# Fuel Management System for Variable Ethanol Octane Enhancement of Gasoline Engines

[0001] This application is a continuation of United States Patent Application No. 11/840,719 filed on August 17, 2007, which is a continuation of United States Patent Application No. 10/991,774, which is now issued as United States Patent No. 7,314,033.

## **BACKGROUND**

[0002] This invention relates to spark ignition gasoline engines utilizing an antiknock agent which is a liquid fuel with a higher octane number than gasoline such as ethanol to improve engine efficiency.

[0003] It is known that the efficiency of spark ignition (SI) gasoline engines can be increased by high compression ratio operation and particularly by engine downsizing. The engine downsizing is made possible by the use of substantial pressure boosting from either turbocharging or supercharging. Such pressure boosting makes it possible to obtain the same performance in a significantly smaller engine. See, J. Stokes, et al., "A Gasoline Engine Concept For Improved Fuel Economy – The Lean-Boost System," SAE Paper 2001-01-2902. The use of these techniques to increase engine efficiency, however, is limited by the onset of engine knock. Knock is the undesired detonation of fuel and can severely damage an engine. If knock can be prevented, then high compression ratio operation and high pressure boosting can be used to increase engine efficiency by up to twenty-five percent.

[0004] Octane number represents the resistance of a fuel to knocking but the use of higher octane gasoline only modestly alleviates the tendency to knock. For example, the difference between regular and premium gasoline is typically six octane numbers. That is significantly less than is needed to realize fully the efficiency benefits of high compression ratio or turbocharged operation. There is thus a need for a practical means for achieving a much higher level of octane enhancement so that engines can be operated much more efficiently.

[0005] It is known to replace a portion of gasoline with small amounts of ethanol added at the refinery. Ethanol has a blending octane number (ON) of 110 (versus 95 for premium gasoline) (see J.B. Heywood, "Internal Combustion Engine Fundamentals," McGraw Hill, 1988, p. 477) and is also attractive because it is a renewable energy, biomass-derived fuel, but the small amounts of ethanol that have heretofore been added to gasoline have had a relatively small impact on engine performance. Ethanol is much more expensive than gasoline and the amount of ethanol that is readily available is much smaller than that of gasoline because of the relatively limited amount of biomass that is available for its production. An object of the present invention is to minimize the amount of ethanol or other antiknock agent that is used to achieve a given level of engine efficiency increase. By restricting the use of ethanol to the relatively small fraction of time in an operating cycle when it is needed to prevent knock in a higher load regime and by minimizing its use at these times, the amount of ethanol that is required can be limited to a relatively small fraction of the fuel used by the spark ignition gasoline engine.

#### **SUMMARY**

[0006] In one aspect, the invention is a fuel management system for efficient operation of a spark ignition gasoline engine including a source of an antiknock agent such as ethanol. An injector directly injects the ethanol into a cylinder of the engine and a fuel management system controls injection of the antiknock agent into the cylinder to control knock with minimum use of the antiknock agent. A preferred antiknock agent is ethanol. Ethanol has a high heat of vaporization so that there is substantial cooling of the air-fuel charge to the cylinder when it is injected directly into the engine. This cooling effect reduces the octane requirement of the engine by a considerable amount in addition to the improvement in knock resistance from the relatively high octane number of ethanol. Methanol, tertiary butyl alcohol, MTBE, ETBE, and TAME may also be used. Wherever ethanol is used herein it is to be understood that other antiknock agents are contemplated.

[0007] The fuel management system uses a fuel management control system that may use a microprocessor that operates in an open loop fashion on a predetermined correlation between octane number enhancement and fraction of fuel provided by the antiknock agent. To conserve the ethanol, it is preferred that it be added only during portions of a drive cycle requiring knock resistance and that its use be minimized during these times. Alternatively, the gasoline engine

may include a knock sensor that provides a feedback signal to a fuel management microprocessor system to minimize the amount of the ethanol added to prevent knock in a closed loop fashion.

[0008] In one embodiment the injectors stratify the ethanol to provide non-uniform deposition within a cylinder. For example, the ethanol may be injected proximate to the cylinder walls and swirl can create a ring of ethanol near the walls.

[0009] In another embodiment of this aspect of the invention, the system includes a measure of the amount of the antiknock agent such as ethanol in the source containing the antiknock agent to control turbocharging, supercharging or spark retard when the amount of ethanol is low.

[0010] The direct injection of ethanol provides substantially a 13°C drop in temperature for every ten percent of fuel energy provided by ethanol. An instantaneous octane enhancement of at least 4 octane numbers may be obtained for every 20 percent of the engine's energy coming from the ethanol.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

- [0011] FIG. 1 is a block diagram of one embodiment of the invention disclosed herein.
- [0012] FIG. 2 is a graph of the drop in temperature within a cylinder as a function of the fraction of energy provided by ethanol.
- [0013] FIG. 3 is a schematic illustration of the stratification of cooler ethanol charge using direct injection and swirl motion for achieving thermal stratification.
- [0014] FIG. 4 is a schematic illustration showing ethanol stratified in an inlet manifold.
- [0015] FIG. 5 is a block diagram of an embodiment of the invention in which the fuel management microprocessor is used to control a turbocharger and spark retard based upon the amount of ethanol in a fuel tank.

# **DETAILED DESCRIPTION**

[0016] With reference first to FIG. 1, a spark ignition gasoline engine 10 includes a knock sensor 12 and a fuel management microprocessor system 14. The fuel management microprocessor system 14 controls the direct injection of an antiknock agent such as ethanol from an ethanol tank 16. The fuel management microprocessor system 14 also controls the delivery of gasoline from a gasoline tank 18 into engine manifold 20. A turbocharger 22 is

provided to improve the torque and power density of the engine 10. The amount of ethanol injection is dictated either by a predetermined correlation between octane number enhancement and fraction of fuel that is provided by ethanol in an open loop system or by a closed loop control system that uses a signal from the knock sensor 12 as an input to the fuel management microprocessor 14. In both situations, the fuel management processor 14 will minimize the amount of ethanol added to a cylinder while still preventing knock. It is also contemplated that the fuel management microprocessor system 14 could provide a combination of open and closed loop control.

[0017] As show in FIG. 1 it is preferred that ethanol be directly injected into the engine 10. Direct injection substantially increases the benefits of ethanol addition and decreases the required amount of ethanol. Recent advances in fuel injector and electronic control technology allows fuel injection directly into a spark ignition engine rather than into the manifold 20. Because ethanol has a high heat of vaporization there will be substantial cooling when it is directly injected into the engine 10. This cooling effect further increases knock resistance by a considerable amount. In the embodiment of FIG. 1 port fuel injection of the gasoline in which the gasoline is injected into the manifold rather than directly injected into the cylinder is preferred because it is advantageous in obtaining good air/fuel mixing and combustion stability that are difficult to obtain with direct injection.

[0018] Ethanol has a heat of vaporization of 840kJ/kg, while the heat of vaporization of gasoline is about 350kJ/kg. The attractiveness of ethanol increases when compared with gasoline on an energy basis, since the lower heating value of ethanol is 26.9MJ/kg while for gasoline it is about 44MJ/kg. Thus, the heat of vaporization per Joule of combustion energy is 0.031 for ethanol and 0.008 for gasoline. That is, for equal amounts of energy the required heat of vaporization of ethanol is about four times higher than that of gasoline. The ratio of the heat of vaporization per unit air required for stoichiometric combustion is about 94 kJ/kg of air for ethanol and 24 kJ/kg of air for gasoline, or a factor of four smaller. Thus, the net effect of cooling the air charge is about four times lower for gasoline than for ethanol (for stoichiometric mixtures wherein the amount of air contains oxygen that is just sufficient to combust all of the fuel).

[0019] In the case of ethanol direct injection according to one aspect of the invention, the charge is directly cooled. The amount of cooling due to direct injection of ethanol is shown in FIG. 2. It is assumed that the air/fuel mixture is stoichiometric without exhaust gas recirculation (EGR), and that gasoline makes up the rest of the fuel. It is further assumed that only the ethanol contributes to charge cooling. Gasoline is vaporized in the inlet manifold and does not contribute to cylinder charge cooling. The direct ethanol injection provides about 13°C of cooling for each 10% of the fuel energy provided by ethanol. It is also possible to use direct injection of gasoline as well as direct injection of ethanol. However, under certain conditions there can be combustion stability issues.

[0020] The temperature decrement because of the vaporization energy of the ethanol decreases with lean operation and with EGR, as the thermal capacity of the cylinder charge increases. If the engine operates at twice the stoichiometric air/fuel ratio, the numbers indicated in FIG. 2 decrease by about a factor of 2 (the contribution of the ethanol itself and the gasoline is relatively modest). Similarly, for a 20% EGR rate, the cooling effect of the ethanol decreases by about 25%.

[0021] The octane enhancement effect can be estimated from the data in FIG. 2. Direct injection of gasoline results in approximately a five octane number decrease in the octane number required by the engine, as discussed by Stokes, *et al.* Thus the contribution is about five octane numbers per 30K drop in charge temperature. As ethanol can decrease the charge temperature by about 120K, then the decrease in octane number required by the engine due to the drop in temperature, for 100% ethanol, is twenty octane numbers. Thus, when 100% of the fuel is provided by ethanol, the octane number enhancement is approximately thirty-five octane numbers with a twenty octane number enhancement coming from direct injection cooling and a fifteen octane number enhancement coming from the octane number of ethanol. From the above considerations, it can be projected that even if the octane enhancement from direct cooling is significantly lower, a total octane number enhancement of at least 4 octane numbers should be achievable for every 20% of the total fuel energy that is provided by ethanol.

