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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	0492611-0828		
		Application Number			
Title of Invention	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES				
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Application Data Shoot 37 CEP 1 76		Attorney Docket Number	0492611-0828	
Application Data Sheet 57 CFK 1.76			Application Number	
Title of Invention OPTIMIZED FUEL MANAGE GASOLINE ENGINES			MENT SYSTEM FOR DIRECT I	NJECTION ETHANOL ENHANCEMENT OF
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Title of the Invention	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES					
Attorney Docket Number	0492611-0828		Small Entity Status	s Claimed 🛛 🗙		
Application Type	Nonprovisional					
Subject Matter	Utility					
Suggested Class (if any)			Sub Class (if any)			
Suggested Technology Center (if any)						
Total Number of Drawing Sheets (if any)		3	Suggested Figure	for Publication (if any)	3	

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Title of Invention	OPTIMIZED FUEL MANAGE GASOLINE ENGINES	MENT SYSTEM FOR DIRECT I	NJECTION ETHANOL ENHANCEMENT OF			
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Title of Invention	OPTIMIZED FUEL MANAGEN GASOLINE ENGINES	MENT SYSTEM FOR DIRECT I	NJECTION ETHANOL ENHANCEMENT OF

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First Name	Sam Last Name Pasternack			Registration Number	29576	

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Fig. 2a





Fig. 3

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Ethanol fuel line

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OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES

This application is a continuation of U.S. Patent Application Serial number 11/758,157 filed June 5, 2007, which is a continuation of U.S. Patent Application serial number 11/100, 026 filed April 6, 2005, now U.S. Patent number 7,225,787 the contents of both of which are incorporated herein by reference.

Background of the Invention

This invention relates to an optimized fuel management system for use with spark ignition gasoline engines in which an anti-knock agent which is a fuel is directly injected into a cylinder of the engine.

There are a number of important additional approaches for optimizing direct injection ethanol enhanced knock suppression so as to maximize the increase in engine efficiency and to minimize emissions of air pollutants beyond the technology disclosed in parent application serial number 10/991,774 set out above. There are also additional approaches to protect the engine and exhaust system during high load operation by ethanol rich operation; and to minimize cost, ethanol fuel use and ethanol fuel storage requirements. This disclosure describes these approaches.

These approaches are based in part on more refined calculations of the effects of variable ethanol octane enhancement using a new computer model that we have developed. The model determines the effect of direct injection of ethanol on the occurrence of knock for different times of injection and mixtures with port fuel injected gasoline. It determines the beneficial effect of evaporative cooling of the direct ethanol injection upon knock suppression.

Summary of the Invention

In one aspect, the invention is a fuel management system for operation of a spark ignition gasoline engine including a gasoline engine and a source of an anti-knock agent which is a fuel. The use of the anti-knock agent provides gasoline savings both by facilitating increased engine efficiency over a drive cycle and by substitution for gasoline as a fuel. An injector is provided for direct injection of the anti-knock agent into a cylinder of the engine and a fuel management control system controls injection of the anti-knock agent can be initiated by a signal from a knock sensor. It can also be

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initiated when the engine torque is above a selected value or fraction of the maximum torque where the value or fraction of the maximum torque is a function of the engine speed. In a preferred embodiment, the injector injects the anti-knock agent after inlet valve/valves are closed. It is preferred that the anti-knock agent have a heat of vaporization that is at least twice that of gasoline or a heat of vaporization per unit of combustion energy that is at least three times that of gasoline. A preferred anti-knock agent is ethanol. In a preferred embodiment of this aspect of the invention, part of the fuel is port injected and the port injected fuel is gasoline. The directly injected ethanol can be mixed with gasoline or with methanol. It is also preferred that the engine be capable of operating at a manifold pressure at least twice that pressure at which knock would occur if the engine were to be operated with naturally aspirated gasoline. A suitable maximum ethanol fraction during a drive cycle when knock suppression is desired is between 30% and 100% by energy. It is also preferred that the compression ratio be at least 10. With the higher manifold pressure, the engine can be downsized by a factor of two and the efficiency under driving conditions increased by 30%.

It is preferred that the engine is operated at a substantially stoichiometric air/fuel ratio during part or all of the time that the anti-knock agent such as ethanol is injected. In this case, a three-way catalyst can be used to reduce the exhaust emissions from the engine. The fuel management system may operate in open or closed loop modes.

In some embodiments, non-uniform ethanol injection is employed. Ethanol injection may be delayed relative to bottom dead center when non-uniform ethanol distribution is desired.

Many other embodiments of the invention are set forth in detail in the remainder of this application.

Brief Description of the Drawings

Fig. 1 is a graph of ethanol fraction (by energy) required to avoid knock as a function of inlet manifold pressure. The ethanol fraction is shown for various values of β , the ratio of the change in temperature in the air cylinder charge due to turbocharging (and aftercooling if used) to the adiabatic temperature increase of the air due to the turbocharger.

Fig. 2a is a graph of cylinder pressure as a function of crank angle for a three bar manifold pressure.

Fig. 2b is a graph of charge temperature as a function of crank angle for a three bar manifold pressure.

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Fig. 3 is a schematic diagram of an embodiment of the fuel management system disclosed herein for maintaining stoichiometric conditions with metering/control of ethanol, gasoline, and air flows into an engine.

Figs. 4a and 4b are schematic illustrations relating to the separation of ethanol from ethanol/gasoline blends.

Fig. 5 is a cross-sectional view of a flexible fuel tank for a vehicle using ethanol boosting of a gasoline engine.

Description of the Preferred Embodiment

Ethanol has a heat of vaporization that is more than twice that of gasoline, a heat of combustion per kg which is about 60% of that of gasoline, and a heat of vaporization per unit of combustion energy that is close to four times that of gasoline. Thus the evaporative cooling of the cylinder air/fuel charge can be very large with appropriate direct injection of this antiknock agent. The computer model referenced below shows that evaporative cooling can have a very beneficial effect on knock suppression. It indicates that the beneficial effect can be maximized by injection of the ethanol after the inlet valve that admits the air and gasoline into the cylinder is closed. This late injection of the ethanol enables significantly higher pressure operation without knock and thus higher efficiency engine operation than would be the case with early injection. It is thus preferred to the conventional approach of early injection which is used because it provides good mixing. The model also provides information that can be used for open loop (*i.e.*, a control system that uses predetermined information rather than feedback) fuel management control algorithms.

The increase in gasoline engine efficiency that can be obtained from direct injection of ethanol is maximized by having the capability for highest possible knock suppression enhancement. This capability allows the highest possible amount of torque when needed and thereby facilitates the largest engine downsizing for a given compression ratio.

Maximum knock suppression is obtained with 100% or close to 100% use of direct injection of ethanol. A small amount of port injection of gasoline may be useful in order to obtain combustion stability by providing a more homogeneous mixture. Port fuel injection of gasoline also removes the need for a second direct fuel system or a more complicated system which uses one set of injectors for both fuels. This can be useful in minimizing costs.

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The maximum fraction of ethanol used during a drive cycle will depend upon the engine system design and the desired level of maximum torque at different engine speeds. A representative range for the maximum ethanol fraction by energy is between 20% and 100%.

In order to obtain the highest possible octane enhancement while still maintaining combustion stability, it may be useful for 100% of the fuel to come from ethanol with a fraction being port injected, as an alternative to a small fraction of the port-fueled gasoline.

The initial determination of the knock suppression by direct injection of ethanol into a gasoline engine has been refined by the development of a computer model for the onset of knock under various conditions. The computer modeling provides more accurate information for use in fuel management control. It also shows the potential for larger octane enhancements than our earlier projections. Larger octane enhancements can increase the efficiency gain through greater downsizing and higher compression ratio operation. They can also reduce the amount of ethanol use for a given efficiency increase.

The computer model combines physical models of the ethanol vaporization effects and the effects of piston motion of the ethanol/gasoline/air mixtures with a state of the art calculational code for combustion kinetics. The calculational code for combustion kinetics was the engine module in the CHEMKIN 4.0 code [R. J. Kee, F. M. Rupley, J. A. Miller, M. E. Coltrin, J. F. Grcar, E. Meeks, H. K. Moffat, A. E. Lutz, G. Dixon-Lewis, M. D. Smooke, J. Warnatz, G. H. Evans, R. S. Larson, R. E. Mitchell, L. R. Petzold, W. C.Reynolds, M. Caracotsios, W. E. Stewart, P. Glarborg, C. Wang, O. Adigun, W. G. Houf, C. P. Chou, S. F. Miller, P. Ho, and D. J. Young, CHEMKIN Release 4.0, Reaction Design, Inc., San Diego, CA (2004)]. The CHEMKIN code is a software tool for solving complex chemical kinetics problems. This new model uses chemical rates information based upon the Primary Reference gasoline Fuel (PRF) mechanism from Curran *et al.* [Curran, H. J., Gaffuri, P., Pitz, W. J., and Westbrook, C. K. "A Comprehensive Modeling Study of iso-Octane Oxidation," *Combustion and Flame* **129**:253-280 (2002) to represent onset of autoignition.

The compression on the fuel/air mixture end-gas was modeled using the artifact of an engine compression ratio of 21 to represent the conditions of the end gas in an engine with an actual compression ratio of 10. The end gas is defined as the un-combusted air/fuel mixture remaining after 75% (by mass) of the fuel has combusted. It is the end gas that is most prone to autoignition (knock). The larger compression ratio includes the effect of the increase in pressure

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in the cylinder due to the energy released in the combustion of 75% of the fuel that is not in the end gas region. The effect of direct ethanol vaporization on temperature was modeled by consideration of the effects of the latent heat of vaporization on temperature depending upon the time of the injection.

The effect of temperature increase due to turbocharging was also included. The increase in temperature with turbocharging was calculated using an adiabatic compression model of air. It is assumed that thermal transfer in the piping or in an intercooler results in a smaller temperature increase. The effect is modeled by assuming that the increase in temperature of the air charge into the cylinder ΔT_{charge} is $\Delta T_{charge} = \beta \Delta T_{turbo}$ were ΔT_{turbo} is the temperature increase after the compressor due to boosting and beta is a constant. Values of β of 0.3, 0.4 and 0.6 have been used in the modeling. It is assumed that the temperature of the charge would be 380 K for a naturally aspirated engine with port fuel injection gasoline.

Fig. 1 shows the predictions of the above-referenced computer model for the minimum ethanol fraction required to prevent knock as a function of the pressure in the inlet manifold, for various values of β . In Fig. 1 it is assumed that the direct injection of the ethanol is late (i.e. after the inlet valve that admits air and gasoline to the cylinder is closed) and a 87 octane PRF (Primary Reference Fuel) to represent regular gasoline. The corresponding calculations for the manifold temperature are shown in Table 1 for the case of a pressure in the inlet manifold of up to 3 bar for an engine with a conventional compression ratio of 10. The temperature of the charge varies with the amount of ethanol directly injected and is self-consistently calculated in Table 1 and Fig. 1. The engine speed used in these calculations is 1000 rpm.

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Table 1

Computer model calculations of temperature and ethanol fraction required for knock prevention for an inlet manifold pressure of 3 bar for an engine with a compression ratio of 10, for various values of β (ratio of change of the cylinder air charge temperature due to turbocharging to the adiabatic temperature increase due to turbocharging $\Delta T_{charge} = \beta \Delta T_{turbo}$). The engine speed is 1000 rpm.

β		0.3	0.4	0.6
T_charge init Delta T turbo Delta T affor intercoolor	K K	380 180	380 180 72	380 180 108
Delta T due to DI ethanol and gasoline T_init equivalent charge	K K	-103 331	-111 341	-132 356
Gasoline octane Ethanol fraction (by energy) needed		87	87	87
to prevent knock		74%	82%	97%

Direct fuel injection is normally performed early, before the inlet valve is closed in order to obtain good mixing of the fuel and air. However, our computer calculations indicate a substantial benefit from injection after the inlet valve is closed.

The amount of air is constant in the case of injection after the inlet valve has closed. Therefore the temperature change is calculated using the heat capacity of air at constant volume (c_v) . The case of early injection where the valve that admits air and fuel to the cylinder is still open is modeled with a constant-pressure heat capacity (c_p) . The constant volume case results in a larger evaporation induced decrease in charge temperature than in the case for constant pressure, by approximately 30%. The better evaporative cooling can allow operation at higher manifold pressure (corresponding to a greater octane enhancement) without knock that would be the case of early injection by a difference of more than 1 bar. The increase in the evaporative cooling effect at constant volume relative to that at constant pressure is substantially higher for the case of direct injection of fuels such as ethanol and methanol than is the case for direct injection of gasoline.

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FORD Ex. 1126, page 14 IPR2020-00013 Typical results from the calculations are shown in Fig. 2. The figure shows the pressure (a) and the temperature (b) of the cylinder charge as a function of crank angle, for a manifold pressure of 3 bar and a value of $\beta = 0.4$ Two values of the ethanol fraction are chosen, one that results in autoignition, and produces engine knock (0.82 ethanol fraction by fuel energy), and the other one without autoignition, i.e., no knock (0.83 ethanol fraction). Autoignition is a threshold phenomenon, and in this case occurs between ethanol fractions of 0.82 and 0.83. For an ethanol energy fraction of 0.83, the pressure and temperature rise at 360° (top dead center) is due largely to the compression of the air fuel mixture by the piston. When the ethanol energy fraction is reduced to 0.82, the temperature and pressure spikes as a result of autoignition. Although the autoignition in Figure 2 occurs substantially after 360 degrees, the autoignition timing is very sensitive to the autoignition temperature (5 crank angle degrees change in autoignition timing for a change in the initial temperature of 1 K, or a change in the ethanol energy fraction of 1%).

The effect of evaporative cooling from the antiknock agent (in this case, ethanol) is shown in Table 2, where three cases are compared. The first one is with port fuel injection of ethanol. In this case the vaporization of the ethanol on the walls of the manifold has a negligible impact on the temperature of the charge to the cylinder because the walls of the manifold are cooled rather than the air charge. The second case assumes direct injection, but with the inlet valve open, with evaporation at constant pressure, where the cooling of the charge admits additional air to the cylinder. The third case assumes, as in the previous discussions, late injection after the inlet valve has closed. It is assumed stoichiometric operation, that the baseline temperature is 380 K, and that there is cooling in the manifold after the turbocharger with $\beta =$ 0.4.

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Table 2

Knock-free operation of ethanol port fuel injection (assuming no charge cooling), and of direct injection before and after the inlet valve is closed. Compression ratio of 10, baseline charge temperature of 380 K, intercooler/cooling post turbo with $\beta = 0.4$, stoichiometric operation, gasoline with 87 RON. Engine speed is 1000 rpm.

	No Evaporative Cooling	Evaporative cooling			
		Before Valve Closing	After Valve Closing		
Ethanol fraction (by energy)	0.95	0.95	0.95		
Max manifold pressure (bar)	1.05	2.4	4.0		
Cylinder pressure after cooling (bar)	1.05	2.4	3.0		
Cylinder charge temperature after cooling (K)	383	360	355		

The results indicate the strong effect of the cooling. The maximum manifold pressure that prevents knock (without spark retard), with 0.95 ethanol fraction by energy in the case of port fuel injection is 1.05 bar. With direct injection of the ethanol, the maximum knock-free manifold and cylinder pressures are 2.4 bar, with a temperature decrease of the charge of ~75K. The final case, with injection after inlet valve closing, allows a manifold pressure of 4 bar, a cylinder pressure (after cooling) of 3 bar, and a charge temperature decrease of ~120 K. It should be noted that the torque of the late injection case after the valve has closed is actually higher than that of the early injection case, even though the early injection case allows for additional air (at constant pressure). For comparison, the model is also used to calculate the manifold pressure at which knock would occur for port fuel injection of 87 octane gasoline alone. This pressure is ~ 0.8 bar assuming spark timing at MBT (Maximum Brake Torque). Conventional gasoline engines operate at 1 bar by retarding the timing at high torque regions where knock would otherwise occur. Thus the model indicates that evaporative cooling effect of direct injection of ethanol after the inlet valve has closed can be significantly greater than that of the higher octane number rating of ethanol relative to gasoline.

A manifold pressure of 4 bar is very aggressive. Table 2 is indicative of the dramatically improved performance of the system with direct injection after the inlet valve has closed. The Page 8 of 28

improved performance in this case can be traded for increased compression ratio or reduced use of the anti-knock agent.

It should be noted that, as mentioned above, the calculations of autoignition (knock) are conservative, as autoignition for the case shown in Fig. 2 occurs relatively late in the cycle, and it is possible that the fuel has been combusted before it autoignites. Also it should be noted that the calculations in Fig. 2 break down after autoignition, as the pressure trace would be different from that assumed. Figures similar to Fig. 2 are used to determine conditions where autoignition would not occur, and those conditions are then used to provide the information for Fig. 1. The initial temperatures of the cases shown in Fig. 2 are 341 K for 0.82 ethanol fraction, and 340 K for 0.83 ethanol fraction, a difference of 1 K (the difference due to the cooling effect of the ethanol).

Because of the large heat of vaporization, there could be enough charge cooling with early injection so that the rate of vaporization of ethanol is substantially decreased. By instead injecting into the hot gases, which is the case with injection after the inlet valve has closed, the temperature at the end of full vaporization of the ethanol is substantially increased with respect to early injection, increasing the evaporation rate and minimizing wall wetting.

The optimum timing of the injection for best mixing and a near homogeneous charge is soon after the inlet valve closes, provided that the charge is sufficiently warm for antiknock agent vaporization. If, on the other hand, a non-uniform mixture is desired in order to minimize ethanol requirements and improve ignition stability, then the injection should occur later than in the case where the best achievable mixing is the goal.

Late injection of the ethanol after the inlet valve has closed can be optimized through the use of diesel-like injection schemes, such as injectors with multiple sprays. It is important to inject the fuel relatively quickly, and at velocities which minimize any cylinder wall wetting, which as described below could result in the removal of the lubrication oils from the cylinder liner. Multiple sprays from a nozzle that has multiple holes results in a distributed pattern of sprays, with relatively low injection velocities. This is particularly important for ethanol, because of the higher volume throughputs (as compared with gasoline) of ethanol for equal energy content.

Injection after the valve has closed may require that a modest fraction of the fuel (e.g. 25%) be port injected in order to achieve the desired combustion stability. A tumble-like or swirl Page 9 of 28

motion can be introduced to achieve the desired combustion stability. The port injected fuel can be either gasoline or ethanol.

Use of the computer model for operation with gasoline alone gives results that are consistent with the observed occurrence of knock in gasoline engine vehicles, thereby buttressing the credibility of the projections for ethanol. The computer model indicates that for knock-free gasoline operation alone with a compression ratio of 10, knock imposes a severe constraint upon the allowed manifold pressure for a naturally aspirated gasoline engine and very limited (*i.e.*, less than 1.2 bar) manifold pressure can be achieved even with direct injection of gasoline unless spark retard and/or rich operation is used. These changes, however, can reduce efficiency and increase emissions.

Fig. 1 shows that knock can be prevented at manifold pressures greater than 2 bar with direct injection of an ethanol fraction of between 40 and 80% in an engine with a compression ratio of 10. The manifold pressure can be at least 2.5 bar without engine knock. A pressure of 3 bar would allow the engine to be downsized to $\sim 1/3$ of the naturally aspirated gasoline engine, while still producing the same maximum torque and power. The large boosting indicated by the calculations above may require a multiple-stage turbocharger. In addition to a multiple stage turbocharger, the turbocharger may be of the twin-scroll turbo type to optimize the turbocharging and decrease the pressure fluctuations in the inlet manifold generated by a small number of cylinders.

With an increase in allowed manifold pressure in an engine by more than a factor of 2, the engine could be downsized by a factor of 2 (that is, the cylinder volume is decreased by a factor of 2 or more) and the compression ratio could be held constant or raised. For example, the performance of an eight cylinder engine is achieved by a four cylinder engine.

The occurrence of knock at a given value of torque depends upon engine speed. In addition to providing substantially more maximum torque and power, direct injection of ethanol can be used to provide a significant improvement in torque at low engine speeds (less than 1500 rpm) by decreasing or eliminating the spark retard. Spark retard is generally used with gasoline engines to prevent knock at low engine speeds where autoignition occurs at lower values of torque than is the case at high engine speeds.

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Fig. 1 can also be used to determine the ethanol fraction required to prevent knock at different levels of torque and horsepower, which scale with manifold pressure in a given size engine. This information can be used in an open loop control system.

The efficiency of a gasoline engine under driving conditions using direct ethanol injection enhancement can be at least 20% and preferably at least 30% greater than that of a naturally aspirated gasoline engine with a compression ratio of 10. This increase results from the substantial engine boosting and downsizing to give the same power, and also the high compression ratio operation (compression ratio of 11 or greater) that is enabled by a large octane enhancement. With more aggressive downsizing of more than 50% (where the same engine performance is obtained with less than one-half the displacement), the increase in efficiency could exceed 30%.

Greater downsizing and higher efficiency may also be obtained by decreasing the octane requirement of the engine by using variable valve timing (VVT). Thus, at conditions of high torque, variable valve timing can be used to decrease the compression ratio by appropriately changing the opening/closing of the inlet and exhaust valves. The loss in efficiency at high torque has a small impact on the overall fuel economy because the engine seldom operates in these conditions.

VVT can also be used to better scavenge the exhaust gases [B. Lecointe and G. Monnier, "Downsizing a Gasoline Engine Using Turbocharging with Direct Injection" SAE paper 2003-01-0542]. Decreasing the exhaust gas decreases the air/fuel temperature. Keeping both the inlet and exhaust valves open, while the pressure in the inlet manifold is higher than in the exhaust, can be used to remove the exhaust gases from the combustion chamber. This effect, coupled with slightly rich operation in-cylinder, can result in increased knock avoidance while the exhaust is still stoichiometric. Cooled EGR and spark timing adjustment can also be used to increase knock avoidance.

Any delay in delivering high engine torque at low engine speeds can decrease drivability of the vehicle. Under these conditions, because of the substantial engine downsizing, the vehicle would have insufficient acceleration at low engine speeds until the turbo produces high pressures. This delay can be removed through the use of direct injection of ethanol by reduction of the spark retard or ethanol/gasoline with rich operation and also with the use of variable valve timing.

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Another approach would be to use an electrically assisted turbo charger. Units that can generate the required boosting for short periods of time are available. The devices offer very fast response time, although they have substantial power requirements.

A multiple scroll turbocharger can be used to decrease the pressure fluctuations in the manifold that could result from the decreased number of cylinders in a downsized engine.

The temperature of the air downstream from the turbocharger is increased by the compression process. Use of an intercooler can prevent this temperature increase from increasing the engine's octane requirement. In addition, in order to maximize the power available from the engine for a given turbocharging, cooling of the air charge results in increased mass of air into the cylinder, and thus higher power.

In order to minimize emissions, the engine should be operated substantially all of the time, or most of the time, with a stoichiometric air/fuel ratio in order that a 3-way exhaust catalyst treatment can be used. Fig. 3 shows a 3-way exhaust treatment catalyst 10 and air, gasoline and ethanol control needed to maintain the substantially stoichiometric ratio of fuel to air that is needed for its effective operation. The system uses an oxygen sensor 12 as an input to an electronic control unit (ECU) 14. The ECU 14 controls the amount of air into a turbocharger 16, the amount of gasoline and the amount of ethanol so as to insure stoichiometric operation. During transients, open-loop algorithms from a stored engine map (not shown) are used to determine air, gasoline and ethanol flows for keeping substantially stoichiometric combustion in a cylinder of the engine 18.

Thus when variable ethanol octane enhancement is employed, the fuel management system needs to adjust the amounts of air, gasoline and ethanol such that the fuel/air ratio is substantially equal to 1. The additional control is needed because, if the air/gasoline ratio determined by the fuel management were not be corrected during the injection of ethanol, the mixture would no longer be stoichiometric. In contrast to the lean boost approach of Stokes *et al* .[J. Stokes, T. H. Lake and R. J. Osborne, "A Gasoline Engine Concept for Improved Fuel Economy –The Lean Boost System," SAE paper 2000-01-2902] stoichiometric operation with a 3-way catalyst results in very low tailpipe emissions.

There are certain regions in the engine operating map where the ECU 14 may operate open loop, that is, the control is determined by comparison to an engine map lookup table rather

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than by feedback from a sensed parameter which in this case is engine knock (closed loop). As mentioned previously, open loop operation during transients may be advantageous.

Another situation where open loop control can be advantageous would be under high load, where fuel rich conditions (where the fuel/air ratio is greater than stoichiometric) may be required to decrease the temperature of the combustion and thus protect the engine and the exhaust system (especially during prolonged operation). The conventional approach in gasoline engine vehicles is to use increased fuel/air ratio, that is, operating at rich conditions. The presence of ethanol on-board allows for two alternatives. The first is the use of ethanol fuel fractions beyond what is required to control knock, thus reducing the combustion temperature by a greater amount than could be obtained by gasoline alone due to the higher cooling effect of evaporation in direct ethanol injection, even while at stoichiometric conditions. The second one is, as in conventional applications, the use of increased fueling in rich operation (which could result in relative air/fuel mass ratios as low as 0.75 where a stoichiometric mixture has a relative air/fuel ratio of 1). The control system can choose between two fuels, ethanol and gasoline. Increased use of ethanol may be better than use of gasoline, with emissions that are less damaging to the environment than gasoline and decreased amount of rich operation to achieve the temperature control needed. Open loop operation with both gasoline and ethanol may require substantial modification of the engine's "lookup table."

Thus, a method of operating an engine is, under conditions of partial load, to operate closed loop with the use of only gasoline. As the engine load increases, the engine control system may change to open loop operation, using a lookup table.

The closed loop control of the engine can be such that a knock sensor (not shown) determines the fraction required of ethanol, while the oxygen sensor 12 determines the total amount of fuel. A variation of this scheme is to operate the knock control open loop, using a lookup table to determine the ethanol to gasoline ratio, but a closed loop to determine the total amount of fuel.

In order to minimize evaporative emission of the ethanol (which has a relatively low boiling point), solvents can be added to the ethanol to minimize the effect. An alternative means is to place an absorptive canister between the ethanol tank and the atmosphere that captures the ethanol and releases it when the engine is operational.

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Because of the large cooling effect from ethanol, it has been known for some time that startup of a cold engine is difficult (for example, during the first 30 seconds). With the multiple fuels, it is possible to start up the engine without ethanol addition. Gasoline vaporizes easier than ethanol, and conventional operation with port-fuel or direct injected gasoline would result in easier engine start up. A greater fraction of gasoline than would be ordinarily used can be used to facilitate start-up operation at times during the first 30 seconds of engine operation.

Increased efficiency due to engine downsizing made possible through the use of 100% or close to 100% ethanol at the highest values of torque has the undesirable effect of requiring higher ethanol fractions. Hence the use of non-uniform ethanol distribution to minimize the use of ethanol at these values of torque becomes more attractive when achievement of the maximum efficiency gain is desired.

Below a certain value of torque or boost pressure it can be advantageous to use a nonuniform ethanol distribution in order to reduce the amount of ethanol that is used. Above certain torque or turbocharger or supercharger boost pressures, non-uniform charge would not be used since the engine is operating mostly on ethanol and ethanol non-uniformity cannot be used for minimizing ethanol consumption. This is especially important if the desired fraction is higher than 50%.

The capability to minimize the use of ethanol by non-uniform ethanol distribution in the cylinder can be realized by certain ethanol injection geometries. Ethanol can be injected in the periphery of a swirling charge. In order to minimize wall wetting by the ethanol, it would be convenient to achieve the injection in a manner such that the ethanol injection matches the swirling motion of the charge. The injection direction is thus positioned at an angle with respect to the main axis of the cylinder, injecting the ethanol with an angular direction component. Charge stratification in the case of swirl can be maintained by temperature stratification, with the cooler (and denser) regions in the periphery, which correspond to the end-gas zone.

An alternative or additional method to provide ethanol non-uniform distribution in the cylinder is to inject the ethanol relatively late with respect to bottom dead center. Thus the time for transport and diffusion of the ethanol is minimized. However, sufficient time should be allowed for full vaporization of the ethanol. As the temperatures are higher after Bottom-Dead-Center (BDC), the vaporization time is reduced, and it is less likely that the ethanol would wet the cylinder walls. Improved vaporization of the ethanol can also be achieved by using injectors

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that produce small droplets. The injector could be a single spray pattern injector with a relatively narrow directed jet. This type of jet would optimize the deposition of the ethanol in the desired region.

Creating a non-uniform ethanol distribution in the cylinder (in the outer regions of the cylinder) has two advantages. The first one is the increased cooling effect of the region that has the propensity to autoignite (knock), the end gas region. The second is that the central region is not cooled, improving ignition and initial flame propagation. It is preferable to keep the central region hot, as having a fast flame speed early in the flame propagation has antiknock advantages, by reducing the burn time and the time for precombustion chemistry of the end gas. Minimizing the burn time decreases the propensity to knock, as there is no knock if the end gas is burned before it can autoignite. Thus it is possible to have good ignition properties of the air/fuel mixture, even under conditions where the gasoline is evenly spread throughout the cylinder.

Stratified operation can result in locally increased charge cooling. This is because the injected ethanol cools only a small fraction of the charge, and thus, for a given amount of ethanol, the local decrease in temperature is larger with stratified operation than the average decrease of temperature with uniform ethanol distribution. Late injection can aid in the formation of a non-uniform air/ethanol mixture as mixing time is limited. Since a fraction of the cylinder, but ethanol is preferentially in the cooler edges (the end-gas). Thus, although overall the air/fuel charge is stoichiometric, locally near the spark it is lean while in the region of the end gas it is rich. Both of these conditions are advantageous, since the ignition occurs in a region with higher temperature (although slightly lean), while the outside is rich and cool, both of which are knock-suppressors.

In the case of swirl or tumble stratified air fuel charges with hot air/gasoline in the center and colder air/ethanol or air/ethanol/gasoline mixtures in the end gas, it is advantageous to place the spark in the region of the hot air/gasoline mixture (substantially near the center of the combustion chamber).

Ethanol consumption can be minimized if the gasoline is also directly injected. In this case, the heat of vaporization of gasoline is also useful in decreasing the temperature of the charge in the cylinder. The gasoline can be injected using a separate set of injectors. This would provide the most flexibility. However, it may be difficult to fit two sets of injectors per cylinder Page 15 of 28

in the limited space in the cylinder head. An alternative means is to provide a single set of injectors for injection of both the ethanol and the gasoline. Two options are possible, one in which there is a single nozzle and valve (and the gasoline and ethanol are co-injected), and one in which each fuel has a separate nozzle and valve.

Using direct injection of both the gasoline and the ethanol has the disadvantage of increased cost. In addition to a sophisticated injector or injectors, a second high pressure fuel pump is also needed. The ethanol and the gasoline also need to have parallel common plenums.

When a single nozzle is used, the ethanol and the gasoline are distributed in the same manner in the cylinder. In the case with a single nozzle and single valve, the fuels need to be mixed prior to the valve/nozzle part of the injector. This could be done either outside of the injector or in the injector body. The volume between the mixing point and the nozzle should be minimized to allow for fast response of the fuel mixture.

A slight modification of the above embodiment involves an injector that has two valves but a single nozzle. This minimizes the need for a second valve outside the injector for controlling the gasoline/ethanol mixture, in addition to minimizing the volume between the mixing point and the valves.

It is possible to use a separate nozzle/valve for each fuel in a single injector. In this case, the gasoline and the ethanol can be deposited in different regions of the cylinder. An additional advantage would be to provide different spray patterns for the ethanol and for the gasoline. This would provide the most flexible system (comparable to two independent injectors), with possibilities of simultaneous or asynchronous injection of varying fractions of ethanol/gasoline, as well as being able to deposit the ethanol and the gasoline in the desired location of the charge, for optimal non-uniform distribution of ethanol in the cylinder. Optimal distribution means knock avoidance with minimal consumption of ethanol, while maintaining engine drivability. Optimal non-uniform ethanol distribution can be obtained by centrally depositing the gasoline and by preferentially depositing the ethanol in the periphery of the cylinder, where the end gas will be. This can be accomplished more easily with direct injection as opposed to achieving non-uniform distribution of the gasoline through non-uniform spraying in the inlet manifold. Because the heat of vaporization of the gasoline is substantially lower than for ethanol (a factor of 4 smaller on an energy basis), the cooling effect in the region near the spark is smaller, affecting

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less the initial flame propagation. In addition, it may be beneficial to retard the injection of the ethanol with respect to the gasoline.

When the ethanol has been exhausted, the engine can operate in a 'lower performance gasoline only' mode with turbocharger boost decrease (e.g. by a wastegate) and elimination or avoidance of operation at maximum torque levels. These conditions could be limiting, and in some cases a means of operating the vehicle at higher loads would be desired. This could be accomplished by using gasoline in the ethanol system with gasoline direct injection (GDI), while at the same time port-fuel injecting a fraction of the gasoline. Under these conditions the engine will operate at higher loads and higher torques, but still far below what ethanol could achieve. Only the cooling effect of the direct injection fuel is obtained, since the directly injected fuel has the same octane number as the port-injection fuel (gasoline in both cases).

If the ratio of ethanol in the ethanol fuel tank to gasoline in the gasoline fuel tank is lower than a predetermined value (because of the lack or availability of ethanol or for some other reason), it is possible to change the engine operation condition such that the ethanol/gasoline consumption ratio over a drive cycle is decreased. This is done for reducing the maximum ethanol fraction at a given engine speed that can be used in the engine. The allowed level of turbocharging and the maximum pressure, torque and horsepower would be correspondingly reduced to prevent knock. In this way, a continuous tradeoff between the ethanol/gasoline consumption ratio and the maximum torque and horsepower can be accomplished.

By proper expert system evaluation of the recent ethanol/gasoline usage and amounts of gasoline and ethanol it is possible to provide means to minimize the need of the 'low performance, gasoline only' mode. The usage of the antiknock agent can be restricted when the amount left in the tank is below a predetermined level, such that the main fuel will be exhausted prior to or simultaneously with the ethanol. It would be desirable to place a switch so that the operator could override the limitations, in those conditions where the desired vehicle operation will not be limited by the exhaustion of the antiknock agent.

Over a drive cycle, the amount of ethanol (by energy) required to enhance the octane number sufficiently to increase efficiency by at least 25% would be less than 15% of the fuel (ethanol + gasoline energy) without ethanol stratification and less than 5% with ethanol stratification.

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FORD Ex. 1126, page 25 IPR2020-00013 Onboard separation of ethanol from diesel by fractional distillation has been demonstrated for use in ethanol exhaust aftertreatment catalysts ["Fuel-Borne Reductants for NOx Aftertreatment: Preliminary EtOH SCR Study", John Thomas, Mike Kass, Sam Lewis, John Storey, Ron Graves, Bruce Bunting, Alexander Panov, Paul Park, presented at the 2003 DEER (Diesel Engine Emissions Reduction] Workshop, Newport RI August 2003]. This approach could be employed for onboard separation of ethanol from a gasoline mixture. However, use of membrane separation can be simpler and less expensive. Although there is information about the use of membranes for the separation of ethanol from water, to our knowledge there is no available information on the membrane separation of ethanol from gasoline. Because the ethanol molecule is on the order of 4 Angstroms and the typical hydrocarbon fuel molecules are much larger, it is possible to use membranes for the separation. Both organic and inorganic membranes could be used. Since it is not necessary to obtain high purity ethanol, the process is relatively simple and requires low pressure.

Both porous and transfusion membranes can be used because ethanol with two carbon atoms has significantly different properties than most other gasoline compounds which have five to ten carbon atoms. The other antiknock agents contemplated for use in this invention also have a small number of carbons relative to gasoline. For example, methanol has one carbon. The membrane approach can be significantly simpler than the distillation or absorption/desorption approaches (see Ilyama et al, US patent no. 6,332,448) that have been suggested for separation of various gasoline/diesel fuels where there is much less of a difference in the number of carbon atoms.

The location of the membrane could be in the region of high pressure in the fuel line (downstream from the pump), or upstream from it. If it is located downstream, the separation occurs only when the engine is operational and the pump is on, while if it is upstream the separation is continuous. The pressure of the fuel downstream from the pump is a few bars (characteristic of port fuel injection). This is to be differentiated from the pressure of the ethanol system, which is directly injected and thus requires much higher pressures.

The separated ethanol is transported to a separate tank where it is stored. If there is too much ethanol, three options are available: 1) additional separation is stopped; 2) some ethanol is used in the engine, even if not required 3) ethanol is returned to the main gasoline tank.

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The tank should be reachable, in order to be able to introduce additional ethanol when required, as when towing, in high temperatures, or when doing extensive climbing, conditions that require operation at high torque and which if for extended periods of time would consume ethanol at a rate higher than what can be extracted from the fuel.

Extraction of ethanol from the gasoline can have the unintended effect of reducing the octane of the rest of the fuel. Thus, it is likely that somewhat increased use of injected ethanol would be required to prevent knock. Even in the case without non-uniform distribution of the ethanol, under normal driving conditions the system can be designed so that the amount of ethanol extracted from the fuel matches the required ethanol.

