

Description

The present invention relates to treatment of hydrocarbon fuel to improve combustion efficiency, minimize fuel cost and save the petroleum source.

Treatment of fuel with a magnet has been proposed as a method of reducing fuel cost for a car engine, for instance, in Japanese Patent Publication No. 205712/1985. However, such a proposal has not been actually practiced, because trials only show unreliable results as well as the lack of theoretical bases. Actually, running tests with cars using a conventionally available magnet does not show any significant result concerning the reduction of the fuel cost.

It has been found that a significant reduction of fuel cost by about 20 - 30% with high reproducibility can be achieved by the treatment of hydrocarbon fuel in accordance with the present invention.

The present invention provides a method of treating a liquid hydrocarbon fuel with one or more magnets having a magnet flux density of 5 to 18×10^{-4} Tesla at the S pole and a magnetic flux density of less than 6×10^{-4} Tesla at the N pole, the ratio of the latter to the former not exceeding 0.5, and a device usable for such a treatment.

The term hydrocarbon fuel used in relation to the present invention means a fuel containing a hydrocarbon as a main component, and includes petroleum distillates, dry distillation or decomposition products of coal, heavy oil, light oil, kerosene, gasoline, natural gas or PL gas and the like.

The method of treatment of the hydrocarbon fuel comprises putting the relevant magnet or magnets into or onto a fuel tank such as a fuel tank of an automobile, a stock tank including a storage tank in a gas station, or a circulation pipe or a distillation line such as a coolant or a reservoir. In order to treat the fuel with one or more magnets the fuel need not always be directly exposed to or contacted with the magnet(s). Instead, the fuel may be stored in a vessel or circulated in a pipe, which are made of a material lower in a magnetic permeability as controlling the magnetic induction onto the fuel within a given level. Such a control may be achieved by adjusting the distance between the vessel or pipe and the magnet. The use of magnet is the most preferable way to expose the fuel to magnetic circumstances, but an electromagnet can be used or a desirable magnetic circumstances may be formed by a magnetic inducement.

A magnetic metal usable for the present invention has an extremely lower magnetic flux density than that of a conventional magnet, and in addition the magnetic flux density at the S pole is higher than that at the N pole. Such a magnet is not usual, but it can be made by contacting an end portion of a long metal having a low residual magnetic flux density with the N pole of magnetization device. The magnitude of the magnetic flux density at the S pole can be controlled by selecting the sort of metal, the residual magnetic flux density, the magnetic flux density of the magnetization device at the N pole, the period of contact with the N pole. The magnitude of the magnetic flux density at the N pole can be also controlled by selecting the sort of metal to be used as a magnet, a magnetic flux density of magnetization device at the N pole, contacting time, the ratio of the length and the area of a cross section of the metal to be magnetized and the like. Further, a magnet having a magnetic flux density at the S pole equal to that at the N pole can be used by changing the distances from the N pole and the S pole to the fuel to be treated in a suitable range. However, in such a case the N pole does not contact with the fuel usually.

In order to contact or expose the fuel to a magnetic field the magnetic metal may be preferably arranged such that the fuel can be exposed to a given magnetic flux density at any positions. These can be achieved by stirring, agitation, or circulation of a fuel in a tank. The effect of the present invention can be achieved even by the use of a small amount of a magnetic metal by stirring for a sufficient time.

The time for exposing the fuel to the magnetic field may be very short when a sufficient amount of magnetic metal is used, and as the amount of the magnetic metal to be used is reduced, the exposing period may be extended. There is, however, a tendency to decrease the effect achieved by the treatment with a magnet with time when the fuel is left outside the magnetic field after the treatment with the magnet. Accordingly, too less magnet will be able to provide only insufficient effect to the fuel even if the exposing period is extended. In general, a magnetic metal having a given magnetic flux density may be preferably used in the amount of more than 300 g or more preferably more than 500 g per 1 liter of fuel. The amount of the magnetic metal may be controlled according to the shape of the magnetic metal, manner of arrangement, treatment such as settlement or circulation of a fuel, exposing period and the like. When the magnetic metal is installed in a fuel tank of a car, it does not need so much because the fuel can be used simultaneously with the treatment, whereas when the fuel is treated with the magnetic metal in a stock tank it is preferably treated using a comparatively large amount of magnetic metal for long period, because it is often used after fairly long time is elapsed since treated. The effect from the treatment is probably not influenced by temperature, but much lower temperature may decrease the effect, and at extremely higher temperature the effect varies because of the change of fuel components, change of magnetic flux density and the like.