[0022] Alternatively the ethanol and gasoline can be mixed together and then port injected through a single injector per cylinder, thereby decreasing the number of injectors that would be used. However, the air charge cooling benefit from ethanol would be lost.

[0023] Alternatively the ethanol and gasoline can be mixed together and then port fuel injected using a single injector per cylinder, thereby decreasing the number of injectors that would be used. However, the substantial air charge cooling benefit from ethanol would be lost. The volume of fuel between the mixing point and the port fuel injector should be minimized in order to meet the demanding dynamic octane-enhancement requirements of the engine.

[0024] Relatively precise determinations of the actual amount of octane enhancement from given amounts of direct ethanol injection can be obtained from laboratory and vehicle tests in addition to detailed calculations. These correlations can be used by the fuel management microprocessor system 14.

[0025] An additional benefit of using ethanol for octane enhancement is the ability to use it in a mixture with water. Such a mixture can eliminate the need for the costly and energy consuming water removal step in producing pure ethanol that must be employed when ethanol is added to gasoline at a refinery. Moreover, the water provides an additional cooling (due to vaporization) that further increases engine knock resistance. In contrast the present use of ethanol as an additive to gasoline at the refinery requires that the water be removed from the ethanol.

[0026] Since unlike gasoline, ethanol is not a good lubricant and the ethanol fuel injector can stick and not open, it is desirable to add a lubricant to the ethanol. The lubricant will also denature the ethanol and make it unattractive for human consumption.

[0027] Further decreases in the required ethanol for a given amount of octane enhancement can be achieved with stratification (non-uniform deposition) of the ethanol addition. Direct injection can be used to place the ethanol near the walls of the cylinder where the need for knock reduction is greatest. The direct injection may be used in combination with swirl. This stratification of the ethanol in the engine further reduces the amount of ethanol needed to obtain a given amount of octane enhancement. Because only the ethanol is directly injected and because it is stratified both by the injection process and by thermal centrifugation, the ignition stability issues associated with gasoline direct injection (GDI) can be avoided.

[0028] It is preferred that ethanol be added to those regions that make up the end-gas and are prone to auto-ignition. These regions are near the walls of the cylinder. Since the end-gas

contains on the order of 25% of the fuel, substantial decrements in the required amounts of ethanol can be achieved by stratifying the ethanol.

[0029] In the case of the engine 10 having substantial organized motion (such as swirl), the cooling will result in forces that thermally stratify the discharge (centrifugal separation of the regions at different density due to different temperatures). The effect of ethanol addition is to increase gas density since the temperature is decreased. With swirl the ethanol mixture will automatically move to the zone where the end-gas is, and thus increase the anti-knock effectiveness of the injected ethanol. The swirl motion is not affected much by the compression stroke and thus survives better than tumble-like motion that drives turbulence towards top-dead-center (TDC) and then dissipates. It should be pointed out that relatively modest swirls result in large separating (centrifugal) forces. A 3m/s swirl motion in a 5cm radius cylinder generates accelerations of about 200m/s², or about 20g's.

[0030] FIG. 3 illustrates ethanol direct injection and swirl motion for achieving thermal stratification. Ethanol is predominantly on an outside region which is the end-gas region.

**FIG. 4** illustrates a possible stratification of the ethanol in an inlet manifold with swirl motion and thermal centrifugation maintaining stratification in the cylinder. In this case of port injection of ethanol, however, the advantage of substantial charge cooling may be lost.

[0031] With reference again to FIG. 2, the effect of ethanol addition all the way up to 100% ethanol injection is shown. At the point that the engine is 100% direct ethanol injected, there may be issues of engine stability when operating with only stratified ethanol injection that need to be addressed. In the case of stratified operation it may also be advantageous to stratify the injection of gasoline in order to provide a relatively uniform equivalence ratio across the cylinder (and therefore lower concentrations of gasoline in the regions where the ethanol is injected). This situation can be achieved, as indicated in FIG. 4, by placing fuel in the region of the inlet manifold that is void of ethanol.

[0032] The ethanol used in the invention can either be contained in a separate tank from the gasoline or may be separated from a gasoline/ethanol mixture stored in one tank.

[0033] The instantaneous ethanol injection requirement and total ethanol consumption over a drive cycle can be estimated from information about the drive cycle and the increase in torque (and thus increase in compression ratio, engine power density, and capability for downsizing)

that is desired. A plot of the amount of operating time spent at various values of torque and engine speed in FTP and US06 drive cycles can be used. It is necessary to enhance the octane number at each point in the drive cycle where the torque is greater than permitted for knock free operation with gasoline alone. The amount of octane enhancement that is required is determined by the torque level.

[0034] A rough illustrative calculation shows that only a small amount of ethanol might be needed over the drive cycle. Assume that it is desired to increase the maximum torque level by a factor of two relative to what is possible without direct injection ethanol octane enhancement. Information about the operating time for the combined FTP and US06 cycles shows that approximately only 10 percent of the time is spent at torque levels above 0.5 maximum torque and less than 1 percent of the time is spent above 0.9 maximum torque. Conservatively assuming that 100 % ethanol addition is needed at maximum torque and that the energy fraction of ethanol addition that is required to prevent knock decreases linearly to zero at 50 percent of maximum torque, the energy fraction provided by ethanol is about 30 percent. During a drive cycle about 20 percent of the total fuel energy is consumed at greater than 50 percent of maximum torque since during the 10 percent of the time that the engine is operated in this regime, the amount of fuel consumed is about twice that which is consumed below 50 percent of maximum torque. The amount of ethanol energy consumed during the drive cycle is thus roughly around 6 percent (30 percent x 0.2) of the total fuel energy.

[0035] In this case then, although 100% ethanol addition was needed at the highest value of torque, only 6% addition was needed averaged over the drive cycle. The ethanol is much more effectively used by varying the level of addition according to the needs of the drive cycle.

[0036] Because of the lower heat of combustion of ethanol, the required amount of ethanol would be about 9% of the weight of the gasoline fuel or about 9% of the volume (since the densities of ethanol and gasoline are comparable). A separate tank with a capacity of about 1.8 gallons would then be required in automobiles with twenty gallon gasoline tanks. The stored ethanol content would be about 9% of that of gasoline by weight, a number not too different from present-day reformulated gasoline. Stratification of the ethanol addition could reduce this amount by more than a factor of two. An on-line ethanol distillation system might alternatively

be employed but would entail elimination or reduction of the increase torque and power available from turbocharging.

[0037] Because of the relatively small amount of ethanol and present lack of an ethanol fueling infrastructure, it is important that the ethanol vehicle be operable if there is no ethanol on the vehicle. The engine system can be designed such that although the torque and power benefits would be lower when ethanol is not available, the vehicle could still be operable by reducing or eliminating turbocharging capability and/or by increasing spark retard so as to avoid knock. As shown in FIG. 5, the fuel management microprocessor system 14 uses ethanol fuel level in the ethanol tank 16 as an input to control the turbocharger 22 (or supercharger or spark retard, not shown). As an example, with on-demand ethanol octane enhancement, a 4-cylinder engine can produce in the range of 280 horsepower with appropriate turbocharging or supercharging but could also be drivable with an engine power of 140 horsepower without the use of ethanol according to the invention.

[0038] The impact of a small amount of ethanol upon fuel efficiency through use in a higher efficiency engine can greatly increase the energy value of the ethanol. For example, gasoline consumption could be reduced by 20% due to higher efficiency engine operation from use of a high compression ratio, strongly turbocharged operation and substantial engine downsizing. The energy value of the ethanol, including its value in direct replacement of gasoline (5% of the energy of the gasoline), is thus roughly equal to 25% of the gasoline that would have been used in a less efficient engine without any ethanol. The 5% gasoline equivalent energy value of ethanol has thus been leveraged up to a 25% gasoline equivalent value. Thus, ethanol can cost roughly up to five times that of gasoline on an energy basis and still be economically attractive. The use of ethanol as disclosed herein can be a much greater value use than in other ethanol applications.

[0039] 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 tertiary butyl alcohol, or ethers such as methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), or tertiary amyl methyl ether (TAME).

[0040]	It is recognized that modifications and variations of the invention disclosed herein will
be appar	ent to those of ordinary skill in the art and it is intended that all such modifications and
variation	as be included within the scope of the appended claims.

