second outlet pipe 212 to the air induction system 110 of the engine.

The inlet pipes 202, 204 and 206 are disposed in a mixing chamber 207 having a semi-cylindrical basin 220. Each pipe 202, 204, 206 has a plurality of openings 230 along its length, the openings 230 in pipes 202, 204 being for introducing gases into the mixing chamber. The pipe 206 sprays a liquid being a water and alcohol solution preferably of ethanol $\text{CH}_3\text{CH}_2\text{OH}$ or methanol CH_3OH or alternatively turpentine $\text{C}_{10}\text{H}_{16}$ at a concentration of 5 - 30% into the mixing chamber. The basin 220 has openings in the base through which liquid sprayed from pipe 206 falls. The liquid then passes through filter 250 and out of the apparatus through outlet pipe 208 to be pumped back through inlet pipe 206.

The gaseous mixture of volatized ethane, methane, blow-by and petrol vapour gases, alcohol and water vapour is drawn by vacuum from the air induction system 110 through deflector channel 230, which acts to trap liquid solution and over the ionizing points of two ionizers 240 before exiting the apparatus 140 through outlet pipe 212. The ionizer uses the process of corona discharge to ionize and negatively charge the gas mixture. The gas mixture is passed from outlet pipe 212 to the air induction system 110 of the engine 100 where it mixes with the air flowing into the combustion chamber. It has been found that introduction of this gas mixture to the air induction system helps reduce pollution and fuel consumption of the internal combustion engine.

The carbon canister 170 is illustrated in Figure 4 and comprises a housing 300 having an inlet pipe 302 and output pipe 304. The pipe 302 connects to an inlet channel 306 adjacent absorbing element 307 comprised of pressed charcoal which on the downstream



5

side is provided with an outlet channel 308 leading to pipe 304. An air inlet 310 is provided at the opposed end of the channel 308. Volatile gases evaporate and pass through the petrol tank vent to inlet channel 306 of the canister. The gases are absorbed and lightly held by the carbon. When the engine starts, air is drawn both through opening 310 and through charcoal 306. Since the hydrocarbon gases are lightly held in the charcoal, they are drawn out by the vacuum pressure to the second inlet pipe 204. The oil separator filter 160 is shown in Figure 5. The separator comprises a housing 400 having a vapour inlet 402, vapour output 404, a plurality of upper deflectors 406, lower deflectors 407 each having an oil flow passage 408 and a filter 409, all disposed in the housing. The deflectors 406, 407 provide a tortuous path for the blow-by gases with oil droplets being collected on the deflectors or held by the filter 409 as the gases pass through the separator. Oil will be collected by a removable oil collector 410. Any oil collected in the separator 160 is passed back to the engine through pipe 402.

A second embodiment of the invention is illustrated in Figure 6 in which like elements to the embodiment of Figure 3 - 5 are illustrated by like reference numerals. A principal difference in this embodiment of the invention concerns the mixing chamber 500 which in this embodiment is of hollow cylindrical form provided with a longitudinal opening 502. Hollow cylindrical inlet pipes 510, 512 are connected respectively to the petrol tank vent and engine crankcase vent inlets. Pipe 510 is provided with a longitudinal array of openings 514 with pipe 512 being provided with a longitudinal array of openings 516. Inlet pipe 520 from pump 210 is provided with two longitudinal arrays of openings 522, 524. The arrays of openings 514, 516, 520, 524 and chamber opening 502 are so disposed that the openings are submerged within the alcohol solution 530 and openings 512, 514 are disposed to direct the flow of hydrocarbon gases into a mixing zone 240

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into which openings 522, 524 introduce the alcohol solution. In place of deflector channel 230, a liquid solution filter 550 is provided, preferably formed from 3M Type P filter material. This embodiment is further provided with only a single ionizer. Since the gas inlet pipes are submerged, it is necessary to supply positive pressure to bubble the gases through the liquid. In the case of gases from the crankcase, these are already under positive crankcase pressure as for the gases from the petrol tank are drawn during the presence of air flow through the air induction system having a vacuum effect. The gaseous mixture of blow-by gases, petrol tank gases and alcohol passed to the engine from the apparatus is to some extent disassociated by the ionisation process thus forming ionisation Make-Weight Substances products which react in the combustion chamber in a more efficient manner than if the blow-by and petrol tank gases were introduced directly to the air intake.