The shape or structure of the device for saving a fuel according to the present invention is not restricted. The device, for instance, may be a rod, a comb, a plate, a tube of the magnetic metal as it is, or these may be fixed on a tank wall or inner pipe, or used as a blade of an agitator or a obstacle plate.

The present invention is illustrated by the following examples, which should not be construed as limiting In these examples the magnetic flux densities shown are of the portion exhibiting the highest density in each magnetic metal used, and are expressed in SI units Tesla(T) (1 gauss = 1×10^{-4} Tesla)

Example 1

10 Combustion Test:

(I) In case that magnetic metals are used so that the total magnetic flux density is equal at N and S poles (Comparative Example):

15 Four pieces of each magnetic metal; one has a magnetic flux density of 15×10^{-4} T at the S pole and 5×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g), and the other has a magnetic flux density of 5×10^{-4} T at the S pole and 15×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g), total 960 g were inserted into a fuel tank (146 liter) of a furnace with light oil 134 liter. After 15 hour, the temperature of the furnace was raised to 400 °C and then to 1200 °C. The time necessary to raise the temperature from 400 °C to 1200 °C, light oil consumption, 20 and the amount of residual oxygen in the exhaust gas were determined every 15 minutes (oil pressure 7 kg/cm², air supplied 14.4 m³N-oil).

The same determination as the above were made in combustion under the same conditions except that a magnetic metal is not used.

The results were shown in Table 1.

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The test items and conditions:

(1) Amount of the residual oxygen: FOA-7 oxygen combustible gas measuring instrument (available from Komyo Rikagaku Kogyo K.K.).

30 (2) Temperature of furnace: PZT temperature controlling instrument (available from Fuji Denki Seizo K.K.).

(II) In case that the magnetic flux density at the N pole is larger than that at the S pole (Comparative Example):

35 The same test as described in the above (I) was repeated except that four pieces of each magnetic metal, one having 5×10^{-4} T at the S pole and 2×10^{-4} at the N pole ($14 \times 18 \times 60$ mm³, 120 g), and the other having 5×10^{-4} T at the S pole and 15×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g), total 960 g were used. The results were shown in Table 1.

40 (III) In case that the magnetic flux density at the S pole is larger than that at the N pole (Example):

The same combustion test as described in (I) was repeated except that four pieces of each magnetic metal, one having 15×10^{-4} T at the S pole and 5×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g), and the other having 2×10^{-4} T at the S pole and 5×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g), total 960 g were used.

45 The results were shown in Table 1.

(IV) In case that the magnetic flux density at the S pole is larger than that at the N pole, and larger than 18×10^{-4} T (Comparative Example):

50 The same combustion test as described in (I) was repeated except that eight pieces of magnetic metal having 27×10^{-4} T at the S pole and 8×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g), total 960 g were used. The results were shown in Table 1.

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Table 1

	blank				Comparative Example I			
	min.	temp. °C	consp. liter	oxygen %	min.	temp. °C	consp. liter	oxygen %
0	0	400	0	8.0	0	400	0	8.0
15	15	910	6.83	5.0	15	920	7.00	5.0
30	30	1070	13.66	3.2	30	1085	14.00	3.2
45	45	1160	20.33	2.7	45	1190	20.83	2.7
52	52	1200	23.33	2.5	48	1200	22.16	2.2
	Comparative Example II				Example III			
	min.	temp. °C	consp. liter	oxygen %	min.	temp. °C	consp. liter	oxygen %
0	0	400	0	8.0	0	400	0	8.0
15	15	920	7.00	5.0	15	940	7.17	4.4
30	30	1085	14.00	3.2	30	1110	14.34	2.4
45	45	1145	20.83	2.7	42	1200	19.84	1.8
56	56	1200	26.33	2.2				
	Comparative Example IV							
	min.	temp. °C	consp. liter	oxygen %				
0	0	400	0	8.0				
15	15	910	7.33	4.7				
30	30	1065	13.83	3.0				
45	45	1165	20.83	2.5				
52	52	1200	23.83	2.3				

min. : combustion time,
temp. : furnace temperature,
consp.: light oil consumption,
oxygen: amount of residual oxygen in the exhaust gas.

Example 2

Following tests were carried out using a commercially available light oil of the same lot.

A magnetic metal having a magnetic flux density of 8×10^{-4} T at the S pole and 2×10^{-4} T at the N pole (14 x 18 x 120g) was hung at a central portion of aluminium vessel (18 liter) containing 17 liter of light oil for 1 hour, 2 hours, 3 hours, 5 hours and 7 hours to give 5 kinds of light oil treated with a magnetic metal.