It may also be advantageous to separate the ethanol from a gasoline/ethanol mixture at the fueling station. As with onboard separation, this approach also allows use of the present fuel transportation infrastructure. The potential advantages could be greater flexibility in choice of a fuel separation system and lower cost relative to onboard separation. It may be of particular interest during the introductory phase of ethanol boosted engine vehicles.

It can be useful to have the capability to adjust the volume of the ethanol tank, thus varying the maximum amount of ethanol in the ethanol tank. This capability would make it possible to drive longer distances between ethanol refueling and to operate on different gasoline/ethanol ratios over a drive cycle, depending on the availability and cost of ethanol and gasoline. In some cases, it may be advantageous to use more ethanol than is needed to provide the desired octane enhancement (*e.g.*, to meet alternative fuel or CO_2 reduction goals). It is desirable to have this capability without increasing the overall fuel tank size. A single fuel tank with a membrane or plate separating variable amounts of gasoline and ethanol can be used to accomplish this goal.

The tank can be configured to have a horizontal or vertical moveable/deformable walls that are substantially impervious and separate the regions that are filled with gasoline and ethanol. Separate filling ports and fuel lines are incorporated for each region as shown in Figs. 4a and b. The separation between the gasoline and ethanol (or other anti-knock agent) does not have to be perfect since a small amount of leakage of one fuel into the other will not adversely affect operation of the vehicle. The wall can be moved in response to the amount of either fuel in the tank. This process is automatic in the case of a separating membrane, and the latter can be more impervious to leaks from one fuel to the other.

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Ethanol is denser than gasoline. The movable/deformable wall can be placed such that the ethanol is located either on top of the gasoline or below the gasoline. However, since it is expected that less ethanol is required than gasoline, the preferred embodiment has the ethanol above the gasoline, as shown in Figure 5.

If the ethanol is stored so that it is separate from the gasoline, it can be mixed with various additives to insure the desired operation of the ethanol injection system. In addition, it is possible to use gasoline-ethanol mixtures, such as E85 (which contains 15% by volume of gasoline). The lubricity additives include fatty acids, organic amine salts (amine salts of acid phosphates and polyethyleneoxy acid phosphates), alkyl and aryl acid phosphates and dialkyl alkyl phosphonates.

The modeling calculations show that for direct injection of alcohols, the larger impact of knock suppression is not the intrinsic knock-resistance of the fuel antiknock agent but rather its high heat of vaporization. In order to evaluate alternatives to ethanol, Table 3 shows the properties of proposed fuel antiknock/alternative fuels. Although some of these additives have higher octane numbers than gasoline, some of them have a much larger effect on the cylinder charge temperature (Table 3 assumes injection after the inlet valve has closed). Some of these additives (mostly the ethers) have a comparable charge temperature effect to that of gasoline direct injection, and thus are of less interest. The alcohols have optimal properties for the application, with temperature changes that are a factor of 3 or more larger than the temperature change due to gasoline direct injection (for 100% or near 100% operation with the additive). For ethanol, the change in temperature is a factor of more than 4 larger than that of gasoline, and for methanol the change is about 9 times larger. The temperature decrease of the air increases with the amount of oxygen in the fuel (in terms of the O/C ratio). Thus, it is highest for methanol, with an O/C ratio of 1, second for ethanol (O/C =2), and so on.

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Table 3

Antiknock properties of various fuels (calculated from data obtained in SAE standard J 1297 Alternative Automotive Fuels, Sept 2002)

Fuel type	Chemical formula	RON	MON	(R+M)/2	Net heat of Combustion	Latent heat of vaporization	Vaporization energy/ heat of combustion	Stoic air/fuel ratio	Equiv. Latent heat of vaporization	∆T air
					MJ/kg	MJ/kg			MJ/kg air	к
Gasoline					42.8	0.30	0.007	14.6	0.020	-28
Ethyl t-Butyl Ether	CH3CH2-O-C(CH3)3	118	102	110	36.3	0.31	0.009	12.1	0.026	-35
-Amyl Methyl Ether	C2H5 C (CH3)2-O-CH3	111	98	105	36.3	0.32	0.009	12.1	0.027	-36
Foluene	C7H8	111	95	103	40.5	0.36	0.009	13.5	0.027	-37
Methyl t-Butil Ether	CH3-O-C(CH3)3	116	103	110	35.2	0.32	0.009	11.7	0.028	-37
Diisopropyl Ether	(CH3)2CH-O-CH(CH3)2	110	97	103	38.2	0.34	0.009	12.1	0.028	-39
-Butyl Alcohol	(CH3)3 C-OH	103	91	97	32.9	0.60	0.018	11.1	0.054	-74
sopropanol	(CH3)2CHOH	118	98	108	30.4	0.74	0.024	10.4	0.071	-97
Methanol with cosolvent	50% methanol/TBA	114	96	105	26.5	0.88	0.033	8.8	0.100	-137
Ethanol	CH3CH2OH	129	102	115	26.7	0.91	0.034	9	0.102	-138
Methanol	СНЗОН	133	105	119	20.0	1.16	0.058	6.4	0.181	-246

Also shown in Table 3 are the ratios of the heat of vaporization to the heat of combustion, a measure of the potential effects when used as antiknock agents. This parameter gives a measure of the amount of evaporative cooling for a given level of torque. The last entry, ΔT_{air} , measures the decrease in air temperature for a stoichiometric mixture with injection after the inlet valve closes. Although the effect clearly is maximized by the use of methanol, other considerations may make ethanol the preferred choice. Methanol is toxic and corrosive.

Hydrous ethanol (with a small amount of water) has the advantage of lower cost than pure (neat) ethanol. Removing the last 10% to 15% water from ethanol has significant expense and consumes considerable energy. Manufacturing facilities typically produce ethanol with about 10% water by volume unless there is a need for essentially pure (anhydrous) ethanol. It could be advantageous to use ethanol with a water concentration of 5% to 15% by volume.

By using a closed loop approach to identify engine knock, flexible gasoline grades (with different octane ratings) and flexible knock-prevention fuel grades can be used. An open loop system would require measurement of the quality of the antiknock additive. Similarly, an open loop system would require determining the quality of the fuel (octane number). Closed loop operation allows the use of less expensive gasoline, when available, thus partially compensating for the more expensive anti-knock agent. It is also possible to use different antiknock fuel according to its availability, such as ethanol in the regions that produce and process corn, and methanol in those that have methanol production capabilities. Thus, the least expensive grade of

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gasoline available and the least expensive antiknock fuel can be used, allowing a decrease of the cost of operating the vehicle as well as increasing the availability of the antiknock fuel.

Although the above discussion has featured ethanol as an exemplary anti-knock agent, the same approach can be applied to other high octane fuel and fuel additives with high vaporization energies such as methanol (with higher vaporization energy per unit fuel), and other anti-knock agents such as isopropanol, tertiary butyl alcohol, or ethers such as methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), or tertiary amyl methyl ether (TAME). It may be advantageous to use various mixtures of these fuels and additives with each other and with ethanol.

Particularly during the introduction phase of the present invention, the ethanol fueling could be performed by the use of containers, such as one-gallon containers. To facilitate ease of fueling an expandable pipe and funnel can be built into the ethanol fuel tank of the vehicle.

The ethanol in these containers would be denatured so as to prevent human consumption as an alcoholic beverage and could contain the additives described above. Ethanol sold for fuel, such as in Brazil, is denatured by a small fraction of gasoline (2%) among other denaturing agents (methanol, isopropanol and others).

Recycling of the container could take place at certain specific locations such as gasoline stations

Using a signal from a knock sensor to determine when and how much ethanol or other anti-knock agent must be used at various times in a drive cycle to prevent knock, the fuel management system can be employed to minimize the amount of ethanol or other anti-knock agent that is consumed over the drive cycle. If sufficient ethanol or other ant-knock agent is available, the fuel management system can also be used to employ more ethanol than would be needed to prevent knock. This would allow greater gasoline savings (the gasoline savings component from substitution of ethanol for gasoline would increase) and carbon dioxide reduction. In this case it may be desirable to operate at an anti-knock agent fraction which is either varied or constant during the drive cycle.

The contents of all of the references cited in this specification are incorporated by reference herein in their entirety.

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FORD Ex. 1126, page 30 IPR2020-00013 It is recognized that modifications and variations of the inventions disclosed herein will be apparent to those of ordinary skill in the art and all such modifications and variations are included within the scope of the appended claims.

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What is claimed is:

- A turbocharged or supercharged spark ignition engine which is fueled by a directly injected mixture of ethanol and gasoline wherein under some operating conditions the ethanol energy fraction is at least 20% and wherein manifold pressure is at least 2 bar and; wherein the maximum level of pressure increase from the turbocharger or supercharger is decreased when the ethanol/gasoline ratio is lowered.
- 2. The engine system of claim 1 wherein the maximum level of pressure increase is decreased so as to prevent knock.
- 3. The engine system of claim 1 wherein spark retard is increased when the ethanol/gasoline ratio is lowered.
- 4. The engine system of claim 1 wherein the compression ratio is 11 or greater.
- 5. A turbocharged or supercharged spark ignition engine wherein an ethanol–gasoline mixture is directly injected from a first source and there is also a means for independently controlling fueling with gasoline from a second source comprising:

a spark ignition engine;

a turbocharger or supercharger;

a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder;

a means for fueling the engine with gasoline from the second source;

wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20 % and further wherein under some driving conditions the manifold pressure is greater than 2 bar; and

wherein the engine is operated at a substantially stoichiometric fuel/air ratio during at least part the operating time.

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- 6. The engine system of claim 5 wherein more gasoline from the second source than would ordinarily be used is employed during the first 30 seconds of engine operation.
- 7. The engine system of claim 5 wherein the engine is started up with only the gasoline from the second source.
- 8. The engine system of claim 5 wherein under some driving conditions the engine is operated with only the directly injected ethanol –gasoline mixture from the first source.
- 9. The engine system of claim 5 wherein the level of turbocharging or supercharging is decreased so as to reduce the amount of the ethanol-gasoline mixture from the first source that is needed to prevent knock.
- 10. The engine system of claim 5 wherein the usage of the ethanol-gasoline mixture from the first source is determined by the amount of fuel in the first source.
- 11. The engine system of claim 5 wherein the usage of the ethanol-gasoline mixture from the first source is determined by the driver.
- 12. The engine system of claim 5 wherein spark retard is changed when the ethanol/gasoline ratio is changed.
- 13. The engine system of claim 5 wherein the fuel/air ratio in the engine is rich at high loads.
- 14. The engine system of claim 5 wherein the gasoline from the second source is port fuel injected.
- 15. A turbocharged or supercharged spark ignition engine wherein ethanol is separated onboard from an ethanol-gasoline mixture which is stored in a fuel tank and wherein the separated ethanol is directly injected into the engine and ;

wherein the mixture in the fuel tank that is not separated is used to fuel the engine using a

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fuel injection system that is controlled separately from a direct injection system for direct injection of the separated ethanol.

- 16. The turbocharged or supercharged spark ignition engine system of claim 15 wherein the mixture from the fuel tank that is not separated is port fuel injected.
- 17. The turbocharged or supercharged spark ignition engine of claim 15 wherein the ratio of the directly injected ethanol that is separated onboard to the nonseparated mixture that is used for separately controlled fueling of the engine increases with increasing torque and wherein during at least part of the operating time the fuel/air ratio in the engine is maintained at a substantially stoichiometric ratio as the torque is increased.
- 18. The turbocharged or supercharged spark ignition engine system of claim 15 wherein a porous membrane is used for separation.
- 19. The turbocharged or supercharged spark ignition engine of claim 15 wherein a transfusion membrane is used for separation.
- 20. A turbocharged or supercharged spark ignition engine system wherein a mixture of alcohol and gasoline is directly injected from a single injector and wherein the alcohol/gasoline ratio is increased as the torque is increased so as to prevent knock and wherein during at least part of the operating time the fuel/air ratio in the engine is maintained at a stoichiometric fuel/air ratio as the alcohol/gasoline ratio is changed.
- 21. The turbocharged or supercharged spark ignition engine system of claim 20 wherein the injector has one nozzle and two valves and these valves are used to vary the alcohol/gasoline ratio.
- 22. The turbocharged or supercharged spark ignition engine system of claim 20 wherein the gasoline and alcohol are mixed outside of an injector with a single nozzle.

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- 23. The turbocharged or supercharged engine system of claim 22 where the volume between the mixing point and the nozzle is minimized to allow for fast response change of the alcohol/gasoline mixture as the torque increases.
- 24. The turbocharged or supercharged engine system of claim 20 where the injector has two nozzles.
- 25. A turbocharged or supercharged engine wherein alcohol is directly injected from a first source and wherein the engine is also fueled with gasoline from a second source and wherein the ratio of volumes of the first and second sources can be varied and wherein the alcohol/gasoline ratio is adjusted so as to prevent knock.

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Abstract of the Disclosure

Fuel management system for enhanced operation of a spark ignition gasoline engine. Injectors inject an anti-knock agent such as ethanol directly into a cylinder. It is preferred that the direct injection occur after the inlet valve is closed. It is also preferred that stoichiometric operation with a three way catalyst be used to minimize emissions. In addition, it is also preferred that the anti-knock agents have a heat of vaporization per unit of combustion energy that is at least three times that of gasoline.

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Electronic Patent Application Fee Transmittal					
Application Number:					
Filing Date:					
Title of Invention: Direct Ir Enhancement of Gasoline Engines			em for Direct Inje	ction Ethanol	
First Named Inventor/Applicant Name: Leslie Bromberg					
Filer: Sam Pasternack/Michelle Hayes					
Attorney Docket Number:	04	92611-0828			
Filed as Small Entity					
Utility Filing Fees					
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:					
Utility filing Fee (Electronic filing)		4011	1	75	75
Utility Search Fee		2111	1	255	255
Utility Examination Fee		2311	1	105	105
Pages:					
Claims:					
Claims in excess of 20		2202	5	25	125
Independent claims in excess of 3		2201	2	105	210
Miscellaneous-Filing:	_				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
	Tota	al in USE) (\$)	770

Electronic Acknowledgement Receipt				
EFS ID:	2770061			
Application Number:	12020285			
International Application Number:				
Confirmation Number:	1610			
Title of Invention:	Optimized Fuel Management System for Direct Injection Ethanol Enhancement of Gasoline Engines			
First Named Inventor/Applicant Name:	Leslie Bromberg			
Customer Number:	24280			
Filer:	Sam Pasternack/Michelle Hayes			
Filer Authorized By:	Sam Pasternack			
Attorney Docket Number:	0492611-0828			
Receipt Date:	25-JAN-2008			
Filing Date:				
Time Stamp:	17:08:38			
Application Type:	Utility under 35 USC 111(a)			

Payment information:

Submitted wi	ith Payment	yes		
Payment Typ	De	Credit Card		
Payment was	s successfully received in RAM	\$770		
RAM confirmation Number		2471		
Deposit Account				
Authorized L	lser			
File Listin	ng:			
Document Number	Document Description	File Name	File Size(Bytes)MultiPages/Message DigestPart /.zip(if appl.)	

1	Application Data Sheet	Application Data Sheet ADS.pdf	1173369	no	5
	Application Bata oncor	, noc.par	980c89af0eb598663fcff8213604fdod75 97b7d0	110	
Warnings:					
Information					
2	Drawings-only black and white line	Figures odf	77759	no	3
_	drawings	drawings	3ff8d393838bb4f68b50f97b2da820385 d5a750c	110	
Warnings:					
Information					
3			216473	Ves	28
		CONTRAPPICATION.pdf	d2634105c24ea2ce4d603dbbd9464a0 37da5b28f	yc5	20
	Multipa	rt Description/PDF files in	.zip description		
	Document De	Start	E	nd	
	Specifical	tion	1	:	23
	Claims	3	24	:	27
	Abstrac	t	28	:	28
Warnings:					
Information	:				
4	Fee Worksheet (PTO-06)	fee-info ndf	8592	no	2
			b18ffeb9827d7732fecfa542eea074a54 4b01cf9		2
Warnings:					
Information	:		1		
		Total Files Size (in bytes)	14	76193	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (12-04)

Filing Date: 01/25/08

Approved for use through 7/31/2006, OMB 0651-0032 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Un	der the Paperwo	ork Reduction A	ct of 199	95, no persons	are required to resp	ond to a co	ollection of i	information unl	ess it disp	lays a valid OMB	control number.
	PATE	NT APPLIC	ATION	FEE DETE	RMINATION RE	CORD			Applicatio	n or Docket Num	ber
			Substitu	te for Form PT	0-875	_			12/	020,285	
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	FOR		NUN	BER FILED	NUMBER EXTRA	F	ATE (\$)	FEE (\$)		RATE (\$)	FEE (\$)
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•	If the entry in c	olumn 1 is less	than the	entry in colum	n 2, write "0" in colu	ımn 3.					
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This	collection of infe	ormation is real	ired by 1	37 CFR 1.16	The information is re	quired to o	btain or ret	ain a benefit by	the publi	c which is to file (and by the
1100		an application	Confider	tielle is sever	and by 25 11 6 C 12	2 and 27 (CD 1 14 T	'his collection i		d to toko 12 min	itos to complete

USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patern and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections

Applicant(s)

Leslie Bromberg, Sharon, MA; Daniel R. Cohn, Cambridge, MA; John B. Heywood, Newton, MA;

Assignment For Published Patent Application

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 11/758,157 06/05/2007 which is a CIP of 11/100,026 04/06/2005 PAT 7,225,787

Foreign Applications

If Required, Foreign Filing License Granted: 02/09/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/020,285**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No ** SMALL ENTITY **

page 1 of 3

OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES

Preliminary Class

123

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where

page 2 of 3

FORD Ex. 1126, page 44 IPR2020-00013

Title

the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

page 3 of 3

UNITED STA	ates Patent and Tradema	RK OFFICE UNITED STA United State Address: COMMI PO. Box Alexandri www.sph	TES DEPARTMENT OF COMMERCE s Patent and Trademark Office SSIONER FOR PATENTS 450 a, vingina 22313-1450 ogov
APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/020,285	01/25/2008	Leslie Bromberg	0492611-0828
			CONFIRMATION NO. 1610
24280		FORMALI	TIES LETTER

CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110



Date Mailed: 02/11/2008

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

• The oath or declaration is missing.

A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

• To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of \$65 for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this notice.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **\$65** for a small entity **• \$65** Surcharge.

page 1 of 2

Replies should be mailed to:

Mail Stop Missing Parts Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web. <u>https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html</u>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <u>http://www.uspto.gov/ebc.</u>

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/tnguyen/

Office of Initial Patent Examination (571) 272-4000 or 1-800-PTO-9199

page 2 of 2

ATTORNEY'S DOCKET NUMBER: 0492611-0828(MIT CON 11381) <u>IN THE UNITED STATES PATENT AND TRADEMARK OFFICE</u>

Applicant:	Bromberg, et al.	Examiner:	Not yet assigned
Serial No.:	12/020,285	Art Unit:	Not yet assigned
Filing Date:	January 25, 2008	Confirmation No.:	1610
Title:	OPTIMIZED FUEL M INJECTION ETHANC ENGINES	IANAGEMENT SYSTE DL ENHANCEMENT O	M FOR DIRECT F GASOLINE

VIA EFS WEB FILING – WWW.USPTO.GOV

Mail Stop Missing Parts Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Sir:

<u>RESPONSE TO NOTICE TO FILE MISSING PARTS</u> <u>OF NONPROVISIONAL APPLICATION</u>

Enclosed herewith in response to the Notice to File Missing Parts of A NonProvisional Application mailed February 11, 2008 are the following documents:

1. The Notice States that an executed Declaration is missing.

The executed Declaration is being submitted herewith. Applicant thus submits that the present Response is timely submitted on March 28, 2008.

2. The Notice States that a late surcharge in the amount of \$65.00 for a small entity must be submitted.

The \$65.00 fee is being electronically paid herewiith

Please charge any additional fees or credit any overpayments that may be required to our Deposit Account No. 03-1721.

Respectfully Submitted, CHOATE, HALL & STEWART LLP

Date: March 28, 2008

/SamPasternack/ SamPasternack Reg. No. 29,576

PATENT DEPARTMENT CHOATE, HALL & STEWART LLP Two International Place Boston, Massachusetts 02110 Telephone: (617) 248-5000 Facsimile: (617) 248-4000

4315906v1

FORD Ex. 1126, page 49 IPR2020-00013

DECLARATION

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention titled: OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES, the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulation, § 1.56. I hereby claim foreign priority benefits under Title 35, United States Code, §119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate disclosing the subject matter claimed in their application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority is claimed, before the filing date of this application.

	· .	Prior Foreign Application(s)		
Number	Country	Day/Month/Year Filed	Priority Claimed	1
			() Yes ()	No

I hereby claim the benefit under Title 35, United States Code, §120/365 of any United States application(s) listed below and PCT International Applications listed above or below, and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

10/991.774	November 18, 2004	Pending
(Application Number)	Day/Month/Year Filed	Status (Patented, Pending, Abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventor's signature Fishe Londing	Date 6/29/05
Full name of first inventor (given name, family name): Leslie Bromberg	r - 3
Residence: MWilshire Drive, Sharon, MA 02067	Citizenship: U.S.
Post Office Address (include zip code): Same	
Inventor's signature Daniel Color	Date 6/29/05
Full name of second inventor (given name, family name): Daniel R. Cohn	
Residence:100 Memorial Drive, Apt. # [] # 225 Cambridge, MA 02142	Citizenship: U.S.
Post Office Address (include zip code): <u>Same</u> (X) Additional inventors are being named on separately number	ered sheets attached hereto.

3909186v1

Attorney Docket No. 0492611-0617 MIT Ref. No. MIT 11381 CIP

DECLARATION (continued)

Inventor's signature Hub Heywood	Date 6/29/05
Full name of third inventor (given name, family name): John B. Heywood	
Residence:218 Mill Street, Newton, MA 02460	Citizenship: U.S.
Post Office Address (include zip code): Same	

ost Office Address (mende zip code).

3909186v1

Electronic Patent Application Fee Transmittal						
Application Number:	12	020285				
Filing Date:	25	-Jan-2008				
Title of Invention:	OF	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES				
First Named Inventor/Applicant Name:	Le	slie Bromberg				
Filer:	Sa	m Pasternack/Mic	chelle Hayes			
Attorney Docket Number:	0492611-0828					
Filed as Small Entity						
Utility Filing Fees						
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)	
Basic Filing:						
Pages:						
Claims:						
Miscellaneous-Filing:						
Late filing fee for oath or declaration		2051	1	65	65	
Petition:						
Patent-Appeals-and-Interference:						
Post-Allowance-and-Post-Issuance:						
Extension-of-Time:						

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
	Total in USD (\$)			65

Electronic Acknowledgement Receipt			
EFS ID:	3068512		
Application Number:	12020285		
International Application Number:			
Confirmation Number:	1610		
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES		
First Named Inventor/Applicant Name:	Leslie Bromberg		
Customer Number:	24280		
Filer:	Sam Pasternack/Michelle Hayes		
Filer Authorized By:	Sam Pasternack		
Attorney Docket Number:	0492611-0828		
Receipt Date:	28-MAR-2008		
Filing Date:	25-JAN-2008		
Time Stamp:	13:09:15		
Application Type:	Utility under 35 USC 111(a)		

Payment information:

Submitted w	ith Payment	yes	yes			
Payment Typ	De	Credit Card	Credit Card			
Payment was	s successfully received in RAM	\$65				
RAM confirm	ation Number	7952				
Deposit Acco	punt					
Authorized User						
File Listing:						
Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)	

Warnings: Information			35210312763755309018c7ea621a9cdb6 740366b	no	2
Information					•
2	Oath or Declaration filed	Declaration.pdf	190781	no	2
_			4db3ed52a72fab07cc967c9a164059b4 328a75b5		
Warnings:					
Information			•	1	1
3	Fee Worksheet (PTO-06)	fee-info pdf	8216	no	2
			86ebd96954450018a08bdf7e1abc29e3 affb484d		
Warnings:					
Information			1		
Information		Total Files Size (in bytes)	3	10268	
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Information This Acknow characterize similar to a <u>New Applic</u> If a new app 37 CFR 1.53 shown on th <u>National Sta</u> If a timely s of 35 U.S.C. application in due court	wledgement Receipt evidences read by the applicant, and including Post Card, as described in MPEP ations Under 35 U.S.C. 111 lication is being filed and the app (b)-(d) and MPEP 506), a Filing Re his Acknowledgement Receipt will age of an International Application ubmission to enter the national st 371 and other applicable requirer as a national stage submission ur se.	Total Files Size (in bytes) ceipt on the noted date by page counts, where applic 503. lication includes the neces ceipt (37 CFR 1.54) will be l establish the filing date of <u>under 35 U.S.C. 371</u> age of an international app nents a Form PCT/DO/EO/g nder 35 U.S.C. 371 will be is	the USPTO of the in able. It serves as e sary components for issued in due cours the application. lication is complian 003 indicating accept ssued in addition to	10268 dicated do vidence of or a filing d se and the se and the o tance of th the Filing	cuments, receipt late (see date conditions ne Receipt,
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Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections

Applicant(s)

Leslie Bromberg, Sharon, MA; Daniel R. Cohn, Cambridge, MA; John B. Heywood, Newton, MA;

Assignment For Published Patent Application

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 11/758,157 06/05/2007 which is a CIP of 11/100,026 04/06/2005 PAT 7,225,787

Foreign Applications

If Required, Foreign Filing License Granted: 02/09/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/020,285**

Projected Publication Date: 07/17/2008

Non-Publication Request: No

Early Publication Request: No ** SMALL ENTITY **

page 1 of 3

OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES

Preliminary Class

123

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where

page 2 of 3

FORD Ex. 1126, page 57 IPR2020-00013

Title

the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

UNITED STA	ntes Patent and Tradem	ARK OFFICE UNITED STA United State Address: COMMI PO, Box Alexand www.usp	XTES DEPARTMENT OF COMMERCE s Patent and Trademark Office ISSIONER FOR PATENTS 1450 ia, Vigninia 22313-1450 togov
APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
			0492611-
12/020,285	01/25/2008	Leslie Bromberg	0828(MITCON11381)
			CONFIRMATION NO. 1610
24280		PUBLICA	TION NOTICE
CHOATE, HALL & STEWA	ART LLP		
TWO INTERNATIONAL PI BOSTON, MA 02110	LACE		OC000000031019139*
·			Date Mailed: 07/17/2008

Title:OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES

Publication No.US-2008-0168966-A1 Publication Date:07/17/2008

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

page 1 of 1

	TED STATES PATEN	T AND TRADEMARK OFFICE	UNITED STATES DEPAR United States Patent and Address: COMMISSIONER F P.O. Box 1450 Alexandria, Virginia 22: www.usplo.gov	TMENT OF COMMERCE Trademark Office OR PATENTS 313-1450
APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/020,285	01/25/2008	Leslie Bromberg	0492611-0828(MITCON1138	1) 1610
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TWO INTERN	ATIONAL PLACE		DUFF, DO	DUGLAS J
BOSTON, MA	. 02110		ART UNIT	PAPER NUMBER
			3748	
			NOTIFICATION DATE	DELIVERY MODE
			04/16/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@choate.com

	Application No.	Applicant(s)			
	12/020,285	BROMBERG ET AL.			
Office Action Summary	Examiner	Art Unit			
	DOUGLAS J. DUFF	3748			
The MAILING DATE of this communication app Period for Reply	pears on the cover sheet with the o	correspondence address			
 A SHORTENED STATUTORY PERIOD FOR REPL WHICHEVER IS LONGER, FROM THE MAILING D Extensions of time may be available under the provisions of 37 CFR 1.1 after SIX (6) MONTHS from the mailing date of this communication. If NO period for reply is specified above, the maximum statutory period + Failure to reply within the set or extended period for reply will, by statute Any reply received by the Office later than three months after the mailing earned patent term adjustment. See 37 CFR 1.704(b). 	Y IS SET TO EXPIRE <u>3</u> MONTH ATE OF THIS COMMUNICATIO 36(a). In no event, however, may a reply be tir will apply and will expire SIX (6) MONTHS from , cause the application to become ABANDONE g date of this communication, even if timely file	S) OR THIRTY (30) DAYS, N. nely filed the mailing date of this communication. D (35 U.S.C. § 133). d, may reduce any			
Status					
1) Responsive to communication(s) filed on					
2a) This action is FINAL . 2b) This	action is non-final.				
3) Since this application is in condition for allowa	nce except for formal matters, pro	osecution as to the merits is			
closed in accordance with the practice under E	Ex parte Quayle, 1935 C.D. 11, 4	53 O.G. 213.			
Disposition of Claims					
4) Claim(s) 1-25 is/are pending in the application					
 4)∑ Claim(s) <u>1-25</u> is/are pending in the application. 4a) Of the above claim(s) is/are withdrawn from consideration. 5) Claim(s) is/are allowed. 6) Claim(s) is/are rejected. 7) Claim(s) is/are objected to. 8)∑ Claim(s) <u>1-25</u> are subject to restriction and/or election requirement. 					
Application Papers					
 9) The specification is objected to by the Examine 10) The drawing(s) filed on is/are: a) acc Applicant may not request that any objection to the Replacement drawing sheet(s) including the correct 11) The oath or declaration is objected to by the Example. 	 Application Papers 9) The specification is objected to by the Examiner. 10) The drawing(s) filed on is/are: a) accepted or b) objected to by the Examiner. Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a). Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d). 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152 				
Priority under 35 U.S.C. § 119					
 Priority under 35 U.S.C. § 119 12) △ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f). a) △ All b) ○ Some * c) ○ None of: Certified copies of the priority documents have been received. Certified copies of the priority documents have been received in Application No 3. ○ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)). * See the attached detailed Office action for a list of the certified copies not received. 					
Attachment(s) 1) Notice of References Cited (PTO-892) 2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 3) Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date US. Patent and Trademark Office	4) Interview Summary Paper No(s)/Mail D 5) Notice of Informal F 6) Other:	P(PTO-413) ate Patent Application			
PTOL-326 (Rev. 08-06) Office A	ction Summary Pa	art of Paper No./Mail Date 20090408			

FORD Ex. 1126, page 61 IPR2020-00013

DETAILED ACTION

Election/Restrictions

- 1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - Claims 1-14, drawn to a turbocharged engine means, classified in class 123, subclass 559.1.
 - II. Claims 15-25, drawn to a fuel injection means, classified in class 239, subclass 5.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different designs, modes of operation, and effects (MPEP § 802.01 and § 806.06). In the instant case, the different inventions have different designs (turbocharger/supercharger control system and fuel injection structure), modes of operation (operating conditions of the intake and fuel injector/tank operation) and effects (intake pressure and knock prevention).

3. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above <u>and</u> there would be a serious search and examination burden if restriction were not required because one or more of the following reasons apply:

(a) the inventions have acquired a separate status in the art in view of their different classification;

Application/Control Number: 12/020,285 Art Unit: 3748

- (b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;
- (c) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);
- (d) the prior art applicable to one invention would not likely be applicable to another invention.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) and (ii) identification of the claims encompassing the elected invention.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected invention.

If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Application/Control Number: 12/020,285 Art Unit: 3748

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

4. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DOUGLAS J. DUFF whose telephone number is (571)272-3459. The examiner can normally be reached on M-Th 7 AM - 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Denion can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Application/Control Number: 12/020,285 Art Unit: 3748

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Thomas E. Denion/ Supervisory Patent Examiner, Art Unit 3748

/Douglas J Duff/ Examiner, Art Unit 3748 4/8/09



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandra, Virginia 22313-1450 www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 1610

SERIAL NUM 12/020,28	IBER 35	FILING or 371(c) DATE 01/25/2008	CLASS 123	GR	ROUP ART 3748	UNIT 049	ATTC 2611-0	RNEY C NO. 0828(MI ⁻	DOCKET
		RULE							
APPLICANT Leslie Bro Daniel R. John B. H	S omberg Cohn, Heywoo	, Sharon, MA; Cambridge, MA; d, Newton, MA;					-		
** CONTINUING DATA ***********************************									
** FOREIGN APPLICATIONS ************************************									
** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 02/09/2008									
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BIB (Rev. 05/07).

ATTORNEY DOCKET NO.: 0492611-0828 (MITCON11381)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Leslie Bromberg	Examiner:	Douglas J. Duff
Serial No.:	12/020285	Art Unit:	3748
Filing Date:	January 25, 2008	Confirmation No.	1610
Title:	OPTIMIZED FUEL M. INJECTION ETHANO ENGINES	ANAGEMENT SYSTEN L ENHANCEMENT OF	M FOR DIRECT F GASOLINE

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Madam:

RESPONSE TO ELECTION REQUIREMENT

In response to the election requirement set forth in the Office Action mailed April 16, 2009, Applicant hereby elects invention 1 for examination purposes. Invention 1 includes claims 1-14. This election is being made without traverse.

Respectfully submitted,

/Sam Pasternack, Ph.D./ Sam Pasternack, Ph.D. Registration No. 29,576

Date: May 8, 2009

Patent Department CHOATE, HALL & STEWART Exchange Place 53 State Street Boston, MA 02109-2804 Tel: (617) 248-5000 Fax: (617) 248-4000

4481663v1

Electronic Acknowledgement Receipt			
EFS ID:	5302449		
Application Number:	12020285		
International Application Number:			
Confirmation Number:	1610		
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES		
First Named Inventor/Applicant Name:	Leslie Bromberg		
Customer Number:	24280		
Filer:	Sam Pasternack/Christina Andrews		
Filer Authorized By:	Sam Pasternack		
Attorney Docket Number:	0492611-0828(MITCON11381)		
Receipt Date:	08-MAY-2009		
Filing Date:	25-JAN-2008		
Time Stamp:	15:22:05		
Application Type:	Utility under 35 USC 111(a)		

Payment information:

Submitted wi	th Payment	no				
File Listing:						
Document Number	Document Description		File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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Warnings:						
Information:						

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

	··· • • • • • • • • • •		· · - · · 40	-		• ••	U.S. Patent a	Approved fo nd Trademark Off	or use th fice; U.S	1rough 1/31/2 5. DEPARTME	PTO/SB/06 (07-06) 007. OMB 0651-0032 ENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to response of the paperwork Reduction FEE DETERMINATION RECORD Substitute for Form PTO-875						nd to	d to a collection of information unle Application or Docket Number 12/020,285		ss it displays a valid Filing Date 01/25/2008		OMB control number.
	APPLICATION AS FILED – PART I								OT		HER THAN
			(Column '	1) ((Column 2)	_	SMALL	ENTITY 🛛	OR	SMA	ALL ENTITY
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	SEARCH FEE (37 CFR 1.16(k), (i),	or (m))	N/A		N/A		N/A			N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		E or (q))	N/A		N/A		N/A			N/A	
TO (37	TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =		*		X \$ =		OR	X \$ =	
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* lf t	the difference in colu	umn 1 is less than	zero, ente	r "0" in column 2.			TOTAL			TOTAL	
		(Column 1)	AMENE)ED – PART II (Column 2)	(Column 3)	9	SMAL	L ENTITY	OR	OTH SM/	ER THAN ALL ENTITY
ËNT	05/08/2009	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	additional Fee (\$)		RATE (\$)	ADDITIONAL FEE (\$)
JME	Total (37 CFR 1.16(i))	* 25	Minus	** 25	= 0		X \$26 =	0	OR	X \$ =	
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This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.		
12/020,285	01/25/2008	Leslie Bromberg	0492611-0828(MITCON1138	1) 1610		
24280 CHOATE HA	7590 09/04/200	EXAMINER				
TWO INTERN	JATIONAL PLACE	DUFF, DOUGLAS J				
BOSTON, MA	. 02110		ART UNIT	PAPER NUMBER		
			3748			
			NOTIFICATION DATE	DELIVERY MODE		
			09/04/2009	ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@choate.com

	Application No.	Applicant(s)						
	12/020,285	BROMBERG ET AL.						
Office Action Summary	Examiner	Art Unit						
	DOUGLAS J. DUFF	3748						
The MAILING DATE of this communication ap Period for Reply	The MAILING DATE of this communication appears on the cover sheet with the correspondence address Period for Reply							
 A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION. Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any and patient terms of Yange 37 CFR 1.70(h). 								
Status								
1)⊠ Responsive to communication(s) filed on <u>08 Λ</u>	<i>lay 2008</i> .							
2a) This action is FINAL . 2b)⊠ This	s action is non-final.							
3) Since this application is in condition for allowa	nce except for formal matters, pro	osecution as to the merits is						
closed in accordance with the practice under	Ex parte Quayle, 1935 C.D. 11, 4	53 O.G. 213.						
Disposition of Claims								
4)⊠ Claim(s) 1-14 is/are pending in the application								
4a) Of the above claim(s) is/are withdra	wn from consideration							
5) Claim(s) is/are allowed	4a) Of the above claim(s) is/are withdrawn from consideration.							
6)X Claim(s) 1-6 and 9-14 is/are rejected								
7 Claim(s) 7 8 is/are objected to								
(3) Claim(s) (3) are subject to restriction and/	or election requirement							
	si ciccilon requirement.							
Application Papers								
9) The specification is objected to by the Examin	er.							
10) The drawing(s) filed on is/are: a) acc	cepted or b) objected to by the	Examiner.						
Applicant may not request that any objection to the	drawing(s) be held in abeyance. See	e 37 CFR 1.85(a).						
Replacement drawing sheet(s) including the correct	tion is required if the drawing(s) is ob	jected to. See 37 CFR 1.121(d).						
11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.								
Priority under 35 U.S.C. § 119								
12) Acknowledgment is made of a claim for foreign	priority under 35 U.S.C. & 119(a))-(d) or (f)						
a) All b) Some * c) None of	12μ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § T19(a)-(d) or (f).							
a $(\Box A \Pi B) \Box B O \Pi B C (\Box B O H B O H)$								
 Certified copies of the priority documents have been received in Application No. 								
$3 \square$ Copies of the certified copies of the prior	rity documents have been received	ed in this National Stage						
opplies of the certified copies of the priority documents have been received in this National Stage								
* See the attached detailed Office action for a list of the contified conics not received								
See the attached detailed Unice action for a list of the certified copies not received.								
Attachment(s)								
1) 🔟 Notice of References Cited (PTO-892)	4) 🔲 Interview Summary	(PTO-413)						
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Da	ate						
3) Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date	5) I Notice of Informal F 6) Other:	αιεπι Αρρικαιιση						
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FORD Ex. 1126, page 72 IPR2020-00013
DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 6 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed phrase "than would ordinarily be used" is not definite as it does not distinctly claim an amount that would be considered ordinary. Given the multiple configurations of these diverse fuel engines, a person having ordinary skill in the art would not be able to ascertain an ordinary amount used.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-6 and 9-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gray, Jr. et al. (US 6651432) in view of Mochizuki et al. (US 5131228). Regarding claims 1 and 5, Gray, Jr. et al. discloses a turbocharged (27) or supercharged spark ignition engine wherein a mixture is directly injected from a first source (23) and there is also a means for independently controlling fueling with gasoline from a second source (53) comprising a spark ignition engine; a turbocharger or supercharger; a means for

directly injecting a gasoline mixture from the first source into at least one cylinder; a means for fueling the engine with gasoline from the second source; further wherein under some driving conditions the manifold pressure is greater than 2 bar (col. 8, lines 62-67); and wherein the engine is operated at a substantially stoichiometric fuel/air ratio during at least part the operating time (col. 10, lines 24-32). Gray, Jr. et al. discloses an ethanol-gasoline mixture to be directly injected (col. 10, lines 34-49), but fails to specifically disclose a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20 % and fails to disclose the maximum level of pressure increase from the turbocharger is decreased when an ethanol/gasoline ratio is lowered.