Observation during the test it was observed that continuing use of the apparatus appears to remove carbon particle deposits from the engine thus having a cleaning effect. Oil separator filter further removes oil residues from the crankcase blow-by gases so that the oil residues do not interfere with combustion. Oil consumption is also reduced since the oil residues are returned to the engine.

The embodiment of the invention described is not to be construed as limitative. For example, although shown used with a carburettor intake system, the invention is equally of use with fuel injected petrol engines and other kinds of internal combustion engines such as diesel engines. Although a solution of ethanol or methanol is used in the apparatus, other alcohols may be used. Furthermore, although inlets from both the engine crankcase and the petrol tank vent have been shown, the apparatus of the invention may be used with only one inlet from one or the other vent. When connected to the petrol

tank vent, the filter 170 may be omitted provided the petrol tank is provided with an air vent through which air can be drawn by the apparatus. The embodiment of Figure 3 has been shown with two ionizers and the embodiment of Figure 6 with a single ionizer. This is not to be construed as limitative, and any number of ionizers may be employed, dependent upon the gas mixture flow rate. The mixing means mixes the gases with the alcohol solution in the embodiment of Figure 3 by spraying the solution into contact with the gases and in the embodiment of Figure 6 by bubbling the gases through the solution. However, other mixing methods may be used, for example an ultrasonic spraying device may be used instead of the spraying pipe of the embodiment of Figure 3 and a mechanical mixer or a vibration mixing device may be used with the embodiment of Figure 6 to assist mixing of the gases with the solution.

Tests were conducted to evaluate the effect of a test device in accordance with the embodiment of the invention described upon a diesel vehicle's performance in terms of smoke level, fuel consumption and power measurement.

For this purpose, comparative tests were conducted whereby measurement of smoke level, fuel consumption and power measurement were carried out before and after installation of the test device to a Mitsubishi Canter 1992 lorry pickup having a two litre fuel injected diesel engine.

MEASUREMENT PROCEDURE

1. Smoke Level

The smoke levels were measured using a Hartridge Smokemeter.

2. Fuel Consumption Measurement

a. At the constant speed.

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This test was carried out while the test vehicle is being driven on a chassis dynamometer simulating on-the-road driving condition. The amount of fuel consumed in 10 minutes is measured while the vehicle is being driven at the constant speed of 90 km/h.

b. At the medium and maximum load

This test were carried out while the test vehicle is being driven on a chassis dynamometer simulating on-the-road driving condition. The load were applied to the test vehicle which for medium load was 0.67 kN and for maximum load was 1.33 kN. The amount of fuel consumed in 1 minute is measured while the vehicle is being driven at the both load (medium and maximum) at the speed of 20 km/h.

c. Power Measurement

The maximum power of the test vehicle was measured using a chassis dynamometer.

EQUIPMENT

1. Hartridge Smokemeter MK III.
2. PLU 401/108 Fuel Metering System.
3. MAHA Chassis Dynamometer.

TEST PROCEDURE

1. Carry out measurements tests on smoke level, fuel consumption and power measurement.
2. Install the device in the test vehicle as described in II.
3. Run for 200 km.
4. Repeat step 1.

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TEST RESULTS**1. At the Constant Speed 90 km**

Text Speed (km/h)	Sampling Time (min)	WITHOUT DEVICE			WITH DEVICE		
		Fuel Consumed (litre)	Average (l/h)	Average (l/h)	Fuel Consumed (litre)	Average (l/h)	Average (l/h)
90	10	1.3548	8.12	8.0730	1.3170	7.90	7.903
		1.3348	8.01		1.3168	7.90	
		1.3486	8.09		1.3185	7.91	
		—	—		—	—	

2. At Medium Load 0.67 kN

Text Speed (km/h)	Sampling Time (min)	WITHOUT DEVICE			WITH DEVICE		
		Fuel Consumed (litre)	Average (l/h)	Average (l/h)	Fuel Consumed (litre)	Average (l/h)	Average (l/h)
20	1	0.0740	4.40	4.342	0.0701	4.18	4.126
		0.0725	4.31		0.0690	4.10	
		0.0715	4.27		0.0677	4.04	
		0.0729	4.35		0.0694	4.14	
		0.0734	4.38		0.0698	4.17	