The temperature of an inner furnace was raised to 600 °C, and then to 1100 °C using a light oil of the same lot, which has not been treated with the magnetic metal (non-treated light oil). The combustion was carried out under the condition of oil pressure being 7 kg/cm², air supplied 13.4 m³N-oil). The combustion time, consumption of the light oil and the amount of residual oxygen in the exhaust gas were determined every 5 minutes.

The same combustion tests were repeated using the above light oil treated with a magnetic metal, and finally the same test was repeated by the light oil.

The same test was repeated two times, and the mean value of the both was shown in Table 2 (1) - (3). The instruments used for the determination of the amount of the residual oxygen and the furnace temperature are the same as used in the Example 1.

Table 2 (1) (consumption of a light oil (1))

time (min.)	non- treated	treating time with magnetic metal					non- treated
		1 hr.	2 hr.	3 hr.	5 hr.	7 hr.	
0	0	0	0	0	0	0	0
5	2.50	2.17	2.33	2.00	2.33	2.33	2.17
10	4.83	4.00	4.66	4.17	4.66	4.50	4.50
15	7.16	6.17	6.99	6.50	6.66	6.83	7.00
17	-	-	-	-	-	8.00	-
18	-	-	-	-	8.33	-	-
20	9.47	-	-	9.00	-	-	9.1
21	-	-	9.32	-	-	-	-
22	-	9.84	-	-	-	-	-
24	11.29	-	-	-	-	-	11.17
index * 100	87.2	82.6	79.7	73.8	70.9	98.9	

*

Consumption amount of the light oil is expressed by liter.

Index is expressed by a converted value assuming the amount of the non-treated oil is 100, which is consumed to increase the furnace temperature to 1100 °C

Table 2 (2) (residual amount of oxygen (%))

time (min.)	non- treated	treating time with magnetic metal					non- treated
		1 hr.	2 hr.	3 hr.	5 hr.	7 hr.	
0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
5	4.5	4.5	4.5	4.2	4.0	4.0	4.8
10	4.2	4.0	4.0	3.8	3.5	3.5	4.2
15	4.0	3.6	3.5	3.5	3.3	3.0	3.8
17	-	-	-	-	-	3.0	-
18	-	-	-	-	3.1	-	-
20	3.8	3.3	-	3.2	-	-	3.5
21	-	-	3.2	-	-	-	-
22	-	3.0	-	-	-	-	-
24	3.7	-	-	-	-	-	3.4

Table 2 (3) (temperature (°C))

time (min.)	non- treated	treating time with magnetic metal					non- treated
		1 hr.	2 hr.	3 hr.	5 hr.	7 hr.	
0	600	600	600	600	600	600	600
5	860	870	865	860	900	910	850
10	970	970	970	985	995	1025	945
15	1020	1030	1040	1045	1070	1085	1015
17	-	-	-	-	-	1100	-
18	-	-	-	-	1100	-	-
20	1065	1080	-	1100	-	-	1070
21	-	-	1100	-	-	-	-
22	-	1100	-	-	-	-	-
24	1100	-	-	-	-	-	1100

As apparent from Table 2 (1) the consumption of a light oil can be reduced more effectively by the longer treatment with a magnetic metal, and about 30 % reduction of consumption of the light oil can be effected.

Example 3

Similar manner to Example 2 was repeated, except that nine pieces of magnetic metal having a magnetic flux density of 8×10^{-4} T at the S pole and 2×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g) each were arranged at intervals of 10 cm at right and left and vertically, and immersed into a light oil for 30 minutes and one hours. The results were shown in Table 3.

Table 3

	time non-treatment with magnet			treatment with magnetic metal (30 min.) (1 hour)					
	temp. °C	consp. liter	O ₂ %	temp. °C	consp. liter	O ₂ %	temp. °C	consp. liter	O ₂ %
0	600	0	7.0	600	0	7.0	600	0	7.0
5	850	2.17	4.8	925	2.50	3.5	920	2.17	3.5
10	945	4.50	4.2	1035	4.67	3.1	1030	4.50	3.0
15	1015	7.00	3.8	1100	7.00	2.9	1100	6.67	2.8
20	1070	9.17	3.5						
24	1100	11.17	3.4						
index	100			62.7			59.7		

consp.: consumption of a light oil,

index: Index is expressed by a converted value assuming the amount of the non-treated oil is 100, which is consumed to increase the furnace temperature to 1100 °C

As apparent from the above results, the consumption amount light oil can be highly reduced, for instance, to about 40 % by a magnetic metal even in a shorter time when the magnetic metals are arranged highly close to each other.