5. Mochizuki et al. teaches a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20 % (Figure 4). It would have been obvious for a person having ordinary skill in the art at the time the invention was made to utilize an ethanol-gasoline mixture with an energy fraction of ethanol of at least 20% directly injected into the first source cylinder injector of Gray, Jr. et al. in order to avoid auto-ignition of the mixture of the supercharged engine of Gray, Jr. et al. (col. 4, lines 41-50).

6. Additionally, Mochizuki et al. teaches a supercharged engine wherein the maximum level of pressure increase from the supercharger is decreased when an ethanol/gasoline ratio is lowered (col. 4, lines 41-50). It would have been obvious for a

person having ordinary skill in the art at the time the invention was made to utilize the lowering of maximum supercharger pressure when the ethanol/gasoline ratio is lowered in order to avoid engine knock due to the lowering of octane of the fuel mixture.

7. Regarding claims 2-4, the modified Gray, Jr. et al. device discloses the maximum pressure increase is decreased so as to prevent knock (col. 4, lines 41-50), the spark retard is increased when the ethanol/gasoline ratio is lowered (claim 26) and the compression ratio is 11 or greater (claim 21).

8. Regarding claims 6 and 9-14, the modified Gray, Jr. et al. device discloses wherein more gasoline from the second source than would ordinarily be used is employed during the first 30 seconds of engine operation (Gray, an inherent rich air/fuel ratio upon cold startup), wherein the level of turbocharging is decreased so as to reduce the amount of the ethanol/gasoline mixture from the first source that is needed to prevent knock (col. 4, lines 41-50), wherein the usage of the ethanol/gasoline mixture from the first source (fuel supply), wherein the usage of the mixture from the first source (fuel supply), wherein the usage of the mixture from the first source (fuel supply), wherein the usage of the mixture from the first source is determined by the amount of fuel in the ethanol/gasoline ratio is changed (col. 6, lines 29-31), wherein the fuel/air ratio in the engine is rich at high loads and wherein the gasoline from the second source is port fuel injected (col. 4, lines 13-40).

Allowable Subject Matter

9. Claims 7 and 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DOUGLAS J. DUFF whose telephone number is (571)272-3459. The examiner can normally be reached on M-Th 7 AM - 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Denion can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Thomas E. Denion/ Supervisory Patent Examiner, Art Unit 3748

/Douglas J Duff/ Examiner, Art Unit 3748

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Page 6

					Application/	Control No	Applicant(s)/Pa	itent Under		
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		Document Number	Date	U.S. PAI	ENT DOCUM	ENIS				
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*	A	US-6,651,432	11-2003	Gray, Jr.,	Charles L.			60/605.2		
*	В	US-6,575,147	06-2003	Wulff et a	al.			123/525		
*	С	US-6,230,683	05-2001	zur Loye	et al.			123/435		
*	D	US-6,076,487	06-2000	Wulff et a	al.			123/1A		
*	E	US-7,188,607	03-2007	Kobayas	hi, Tatsuo			123/431		
*	F	US-7,444,987	11-2008	Cohn et a	al.			123/431		
*	G	US-4,993,386	02-1991	Ozasa et	al.			123/25J		
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*	I	US-5,233,944	08-1993	Mochizuk	ki, Kenji			123/1A		
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*	к	US-7,461,628	12-2008	Blumberg	g et al.			123/304		
*	L	US-7,426,925	09-2008	Leone et	al.		123/575			
*	м	US-7,426,908	09-2008	Brehob, I	Diana		123/25C			
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).) Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office PTO-892 (Rev. 01-2001)

Notice of References Cited

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EAST Search History

EAST Search History (Prior Art)

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		[*] 20080053399" "20080127933" "20080156303" "20080173278" "2221405"				
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		7357101 7412900 7420908 7420923 7401028 7533051).UHPIN.		, ,		
L10	61	9 and (ratio near3 (alcohol or ethanol))	US-PGPUB;	OR	ON	2009/08/30
			USPAT;			19:49
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11	49	10 and (turbo or turbochara\$3 or superchara\$3)	ILIS-PGPLIB	OR	ON	2009/08/30
3-11	Ţ		USPAT	on		19.50
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L12	20	("4424676" "4539948" "4703732").PN. OR ("5131228").URPN.	US-PGPUB;	OR	ON	2009/08/30
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			USOCR			
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L14	24	("20020014226" "20060102136" "20060102145" "20070039588" "4402296"	US-PGPUB;	OR	ON	2009/08/30
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		"6990956" "7159568" "7178503" "7188607" "7225787").PN. OR ("7444987").				
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15	4	("2007/0039588").URPN.	USPAT	OR	ON	2009/08/30
				Unt		20.08
L16	8	[^{60/128}]	USPAT	OK	ON	2009/08/30
		1	1	}	1	20:10
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L17	20	("20020007816" "3924598" "4254741" "4414940" "4612898" "4748949" "5076229" "5243940" "5365902" "5941210" "6227151" "6341487" "6354264" "6390057" "6494064" "6659071" "6684849" "6684852").PN. OR ("7188607"). URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2009/08/30 20:13
L18	6	17 and (port with inject\$3) and ((direct\$2 or cylinder) near3 inject\$3) and (turbo or supercharg\$3 or turbocharg\$3)	US-PGPUB; USPAT; USOCR	OR	ON	2009/08/30 20:15
L19	180	("20010017127" "20020014226" "20060102136" "20060102145" "20070039588" "2977942" "3924598" "4306526" "4402296" "4421280" "4430978" "4480616" "4499885" "4541383" "4572133" "4574754" "4603674" "4606322" "4622393" "4768481" "4774909" "4924828" "4926806" "4949689" "5031594" "5048470" "50505500" "5052560" "5060610" "5067467" "5076244" "5119780" "5123397" "5190006" "5205254" "5233944" "5237812" "5265562" "5322044" "5329908" "5365902" "5394852" "5467757" "5476072" "5497737" "5531193" "5535716" "5549087" "5609131" "5623909" "5642705" "5713328" "5797367" "5832880" "5875743" "5890459" "5937799" "5950603" 6026781" "6032617" 6076487" "6213086" "6230683" 6234123" "6240895" "6267097" "6276334" 6286482" "6287351" "6293246" 6298838" "6321157" "6332448" "6349698" 6352490" "6363908" "6386177" "6390055" "6474293" "6508233" 6513505" 66543423" "6151157" "6575132" "675827" "595111" "6698044" "6725827" "6990956" "7159568" "7178503" "7188607" "7225787").PN. OR ("2002/0007816" "5941210" "6354264" "6684849" "6684852" "7444987").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2009/08/30 20:19
L20	25	19 and ethanol	US-PGPUB; USPAT; USOCR	OR	ON	2009/08/30 20:20
L21	22	20 and ((direct\$2 or "in-cylinder" or cylinder) near2 inject\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2009/08/30 20:23
L22	15	20 and ((direct\$2 or "in-cylinder" or cylinder) near2 inject\$3) and (port near3 inject\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2009/08/30 20:23
L23	72	(9 10 11 12 13 14 15 16 17 18 19 20 21 22) and (bar or psi)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2009/08/30 20:37

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L24	60	(9 10 11 12 13 14 15 16 17 18 19 20 21 22) and (pressure with (bar or psi))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2009/08/30 20:38
L25	25	(9 10 11 12 13 14 15 16 17 18 19 20 21 22) and (supercharg\$3 or turbo or turbocharg \$3) and (pressure with (bar or psi))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	ON	2009/08/30 20:39
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L27	34	(10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26) and ((direct\$2 or "in-cylinder" or cylinder) near2 inject\$3) and ((bar or psi) same pressure) and "compression ratio"	US-PGPUB; USPAT; USOCR	OR	ON	2009/08/30 21:07
L28	33	("4612770" "5778857" "6209515" "6230683" "6276139" "6276334" "6279550" "6286482" "6295816" "6325054" "6516774").PN. OR ("6651432").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2009/08/30 21:30

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ATTORNEY DOCKET NO.: 0492611-0828 (MITCON11381)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Leslie Bromberg	Examiner:	Douglas J. Duff
Serial No.:	12/020285	Art Unit:	3748
Filing Date:	January 25, 2008	Confirmation No.	1610
Title:	OPTIMIZED FUEL M. INJECTION ETHANO ENGINES	ANAGEMENT SYSTEN L ENHANCEMENT OF	M FOR DIRECT F GASOLINE

VIA EFS WEB FILING – WWW.USPTO.GOV

Mail Stop Amendment Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Sir:

AMENDMENT

In response to the office action mailed September 4, 2009 please Amend the Application as follows:

Amendment to the Claims begin on page 2;

Remarks begin on page 6;

4546649v1

FORD Ex. 1126, page 86 IPR2020-00013

Listing of Claims

- (Original) A turbocharged or supercharged spark ignition engine which is fueled by a directly injected mixture of ethanol and gasoline wherein under some operating conditions the ethanol energy fraction is at least 20% and wherein manifold pressure is at least 2 bar and; wherein the maximum level of pressure increase from the turbocharger or supercharger is decreased when the ethanol/gasoline ratio is lowered.
- 2. (Original) The engine system of claim 1 wherein the maximum level of pressure increase is decreased so as to prevent knock.
- 3. (Original) The engine system of claim 1 wherein spark retard is increased when the ethanol/gasoline ratio is lowered.
- 4. (Original)The engine system of claim 1 wherein the compression ratio is 11 or greater.
- (Original)A turbocharged or supercharged spark ignition engine wherein an ethanol–gasoline mixture is directly injected from a first source and there is also a means for independently controlling fueling with gasoline from a second source comprising: a spark ignition engine;

a turbocharger or supercharger;

a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder;

a means for fueling the engine with gasoline from the second source;

wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20 % and further wherein under some driving conditions the manifold pressure is greater than 2 bar; and

wherein the engine is operated at a substantially stoichiometric fuel/air ratio during at least part the operating time.

6. (Cancelled)

- 7. (Original) The engine system of claim 5 wherein the engine is started up with only the gasoline from the second source.
- 8. (Original) The engine system of claim 5 wherein under some driving conditions the engine is operated with only the directly injected ethanol –gasoline mixture from the first source.
- 9. (Original) The engine system of claim 5 wherein the level of turbocharging or supercharging is decreased so as to reduce the amount of the ethanol-gasoline mixture from the first source that is needed to prevent knock.
- 10. (Original) The engine system of claim 5 wherein the usage of the ethanol-gasoline mixture from the first source is determined by the amount of fuel in the first source.
- 11. (Original) The engine system of claim 5 wherein the usage of the ethanol-gasoline mixture from the first source is determined by the driver.
- 12. (Original) The engine system of claim 5 wherein spark retard is changed when the ethanol/gasoline ratio is changed.
- 13. (Original) The engine system of claim 5 wherein the fuel/air ratio in the engine is rich at high loads.
- 14. (Original) The engine system of claim 5 wherein the gasoline from the second source is port fuel injected.
- 15. (Withdrawn) A turbocharged or supercharged spark ignition engine wherein ethanol is separated onboard from an ethanol-gasoline mixture which is stored in a fuel tank and wherein the separated ethanol is directly injected into the engine and ; wherein the mixture in the fuel tank that is not separated is used to fuel the engine using a fuel injection system that is controlled separately from a direct injection system for direct injection of the separated ethanol.
- 16. (Withdrawn) The turbocharged or supercharged spark ignition engine system of claim 15 wherein the mixture from the fuel tank that is not separated is port fuel injected.
- 17. (Withdrawn) The turbocharged or supercharged spark ignition engine of claim 15 wherein the ratio of the directly injected ethanol that is separated onboard to the nonseparated mixture

- 3 -

that is used for separately controlled fueling of the engine increases with increasing torque and wherein during at least part of the operating time the fuel/air ratio in the engine is maintained at a substantially stoichiometric ratio as the torque is increased.

- 18. (Withdrawn) The turbocharged or supercharged spark ignition engine system of claim 15 wherein a porous membrane is used for separation.
- 19. (Withdrawn) The turbocharged or supercharged spark ignition engine of claim 15 wherein a transfusion membrane is used for separation.
- 20. (Withdrawn) A turbocharged or supercharged spark ignition engine system wherein a mixture of alcohol and gasoline is directly injected from a single injector and wherein the alcohol/gasoline ratio is increased as the torque is increased so as to prevent knock and wherein during at least part of the operating time the fuel/air ratio in the engine is maintained at a stoichiometric fuel/air ratio as the alcohol/gasoline ratio is changed.
- 21. (Withdrawn) The turbocharged or supercharged spark ignition engine system of claim 20 wherein the injector has one nozzle and two valves and these valves are used to vary the alcohol/gasoline ratio.
- 22. (Withdrawn) The turbocharged or supercharged spark ignition engine system of claim 20 wherein the gasoline and alcohol are mixed outside of an injector with a single nozzle.
- 23. (Withdrawn) The turbocharged or supercharged engine system of claim 22 where the volume between the mixing point and the nozzle is minimized to allow for fast response change of the alcohol/gasoline mixture as the torque increases.

24. (Withdrawn) The turbocharged or supercharged engine system of claim 20 where the injector has two nozzles.

25. (Withdrawn) A turbocharged or supercharged engine wherein alcohol is directly injected from a first source and wherein the engine is also fueled with gasoline from a second source and wherein the ratio of volumes of the first and second sources can be varied and wherein the alcohol/gasoline ratio is adjusted so as to prevent knock.

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FORD Ex. 1126, page 89 IPR2020-00013

Remarks

Re-examination and reconsideration of the rejections are hereby requested.

Claims 1-25 are pending in the Application. Claims 15-25 have been withdrawn as directed to a non- elected invention. Claims 1-6 and 9-14 stand rejected. Claims 7 and 8 have been objected to as being dependent upon a rejected base claim but would be allowable if rewritten into independent form including all of the limitations of the base claim and any intervening claims. Claim 6 has also been rejected under 35 USC §112, 2nd Paragraph, as being indefinite. To move prosecution forward, Claim 6 is being cancelled herein.

The present invention is directed to an optimized fuel management system for directinjection ethanol enhancement of gasoline engines. Independent Claim 1 requires that a turbocharged or super-charged spark ignition engine be fueled by a directly-injected mixture of ethanol and gasoline. Under some operating conditions the ethanol energy fraction is at least 20% and the manifold pressure is at least 2 bar. The maximum level of pressure increase from the turbo-charger or super-charger is decreased when the ethanol/gasoline ratio is lowered. Independent Claim 5 is directed to a turbo-charged or super-charged spark ignition engine in which an ethanol/gasoline mixture is directly injected from a first source and means are provided for independently controlling fueling with gasoline from a second source. This Claim also requires that the engine be operated at a substantially stoichiometric fuel/air ratio during at least part of the operating time.

The present invention allows the amount of ethanol that is mixed with gasoline to be controlled depending on torque requirements of the engine and the maximum level of pressure is decreased when the ethanol/gasoline ratio is lowered. The present invention allows the engine to be down-sized considerably by utilizing ethanol as an anti-knock agent thereby permitting higher compression ratios and higher boost pressures than could be achieved without the introduction of alcohol.

Claims 1-6 and 9-14 stand rejected under the 35 USC §103(a) as being unpatentable over *Gray, Jr., et al* US Patent No.: 651,432 in view *Mochizuki,* US Patent No.: 5131228. Gray is directed to a controlled temperature combustion engine in which combustion temperature is controlled to be below approximately 2100°K so as to prevent the formation of oxides of

nitrogen which are pollutants. It is important to recognize that Gray does not teach introducing a mixture of ethanol and gasoline into the engine. In fact, Gray does not teach the mixing of any fuels whatsoever. The only mixture referred to is a mixture of a single fuel with charge air. Gray discloses three embodiments. A first embodiment uses a fuel such as conventional diesel fuel. The second embodiment utilizes a fuel characterized by a relatively high octane and relatively low cetane such as conventional gasoline fuel. No mixture is taught. A third embodiment in Gray utilizes a very high octane fuel such as methanol, ethanol or certain gasolines. Again, no mixture is taught whatsoever.

Near the bottom of page 2 of the Office Action, the examiner asserts that Gray discloses that a mixture is directly injected. Again, the only mixture taught by Gray is a mixture of one of the fuels from the three embodiments along with the charge air to promote combustion. Thus, Gray does not meet the limitation in Claim 1 of an engine fueled by a directly injected mixture of ethanol and gasoline. Nor does Gray meet the limitation in independent Claim 5 of a directly injected ethanol/gasoline mixture, nor a means for fueling the engine with gasoline from a second source. It is submitted that the primary reference to Gray lacks the material teaching of introducing a mixture of gasoline and ethanol into the engine. The examiner has combined this flawed primary reference with the reference to Mochizuki, et al. Mochizuki is directed to a control apparatus for a turbo-charged alcohol engine. In Mochizuki, an alcohol/gasoline mixture that is of fixed proportion is injected into the engine. A detector determines the concentration of alcohol and determines an appropriate boost pressure. In Mochizuki, the relative amount of alcohol cannot be altered. It is merely the amount that happens to have been put into the fuel tank. This is unlike the present invention in which the alcohol to gasoline ratio is adjusted depending on operating conditions. In summary, Gray lacks any teaching of introducing a directly injected mixture of ethanol and gasoline into an engine. Thus this material limitation is totally lacking. It is submitted that Claims 1-5 and 9-14 are patentable over the prior art. It is noted that Claim 7 and 8 are directed to allowable subject matter and applicant reserves the right to rewrite those claims into independent form at a later stage if necessary.

FORD Ex. 1126, page 91 IPR2020-00013 For the foregoing reasons, it is submitted that the pending claims are in condition for allowance and early favorable action is requested.

Respectfully submitted,

/Sam Pasternack, Ph.D./ Sam Pasternack, Ph.D. Registration No. 29,576

Date: December 4, 2009

Patent Department CHOATE, HALL & STEWART Two International Place Boston, MA 02110 Tel: (617) 248-5000 Fax: (617) 502-5002

Docket No.: 0492611-0828 (MIT-11381CON) (PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Leslie Bromberg

Application No.: 12/020,285

Filed: January 25, 2008

Confirmation No.: 1610

Art Unit: 3748

For: OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES Examiner: Duff, Douglas J.

INFORMATION DISCLOSURE STATEMENT (IDS)

MS Amendment Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Dear Sir:

Pursuant to 37 CFR 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

This Information Disclosure Statement is filed more than three months after the U.S. filing date, OR more than three months after the date of entry of the national stage of a PCT application, AND after the mailing date of the first Office Action on the merits, whichever occurs first, but before the mailing date of a Final Office Action or Notice of Allowance (37 CFR 1.97(c)).

In accordance with 37 CFR 1.98(a)(2)(ii), Applicant has not submitted copies of U.S. patents and U.S. patent applications. Applicant submits herewith copies of foreign patents and non-patent literature in accordance with 37 CFR 1.98(a)(2).

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FORD Ex. 1126, page 93 IPR2020-00013 In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. In accordance with 37 CFR 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that any patent, publication or other information referred to therein is "prior art" for this invention unless specifically designated as such.

It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

Our credit card payment in the amount of \$180.00 covering the fee set forth in 37 CFR 1.17(p) is enclosed. Please charge only fees that are *necessary* to maintain pendency and/or protect the filing date of the present application to our Deposit Account Number 03-1721, referencing Attorney's Docket Number 0492611-0828(MIT-11381CON). <u>No authorization is</u> <u>given to charge any other fees.</u> To the extent that there are any discrepancies between what Applicant has paid with the filing of the present Application and what the USPTO believes is owed, Applicant respectfully requests that a Notice be issued explaining any such discrepancy.

Dated: December 4, 2009

Respectfully submitted, /Sam Pasternack/

Sam Pasternack, PhD Registration No. 29,576 Attorney for Applicant

CHOATE, HALL & STEWART, LLP Two International Place Boston, Massachusetts 02110 (617) 248-5000 (617) 502-5002

Used in Lieu of PTO/SB/08A/B (Based on PTO 10-07 version)

Substitute for form 1449/PTO						
INFORMATION DISCLOSURE STATEMENT BY APPLICANT						
(Use as many sheets as necessary)						
Sheet	1	of	4	Attorne		

Complete if Known			
Application Number	12/020,285		
Filing Date	January 25, 2008		
First Named Inventor	Leslie Bromberg		
Art Unit	3748		
Examiner Name	Duff, Douglas J.		
Attorney Docket Number	0492611-0828 (MITCON11381)		

Examiner	Cite	Document Number	Publication Date	Name of Pater	ntee or	Pages, Columns, Lines, Where
Initials*	No.1	Number-Kind Code ² (if known)	MM-DD-YYYY	Applicant of Cited	Document	Figures Appear
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	A2	2006/0102146	05-2006	Cohn et al.		
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	A31	5497744	03-12-1996	Nagaosa et al.		
	A32	5560344	10-01-1996	Chan, Anthony K.		
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	A42	6298838	10-09-2001	Huff, et al.		
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Examiner	•				Date	
Signature					Considered	
-						

Sul	bstitute for form 1449/PTO			Complete if Known		
			I	Application Number	12/020,285	
11	VFORMATION	1 DI	SCLOSURE	Filing Date	January 25, 2008	
S	TATEMENT F	3Y /	APPLICANT	First Named Inventor	Leslie Bromberg	
			- 1	Art Unit	3748	
	(Use as many she	eets as	; necessary)	Examiner Name	Duff, Douglas J.	
Sheet	2	of	4	Attorney Docket Number	0492611-0828 (MITCON11381)	

A46	6358180	03-19-2002	Kuroda et al	
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A48	6513505	02-04-2003	Watanabe et al.	
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A86	7581528	09-2009	Stein et al.	

		FORE	IGN PATENT	DOCUMENT	S			
		Foreign Patent Document	Publication	Nar Applica	ne of Patentee or	nt	Pages, Columns, Lines, Where Relevant	
Examiner Initials*	Cite No. ¹	Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)	MM-DD-YYYY	, applied	int of Cited Document		Passages Or Relevant Figures Appear	T ⁶
Examiner Signature					Date Considered			

Used in Lieu of PTO/SB/08A/B (Based on PTO 10-07 version)

Sut	ostitute for form 1449/PTO			Complete if Known		
				Application Number	12/020,285	
11	IFORMATION	I DI	SCLOSURE	Filing Date	January 25, 2008	
S	TATEMENT E	BY A	APPLICANT	First Named Inventor	Leslie Bromberg	
				Art Unit	3748	
	(Use as many she	eets as	s necessary)	Examiner Name	Duff, Douglas J.	
Sheet	3	of	4	Attorney Docket Number	0492611-0828 (MITCON11381)	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ¹Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at <u>MAXENENERS</u> or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

		NON PATENT LITERATURE DOCUMENTS	
Examiner Initials	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
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	C3	GRANDIN et al., Replacing Fuel Enrichment in a Turbo Charged SI Engine: Lean Burn or Cooled EGR, Society of Automotive Engineers, Inc. 199-01-3505	
	C4	GRANDIN et al., Knock Suppression in a Turbocharged SI Engine by Using Cooled EGR, Society of Automotive Engineers, Inc. 982476, International Fall Fuels and Lubricants Meeting and Exposition in San Francisco, California (October 19-22, 1998)	
	C5	STAN et al., Internal Mixture Formation and Combustion – from Gasoline to Ethanol, Society of Automotive Engineers, Inc. 2001-01-1207s	
	C6	YUKSEL et al., "The Use of Ethanol-Gasoline Blend as a Fuel in an SI Engine," Renewable Energy, Vol. 29 (2004) pp. 1181-1191.	
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	C8	International Search Report and The Written Opinion of the International Searching Authority for PCT/US05/41317, mailed on April 6, 2006	
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	C10	J. Stokes et al., "A gasoline engine concept for improved fuel economy - the lean-boost system," SAE paper 2001-01-2902, pp. 1-12.	
	C11	J.B. Heywood, "Internal Combusion Engine Fundamentals," McGraw Hill, 1988, page 477.	
	C12	LoRUSSO et al., Direct Injection Ignition Assisted Alcohol Engine, Society of Automotive Engineers, Inc. 880495, International Congress and Exposition in Detroit Michigan (February 29-March 4, 1998)	
	C13	Yuksel et al., Renewable Energy, volume 29, issue 7, June 2004, pages 1181-1191	
	C14	PCT International Search Report and Written Opinion, Application No. PCT/IB07/03004, July 9, 2008.	
	C15	PCT International Search Report and Written Opinion, Application No. PCT/US07/05777, March 24, 2008.	
	C16	PCT International Search Report and Written Opinion, Application No. PCT/US07/74227, February 25, 2008.	
	C17	PCT International Search Report and Written Opinion, Application No. PCT/US08/69171, October 3, 2008.	
	C18	USPTO Final Office Action, Application No. 10/991,774, September 27, 2006.	
	C19	USPTO Final Office Action, Application No. 11/682,372, October 17, 2008.	
	C20	USPTO Non-Final Office Action, Application No. 10/991,774, April 25, 2006.	
	C21	USPTO Non-Final Office Action, Application No. 10/991,774, May 25, 2007.	
Examiner Signature		Date Considered	<u>. </u>

Sub	stitute for form 1449/PTO			Complete if Known		
				Application Number	12/020,285	
IN	FORMATION	I DI	SCLOSURE	Filing Date	January 25, 2008	
S	TATEMENT E	BY A	APPLICANT	First Named Inventor	Leslie Bromberg	
				Art Unit	3748	
	(Use as many she	eets as	necessary)	Examiner Name	Duff, Douglas J.	
Sheet	4	of	4	Attorney Docket Number	0492611-0828 (MITCON11381)	

C22	USPTO Non-Final Office Action, Application No. 11/100,026, August 3, 2006.	
C23	USPTO Non-Final Office Action, Application No. 11/229,755, March 22, 2007.	
C24	USPTO Non-Final Office Action, Application No. 11/229,755, October 4, 2007.	
C25	USPTO Non-Final Office Action, Application No. 11/682,372, January 2, 2008.	
C26	USPTO Non-Final Office Action, Application No. 11/684100, June 3, 2008.	
C27	USPTO NOn-Final Office Action, Application No. 11/840,719, July 11, 2008.	
C28	USPTO Notice of Allowance, Application No. 11/684 100, March 3, 2009	

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

Examiner		Date			
Signature		Considered			
-					

	sp to Winter Uginiku				
PATENT COOPE	RATION TREATY DOCKETED				
From the INTERNATIONAL SEARCHING AUTHORITY	Due <u>9.18.06</u>				
To: SAM PASTERNACK CHOATE, HALL & STUART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110 Amend Claws Docketed	PCT NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION (PCT Rule 44.1)				
Due <u>68686</u>	Date of mailing (day/month/year) 06 APR 2006				
Applicant's or agent's file reference 0492612-0406	FOR FURTHER ACTION See paragraphs 1 and 4 below				
International application No. PCT/US05/41317	International filing date (<i>day/month/year</i>) 14 November 2005 (14.11.2005)				
Applicant MASSACHUSETTS INSTITUTE OF TECHNOLOGY					
1. The applicant is hereby notified that the international sear have been established and are transmitted herewith. Filing of amendments and statement under Article 19	rch report and the written opinion of the International Searching Authority :				
When? The time limit for filing such amendments is	s normally two months from the date of transmittal of the international				
Where? Directly to the International Bureau of WIP(O, 34 chemin des Colombettes				
For more detailed instructions, see the notes on the a	accompanying sheet.				
2. The applicant is hereby notified that no international sear Article 17(2)(a) to that effect and the written opinion of t	rch report will be established and that the declaration under the International Searching Authority are transmitted herewith.				
3. With regard to the protest against payment of (an) add	itional fee(s) under Rule 40.2, the applicant is notified that:				
the protest together with the decision thereon has be request to forward the texts of both the protest and no decision has been made yet on the protest; the ar	een transmitted to the International Bureau together with the applicant's the decision thereon to the designated Offices. oplicant will be notified as soon as a decision is made.				
 4. Reminders Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication. 					
International Bureau. The International Bureau will send a cop preliminary examination report has been or is to be established before the expiration of 30 months from the priority date.	by of such comments to all designated Offices unless an international d. These comments would also be made available to the public but not				
Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.					
In respect of other designated Offices, the time limit of 30 mon See the Annex to Form PCT/IB/301 and, for details about the a	ths (or later) will apply even if no demand is filed within 19 months. applicable time limits, Office by Office, see the PCT Applicant's Guide,				
Volume II, National Chapters and the WIPO Internet site. Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450	Authorized officer For HENRY YUEN Juginia Liby Elephone No. (703)908=0861				
Form PCT/ISA/220 (January 2004)	APR 1 0 2006				
	 Standard Manager Standards and Standard Standards Standards Standard Standards Standard Manager Standards Standards Standards Standards Standards Standards Standards Manager Standards Standards Standards Standards Standards Standards Standards Manager Standards Standards Standards Standards Standards Standards Standards Manager Standards Standards Standards Standards Standards Standards Standards Standards Standards Standards 				

FORD Ex. 1126, page 99 IPR2020-00013

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 0492612-0406	FOR FURTHER se ACTION as well as, w	e Form PCT/ISA/220 here applicable, item 5 below.			
International application No. PCT/US05/41317	International filing date (<i>day/month/year</i>) 14 November 2005 (14.11.2005)	(Earliest) Priority Date (<i>day/month/year</i>) 18 November 2004 (18.11.2004)			
Applicant MASSACHUSETTS INSTITUTE OF TECHNOLOGY					
This international search report has been according to Article 18. A copy is being This international search report consists It is also accompanied Basis of the Report a. With regard to the language , the	prepared by this International Searching A transmitted to the International Bureau. of a total of <u>A</u> sheets. I by a copy of each prior art document cite	Authority and is transmitted to the applicant d in this report.			
the international	application in the language in which it was f	iled.			
a translation of the of a translation of the of a translation fills	ne international application into urnished for the purposes of international sea	, which is the language arch (Rules 12.3(a) and 23.1(b))			
b. With regard to any nucleoti	de and/or amino acid sequence disclosed in	the international application, see Box No. I.			
2. Certain claims were found	unsearchable (See Box No. II)				
3. Unity of invention is lacking 4. With regard to the title,	 Unity of invention is lacking (See Box No. III) With regard to the title, 				
the text is approved as subn	nitted by the applicant.				
the text has been established	the text has been established by this Authority to read as follows:				
;					
5. With regard to the abstract ,	witted by the employert				
the text is approved as sub-	d, according to Rule 38.2(b), by this Author n the date of mailing of this international sea	ty as it appears in Box No. IV. The applicant urch report, submit comments to this Authority.			
6. With regard to the drawings , a. the figure of the drawings to be as suggested by th as selected by this	published with the abstract is Figure No. <u>1</u> e applicant. Authority, because the applicant failed to su	- ggest a figure.			
as selected by this Authority, because this figure better characterizes the invention.					
b none of the figures is to be	b none of the figures is to be published with the abstract.				

Form PCT/ISA/210 (first sheet) (April 2005)

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			International applic	ration No
	INTERNATIONAL SEARCH REPOR'	Г	international application No.	
			PCT/US05/41317	
A. CLASS IPC(8):	A. CLASSIFICATION OF SUBJECT MATTER IPC(8): F02B 75/12 (2006.01)			
USPC: According to I	123/198A,575,1A,525 international Patent Classification (IPC) or to both natio	onal classification an	d IPC	
B. FIELD	S SEARCHED			
Minimum doc U.S. : 123	umentation searched (classification system followed by 3/ 198A, 575, 1A, 525	classification symbo	bls)	
Documentatio NONE	n searched other than minimum documentation to the e	xtent that such docu	ments are included in	the fields searched
Electronic dat NONE	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) NONE			
C. DOCL	JMENTS CONSIDERED TO BE RELEVANT			
Category *	Citation of document, with indication, where ap	propriate, of the rele	vant passages	Relevant to claim No.
X	US 6,076,487 A (WULFF et al) 20 June 2000 (20.06.	2000), column 4, lin	es 60-64 and	1,4,54
A	column 5, lines 3-6. US 4,495,930 A (NAKAJIMA) 29 January 1985 (29.0)1.1985), see entire o	locument.	1-22,24-85
A	A US 4,402,296 A (SCHWARZ) 06 September 1983 (06.09.1983), see entire document. 1-22,24-85			1-22,24-85
Further	documents are listed in the continuation of Box C.	See pater	nt family annex.	
* S "A" document	pecial categories of cited documents: defining the general state of the art which is not considered to be of	"T" later docur date and n principle o	nent published after the inte ot in conflict with the applic r theory underlying the inve	rnational filing date or priority ation but cited to understand the ntion
particular "E" earlier apj	relevance plication or patent published on or after the international filing date	"X" document considered when the c	of particular relevance; the o l novel or cannot be conside locument is taken alone	claimed invention cannot be red to involve an inventive step
"L" document establish specified)	which mây throw doubts on priority claim(s) or which is cited to the publication date of another citation or other special reason (as	"Y" document considered with one o	of particular relevance; the of to involve an inventive step r more other such document	claimed invention cannot be o when the document is combined is, such combination being
"O" document "P" document priority da	"U" document reterring to an oral disclosure, use, exhibition or other means obvious to a person skilled in the art "P" document published prior to the international filing date but later than the "&" document member of the same patent family priority date claimed			family
Date of the ad	Date of the actual completion of the international search Date of mailing of the international search report			ch report
13 March 20	13 March 2006 (13.03.2006) 06 APR 2005			
Name and mailing address of the ISA/US Authorized officer Mail Stop PCT, Attn: ISA/US FOF Commissioner for Patents FOF P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201 Telephone No. (703) 308-0861			liby	

(

Facsimile No. (571) 273-3201Form PCT/ISA/210 (second sheet) (April 2005)

(PATENT COOPERATION TREATY

From the INTERNATI	IONAL SEARCH	ING AUTH	ORITY				
To: SAM PASTERNACK CHOATE, HALL & STUART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110		PCT WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY					
						(PCT Rule 43bis.1)	
					Date of mailing (day/month/year)	0 6 APR 2006	
Applicant's	s or agent's file re	ference			FOR FURTHER ACTION		
0492612-0	406						
Internation	al application No.	,	Internatio	onal filing date	(day/month/year)	Priority date (<i>day/month/year</i>)	
PCT/US05	/41317	notion (IPC)	14 Nover	mber 2005 (14.	11.2005)	18 November 2004 (18.11.2004)	
Internation			or both hat	ional classificat			
USPC: 1	F02B 75/12(2006 123/198A,575,1A,	.01) ,525					
Applicant							
MASSAC	HUSETTS INSTI	TUTE OF T	ECHNOLO	DGY			
1. This c	pinion contains ir	dications rel	ating to the	e following iten	15:		
	Box No. I	Basis of the	e opinion				
	Box No. II	Priority					
	Box No. III	Non-establ	ishment of	opinion with re	egard to novelty, inver	tive step and industrial applicability	
	Box No. IV Lack of unity of invention						
	Box No. V Reasoned statement under Rule 43 <i>bis</i> .1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement						
	Box No. VI Certain documents cited						
	Box No. VII	Certain de	fects in the	international a	oplication		
	Box No. VIII	Certain ob	servations	on the internation	onal application		
2. FURTHER ACTION							
If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.							
If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.							
For f	urther options, see	e Form PC17	13A/220.				
3. For f	urther details, see	notes to For	m PCT/ISA	/220.			
Name and	d mailing address	of the ISA/	US	Date of comp	letion of this opinion	Authorized officer	
	Mail Stop PCT, Att	n: ISA/US Patents		13 March 200	6 (13.03.2006)	HENRY YUEN	
	P.O. Box 1450	- 10212 1460				Ungma energy	
Facsimile	No. (571) 273-32	a 22513-1450 201				Telephone No. (703) 308-0861	
Form PCT/	ISA/237 (cover sl	neet) (April 2	2005)				

WRITTEN OPINION OF THE

(1

International application No.