3. At Maximum Load 1.33 kN

Text Speed (km/h)	Sampling Time (min)	WITHOUT DEVICE			WITH DEVICE		
		Fuel Consumed (litre)	Average (l/h)	Average (l/h)	Fuel Consumed (litre)	Average (l/h)	Average (l/h)
20	1	0.0938	5.59	5.566	0.0870	5.18	5.200
		0.0933	5.56		0.0862	5.14	
		0.0931	5.55		0.0872	5.20	
		0.0937	5.59		0.0879	5.24	
		0.0735	5.54		0.0877	5.24	

SUMMARY OF TEST RESULTS**4. Fuel consumption test at the constant speed**

TEST SPEED	WITHOUT DEVICE	WITH DEVICE	PERCENTAGE DIFFERENCE
90 km/h	8.97 L/100 km	8.78 L/100 km	-2.12 %

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5. Fuel consumption test at the medium load 0.67kN

TEST SPEED	WITHOUT DEVICE	WITH DEVICE	PERCENTAGE DIFFERENCE
20 km/h	21.71 L/100 km	20.63 L/100 km	-4.97 %

6. Fuel consumption test at the maximum load 1.33 kN

TEST SPEED	WITHOUT DEVICE	WITH DEVICE	PERCENTAGE DIFFERENCE
20 km/h	27.83 L/100 km	26.00 L/100 km	-6.58 %

7. Smoke Level Test

	WITHOUT DEVICE	WITH DEVICE	PERCENTAGE DIFFERENCE
SMOKE LEVEL (HS)	84	37	-55.95 %

8. Maximum Power Test

	WITHOUT DEVICE	WITH DEVICE	PERCENTAGE DIFFERENCE
MAXIMUM POWER (	39	42	+7.69 %

SUMMARY

1. Fuel consumption at the constant speed 90 km/h reduced by 2.12%.
2. Fuel consumption at the medium load 0.67 kN and the speed 20 km/h reduced by 4.97%.
3. Fuel consumption at the maximum load 1.33 kN and the speed 20 km/h reduced by 6.58%.
4. Smoke level reduced by 55.95%.
5. Maximum power increased by 7.69%.

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**CLAIMS**

1. Apparatus for an internal combustion engine comprising:
a gas inlet connectable to one of a petrol tank vent and an engine crankcase vent;
means for mixing gases from the inlet with an alcohol solution to form Make-Weight gaseous substances;
an ionizer for ionizing the gas mixture; and
a mixture outlet connectable to an air intake of the engine.
2. Apparatus as claimed in Claim 1 further comprising a further gas inlet connectable to the other of the petrol tank vent and the engine crankcase vent, the further inlet being connected to the mixing means.
3. Apparatus as claimed in Claim 1 or Claim 2 wherein the mixing means comprises means for spraying the solution into contact with the gases.
4. Apparatus as claimed in Claim 1 or Claim 2 wherein the mixing means comprises a mixing chamber in which the solution is disposed and means for bubbling the gases from the crankcase vent and fuel tank vent to each inlet through the solution.
5. Apparatus as claimed in Claim 3 or Claim 4 wherein the mixing means has an inlet and outlet for the solution and a pump for pumping the solution therebetween.
6. Apparatus as claimed in any one of the preceding claims wherein the solution has an alcohol concentration in the range 5% to 30% with the balance being distilled water.
7. Apparatus as claimed in any one of the preceding claims wherein the alcohol is selected from ethanol or methanol or alternatively turpentine, all organic.

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8. Apparatus as claimed in any one of the preceding claims further comprising a gas and vapour absorbing element connected to the gas inlet for connection to a petrol tank vent.
9. Apparatus as claimed in Claim 8 wherein the absorbing element includes charcoal canister and an air intake downstream of the canister.
10. Apparatus as claimed in Claim 1 further comprising an oil separator filter connected to the gas inlet for connection to the engine crankcase vent.
11. Apparatus as claimed in Claim 10 wherein the separator includes an oil filter.
12. Apparatus as claimed in Claim 10 or Claim 11 wherein the separator includes means for trapping oil in the separator.
13. Apparatus as claimed in Claim 12 wherein the trapping means comprises a plurality of deflector members forming a tortuous path for the gases.
14. Apparatus as claimed wherein Make-Weight Substances is added in the combustion, absorbing some heat to reduce engine temperature particularly reducing oxides of nitrogen.

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