#### **CLAIMS**

# What is claimed is:

- 1. A spark ignition engine system for which fuel is introduced into the engine from a first source and a liquid is separately introduced into the engine from a second source by direct injection comprising:
  - a spark ignition engine;
  - a first means for introducing the fuel from the first source into the engine;
- a second means for direct injection of the liquid from the second source into the engine, wherein during part of the engine operating time, the engine receives both the fuel from the first source and the liquid that is directly injected from the second source; and
- a fuel management system which varies the relative amount of the liquid from the second source that is introduced into the engine so as to prevent knock, wherein the fuel management system employs information from a knock detector and uses closed loop control to control the amount of directly injected liquid from the second source; and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

- 2. The engine system of claim 1, wherein the engine is turbocharged or supercharged.
- 3. The engine system of claim 1 or 2, wherein the liquid from the second source is alcohol.
- 4. The engine system of claim 3, wherein the alcohol is methanol.
- 5. The engine system of claim 3, wherein the alcohol is ethanol.
- **6.** The engine system of claim **1** or **2**, wherein the liquid from the second source is an alcohol—water mixture.
- 7. The engine system of claim 1 or 2, wherein the liquid from the second source includes water.
- **8.** The engine system of claim **1** or **2**, wherein the fuel from the first source is gasoline and the liquid from the second source includes water.

- 9. The engine system of claim 1 or 2, wherein the liquid from the second source is injected so as to result in a non-uniform distribution in the engine cylinder.
- 10. The engine system of claim 9, wherein the liquid from the second source is injected so as to be more concentrated near the periphery of the engine cylinder, and

wherein the liquid from the second source includes alcohol, and

wherein the alcohol energy fraction is sufficiently high to prevent knock but the alcohol energy fraction is reduced as compared to the situation using a uniform distribution.

11. The engine system of claim 1 or 2, wherein the fuel management system employs a microprocessor for control of the relative amount of liquid from the second source that is directly injected into the engine using information from a knock sensor, and

wherein the relative amount of the liquid from the second source increases with increasing torque, and

wherein the fuel management system minimizes the amount of directly injected liquid from the second source that is used over a drive cycle.

- 12. The engine system of claim 11 further including open loop control with a look up table.
- 13. The engine system of claims 1 or 2, wherein spark retard is used and is varied according to the consumption of the liquid from the second tank.
- 14. A spark ignition engine system into which fuel is introduced into the engine from a first source using a first fuel injector and a liquid from a second source is introduced into the engine using a second fuel injector comprising:
  - a spark ignition engine;
  - a first fuel injector for introducing fuel into the engine from the first source;
- a second fuel injector for introducing the liquid from the second source into the engine wherein during part of the engine operating time, the engine receives both the fuel from the first source and the liquid from the second source; and
- a fuel management system which varies the relative amount of the liquid from the second source that is introduced into the engine so as to prevent knock, wherein the fuel management

system uses closed loop control to control the amount of liquid from the second source and employs information from a knock detector, and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

- 15. The engine system of claim 14, wherein the fuel from the first source is port fuel injected.
- 16. The engine system of claim 14 or 15, wherein the liquid from the second source is alcohol.
- 17. The engine system of claim 16, wherein the alcohol is methanol.
- 18. The engine system of claim 16, wherein the alcohol is ethanol.
- 19. The engine system of claims 14 or 15, wherein the liquid from the second source is an alcohol-water mixture.
- **20.** The engine system of claims **14** or **15**, wherein the liquid from the second source includes water.
- 21. The engine system of claims 14 or 15, wherein the fuel from the first source is gasoline and the liquid from the second source includes water.
- 22. The engine system of claims 14 or 15, wherein the fuel management system employs a microprocessor for control of the relative amount of liquid from the second source that is directly injected into the engine using information from a knock sensor, and wherein

the relative amount of liquid from the second source increases with increasing torque, and wherein the fuel management system minimizes the amount of directly injected liquid from the second source that is used over a drive cycle.

- 23. The engine system of claim 22 further including open loop control with a look up table.
- 24. The engine system of claims 14 or 15, wherein spark retard is used and is varied according to the consumption of the liquid from the second tank.
- 25. The engine system of claims 14 or 15, wherein the engine is turbocharged.

- 26. The engine system of claims 14 or 15, wherein the engine is supercharged.
- 27. A turbocharged or supercharged spark ignition engine system which uses both port fuel injection of gasoline from a first source and direct fuel injection of alcohol from a second source comprising:

a spark ignition engine;

a turbocharger or supercharger;

means for port fuel injection of gasoline from the first source;

means for direct fuel injection of alcohol from the second source, wherein during part of the engine operating time, the engine is fueled both by gasoline that is port fuel injected and alcohol that is directly injected; and

a fuel management system which increases the relative amount of alcohol in the engine with increasing torque so as to prevent knock, wherein the fuel management system employs information from a knock detector and uses closed loop control to control the amount of directly injected alcohol, and

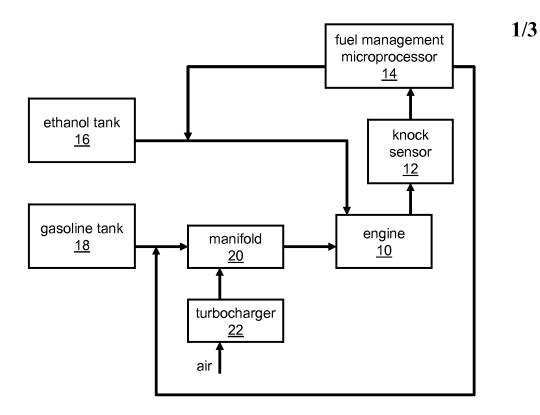
wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

- 28. The engine system of claim 27, wherein the alcohol is methanol.
- 29. The engine system of claim 27, wherein the alcohol is ethanol.
- **30.** The engine system of claim **27**, wherein the alcohol is mixed with water.
- 31. The engine system of claim 27, wherein the fuel management system employs a microprocessor for control of the relative amount of alcohol from the second source that is directly injected into the engine using information from a knock sensor.
- 32. The engine system of claim 31, wherein the fuel management system minimizes the amount of directly injected alcohol from the second source that is used over a drive cycle.

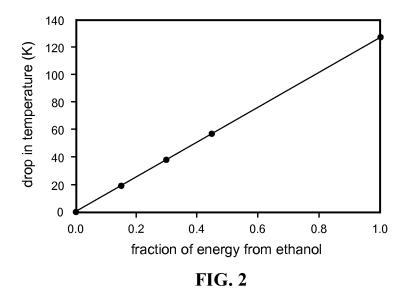
## **ABSTRACT**

Fuel management system for efficient operation of a spark ignition gasoline engine. Injectors inject an anti-knock agent such as ethanol directly into a cylinder of the engine. A fuel management microprocessor system controls injection of the anti-knock agent so as to control knock and minimize that amount of the anti-knock agent that is used in a drive cycle. It is preferred that the anti-knock agent is ethanol. The use of ethanol can be further minimized by injection in a non-uniform manner within a cylinder. The ethanol injection suppresses knock so that higher compression ratio and/or engine downsizing from increased turbocharging or supercharging can be used to increase the efficiency of the engine.





**FIG.** 1



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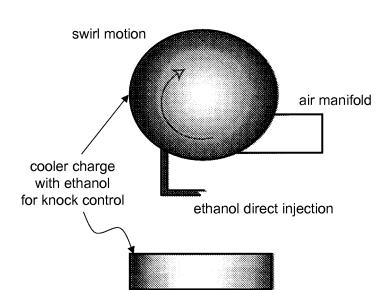


FIG. 3

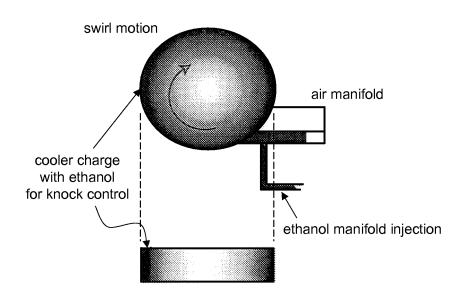
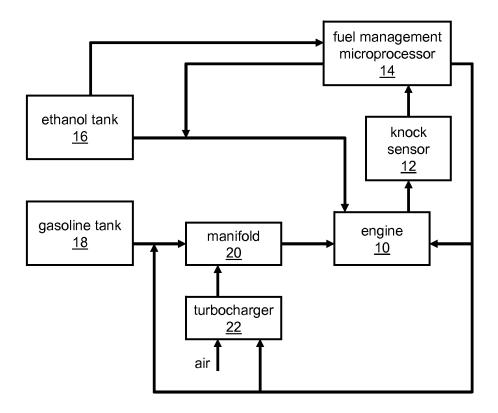


FIG. 4

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**FIG. 5** 



# 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,

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

# FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES

the specification of which (I authorize Choate, Hall & Stewart to check one of the following three choices, and fill in the blanks, if applicable): is attached hereto X was filed on November 18, 2004 as Application Serial No. 10/991,774 and amended on (if applicable). was filed as PCT international application No. on \_\_\_\_\_ and was amended under PCT Article 19 on \_\_\_\_\_ (if applicable). I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledged the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56. I hereby claim foreign priority benefits under Title 35, United States Code, §119 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 having a filing date before that of the application on which priority is claimed: **Priority Claimed** Prior Foreign Application(s): (Day/Month/Year/Filed) (Country) (Number) (Country) (Day/Month/Year/Filed) Yes No (Number)

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I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America listed 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 material information 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:

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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 State Code and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