	INTERNATIONAL SEARCHING AUTHORITY	PCT/US05/41317
Box No	o. I Basis of this opinion	
1. With	regard to the language, this opinion has been established on the basis of:	
\boxtimes	the international application in the language in which it was filed	
	a translation of the international application into, which is the lang international search (Rules 12.3(a) and 23.1(b)).	uage of a translation furnished for the purposes of
2. With inven	regard to any nucleotide and/or amino acid sequence disclosed in the in- tion, this opinion has been established on the basis of:	ternational application and necessary to the claimed
a.	type of material	
	a sequence listing	
	table(s) related to the sequence listing	
b.	format of material	
	on paper	
	in electronic form	
с.	time of filing/furnishing	
	contained in the international application as filed.	
	filed together with the international application in electronic form	
	furnished subsequently to this Authority for the purposes of search	1.
3.	In addition, in the case that more than one version or copy of a sequence or furnished, the required statements that the information in the subse application as filed or does not go beyond the application as filed, as app	e listing and/or table(s) relating thereto has been filed quent or additional copies is identical to that in the propriate, were furnished.
4. Addi	tional comments:	

Form PCT/ISA/237(Box No. I) (April 2005)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/US05/41317		
Box No. V Reasoned statement under Rule 43 <i>bis.</i> 1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement			
1. Statement			

Novelty (N)	Claims <u>2,3,5-22,24-53,55-85</u>	YES NO
Inventive step (IS)	Claims <u>2,3,5-22,24-53,55-85</u>	YES
Industrial applicability (IA)	Claims <u>1-22,24-85</u>	NO
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Claims 1,4,54 lack novelty under PCT Article 33(2) as being anticipated by Wulff et al (US 6,076,487).

As to Claim 1, Wulff et al discloses fuel management system for operation of a spark ignition gasoline engine comprising: a gasoline engine; a source of an anti-knock agent; an injector 57 for direct injection of the anti-knock agent into a cylinder of the engine 14; and a fuel management control system 45 for controlling injection of the anti-knock agent into the cylinder to control knock.

As to Claim 4, Wulff et al discloses the anti-knock agent is selected from the group consisting of ethanol, methanol, tertiary butyl alcohol, MTBE, ETBE and TAME.

As to Claim 54, Wulff et al discloses fuel management system for operation of a spark ignition gasoline engine comprising: a gasoline engine; a source of an anti-knock agent; an injector 57 for direct injection of the anti-knock agent into a cylinder of the engine 14; and a fuel management control system 45 for controlling injection of the anti-knock agent into the cylinder to control knock; wherein the anti-knock agent is selected from the group consisting of methanol, tertiary butyl alcohol, MTBE, ETBE, and TAME.

Claims 2,3,5-22,24-53,55-85 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a measure of the amount of anti-knock agent in the source to control turbocharging, supercharging or spark retard when the amount of anti-knock agent is low.

Claims 1-22,24-85 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Form PCT/ISA/237 (Box No. V) (April 2005)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

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International application No.

PCT/US05/41317

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims 1 and 23 are objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: Regarding claim 1, currently there are two claims, which are numbered 1. Regarding claim 23, currently there is no claim 23 in the application.

Form PCT/ISA/237 (Box No. VII) (April 2005)

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under Article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article," "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report and the written opinion of the International I ne applicant has, after having received the international search report and the written opinion of the International Searching Authority, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only (see *PCT Applicant's Guide*, Volume I/A, Annexes B1 and B2).

The attention of the applicant is drawn to the fact that amendments to the claims under Article 19 are not allowed where the International Searching Authority has declared, under Article 17(2), that no international search report would be established (see *PCT Applicant's Guide*, Volume I/A, paragraph 296).

What parts of the international application may be amended ?

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Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Preliminary Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1). When ?

Where not to file the amendments ?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one How ? or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments ?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

Notes to Form PCT/ISA/220 (first sheet) (January 2004)

<i>1,1</i>	PATENT COOPE	ration treaty Docketed	
	From the INTERNATIONAL SEARCHING AUTHORITY	Due 9,2807	
	To: SAM PASTERNACK CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110 DOCKETED DUE 8.28.0	PCT NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION (PCT Rule 44.1)	
		Date of mailing (day/month/year) 28 JUN 2007	
	Applicant's or agent's file reference 0492611- 0617 / 0433	FOR FURTHER ACTION See paragraphs 1 and 4 below	
	International application No. PCT/US06/12750	International filing date (day/month/year) 06 April 2006 (06.04.2006)	
	Applicant MASSACHUSETTS INSTITUTE OF TECHNOLOGY		
\bigcirc	1. The applicant is hereby notified that the international searchave been established and are transmitted herewith.	h report and the written opinion of the International Searching Authority	
	The applicant is entitled, if he so wishes, to amend the claim	ns of the international application (see Rule 46):	
	When? The time limit for filing such amendments is n search report.	normally two months from the date of transmittal of the international	
	Where? Directly to the International Bureau of WIPO, 1211 Geneva 20, Switzerland, Facsimile No.:	34 chemin des Colombettes (41-22) 338.82.70.	
	For more detailed instructions, see the notes on the action	companying sheet.	
	2. The applicant is hereby notified that no international search Article 17(2)(a) to that effect and the written opinion of the	report will be established and that the declaration under International Searching Authority are transmitted herewith.	
	3. With regard to the protest against payment of (an) addition	onal fee(s) under Rule 40.2, the applicant is notified that:	
	the protest together with the decision thereon has been request to forward the texts of both the protest and the	a transmitted to the International Bureau together with the applicant's edecision thereon to the designated Offices.	
	no decision has been made yet on the protest; the appl	icant will be notified as soon as a decision is made.	
	4. Reminders		
\bigcirc	Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90 <i>bis</i> .1 and 90 <i>bis</i> .3, respectively, before the completion of the technical preparations for international publication.		
	The applicant may submit comments on an informal basis on the International Bureau. The International Bureau will send a copy preliminary examination report has been or is to be established. The before the expiration of 30 months from the priority date.	he written opinion of the International Searching Authority to the of such comments to all designated Offices unless an international hese comments would also be made available to the public but not	
	Within 19 months from the priority date, but only in respect of examination must be filed if the applicant wishes to postpone the o (in some Offices even later); otherwise, the applicant must, within entry into the national phase before those designated Offices.	f some designated Offices, a demand for international preliminary entry into the national phase until 30 months from the priority date n 20 months from the priority date, perform the prescribed acts for	
	In respect of other designated Offices, the time limit of 30 months	(or later) will apply even if no demand is filed within 19 months.	
	See the Annex to Form PCT/IB/301 and, for details about the appl Volume II, National Chapters and the WIPO Internet site.	licable time limits, Office by Office, see the PCT Applicant's Guide,	
	Name and mailing address of the ISA/ US Mail Stop PCT Attn: ISA/US	Authorized office	
	Commissioner for Patents	Stephen Kirk Cronin	
	Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Telephone No. (703) 308-0861	

Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

PATENT COOPERATION TREATY

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PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 0492611-0617	FOR FURTHER see ACTION as well as, who	Form PCT/ISA/220 ere applicable, item 5 below.
International application No. PCT/US06/12750	International filing date (<i>day/month/year</i>) 06 April 2006 (06.04.2006)	(Earliest) Priority Date (<i>day/month/year</i>) 06 April 2005 (06.04.2005)
Applicant MASSACHUSETTS INSTITUTE OF T	ECHNOLOGY	
This international search report has been coording to Article 18. A copy is bein This international search report consist	en prepared by this International Searching Au ng transmitted to the International Bureau. s of a total of 2 sheets.	ithority and is transmitted to the applican
	ed by a copy of each prior art document ched	п піз героп.
 Basis of the Report With regard to the language. th 	e international search was carried out on the bas	is of
the internation	al application in the language in which it was file	ed.
a translation of	the international application into	, which is the language
of a translation	furnished for the purposes of international searc	h (Rules 12.3(a) and 23.1(b))
b. With regard to any nucleo	tide and/or amino acid sequence disclosed in the	he international application, see Box No. I.
. Certain claims were four	d unsearchable (See Box No. II)	
. Unity of invention is lack	ing (See Box No. III)	
With regard to the title ,		
the text is approved as sub	mitted by the applicant.	
the text has been establish	ed by this Authority to read as follows:	
With regard to the abstract.		
the text is approved as sub	mitted by the applicant.	
the text has been established may, within one month fro	ed, according to Rule 38.2(b), by this Authority a m the date of mailing of this international search	is it appears in Box No. IV. The applicant report, submit comments to this Authority.
With regard to the drawings ,	a published with the obstance in Discon No. 2	
a. the figure of the unawings to be	e applicant	
as selected by this	Authority because the applicant failed to sugge	st a figure
as selected by this	Authority, because this figure better characterize	or a rigure.
h none of the figures is to be	publiched with the abstract	
	puonsneu with the abstract.	

Form PCT/ISA/210 (first sheet) (April 2005)
	INTERNATIONAL SEARCH REPO	RT	International appli PCT/US06/12750	cation No.
A. CLAS IPC:	SIFICATION OF SUBJECT MATTER F02B 77/04(2006.01)			
USPC: According to	123/198A,435,406.29,406.47,25C,559.1 International Patent Classification (IPC) or to both na	tional classifica	tion and IPC	
B. FIELI	DS SEARCHED			· · · · · · · · · · · · · · · · · · ·
Minimum do U.S. : 12	cumentation searched (classification system followed t 3/198A,435,406.29,406.47,25C,559.1	by classification	symbols)	
Documentatio NONE	on searched other than minimum documentation to the	extent that suc	h documents are included in	the fields searched
Electronic da NONE	ta base consulted during the international search (name	e of data base a	nd, where practicable, searc	h terms used)
C. DOCI	JMENTS CONSIDERED TO BE RELEVANT	* , * - ¹		
Category *	Citation of document, with indication, where a	appropriate, of t	he relevant passages	Relevant to claim No.
Х	US 6,513,505 B2 (WATANABE et al) 04 February 2	2003 (04.02.200	03), column 5, lines 45-	1,2,17,36
A	66. US 4,541,383 A (JESSEL) 17 September 1985 (17.09.1985), column 1, lines 10-20. 1-51			1-51
А	US 5,937,799 A (BINION) 17 August 1999 (17.08.1	1999), column 8	, lines 20-35.	1-51
Further	documents are listed in the continuation of Box C.	See	patent family annex.	
* Sj "A" document	pecial categories of cited documents: defining the general state of the art which is not considered to be of relevance	"T" late date prin	r document published after the inter and not in conflict with the applica ciple or theory underlying the inver	national filing date or priority ation but cited to understand the ation
"E" earlier app	plication or patent published on or after the international filing date	"X" doc con whe	ument of particular relevance; the c sidered novel or cannot be consider in the document is taken alone	laimed invention cannot be ed to involve an inventive step
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "Y" "Y" document of particular relevance; the claimed invention canne considered to involve an inventive step when the document is combined with one or more other such documents, such comb being obvious to a person skilled in the art 			laimed invention cannot be when the document is documents, such combination art	
"P" document published prior to the international filing date but later than the "&" document member of the same patent family priority date claimed			àmily	
Date of the ac 31 May 2007	tual completion of the international search (31.05.2007)	Date of mailin	ig of the international search	n report
Name and ma Mai Con P.O. Alex Facsimile No.	ling address of the ISA/US I Stop PCT, Attn: ISA/US unissioner for Patents Box 1450 candria, Virginia 22313-1450 (571) 273-3201	Authorized of Stephen Kirk Telephone No	ficer Cronin . (703) 308-0861	

Form PCT/ISA/210 (second sheet) (April 2005)

rom the	PAT	LINT COOPE	KATION TRI	
NTERNATIONAL SEARC To: SAM PASTERNACK CHOATE, HALL & STEV TWO INTERNATIONAL	HING AUTHORITY VART LLP PLACE		W	PCT
BOSTON, MA 02110			INTERNATI	ONAL SEARCHING AUTHOR
				(PCT Rule 43bis.1)
			Date of mailing (day/month/year)	28 JUN 2007
Applicant's or agent's file	reference	1	FOR FURTHEF	RACTION See paragraph 2 below
International application N	o. Intern	ational filing date (/ /day/month/year)	Priority date (<i>dav/month/year</i>)
PCT/US06/12750	06 Ap	oril 2006 (06.04.200)6)	06 April 2005 (06.04,2005)
International Patent Classif	fication (IPC) or both	national classificati	on and IPC	
IPC: F02B 77/04(200	6.01)			
USPC: 123/198A,406.29	9,406.47,435,559.1,25	С	·	
MASSACHUSETTS INST	TITLITE OF TECHNO			
MA33ACH03E113 IN31	HOTE OF TECHNO			
1. This opinion contains i	indications relating to	the following items	3 : ·	
Box No. I Basis of the opinion				
	•	1		
Box No. II	Priority	1		
Box No. II Box No. III	Priority Non-establishment	ı of opinion with reg	ard to novelty, inve	ntive step and industrial applicability
Box No. II Box No. III Box No. IV	Priority Non-establishment Lack of unity of inv	ı of opinion with reg vention	ard to novelty, inve	ntive step and industrial applicability
Box No. II Box No. III Box No. IV Box No. V	Priority Non-establishment Lack of unity of inv Reasoned statemen applicability; citatic	n of opinion with reg vention t under Rule 43 <i>bis</i> . ons and explanation	ard to novelty, invo 1(a)(i) with regard t s supporting such s	entive step and industrial applicability o novelty, inventive step or industrial tatement
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Box No. II Box No. III Box No. IV Box No. IV Box No. V Box No. V Box No. VI Box No. VII Box No. VII Box No. VII Box No. VIII C. FURTHER ACTIO If a demand for intern International Prelimina Authority other than th that written opinions of If this opinion is, as p IPEA a written reply to of Form PCT/ISA/220 For further options, see 3. For further details, see Name and mailing address Mail Stop PCT, Att Commissioner for P. P.O. Box 1450	Priority Non-establishment Lack of unity of inv Reasoned statemen applicability; citatio Certain documents Certain defects in th Certain observation Certain observation N autional preliminary e: ary Examining Authoris one to be the IPE/ f this International Sea rovided above, consid ogether, where approp or before the expiration of the ISA/US 1: ISA/US atents	of opinion with reg vention t under Rule 43 <i>bis</i> . ons and explanation cited he international app s on the internation xamination is made ority ("IPEA") exc A and the chosen IJ rrching Authority w lered to be a writter riate, with amendm on of 22 months from A/220.	ard to novelty, inve 1(a)(i) with regard to s supporting such s lication al application a, this opinion will ept that this does PEA has notified the ill not be so consid en opinion of the II ents, before the ex m the priority date, on of this opinion 1.05.2007)	entive step and industrial applicability o novelty, inventive step or industrial tatement be considered to be a written opinion o not apply where the applicant choose he International Bureau under Rule 66.12 ered. PEA, the applicant is invited to submit to piration of 3 months from the date of ma whichever expires later.

Form PCT/ISA/237 (cover sheet) (April 2005)

WRITTE	N OPINION	OF TH	IE
ERNATIONAI	L SEARCHI	NG AU	THORI

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International application No.

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	INTERNATIONAL SEARCHING AUTHORITY	PCT/US06/12750
Box N	o. I Basis of this opinion	
		· · · · · · · · · · · · · · · · · · ·
1. With	regard to the language, this opinion has been established on the basis of:	
\boxtimes	the international application in the language in which it was filed	
	a translation of the international application into, which is the lang international search (Rules 12.3(a) and 23.1(b)).	guage of a translation furnished for the purposes c
2. With inven	regard to any nucleotide and/or amino acid sequence disclosed in the in tion, this opinion has been established on the basis of:	ternational application and necessary to the clain
a.	type of material	
	a sequence listing	
	table(s) related to the sequence listing	
b.	format of material	
	on paper	
	in electronic form	
c.	time of filing/furnishing	
	contained in the international application as filed.	
	filed together with the international application in electronic form.	
	furnished subsequently to this Authority for the purposes of search	
3.	In addition, in the case that more than one version or copy of a sequence or furnished, the required statements that the information in the subseq application as filed or does not go beyond the application as filed, as app	listing and/or table(s) relating thereto has been fi juent or additional copies is identical to that in ropriate, were furnished.
4. Additi	ional comments:	

(
WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY		International application No. PCT/US06/12750		
Box No. V Reasoned statement under Rule 43 <i>bis</i> .1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement				
1. Statement				
Novelty (N)	Claims <u>3-16,18-35,3</u>	7-51YES		
	Claims <u>1.2.17,36</u>	NO		
Inventive step (IS)	Claims <u>3-16,18-35,3</u>	7-51YES		
	Claims <u>1,2,17,36</u>	NO		
Industrial applicability (IA)	Claims 1-51	YES		
	Claims <u>NONE</u>	NO		
2. Citations and explanations:	n de antre de la decentra de la dec			
Claims 1.2,17,36 lacks novelty under PCT Article 33	(2) as being anticipated by W	/atanabe et al (US 6,513,505).		
 into the cylinder 1a to control knock, wherein the antileast three times that of gasoline. See col. 2, lines 12-As to Claim 2, Watanabe et al discloses fuel manageren engine 1; a source of gasoline; a source of an anti-kno 9 into a cylinder of the engine; and a fuel managemen cylinder when engine torque is above a selected value a function of engine speed. As to Claim 17, Watanabe et al discloses wherein the cylinder per cycle are controlled so as to achieve a su As to Claim 36, Watanabe et al discloses fuel managemen a gasoline engine 1; a source of an anti-knock agent 9 into a cylinder of the engine; and a fuel management of the control knock. Claims 3-16,18-35,37-51 meets the criteria set out in wherein the maximum anti-knock agent energy fraction. 	iknock agent 9 has a heat of 20, col. 5, lines 45-66 and co nent system for operation of ock agent 9 which is a fuel ar it control system 30 for contri- e or fraction of maximum tor anti-knock agent is ethanol a bstantially stoichiometric fue- ement system for efficient op 0; an injector 2 for direct injec control system 30 for control PCT Article 33(2)-(3), becau on used during a drive cycle	vaporization per unit of combustion energy that is at ol. 6, lines 1-27 and Figs. 1-6. a spark ignition gasoline comprising: a spark ignition injector 2 for direct injection of the anti-knock agent olling injection of the anti-knock agent 9 into the que where the value or fraction of maximum torque is and where the amounts of air, ethanol and gasoline per el/ air ratio. eration of a spark ignition gasoline engine comprising ction of both the anti-knock agent and the gasoline ling injection of the anti-knock agent into the cylinder set the prior art does not teach or fairly suggest is between 30% and 100%.		
Claims 1-51 meets the criteria set out in PCT Article 3 be made or used in industry.	3(4), and thus have industria	l applicability because the subject matter claimed can		

V) (April 2005) (B

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US06/12750

Box No. VII Certain defects in the international application

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The following defects in the form or contents of the international application have been noted:

Claims 4,42,48 objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: The inlet valve of claim 4 lacks proper antecedent basis. The claim 42 is an improper multiple dependent claim (not in alternative format, and dependent upon other multiple dependent claims). The claim 48, "expandable pipe and funnel" is not shown in the drawings.

Form PCT/ISA/237 (Box No. VII) (April 2005)

PCT/IB2007 03004 09.07.2008

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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

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To: SAM PASTERNACK	РСТ				
CHOATE, HALL & STEWART TWO INTERNATIONAL PLACE BOSTON, MA 02110	NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL				
	(PCT Rule 44.1)				
	Date of mailing (day/month/year) 0 9 JUL 2008				
Applicant's or agent's file reference 2006734-0002	FOR FURTHER ACTION See paragraphs 1 and 4 below				
International application No. PCT/IB07/03004	International filing date (day/month/year) 06 March 2007 (06.03.2007)				
Applicant ETHANOL BOOSTING SYSTEMS. LLC					
1. The applicant is hereby notified that the international sea have been established and are transmitted herewith.	arch report and the written opinion of the International Searching Authority				
Filing of amendments and statement under Article 19 The applicant is entitled, if he so wishes, to amend the cl	: aims of the international application (see Rule 46):				
When? The time limit for filing such amendments i search report.	s normally two months from the date of transmittal of the international				
Where? Directly to the International Bureau of WIP 1211 Geneva 20, Switzerland, Facsimile No	O, 34 chemin des Colombettes .: (41-22) 338.82.70.				
For more detailed instructions, see the notes on the	accompanying sheet.				
2. The applicant is hereby notified that no international sea Article 17(2)(a) to that effect and the written opinion of	The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted berewith				
3. With regard to the protest against payment of (an) add	With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:				
the protest together with the decision thereon has be request to forward the texts of both the protest and	the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's				
no decision has been made yet on the proset; the ap	plicant will be notified as soon as a decision is made.				
4. Reminders					
Shortly after the expiration of 18 months from the priority dat Bureau. If the applicant wishes to avoid or postpone publicati priority claim, must reach the International Bureau as provided i technical preparations for international publication.	ie, the international application will be published by the International on, a notice of withdrawal of the international application, or of the n Rules 90 <i>bis</i> .1 and 90 <i>bis</i> .3, respectively, before the completion of the				
The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.					
Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.					
In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.					
See the Annex to Form PCT/IB/301 and, for details about the a Volume II, National Chapters and the WIPO Internet site.	pplicable time limits, Office by Office, see the PCT Applicant's Guide,				
Name and mailing address of the ISA/US	Authorized officer				
Mail Stop PCT, Attr. ISA/US Commissioner for Patents P.O. Box 1450	Stephen K Cronin Chan Head				
Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Telephone No. (571) 272-4383				
Form PCT/ISA/220 (January 2004)	(See notes on accompanying sheet)				

PCT/IB2007 03004 09.07.2008

PATENT COOPERATION TREATY

PCT

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0002	FOR FURTHER see ACTION as well as, wi	e Form PCT/ISA/220 here applicable, item 5 below
International application No. PCT/IB07/03004	International filing date (day/month/year) 06 March 2007 (06.03.2007)	(Earliest) Priority Date (day/month/year) 08 March 2006 (08.03.2006)
Applicant ETHANOL BOOSTING SYSTEMS. LLC		
This international search report has been according to Article 18. A copy is being	prepared by this International Searching A transmitted to the International Bureau.	uthority and is transmitted to the applicant
This international search report consists o It is also accompanied	of a total of $\cancel{\mathcal{V}}$ sheets. by a copy of each prior art document cited	l in this report.
1. Basis of the Report a. With regard to the language, the i the international a a translation of the of a translation fu	nternational search was carried out on the ba application in the language in which it was fil e international application into	isis of: led. , which is the language ch (Rules 12.3(a) and 23.1(b))
b. This international search repo authorized by or notified to the	ort has been established taking into account t his Authority under Rule 91 Rule 43.6 <i>bis(a)</i>	the international application see Box No. I
2. Certain claims were found	unsearchable(See Box No. II)	ine mematonal appreation, see Dox No. 1.
 Unity of invention is lacking With regard to the title, 	g (See Box No. III)	
the text is approved as submit	tred by the applicant. by this Authority to read as follows:	
5. With regard to the abstract,	,	
the text is approved as submitted the text has been established, may within one month from	itted by the applicant. according to Rule 38.2(b), by this Authority the date of mailing of this international search	as it appears in Box No. IV. The applicant
 6. With regard to the drawings, a. the figure of the drawings to be p as suggested by the as selected by this A b. none of the figures is to be p 	aublished with the abstract is Figure No. <u>1</u> applicant. Authority, because the applicant failed to sugg Authority, because this figure better character aublished with the abstract.	gest a figure.

PCT/IB2007 03004 09.07.2008

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INTERNATIONAL SEARCH REPOR		International	ational application No.	
		. PCT/IB07/03004		
A. CLASSIFICATION OF SUBJECT MATTER IPC: F02M 17/00(2006.01)				
USPC: 123/447 According to International Patent Classification (IPC) or to b	oth national classif	ication and IPC		
B. FIELDS SEARCHED				
Minimum documentation searched (classification system foll U.S. : 123/447	owed by classificat	ion symbols)		
Documentation searched other than minimum documentation	to the extent that s	uch documents are inclu	ded in the fields searched	
· · · ·				
Electronic data base consulted during the international search	ı (name of data bas	e and, where practicable,	search terms used)	
C. DOCUMENTS CONSIDERED TO BE RELEVANT			·	
Category * Citation of document, with indication, v	vhere appropriate, o	of the relevant passages	Relevant to claim No.	
A US 2005/0056264 A1, (WEISSMAN et al) 1'	7 March 2005, Figu	ire 2, claim 11.	1-15	
A US 5,560,344 A (CHAN) 1, October 1996 (01	.10.1996), whole a	locument.	1-15	
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Further documents are listed in the continuation of Box	«С.	See patent family annex.		
Special categories of cited documents:	"T"	later document published after	the international filing date or priority	
"A" document defining the general state of the art which is not considered t	o be of	date and not in conflict with the principle or theory underlying t	application but cited to understand the he invention	
particular relevance	"X"	document of particular relevand considered novel or cannot be o	e; the claimed invention cannot be considered to involve an inventive step	
"L" document which may throw doubts on priority claim(s) or which is cite establish the publication date of another citation or other special reason	:d to 1 (as "Y"	when the document is taken alo document of particular relevance	ne	
specified) O" document referring to an oral disclosure, use, exhibition or other means		considered to involve an invent with one or more other such do obvious to a person skilled in th	ive step when the document is combine cuments, such combination being ne art	
"P" document published prior to the international filing date but later than the "&" document member of the same patent family priority date claimed			patent family	
Date of the actual completion of the international search	Date of m	ailing of the international	search report	
08 June 2008 (08.06.2008)		d officer		
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents	Stephen I		Nedette	
P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Telephone	No. (571) 272-4383	Jer	
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PCT/IB2007/(3004 09.07.2008

FILE COPY

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

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To: SAM PASTERNACK CHOATE, HALL & STEWART .TWO INTERNATIONAL PLACE BOSTON, MA 02110	PCT NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION (PCT Rule 44.1) Date of mailing			
Applicant's or agent's file reference	(day/month/year)			
2006734-0002	FOR FURTHER ACTION See paragraphs 1 and 4 below			
International application No. PCT/IB07/03004	International filing date (<i>day/month/year</i>) 06 March 2007 (06.03.2007)			
Applicant ETHANOL BOOSTING SYSTEMS, LLC				
The applicant is hereby notified that the international sea have been established and are transmitted herewith. Filling of amendments and statement under Article 19	rch report and the written opinion of the International Searching Authority			
The applicant is entitled, if he so wishes, to amend the cla	ims of the international application (see Rule 46):			
When? The time limit for filing such amendments is search report.	normally two months from the date of transmittal of the international			
Where? Directly to the International Bureau of WIP 1211 Geneva 20, Switzerland, Facsimile No	D, 34 chemin des Colombettes .: (41-22) 338.82.70.			
For more detailed instructions, see the notes on the a	accompanying sheet.			
2. The applicant is hereby notified that no international sear Article 17(2)(a) to that effect and the written opinion of t	ch report will be established and that the declaration under he International Searching Authority are transmitted herewith.			
3. With regard to the protest against payment of (an) addi	tional fee(s) under Rule 40.2, the applicant is notified that:			
the protest together with the decision thereon has be request to forward the texts of both the protest and t	en transmitted to the International Bureau together with the applicant's he decision thereon to the designated Offices.			
no decision has been made yet on the protest; the ap	plicant will be notified as soon as a decision is made.			
 Reminders Shortly after the expiration of 18 months from the priority dat Bureau. If the applicant wishes to avoid or postpone publicati priority claim, must reach the International Bureau as provided i technical preparations for international publication. 	e, the international application will be published by the International on, a notice of withdrawal of the international application, or of the n Rules $90bis$. I and $90bis$. 3, respectively, before the completion of the			
The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.				
Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.				
In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.				
Volume II, National Chapters and the WIPO Internet site.	opplicable time limits, Office by Office, see the PCT Applicant's Guide,			
Name and mailing address of the ISA/ US	Authorized officer			
Commissioner for Patents	Stephen K Cronin			
P.O. Box 1450 Alexandria, Virginia 22313-1450	Telephone No. (571) 272-4383			
Facsimile No. (571) 273-3201 Form PCT/ISA/220 (January 2004) (See notes on accompanyi				

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PCT/IB2007/ 3004 09.07.2008

PATENT COOPERATION TREATY FILE COPY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0002	FOR FURTHER ACTION	see F as well as, whe	Form PCT/ISA/220 re applicable, item 5 below.			
International application No. PCT/IB07/03004	International filing date (day/me 06 March 2007 (06.03.2007)	onth/year)	(Earliest) Priority Date (day/month/year) 08 March 2006 (08.03.2006)			
Applicant ETHANOL BOOSTING SYSTEMS. LLC	Applicant ETHANOL BOOSTING SYSTEMS. LLC					
This international search report has been according to Article 18. A copy is being This international search report consists of It is also accompanied	This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau. This international search report consists of a total of sheets. It is also accompanied by a copy of each prior art document cited in this report.					
a. With regard to the language, the the international at the internation	international search was carried o application in the language in wh	out on the basis ich it was filed	s of:			
a translation of th of a translation fu	e international application into rnished for the purposes of inter	national search	, which is the language (Rules 12.3(a) and 23.1(b))			
b. This international search rep authorized by or notified to t	ort has been established taking in his Authority under Rule 91 Rule	to account the e 43.6 bis(a)	e rectification of an obvious mistake			
c. With regard to any nucleotic	le and/or amino acid sequence o unsearchable (See Box No. II)	lisclosed in th	e international application, see Box No. I.			
3. Unity of invention is lackin	g (See Box No. III)					
4. With regard to the title, the text is approved as subm	4. With regard to the title, the text is approved as submitted by the applicant.					
the text has been established	by this Authority to read as follo	ws:				
5. With regard to the abstract,	itted by the annlicant					
the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.						
 6. With regard to the drawings, a. the figure of the drawings to be published with the abstract is Figure No. 1 as suggested by the applicant. as selected by this Authority, because the applicant failed to suggest a figure. as selected by this Authority, because this figure better characterizes the invention. 						
b. none of the figures is to be published with the abstract.						

PCT/IB2007/()004 09.07.2008

INTERNATIONAL SEADOU DEDODT	International application No. P	
INTERNATIONAL SEARCH REFORT	PCT/IB07/03004	
A. CLASSIFICATION OF SUBJECT MATTER IPC: F02M 17/00(2006.01)		
USPC: 123/447 According to International Patent Classification (IPC) or to both national classifica	tion and IPC	
B. FIELDS SEARCHED	· · · · · · · · · · · · · · · · · · ·	
Minimum documentation searched (classification system followed by classification U.S. : 123/447	n symbols)	
Documentation searched other than minimum documentation to the extent that such	h documents are included in the fields searched	
Electronic data base consulted during the international search (name of data base at EAST	nd, where practicable, search terms used)	
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category * Citation of document, with indication, where appropriate, of t	he relevant passages Relevant to claim No.	
A US 2005/0056264 A1, (WEISSMAN et al) 17 March 2005, Figure	2, claim 11. 1-15	
A US 5,560,344 A (CHAN) 1, October 1996 (01.10.1996), whole doc	ument. 1-15	
Further documents are listed in the continuation of Box C.	e patent family annex.	
Special categories of cited documents: "T" late dat	er document published after the international filing date or priority te and not in conflict with the application but cited to understand the	
"A" document defining the general state of the art which is not considered to be of prize particular relevance	nciple or theory underlying the invention	
"E" carlier application or patent published on or after the international filing date cor "I." document which may throw doubts on priority claim(s) or which is cited to	cument of particular relevance; the claimed invention cannot be ssidered novel or cannot be considered to involve an inventive step en the document is taken alone	
establish the publication date of another citation or other special reason (as "Y" specified) "O" document referring to an oral disclosure use exhibition or other means		
"p" document published prior to the international filing date but later than the "&" doc	cument member of the same patent family	
Date of the actual completion of the international search Date of maili	ng of the international search report	
08. June 2008 (08.06.2008)		
Name and mailing address of the ISA/US Authorized o Mail Stop PCT, Attn: ISA/US Stephen K C Commissioner for Patents Stephen K C P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201 Telephone N	fficer Cronin Bola o. (571) 272-4383	

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Form PCT/ISA/210 (second sheet) (April 2007)

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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY			FILE COPY		
To: SAM PASTERNACK CHOATE, HALL & STEWART TWO INTERNATIONAL PLACE BOSTON, MA 02110		WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY			
			(PCT Rule 43bis.1)		
		Date of mailing (day/month/year)			
Applicant's or agent's file reference		FOR FURTHER	ACTION		
2006734-0002			See paragraph 2 below		
International application No. Internat	tional filing date ((day/month/year)	Priority date (day/month/year)		
PCT/IB07/03004 06 Mar	ch 2007 (06.03.20	007)	08 March 2006 (08.03.2006)		
International Patent Classification (IPC) or both na	ational classificati	on and IPC			
IPC: Please See Continuation Sheet USPC: 123/447,1A,300,304,431,478,575,577,19	98C,198A;701/10	1			
Applicant					
ETHANOL BOOSTING SYSTEMS. LLC					
1. This opinion contains indications relating to the	ne following item	S:			
Box No. I Basis of the opinion					
Box No. II Priority					
Box No. III Non-establishment of	f opinion with reg	gard to novelty, inventive step and industrial applicability			
Box No. IV Lack of unity of inve	ention				
Box No. V Reasoned statement of applicability; citation	under Rule 43 <i>bis</i> . 1s and explanation	I(a)(i) with regard to as supporting such st	o novelty, inventive step or industrial atement		
Box No. VI Certain documents c	ited				
Box No. VII Certain defects in the	e international app	olication			
Box No. VIII Certain observations	on the internation	nal application			
2 FURTHER ACTION					
2. FORTHERACTION If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.					
If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later. For further options, see Form PCT/ISA/220.					
3. For further details, see notes to Form PCT/ISA/220.					
Name and mailing address of the ISA/US	Date of complet	tion of this opinion	Authorized officer		
Mail Stop PCT, Attn: ISA/US Commissioner for Patents	08 June 2008 (0	8.06.2008)	Stephen K Cronin		
Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201			Telephone No. (571) 272-4383		

Form PCT/ISA/237 (cover sheet) (April 2007)

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PCT/IB2007/ 3004 09.07.2008

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/IB07/03004					
Box No. I Basis of this opinion						
 With regard to the language, this opinion has been established on the basis of: the international application in the language in which it was filed a translation of the international application into, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)). This opinion has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a)) With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of: 						
a. type of material						
a sequence listing						
table(s) related to the sequence listing						
 b. format of material in paper in electronic form 						
c. time of filing/furnishing	· · · · ·					
contained in the international application as filed.						
filed together with the international application in electronic form.						
furnished subsequently to this Authority for the purposes of search.						
4. In addition, in the case that more than one version or copy of a sequence or furnished, the required statements that the information in the subseq application as filed or does not go beyond the application as filed, as appr	listing and/or table(s) relating thereto has been filed uent or additional copies is identical to that in the opriate, were furnished.					
5. Additional comments:						
Form DCT/ISA (227/Dev) No. D (Anail 2002)						

PCT/IB2007/()004 09.07.2008

applicability; citations and explanations supporting such statement 1. Statement Claims <u>1-15</u> Novelty (N) Claims <u>1-15</u> Inventive step (IS) Claims <u>1-15</u> Industrial applicability (IA) Claims <u>1-15</u> Industrial applicability (IA) Claims <u>1-15</u> 2. Citations and explanations: Claims 1-15 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed invent Claim 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.	Box No. V Reasoned statement under Rul	ard to novelty, inventive step	or industrial	
1. Statement Novelty (N) Claims 1-15 Claims NONE 1 Inventive step (IS) Claims 1-15 Claims NONE 1 Industrial applicability (IA) Claims 1-15 Claims NONE 1 2. Citations and explanations: Claims 1-15 1 Claims 1-15 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed invent Claims 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.	applicability; citations and exp	anations supporting suc	ch statement	
Novelty (N) Claims 1-15 Claims MONE 1 Inventive step (IS) Claims 1-15 Claims MONE 1 Industrial applicability (IA) Claims 1-15 Claims NONE 1 Industrial applicability (IA) Claims 1-15 Claims 1-15 Claims NONE 2. Citations and explanations: Claims 1-15 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed invent Claim 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.	1. Statement			
Claims NONE	Novelty (N)	Claims 1-15	•	<u> </u>
Inventive step (IS) Claims 1.15 Claims NONE 1 Industrial applicability (IA) Claims 1.15 Claims NONE 1 2. Citations and explanations: Claims 1-15 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed invent Claims 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.		Claims NONE		N
Claims <u>NONE</u> Industrial applicability (IA) Claims <u>I-15</u> Claims <u>NONE</u> Claims <u>NONE</u> Claims <u>1-15</u>	Inventive sten (IS)	Claims 1-15		•
Industrial applicability (IA) Claims <u>I-15</u> Claims MONE		Claims <u>NONE</u>		Y
Industrial applicability (IA) Claims <u>1-15</u> Claims <u>NONE</u>	· · · · · · · · · · · · · · · · · · ·			
2. Citations and explanations: Claims 1-15 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed invent Claim 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.	Industrial applicability (IA)	Claims <u>1-15</u>		Y
2. Citations and explanations: Claims 1-15 meet the oriteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed invent Claim 1-15 meet the oriteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.		Claims <u>NONE</u>		l
Claims 1-15 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed invent Claim 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.	2. Citations and explanations:		****	
Claim 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.	Claims 1-15 meet the criteria set out in PCT Article	e 33(2)-(3), because the prio	r art does not teach or fairly suge	est claimed inventi
Claim 1-15 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed be made or used in industry.				
be made or used in industry.	Claim 1-15 meet the criteria set out in PCT Article	33(4), and thus have industr	ial applicability because the subje	ct matter claimed of
	be made or used in industry.	•		
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FORD Ex. 1126, page 122 IPR2020-00013

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PCT/IB2007/ 3004 09.07.2008

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No PCT/IB07/03004 DPY

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Supplemental Box In case the space in any of the preceding boxes is not sufficient.