Example 4

A combustion test was repeated according to Example 3 except that the light oil of 17 liter which was the same one as in the Example 3 was treated with magnetic metals having following magnetic flux density for one hour respectively. The results are shown in Table 4.

	magnetic	S pole	N pole	size (mm ³)	number	interval
45		(x10 ⁻⁴ T)	(x10 ⁻⁴ T)			(cm)
	(b)	5	2	14x18x60	9	10
50	(c)	10	3	14x18x60	9	10
	(d)	12	4	14x18x60	9	10
	(e)	15	5	14x18x60	9	10

Table 4

time non-treatment with
magnetic metal

(min.)

temp. consp. O₂
°C liter %

0	600	0	7.0
5	850	2.17	4.8
10	945	4.50	4.2
15	1015	7.00	3.8
20	1070	9.17	3.5
24	1100	11.17	3.4

index 100

time treated with (b)
S pole: 5 gauss
N pole: 2 gauss

(min.)

temp. consp. O₂
°C liter %

0	600	0	7.0
5	905	2.50	3.6
10	1005	4.83	3.1
15	1075	7.16	2.8
18	1100	8.66	2.6

index 77.5

time treated with (c)
S pole: 10 gauss
N pole: 3 gauss

(min.)

temp. consp. O₂
°C liter %

0	600	0	7.0
5	915	2.50	3.8
10	1025	4.83	3.0
15	1090	7.16	2.8
16	1100	7.66	2.8

index 68.6

Table 4 (continue)

time (min.)	treated with (d) S pole: 12 gauss N pole: 4 gauss			time (min.)	treatment with (e) S pole: 15 gauss N pole: 5 gauss		
	temp. °C	consp. liter	O ₂ %		temp. °C	consp. liter	O ₂ %
0	600	2.33	7.0	0	600	0	7.0
5	895	4.66	3.8	5	880	2.17	4.0
10	1000	6.83	3.2	10	985	4.50	3.2
15	1070	7.00	3.0	15	1050	6.83	2.9
18	1100	8.03	2.8	20	1100	9.33	2.3
index	71.9			index	83.5		

consp.: consumption of a light oil,

Index is expressed by a converted value assuming the amount of the non-treated oil is 100, which is consumed to increase the furnace temperature to 1100 °C.

The above results indicate that the effect of a magnetic metal treatment on the combustion efficiency decreases gradually as the magnitude of magnetic flux density at the S pole increases, but when the magnetic flux density at the S pole exceeds 27 gauss or the magnetic flux density at the N pole exceeds 8 gauss, a desirable effect could not be obtained.

Example 4.1

Nine pieces of magnetic metal each having a magnetic flux density of 10×10^{-4} T at the S pole and 3×10^{-4} T at the N pole (each 120 gr) was arranged at intervals of 10 cm in right and left and up and down in an aluminum vessel of 18 liter containing a light oil of 17 liter, and immersed for one hour. Two batches of the treated light oil (total 34 liter) were prepared. One batch was charged into a fuel tank for a light oil just after the treatment with the magnetic metal, and after the temperature of the furnace increased to 60 °C, the combustion time, the consumption of the light oil, the amount of remaining oxygen in the exhaust gas were determined every 5 minutes (oil pressure 7 kg/cm², air supplied 13.4 m³N/oil). The other batch was held for 4 days after removing the magnetic metal, and then combustion test was repeated according to the same manner as the above. The test condition of the both were the same as in Example 2. The results are shown in Table 4.1.

Table 4.1

time (min.)	non-treatment with magnetic metal			time (min.)	treated with magnetic metal (after 4 days)		
	temp. °C	consp. liter	O ₂ %		temp. °C	consp. liter	O ₂ %
0	600	0	7.0	0	600	0	7.0
5	850	2.17	4.8	5	855	2.50	4.5
10	945	4.50	4.2	10	950	4.67	4.0
15	1015	7.00	3.8	15	1020	7.00	3.6
20	1070	9.17	3.5	20	1080	9.00	3.3
24	1100	11.17	3.4	23	1100	10.50	3.2
index 100				index 94			
time (min.)	treated with magnet (just after)			time (min.)	treated with magnet (just after)		
	temp. °C	consp. liter	O ₂ %		temp. °C	consp. liter	O ₂ %
0	600	0	7.0	0	600	0	7.0
5	920	2.17	3.5	5	920	2.17	3.5
10	1030	4.50	3.0	10	1030	4.50	3.0
15	1095	7.00	2.8	15	1095	7.00	2.8
17	1100	7.85	2.8	17	1100	7.85	2.8
index 70.3							

consp.: consumption of a light oil,
 O₂: amount of remaining oxygen in the exhaust gas,
 index: Index is expressed by a converted value assuming the amount of the non-treated oil is 100, which is consumed to increase the furnace temperature to 1100 °C.