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<b>Application Data Sheet 37 CFR 1.76</b>				Attorney			04926	11-0883 (IVII	111381)			
FUEL MANAGEMENT OVER						OOTANI	- FNILIANIOI	ENACHT OF CAROLI	NIT.			
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Applic		011110	401111								Remove	
	ant Author	rity 💿	Inventor	OLe	egal Rep	presentative ι	under 35	U.S.C. 11	7	)Party of In	terest under 35 U.S.	.C. 118
Prefix					М	liddle Name	<del></del>		Famil	y Name		Suffix
	Daniel				R.				COHN			
Resid	ence Infor	mation	(Select	One)	① US	Residency	○ N	on US Res	sidency	○ Active	e US Military Service	<u>;</u>
City	Chestnut F	lill			State/	/Province	MA	Countr	y of Re	sidence i	US	
Citizei	nship unde	er 37 C	FR 1.41(	<b>b)</b> i	US							
	g Address	of App	olicant:									
Addre	ss 1		26 Walnı	ut St.								
Addre	ss 2											
City	Chest	nut Hill					Sta	te/Provin	ce	MA		
Postal	Code		02467			(	Country	US				
Applic	ant 2										Remove	
	ant Autho	rity 💿	Inventor	⊜Le	egal Rep	presentative ι	under 35	U.S.C. 11	7	Party of In	terest under 35 U.S	.C. 118
Prefix					М	Middle Name Family Name				Suffix		
	Leslie								BROM	BERG		
Resid	ence Infor	mation	(Select	One)	<ul><li>US</li></ul>	Residency	O N	on US Res			US Military Service	)
City	Sharon				State/	/Province	MA	Countr	y of Re	sidence i	US	
	nship unde			<b>b)</b> i	US							
	g Address	of App										
Addre			176 Wils	hire Dr	ive							
	Address 2											
City	Sharo	n	State/Province MA									
Posta	Code		02067				Country	US				
Applic											Remove	
Applic	ant Autho	rity 💿	Inventor	⊖L6	egal Rep	presentative ι	under 35	U.S.C. 11	7 (	Party of In	terest under 35 U.S.	.C. 118
Prefix	Given Na	me			М	liddle Name	•		Family Name		Suffix	
	John				B.				HEYW	OOD		
	ence Infor	mation	(Select	One)		Residency	<del></del>	on US Res			US Military Service	;
City Newton State				State/	/Province	MA	Countr	y of Re	sidence i	US		

Approved for use through 06/30/2010. OMB 0651-0032 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. 0492611-0883 (MIT11381) Attorney Docket Number **Application Data Sheet 37 CFR 1.76 Application Number** FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE Title of Invention **ENGINES** Citizenship under 37 CFR 1.41(b) i **Mailing Address of Applicant:** Address 1 218 Mill Street Address 2 City Newton State/Province MA **Postal Code** 02460 Country US All Inventors Must Be Listed - Additional Inventor Information blocks may be Add generated within this form by selecting the Add button. Correspondence Information: Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a). An Address is being provided for the correspondence Information of this application. **Customer Number** 24280 **Email Address** spasternack@choate.com Add Email Remove Email Application Information: FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF Title of the Invention **GASOLINE ENGINES Attorney Docket Number** 0492611-0883 (MIT11381) **Small Entity Status Claimed Application Type** Nonprovisional **Subject Matter** Utility Suggested Class (if any) Sub Class (if any) 123 198A Suggested Technology Center (if any) **Total Number of Drawing Sheets (if any)** 3 Suggested Figure for Publication (if any) Publication Information: Request Early Publication (Fee required at time of Request 37 CFR 1.219) Request Not to Publish. I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at

# Representative Information:

eighteen months after filing.

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).

Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:

O Customer Number

O Limited Recongnition (37 CFR 11.9)

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Application Da	ta Sheet 37 CFR 1.76	Attorney Docket Number	0492611-0883 (MIT11381)
Application ba	ita Sileet 37 Cl K 1.70	Application Number	
Title of Invention	FUEL MANAGEMENT SYSTI ENGINES	EM FOR VARIABLE ETHANOL	OCTANE ENHANCEMENT OF GASOLINE
Customer Number	24280		

# **Domestic Benefit Information:**

This section allows for the applicant to claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c). Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(4), and need not otherwise be made part of the specification.						
Prior Application Status	Pending		Remove			

Prior Application Status		Pending		Remove			
Application Number		Continuity Type		Prior Application Number Filing D		te (YYYY-MM-DD)	
		Continuation of	of	11/840719	2007-08-17		
Prior Application	Prior Application Status			Remove			
Application Number	Cont	tinuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)	
11/840719	719 Continuation of		10/991774	2004-11-18	7314033	2008-01-01	
Additional Dome	Additional Domestic Priority Data may be generated within this form by selecting						

the Add button.

Add	

# **Foreign Priority Information:**

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is
not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b)
and 37 CFR 1.55(a).

		Re	move				
Application Number	Country i	Parent Filing Date (YYYY-MM-DD)	Priority Claimed				
			◯ Yes ⊙ No				
Additional Foreign Priority Data may be generated within this form by selecting the  Add button							

# **Assignee Information:**

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37

of the of the have an adolgrament recorded in the office.								
Assignee 1	Assignee 1							
If the Assignee is an O	rganization check here.	X						
Organization Name	Massachusetts Institute of Te	chnology						
Mailing Address Infor	mation:							
Address 1	77 Massachusetts Avenu	е						
Address 2								
City	Cambridge	State/Province	MA					
Country i US		Postal Code	02139					
Phone Number		Fax Number						
Email Address								

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Da	ata Sheet 37 CFR 1.76	Attorney Docket Number	0492611-0883 (MIT11381)				
Application Da	ita Sileet 37 CFK 1.70	Application Number					
Title of Invention	FUEL MANAGEMENT SYSTI ENGINES	EM FOR VARIABLE ETHANOL	OCTANE ENHANCEMENT OF GASOLINE				
Additional Assignee Data may be generated within this form by selecting the Add button.							

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.

# Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.							
Signature	/SamPasternack/		Date (YYYY-MM-DD)	2008-12-08			
First Name	Sam Last Name Pasternack		Pasternack	Registration Number	29576		

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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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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
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result in termination of proceedings or abandonment of the application or expiration of the patent.

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- 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 the Freedom of Information Act requires disclosure of these records.
- 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.
- 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
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- 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 inspections or an issued patent.
- 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.

Electronic Patent Application Fee Transmittal								
Application Number:								
Filing Date:								
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES							
First Named Inventor/Applicant Name:	Da	niel R. Cohn						
Filer:	Sam Pasternack/Elyse Pino							
Attorney Docket Number:	0492611-0883 (MIT11381)							
Filed as Small Entity								
Utility under 35 USC 111(a) Filing Fees								
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)			
Basic Filing:								
Utility filing Fee (Electronic filing)		4011	1	82	82			
Utility Search Fee		2111	1	270	270			
Utility Examination Fee		2311	1	110	110			
Pages:								
Claims:								
Claims in excess of 20		2202	34	26	884			
Multiple dependent claims		2203	1	195	195			
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:				
	Tot	al in USD	(\$)	1541

Electronic Acknowledgement Receipt									
EFS ID:	4408973								
Application Number:	12329729								
International Application Number:									
Confirmation Number:	9459								
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES								
First Named Inventor/Applicant Name:	Daniel R. Cohn								
Customer Number:	24280								
Filer:	Sam Pasternack/Elyse Pino								
Filer Authorized By:	Sam Pasternack								
Attorney Docket Number:	0492611-0883 (MIT11381)								
Receipt Date:	08-DEC-2008								
Filing Date:									
Time Stamp:	11:16:23								
Application Type:	Utility under 35 USC 111(a)								
Payment information:									
Submitted with Payment	yes								
Payment Type	Credit Card								
Payment was successfully received in RAM	\$1541								
RAM confirmation Number	5791								
Deposit Account									
Authorized User									
File Listing:									
Document Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)					

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1		specification_0492611_0883.	138694	yes	15
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	Document De	scription	Start	E	nd
	Specificat	ion	1		10
	Claims		11		14
	Abstrac	:t	15		15
Warnings:					
Information:					
2	Drawings-only black and white line	drawings_0492611_0883.pdf	115624	no	3
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3	Oath or Declaration filed	   declaration_0492611_0598.pdf	193110	no	3
			4b62eb43f5b321b9ec1e20b6533b7b7011 3773e9		<u>.                                    </u>
Warnings:					
Information:					
4	Application Data Sheet	ADS.pdf	1082541	no	5
·		7.55,64.	b5b02858277eb934587d9ae848de1f3e54b ff02c		
Warnings:					
Information:					•
5	Fee Worksheet (PTO-06)	fee-info.pdf	38164	no	2
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Warnings:					
Information:			1		
		Total Files Size (in bytes)	156	58133	

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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.