Continuation of IPC: F02M 63/00(2006.01),43/00(2006.01);F02B 47/00(2006.01),47/04(2006.01),13/00(2006.01),13/10(2006.01)

Form PCT/ISA/237 (Supplemental Box) (April 2007)

PATENT COOPERATION TREA. Y

From the INTERNATIONAL	SEARCHING AUTHORITY
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	PÄ	TENT DEPARTM	ENT
I	PC'	Γ	and descent to be assessed

To: Sam Pasternack Choate, Hall & Stewart Two International Place Boston, Massachusetts 02110	NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION				
	(PCT Rule 44.1)				
· · · · · · · · · · · · · · · · · · ·	Date of mailing (day/month/year)				
Applicant's or agent's file reference	FOR FUP' A ACTION See paragraphs 1 and 4 below				
2006734-0003PC					
International application No. PCT/US 07/05777	International filing date (day/month/year) 08 March 2007 (08.03.2007)				
to the state of the section Systems 11 C					
Applicant Ethanol Boosting Systems, LLC					
1. The applicant is hereby notified that the international s	earch report and the written opinion of the International Searching rewith.				
Filing of amendments and statement under Article 1	19:				
The applicant is entitled, if he so wishes, to amend the	claims of the international application (see Rule 46):				
When? The time limit for filing such amendme	ents is normally two months from the date of transmittal of the				
Where? Directly to the International Bureau of Wi 1211 Geneva 20 Switzerland, Facsimile	IPO, 34 chemin des Colombettes No.: +41 22 740 14 35				
For more detailed instructions, see the notes on th	e accompanying sheet.				
2. The applicant is hereby notified that no internationa Article 17(2)(a) to that effect and the written opinion of	l search report will be established and that the declaration under of the International Searching Authority are transmitted herewith.				
3 With regard to the protest against payment of (an) a	dditional fee(s) under Rule 40.2, the applicant is notified that:				
the protest together with the decision thereon applicant's request to forward the texts of both	has been transmitted to the International Bureau together with the the protest and the decision thereon to the designated Offices.				
no decision has been made yet on the protest;	the applicant will be notified as soon as a decision is made.				
4. Reminders					
Shortly after the expiration of 18 months from the prior International Bureau. If the applicant wishes to avoid or application, or of the priority claim, must reach the Internati before the completion of the technical preparations for intern	writy date, the international application will be published by the postpone publication, a notice of withdrawal of the international onal Bureau as provided in Rules 90 <i>bis</i> .1 and 90 <i>bis</i> .3, respectively, national publication.				
The applicant may submit comments on an informal basis of International Bureau. The International Bureau will sem- international preliminary examination report has been or is to the public but not before the expiration of 30 months from the	d a copy of such comments to all designated Offices unless an to be established. These comments would also be made available to he priority date.				
Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed offices.					
In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19					
See the Annex to Form PCT/IB/301 and, for details about the Guide, Volume II, National Chapters and the WIPO Internet	See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the PCT Applicant's Guide, Volume II, National Chapters and the WIPO Internet site.				
	Authorized officer				
Name and mailing address of the ISA/US	Lee W. Young				
Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450	PCT Helpdesk: 571-272-4300				
Facsimile No. 571-273-3201	PCT OSP: 571-272-7774				

Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

PATENT COOPERATION TREA.Y

From the INTERNATIONAL SEARCHING AUTHORITY

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Fo: Sam Pasternack Choate, Hall & Stewart Two International Place Boston, Massachusetts 02110	PCT NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION				
	(PCT Rule 44.1)				
	Date of mailing (day/month/year) 24 MAR 2008				
Applicant's or agent's file reference 2006734-0003PC	FOR FURTHER ACTION See paragraphs 1 and 4 below				
International application No. PCT/US 07/05777	International filing date (day/month/year) 08 March 2007 (08.03.2007)				
Applicant Ethanol Boosting Systems, LLC					
 Filing of amendments and statement under Article 19: The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46): When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report. Where? Directly to the International Bureau of WIPO, 34 chemin des Colombet O C K e feed 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35 For more detailed instructions, see the notes on the accompanying sheet. 2. The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith. 3. With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that: the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices. 					
4. Reminters Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication. The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date. Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices. In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months. See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the PCT Applicant's					
Guide, Volume II, National Chapters and the WIPO Internet Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. You new MAR 2 6 2008 PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774				

Form PCT/ISA/220 (January 2004)

PATENT COOPERATION TRE

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PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0003PC	FOR FURTHER ACTION	as well as	see Form PCT/ISA/2 s, where applicable, it	220 tem 5 below.
International application No. PCT/US 07/05777	International filing date (day) 08 March 2007 (08.03.2007)	/month/year)	(Earliest) Priority Da 10 March 2006 (10.03	ate <i>(day/month/year)</i> 3.2006)
Applicant Ethanol Boosting Systems, LLC				
This international search report has a according to Article 18. A copy is be This international search report consist	peen prepared by this Internation ing transmitted to the Internation sts of a total of A sheets	nal Searching Au al Bureau. 5.	thority and is transr	nitted to the applicant
It is also accompanied by	y a copy of each prior art docume	ent cited in this re	eport.	
 Basis of the report a. With regard to the language, X the international a 	the international search was carri pplication in the language in which	ied out on the bas ch it was filed.	sis of:	hich is the language of
a translation of the a translation furnis	shed for the purposes of internation	onal search (Rule	es 12.3(a) and 23.1(b))).
b. This international searc authorized by or notified	n report has been established tal I to this Authority under Rule 91	king into accoun (Rule 43.6 <i>bis</i> (a)	t the rectification o).	f an obvious mistake
c. With regard to any nucl	eotide and/or amino acid seque	nce disclosed in t	the international appl	lication, see Box No. I.
2. Certain claims were fo	und unsearchable (see Box No.	II).		
3. Unity of invention is la	cking (see Box No. III).			
4. With regard to the title,				
the text is approved as s	ubmitted by the applicant.			
the text has been establi	shed by this Authority to read as	follows:		
		•		
5 With record to the obstract				
the text is approved as s	ubmitted by the applicant.			
the text has been establi may, within one month	shed, according to Rule 38.2(b), from the date of mailing of this in	by this Authority ternational searcl	r as it appears in Box h report, submit com	No. IV. The applicant ments to this Authority.
6. With regard to the drawings,				
 a. the figure of the drawings to as suggested by the as selected by this as selected by this 	be published with the abstract is ie applicant. S Authority, because the applicant Authority, because this figure b	Figure No. <u>1</u> t failed to sugges etter characterize	at a figure.	ECEIVE MAR 2 6 2008
b. none of the figures is to	be published with the abstract.			PATENT DEPARTME

Form PCT/ISA/210 (first sheet) (April 2007)

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - F02B 77/04 (2007.10) USPC - 123/198A							
R FIFI	DS SEARCHED						
D. FIEL	cumentation searched (classification system followed by c	classification symbols)					
USPC: 123/1	USPC: 123/198A						
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC: 123/198R, 406.29, 406.47 (text search - see terms below)							
Electronic da PubWEST(U Search Term injection, mo	ta base consulted during the international search (name of SPT,PGPB,EPAB,JPAB); Google Patents; Google Scho is: gasoline engine, ethanol, direct injection, engine knoc tor	data base and, where practicable, search ter blar k, emissions, restart, control system, shut	rms used) down, deceleration, port				
C. DOCUI	MENTS CONSIDERED TO BE RELEVANT						
Category*	Citation of document, with indication, where ap	propriate, of the relevant passages	Relevant to claim No.				
Y	Calculations of Knock Suppression in Highly Turbochar Direct Ethanol Injection (L. Bromberg et al.) 23 Februar especially Abstract, Section I, para [0003], Section II, p	ged Gasolin/Ethanol Engines Using y 2006 (23.02.2006), entire document ara [0001], [0003], [0006]	1-18				
Y	US 4,312,310 A (Chivilo' et al.) 26 January 1982 (26.01	1.1982), col 2, in 20-26 and in 36-54	1-18				
Y	Y US 6,358,180 B1 (Kuroda et al.) 19 March 2002 (19.03.2002), Fig 4, col 3, ln 65-67 to col 4, ln 1 2, 9-10, 13-18 -15, col 8, ln 3-27col 12, ln 54-56						
Y	US 4,974,416 A (Taylor) 04 December 1990 (04.12.1990), col 4, ln 15-21 5						
Y	6, 8, 13-18						
Y	US 4,967,714 A (Inoue) 06 November 1990 (06.11.199	00), col 3, ln 27-30 and ln 66-67	11				
		F	<u> </u>				
Furthe	er documents are listed in the continuation of Box C.						
* Special "A" docume to be o	categories of cited documents: ent defining the general state of the art which is not considered f particular relevance	"T" later document published after the inter date and not in conflict with the applie the principle or theory underlying the	national filing date or priority cation but cited to understand invention				
"E" earlier filing d	application or patent but published on or after the international late	"X" document of particular relevance; the considered novel or cannot be consid step when the document is taken along	claimed invention cannot be lered to involve an inventive				
cited to special	"L" document which may throw doubts on priority clam(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "Y" document of particular relevance; the claimed invention cannot considered to involve an inventive step when the document						
"O" documents	"O" document referring to an oral disclosure, use, exhibition or other means """ document referring to an oral disclosure, use, exhibition or other being obvious to a person skilled in the art						
the pric	r document published prior to the memauonal ining date out race una "&" document member of the same patent family						
Date of the actual completion of the international searchDate of mailing of the international search report03 December 2007 (03.12.2007)24 MAR 2008							
Name and n	nailing address of the ISA/US	Authorized officer:					
Mail Stop PC P.O. Box 145	T, Attn: ISA/US, Commissioner for Patents O, Alexandria, Virginia 22313-1450	Lee W. Young PCT Helpdesk: 571-272-4300					
Facsimile N	Facsimile No. 571-273-3201 PCT OSP: 571-272-7774						

Form PCT/ISA/210 (second sheet) (April 2007)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHOR	RITY				
_{To:} Sam Pasternack Choate, Hall & Stewart Two International Place		PCT			
Boston, Massachusetts 02110		WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY			
		(PCT Rule 43 <i>bis</i> .1)			
		Date of mailing		ļ	
		(day/month/year)	24 MAR 2008		
Applicant's or agent's file reference 2006734-0003PC		FOR FURTHER A	ACTION See paragraph 2 below		
International application No.	International filing date	(day/month/year)	Priority date (day/month/year)		
PCT/US 07/05777	08 March 2007 (08.	03.2007)	10 March 2006 (10.03.2006)		
International Patent Classification (IPC) or IPC(8) - F02B 77/04 (2007.10) USPC - 123/198A	both national classificat	ion and IPC			
Applicant Ethanol Boosting System	ns, LLC				
· · · · · · · · · · · · · · · · · · ·				1	
1. This opinion contains indications relat	ing to the following iten	15:	Docketed		
	non		Duez IIIIA		
			Sesponse to Notten Upinior	\downarrow	
Box No. III Non-establishme	ent of opinion with regar	d to novelty, inventiv	e step and industrial applicability	4/08	
Box No. IV Lack of unity of	invention			MPL	
Box No. V Reasoned statem citations and exp	planations supporting sup	ch statement	eny, inventive step of industrial application,		
Box No. VI Certain documer	nts cited				
Box No. VII Certain defects in	n the international appli	cation			
Box No. VIII Certain observat	tions on the international	application			
2. FURTHER ACTION					
If a demand for international prelimir International Preliminary Examining A other than this one to be the IPEA and opinions of this International Searching	nary examination is mad Authority ("IPEA") excep I the chosen IPEA has n g Authority will not be s	de, this opinion will pt that this does not ap otified the Internation so considered.	be considered to be a written opinion of the pply where the applicant chooses an Authority nal Bureau under Rule 66.1 <i>bis</i> (b) that written		
If this opinion is, as provided above, co a written reply together, where appropr PCT/ISA/220 or before the expiration	onsidered to be a written riate, with amendments, of 22 months from the p	opinion of the IPEA, before the expiration riority date, whicheve	the applicant is invited to submit to the IPEA of 3 months from the date of mailing of Form or expires later.		
For further options, see Form PCT/ISA/220.					
3. For further details, see notes to Form PCT/ISA/220.					
Name and mailing address of the ISA//IS	Date of completion of th	his opinion	Authorized officer	-	
Mail Stop PCT, Attn: ISA/US			Lee W. Young	-	
P.O. Box 1450, Alexandria, Virginia 22313-1450	03 December 2007	7 (03.12.2007)	PCT Helpdesk: 571-272-4300		
Facsimile No. 5/1-2/3-3201 PCT OSP: 571-272-7774					

Form PCT/ISA/237 (cover sheet) (April 2007)

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

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			PCT/US 07/05777
Box	No. I	Basis of this opinion	
1.	With r	egard to the language , this opinion has been established on the basis of: the international application in the language in which it was filed. a translation of the international application into	which is the language of a) and 23.1(b)).
2.		This opinion has been established taking into account the rectification of an to this Authority under Rule 91 (Rule 43 <i>bis</i> .1(a))	obvious mistake authorized by or notified
3.	With r establi	egard to any nucleotide and/or amino acid sequence disclosed in the intersteed on the basis of:	national application, this opinion has been
	a. typ	e of material a sequence listing table(s) related to the sequence listing	
	b. for	mat of material on paper in electronic form	
	c. tim	 e of filing/furnishing contained in the international application as filed filed together with the international application in electronic form furnished subsequently to this Authority for the purposes of search 	•
4.		In addition, in the case that more than one version or copy of a sequence list filed or furnished, the required statements that the information in the subseq in the application as filed or does not go beyond the application as filed, as	ing and/or table(s) relating thereto has been juent or additional copies is identical to that appropriate, were furnished.
5.	Additi	onal comments:	

Form PCT/ISA/237 (Box No. I) (April 2007)

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INTERNATIONAL SEARCHING AUTHORITY PCTUS 07/06777 Box No. V Reasoned statement under Rule 43/s/s.1(a)(i) with regard to novelty, inventive step or industrial applications and explanations supporting such statement 1. Statement Novely (N) Claims Inventive step (IS) Claims Inventive step (IS) Claims Industrial applicability (IA) Claims 1-18 Industrial applicability (IA) Claims 1-18 Industrial applicability (IA) Claims Claims 1-18 Industrial applicability (IA) Claims Claims 1-18 Rome Industrial applicability (IA) Claims 1-18 Reasoned scenarios Claims Suppression In Highly Turbochraped Geaoline/Ethanol Engine Using Direct Ethanol Injection" by L. Bromberg of alcokee 4 using applicability applicability (IA) As per claim 1, Bromberg disclese 3 using the source of geaoline for introduction into the engine logic diver demand (OL) in 0.245.8 (IA) to Chilo as a control applicability down the engine by stopping gaazoline engine unit and training will in the at to modify the training the diver demand (OL) in 0.25.8 (IA) to Chilo as a control applicability diver demand (OL) in 0.25.8 (IA) to Chilo applicability ethanol intection by L.	INTEDNATIO	FTEN OPINION O)F THE	International application No.
Box No. V Reasoned statement under Rule 436/s.1(a)(f) with regard to novelty, inventive step or industrial ap citations and explanations supporting such statement 1. Statement Novelty (N) Claims Inventive step (IS) Claims Industrial applicability (IA) Claims Industrial applicability (IA) Claims 1.16 Industrial applicability (IA) Claims 1-16 Industrial applicability (IA) Claims Claims 1-16 Claims 1-16 Industrial applicability (IA) Claims Claims 1-16 Claims 1-16 None 1-16 Claims 1-16 None 1-16 Suppression in Highy Turboharged Gasoline/Ehanol Engines Using Direct Ehanol Injection* by L. Bromberg in a vehicl gasoline argine powering the vehicle gasoline and interduction into the engine by comparing social field with the engine to engine by stepping gasoline for introduction in the engine by comparing gasoline for introduction in the engine direct powering gasoline and with the engine by engine vehicle gasoline and with engine vehicle directeration and diling and restating the engine by comparing gasoline for introduction in the engine directeration and diling and restating the engine vehicle directeration and	IN LENNATIO	ONAL SEARCHIN	GAUTHORITY	PCT/US 07/05777
1. Statement Novelty (N) Claims 1-18 Claims None	Box No. V Reasoned statem citations and exp	nent under Rule 43/ planations supporti	bis.1(a)(i) with regard to ring such statement	iovelty, inventive step or industrial appli
Novelry (N) Claims 1-18 Claims None Inventive step (IS) Claims None Claims 1-16 Industrial applicability (IA) Claims Claims 1-18 Industrial applicability (IA) Claims Approxima 1.54.7 And 12 (Back an inventive step under PCT Article 33(3) as being obvious over the article entitled "Calculatio Suppression in thight Turcobardese a luel management system for patient provem by L Bromberg deal (Integer Bromberg) in view of US 4.312,210 A to Chivio Glaima (1003) an injection of an epine into a cylinder of the epine diver demand (021, In 20.26 and 13 8-56). It would have been ovious to ore ordinary skill in the art to modify the tur system as disclosed by Bromberg deal and 18-56). It would have been ovious to ore ordinary skill in the art to include a famole inder ovious to ore ordinary skill in the art to include a famole inder ovious to ore ordinary skill in the art to include a famol inder ovious to ore ordinary skill in the art to i	1. Statement			
Claims None Inventive step (IS) Claims None Claims 1-18	Novelty (N)	Claims	1-18	
Inventive step (IS) Claims None Industrial applicability (IA) Claims 1-18 Industrial applicability (IA) Claims 1-18 Claims None 1-18 Claims None 1-18 Claims 1, 3-4, 7 and 12 lack an inventive step under PCT Article 33(3) as being obvious over the article entitled "Calculatio Suppression in Highy Turbocharged Gascine/Ethanol Engines Using Direct Ethanol Injection" by L. Bromberg 1 were of U 5, 43:23 01 A to Chivide tail, (hereinather Chivido). As per claim 1, Bromberg discloses a fuel management system for operation of a spark ignition gasoline engine in a vehicle (see Abstract): a source of gasoline 6 introduction in the engine (see Section II, para 10001). As per claim 1, Bromberg discloses a chird osiset or starting the engine upon driver demand. Chivid osicoses a chird system of shutting down the engine by stopping gasoline a into the engine during vehicle (see Abstract): a source of gasoline 6 into to the engine during vehicle deceleration and idling and restarting the driver demand. Chivid osicoses a chird system of shutting down the engine by stopping gasoline a situting down the engine by stopping gasoline a situting down the engine diverse within the orbit ob system situ stupit by Chivid science a majc development in the system of Bromberg is tuel conservation and an obvious way to conserve fuel is to shut down the engine evelopement in the system of Bromberg is tuel conservation and an obvious way to conserve fuel is to shut down the engine evelopement in the system discloses the system wherein the engine uses direct ethanol linjection during engin remissions. Howev		Claims	None	
Industrial applicability (LA) Claims 1-18 Industrial applicability (LA) Claims 1-18 Industrial applicability (LA) Claims 1-18 Claims None 1 2. Citations and explanations: Claims None Claims 1, 3-4, 7 and 12 lack an inventive step under PCT Article 33(3) as being obvious over the article entitled "Calculatic Suppression in Highy Turbocharged Gascine/Ethanol Engines Using Direct Ethanol Injection" by L. Bromberg et al. (herei Bromberg) in view of US 4,312,310 A to Chivilo et al. (herei Bromberg Citabino 1), Bromberg discloses a fuel management system for operation of a spark ignition gasoline engine powering the vehicle (see Abstract); a source of gasoline for introduction into the engine less Section II, para (0001)). Thormberg dese not disclose a control system for shutting down the engine mad. Chivilo discloses a control system for shutting down the engine during divide deceleration and clinus and restarting the driver demark (of 21, the 2-26 and 198-64). It would have been obvious to one of ordinary skill in the art to modify the fur system as disclosed by Bromberg further discloses the system wherein the engine uses direct ethanol injection during a range of e conditions to prevent engine knock. (were r.) it would have been obvious to one or dordary skill in the art to include e during engine restart as one of the operating conditions since engine knock one of the object so the order and the divous to one of ordary skill in the art to include e engine knock. As per claim 4, Bromberg discloses the system wherein the engine used frect ethanol injection during engine restart to minimize by dir	Inventive step (IS)	Claims	None	
Industrial applicability (IA) Claims 1-18 None		Claims	1-18	
Industrial appreciation (inf) Chaims None Claims Claims None Claims Claims Claims Claims None Claims	Industrial applicability /	(IA) Claims	1-18	
2. Citations and explanations: Claims 1, 3-4, 7 and 12 lack an inventive step under PCT Article 33(3) as being obvious over the article entitled "Calculatic Suppression in Highly Turbocharged Gasoline/Ethanol Engines Using Direct Ethanol Injection" by L. Bromberg et al. (herei Bromberg') in view of US 4,312,310 A to Chivio et al. (hereinater 'Chivio'). As per claim 1, Bromberg discloses a fuel management system for operation of a spark ignition gasoline engine powering the vehicle (see Abstract): a source of gasoline for introduction into the engine (see Section II, para (0001)). Bromberg does not disclose a control system for shutting down the engine by stopping gasoline a vehicl gasoline during vehicle deceleration and ilding and restarting the engine upon driver demand. Chivio discloses a co- shutting down the engine by stopping gasoline flow into the engine during vehicle deceleration and ilding and restarting the engine upon the engine by stopping gasoline flow into the engine during vehicle deceleration and diffig and restarting the engine upon the engine knock. (New 2 hu oway to conserve fuel is to shut down the engine during vielle or deceleration. As per claim 3, Bromberg further discloses the system wherein the engine uses direct ethanol injection during a range of e conditions to prevent engine knock. (New 2, it would have been obvious to one of ordinary skill in the art to include during engine restart as one of the operating conditions since engine knock often occurs during restart and one of the obje is to prevent engine knock. As per claim 4, Bromberg discloses the system wherein the engine uses direct ethanol injection during engine minimize hydrocarbon emissions. As per claim 1, Bromberg further discloses the system wherein the engine is turbocharged or supercharged (see Section II, para (0006)). Bromberg does not specifically disclose direct ethanol injection during engin minimize hydrocarbon emissions. As per claim 2, Bromberg further discloses the system wherein the e	maasinai approaomiy (Claims	None	
As per claim 7, Bromberg further discloses the system wherein the engine is turbocharged or supercharged (see Section I As per claim 12, Bromberg further disclose the system wherein gasoline is not used and ethanol, E85, methanol, other alc thereof are used as the only fuel (see Abstract). Bromberg states direct ethanol injection could be be used to displace gas Claims 2, 9 and 10 lack an inventive step under PCT Article 33(3) as being obvious over Bromberg in view of Chivilo, furth 6,358,180 B1 to Kuroda et al. (hereinafter 'Kuroda'). As per claim 2, Chivilo discloses a control system for shutting down the engine by stopping gasoline flow into the engine di deceleration and idling and restarting the engine upon driver demand (col 2, In 20-26 and In 36-54). Chivilo does not spec wherein the control system disables the shutting down of the engine during deceleration and idling when an auxiliary power equirement exceeds a selected level. Kuroda discloses wherein the control system disables the shutting down of the engine deceleration and idling when an auxiliary power or energy requirement exceeds a selected level (col 3, In 65-67 to col 4, In have been obvious to one of ordinary skill in the art to modify the control system as disclosed by Chivilo with the system as Kuroda, since both relate to the technology of shutting engines down to conserve fuel and since such would avoid having t down when the batteries are unable to perform important functions such as restarting. As per claim 9, Kuroda further discloses the system further including a 12V motor to restart the engine after shutdown duri and/or idle (Fig 4; col 12, In 54-56). Please See Continuation Sheet	Bromberg is fuel conservation and	with the control syste	em as taught by Chivilo sind	f ordinary skill in the art to modify the fuel m ce a major development in the system disclo n the engine during idle or deceleration
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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 07/05777

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Box V. 2. Citations and explanations:

As per claim 10, Kuroda further discloses the system including a restart motor (Fig 4; col 12, ln 54-56), wherein the low voltage motor is a low voltage motor (Fig 4 - the motor used for restarting the engine is a low voltage motor operating on 12 V).

Claim 5 lacks an inventive step under PCT Article 33(3) as being obvious over Bromberg in view of Chivilo, further in view of US 4,974,416 A (Taylor).

As per claim 5, Bromberg discloses the system wherein the engine uses direct injection (see Section II, para [0001]). Bromberg does not specifically disclose the system wherein the engine uses direct injection during engine restart to supplement port fuel injection while a fuel film that feeds the engine is established so as to minimize energy, emissions and time required for engine restart. Taylor discloses a system wherein the engine includes port fuel injection while a fuel film that feeds the engine is established so as to minimize energy, emissions and time required for engine restart. Taylor discloses a system wherein the engine includes port fuel injection while a fuel film that feeds the engine is established (col 4, In 15-21). It would have been obvious to one of ordinary skill in the art to supplement port injection with direct injection and since fuel films are well known and the use of such would have minimized energy, emissions and time required for engine restart.

Claims 6 and 8 lack an inventive step under PCT Article 33(3) as being obvious over Bromberg in view of Chivilo, further in view of US 6,260,525 B1 (Moyer).

As per claim 6, Chivilo discloses a control system for shutting down the engine by stopping gasoline flow into the engine (col 2, In 20-26 and In 36-54). Chivilo does not specifically disclose the system further including a valve disabler for all engine valves. Moyer discloses the system further including a valve disabler for all engine valves (col 3, In 5-8). It would have been obvious to one of ordinary skill in the art to modify the system as disclosed by Chivilo and Bromberg with the valve disabler as taught by Moyer, since all relate to the technology of shutting engines down to conserve fuel and since such would have enagled the engine to be a variable displacement engine so that when less than maximum power is required some cylinders can be shut down and power increased in the remaining cylinders which will then operate at greater efficiency.

As per claim 8, Bromberg further discloses the system wherein maximum manifold pressure is increased by at least a factor of two over a non-pressure-boosted engine (see Abstract).

Claims 11 lacks an inventive step under PCT Article 33(3) as being obvious over Bromberg in view of Chivilo, further in view of US 4,967,714 A (Inoue).

As per claim 11, Bromberg further discloses the system wherein the ethanol is injected through a fuel injector (see Section II, para [0001]). Bromber does not specifically disclose wherein the gasoline and the ethanol are injected through the same fuel injector. Inoue discloses the system wherein the gasoline and the ethanol are injected through the same fuel injector. Inoue discloses been obvious to one of ordinary skill in the art to modify the system as disclosed by Bromberg to enable the system to inject ethanol and gasoline through the same fuel injector as taught by Inoue, since both relate to the technology of ethanol burning systems and since such would have enabled the system to operate using only one fuel injector per cylinder which is a well known design to one of ordinary skill in the art.

Claims 13-18 lack an inventive step under PCT Article 33(3) as being obvious over Bromberg in view of Chivilo, further in view of Kuroda, further in view of Moyer.

As per claim 13, Bromberg discloses a turbocharged spark ignition engine which uses separately controlled direct injection of ethanol and port fuel injection of gasoline (see Abstract). Bromberg does not specifically disclose where the engine is shut down during periods of deceleration and idle. Kuroda discloses where the engine is shut down during periods of deceleration and idle. Kuroda discloses where the engine is shut down during periods of deceleration and idle (col 8, In 3-27). Bromberg further discloses the engine comprising a first source of gasoline (see Section II, para [0003]); a second source of ethanol (see Section II, para [0003]); a gasoline engine (see Abstract). Bromberg does not specifically disclose a means to engine cylinder deactivation through valve disabling during engine deceleration and idling. Moyer discloses a means to engine cylinder deactivation through valve disabling (col 3, In 5-8). It would have been obvious to one of ordinary skill in the art to modify the engine as disclosed by Bromberg with the shut down during deceleration and idle as taught by Kuroda and the disabling of the valves as taught by Moyer, since all relate to the technology of improving fuel economy and since the disabling of the valves is well known in the art as an effective way to shut down the engine and since shutting down the engine during deceleration and idle is an obvious means to conserving fuel.

As per claim 14, Bromberg further discloses the turbocharged spark ignition engine (see Section II, para [0001]) wherein the engine uses direct ethanol injection during a range of engine operating conditions to prevent engine knock (see Section I, para [0003]). Bromberg does not specifically disclose direct ethanol injection during engine restart to prevent engine knock. However, it would have been obvious to one of ordinary skill in the art to include ethanol injection during engine restart as one of the operating conditions since engine knock often occurs during restart and one of the objects of Bromberg is to prevent engine knock.

----- Please See Continuation Sheet ----

Form PCT/ISA/237 (Supplemental Box) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No. PCT/US 07/05777

Supplemental Box

In case the space in any of the preceding boxes is not sufficient. Continuation of: Suplemental Box 1:

As per claim 15, Bromberg discloses the turbocharged spark ignition engine (see Section II, para [0001]) wherein the engine uses direct ethanol injection to minimize hydrocarbon emissions (see Section II, para [0006]). Bromberg does not specifically disclose direct ethanol injection during engine restart to minimize hydrocarbon emissions. However, it would have been obvious to one of ordinary skill in the art to include ethanol injection during engine restart to minimize hydrocarbon emissions since hydrocarbon emissions can be high during restart and one of the objects of Bromberg is to minimize hydrocarbon emissions.

As per claim 16, Bromberg discloses the turbocharged spark ignition engine (see Section II, para [0001]). Bromberg does not specifically disclose the turbocharged spark ignition engine where a low voltage motor is used to restart the engine. Kuroda discloses the system wherein the low voltage motor is a low voltage motor (Fig 4; col 12, In 54-56). Furthermore, it would have been obvious to one of ordinary skill in the art to modify the engine as disclosed by Bromberg and Chivilo with the low voltage motor for restart since most vehicles currently operate with a 12 V battery and using a low voltage motor for restart would not require an additional battery for operating the restart motor.

As per claim 17, Bromberg discloses a turbocharged spark ignition engine which uses separately controlled direct injection of ethanol and port fuel injection of gasoline (see Abstract). Bromberg does not specifically disclose where the engine is shut down during periods of deceleration and idle. Kuroda discloses where the engine is shut down during periods of deceleration and idle (col 8, In 3-27). Bromberg further discloses the engine comprising a first source of gasoline (see Section II, para [0003]); a second source of ethanol (see Section II, para [0003]); a gasoline engine (see Abstract). Bromberg does not specifically disclose a means to disable the engine cylinders and where direct ethanol injection is used during engine restart and further where a low voltage motor is used for engine restart. Moyer discloses a means to engine cylinder deactivation through valve disabling (col 3, In 5-8). Kuroda further discloses where a low voltage motor is used for engine restart (Fig 4; col 12, In 54-56). It would have been obvious to one of ordinary skill in the art to modify the engine as disclosed by Bromberg with the shut down during deceleration and idle and low voltage restart motor as taught by Kuroda and the disabling of the valves as taught by Moyer, since all relate to the technology of improving fuel economy and since the disabling of the valves is well known in the art as an effective way to shut down the engine and since shutting down the engine during deceleration and idle is an obvious means to conserving fuel.

As per claim 18. Bromberg discloses a turbocharged spark ignition engine which uses direct injection of ethanol (see Abstract). Bromberg does not specifically disclose where the engine is shut down during periods of deceleration and idle comprising a turbocharged spark ignition engine; and a means to shutdown the engine cylinders and where direct ethanol injection is used during engine restart and further where a low voltage motor is used for engine restart. Kuroda discloses where the engine is shut down during periods of deceleration and idle comprising a turbocharged spark ignition engine; and a means to shutdown the engine cylinder sand where direct ethanol injection is used during engine restart and further where a low voltage motor is used for engine restart. Kuroda discloses where the engine is shut down during periods of deceleration and idle (col 8, In 3-27). Moyer discloses a means to engine cylinder deactivation through valve disabling (col 3, In 5-8). Kuroda further discloses where a low voltage motor is used for engine restart (Fig 4; col 12, In 54-56). It would have been obvious to one of ordinary skill in the art to modify the engine as disclosed by Bromberg with the shut down during deceleration and idle and low voltage restart motor as taught by Kuroda and the disabling of the valves as taught by Moyer, since all relate to the technology of improving fuel economy and since the disabling of the valves is well known in the art as an effective way to shut down the engine and since shutting down the engine during deceleration and idle is an obvious means to conserving fuel.