Example 4.2

A combustion test was repeated according to the Example 4.1 except that the fuel was treated with the magnetic metal for 24 hrs. The results are shown in Table 4.2.

Table 4.2

time (min.)	non-treatment with magnetic metal			time (min.)	treated with magnetic metal (after 4 days)		
	temp. °C	consp. liter	O ₂ %		temp. °C	consp. liter	O ₂ %
0	600	0	7.0	0	600	0	7.0
5	850	2.17	4.8	5	885	2.50	4.0
10	945	4.50	4.2	10	995	4.67	3.8
15	1015	7.00	3.8	15	1065	7.00	3.5
20	1070	9.17	3.5	19	1100	9.17	3.0
24	1100	11.17	3.4				
index 100				index 82.1			

time (min.)	treated with magnet (just after)		
	temp. °C	consp. liter	O ₂ %
0	600	0	7.0
5	920	2.50	3.8
10	1030	4.83	3.0
15	995	7.16	2.8
16	00	7.66	2.8
index 69			

The above results from the Example 4.1 and 4.2 show the combustion efficiency effected by the treatment of a fuel with a magnetic metal is reduced with the time after the magnetic metal is removed from the fuel.

Example 5

A combustion test was repeated according to Example 4 except that a heavy oil was used instead of a light oil, and as a magnetic metal following metals (c'), (d'), and (e') were used instead of (c), (d) and (e). The magnetic metals (b) were the same as those in Example 4. The same lot of the heavy oil was used in each test. The results are shown in Table 5.

	magnetic	S pole	N pole	size (mm ³)	number	interval
		(x10 ⁻⁴ T)	(x10 ⁻⁴ T)			(cm)
5	(c')	8	2	14x18x60	9	10
10	(d')	10	3	14x18x60	9	10
	(e')	18	6	14x18x60	9	10
15						
20						
25						
30						
35						
40						
45						
50						
55						

Table 5

5

time non-treatment with
magnetic metal

(min.)

10

temp. consp. O₂
°C liter %

15

0 600 0 7.0

5 830 2.17 4.2

10 935 4.50 3.5

20

15 1010 6.83 3.2

20 1075 9.33 3.0

25 1100 11.16 2.9

25

index 100

30

time treated with (b)
S pole: 5 gauss
N pole: 2 gauss
(min.)

temp. consp. O₂
°C liter %

35

0 600 0 7.0

5 870 2.17 3.9

10 980 4.34 3.1

15 1060 6.67 2.8

45

20 1100 8.97 2.5

index 80.4

time treated with (c')
S pole: 8 gauss
N pole: 2 gauss
(min.)

temp. consp. O₂
°C liter %

40

0 600 0 7.0

5 900 2.33 3.5

10 1005 4.50 3.2

15 1080 6.67 3.0

45

17 1100 7.54 2.8

index 67.6

55

Table 5 (continued)

5

time treated with (d')

S pole: 10 gauss

N pole: 3 gauss

(min.)

temp. °C

consp. liter

O₂ %

10

0

600

0

7.0

5

905

2.17

3.8

10

1015

4.34

3.1

15

1085

6.34

2.7

16

1100

7.01

2.7

index

62.8

time treated with (e')

S pole: 18 gauss

N pole: 6 gauss

(min.)

temp. °C

consp. liter

O₂ %

0

600

0

7.0

5

875

2.33

3.2

10

980

4.50

3.0

15

1050

6.67

2.8

20

1085

9.00

2.5

21

1100

10.00

2.4

index

89.6

20

- consp.: consumption of a light oil,
 O₂: amount of remaining oxygen in the exhaust gas,
 index: Index is expressed by a converted value assuming the amount of the non-treated oil is 100, which is consumed to increase the furnace temperature to 1100 °C.

As apparent from the above results a magnetic metal having a magnetic flux density of from 5 - 18 x 10⁻⁴ T at the S pole and less than 6 x 10⁻⁴ T at the N pole, and the magnetic flux density at the S pole is larger than it at the N pole can improve a combustion efficiency.

Example 6

Eight pieces of magnetic metal having a magnetic flux density of 3 and 1 x 10⁻⁴ T at the S pole and at the N pole respectively (14 x 18 x 30 mm³, 60 g) were thrown into a fuel tank (content 55 cc) of a gasoline car for domestic use (Colona 1500 cc, 1984 type, available from Toyota). The car was provided for daily use for 7 days and the consumption was measured. The same test was made using the same car without the magnetic metal for the comparison. The results are shown in Table 6.

index of mileage: a distance which a car can drive by a fuel of 1 liter when the distance driven by a fuel of 1 liter which is not treated with a magnetic metal is assumed as 100.