Filing Date: 12/08/08

Approved for use through 7/31/2006. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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	PATE			FEE DETER	RMINATION REC 0-875	ORD				n or Docket Numb 329,729	er
	AP	PLICATION		ED – PART column 1)	(Column 2)	<u> </u>	SMALL E	ENTITY	OR	OTHER SMALL	
	FOR		NUN	MBER FILED	NUMBER EXTRA	R/	ATE (\$)	FEE (\$)		RATE (\$)	FEE (\$)
	IC FEE			N/A	N/A		N/A	82	1	N/A	
	CFR 1.16(a), (b), or RCH FEE	(c))	<b></b>				····	<del> </del>	ł		
37 (	CFR 1.16(k), (i), or (	m))		N/A	N/A		N/A	270	i	N/A	
	MINATION FEE CFR 1.16(o), (p), or	(n))		N/A	N/A		N/A	110	l	N/A	
	AL CLAIMS	(4//	54		34		×\$26	884	1	x\$52	
	CFR 1.16(i)) EPENDENT CLAIM			minus 20 =		. —		007	OR		
	EPENDENT CLAIM CFR 1.16(h))	5	3	minus 3 =	•	×	\$110			x\$220	
EE	LICATION SIZE		sheets of \$260 (\$1 50 sheet	f paper, the applic							
MU	LTIPLE DEPEND	ENT CLAIM PE	RESENT	(37 CFR 1.16(	i))		195	195	1	390	
_	he difference in c			<u></u>			OTAL	1541 <sup>-</sup>	1	TOTAL	
	APPL	(Column 1)	AMEN	(Column 2)	(Column 3)		SMALL E	ENTITY	OR		R THAN ENTITY
NT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	R/	ATE (\$)	ADDI- TIONAL FEE (\$)		RATE (\$)	ADDI- TIONAL FEE (\$)
Ž	Total (37 CFR 1.16(i))	*	Minus	<b></b>	=	x	=	,	OR	x =	
<b>AMENDMENT</b>	Independent (37 CFR 1.16(h))	*	Minus	***	=	х	=		OR	x =	
₹		e Fee (37 CFR	1.16(s))						1 ***		
	FIRST PRESENT	ATION OF MULTI	PLE DEP	ENDENT CLAIM	(37 CFR 1.16(j))		N/A		OR	N/A	
						TOTAI ADD'T			OR	TOTAL ADD'T FEE	
		(Column 1)	<del>,</del>	(Column 2)	(Column 3)			<u>,                                    </u>	OR		
NT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	R/	ATE (\$)	ADDI- TIONAL FEE (\$)		RATE (\$)	ADDI- TIONAI FEE (\$)
	Total (37 CFR 1.16(i))	• .	Minus	**	=	х	=		OR	x =	
OME	Independent	*	Minus	***	=	х	=		OR	x =	
	I (37 CFR 1.16(h)))		1.16(s))	<u> </u>				,	1 ```		
	(37 CFR 1.16(h)) Application Size	e Fee (37 CFR 1				<b>—</b>	N/A		1	N//A	1
AMENDMENT	Application Size	ATION OF MULT		ENDENT CLAIM	(37 CFR 1.16(j))		IVA		OR	N/A	

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# United States Patent and Trademark Office

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APPLICATION	FILING or	GRP ART				
NUMBER	371(c) DATE	UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/329,729	12/08/2008	1797	1541	0492611-0883 (MIT11381)	32	3

CONFIRMATION NO. 9459 FILING RECEIPT

24280 CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110

\*00000033653762\*

Date Mailed: 12/23/2008

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 submit a written request for a Filing Receipt Correction. 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)

Daniel R. COHN, Chestnut Hill, MA; Leslie BROMBERG, Sharon, 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 11/840,719 08/17/2007 which is a CON of 10/991,774 11/18/2004 PAT 7,314,033

**Foreign Applications** 

If Required, Foreign Filing License Granted: 12/16/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/329,729** 

**Projected Publication Date: 04/02/2009** 

Non-Publication Request: No
Early Publication Request: No

\*\* SMALL ENTITY \*\*

page 1 of 3

#### Title

FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES

# **Preliminary Class**

044

#### PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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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.

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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).

	Application Number		12329729	
	Filing Date		2008-12-08	
	First Named Inventor	Inventor Daniel R. Cohn		
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		1797	
	Examiner Name	not yet assigned		
	Attorney Docket Number		0492611-0883	

	U.S.PATENTS Remove										
Examiner Initial*	Cite No	Patent Number	Kind Code <sup>1</sup> Issue Date Name of Patentee or Applicant of cited Document		Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear						
	1	2741230		1956-04-10	Reynolds, Blake						
	2	3106194		1963-10-08	Cantwell, et al.						
	3	3557763		1971-01-26	Probst, Stephen C.						
	4	4031864		1977-06-28	Crothers, William T.						
	5	4056087		1977-11-01	Boyce, Leonard D.						
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( Not for submission under 37 CFR 1.99)

Application Number		12329729	
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First Named Inventor	Danie	l R. Cohn	
Art Unit		1797	
Examiner Name	not ye	et assigned	
Attorney Docket Number		0492611-0883	

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10	4541383	1985-09-17	Jessel, Alfred J.	
11	4594201	1986-06-10	Phillips et al.	
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( Not for submission under 37 CFR 1.99)

Application Number		12329729	
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Attorney Docket Number		0492611-0883	

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21	6076487	2000-06-20	Wulff et al.	
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( Not for submission under 37 CFR 1.99)

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Attorney Docket Number		0492611-0883		

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First Named Inventor Daniel R. Cohn

Art Unit 1797

Examiner Name not yet assigned

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12329729

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	1	A. MODAK and L.S. CARLETTO, "Engine Cooling by Direct Injection of Cooling Water," Society of Automotive Engineers, Inc., 700887.											
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**Application Number** 

Attorney Docket Number

## INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) Filling Date First Named Inventor

Application Number		12329729
Filing Date		2008-12-08
First Named Inventor	Danie	l R. Cohn
Art Unit		1797
Examiner Name	not ye	et assigned
Attorney Docket Number		0492611-0883

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( Not for submission under 37 CFR 1.99)

Application Number		12329729		
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Examiner Name	not ye	et assigned		
Attorney Docket Number		0492611-0883		

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**Application Number** 12329729 Filing Date 2008-12-08 Daniel R. Cohn 1797 not yet assigned

First Named Inventor Art Unit ( Not for submission under 37 CFR 1.99) **Examiner Name** 0492611-0883 Attorney Docket Number

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Examiner Signature		Date Considered					
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Standard ST.3). 3 For Japa	O Patent Documents at <u>www.USPTO.GOV</u> or MPEP 901.04. <sup>2</sup> Enter officinese patent documents, the indication of the year of the reign of the Empappropriate symbols as indicated on the document under WIPO Standard in is attached.	peror must precede the ser	rial number of the patent document.				

( Not for submission under 37 CFR 1.99)

Application Number		12329729
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Art Unit		1797
Examiner Name not ye		et assigned
Attorney Docket Number	er	0492611-0883

	CERTIFICATION STATEMENT							
Plea	ase see 37 CFR 1	.97 and 1.98 to make the appropriate selection	on(s):					
	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).							
OR	<b>!</b>							
	That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).							
X	See attached ce	rtification statement.						
	Fee set forth in 3	7 CFR 1.17 (p) has been submitted herewith	1.					
	None							
	ignature of the ap n of the signature.	SIGNAT plicant or representative is required in accord		18. Please see CFR 1.4(d) for the				
Sigr	gnature /John D. Lanza/ Date (YYYY-MM-DD) 2009-03-09							
Nan	ame/Print John D. Lanza Registration Number 40,060							
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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.

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App. No.: 12/329,729

## ATTORNEY'S DOCKET NUMBER: 0492611-0883 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

1<sup>st</sup> Inventor: Daniel R. Cohn
U.S. App. No.: 12/329,729

Confirmation No.: 9459

Art Unit: 1797

Filing Date: December 8, 2008 Examiner: Not yet assigned

Title: FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF

**GASOLINE ENGINES** 

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

#### INFORMATION DISCLOSURE STATEMENT (IDS) LETTER WITH CERTIFICATION STATEMENT

Madam:

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 form. It is respectfully requested that the information be expressly considered during the prosecution of the above-identified application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

#### CERTIFICATION STATEMENT

This Information Disclosure Statement (IDS) is filed in compliance with the following Rule(s), as far as is known to the undersigned:

37 CFR § 1.97 (b)(3), i.e. before the mailing of a first Office action on the merits.

Copies of any cited foreign patent or non-patent literature documents not previously provided to the USPTO are enclosed herewith.

1 of 2 Attorney Docket No.: 0492611-0883

4425579v1

App. No.: 12/329,729

Additionally, the Applicant brings to the attention of the Examiner co-pending or prior

U.S. patent applications: App. No. 10/991,774 now issued as patent No. 7,314,033; App. No.

11/100,026 now issued as patent No. 7,225,787; App. No. 11/229,755 now issued as patent No.

7,444,987; App. No. 11/840,719; App. No. 11/758,157; App. No. 11/871,384 and App. No.

12/020,285. Applicant also brings to the attention of the Examiner co-pending U.S. patent

applications: App. No. 11/682,372; App. No. 11/683,564; App. No. 11/782,050; App. No.

11/684,100; and App. No. 12/167,534. Prosecution of these applications may have bearing on

the above-identified application.

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. The Director is

hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should

have been filed herewith to our Deposit Account No. 03-1721.

Respectfully submitted, CHOATE, HALL & STEWART LLP

Date: March 9, 2009

/John D. Lanza/
John D. Lanza
Registration No. 40,060

CHOATE, HALL & STEWART LLP Intellectual Property Two International Place Boston, MA 02110

Phone: (617) 248-5000 Fax: (617) 502-5002 patentdocket@choate.com

2 of 2 Attorney Docket No.: 0492611-0883

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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) Application Number 12329729 Filing Date 2008-12-08 First Named Inventor Daniel R. Cohn Art Unit 1797 Examiner Name not yet assigned Attorney Docket Number 0492611-0883

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	1	6340015		2002-01-22	Benedikt et al.		
	2	6536405		2003-03-25	Rieger et al.		
	3	6745744		2004-06-08	Suckewer et al.		
	4	6748918		2004-06-15	Rieger et al.		
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	7	7013847		2006-03-21	Auer, Gerhard		
	8	7077100		2006-06-18	Vogel et al.		