Claims 1-18 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

Form PCT/ISA/237 (Supplemental Box) (April 2007)

FORD Ex. 1126, page 132 IPR2020-00013

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	From the INTERNATIONAL SEARCHING AUTHORITY	DUB 5.25.08				
	To: SAM PASTERNACK CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110 DOCKETED	PCT NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION				
	DUB 4.25.08	Date of mailing (day/month/year) 25 FEB 2008				
Γ	Applicant's or agent's file reference	FOR FURTHER ACTION See paragraphs 1 and 4 below				
F	International application No.	International filing date (day/month/war) 24 July 2007 (24.07.2007)				
ŀ	Applicant ETHANOL BOOSTING SYSTEMS, LLC	(uu)///////////////////////////////////				
	 The applicant is hereby notified that the international sear have been established and are transmitted herewith. 	ch report and the written opinion of the International Searching Authority				
	Filing of amendments and statement under Article 19: The applicant is entitled, if he so wishes, to amend the cla	ims of the international application (see Rule 46):				
	When? The time limit for filing such amendments is search report.	normally two months from the date of transmittal of the international				
	Where? Directly to the International Bureau of WIPC 1211 Geneva 20, Switzerland, Facsimile No.), 34 chemin des Colombettes : (41-22) 338.82.70.				
	For more detailed instructions, see the notes on the a	ccompanying sheet.				
	2. The applicant is hereby notified that no international search Article 17(2)(a) to that effect and the written opinion of the	ch report will be established and that the declaration under he International Searching Authority are transmitted herewith.				
	3. With regard to the protest against payment of (an) addi	tional fee(s) under Rule 40.2, the applicant is notified that:				
	the protest together with the decision thereon has been request to forward the texts of both the protest and the texts of both texts o	en transmitted to the International Bureau together with the applicant's he decision thereon to the designated Offices.				
	no decision has been made yet on the protest; the ap	plicant will be notified as soon as a decision is made.				
	4. Reminders Shortly after the expiration of 18 months from the priority dat Bureau. If the applicant wishes to avoid or postpone publication priority claim, must reach the International Bureau as provided in technical preparations for international publication.	e, the international application will be published by the International on, a notice of withdrawal of the international application, or of the n Rules 90 <i>bis</i> .1 and 90 <i>bis</i> .3, respectively, before the completion of the				
	The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.					
	Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.					
	In respect of other designated Offices, the time limit of 30 month See the Annex to Form PCT/IB/301 and, for details about the ap	is (or later) will apply even if no demand is filed within 19 months. pplicable time limits, Office by Office, see the PCT Applicant's Guide,				
-	Volume II, National Chapters and the WIPO Internet site.	Authorized officer				
	Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Pay 1450	Stephen K Cronin				
	Alexandria, Virginia 22313-1450	Telephone No. (571) 272-4383				
l	Form PCT/ISA/220 (January 2004)	FEB 2 7 2008				
		PATENT DEPARTMENT				

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FORD Ex. 1126, page 133 IPR2020-00013

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0015	FOR FURTHER see F	Form PCT/ISA/220 re applicable, item 5 below
International application No. PCT/US07/74227	International filing date (<i>day/month/year</i>) 24 July 2007 (24.07.2007)	(Earliest) Priority Date (<i>day/month/year</i>) 24 July 2006 (24.07.2006)
Applicant ETHANOL BOOSTING SYSTEMS, LLC	L	
This international search report has been according to Article 18. A copy is being This international search report consists of the select accompanied 1. Basis of the Report a. With regard to the language, the international accompanied b. With regard to any nucleotic 2. Certain claims were found 3. Unity of invention is lackin 4. With regard to the title, image: the text is approved as subming the text has been established 5. With regard to the abstract,	prepared by this International Searching Aut transmitted to the International Bureau. of a total of $\int_{-\infty}^{+\infty}$ sheets. by a copy of each prior art document cited in international search was carried out on the basis application in the language in which it was filed e international application into	hority and is transmitted to the applicant n this report. s of: , which is the language n (Rules 12.3(a) and 23.1(b)) e international application, see Box No. I.
the text is approved as subm the text has been established	itted by the applicant. , according to Rule 38.2(b), by this Authority a	s it appears in Box No. IV. The applicant
may, within one month from 6. With regard to the drawings ,	the date of mailing of this international search	report, submit comments to this Authority.
a. the figure of the drawings to be p	published with the abstract is Figure No. 1	
as suggested by the	approant.	st a figure.
as selected by this A	Authority, because this figure better characterize	es the invention.
b. none of the figures is to be p	ublished with the abstract.	·

Form PCT/ISA/210 (first sheet) (April 2005)

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	INTERNATIONAL SEARCH REPOR	RT	International appli	ication No.
			PCT/US07/74227	
A. CLAS IPC:	SIFICATION OF SUBJECT MATTER F02D 41/30(2006.01);F02B 1/08(2006.01)			
USPC: According to 1	123/1A,431,447,575 International Patent Classification (IPC) or to both nat	tional classificat	ion and IPC	
B. FIELD	DS SEARCHED			
Minimum doc U.S. : 12	cumentation searched (classification system followed b 3/1A,300,304,431,447,478,575,577,198C,198A	oy classification	symbols)	
Documentatio	on searched other than minimum documentation to the	extent that such	documents are included in	the fields searched
Electronic dat Please See Co	a base consulted during the international search (name ontinuation Sheet	e of data base an	d, where practicable, search	h terms used)
C. DOCU	JMENTS CONSIDERED TO BE RELEVANT			-
Category *	Citation of document, with indication, where a	ppropriate, of th	e relevant passages	Relevant to claim No
Х	US 2007/0119416 A1 (Boyarski) 31 May 2007 (31.0	5.2007), figure	5 16, 17, 23, 28, 37, 44,	1-23, 26, 42-48, 56
Р, Y	paragraphs [0066], [0107]-[0117], [0284]-[0318], cla	aims 3, 5, 11, 1	5.	24,25,27-41,49-55
x	US 2002/01393321 A1 (Weissman et al.) 3 October 2 [00221-[0046].	2002 (03.10.20	02), figure 2, paragraphs	24-25, 27-56
Further	documents are listed in the continuation of Box C.	See	patent family annex.	
Further	documents are listed in the continuation of Box C.	See	patent family annex. r document published after the inte	emational filing date or priorit
Further Sp 'A" document	documents are listed in the continuation of Box C. secial categories of cited documents: defining the general state of the art which is not considered to be of relevance	T" late data prir	patent family annex. r document published after the inte and not in conflict with the applic ciple or theory underlying the inve	emational filing date or priorit ation but cited to understand ntion
Further Sp A" document particular E" earlier app	documents are listed in the continuation of Box C. secial categories of cited documents: defining the general state of the art which is not considered to be of relevance plication or patent published on or after the international filing date	"T" late data prir "X" doco con who	patent family annex. r document published after the inte and not in conflict with the applic iciple or theory underlying the inve ument of particular relevance; the o sidered novel or cannot be conside in the document is taken alone	emational filing date or priorit ation but cited to understand ention claimed invention cannot be red to involve an inventive sto
Further Further 'A" document particular 'E" earlier app 'L" document establish u specification	documents are listed in the continuation of Box C. pecial categories of cited documents: defining the general state of the art which is not considered to be of relevance slication or patent published on or after the international filing date which may throw doubts on priority claim(s) or which is cited to he publication date of another citation or other special reason (as referring to an oral disclosure, use exhibition or other means	"T" late data prir "X" doc con whe "Y" doc con con con con con con con con	patent family annex. r document published after the inte and not in conflict with the applic iciple or theory underlying the inve ument of particular relevance; the <i>i</i> sidered novel or cannot be conside ument of particular relevance; the <i>i</i> sidered to involve an inventive step bined with one or more other suct	emational filing date or priorit ation but cited to understand intion claimed invention cannot be red to involve an inventive ste claimed invention cannot be p when the document is t documents, such combinatio e art
Further Further 'A'' document particular 'E'' earlier app 'L'' document 'Specified) 'O'' document 'P'' document	documents are listed in the continuation of Box C. pecial categories of cited documents: defining the general state of the art which is not considered to be of relevance plication or patent published on or after the international filing date which may throw doubts on priority claim(s) or which is cited to he publication date of another citation or other special reason (as referring to an oral disclosure, use, exhibition or other means published prior to the international filing date but later than the te claimed	"Y" doc "T" late data prir "X" doc con whe "Y" doc con bein "&" doc	patent family annex. r document published after the inte and not in conflict with the applic iciple or theory underlying the inve ument of particular relevance; the e sidered novel or cannot be conside in the document is taken alone ument of particular relevance; the e sidered to involve an inventive step ibined with one or more other such ag obvious to a person skilled in th ument member of the same patent	emational filing date or priorit ation but cited to understand intion claimed invention cannot be red to involve an inventive stu claimed invention cannot be p when the document is i documents, such combinatio e art family
Further Further Further Furticular l Furticular l Furticular l Furticular l Furticular l Furticular l Further	documents are listed in the continuation of Box C. secial categories of cited documents: defining the general state of the art which is not considered to be of relevance stication or patent published on or after the international filing date which may throw doubts on priority claim(s) or which is cited to he publication date of another citation or other special reason (as referring to an oral disclosure, use, exhibition or other means published prior to the international filing date but later than the te claimed trual completion of the international search	"T" late data data prir "X" doc con wha "Y" doc con con bein "&" doc con con con bein "E" doc con con con con con con con con con c	patent family annex. r document published after the inte and not in conflict with the applic iciple or theory underlying the inve ument of particular relevance; the 4 sidered novel or cannot be conside an the document is taken alone ument of particular relevance; the 4 sidered to involve an inventive step ument of particular relevance; the 4 sidered to involve an inventive step ument of particular relevance; the 4 sidered to involve an inventive step ument of particular relevance; the 4 sidered to involve an inventive step ument of particular relevance; the 4 sidered to involve an inventive step ument of particular relevance; the 4 sidered to involve an inventive step the formation of the same patent and of the integrational secard	emational filing date or priorit ation but cited to understand intion claimed invention cannot be red to involve an inventive ste claimed invention cannot be p when the document is documents, such combinatio e art family ch report
Further Further Comparison Functional of Functional of Functi	documents are listed in the continuation of Box C. recial categories of cited documents: defining the general state of the art which is not considered to be of relevance stication or patent published on or after the international filing date which may throw doubts on priority claim(s) or which is cited to he publication date of another citation or other special reason (as referring to an oral disclosure, use, exhibition or other means published prior to the international filing date but later than the te claimed stual completion of the international search 2007 (07.12.2007)	"T" late data prin "X" doc con who "Y" doc con con bei "&" doc Con Con Date of mailin 2 5 F	patent family annex. r document published after the inte and not in conflict with the applic ciple or theory underlying the inve ument of particular relevance; the sidered novel or cannot be conside en the document is taken alone ument of particular relevance; the of sidered to involve an inventive step ibined with one or more other such ag obvious to a person skilled in th ument member of the same patent ag of the international searce E 2008	emational filing date or priorit ation but cited to understand intion claimed invention cannot be red to involve an inventive sto claimed invention cannot be p when the document is documents, such combinatio e art family ch report
Further Further Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Comparison Further Fur	documents are listed in the continuation of Box C. recial categories of cited documents: defining the general state of the art which is not considered to be of relevance stication or patent published on or after the international filing date which may throw doubts on priority claim(s) or which is cited to he publication date of another citation or other special reason (as referring to an oral disclosure, use, exhibition or other means published prior to the international filing date but later than the te claimed itual completion of the international search 2007 (07.12.2007) iling address of the ISA/US I Stop PCT, Attra: ISA/US	"T" late data prir "X" doc con what "Y" doc con what "Y" doc con con bein "&" doc con con bein "&" doc con stephen K C	patent family annex. r document published after the inte and not in conflict with the applici- ciple or theory underlying the inve- ument of particular relevance; the of- sidered novel or cannot be conside an the document is taken alone ument of particular relevance; the of- sidered to involve an inventive step- abined with one or more other such g obvious to a person skilled in th- ument member of the same patent The of the integnational searce EB 2008 fficer ronin Maxwell	emational filing date or priorit ation but cited to understand intion claimed invention cannot be red to involve an inventive ste claimed invention cannot be o when the document is a documents, such combinatio e art family ch report
Further * Sp *A" document particular *E" earlier app *L" document establish ti specified) *O" document P" document prorivty da Date of the ac 07 December Name and mai Com P.O. Alex	documents are listed in the continuation of Box C. recial categories of cited documents: defining the general state of the art which is not considered to be of relevance stication or patent published on or after the international filing date which may throw doubts on priority claim(s) or which is cited to he publication date of another citation or other special reason (as referring to an oral disclosure, use, exhibition or other means published prior to the international filing date but later than the te claimed tual completion of the international search 2007 (07.12.2007) iling address of the ISA/US 1 Stop PCT, Attn: ISA/US trunsisioner for Patents Box 1450 candria, Virginia 22313-1450	T" late datu prir "X" doc con wh "Y" doc con con bei "&" doc con bei "&" doc con con bei "&" doc con con bei Stephen K C Telephone No	patent family annex. r document published after the inte e and not in conflict with the applic ciple or theory underlying the inve ument of particular relevance; the e sidered to involve an inventive step thind with one or more other such ag obvious to a person skilled in th ument member of the same patent ag of the international searce EB 2008 Efficer ronin Macoument o, (571) 272-4383	rmational filing date or priorit ation but cited to understand i ntion claimed invention cannot be red to involve an inventive sto claimed invention cannot be p when the document is n documents, such combination e art family ch report

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PATENT COOPERATION TREATY

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From the INTERNATIONAL SEARCHING AUT	IORITY		
To: SAM PASTERNACK CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110		. WF	PCT RITTEN OPINION OF THE
		INTERNATI	ONAL SEARCHING AUTHOR ITY
			(PCT Rule 43bis.1)
		Date of mailing (day/month/year)	25 FEB 2008
Applicant's or agent's file reference		FOR FURTHER	ACTION
2006734-0015			See paragraph 2 below
International application No.	International filing date	(day/month/year)	Priority date (day/month/year)
PCT/US07/74227	24 July 2007 (24.07.200	7)	24 July 2006 (24.07.2006)
International Patent Classification (IPC)	or both national classificat	ion and IPC	
IPC: F02D 41/30(2006.01); F02B	1/08(2006.01)	-	
Applicant			
ETHANOL BOOSTING SYSTEMS, L	LC		
1. This opinion contains indications re	lating to the following item	IS:	
Box No. I Basis of the	e opinion		
Box No. II Priority			
Box No. III Non-estab	lishment of opinion with re	gard to novelty, inve	ntive step and industrial applicability
Box No. IV Lack of ur	ity of invention		
Box No. V Reasoned applicability	statement under Rule 43 <i>bis</i> ty; citations and explanatio	.1(a)(i) with regard to ns supporting such st	o novelty, inventive step or industrial tatement
Box No. VI Certain do	cuments cited		
Box No. VII Certain de	fects in the international ap	plication	
Box No. VIII Certain ob	servations on the internatio	nal application	
2. FURTHER ACTION			
If a demand for international preli International Preliminary Examini Authority other than this one to be that written opinions of this Interna	minary examination is main ng Authority ("IPEA") ex the IPEA and the chosen tional Searching Authority	de, this opinion will kcept that this does IPEA has notified th will not be so consid	be considered to be a written opinion of the s not apply where the applicant chooses an he International Bureau under Rule $66.1bis(b)$ ered.
If this opinion is, as provided abore IPEA a written reply together, when of Form PCT/ISA/220 or before the	ve, considered to be a writ re appropriate, with amend expiration of 22 months fr	ten opinion of the I lments, before the ex rom the priority date,	PEA, the applicant is invited to submit to the piration of 3 months from the date of mailing whichever expires later.
For further options, see Form PCT/	(SA/220.		
3. For further details, see notes to For	n PCT/ISA/220.		
Name and mailing address of the ISA/I	JS Date of comple	tion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450	18 February 20	008 (18.02.2008)	Stephen K Cronin Juno Atta
Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201			Telephone No. (571) 272-4383
Form DCT/ISA /227 (nover sheet) (April 2	007)		

Form PCT/ISA/237 (cover sheet) (April 2007)

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v	VRITTEN	OPINION	OF	THE
FERNA	TIONAL	SEARCHI	NG A	AUTHORITY

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International application No.

PCT/US07/74227

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INTERNATIONAL SEARCHING AUTHORITY	PCT/US07/74227
Box No. I Basis of this opinion	
. With regard to the language, this opinion has been established on the basis of:	
the international application in the language in which it was filed	1
a translation of the international application into, which is the lan	guage of a translation furnished for the purposes of
This opinion has been established taking into account the rectification of	of an obvious mistake authorized by or notified to this
Authority under Rule 91 (Rule 43 <i>bis</i> .1(a))	the international application this opinion has been
established on the basis of:	
a. type of material	
a sequence listing	
table(s) related to the sequence listing	
b. format of material	
on paper	
in electronic form	
_	
c. time of filing/furnishing	
contained in the international application as filed.	
filed together with the international application in electronic form	n
furnished subsequently to this Authority for the purposes of searc	h.
In addition in the case that more than one version or conv. of a sequence	e licting and/or table(s) relating thereto has been filed
or furnished, the required statements that the information in the subset application as filed or does not go beyond the application as filed, as ap	equent or additional copies is identical to that in the propriate, were furnished.
Additional comments:	

Form PCT/ISA/237(Box No. I) (April 2007)

Box No. V Reasoned statement under Rule applicability; citations and expl	e 43 <i>bis</i> .1(a)(i) with reg anations supporting su	ard to novelty, inventive step ch statement	or industrial
1. Statement			
Novelty (N)	Claims 1-56		YES
	Claims NONE		NO
Inventive step (IS)	Claims <u>1-56</u>		YES
	Claims <u>NONE</u>		NO
Industrial applicability (IA)	Claims <u>1-56</u>		YES
	Claims <u>NONE</u>		NO
2 Citations and explanations:		_	
2. Citations and explanations. Claims 1-56 meet the criteria set out in PCT Article	e 33(2)-(3), because the pri	or art does not teach or fairly sugg	gest the claimed
invention.			
Claim 1-56 meet the criteria set out in PCT Article	33(4), and thus have indust	rial applicability because the subj	ect matter claimed can
be made or used in industry.			,
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Form PCT/ISA/237 (Box No. V) (April 2007)

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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY	
To: SAM PASTERNACK Choate, Hall & Stewart LLP	PCT
Two International Place Boston, Massachusetts 02110 Amend Cloim Cite Artin S. Action: Resp to Writh. Opin.	NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION
Due Date	(PCT Rule 44.1)
Final Due Date Date NHDate: 1018	Date of mailing month year n 3° OCT 2008
Applicant's or agent's file reference	TO EXISTING A CTION See paragraphs 1 and 4 below
2006734-0021	FOR FURTHERACTION See paragraphs 1 and 4 below
International application No. PCT/US2008/069171	International filing date (day-month year) 03 July 2008
Applicant ETHANOL BOOSTING SYSTEMS LLC	
The applicant is hereby notified that the international se Authority have been established and are transmitted her	earch report and the written opinion of the International Searching ewith. 9.
The applicant is entitled, if he so wishes, to amend the or When? The time limit for filing such amendmen international search report.	laims of the international application (see Rule 46): nts is normally two months from the date of transmittal of the
Where? Directly to the International Bureau of WII 1211 Geneva 20, Switzerland, Facsimile N	PO, 34 chemin des Colombettes Io.: +41 22 740 14 35 accompanying sheet.
 The applicant is hereby notified that no international Article 17(2)(a) to that effect and the written opinion of 	search report will be established and that the declaration under f the International Searching Authority are transmitted herewith.
3 With regard to the protest against payment of (an) ad	ditional fee(s) under Rule 40.2, the applicant is notified that:
the protest together with the decision thereon h applicant's request to forward the texts of both t	has been transmitted to the International Bureau together with the the protest and the decision thereon to the designated Offices.
no decision has been made yet on the protest; th	he applicant will be notified as soon as a decision is made.
4. Reminders Shortly after the expiration of 18 months from the prior International Bureau. If the applicant wishes to avoid or p application, or of the priority claim, must reach the Internatio before the completion of the technical preparations for intern	ity date, the international application will be published by the postpone publication, a notice of withdrawal of the international nal Bureau as provided in Rules 90 <i>bis</i> .1 and 90 <i>bis</i> .3, respectively, ational publication.
The applicant may submit comments on an informal basis on International Bureau. The International Bureau will send international preliminary examination report has been or is to the public but not before the expiration of 30 months from th	the written opinion of the International Searching Authority to the a copy of such comments to all designated Offices unless an b be established. These comments would also be made available to e priority date.
Within 19 months from the priority date, but only in respect of examination must be filed if the applicant wishes to postpone date (in some Offices even later); otherwise, the applicant mu acts for entry into the national phase before those designated	of some designated Offices, a demand for international preliminary the entry into the national phase until 30 months from the priority ist, within 20 months from the priority date, perform the prescribed Offices.
In respect of other designated Offices, the time limit of 30 months.	months (or later) will apply even if no demand is filed within 19
See the Annex to Form PCT/IB/301 and, for details about the <i>Guide</i> , Volume II, National Chapters and the WIPO Internet	e applicable time limits, Office by Office, see the <i>PCT Applicant's</i> site.
Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Alth: ISA/US Commissioner for Patents	Blaine R. Copenheaver
Facsimile No. 571-273-3201	Telephone No. 571-272-7774

Form PCT/ISA/220 (January 2004)

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(See notes on accompanying sheet)

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0021	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No.	International filing date (day/month/)	ear) (Earliest) Priority Date (day/month/year)
PCT/US2008/069171	03 July 2008	10 July 2007
Applicant ETHANOL BOOSTING SYSTEMS LLC		
This international search report has be according to Article 18. A copy is bein This international search report consists It is also accompanied by a 1. Basis of the report a. With regard to the language, th the international app a translation of the i of a translation furn b. With regard to any nucleo 2. Certain claims were four 3. Unity of invention is lack 4. With regard to the title, the text is approved as sul	en prepared by this International Sear g transmitted to the International Bure of a total of <u>3</u> sheets. a copy of each prior art document cited e international search was carried out of blication in the language in which it was international application into <u>sheets</u> ished for the purposes of international tide and/or amino acid sequence disc and unsearchable (see Box No. II) king (see Box No. III)	ching Authority and is transmitted to the applicant in this report. on the basis of: s filed , which is the language search (Rules 12.3(a) and 23.1(b)) closed in the international application, see Box No. 1.
 5. With regard to the abstract, the text is approved as su the text is approved as su the text has been establismay, within one month fr 6. With regard to the drawings, a. the figure of the drawings to has suggested by the as selected by this as selected by this b. none of the figures is to have 	be by this Authority to read as follows be be applicant hed, according to Rule 38.2(b), by this om the date of mailing of this internati be published with the abstract is Figure c applicant Authority, because the applicant failed Authority, because this figure better cl be published with the abstract	Authority as it appears in Box No. IV. The applicant onal search report, submit comments to this Authority No. 1

Form	PCT/ISA	/210	(first	sheet)	(A	pril 2005))
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		International application No
	INTERNATIONAL SEARCH REFORT	
		PC1/0S2008/069171
Box No. 1	I Observations where certain claims were found unsearchable (Continu	uation of item 2 of first sheet)
This inter	national search report has not been established in respect of certain claims unde	er Article 17(2)(a) for the following reasons:
1.	Claims Nos.: because they relate to subject matter not required to be searched by this Author	rity, namely:
2.	Claims Nos.: because they relate to parts of the international application that do not comply extent that no meaningful international search can be carried out, specifically:	with the prescribed requirements to such an
3.	Claims Nos.: 15-17, 31-33 because they are dependent claims and are not drafted in accordance with the	second and third sentences of Rule 6.4(a).
Box No.	III Observations where unity of invention is lacking (Continuation of ite	m 3 of first sheet)
This Isto	metional Searching Authority found multiple inventions in this international ap	plication, as follows:
This line		
1.	As all required additional search fees were timely paid by the applicant, this it claims.	nternational search report covers all searchable
2.	As all searchable claims could be searched without effort justifying additiona additional fees.	I fees, this Authority did not invite payment of
3.	As only some of the required additional search fees were timely paid by the a only those claims for which fees were paid, specifically claims Nos.:	pplicant, this international search report covers
4.	No required additional search fees were timely paid by the applicant. Co restricted to the invention first mentioned in the claims; it is covered by claim	nsequently, this international search report is ms Nos.:

The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee. The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation. No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.	
PCT/US2008/069171	

			1 017002000		
A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - F02B 77/04 (2008.04) USPC - 123/198A According to International Patent Classification (IPC) or to both national classification and IPC					
B. FIELI	DS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) IPC(8) - F02B 77/04 (2008.04) USPC - 123/198A, 406.29, 435					
Documentati	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) MicroPatent, DialogPro, IP.com					
C. DOCUI	MENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where app	ropriate, of the relev	ant passages	Relevant to claim No.	
Y	US 7,225,787 B2 (BROMBERG et al) 05 June 2007 (05.	.06.2007) entire docu	iment	1-14, 18-30, 34-35	
Y	US 2006/0102145 A1 (COHN et al) 18 May 2006 (18.05	.2006) entire docume	ent	1-14, 18-30, 34-35	
Y	US 6,561,157 B2 (ZUR LOYE et al) 13 May 2003 (13.05.2003) entire document		6, 23, 35		
А	US 3,557,763 A (PROBST) 26 January 1971 (26.01.1971) entire document		1-35		
А	US 4,056,087 A (BOYCE) 01 November 1977 (01.11.19	177) entire document		1-35	
A	US 4,230,072 A (NOGUCHI et al) 28 October 1980 (28.	10.1980) entire docu	iment	1.35	
А	US 4,594,201 A (PHILLIPS et al) 10 June 1986 (10.06.1	1986) entire documer	nt	1 25	
А	US 5,179,923 A (TSURUTANI et al) 19 January 1993 (1	(9.01.1993) entire do		1 35	
A	US 7,156,070 B2 (STROM et al) 02 January 2007 (02.0	1.2007) entire docur	nent	1-35	
A	US 2007/0119421 A1 (LEWIS et al) 31 May 2007 (31.05.2007) entire document			1-35	
А	US 2007/0125321 A1 (RITTER) 07 June 2007 (07.06.2007) entire document		1-00		
	her documents are listed in the continuation of Box C.				
* Specia	al categories of cited documents:	"T" later document	published after the inte	rnational filing date or priority cation but cited to understand	
"A" docum to be o	then the fining the general state of the art which is not considered of particular relevance	the principle or	theory underlying the articular relevance; the	invention claimed invention cannot be	
"E" earlier filing	application of patent but published on of after the mentational date application by throw doubts on priority claim(s) or which is	considered nov step when the o	el or cannot be considered de considered de considered de constant de constant de considered de constant de	dered to involve an inventive	
cited specia	to establish the publication date of another citation or other al reason (as specified) nent referring to an oral disclosure, use, exhibition or other	"Y" document of p considered to combined with being obvious	articular relevance; the involve an inventive one or more other such to a person skilled in t	e claimed invention cannot be step when the document is a documents, such combination he art	
"P" docum	document published prior to the international filing date but later than "&" document member of the same patent family the priority date claimed				
Date of the actual completion of the international search		Date of mailing of the international search report			
25 September 2008		03 OCT	2008		
Name and mailing address of the ISA/US		Authorized officer: Blaine B. Conenheaver			
Mall Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774			
1					

Form PCT/ISA/210 (second sheet) (April 2005)

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PATENT COOPERATION TREATY

^{To:} SAM PASTERNACK Choate, Hall & Stewart LLP Two International Place Boston, Massachusetts 02110	PCT WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY			
		(PCT Rule 43 <i>bis</i> .1)		
	Date of mailing $(day/month/year)$ Λ \mathfrak{F} Ω Γ \mathfrak{T} 2008			
Applicant's or agent's file reference 2006734-0021	FOR FURTHER ACTION See paragraph 2 below			
International application No. International filing da PCT/US2008/069171 03 July 2008	ate (day:month/year)	Priority date (day month year) 10 July 2007		
International Patent Classification (IPC) or both national classifi IPC(8) - F02B 77/04 (2008.04) USPC - 123/198A	ication and IPC			
Applicant ETHANOL BOOSTING SYSTEMS LLC				
1. This opinion contains indications relating to the following items:				
Name and mailing address of the ISA/US Date of completion Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 25 September Eascimile No. 571-273-3201 571-273-3201	of this opinion 2008	Authorized officer: Blaine Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774		

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/US2008/069171
Box No. I Basis of this opinion	
 With regard to the language, this opinion has been established on the basis of: the international application in the language in which it was filed. a translation of the international application into	which is the language of a and 23.1(b)).
2. This opinion has been established taking into account the rectification of an to this Authority under Rule 91 (Rule 43 <i>bis</i> .1(a))	obvious mistake authorized by or notified
 3. With regard to any nucleotide and/or amino acid sequence disclosed in the internestablished on the basis of: a. type of material a sequence listing table(s) related to the sequence listing 	national application, this opinion has been
b. format of material on paper in electronic form	
 c. time of filing/furnishing contained in the international application as filed filed together with the international application in electronic form furnished subsequently to this Authority for the purposes of search 	•
4. In addition, in the case that more than one version or copy of a sequence listifiled or furnished, the required statements that the information in the subsequired in the application as filed or does not go beyond the application as filed, as	ing and/or table(s) relating thereto has been uent or additional copies is identical to that appropriate, were furnished.
5. Additional comments:	

Form PCT/ISA/237 (Box No. I) (April 2007)

41
WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/US2008/069171
Box No. III Non-establishment of opinion with regard to novelty, in	ventive step and industrial applicability
The questions whether the claimed invention appears to be novel, to involv applicable have not been examined in respect of	e an inventive step (to be non obvious), or to be industrially
the entire international application	
claims Nos. 15-17, 31-33	
because:	relate to the following
subject matter which does not require an international search (sp	ecify):
the description, claims or drawings (indicate particular elements are so unclear that no meaningful opinion could be formed (speci	<i>below)</i> or said claims Nos. <u>15-17, 31-33</u> fy):
Claims 15-17, 31-33 are multiple dependent claims not drafted in accordance	e with the second and third sentences of Rule 6.4(a).
· · ·	
· · ·	
the claims or said claims Nos	are so inadequately supported
by the description that no meaningful opinion could be formed (specify):
no international search report has been established for said clain	ns Nos. <u>15-17, 31-33</u>
a meaningful opinion could not be formed without the sequence	isting; the applicant did not, within the prescribed time limit:
furnish a sequence listing on paper complying with the	e standard provided for in Annex C of the Administrative
Instructions, and such listing was not available to the Inter- to it.	national Searching Authority in a form and manner acceptable
furnish a sequence listing in electronic form complying wi	th the standard provided for in Annex C of the Administrative
to it.	lational searching Autority in a form and mainer acceptable
pay the required late furnishing fee for the furnishing Rule 13 <i>ter</i> . 1(a) or (b).	of a sequence listing in response to an invitation under
a meaningful opinion could not be formed without the tables rela	ated to the sequence listings; the applicant did not, within the
prescribed time limit, furnish such tables in electronic form (complying with the technical requirements provided for in were not available to the International Scarching Authority in
a form and manner acceptable to it.	
the tables related to the nucleotide and/or amino acid sequence technical requirements provided for in Annex C-bis of the Adm	e listing, if in electronic form only, do not comply with the inistrative Instructions.
See Supplemental Box for further details.	

Form PCT/ISA/237 (Box No. III) (April 2007)

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WRITTEN OPINION OF THE International application No. INTERNATIONAL SEARCHING AUTHORITY PCT/US2008/069171					
Box No. V	Reasoned statement un citations and explanati	ider Rule 43/ ons supporti	bis.1(a)(i) with regard to nov ng such statement	elty, inventive step or industrial applic	ability;
1. Stateme	ent				
Nov	elty (N)	Claims	1-14, 18-30, 34-35		YES
		Claims	None		NO
Inve	ntive sten (IS)	Claims	None		YES
mve		Claims	1-14, 18-30, 34-35		NO
		a	1 14 19 20 24 25		VEC
Indu	strial applicability (IA)	Claims	None		NO
2. Citation Claims 1-5, 7-	is and explanations: 14, 18-22, 24-30, and 34 la	ck an inventiv	e step under PCT Article 33(3) as being obvious over Bromberg et al. in	view of
Into the cylinde engine (18); a provided in an ines 45-55). E needed to pre- a fast burn. CC provided in an was made to a Bromberg et a Regarding cla burn occurs in (burn) occurs Regarding cla lines 45-55) in Regarding cla lines 45-55) in early in the cy Regarding cla ignition sites o sites can be o Regarding cla second fuel is al. show wher near the peripor art to employ I performance.	ers of the engine (18); inject fuel management control s amount needed to prevent iromberg et al. do not show vent knock as torque increa- ohn et al. show a fuel mana amount needed to prevent a person having ordinary sk I. in order to provide improv- im 2, Bromberg et al. and C 15-20 crank angle degrees in a small crank angle rang im 3, Bromberg et al. and C the engine is provided by of the	tors for direct ystem (Col. 1 knock (Fig. 3 c controlling in ases; and a m gement contr knock as torc ill in the art to ved engine pe Cohn et al. dis s. It is obvious e including th Cohn et al. dis charge motior Cohn et al. dis charge motior Cohn et al. dis charge motior Cohn et al. dis but show two promote com Cohn et al. dis on the exhau s a inthe exhau s a inthe dowal d have been c as a staught b	injection of the second liquid f , lines 45-50) for controlling inj) as other conditions require; a jection of the second fuel into i eans for providing fast burn. It ol system (14) for controlling in que increases (paragraph 32), employ the structures and pro- rformance. close that as applied above. B from Bromberg et al. (Figs. 2, at claimed. close that as applied above. B (Col. 10, lines 15-20). close that as applied above. B (Col. 10, lines 15-20). close that as applied above. B perature (Col. 4, lines 1-10) in es 30-45). close that as applied above. B o ignition sources (Col. 1, lines plete combustion. close that as applied above. B st valve side of the cylinder and rd an end gas on an exhaust v bovious at the time the inventio y Cohn et al. in the device of E	uel (Col. 11, lines 23-50) into the cylinders ection of the second fuel into the cylinder s and a means for providing fast flame speec the cylinder so that it is provided in an amo is deemed obvious that a fast flame speec njection of a second fuel into a cylinder so it would have been obvious at the time the bocesses as taught by Cohn et al. in the dev romberg et al. do not show where the 10% A-2B) that a significant portion of the energy romberg et al. show where the fast burn (C romberg et al. show where the fast burn (C romberg et al. show where the fast burn (C the unburned zone of air/fuel mixture zon romberg et al. do not show where there ar 13-15, Col. 6, lines 23-30). It is obvious the romberg et al. do not show where the sprad d the injector is located near the periphery alve side of the cylinder and an injector is mas made to a person having ordinary s Bromberg et al. in order to provide improve	s of the so that it is d (Col. 10, bunt d produces that it is e invention vice of 6 - 90% gy fraction Col. 10, Col. 10, col. 10, e that burns re dual nat the dual ay of the . Cohn et located kill in the ed engine
Regarding cla injection of the	im 8, Bromberg et al. and C e second fuel is adjusted to	Cohn et al. dis minimize the	close that as applied above. B ethanol consumption (Col. 6, I	romberg et al. show where the time of the ines 48-52, Col. 10, lines 25-35).	direct
Regarding cla created at or r been obvious taught by Coh	im 9, Bromberg et al. and C near the intake port. Cohn e at the time the invention wa n et al. in the device of Bro	Cohn et al. dis et al. show wh as made to a p mberg et al. ir	close that as applied above. B ere turbulence is created at or person having ordinary skill in i n order to provide improved en	romberg et al. do not show where turbulen near an intake port (paragraph 28). It wou the art to employ the structures and proces gine performance.	nce is Ild have sses as
Regarding cla by means of s	im 10, Bromberg et al. and park retard relative to what	Cohn et al. di it would be if	sclose that as applied above. I fast burn were not employed (Bromberg et al. show where combustion is Col. 8, lines 20-25).	s retarded
Regarding cla measured by t spark retard (0	im 11, Bromberg et al. and the 50% burn crank angle, Col. 8, lines 20-25). It is dee	Cohn et al. di is retarded us emed obvious	sclose that as applied above. ing appropriate spark retard by that spark retard is a small bu	Bromberg et al. do not show where combu y an amount between 5 and 10 degrees bu t significant amount including that claimed	istion, as ut show I.
(Continued in	Supplemental Box)				

Form PCT/ISA/237 (Box No. V) (April 2007)

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Supplemental Box
In case the space in any of the preceding boxes is not sufficient. Continuation of: Box V
Regarding claim 12, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where the amount of second fuel that is used is reduced when the fast burn is provided (Col. 3, lines 25-30).
Regarding claim 13, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where the amount of combustion retard is varied as a function of load (Col. 1, lines 20-25) and speed by means of appropriate spark retard (Col. 8, lines 20-25).
Regarding claim 14, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where the degree of combustion retard is chosen so as to optimize the combination of efficiency gain and minimization of the required amount of the second fluid fuel. Cohn et al. show where a degree of combustion retard is chosen so as to optimize the combination of efficiency gain and minimization of the required amount of the second fluid fuel (Fig. 5, paragraphs 14 and 35). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. in the device of Bromberg et al. in order to provide improved engine performance.
Regarding claim 18, Bromberg et al. disclose a fuel management system for a spark ignition gasoline engine (Abstract) comprising: a gasoline engine (18) of compression ratio between 13 and 14 (Col. 7, lines 55-60); a source of a second liquid fuel (Fig. 4a); a means for introducing gasoline (Fig. 4b) into the cylinders of the engine (18); injectors for direct injection of the second liquid fuel (Col. 11, lines 23-50) into the cylinder so that it is provided in an amount needed to prevent knock (Fig. 3) as torque increases or other conditions require; and a means for fast flame speed (Col. 10, lines 45-55). Bromberg et al. do not show controlling injection of the second fuel into the cylinder so that it is provided in an amount needed to prevent knock (Fig. 3) as torque increases or other conditions require; so that it is provided in an amount needed to prevent knock (Fig. 3) as torque increases or other conditions require; so that it is provided in an amount needed to prevent knock as torque increases; and a means for fast flame speed produces a fast burn. Cohn et al. show a fuel management control system (14) for controlling injection of a second fuel into a cylinder so that it is provided in an amount needed to prevent knock as torque increases; and a means for for the second fuel into the second fuel into a cylinder so that it is provided in an amount needed to prevent knock as torque increases (paragraph 32). It is deemed obvious that a fast flame speed produces a fast burn. Cohn et al. show a fuel management control system (14) for controlling injection of a second fuel into a cylinder so that it is provided in an amount needed to prevent knock as torque increases (paragraph 32). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. In the device of Bromberg et al. In order to provide improved engine performance.
Regarding claim 19, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where the 10% - 90% burn occurs in 15-20 crank angle degrees. It is obvious from Bromberg et al. (Figs. 2A-2B) that a significant portion of the energy fraction (burn) occurs in a small crank angle range including that claimed.
Regarding claim 20, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where the fast burn (Col. 10, lines 45-55) in the engine is provided by charge motion (Col. 10, lines 15-20).
Regarding claim 21, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where the fast burn (Col. 10, lines 45-55) in the engine is provided by increased temperature (Col. 4, lines 1-10) in the unburned zone of air/fuel mixture zone that burns early in the cycle after the firing of the spark (Col. 4, lines 30-45).
Regarding claim 22, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where there are dual ignition sites on either side of the cylinder but show two ignition sources (Col. 1, lines 13-15, Col. 6, lines 23-30). It is obvious that the dual sites can be on opposite cylinder sides to promote complete combustion.
Regarding claim 24, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where the spray of the second fuel is aimed toward the end gas on the exhaust valve side of the cylinder. Cohn et al. show where spray of the second fuel is aimed toward an end gas on the exhaust valve side of the cylinder (paragraph 7). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. in the device of Bromberg et al. in order to provide improved engine performance.
Regarding claim 25, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where turbulence is created at or near the intake port. Cohn et al. show where turbulence is created at or near an intake port (paragraph 28). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. in the device of Bromberg et al. in order to provide improved engine performance.
Regarding claim 26, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where combustion is retarded by means of spark retard relative to what it would be if fast burn were not employed (Col. 8, lines 20-25).
Regarding claim 27, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where combustion, as measured by the 50% burn crank angle, is retarded using appropriate spark retard by an amount between 5 and 15 degrees but show spark retard (Col. 8, lines 20-25). It is deemed obvious that spark retard is a small but significant amount including that claimed.
Regarding claim 28, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where the amount of second fuel that is used is reduced when the fast burn is provided (Col. 3, lines 25-30).
Regarding claim 29, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where the amount of combustion retard is varied as a function of load (Col. 1, lines 20-25) and speed by means of appropriate spark retard (Col. 8, lines 20-25)
(Continued in next Supplemental Box)
L Form PCT/ISA/237 (Supplemental Box) (April 2007)

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No. PCT/US2008/069171

Supplemental Box

In case the space in any of the preceding boxes is not sufficient. Continuation of:

Previous Supplemental Box

Regarding claim 30, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where the degree of combustion retard is chosen so as to optimize the combination of efficiency gain and minimization of the required amount of the second fluid fuel. Cohn et al. show where a degree of combustion retard is chosen so as to optimize the combination of efficiency gain and minimization of the required amount of the second fluid fuel. Cohn et al. show where a degree of combustion retard is chosen so as to optimize the combination of efficiency gain and minimization of the required amount of the second fluid fuel (Fig. 5, paragraphs 14 and 35). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. in the device of Bromberg et al. in order to provide improved engine performance.