Table 6

	non-treatment	treated for 7 days
mileage (km)	277.5	406.0
fuel consumption (liter)	29.1	41.3
mileage per fuel (km/l)	9.54	9.83
index of mileage	100	103

Example 7

Eight pieces of magnetic metal having a magnetic flux density of 8 and 2×10^{-4} T at the S pole and at the N pole respectively ($14 \times 18 \times 30$ mm³, 60 g) were thrown into a fuel tank (content 55 cc) of a gasoline car for domestic use (Colona 1800 cc, 1986 type, available from Toyota). The car was driven a given mileage on the Hanshin High Way Road and Chugoku-Traversing Road after 20 hours since the magnetic metal was thrown, and then the consumption was measured. The measurement was started after the car was driven several km. The same test was made using the same car without the magnetic metal for the comparison. The results are shown in Table 7.

Table 7

	non-treatment	treated for 7 days
mileage (km)	211.6	211.6
average velocity (km/h)	90	90
fuel consumption (liter)	14.0	10.9
mileage per fuel (km/l)	15.1	19.4
index of mileage	100	128

Example 8

The same tests as these of Example 7 were repeated except that magnetic metals having a magnetic flux density of 23×10^{-4} T at the S pole and 7×10^{-4} T at the N pole ($14 \times 18 \times 30$ mm³, 60 g) were used. The results are shown in Table 8.

Table 8

	non-treatment	treated for 7 days
mileage (km)	211.6	211.6
average velocity (km/h)	90	90
fuel consumption (liter)	14.0	13.5
mileage per fuel (km/l)	15.1	15.7
index of mileage	100	104

Example 9

Magnetic metals having a magnetic flux density of 9×10^{-4} T at the S pole and 2×10^{-4} T at the N pole ($14 \times 18 \times 30$ mm³) 5.5 g/liter and 11.9 g/liter were inserted into fuel tanks of two bans of domestic gasoline cars (1500 cc) respectively. After 20 hours from the insertion the cars were driven at a constant velocity under the conditions shown in Table 9 (1). The starting time was 5 am in both case. The results were shown in Table

9 (2)

Table 9 (1)

cars: Nissan Sunny Bans		No. 1	No. 2
type		1986	1988
fuel		regular gasoline	
total amount of exhaust gas (l)		1.48	1.48
weight of cars (kg)		1325	1325
the number of riders		2	2
loaded freight weight (kg)		60	60
driving way: going up		from Sakai to Shirahama	
going back		from Shirahama to Sakai	

Table 9 (2)

	up	down	up	down
amount of magnetic metal (g/l)	0	5.5	0	11.9
	(blank)		(blank)	
mileage (km)	203.8	192.8	182.4	175.4
consumption of fuel (liter)	18.4	15.0	15.3	10.8
consumption of fuel (liter)	11.08	12.85	11.92	16.24
reduction of fuel (%)	16.0	16.0	36.2	36.2

Comparative Example

Consumption of gasoline was measured according to Example 7 except that eight pieces of magnetic metal having a magnetic flux density of 35×10^{-4} T at the S pole, and 12×10^{-4} T at the N pole ($14 \times 18 \times 30$ mm³, 60 g) were used. Through the test the same lot of the gasoline and car were used. The results are shown in Table 10.

Table 10

	non-treatment	treated for 24 hrs.
mileage (km)	211.6	168.9
average velocity (km/h)	90	90
fuel consumption (liter)	14.0	13.2
mileage per fuel (km/l)	15.1	12.8
index of mileage	100	84.8

As apparent from the above results the mileage by a unit fuel decreases when a magnetic metal of high magnetic flux density at the S pole was used.

Example 10

Eight pieces of a magnetic metal having a magnetic flux density of 13×10^{-4} T at the S pole and 4×10^{-4} T at the N pole ($14 \times 18 \times 60$ mm³, 120 g) were thrown into a fuel tank (200 liter) of a truck (4 ton, 1983 type available from Isuzu) The consumption of a light oil by 8 days drive was determined. According to a similar manner as the above was repeated except that the treatment by the magnetic metal was not made. The consumptions of the fuel in the both cases are shown in Table 11.