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Art Unit		1797
Examiner Name not ye		et assigned
Attorney Docket Number	er	0492611-0883

	9	7086376		2006-08	3-08	McKay, Michae	<del>j</del>				
	10	7201136		2007-04	I-10	McKay et al.					
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Attorney Docket Numb	er	0492611-0883

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Attorney Docket Numb	er	0492611-0883

	CERTIFICATION STATEMENT						
Plea	ase see 37 CFR 1	.97 and 1.98 to make the appropriate selection	on(s):				
	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).						
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	That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).						
×	See attached cer	tification statement.					
	Fee set forth in 3	7 CFR 1.17 (p) has been submitted herewith					
	None						
		SIGNAT					
	A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.						
Sigr	Gignature /John D. Lanza/ Date (YYYY-MM-DD) 2009-03-09						
Name/Print         John D. Lanza         Registration Number         40,060				40,060			
pub 1.14	This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour 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.

#### **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 the Freedom of Information Act requires disclosure of these record s.
- 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 inspections 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.

Electronic Acl	Electronic Acknowledgement Receipt					
EFS ID:	4926174					
Application Number:	12329729					
International Application Number:						
Confirmation Number:	9459					
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES					
First Named Inventor/Applicant Name:	Daniel R. COHN					
Customer Number:	24280					
Filer:	John D. Lanza/Kimberly Hutchins					
Filer Authorized By:	John D. Lanza					
Attorney Docket Number:	0492611-0883 (MIT11381)					
Receipt Date:	09-MAR-2009					
Filing Date:	08-DEC-2008					
Time Stamp:	18:50:35					
Application Type:	Utility under 35 USC 111(a)					

#### **Payment information:**

Submitted with Payment			no			
File Listing:						
Document Number	Document Description		File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	NPL Documents	Me	odak Engine Cooling.pdf	1039142	no	6
'	bf4560dbad1e075295029480d8cb561f568 4947b					
Warnings:						
Information:						

2	NPL Documents	LoRusso_Direct_Injection_1998	5221166	no	21
		.pdf	0e1a325a716456cf4f5905933c4c3fa0e37e b995		
Warnings:		•			•
Information:					
3	NPL Documents	Grandin_Knock_Suppression_1	1965670	no	11
		998.pdf	9805e75de6a7f7c60053368f930f003814d0 6851		
Warnings:					
Information:					
4	NPL Documents	Grandin_Replacing_Fuel_Enric hment_1999.pdf	2286041	no	10
		Illiletit_1999.pdf	e1d1123edfce4869805b2c389fdbac912a5c c35c		
Warnings:					•
Information:					
5	NPL Documents	Stan_Internal_Mixture_2001.	6979876	no	11
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Warnings:					
Information:					
6	NPL Documents	OA_10991774_060425.pdf	367712	no	10
			51e0a8dc46d919b7c3b420c17a76c9ef173 ca8fc		
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Information:					
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Information:					
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Warnings:		'	'		'
Information:					
9	NPL Documents	OA_11100026_060803.pdf	255018	no	7
	2 Documents	5rivos2s_coccs.pui	377cc950f21e2da320406c81bd008e69e2d ca25e		
Warnings:					
Information:					
10	NPL Documents	Yuksel_Renewable_Energy_20	611425	no	9
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Warnings:					
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			42f650eaf513de40593d559c035aa5c7134ff 2bc		
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Information:					
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13	NPL Documents	OA_11682372_080102.pdf	224282	no	6
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Warnings:					
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15	NPL Documents	OA_11684100_080603.pdf	173736	no	5
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Warnings:					
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10	NEL Documents	13K_WO_FC11B0703004.pu1	16908fda10dae50c49e01269a4a5b48360c 842cd	110	
Warnings:					
Information:					
17	NPL Documents	ISR_WO_PCTUS0705777.pdf	919580	no	9
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			b525a57242d868818b39c28e98568fb2b3d ea003		
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19	NPL Documents	ISR_WO_PCTUS0869171.pdf	923993	no	11
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24	### APPL Documents   ISR_WO_pctus05041317.pdf   #### APPL Documents   ### APPL Documents   ISR_WO_pctus05011317.pdf   ### APPL Documents   ### APPL Documents   ISR_WO_pctus06012750.pdf   ### APPL Documents   ### APPL Documents   ISR_WO_pctus06012750.pdf   ### APPL Documents   ### A	Information:					
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26 NPL Documents NOA_11684100_090303.pdf 323701 no 7  Warnings:  Information:  27 NPL Documents OA_11840719_071108_2.pdf 02027d5b179e7dce193ba636c7da25c9539 no 6  Warnings:	26 NPL Documents NOA_11684100_090303.pdf	Warnings:					•
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27 NPL Documents OA_11840719_071108_2.pdf	27         NPL Documents         OA_11840719_071108_2.pdf	Information:					
020c7d5b179c7dce193ba636c7da25c9539 5055f  Warnings:	### Marnings:  28	27	NPI Documents	OA 11840719 071108 2 pdf	419178	no	6
	28 Information Disclosure Statement Letter IDS_ltr_0492611_0883.pdf	۷/	INI E DOCUMENTS	5/1_110 <del>1</del> 0/19_0/1100_2.pdf	020c7d5b179e7dce193ba636c7da25c9539 5055f	110	
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29	Information Disclosure Statement (IDS)	US_IDS_FormSB_08a_1.pdf	1396100	no	11
29	Filed (SB/08)	03_183_1 01111 <u></u> 3B_0000_11.pdf	017a86ae8aaa4b41251d4c6f1bab0e37b5f 3aa44	110	11
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30	Information Disclosure Statement (IDS) US_IDS_FormSB_08a_2.pd		863472	no	5
	Filed (SB/08)		47c325b8d4700974ec24f8bc4175a4cc21b 0bc81	110	
Warnings:					
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		Total Files Size (in bytes)	329	805469	

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.

#### PATENT COOPERATION TREATY

#### From the INTERNATIONAL SEARCHING AUTHORITY

To: SAM PASTERNACK	PCT			
CHOATE, HALL & STEWART TWO INTERNATIONAL PLACE BOSTON, MA 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) 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				
The applicant is hereby notified that the international sea have been established and are transmitted herewith.	rch 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				
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 WIPO 1211 Geneva 20, Switzerland, Facsimile No				
For more detailed instructions, see the notes on the a				
	ch report will be established and that the declaration under ne International Searching Authority are transmitted herewith.			
· — · · · · · · · · · · · · · · · · · ·	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.			
l — — ·	plicant will be notified as soon as a decision is made.			
4. Reminders	·			
Bureau. If the applicant wishes to avoid or postpone 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.1 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.				
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.				
Name and mailing address of the ISA/US	Authorized officer			
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450	Stephen K Cronin Character Health			
Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Telephone No. (571) 272-4383			
Facsimile No. (5/1) 2/3-3201  Form PCT/ISA/220 (January 2004)  (See notes on accompanying s				

#### PATENT COOPERATION TREATY

#### INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0002	FOR FURTHER ACTION		Form PCT/ISA/220 re applicable, item 5 below
International application No. PCT/IB07/03004	International filing date (day/n 06 March 2007 (06.03.2007)	nonth/year)	(Earliest) Priority Date (day/month/year) 08 March 2006 (08.03.2006)
Applicant ETHANOL BOOSTING SYSTEMS, LLC			· · · · · · · · · · · · · · · · · · ·
according to Article 18. A copy is being This international search report consists of	transmitted to the Internationa	al Bureau.	thority and is transmitted to the applicant
a translation of th of a translation fu	application in the language in waterinational application into interinational application into	hich it was filed	d
authorized by or notified to c. With regard to any nucleotic	this Authority under Rule 91 Ru	le 43.6 bis(a)	e international application, see Box No. I.
3. Unity of invention is lackin 4. With regard to the title, the text is approved as subm	g (See Box No. III)		
the text has been established	by this Authority to read as foll	ows:	
5. With regard to the abstract, the text is approved as subm	• • •	his Authority a	s it appears in Box No. IV. The applicant
	the date of mailing of this inter-	national search	report, submit comments to this Authority.
as selected by this A	Authority, because the applicant Authority, because this figure be		•
Form PCT/ISA/210 (first sheet) (April 2007)	)		,