Regarding claim 34, Bromberg et al. disclose a spark ignition gasoline engine (18) where alcohol and gasoline are both directly injected (Col. 1, lines 55-60) and where the alcohol/gasoline ratio needed to prevent knock uses fast burn. Bromberg et al. do not show where the alcohol/gasoline ratio needed to prevent knock is reduced by using fast flame speed. It is deemed obvious that a fast flame speed (Bromberg - Col. 10, lines 45-55) produces a fast burn. Cohn et al. show where an alcohol/gasoline ratio needed to prevent knock is reduced (paragraph 19). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. in the device of Bromberg et al. in order to provide improved engine performance.

Claims 6, 23, 35 lack an inventive step under PCT Article 33(3) as being obvious over Bromberg et al. in view of Cohn et al. and zur Loye et al.

Regarding claim 6, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where the direct injector is located in the center of the cylinder. zur Loye et al. show where a direct injector (62) is located in a center of a cylinder (Fig. 1). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. and zur Loye et al. in the device of Bromberg et al. in order to provide improved engine performance.

Regarding claim 23, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where the direct injector is located in the center of the cylinder. zur Loye et al. show where a direct injector (62) is located in a center of a cylinder (Fig. 1). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. and zur Loye et al. in the device of Bromberg et al. in order to provide improved engine performance.

Regarding claim 35, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. do not show where a high energy spark plug is used to provide fast burn. zur Loye et al. show where a high energy spark plug (52) is used to provide fast burn. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the structures and processes as taught by Cohn et al. and zur Loye et al. in the device of Bromberg et al. in order to provide improved engine performance.

Claims 1-14, 18-30, and 34-35 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Form PCT/ISA/237 (Supplemental Box) (April 2007)

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

- [Where originally there were 48 claims and after amendment of some claims there are 51]: "Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
- 2. [Where originally there were 15 claims and after amendment of all claims there are 11]: Claims 1 to 15 replaced by amended claims 1 to 11."
- 3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:

"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or "Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."

4. [Where various kinds of amendments are made]:

"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under Article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims. It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/IPEA/401).

If a demand for international preliminary examination is made, the written opinion of the International Searching Authority will, except in certain cases where the International Preliminary Examining Authority did not act as International Searching Authority and where it has notified the International Bureau under Rule 66.1*bis*(b), be considered to be a written opinion of the International Preliminary Examining Authority. If a demand is made, the applicant may submit to the International Preliminary Examining Authority a reply to the written opinion together, where appropriate, with amendments before the expiration of 3 months from the date of mailing of Form PCT/ISA/20 or before the expiration of 22 months from the priority date, whichever expires later (Rule 43*bis* 1(c)) PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later (Rule 43bis.1(c)).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see the PCT Applicant's Guide, Volume II.

Notes to Form PCT/ISA/220 (second sheet) (October 2005)

Electronic Patent Application Fee Transmittal					
Application Number:	12	020285			
Filing Date:	25.	Jan-2008			
Title of Invention:	OP	TIMIZED FUEL MAN HANCEMENT OF GA	IAGEMENT SYST ASOLINE ENGINE	EM FOR DIRECT IN S	JECTION ETHANOL
First Named Inventor/Applicant Name:	Leslie Bromberg				
Filer:	Sam Pasternack/Christina Andrews				
Attorney Docket Number:	0492611-0828(MITCON11381)				
Filed as Small Entity					
Utility under 35 USC 111(a) Filing Fees					
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:	Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:	Post-Allowance-and-Post-Issuance:				
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
	Tot	al in USD	(\$)	180

Electronic Acknowledgement Receipt				
EFS ID:	6574315			
Application Number:	12020285			
International Application Number:				
Confirmation Number:	1610			
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES			
First Named Inventor/Applicant Name:	Leslie Bromberg			
Customer Number:	24280			
Filer:	Sam Pasternack/Christina Andrews			
Filer Authorized By:	Sam Pasternack			
Attorney Docket Number:	0492611-0828(MITCON11381)			
Receipt Date:	04-DEC-2009			
Filing Date:	25-JAN-2008			
Time Stamp:	13:41:03			
Application Type:	Utility under 35 USC 111(a)			

Payment information:

Submitted wit	th Payment	yes			
Payment Type		Credit Card	Credit Card		
Payment was successfully received in RAM		\$180	\$180		
RAM confirmation Number		9579			
Deposit Account					
Authorized Us	ser				
File Listing	g:				
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1		Pernence ndf	136745 ves	Voc	7
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	Amendment/Req. Reconsiderati	Amendment/Req. Reconsideration-After Non-Final Reject			1
	Claims		2		4
	Applicant Arguments/Remarks	Made in an Amendment	5		7
Warnings:					
Information			11		
2	Transmittal Letter	IDS 12 04 09 pdf	112173	no	2
<u>_</u>	Hansmittal Letter	105_12_04_05.pdf	7fe6d0fb8b798fe5b3ff43b4a9cc922d158b c78e	10	
Warnings:			1		I
Information					
	Information Disclosure Statement (IDS)		137456		
	Filed (SB/08)	6ad50	6ad5057faa0857f42622617e323b780a4fa4 04f9		
Warnings:					
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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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	OR	First Named Inventor	Daniel	R. Cohn et al.	
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U.S. Patent an Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of	PTO/SB/96 (07-09) Approved for use through 07/31/2012. OMB 0651-0031 d Trademark Difice; U.S. DEPARTMENT OF COMMERCE information unless it displays a valid OMB control numbor.
STATEMENT UNDER 37 CFR 3.73(b)	· · ·
Applicant/Patent Owner Daniel R. Cohn et al.	
Application No./Patent No.: 12/020285 Filed/Issue Date:	01/25/2008
Titled: OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION GASOLINE ENGINES	ETHANOL ENHANCEMENT OF
Massachusetts Institute of Technology a Non-profit	
(Name of Assignee) (Type of Assignee, e.g., corporation	, partnership, university, government agency, etc.
states that it is:	
1. X the assignee of the entire right, title, and interest in;	
2. an assignee of less than the entire right, title, and interest in `(The extent (by percentage) of its ownership interest is%); or	
3. I the assignee of an undivided interest in the entirety of (a complete assignment fr	om one of the joint inventors was made)
the patent application/patent identified above, by virtue of either:	
A. X An assignment from the inventor(s) of the patent application/patent identified abit the United States Patent and Trademark Office at Reel 022365 , Fractory therefore is attached	ove. The assignment was recorded in the 0.720 , or for which a
OR	
B. A chain of title from the inventor(s), of the patent application/patent identified abo	ove, to the current assignee as follows:
1. From: To:	
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Reel, Frame, or for	r which a copy thereof is attached.
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Reel, Frame, or for	which a copy thereof is attached.
Additional documents in the chain of title are listed on a supplemental sheet(s).	
As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.	rom the original owner to the assignee was,
[NOTE: A separate copy (<i>i.e.</i> , a true copy of the original assignment document(s)) m accordance with 37 CFR Part 3, to record the assignment in the records of the USPT	ust be submitted to Assignment Division in D. <u>See</u> MPEP 302.08]
The undersigned (whose title is supplied below) is authorized to act on behalf of the assigned	e.
hannie Opnen	12/30/2009
Signature	Date
Daniel O'Brien	IP Manager
Printed or Typed Name	Title
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MIT Technical Licensing Office

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To:	Commissioner for Patents	From:	Maureen Joyce	
			Patent Docket Manager	
Fax:	571.273.8300	Pages:	Fifteen	
Phone:	617.258.6729	Date:	December 30, 2009	
Re:	Please reference below.	cc:	·	

Dear Sir:

Please process the Revocation of Power of Attorney document (PTO/SB/81) along with the required accompanying Statement Under 37 C.F.R. 3.73 (b) form (PTO/SB/96) for each of the following pending patent applications:

12/020285 12/563469 12/621425 11/758157 12/594766 12/488174 12/562766

Thank you for your assistance with these filings. Please contact me with any questions.

Sincerely,

Maureen A. Joyce

Dec 30 2009 4:52PM Technology Licensing Offi 617 258 6790

FORD Ex. 1126, page 161 IPR2020-00013

UNITED ST.	ates Patent and Tradema	RK OFFICE UNITED STA United States Address. COMMI PO. Box 1 Alexandi www.uspu	TES DEPARTMENT OF COMMERCE s Patent and Trademark Office SSIONER FOR PATENTS 450 a, Vingina 22313-1450 ogov
APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/020,285	01/25/2008	Leslie Bromberg	11381.106198
			CONFIRMATION NO. 1610
91197		POA ACC	EPTANCE LETTER
Technology Licensing Offi	ICE		
Masachusetts Institute of	Technology		
Five Cambridge Center		~(000000039626787*
Kendall Square			
Cambridge, MA 02142-14	93		

Date Mailed: 01/15/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/30/2009.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/hgray/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

page 1 of 1

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.	
12/020,285	01/25/2008	Leslie Bromberg	11381.106198	1610	
91197 Technology Li	7590 02/19/2010)	EXAM	INER	
Masachusetts I	nstitute of Technology		DUFF, DO	DUGLAS J	
Five Cambridg Kendall Square	e Center e		ART UNIT PAPER NUMBER		
Cambridge, M	A 02142-1493		3748		
			NOTIFICATION DATE	DELIVERY MODE	
			02/19/2010	ELECTRONIC	

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The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mitdocket@mit.edu mjoyce@mit.edu

	Application No.	Applicant(s)						
	12/020,285	BROMBERG ET AL.						
Office Action Summary	Examiner	Art Unit						
	DOUGLAS J. DUFF	3748						
The MAILING DATE of this communication appears on the cover sheet with the correspondence address Period for Reply								
A SHORTENED STATUTORY PERIOD FOR REPLY WHICHEVER IS LONGER, FROM THE MAILING D/ - Extensions of time may be available under the provisions of 37 CFR 1.1 after SIX (6) MONTHS from the mailing date of this communication. - If NO period for reply is specified above, the maximum statutory period v - Failure to reply within the set or extended period for reply will, by statute Any reply received by the Office later than three months after the mailing earned patent term adjustment. See 37 CFR 1.704(b).	 A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION. Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earmed patent term adjustment. See 37 CFR 1.704(b). 							
Status								
1) Responsive to communication(s) filed on $04 D$	ecember 2009.							
2a This action is FINAL . $2b$ This	action is non-final.							
3) Since this application is in condition for allowar	accept for formal matters pro	secution as to the merits is						
closed in accordance with the practice under E	x parte Quavle, 1935 C.D. 11, 45	53 O.G. 213.						
Disposition of Claims								
4)⊠ Claim(s) <u>1-5 and 7-14</u> is/are pending in the ap	olication.							
4a) Of the above claim(s) is/are withdraw	wn from consideration.							
5) Claim(s) is/are allowed.								
6)⊠ Claim(s) <u>1-5 and 9-14</u> is/are rejected.								
7)⊠ Claim(s) <u>7 and 8</u> is/are objected to.								
8) Claim(s) are subject to restriction and/o	r election requirement.							
Application Papers								
9) The specification is objected to by the Examine	r							
10) The drawing(s) filed on $is/are: a)$	(1)	= xaminer						
Applicant may not request that any objection to the	drawing(s) be held in abevance. Set	- 37 CER 1 85(a)						
Replacement drawing sheet(s) including the correct	ion is required if the drawing(s) is ob	i_{1} instant of the second tension of te						
11) The eath or declaration is objected to by the Ex	caminer Note the attached Office	Action or form PTO_{-152}						
Priority under 35 U.S.C. § 119								
12) Acknowledgment is made of a claim for foreign	priority under 35 U.S.C. § 119(a))-(d) or (f).						
a) All b) Some * c) None of:								
1. Certified copies of the priority document	s have been received.							
2. Certified copies of the priority document	s have been received in Applicati	on No						
3. Copies of the certified copies of the prior	rity documents have been receive	ed in this National Stage						
application from the International Bureau	ו (PCT Rule 17.2(a)).							
* See the attached detailed Office action for a list	* See the attached detailed Office action for a list of the certified copies not received.							
Attachment(s)		(PTO 442)						
2) Notice of References Cited (PTO-892)	4) 🔄 Interview Summary Paper No(s)/Mail Da	(FTU-413) ate.						
3) X Information Disclosure Statement(s) (PTO/SB/08)	5) Notice of Informal P	Patent Application						
Paper No(s)/Mail Date <u>12/4/09</u> .	6) 🗌 Other:							
U.S. Patent and Trademark Office PTOL-326 (Rev. 08-06) Office Ad	tion Summary Pa	rt of Paper No./Mail Date 20100209						

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This Office Action is in response to Applicant's request for reconsideration filed 12/4/09.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-5 and 9-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gray, Jr. et al. (US 6651432) in view of Mochizuki et al. (US 5131228). Regarding claims 1 and 5, Gray, Jr. et al. discloses a turbocharged (27) or supercharged spark ignition engine wherein a mixture is directly injected from a first source (23) and there is also a means for independently controlling fueling with gasoline from a second source (53) comprising a spark ignition engine; a turbocharger or supercharger; a means for directly injecting a gasoline mixture from the first source into at least one cylinder; a means for fueling the engine with gasoline from the second source; further wherein under some driving conditions the manifold pressure is greater than 2 bar (col. 8, lines 62-67); and wherein the engine is operated at a substantially stoichiometric fuel/air ratio during at least part the operating time (col. 10, lines 24-32). Gray, Jr. et al. discloses an ethanol-gasoline mixture to be directly injected (col. 10, lines 34-49), but fails to specifically disclose a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20 % and fails to disclose the

maximum level of pressure increase from the turbocharger is decreased when an ethanol/gasoline ratio is lowered.

3. Mochizuki et al. teaches a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20 % (Figure 4). It would have been obvious for a person having ordinary skill in the art at the time the invention was made to utilize an ethanol-gasoline mixture with an energy fraction of ethanol of at least 20% directly injected into the first source cylinder injector of Gray, Jr. et al. in order to avoid auto-ignition of the mixture of the supercharged engine of Gray, Jr. et al. (col. 4, lines 41-50).

4. Additionally, Mochizuki et al. teaches a supercharged engine wherein the maximum level of pressure increase from the supercharger is decreased when an ethanol/gasoline ratio is lowered (col. 4, lines 41-50). It would have been obvious for a person having ordinary skill in the art at the time the invention was made to utilize the lowering of maximum supercharger pressure when the ethanol/gasoline ratio is lowered in order to avoid engine knock due to the lowering of octane of the fuel mixture.

5. Regarding claims 2-4, the modified Gray, Jr. et al. device discloses the maximum pressure increase is decreased so as to prevent knock (col. 4, lines 41-50), the spark retard is increased when the ethanol/gasoline ratio is lowered (claim 26) and the compression ratio is 11 or greater (claim 21).

6. Regarding claims 9-14, the modified Gray, Jr. et al. device discloses the level of turbocharging is decreased so as to reduce the amount of the ethanol/gasoline mixture

from the first source that is needed to prevent knock (col. 4, lines 41-50), wherein the usage of the ethanol/gasoline mixture from the first source is determined by the amount of fuel in the first source (fuel supply), wherein the usage of the mixture from the first source is determined by the driver (demand/throttle), wherein the spark retard is changed when the ethanol/gasoline ratio is changed (col. 6, lines 29-31), wherein the fuel/air ratio in the engine is rich at high loads and wherein the gasoline from the second source is port fuel injected (col. 4, lines 13-40).

Allowable Subject Matter

7. Claims 7 and 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

8. Applicant's arguments filed 12/4/09 have been fully considered but they are not persuasive. Applicant argues that Gray, Jr. fails to disclose a mixture of ethanol and gasoline. Examiner respectfully disagrees. Column 10, lines 34-39 discusses "an engine which utilizes a pre-mixed charge of very high octane fuel ... such as methanol *or* ethanol *and* certain gasolines, with spark or similar controlled ignition means." Gray, Jr. discloses *either* methanol *or* ethanol mixed with gasoline to form a high octane fuel.

9. Applicant further argues that Mochizuki fails to disclose that the ethanol/gasoline ratio is adjusted depending on operating conditions because the ratio is determined by what has been put into the fuel tank. Applicant asserts that the relative amount of ethanol of the Mochizuki engine cannot be altered. However, Mochizuki teaches

adjusting the fuel ratio by filling the tank with varying fuel ratios. Based on the required operating conditions, the ethanol/gasoline ratio is lowered (col. 4, lines 34-40 and 46-50).

10. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., an adjusting of the ethanol/gasoline ratio outside of filling the fuel tank) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DOUGLAS J. DUFF whose telephone number is (571)272-3459. The examiner can normally be reached on M-Th 7 AM - 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Denion can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Thomas E. Denion/ Supervisory Patent Examiner, Art Unit 3748

/Douglas J Duff/ Examiner, Art Unit 3748 2/9/10

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandra, Virginia 22313-1450 www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 1610

SERIAL NUMBER FILING or 371(c) CLASS					GR	OUP ART	UNIT	ΑΤΤΟ	RNEY DOCKET
12/020,28	85	DATE 01/25/2008		123		3748		1	NO. 1381.106198
		RULE							
APPLICANTS Leslie Bromberg, Sharon, MA; Daniel R. Cohn, Cambridge, MA; John B. Heywood, Newton, MA;									
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BIB (Rev. 05/07).

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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Substitute for form 1449/PTO				Complete if Known		
				Application Number	12/020,285	
IN	FORMATION	I DI	SCLOSURE	Filing Date	January 25, 2008	
S	TATEMENT E	BY A	APPLICANT	First Named Inventor	Leslie Bromberg	
				Art Unit	3748	
	(Use as many she	eets as	necessary)	Examiner Name	Duff, Douglas J.	
Sheet	1	of	4	Attorney Docket Number	0492611-0828 (MITCON11381)	

	U.S. PATENT DOCUMENTS						
Examiner	Cite	Document Number	Publication Date MM-DD-YYYY	Name of Pater	ntee or Document	Pages, Columns, Lines, Where Relevant Passages or Relevant	
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> FORD Ex. 1126, page 175 IPR2020-00013

Sub	ostitute for form 1449/PTO			Complete if Known		
				Application Number	12/020,285	
IN	NFORMATION	I DI	SCLOSURE	Filing Date	January 25, 2008	
l s	TATEMENT E	BY /	APPLICANT	First Named Inventor	Leslie Bromberg	
				Art Unit	3748	
	(Use as many she	eets as	s necessary)	Examiner Name	Duff, Douglas J.	
Sheet	2	of	4	Attorney Docket Number	0492611-0828 (MITCON11381)	

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		Foreign Patent Document		Nan	no of Patontoo or		Pages, Columns, Lines	
Examiner Initials*	Cite No. ¹	Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Applica	nt of Cited Docume	nt	Where Relevant Passages Or Relevant Figures Appear	Т ⁶
Examiner Signature		/Douglas Duff/			Date Considered	02/	09/2010	
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.D./

FORD Ex. 1126, page 176 IPR2020-00013

Sut	ostitute for form 1449/PTO			Complete if Known		
				Application Number	12/020,285	
- IN	VFORMATION	I DI	SCLOSURE	Filing Date	January 25, 2008	
S	TATEMENT E	BY A	APPLICANT	First Named Inventor	Leslie Bromberg	
				Art Unit	3748	
	(Use as many she	eets as	necessary)	Examiner Name	Duff, Douglas J.	
Sheet	3	of	4	Attorney Docket Number	0492611-0828 (MITCON11381)	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at <u>www.execto.exec</u> or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁰ Applicant is to place a check mark here if English language Translation is attached.

		NON PATENT LITERATURE DOCUM	ENTS			
Examiner Initials	Pr Cite No.1 Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (bool magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. C1 MODAK et al. Engine Cooling by Direct instance of Cooling Materna Cooling Materna					
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Examiner Signature	/Douglas Duff/ Douglas Duff/ Douglas Duff/ Date Considered 02/09/2010					

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.D./

Sub	stitute for form 1449/PTO			Complete if Known		
				Application Number	12/020,285	
IN	FORMATION	I DI	SCLOSURE	Filing Date	January 25, 2008	
S	TATEMENT E	BY A	APPLICANT	First Named Inventor	Leslie Bromberg	
_				Art Unit	3748	
	(Use as many sh	eets as	necessary)	Examiner Name	Duff, Douglas J.	
Sheet	4	of	4	Attorney Docket Number	0492611-0828 (MITCON11381)	

C22	USPTO Non-Final Office Action, Application No. 11/100,026, August 3, 2006.	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

Examiner Signature	/Douglas Duff/	Date Considered	02/09/2010
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.D./



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Application/Control No.	Applicant(s)/Patent under Reexamination			
12/020,285	D20,285 BROMBERG ET AL.			
Examiner	Art Unit			
DOUGLAS J. DUFF	3748			

SEARCHED					
Class	Subclass	Date	Examiner		
123	299, 300, 304, 406.45	8/30/2009	DJD		
123	406.47	8/30/2009	DJD		
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INTERFERENCE SEARCHED									
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SEARCH NOTES (INCLUDING SEARCH STRATEGY)							
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U.S. Patent and Trademark Office

Part of Paper No. 20090830

Doc description: Request for Continued Examination (RCE)

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL										
Application Number	12020285	Filing Date	2008-01-25	Docket Number (if applicable)	11381.106198	Art Unit	3748			
First Named Inventor	First Named Inventor				Douglas J. Duff	,				
This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application. Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV										
	SUBMISSION REQUIRED UNDER 37 CFR 1.114									
Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).										
Previousl submissio	Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.									
Consider the arguments in the Appeal Brief or Reply Brief previously filed on										
Otl	Other									
Enclosed										
🔀 An	nendment/Reply									
Infi	ormation Disclos	ure Statemer	nt (IDS)							
Affidavit(s)/ Declaration(s)										
Ot	her									
	MISCELLANEOUS									
Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)										
Other										
1				FEES						
The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed. Image: The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No Image: Market Account No Image: Market Account No										
		SIGNATUF	RE OF APPLICAN	T, ATTORNEY, OF	AGENT REQUIRED					
Patent	Practitioner Sigi	nature								
Applic	ant Signature									
Doc code: RCEX Doc description: Request for Continued Examination (RCE) PTO/SE/30EFS (07-09) Approved for use through 07/31/2012 OMB 0651-0031 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Signature of Registered U.S. Patent Practitioner						
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Name	Sam Pasternack	Registration Number	29576			

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal								
Application Number:	12	12020285						
Filing Date:	25.	25-Jan-2008						
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES							
First Named Inventor/Applicant Name:	Leslie Bromberg							
Filer:	Sam Pasternack/Anna Yem							
Attorney Docket Number:	11	381.106198						
Filed as Large Entity								
Utility under 35 USC 111(a) Filing Fees								
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)			
Basic Filing:								
Pages:								
Claims:								
Miscellaneous-Filing:								
Petition:								
Patent-Appeals-and-Interference:								
Post-Allowance-and-Post-Issuance:								
Extension-of-Time:								
Extension - 3 months with \$0 paid		1253	1	1110	1110			

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)	
Miscellaneous:					
Request for continued examination	1801	1	810	810	
	Tot	Total in USD (\$)			

Electronic Acknowledgement Receipt						
EFS ID:	8123364					
Application Number:	12020285					
International Application Number:						
Confirmation Number:	1610					
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES					
First Named Inventor/Applicant Name:	Leslie Bromberg					
Customer Number:	91197					
Filer:	Sam Pasternack/Anna Yem					
Filer Authorized By:	Sam Pasternack					
Attorney Docket Number:	11381.106198					
Receipt Date:	30-JUL-2010					
Filing Date:	25-JAN-2008					
Time Stamp:	11:15:11					
Application Type:	Utility under 35 USC 111(a)					

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$1920
RAM confirmation Number	8275
Deposit Account	192553
Authorized User	O'BRIEN, DANIEL
The Director of the USPTO is hereby authorized to charge	e indicated fees and credit any overpayment as follows:
Charge any Additional Fees required under 37 C.F.R. Se	ction 1.17 (Patent application and reexamination processing fees)
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File Listing	g:							
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)			
1	Extension of Time	11381106198evtime odf	60255	Multi Part /.zip	1			
'	Extension of filme	riserreersextine.par	43275a2983de6505278a0753f207b9eeac7 6ec25	110	·			
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Information:			í					
2	Amendment Submitted/Entered with	113811061980asrsp.pdf	98919	no	4			
	Filing of CPA/RCE		bc963e499840c866a80dd917c75006fe76a cf141					
Warnings:								
Information:			,					
3	Request for Continued Examination	11381106198rce.pdf	67840	no	2			
	(RCE)		aff4882cb98ea28eca627f69e274eb91a5f6e 72d					
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Information:								
4	Fee Worksheet (PTO-875)	fee-info ndf	32705	no	2			
7		ice init.pui	26d487fd46f23b1c8a770ba57ae089ad001 e4a89	110	2			
Warnings:								
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		Total Files Size (in bytes)	: 25	59719				
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.								
National Stac If a timely sul U.S.C. 371 an national stag <u>New Internat</u> If a new inter an internatio and of the Int	ge of an International Application un bmission to enter the national stage d other applicable requirements a Fo e submission under 35 U.S.C. 371 wi <u>tional Application Filed with the USP</u> mational application is being filed ar mal filing date (see PCT Article 11 an ternational Filing Date (Form PCT/RC	nder 35 U.S.C. 371 of an international applicati orm PCT/DO/EO/903 indicati Il be issued in addition to the <u>TO as a Receiving Office</u> nd the international applicat d MPEP 1810), a Notification	ion is compliant with ing acceptance of the e Filing Receipt, in du ion includes the nece of the International /	the condition application e course. ssary comp Application	ons of 35 as a onents for Number			

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	paperwork Reduction Act or 1995, no persons are req	uired to respond to a collect	ion of information unless it dis	plays a valid OMB control number	
PETITION	FOR EXTENSION OF TIME UNDER	Docket Number (Optio	nal)		
(Fees	FY 2009 pursuant to the Consolidated Appropriations Act.	11381.106198	11381.106198		
Application	Number 12/020285	Filed January 25,	2008		
For OPT	IMIZED FUEL MANAGEMENT SYST				
Art Unit 37	48		Examiner Dougla	s J. Duff	
This is a rec application.	quest under the provisions of 37 CFR 1.13	6(a) to extend the per	iod for filing a reply in th	ne above identified	
The request	ted extension and fee are as follows (chec	k time period desired	and enter the appropria	ite fee below):	
		Fee	Small Entity Fee		
	One month (37 CFR 1.17(a)(1))	\$130	\$65	\$	
	Two months (37 CFR 1.17(a)(2))	\$490	\$245	\$	
\square	Three months (37 CFR 1.17(a)(3))	\$1110	\$555	\$_1110.00	
	Four months (37 CFR 1.17(a)(4))	\$1730	\$865	\$	
	Five months (37 CFR 1.17(a)(5))	\$2350	\$1175	\$	
Applica	int claims small entity status. See 37 CFR	1.27			
A chec	k in the amount of the fee is enclosed	l.			
Payme	ent by credit card. Form PTO 2038 is a	attached-			
The Di	irector has already been authorized to	charge fees in this	application to a Depo	sit Account.	
The Di Depos	rector is hereby authorized to charge it Account Number _192553	any fees which may	be required, or cred	it any overpayment, to	
WARNI Provide	NG: Information on this form may become portion of the second port	ublic. Credit card inform n PTO-2038.	nation should not be inc	luded on this form.	
I am the	applicant/inventor.				
	assignee of record of the entir Statement under 37 CFR 3	e interest. See 37 C .73(b) is enclosed (FR 3.71. Form PTO/SB/96).		
	attorney or agent of record. Re	egistration Number	29576		
	attorney or agent under 37 CF Registration number if acting under	R 1.34. er 37 CFR 1.34			
	Am Pactime		July 30, 2010)	
	Signature			Date	
Sam P	Pasternack		617.258.717	1	
	Typed or printed name		Telepi	hone Number	
NOTE: Signatu signature is rec	ires of all the inventors or assignees of record of the er quired, see below.	ntire interest or their represe	ntative(s) are required. Subm	it multiple forms if more than one	
🚺 Total	of <u>1</u> forms a	re submitted.		An	

USPTO to process) an application. Confidentiality is governed by 35 USC. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, US, Patent and Trademark Office, US. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Docket No.: 11381.106198

Application No. 12/020285 Date: July 30, 2010

ATTORNEY DOCKET NO.: 11381.106198 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Leslie Bromberg et al.	Examiner: Douglas J. Duff
Serial No.:	12/020285	Art Unit: 3748
Filing Date:	January 25, 2008	Confirmation No.: 1610
Title:	OPTIMIZED FUEL MANAGEMENT SY ETHANOL ENHANCEMENT OF GAS	YSTEM FOR DIRECT INJECTION OLINE ENGINES

AMENDMENT

Via EFS-Web

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action mailed February 19, 2010, please amend the application as follows.

<u>Remarks</u>

Accompanying this amendment is a Request for Continuing Examination. Also enclosed is a Petition for a three months Extension of Time.

Claims 1-5 and 7-14 are pending. Claims 1-5 and 9-14 stand finally rejected and are being cancelled herein without prejudice and will be pursued in a continuing application.

Claims 7 and 8 are indicated as allowable and are being amended herein into independent form. It is submitted that amended claims 7 and 8 are now in condition for allowance.

If there is a fee occasioned by this communication, the director hereby authorized to charge any deficiency or credit any overpayment in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 192553, under Docket No. 11381.106198.

Respectfully Submitted,

An / tool

Sam Pasternack Registration No.: 29576 Massachusetts Institute of Technology Five Cambridge Center Room NE25-230 Cambridge, MA 02412-1493 617.258.7171

4

FORD Ex. 1126, page 188 IPR2020-00013

							U.S. Patent a	Approved fo nd Trademark Off	or use th fice; U.S	1rough 1/31/2 6. DEPARTME	PTO/SB/06 (07-06) 007. OMB 0651-0032 ENT OF COMMERCE
P/	Under the Par ATENT APPL	ICATION FE Substitute fo	E DETI r Form P	35, no persons are ERMINATION TO-875	I RECORD	nd to	a collection of Application or 12/02	of information unle Docket Number 20,285	Fil 01/2	plays a valid ing Date 25/2008	OMB control number.
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APPLICATION AS FILED – PART I (Column 1) (Column 2)						SMALL	entity 🛛	OR	SMA	ALL ENTITY	
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	SEARCH FEE (37 CFR 1.16(k), (i),	or (m))	N/A		N/A		N/A			N/A	
	EXAMINATION FE (37 CFR 1.16(o), (p),	E or (q))	N/A		N/A		N/A			N/A	
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* lf t	he difference in colu	umn 1 is less than	zero, ente	r "0" in column 2.	_	-	TOTAL			TOTAL	
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			PLE DEPEN	DENT CLAIM (37 CFF	२ 1.16(j))				OR		
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						•	TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
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This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Docket No.: 11381.106198

Application No. 12/020285 Date: July 30, 2010

Listing of Claims

Claims 1 - 6 (cancelled)

Claim 7 (currently amended) <u>A turbocharged or supercharged spark ignition engine wherein an</u> <u>ethanol-gasoline mixture is directly injected from a first source and there is also a means for</u> <u>independently controlling fueling with gasoline from a second source comprising:</u>

a spark ignition engine;

a turbocharger or supercharger;

a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder;

a means for fueling the engine with gasoline from the second source;

wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20% and further wherein under some driving conditions the manifold pressure is greater than 2 bar; and

wherein the engine is operated at a substantially stoichiometric fuel/air ratio during at least part the operating time The engine system of claim 5 wherein the engine is started up with only the gasoline from the second source.

Claim 8 (currently amended) <u>A turbocharged or supercharged spark ignition engine wherein an</u> ethanol-gasoline mixture is directly injected from a first source and there is also a means for independently controlling fueling with gasoline from a second source comprising:

a spark ignition engine;

a turbocharger or supercharger;

a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder;

a means for fueling the engine with gasoline from the second source;

wherein the energy fraction in the cylinder that is provided by the directly injected ethanol is at least 20% and further wherein under some driving conditions the manifold pressure is greater than 2 bar; and

wherein the engine is operated at a substantially stoichiometric fuel/air ratio during at least part

Application No. 12/020285 Date: July 30, 2010

the operating time The engine system of claim 5 wherein under some driving conditions the engine is operated with only the directly injected ethanol –gasoline mixture from the first source.

3

Claims 9-14 (cancelled)

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

IPR2020-00013

Approved for use through 07/31/2012, OMB 0651-0031 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Number 12020285 Filing Date 2008-01-25 **INFORMATION DISCLOSURE** First Named Inventor Leslie Bromberg STATEMENT BY APPLICANT Art Unit 3748 (Not for submission under 37 CFR 1.99) Examiner Name TRIEU, THAI BA 11381.106198 Attorney Docket Number

				ι	J.S.F	PATENTS				
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date)	Name of Patentee or Applicant of cited Document Figures App		es,Columns,Lines where vant Passages or Relev res Appear	e ∕ant	
	1	4993386		1991-02-19		Ozasa et al.				
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			U.S.P	ATENT AP	PLIC	CATION PUB	LICATIONS			
Examiner Initial* Cite No Number		NO Publication Number	Kind Code ¹	Publicatior Date	ı	Name of Patentee or Applicant of cited Document		Pages,Columns,Lines where Relevant Passages or Releva Figures Appear		e /ant
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EFS Web 2.1.17

PTO/SB/08a (01-10)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

Application Number		12020285	
Filing Date		2008-01-25	
First Named Inventor Leslie		Bromberg	
Art Unit		3748	
Examiner Name TRIE		J, THAI BA	
Attorney Docket Number		11381.106198	

1				
If you wish to add a	ditional non-patent literature document citation information please click the Add b	utton		
	EXAMINER SIGNATURE			
Examiner Signature	Date Considered	**************************************		
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.				
1 Con Kind Codes of LIP				

¹ See Kind Codes of USPTO Patent Documents at <u>www.USPTO.GOV</u> or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

	Filing Date		
INFORMATION DISCLOSURE	First Named Inventor	Leslie	E
(Not for submission under 37 (CER 1 99)	Art Unit		1
	Examiner Name	TRIEL	J,
		1	

Application Number		12020285		
Filing Date		2008-01-25		
First Named Inventor Leslie		Bromberg		
Art Unit		3748		
Examiner Name TRIE		J, THAI BA		
Attorney Docket Number		11381.106198		

		CERTIFICA	TION STATEMENT	
Please see 37 CF	R 1.97 and 1.98	to make the appropriate se	election(s):	
That each ite from a foreig information d	em of informatio gn patent office lisclosure staten	on contained in the informa in a counterpart foreign a rent. See 37 CFR 1.97(e)(1	ition disclosure statement was pplication not more than three).	s first cited in any communication e months prior to the filing of the
OR				
That no item foreign pater after making any individua statement. S	n of information nt office in a co reasonable inqu al designated in ee 37 CFR 1.97	contained in the informati unterpart foreign application uiry, no item of information 37 CFR 1.56(c) more tha (e)(2).	on disclosure statement was n, and, to the knowledge of th contained in the information d in three months prior to the f	cited in a communication from a he person signing the certification isclosure statement was known to iling of the information disclosure
See attached	d certification sta	itement.		
The fee set f	orth in 37 CFR 1	.17 (p) has been submitted	herewith.	
A certification	n statement is n	ot submitted herewith.		
A signature of the form of the signat	e applicant or re ure.	SIC presentative is required in a	GNATURE accordance with CFR 1.33, 10.	18. Please see CFR 1.4(d) for the
Signature	Lillin	Batanto	Date (YYYY-MM-DD)	2011-05-09
Name/Print	Sam Pasteri	nack	Registration Number	29576
This collection of public which is to 1.14. This collect application form to require to comple Patent and Trade FEES OR COMP VA 22313-1450.	information is re file (and by the ion is estimated o the USPTO. 1 te this form and mark Office, U.S LETED FORMS	quired by 37 CFR 1.97 and USPTO to process) an appl to take 1 hour to complete, Time will vary depending up for suggestions for reducing Department of Commerce TO THIS ADDRESS. SEN	1.98. The information is requi lication. Confidentiality is gove including gathering, preparing on the individual case. Any co this burden, should be sent to p. P.O. Box 1450, Alexandria, V ID TO: Commissioner for Pat	ired to obtain or retain a benefit by the erned by 35 U.S.C. 122 and 37 CFR and submitting the completed omments on the amount of time you the Chief Information Officer, U.S. VA 22313-1450. DO NOT SEND tents, P.O. Box 1450, Alexandria,

Electronic Patent Application Fee Transmittal					
Application Number:	12	12020285			
Filing Date:	25	-Jan-2008			
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANC ENHANCEMENT OF GASOLINE ENGINES				JECTION ETHANOL
First Named Inventor/Applicant Name:	Leslie Bromberg				
Filer:	Sam Pasternack/Ellen Byal				
Attorney Docket Number:	11	381.106198			
Filed as Large Entity					
Utility under 35 USC 111(a) Filing Fees					
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:	Miscellaneous-Filing:				
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:	Post-Allowance-and-Post-Issuance:				
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
	Tot	al in USD	(\$)	180

Electronic Acknowledgement Receipt			
EFS ID:	10047119		
Application Number:	12020285		
International Application Number:			
Confirmation Number:	1610		
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES		
First Named Inventor/Applicant Name:	Leslie Bromberg		
Customer Number:	91197		
Filer:	Sam Pasternack/Ellen Byal		
Filer Authorized By:	Sam Pasternack		
Attorney Docket Number:	11381.106198		
Receipt Date:	09-MAY-2011		
Filing Date:	25-JAN-2008		
Time Stamp:	14:38:08		
Application Type:	Utility under 35 USC 111(a)		

Payment information:

Submitted with Payment	yes			
Payment Type	Credit Card			
Payment was successfully received in RAM	\$180			
RAM confirmation Number	1075			
Deposit Account	192553			
Authorized User	O'BRIEN, DANIEL			
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:				
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)				

File Listin	g:				
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
-	Toronomitte II etter		73592		,
I	i ransmittal Letter	1138110619851ATEMENT.pat	1592fa445fcd19a0ed0105c43da6f846bc19 bd48	no	2
Warnings:			<u> </u>		
Information					
2	Information Disclosure Statement (IDS)	11201106100TDANG - df	120662		2
2	Filed (SB/08)	113611001961NAN3.pu	8257f48bf249a2a17e0a97ba91b514dd5f72 0235	110	5
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3	Fee Worksheet (PTO-875)	fee-info.pdf	215c64cad799d00387a06962a35a295ab76 5b548	no	2
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		Total Files Size (in bytes)	: 22	24730	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. New Applications Under 35 U.S.C. 111 If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. National Stage of an International Application under 35 U.S.C. 371 If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other application Filed with the USPTO as a Receiving Office If a new international Application is being filed and the international application includes the necessary components for an international application is compliant with the conditions of 35 U.S.C. 371 and other application Filed with the USPTO as a Receiving Office If a new international Application is being filed and the international application includes the necessary components for an international application is being filed and the international application of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application is being filed and the international stage in due course, subject to prescriptions concerning national security, and the date shown o					

ATTORNEY DOCKET NO.: 11381.106198 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Leslie Bromberg

Serial No.: 12/020285

Filing Date: January 25, 2008 Examiner: TRIEU, THAI BA

Art Unit: 3748

Confirmation No.: 1610

Title: OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES

INFORMATION DISCLOSURE STATEMENT

Via EFS-Web Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Dear Sir:

Pursuant to 37 CFR 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08a. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue there from.