Table 11

	non-treatment	treated for 6
mileage (km)	217	461
fuel consumption (liter)	46.0	82.3
mileage per fuel (km/l)	4.7	5.6
index of mileage	100	119.1

Example 11

Eight pieces of magnetic metal having a magnetic flux density of 13×10^{-4} T at the S pole and 4×10^{-4} T at the N pole ($14 \times 18 \times 30$ mm³, 60 g) were inserted into a LP gas tank (content 80 liter) of a domestic car for LP gas (2000 cc, Nissan Sedoric, 1977 type, available from Nissan). After 15 hours, the car was driven for several km previously, and then for a given distance between the high way interchanges, and the consumption of LP gas for a give distance was determined. The same test was repeated by the same car but no magnetic metal was used. The results were shown in Table 12.

Table 12

	non-treatment	treated for 15 hrs.
mileage (km)	114.4	114.4
average velocity (km/h)	90	90
fuel consumption (liter)	10.0	8.6
mileage per fuel (km/l)	11.4	13.3
index of mileage	100	116.7

Example 12

Eight pieces of a magnetic metal having a magnetic flux density of 8×10^{-4} T at the S pole and 2×10^{-4} T at the N pole ($14 \times 18 \times 30$ mm³, 60 g) were immersed in a fuel tank of a domestic gasoline car (1500 cc, Civic,

type 1982, available from Honda) for 24 hours. The engine of the car was driven, the exhaust gas was collected, and the concentration of CO₂, O₂, CO, and NOx in the exhaust gas were determined as the revolution of the engine of the car was changed. The same determination was made for an engine using a non-treated gasoline.

Each concentration was determined by the following devices:

CO concentration: CGT-10=2A (a portable type gas tester available from Shimazu Selsakusho),

CO₂ concentration: the same as the above

O₂ concentration: POT-101 a portable type oxygen meter available from Shimazu Selsakusho,

NOx concentration: ECL-77A chemical light-emitting type densitometer for nitrogen oxide.

The results are shown in Table 13 by an average of ten minute determination.

As apparent from the above results the Nox concentration in the exhaust gas was reduced by the treatment of fuel with a magnetic metal.

Table 13

concentration	CO ₂ %	O ₂ %	CO %	NOx ppm
non-treated:				
800 rpm	7.6	6.3	6.5	35
2000 rpm	11.2	5.2	2.0	43
3000 rpm	13.9	0.0	4.4	134
treated with magnetic metal:				
800 rpm	4.9	10.3	4.1	23
2000 rpm	10.7	4.1	2.6	26
3000 rpm	13.9	0.0	4.3	128

Example 13

The concentration of CO₂, O₂, CO and NOx in an exhaust gas was determined in a similar manner as in the Example 12, except that a light oil as a fuel and Terester of Ford (2000 cc, 1984 type) were used. Additionally, the concentration of CH₄ was determined using SM-2000 graphite analyzing meter available from K.K. Yamato Yoko. The results are shown in Table 14.

Table 14

concentration	CO ₂ %	O ₂ %	CO %	NOx ppm	CH ₄ %
non-treated:					
600 rpm	2.40	17.22	0.038	115	11.7
2000 rpm	2.25	17.35	0.031	83	9.0
3000 rpm	2.75	16.44	0.038	111	17.3
treated with magnetic metal:					
600 rpm	2.34	17.80	0.025	98	9.3
2000 rpm	2.19	17.94	0.023	64	10.3
3000 rpm	2.58	17.37	0.019	84	14.5

As apparent from the results the concentrations of the NOx and the CH₄ in the exhaust gas were significantly reduced by the treatment of the fuel with a magnetic metal.

Claims

1. A method of treating a liquid hydrocarbon fuel with one or more magnets having a magnetic flux density of 5 to 18 x 10⁻⁴ Tesla at the S pole and a magnetic flux density of less than 6 x 10⁻⁴ Tesla at the N pole, the ratio of the latter to the former not exceeding 0.5.
2. A method according to claim 1 wherein the magnet or magnets is/are mounted in a fuel tank or a fuel stock tank.
3. A device for minimizing consumption of a liquid hydrocarbon fuel comprising one or more magnets, each having a magnetic flux density of 5 to 18 x 10⁻⁴ Tesla at the S pole and a magnetic flux density of less than 6 x 10⁻⁴ Tesla at the N pole, the ratio of the latter to the former not exceeding 0.5.
4. A device according to claim 3 and consisting of a fuel tank or a fuel stock tank.
5. A device according to claim 3 and consisting of a substance to be inserted into a fuel tank or a fuel stock tank.

Patentansprüche

1. Verfahren zur Behandlung eines flüssigen Kohlenwasserstoff-Brennstoffs mit einem oder mehreren Magneten mit einer magnetischen Flußdichte von 5 bis 18 x 10⁻⁴ Tesla an dem Südpol und einer magnetischen Flußdichte von weniger als 6 x 10⁻⁴ Tesla an dem Nordpol, wobei das Verhältnis der Letztgenannten zu der Erstgenannten 0,5 nicht überschreitet.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Magnet oder die Magnete in einen Brennstoffbehälter oder einen Brennstoffvorratstank eingebracht wird/werden.
3. Vorrichtung zur Minimierung des Verbrauchs eines flüssigen Kohlenwasserstoff-Brennstoffs, dadurch gekennzeichnet, daß sie einen oder mehrere Magnete umfaßt, wobei jeder eine magnetische Flußdichte von 5 bis 18 x 10⁻⁴ Tesla am Südpol und eine magnetische Flußdichte von weniger als 6 x 10⁻⁴ Tesla am



Table 14

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600 rpm	2.34	17.80	0.025	98	9.3
2000 rpm	2.19	17.94	0.023	64	10.3
3000 rpm	2.58	17.37	0.019	84	14.5

As apparent from the results the concentrations of the NOx and the CH₄ in the exhaust gas were significantly reduced by the treatment of the fuel with a magnetic metal.

Claims

1. A method of treating a liquid hydrocarbon fuel with one or more magnets having a magnetic flux density of 5 to 18 x 10⁻⁴ Tesla at the S pole and a magnetic flux density of less than 6 x 10⁻⁴ Tesla at the N pole, the ratio of the latter to the former not exceeding 0.5.
2. A method according to claim 1 wherein the magnet or magnets is/are mounted in a fuel tank or a fuel stock tank.
3. A device for minimizing consumption of a liquid hydrocarbon fuel comprising one or more magnets, each having a magnetic flux density of 5 to 18 x 10⁻⁴ Tesla at the S pole and a magnetic flux density of less than 6 x 10⁻⁴ Tesla at the N pole, the ratio of the latter to the former not exceeding 0.5.
4. A device according to claim 3 and consisting of a fuel tank or a fuel stock tank.
5. A device according to claim 3 and consisting of a substance to be inserted into a fuel tank or a fuel stock tank.

Patentansprüche

1. Verfahren zur Behandlung eines flüssigen Kohlenwasserstoff-Brennstoffs mit einem oder mehreren Magneten mit einer magnetischen Flußdichte von 5 bis 18 x 10⁻⁴ Tesla an dem Südpol und einer magnetischen Flußdichte von weniger als 6 x 10⁻⁴ Tesla an dem Nordpol, wobei das Verhältnis der Letztgenannten zu der Erstgenannten 0,5 nicht überschreitet.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Magnet oder die Magnete in einen Brennstoffbehälter oder einen Brennstoffvorratstank eingebracht wird/werden.
3. Vorrichtung zur Minimierung des Verbrauchs eines flüssigen Kohlenwasserstoff-Brennstoffs, dadurch gekennzeichnet, daß sie einen oder mehrere Magnete umfaßt, wobei jeder eine magnetische Flußdichte von 5 bis 18 x 10⁻⁴ Tesla am Südpol und eine magnetische Flußdichte von weniger als 6 x 10⁻⁴ Tesla am



Nordpol aufweist, und das Verhältnis der Letztgenannten zu der Erstgenannten 0,5 nicht überschreitet.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß sie aus einem Brennstoffbehälter oder einem Brennstoffvorratstank besteht.
5. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß sie aus einer Substanz besteht, die in einen Brennstoffbehälter oder einen Brennstoffvorratstank eingebracht wird.

Revendications

1. Procédé de traitement d'un combustible hydrocarboné liquide avec un ou plusieurs aimants ayant une densité du flux magnétique de 5 à 18×10^{-4} Tesla au pôle S et une densité du flux magnétique inférieure à 6×10^{-4} Tesla au pôle N, le rapport entre ce dernier et le premier ne dépassant pas 0,5.
2. Procédé selon la revendication 1, dans lequel l'aimant ou les aimants sont montés dans un réservoir de combustible ou une cuve de stockage de combustible.
3. Dispositif pour rendre minimale la consommation d'un combustible hydrocarboné liquide comprenant un ou plusieurs aimants, chacun ayant une densité du flux magnétique de 5 à 18×10^{-4} Tesla au pôle S et une densité du flux magnétique inférieure à 6×10^{-4} Tesla au pôle N, le rapport entre ce dernier et le premier ne dépassant pas 0,5.
4. Dispositif selon la revendication 3, comprenant un réservoir de combustible ou d'une cuve de stockage de combustible.
5. Dispositif selon la revendication 3, comprenant une substance devant être insérée dans un réservoir de combustible ou une cuve de stockage de combustible.