In accordance with 37 CFR 1.98(a)(2)(ii), Applicant has not submitted copies of U.S. patents and U.S. patent applications. Applicant submits herewith copies of non-patent literature and a PCT Search report in accordance with 37 CFR 1.98(a)(2).

In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. In accordance with 37 CFR 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that any patent, publication or other information referred to therein is "prior art" for this invention unless specifically designated as such.

It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

Docket No.: 11381.106198

Application No. 12/020285 Date: May 9, 2011

If there is a fee occasioned by this communication, the director hereby authorized to charge any deficiency or credit any overpayment in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 192553, under Docket No. 11381.106198.

Respectfully Submitted, m Ketersk

Sam (Bo) Pasternack Registration Number: 29576 Massachusetts Institute of Technology One Cambridge Center Room NE18-501 Cambridge, MA 02142 617.258.7171

FORD Ex. 1126, page 200 IPR2020-00013

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box, 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

⁹¹¹⁹⁷7590 MIT's Technology Licensing Office One Cambridge Center Kendall Square, NE 18-501 Cambridge, MA 02142-1493

EXAMINER
TRIEU, THAI BA

ART UNIT PAPER NUMBER 3748

DATE MAILED: 10/12/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/020 285	01/25/2008	Leslie Bromberg	11381 106198	1610

TITLE OF INVENTION: OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$870	\$300	\$O	\$1170	01/12/2012

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. <u>PROSECUTION ON THE MERITS IS CLOSED</u>. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN <u>THREE MONTHS</u> FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. <u>THIS STATUTORY PERIOD CANNOT BE EXTENDED</u>. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:	If the SMALL ENTITY is shown as NO:
A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.	A. Pay TOTAL FEE(S) DUE shown above, or
B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or	B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450

(571)-273-2885 or <u>Fax</u> INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee still below. maintenance fee notifications. Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission. CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address) 91197 7590 10/12/2011 MIT's Technology Licensing Office Certificate of Mailing or Transmission I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below. One Cambridge Center Kendall Square, NE 18-501 Cambridge, MA 02142-1493 (Depositor's name) (Signature Date APPLICATION NO. FIRST NAMED INVENTOR ATTORNEY DOCKET NO. CONFIRMATION NO. FILING DATE 12/020.285 01/25/2008 Leslie Bromberg 11381.106198 1610 TITLE OF INVENTION: OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES APPLN. TYPE SMALL ENTITY ISSUE FEE DUE PUBLICATION FEE DUE PREV. PAID ISSUE FEE TOTAL FEE(S) DUE DATE DUE YES \$870 \$300 \$0 \$1170 01/12/2012 nonprovisional EXAMINER ART UNIT CLASS-SUBCLASS TRIEU, THAI BA 3748 123-559100 1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). 2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. □ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required. 3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type) PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment. (B) RESIDENCE: (CITY and STATE OR COUNTRY) (A) NAME OF ASSIGNEE Individual Corporation or other private group entity Government Please check the appropriate assignee category or categories (will not be printed on the patent) : 4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above) 4a. The following fee(s) are submitted: Issue Fee A check is enclosed. Dublication Fee (No small entity discount permitted) Payment by credit card. Form PTO-2038 is attached. Advance Order - # of Copies The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number (enclose an extra copy of this form). 5. Change in Entity Status (from status indicated above) a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27 b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2). NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office. Authorized Signature Date Typed or printed name Registration No. This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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	ITED STATES PATE	NT AND TRADEMARK OFFICE	UNITED STATES DEPAR United States Patent and 7 Address: COMMISSIONER F P. O. Box 1450 Alexandria, Virginia 223 www.uspto.gov	TMENT OF COMMERCE Trademark Office OR PATENTS 13-1450	
APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.	
12/020,285	01/25/2008	Leslie Bromberg	11381.106198	1610	
91197 75	90 10/12/2011		EXAM	IINER	
MIT's Technolog	y Licensing Office		TRIEU, THAI BA		
Kendall Square, NI	E 18-501	ART UNIT PAPER NUMBER			
Cambridge, MA 02	2142-1493		3748		
			DATE MAILED: 10/12/201	1	

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 266 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 266 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

	Application No.	Applicant(s)	
Examiner-Initiated Interview Summary	12/020,285	BROMBERG ET	AL.
Examiner-initiated interview Summary	Examiner	Art Unit	
	THAI BA TRIEU	3748	
All participants (applicant, applicant's representative, PTC	personnel):		
(1) <u>THAI BA TRIEU</u> .	(3)		
(2) <u>Mr. Sam Pasternack (Reg. No. 29,576)</u> .	(4)		
Date of Interview: <u>26 September 2011</u> .			
Type: X Telephonic Video Conference Personal [copy given to: Applicant	applicant's representative]		
Exhibit shown or demonstration conducted: Yes If Yes, brief description:	🛛 No.		
Issues Discussed 101 X112 102 103 XOth (For each of the checked box(es) above, please describe below the issue and deta	ers iled description of the discussion)		
Claim(s) discussed: <u>7 and 8</u> .			
Identification of prior art discussed: None.			
Substance of Interview (For each issue discussed, provide a detailed description and indicate if agreemen reference or a portion thereof, claim interpretation, proposed amendments, argum	t was reached. Some topics may include: ents of any applied references etc)	identification or clarifi	cation of a
The Examiner's Amendments to claims 7 and 8 are to add limitations; and to overcome the rejection under 35 USC § antecedent basis in claims.	ress the redundancy of and to 112, second paragraph of inde	clarify the claime finiteness and la	ed Ick of
Applicant recordation instructions: It is not necessary for applicant to	provide a separate record of the subst	ance of interview.	
Examiner recordation instructions : Examiners must summarize the sult the substance of an interview should include the items listed in MPEP 713 general thrust of each argument or issue discussed, a general indication of general results or outcome of the interview, to include an indication as to the interview.	ostance of any interview of record. A c 8.04 for complete and proper recordati of any other pertinent matters discusse whether or not agreement was reache	omplete and proper r on including the iden ed regarding patental d on the issues raise	recordation of tification of the bility and the d.
Attachment			
/Thai-Ba Trieu/ Primary Examiner, Art Unit 3748	September 27, 2011		
L U.S. Patent and Trademark Office PTOL-413B (Rev. 8/11/2010) Interview	l Summary	Paper	No. 20110927

FORD Ex. 1126, page 205 IPR2020-00013

	Application No.	Applicant(s)	
	12/020 285	BBOMBEBG ET AL	
Notice of Allowability	Examiner	Art Unit	
		2740	
		3748	
The MAILING DATE of this communication app All claims being allowable, PROSECUTION ON THE MERITS Is herewith (or previously mailed), a Notice of Allowance (PTOL-85 NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT of the Office or upon petition by the applicant. See 37 CFR 1.31	bears on the cover sheet with S (OR REMAINS) CLOSED in 5) or other appropriate commun RIGHTS. This application is su 3 and MPEP 1308.	h the correspondence address this application. If not included nication will be mailed in due course. Th ubject to withdrawal from issue at the ini	HIS itiative
1. X This communication is responsive to the RCE filed on 07/3	30/2010 and IDS filed on 05/09	<u>//2011</u> .	
2. An election was made by the applicant in response to a re requirement and election have been incorporated into this	striction requirement set forth os action.	during the interview on; the restri	iction
3. 🔀 The allowed claim(s) is/are <u>7 and 8</u> .			
 4. ☐ Acknowledgment is made of a claim for foreign priority und a) ☐ All b) ☐ Some* c) ☐ None of the: 	der 35 U.S.C. § 119(a)-(d) or (f).	
1. U Certified copies of the priority documents hav	ve been received.		
2. Certified copies of the priority documents hav	ve been received in Application	No	
Copies of the certified copies of the priority d	ocuments have been received	in this national stage application from the	he
International Bureau (PCT Rule 17.2(a)).			
* Certified copies not received:			
Applicant has THREE MONTHS FROM THE "MAILING DATE noted below. Failure to timely comply will result in ABANDON THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.	" of this communication to file a MENT of this application.	a reply complying with the requirements	3
5. A SUBSTITUTE OATH OR DECLARATION must be subm INFORMAL PATENT APPLICATION (PTO-152) which give	nitted. Note the attached EXAN ves reason(s) why the oath or	INER'S AMENDMENT or NOTICE OF declaration is deficient.	
6. CORRECTED DRAWINGS (as "replacement sheets") mu	st be submitted.		
(a) 🔲 including changes required by the Notice of Draftspe	rson's Patent Drawing Review	(PTO-948) attached	
1) 🔲 hereto or 2) 🔲 to Paper No./Mail Date	<u>_</u> .		
(b) including changes required by the attached Examine Paper No./Mail Date	r's Amendment / Comment or i	n the Office action of	
ldentifying indicia such as the application number (see 37 CFR each sheet. Replacement sheet(s) should be labeled as such in	1.84(c)) should be written on the the header according to 37 CFF	e drawings in the front (not the back) of { 1.121(d).	
7. DEPOSIT OF and/or INFORMATION about the deposit of attached Examiner's comment regarding REQUIREMENT F	BIOLOGICAL MATERIAL mus OR THE DEPOSIT OF BIOLO	st be submitted. Note the OGICAL MATERIAL.	
Attachment(s) 1. □ Notice of References Cited (PTO-892)	5. ☐ Notice of Info	ormal Patent Application	
2. Notice of Draftperson's Patent Drawing Review (PTO-948)) 6. 🛛 Interview Su	mmary (PTO-413),	
3. Information Disclosure Statements (PTO/SB/08),	Paper No./M 7. 🛛 Examiner's A	nan Date <u>nereto</u> . Amendment/Comment	
 Paper No./Mail Date <u>05/09/2011</u> Examiner's Comment Regarding Requirement for Deposit of Biological Material 	8. 🛛 Examiner's S	Statement of Reasons for Allowance	
or biological Material	9. 🗌 Other		
/Thai-Ba Trieu/			
Primary Examiner, Art Unit 3748			
U.S. Patent and Trademark Office PTOL-37 (Rev. 03-11)	Notice of Allowability	Part of Paper No./Mail Date 20	110927

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 07/30/2010 has been entered.

Claims 7-8 were amended; and

Claims 1-6 and 9-14 were cancelled.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Sam Pasternack (reg. No. 29,576) on Monday September 26, 2011.

The application has been amended as follows:

Claims 7 and 8 have been amended as following (See Pages 6-8 below).

EXAMINER'S COMMENT

The Examiner's Amendments to claims 7 and 8 are to address the redundancy of and to clarify the claimed limitations; and to overcome the rejection under 35 USC § 112, second paragraph of indefiniteness and lack of antecedent basis in claims.

Allowable Subject Matter

The following is an examiner's statement of reasons for allowance:

Regarding claim 7, the prior art fails to disclose or renders obvious the claimed combination of an engine system having a spark ignition engine; at least one of turbocharger and supercharger for compressing air into said spark ignition engine; a first source of an ethanol-gasoline mixture; a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder of the spark ignition engine; a second source of gasoline; a means for directly independently controlling fueling the engine with the gasoline from the second source; and including:

"an energy fraction in the cylinder provided by the directly injected ethanol being at least 20%;

under driving conditions, a manifold pressure being greater than 2 bar;

during at least part of an operating time under said driving conditions, the engine being operated at a substantially stoichiometric fuel/air ratio; and

at a start-up condition, the engine being operated with only the gasoline from the second source."

<u>Regarding claim 8</u>, the prior art fails to disclose or renders obvious the claimed combination of an engine system having a spark ignition engine; at least

> one of turbocharger and supercharger for compressing air into said spark ignition engine; a first source of an ethanol-gasoline mixture; a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder of the spark ignition engine; a second source of gasoline; a means for independently controlling fueling the engine with the gasoline from the second source; and including:

"an energy fraction in the cylinder provided by the directly injected ethanol being at least 20%;

under driving conditions, a manifold pressure being greater than 2 bar;

during at least part of an operating time under said driving conditions, the engine being operated at a substantially stoichiometric fuel/air ratio; and

under said driving conditions, the engine being operated with only the directly injected ethanol-gasoline mixture from the first source."

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THAI BA TRIEU whose telephone number is (571)272-4867. The examiner can normally be reached on Monday - Thursday (6:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas E. Denion can be reached on (571) 272-4859 or Kenneth Bomberg

can be reached on (571) 272-4922. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TTB September 27, 2011 /Thai-Ba Trieu/ Primary Examiner Art Unit 3748

AMENDED CLAIMS:

Claim 7 (currently amended) [[A turbocharged or supercharged spark ignition engine wherein an ethanol-gasoline mixture is directly injected from a first source and there is also a means for independently controlling fueling with gasoline from a second source]] An engine system comprising:

a spark ignition engine;

<u>at least one of</u> turbocharger [[or]] and supercharger for compressing air into said spark ignition engine;

a first source of an ethanol-gasoline mixture;

a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder <u>of the spark ignition engine</u>;

a second source of gasoline;

a means for **independently controlling** fueling the engine with **the** gasoline from the second source;

wherein [[the]] <u>an</u> energy fraction in the cylinder [[that is]] provided by the directly injected ethanol is at least 20 %; and further <u>comprising</u>:

wherein under [[some]] driving conditions. [[the]] a manifold pressure is greater than 2 bar; [[and]]

wherein <u>during at least part of an operating time under</u> <u>said driving conditions</u>, the engine is operated at a substantially stoichiometric fuel/air ratio [[during at least part the operating time]]; and

wherein at a start-up condition, the engine is [[started up]]

<u>operated</u> with only the gasoline from the second source.

Claim 8 (currently amended) [[A turbocharged or supercharged spark ignition engine wherein an ethanol-gasoline mixture is directly injected from a first source and there is also a means for independently controlling fueling with gasoline from a second source]] An engine system comprising:

a spark ignition engine;

<u>at least one of</u> turbocharger [[or]] and supercharger for compressing air into said spark ignition engine;

a first source of an ethanol-gasoline mixture;

a means for directly injecting a liquid ethanol-gasoline mixture from the first source into at least one cylinder <u>of the spark ignition engine</u>;

a second source of gasoline;

a means for **independently controlling** fueling the engine with **the** gasoline from the second source;

wherein [[the]] <u>an</u> energy fraction in the cylinder [[that is]] provided by the directly injected ethanol is at least 20 %; and further <u>comprising</u>:

wherein under [[some]] driving conditions₁ [[the]] a manifold pressure is greater than 2 bar; [[and]]

wherein during at least part of an operating time under

said driving conditions, the engine is operated at a substantially

stoichiometric fuel/air ratio [[during at least part the operating time]]; and

wherein under [[some]] <u>said</u> driving conditions, the engine is operated with only the directly injected ethanol-gasoline mixture from the first source.

	Application/Control No.	Applicant(s)/Patent Under Reexamination
Issue Classification	12020285	BROMBERG ET AL.
	Examiner	Art Unit
	THAI BA TRIEU	3748

ORIGINAL					INTERNATIONAL CLASSIFICATION						ON				
	CLASS SUBCLASS				CLAIMED NO						ON-0	CLAIMED			
60			601			F	0	2	D	23 / 00 (2006.01.01)					
					F	0	2	В	77 / 04 (2006.01.01)						
CRUSS REFERENCE(S)				F	0	2	в	15 / 00 (2006.01.01)							
CLASS	CLASS SUBCLASS (ONE SUBCLASS PER BLOCK)			F	0	2	В	13 / 00 (2006.01.01)							
123	198A	432	575	304		F	0	2	М	25 / 00 (2006.01.01)					
						F	0	2	М	43 / 00 (2006.01.01)					

	Claims renumbered in the same order as presented by applicant					СР	A C] T.D.	[] R.1.	47				
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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NONE	Total Clain	ns Allowed:		
(Assistant Examiner)	(Date)	2		
/THAI BA TRIEU/ Primary Examiner.Art Unit 3748	09/27/2011	O.G. Print Claim(s)	O.G. Print Figure	
(Primary Examiner)	(Date)	1,2	3,1	

U.S. Patent and Trademark Office

Part of Paper No. 20110927

	Application/Control No.	Applicant(s)/Patent Under Reexamination
Search Notes	12020285	BROMBERG ET AL.
	Examiner	Art Unit
	THAI BA TRIEU	3748

SEARCHED									
Class	Subclass	Date	Examiner						
60	600-603, 605.1, 614-615, 619, and 597-598	9/27/11	TTB						
123	299, 300, 304, 406.45, 406.47, 432, 559.1-559.2, 564, and 575-577	9/27/11	TTB						

SEARCH NOTES									
Search Notes	Date	Examiner							
All classes and subclasses are updated and BRS EAST SERACH is attached.	9/27/11	TTB							

INTERFERENCE SEARCH							
Class	Subclass	Date	Examiner				
	Interference Searched History is Print-Out.	9/27/11	TTB				

/THAI BA TRIEU/ Primary Examiner.Art Unit 3748

U.S. Patent and Trademark Office

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Part of Paper No. : 20110927

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	67	"4993386"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/01 17:14
S 2	48	"6651432"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/01 17:20
83	44	"5131228"	US PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/01 17:21
S 4	64	"7225787"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:10
S 5	85	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:21

 $file:///Cl/Documents\%20 and\%20 Settings/ttrieu/My\%20 Docu...20285/EAST Search History. 12020285_Accessible Version.htm (1 of 14)9/27/11 \\ 8:49:39 AMICONFIGURATION (1 of 14)9/27/11 \\ 8:49 AMICONFIGU$
S 6	73	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:22
S7		((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:22
S 8	57	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or p [erecent or "%")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:24
S 9	1	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or p [erecent or "%") and bar\$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:24

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S10	0	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and ((manifold near5 (pressure or boost)) with bar) and (start\$3 with gasoline) and (percentage or p [erecent or "%")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:25
S11	1	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and ((manifold near5 (pressure or boost)) and bar) and (start\$3 with gasoline) and (percentage or perecent or "%")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:25
S12	60	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:26

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S13	1	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and bar	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:26
S14	59	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and (bar or "atm" or atmosphere or atmospheric or ambient)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:27
S15	55	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and (bar or "atm" or atmosphere or atmospheric)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:27

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S16	0	((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and (bar or "atm" or atmosphere or atmospheric)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:29
S17	0	((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and (bar or "atm" or atmosphere or atmospheric)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:30
S18	Ο	((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and (bar or "atm" or atmosphere or atmospheric))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:30

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S19		((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%"))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:30
S20	2	((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:31
S21		((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:32

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S22	2	((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (start\$3 with gasoline))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:33
S23	2	((spark near5 engine \$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (start\$3 with gasoline))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:34
S 24	6	((spark near5 engine \$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (driv\$3 with (ethanol near3 gasoline)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:35
S25	3	((spark near5 engine \$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (driv\$3 with (ethanol near3 gasoline)) and ((percentage or percent or "%") near5 ethanol))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:37

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S26	0	((spark near5 engine \$1) and ((((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) with cylinder\$1) and ((second or secondary) near5 gasoline) and (driv\$3 with (ethanol near3 gasoline)) and ((percentage or percent or "%") near5 ethanol))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:38
S 27	0	((spark near5 engine \$1) and ((((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) with engine\$1) and ((second or secondary) near5 gasoline) and (driv\$3 with (ethanol near3 gasoline)) and ((percentage or percent or "%") near5 ethanol))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:39
S28	3	((spark near5 engine \$1) and ((((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) with engine\$1) and ((second or secondary) near5 gasoline) and (driv\$3 with (ethanol near3 gasoline)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/23 07:39
S 37	2	"7223787"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:40
S38	64	"7225787"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:40

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S39	63	"7225787" and ethanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:41
S40	63	"7225787" and ethanol and gasoline	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:41
S41	61	"7225787" and ethanol and gasoline and mixture	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:42
S42	13	"7225787" and ethanol and gasoline and mixture and (pressure with bar)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:45
S43	193	ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:49
S44	143	ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (start or "start up" or "cold start")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:50
S45	70	(turbocharg\$3 or supercharg\$3) and ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (start or "start up" or "cold start")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:50

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S46	49239	(turbocharg\$3 or supercharg\$3) and ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (start or "start up" or "cold start") stoichiometry	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:51
S47	29	(turbocharg\$3 or supercharg\$3) and ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (start or "start up" or "cold start") and (stoichiometry or stoichiometric)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:51
S 48		(turbocharg\$3 or supercharg\$3) and ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (gasoline with (start or "start up" or "cold start")) and (stoichiometry or stoichiometric)	US PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:52
S 49	0	((turbocharg\$3 or supercharg\$3) and ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (gasoline with (start or "start up" or "cold start")) and (stoichiometry or stoichiometric)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:52
S50	1	((turbocharg\$3 or supercharg\$3) and ethanol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (gasoline with (start or "start up" or "cold start")) and (stoichiometry or stoichiometric) and (mixture with driving))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 14:53

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S51	1	((turbocharg\$3 or supercharg\$3) and alcohol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (gasoline with (start or "start up" or "cold start")) and (stoichiometry or stoichiometric) and (mixture with driving))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 16:00
S52	7	((turbocharg\$3 or supercharg\$3) and alcohol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (gasoline with (start or "start up" or "cold start")) and (stoichiometry or stoichiometric))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 16:00
\$53	Ο	((turbocharg\$3 or supercharg\$3) and alcohol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (gasoline with (start or "start up" or "cold start")) and (stoichiometry or stoichiometric)).clm.	US PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 16:01
S54	4	((turbocharg\$3 or supercharg\$3) and alcohol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (stoichiometry or stoichiometric) and (mixture with driving))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 16:01
S 55		((turbocharg\$3 or supercharg\$3) and alcohol and gasoline and mixture and (pressure with bar) and (spark near5 ignition) and (stoichiometry or stoichiometric) and (mixture with driving)). clm.	US PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/09/26 16:01

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EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
829	0	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and ((manifold near5 (pressure or boost)) and bar) and (start\$3 with gasoline) and (percentage or perecent or "%")	USPAT; UPAD	OR	OFF	2011/09/23 07:26
S 30	28	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or p[erecent or "%")	USPAT; UPAD	OR	OFF	2011/09/23 07:26
S 31	29	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%")	USPAT; UPAD	OR	OFF	2011/09/23 07:26

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S 32	27	(turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and (bar or "atm" or atmosphere or atmospheric)	USPAT; UPAD	OR	OFF	2011/09/23 07:28
833	0	((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and ((first or primary) with ((ethanol near3 gasoline) near5 mixture)) and ((second or secondary) near5 gasoline) and (manifold near5 (pressure or boost)) and (start\$3 with gasoline) and (percentage or percent or "%") and (bar or "atm" or atmosphere or atmospheric)).clm.	USPAT; UPAD	OR	OFF	2011/09/23 07:29
834	0	((turbocharg\$3 or supercharg\$3) and (spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (start\$3 with gasoline))	USPAT; UPAD	OR	OFF	2011/09/23 07:33
S35	0	((spark near5 engine\$1) and (((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) and ((second or secondary) near5 gasoline) and (start\$3 with gasoline))	USPAT; UPAD	OR	OFF	2011/09/23 07:33

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S36	0 ((spark near5 engine\$1) and ((((first or primary) with ((ethanol near3 gasoline) near5 mixture)) with (direct\$2 near3 inject\$3)) with cylinder\$1) and ((second or secondary) near5 gasoline) and (driv\$3 with (ethanol near3 gasoline)) and ((neareagterse or percent)	USPAT; UPAD	OR	OFF	2011/09/23 07:38
	((percentage or percent or "%") near5 ethanol))				

9/27/11 8:49:24 AM

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

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Filing Date		2008-01-25			
First Named Inventor	Leslie	Bromberg			
Art Unit		3748			
Examiner Name TRIEL		J, THAI BA			
Attorney Docket Number		11381.106198			

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/TTB/	1	4993386		1991-02-	19	Ozasa et al.				
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EFS Web 2.1.17

Receipt date: 05/09/2011

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

Application Number		12020285				
Filing Date		2008-01-25				
First Named Inventor	Leslie	Bromberg				
Art Unit		3748				
Examiner Name	TRIE	J, THAI BA				
Attorney Docket Numb	er	11381.106198				

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Examiner	Signa	ature /Thai-Ba Trieu/	Date Considered	09/23/2011	
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¹ See Kind C Standard ST ⁴ Kind of doo English lang	Codes c 1.3). ⁻³ I cument uage tr	of USPTO Patent Documents at <u>www.USPTO.GOV</u> or MPEP 90 For Japanese patent documents, the indication of the year of th by the appropriate symbols as indicated on the document under ranslation is attached.	01.04. ² Enter office that issued the docume he reign of the Emperor must precede the ser er WIPO Standard ST.16 if possible. ⁵ Applic	nt, by the two-letter code (WIPC ial number of the patent docum cant is to place a check mark he) ent. ire if



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UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandra, Virginia 22313-1450 www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 1610

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART	UNIT	ΑΤΤΟ	RNEY DOCKET				
12/020,285	01/25/2008	123	3748	3748		1381.106198				
	RULE									
APPLICANTS Leslie Bromberg, Sharon, MA; Daniel R. Cohn, Cambridge, MA; John B. Heywood, Newton, MA;										
** CONTINUING DAT This application which is a	FA ************************************	* / 06/05/2007 ABN)6/2005 PAT 7,225,787								
** FOREIGN APPLIC	ATIONS ***************	*****								
** IF REQUIRED, FO 02/09/2008	REIGN FILING LICENS	E GRANTED ** ** SMA	LL ENTITY **							
Foreign Priority claimed	Yes VNo		SHEETS	тот	AL					
35 USC 119(a-d) conditions m Verified and /THAI-BA Acknowledged Examiner	Allowa	MA	3	- 25	wi5 2	-5 2				
ADDRESS										
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TITLE										
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			🖵 1.16 F	Fees (Fili	ing)					
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BIB (Rev. 05/07).

Index of Claims						Application/Control No.				Applicant(s)/Patent Under Reexamination BROMBERG ET AL.				
						Examiner THAI BA TRI	EU		Art Unit 3748					
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Part of Paper No. : 20110927

PART B - FEE(S) TRANSMITTAL

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APPLICATION NO.	FILING DATE		FIRST NAMED INVEN	TOR	Al	TORNEY DOCKET NO.	CONFIRMATION NO.
12/020,285 TTILE OF INVENTION: C ENGINES	01/25/2008 DPTIMIZED FUEL N	IANAGEMENT SYST	Leslie Bromberg TEM FOR DIRECT I	NJECTION	ETHANOL E	11381.106198 NHANCEMENT OF G4	1610 ASOLINE
APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE I	DUE PREV	. PAID ISSUE FE	E TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$870	\$300	~~~~~	\$0	\$1170	01/12/2012
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TRIEU, THA	J BA	3748	123-559100	~~~~~			
Change of correspondence CFR 1.363). Change of correspond Address form PTO/SB/12 "Fee Address" indicat PTO/SB/47; Rev 03-02 o Number is required. ASSIGNEE NAME AND	address or indication ence address (or Chan :2) attached. ion (or "Fee Address" r more recent) attached RESIDENCE DATA	of "Fee Address" (37 ge of Correspondence Indication form I. Use of a Customer TO BE PRINTED ON	 For printing on the names of a or agents OR, alter or agents OR, alter (2) the name of a registered attorney 2 registered patennl fisted, no name with the PATENT (print of the patent) 	the patent fr up to 3 regi- matively, single firm (v or agent) a t attorneys of 11 be printed or type)	ront page, list stered patent at (having as a me and the names c or agents. If no r 1.	torneys 1 <u>Sam</u> mber a f up to arme is 3	Pasternack Technology Ising Offile
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This collection of informatic an application. Confidentiali submitting the completed ap this form and/or suggestions Box 1450, Alexandria, Virgi Alexandria, Virginia 22313- Under the Paperwork Reduc	Typed or printed name JUM I (ASTERNACL Registration No. 27216 This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.						

PTOL-85 (Rev. 02/11) Approved for use through 08/31/2013.

OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Patent Application Fee Transmittal								
Application Number:	12020285							
Filing Date:	25-	Jan-2008						
Title of Invention: OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECT INJE								
First Named Inventor/Applicant Name:	Leslie Bromberg							
Filer:	Sam Pasternack/Ellen Byal							
Attorney Docket Number:	113	381.106198						
Filed as Large Entity								
Utility under 35 USC 111(a) Filing Fees								
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)			
Basic Filing:								
Pages:								
Claims:								
Miscellaneous-Filing:								
Petition:								
Patent-Appeals-and-Interference:								
Post-Allowance-and-Post-Issuance:								
Utility Appl issue fee		1501	1	1740	1740			
Publ. Fee- early, voluntary, or normal		1504	1	300	300			

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
	Tot	al in USD	(\$)	2040

Electronic Acknowledgement Receipt						
EFS ID:	11366548					
Application Number:	12020285					
International Application Number:						
Confirmation Number:	1610					
Title of Invention:	OPTIMIZED FUEL MANAGEMENT SYSTEM FOR DIRECT INJECTION ETHANOL ENHANCEMENT OF GASOLINE ENGINES					
First Named Inventor/Applicant Name:	Leslie Bromberg					
Customer Number:	91197					
Filer:	Sam Pasternack/Ellen Byal					
Filer Authorized By:	Sam Pasternack					
Attorney Docket Number:	11381.106198					
Receipt Date:	09-NOV-2011					
Filing Date:	25-JAN-2008					
Time Stamp:	10:26:46					
Application Type:	Utility under 35 USC 111(a)					

Payment information:

Submitted with Payment	yes					
Payment Type	Credit Card					
Payment was successfully received in RAM	\$2040					
RAM confirmation Number	7547					
Deposit Account	192553					
Authorized User	JOYCE,MAUREEN A.					
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:						
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)						

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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Post Card, as <u>New Applica</u> If a new app 1.53(b)-(d) a Acknowledg <u>National Sta</u> If a timely su U.S.C. 371 at national stag <u>New Interna</u> If a new inte an international sec the application	s described in MPEP 503. tions Under 35 U.S.C. 111 lication is being filed and the applica nd MPEP 506), a Filing Receipt (37 Cl ement Receipt will establish the filir ge of an International Application un bmission to enter the national stage nd other applicable requirements a F ge submission under 35 U.S.C. 371 w tional Application Filed with the USF rnational application is being filed a bonal filing date (see PCT Article 11 ar iternational Filing Date (Form PCT/R urity, and the date shown on this Acl ion.	ation includes the necessary of FR 1.54) will be issued in due ng date of the application. <u>Inder 35 U.S.C. 371</u> e of an international application form PCT/DO/EO/903 indication ill be issued in addition to the <u>PTO as a Receiving Office</u> nd the international application of MPEP 1810), a Notification O/105) will be issued in due of knowledgement Receipt will	components for a filin course and the date s ion is compliant with ing acceptance of the e Filing Receipt, in du cion includes the nece of the International course, subject to pres establish the internat	g date (see hown on th the conditio application e course. ssary comp Application scriptions co ional filing	37 CFR is ons of 35 a as a onents for Number oncerning date of



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Bib Data Sheet

CONFIRMATION NO. 1610

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SERIAL NUMB 12/020,285	ER	FILING OR 371(c) DATE 01/25/2008 RULE	(c) CLASS GROUP A 123 374			UP AR 3748	r unit	ی D 1	ATTORNEY OCKET NO. 1381.106198
APPLICANTS									
Leslie Bromberg, Sharon, MA; Daniel R. Cohn, Cambridge, MA; John B. Heywood, Newton, MA;									
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ADDRESS 91197		· · · · · · · · · · · · · · · · · · ·							
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Bib Data Sheet

CONFIRMATION NO. 1610

SERIAL NUMB 12/020,285	FILING OR 371(c) DATE 01/25/2008 RULE		c	CLASS 123	GROUP ART UNIT 3748		ATTORNEY DOCKET NO . 11381.106198			
APPLICANTS Leslie Bromberg, Sharon, MA; Daniel R. Cohn, Cambridge, MA; John B. Heywood, Newton, MA; ** CONTINUING DATA **********************************										
Foreign Priority claimed yes no 35 USC 119 (a-d) conditions yes no Met after Met after Allowance Met after Allowance Initials MA 3 25 5										
ADDRESS 91197										
TITLE OPTIMIZED FUEI GASOLINE ENGI	L MANAGEN NES	IENT SYSTEM	FOR DI	RECT INJECT	ION E	THANO	L ENHA	NCEN	IENT OF	
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							Other Credit			

Used in Lieu of PTO/SB/08A/B (Based on PTO 10-07 version)

Substitute for form 1449/PTO				Complete if Known		
				Application Number	12/020,285	
IN IN	IFORMATION	I DI	SCLOSURE	Filing Date	January 25, 2008	
S	TATEMENT E	BY A	APPLICANT	First Named Inventor	Leslie Bromberg	
				Art Unit	3748	
	(Use as many she	eets as	necessary)	Examiner Name	Duff, Douglas J.	
Sheet 1 of 4		Attorney Docket Number	0492611-0828 (MITCON11381)			

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ļ	Examiner	Cite	Document Number	Publication Date	Name of Pater	ntee or	Pages, Columns, Lines, Where Relevant Passages or Relevant			
	Initials*	No.1	Number-Kind Code ² (<i>if known</i>)	MM-DD-YYYY	Applicant of Cited	Document	Figures Appear			
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4581304v1 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.D./

FORD Ex. 1126, page 241 IPR2020-00013



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U	Inited States Patent and Trademark Office
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	Alexandria, Virginia 22313-1450
	www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/020,285	12/27/2011	8082735	11381.106198	1610

91197759012/07/2011MIT's Technology Licensing OfficeOne Cambridge CenterKendall Square, NE 18-501Cambridge, MA 02142-1493

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment is 266 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Leslie Bromberg, Sharon, MA; Daniel R. Cohn, Cambridge, MA; John B. Heywood, Newton, MA;