#### PCT/IB2007 03004 09.07.2008

INTERNATIONAL SEARCH REPORT			RT International application No.		
		PCT/IB07/03004			
A, CLAS	SSIFICATION OF SUBJECT MATTER F02M 17/00( 2006.01)			T. T	
USPC: According to	123/447 International Patent Classification (IPC) or to both nat	ional clas	sification and IPC		
B. FIELI	DS SEARCHED				
	cumentation searched (classification system followed b	y classifi	cation symbols)		
Documentation	on searched other than minimum documentation to the	extent tha	at such documents are included in	n the fields searched	
Electronic da EAST	ta base consulted during the international search (name	of data b	pase and, where practicable, search	ch terms used)	
C. DOC	UMENTS CONSIDERED TO BE RELEVANT	•		,	
Category *	Citation of document, with indication, where a			Relevant to claim No.	
A	US 2005/0056264 A1, (WEISSMAN et al) 17 Marc	h 2005, F	igure 2, claim 11.	1-15	
A	A US 5,560,344 A (CHAN) 1, October 1996 (01.10.1996), whole document.			1-15	
•					
Further	documents are listed in the continuation of Box C.		See patent family annex.		
"A" document	pecial categories of cited documents; t defining the general state of the art which is not considered to be of relevance	"T"	later document published after the int date and not in conflict with the applic principle or theory underlying the inv	eation but cited to understand the ention	
	plication or patent published on or after the international filing date	"X"	document of particular relevance; the considered novel or cannot be conside when the document is taken alone	claimed invention cannot be ered 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  "O" document referring to an oral disclosure, use, exhibition or other means			p when the document is combined		
"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 actual completion of the international search 08 June 2008 (08.06.2008)			mailing of the international sear JUL 2008	ch report	
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Ale	0. Box 1450 .xandria, Virginia 22313-1450 o. (571) 273-3201	Telepho	one No. (571) 272-4383	Jey	
Form PCT/ISA	A/210 (second sheet) (April 2007)				

#### PCT/IB2007/( 3004 09.07.2008

#### PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: SAM PASTERNACK	PCT			
CHOATE, HALL & STEWART TWO INTERNATIONAL PLACE	NOTIFICATION OF TRANSMITTAL OF			
BOSTON, MA 02110	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 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				
The applicant is hereby notified that the international sea	rch report and the written opinion of the International Searching Authority			
have been established and are transmitted herewith.				
Filing of amendments and statement under Article 19 The applicant is entitled, if he so wishes, to amend the cla				
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				
For more detailed instructions, see the notes on the	accompanying sheet.			
1	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.			
4. Reminders				
Bureau. If the applicant wishes to avoid or postpone publicati	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.1 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.				
See the Annex to Form PCT/IB/301 and, for details about the a Volume II, National Chapters and the WIPO Internet site.	oplicable time limits, Office by Office, see the PCT Applicant's Guide,			
Name and mailing address of the ISA/ US	Authorized officer			
Mail Stop PCT, Attn: ISA/US 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 accompanyin				

(See notes on accompanying sheet)

#### PCT/IB2007/ 3004 09.07.2008

#### PATENT COOPERATION TREATY



#### **PCT**

#### INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0002	FOR FURTHER See Form PCT/ISA/220 ACTION as well as, where 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						
according to Article 18. A copy is being  This international search report consists of the Report  a. With regard to the language, the the international a translation of the of a translation fut.  b. This international search repauthorized by or notified to the constant of the constant	by a copy of each prior art document cited international search was carried out on the basis application in the language in which it was filed the international application into	n this report.  s of: d, which is the language n (Rules 12.3(a) and 23.1(b)) e rectification of an obvious mistake				
	itted by the applicant. , according to Rule 38.2(b), by this Authority a the date of mailing of this international search					
, , , , , , , , , , , , , , , , , , , ,	published with the abstract is Figure No. <u>1</u> applicant.					
	Authority, because the applicant failed to sugge. Authority, because this figure better characterize	ŭ				
b. none of the figures is to be p	-	WINDE				
Corm PCT/ISA/210 (first cheet) (April 2007)						

#### PCT/IB2007/© 3004 09.07.2008

			I I COPY			
INTERNATIONAL SEARCH REPO	ORT	International application No. 11				
		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 n	USPC: 123/447 ccording to International Patent Classification (IPC) or to both national classification and IPC					
B. FIELDS SEARCHED						
Minimum documentation searched (classification system followed U.S.: 123/447	by classification symbo	ls)				
Documentation searched other than minimum documentation to the	e extent that such docum	nents are included in	the fields searched			
Electronic data base consulted during the international search (name EAST	ne of data base and, whe	re practicable, search	n terms used)			
C. DOCUMENTS CONSIDERED TO BE RELEVANT						
Category * Citation of document, with indication, where			Relevant to claim No.			
A US 2005/0056264 A1, (WEISSMAN et al) 17 Mar	rch 2005, Figure 2, clain	n 11.	1-15			
A US 5,560,344 A (CHAN) 1, October 1996 (01.10.1	A US 5,560,344 A (CHAN) 1, October 1996 (01.10.1996), whole document.					
			·			
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	-	family annex.				
Special categories of cited documents:  "A" document defining the general state of the art which is not considered to be of particular relevance	date and not principle or t	in conflict with the applica heory underlying the inven				
"E" earlier application or patent published on or after the international filing date	considered n		aimed 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)	"Y" document of considered to	particular relevance; the cl involve an inventive step	aimed invention cannot be when the document is combined			
"O" document referring to an oral disclosure, use, exhibition or other means	with one or more other such documents, such combination being 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			ımily			
Date of the actual completion of the international search	Date of mailing of th	e international searc	h report .			
08. June 2008 (08.06.2008)	Authorized officer					
Name and mailing address of the ISA/US  Mail Stop PCT, Attn: ISA/US	1	Joseph				
Commissioner for Patents P.O. Box 1450	Stephen K Cronin					
Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Telephone No. (571	) 272-4383				

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

#### PCT/IB2007/ 3004 09.07.2008

#### PATENT COOPERATION TREATY

rom the NTERNATIONAL SEARCHING AUTHORITY			FILE COPY		
To: SAM PASTERNACK CHOATE, HALL & STEWART TWO INTERNATIONAL PLACE BOSTON, MA 02110			PCT RITTEN OPINION OF THE ONAL SEARCHING AUTHORITY		
				(PCT Rule 43bis.1)	
			Date of mailing (day/month/year)		
Applicant's or agent's file r	eference		FOR FURTHER		
2006734-0002				See paragraph 2 below	
International application No	),	International filing date	(day/month/year)	Priority date (day/month/year)	
PCT/IB07/03004		06 March 2007 (06.03.2	007)	08 March 2006 (08.03.2006)	
International Patent Classifi	cation (IPC) or	both national classificat	ion and IPC		
IPC: Please See ContinuUSPC: 123/447,1A,300,3		5,577,198C,198A;701/10	)1		
Applicant					
ETHANOL BOOSTING SY	STEMS. LLC	!		·	
1. This opinion contains in	ndications relat	ing to the following item	s:		
Box No. I	Basis of the o	opinion	•		
Box No. II	Priority				
Box No. III	Non-establish	hment of opinion with re	gard to novelty, inve	ntive step and industrial applicability	
Box No. IV	Lack of unity	of invention			
Box No. V		tement under Rule 43bis citations and explanation		o novelty, inventive step or industrial atement	
Box No. VI	Certain docu	ments cited			
Box No. VII	Certain defec	ets in the international app	plication		
Box No. VIII	Certain obser	rvations on the internation	nal application		
2. FURTHER ACTIO	N				
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 comple	tion of this opinion	Authorized officer	
Mail Stop PCT, Attr Commissioner for P		08 June 2008 (0	)8 06 2008 <b>)</b>	Stephen K Cronin	
P.O. Box 1450		00 June 2000 (1	70.70.2000)	For	
Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201				Telephone No. (571) 272-4383	

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

#### PCT/IB2007/C 3004 09.07.2008

## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

Intermedianal numbination No.	
international application 130.	M M TO TO TO
الساللة السال	
International application No.	9 2 4

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 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))  regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been
estab	lished 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.
	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 listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Addit	ional comments:
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Form PCT/ISA/237(Box No. I) (April 2007)

#### PCT/IB2007/( )004 09.07.2008

### WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No. PCT/IB07/03004	COPY

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement				
1. Statement				
Novelty (N)	Claims <u>I-15</u> Claims <u>NONE</u>	YES		
Inventive step (IS)	Claims <u>I-15</u> Claims <u>NONE</u>			
Industrial applicability (IA)	Claims <u>I-15</u> Claims <u>NONE</u>			
	33(2)-(3), because the prior art does not teach or fairly st	•		
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Form PCT/ISA/237 (Box No. V) (April 2007)

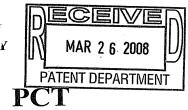
#### PCT/IB2007/ 3004 09.07.2008

#### WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

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

#### PATENT COOPERATION TREA.



From the INTERNATIONAL SEARCHING AUTHORITY

To: Sam Pasternack Choate, Hall & Stewart	PCI			
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 2006734-0003PC	FOR FUT 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				
The applicant is hereby notified that the international s     Authority have been established and are transmitted here.	search report and the written opinion of the International Searching serewith.			
Filing of amendments and statement under Article The applicant is entitled, if he so wishes, to amend the When? The time limit for filing such amendment	19: claims of the international application (see Rule 46): ents is normally two months from the date of transmittal of the			
international search report.  Where? Directly to the International Bureau of W 1211 Geneva 20, Switzerland, Facsimile	IPO, 34 chemin des Colombettes No.: +41 22 740 14 35			
For more detailed instructions, see the notes on the	e accompanying sheet.			
2. The applicant is hereby notified that no international 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:			
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 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 eater 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				
See the Annex to Form PCT/IB/301 and, for details about to Guide, Volume II, National Chapters and the WIPO Internet	et site.			
Name and mailing address of the ISA/US	Authorized officer:			
Mail Stop PCT, Attn: ISA/US	Lee W. Young			
Commissioner for Patents   P.O. Box 1450, Alexandria, Virginia 22313-1450   PCT Helpdesk: 571-272-4300   PCT OSP: 571-272-7774   PCT OSP: 571-272-7774				
	•			

Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

#### PATENT COOPERATION TREALY

From the INTERNATIONAL SEARCHIN	G AUTHORITY
---------------------------------	-------------

To: 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				
Authority have been established and are transmitted her  Filing of amendments and statement under Article of The applicant is entitled, if he so wishes, to amend the When? The time limit for filing such amendment international search report.  Where? Directly to the International Bureau of William (Portion) and For more detailed instructions, see the notes on the The applicant is hereby notified that no international Article 17(2)(a) to that effect and the written opinion of the protest together with the decision thereon applicant's request to forward the texts of both no decision has been made yet on the protest;  4. Reminders  Shortly after the expiration of 18 months from the protest liternational Bureau. If the applicant wishes to avoid on application, or of the priority claim, must reach the International before the completion of the technical preparations for international Bureau. The International Bureau will sen international preliminary examination report has been or is the public but not before the expiration of 30 months from the Within 19 months from the priority date, but only in respect examination must be filed if the applicant wishes to postpon date (in some Offices even later); otherwise, the applicant macts for entry into the national phase before those designate. In respect of other designated Offices, the time limit of 30 months.	claims of the international application (see Rule 46): ents is normally two months from the date of transmittal of the IPO, 34 chemin des Colombetts C C C C No.: +41 22 740 14 35 e accompanying sheet.  Il search report will be established and that the declaration under of the International Searching Authority are transmitted herewith.  In search report will be established and that the declaration under of the International Searching Authority are transmitted herewith.  In search report will be established and that the declaration under of the International Bureau together with the the protest and the decision thereon to the designated Offices.  In the applicant will be notified as soon as a decision is made.  In the written opinion of the International Searching Authority to the day copy of such comments to all designated Offices unless and to be established. These comments would also be made available to the priority date.  It of some designated Offices, a demand for international preliminary the the entry into the national phase until 30 months from the priority must, within 20 months from the priority date, perform the prescribed doffices.  In months (or later) will apply even if no demand is filed within 19 the applicable time limits, Office by Office, see the PCT Applicant's			
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:  Lee W. You MAR 2 6 2008 PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774			

#### PATENT COOPERATION TREAMY

#### **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 a	see Form PCT/ISA/ as, where applicable,	/220 item 5 below.
International application No. PCT/US 07/05777	International filing date <i>(da)</i> 08 March 2007 (08.03.2007)	v/month/year)	(Earliest) Priority D 10 March 2006 (10.0	Date (day/month/year) 03.2006)
Applicant Ethanol Boosting Systems, LLC				
<b></b>	ng transmitted to the Internation	nal Bureau.		smitted to the applicant
<ol> <li>Basis of the report         <ul> <li>a. With regard to the language, t</li> </ul> </li> </ol>	he international search was carr	ied out on the ba	sis of	
n - a	oplication in the language in wh			
a translation of the	international application into		, v	which is the language of
	hed for the purposes of internat report has been established ta			l l
b This international search authorized by or notified	to this Authority under Rule 91	l (Rule 43.6 <i>bis</i> (a	i)).	or an obvious inistance
c. With regard to any nucle	eotide and/or amino acid seque	ence disclosed in	the international app	olication, see Box No. I.
2. Certain claims were for	und unsearchable (see Box No.	II).		
3. Unity of invention is la	cking (see Box No. III).			
4. With regard to the <b>title</b> ,				
the text is approved as si	ibmitted by the applicant.			
the text has been establis	shed by this Authority to read as	follows:		
		*		
5. With regard to the abstract,				
1.	ubmitted by the applicant.	•	*	
the text has been establismay, within one month f	shed, according to Rule 38.2(b), from the date of mailing of this in	by this Authorit	ry as it appears in Bo ch report, submit com	x No. IV. The applicant nments to this Authority.
6. With regard to the drawings,				
a. the figure of the drawings to		s Figure No. 1	<b>F</b>	JECEIVE!
as suggested by th		at follood to our	est a figure	X
	Authority, because the applicar Authority, because this figure by		111	MAR 2 6 2008
p,	be published with the abstract.			PATENT DEPARTMENT

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

#### INTERNA. ONAL SEARCH REPORT

International application No.
PCT/US 07/05777

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - F02B 77/04 (2007.10) USPC - 123/198A According to International Patent Classification (IPC) or to both national classification and IPC				
	DS SEARCHED	The state of the s		
		Jacobian symbols		
Minimum do USPC: 123/1	cumentation searched (classification system followed by c 198A	nassification symbols)		
D	on searched other than minimum documentation to the ext	ont that such documents are included in the	fields searched	
USPC: 123/1	on searched other than minimum documentation to the extenses 198R, 406.29, 406.47 (text search - see terms below)	ent that such documents are mended in the	noids sometimed	
PubWEST/LI	ta base consulted during the international search (name of SPT,PGPB,EPAB,JPAB); Google Patents; Google Schos: gasoline engine, ethanol, direct injection, engine knoctor	lar		
C. DOCUM	MENTS CONSIDERED TO BE RELEVANT			
Category*	Citation of document, with indication, where app	propriate, of the relevant passages	Relevant to claim No.	
Υ	Calculations of Knock Suppression in Highly Turbochar Direct Ethanol Injection (L. Bromberg et al.) 23 Februar especially Abstract, Section I, para [0003], Section II, para	y 2006 (23.02.2006), entire document	1-18	
Υ	US 4,312,310 A (Chivilo' et al.) 26 January 1982 (26.01.1982), col 2, ln 20-26 and ln 36-54			
Υ	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 -15, col 8, ln 3-27col 12, ln 54-56			
Υ	US 4,974,416 A (Taylor) 04 December 1990 (04.12.1990), col 4, ln 15-21			
Υ	US 6,260,525 B1 (Moyer) 17 July 2001 (17.07.2001), c	6, 8, 13-18		
Y US 4,967,714 A (Inoue) 06 November 1990 (06.11.1990), col 3, in 27-30 and in 66-67			11	
Furthe	er documents are listed in the continuation of Box C.			
* Special categories of cited documents:  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand date and not in conflict with the application but cited to understand the experiments of the property and the invention.				
"E" earlier	to be of particular relevance  "E" earlier application or patent but published on or after the international filing date  the principle or theory underlying the invention  document of particular relevance; the claimed invention cannot considered novel or cannot be considered to involve an invention			
"L" docume	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other "Y" document of particular relevance; the claimed invention cann			
"O" document referring to an oral disclosure, use, exhibition or other means combined with one or more other such documents, such combination being obvious to a person skilled in the art				
"P" 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	Date of the actual completion of the international search  Date of mailing of the international search report			
03 December 2007 (03.12.2007) 2 4 MAR 2008				
	Name and mailing address of the ISA/US  Authorized officer:  Lee W. Young			
	P.O. Boy 1450. Alexandria Virginia 22313-1450			
	Facsimile No. 571-273-3201 PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774			

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

From the INTERNATIONAL SEARCHING AUTHORITY		
To: Sam Pasternack Choate, Hall & Stewart Two International Place		PCT
Boston, Massachusetts 02110		RITTEN OPINION OF THE TIONAL SEARCHING AUTHORITY
		(PCT Rule 43bis.1)
	Date of mailing (day/month/year)	24 MAR 2008
Applicant's or agent's file reference 2006734-0003PC	FOR FURTHER	
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 both national class IPC(8) - F02B 77/04 (2007.10) USPC - 123/198A	sification and IPC	
Applicant Ethanol Boosting Systems, LLC		
1. This opinion contains indications relating to the following items:    Box No. I   Basis of the opinion		
2. FURTHER ACTION  If a demand for international preliminary examination International Preliminary Examining Authority ("IPEA") other than this one to be the IPEA and the chosen IPEA opinions of this International Searching Authority will not opinion is, as provided above, considered to be a way a written reply together, where appropriate, with amendm PCT/ISA/220 or before the expiration of 22 months from For further options, see Form PCT/ISA/220.  3. For further details, see notes to Form PCT/ISA/220.	except that this does not a has notified the Internation of be so considered. written opinion of the IPEA ments, before the expiration	pply where the applicant chooses an Authority nal Bureau under Rule 66.1 bis(b) that written , the applicant is invited to submit to the IPEA of 3 months from the date of mailing of Form
PATENT DEPARTMENT		
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  Date of completio 03 December	n of this opinion 2007 (03.12.2007)	Authorized officer:  Lee W. Young  PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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

International application No.

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:
	$\times$	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)).
2.		This opinion has been established taking into account the <b>rectification of an obvious mistake</b> authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3.		egard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been shed on the basis of:
	a. typ	e of material
		a sequence listing
		table(s) related to the sequence listing
	b. for	mat of material
	L	on paper
		in electronic form
	c. tim	e of filing/furnishing
	L	contained in the international application as filed
	<u>_</u>	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 listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5.	Additio	onal comments:

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

International application No.

PCT/US 07/05777

*			
Box No. V Reasoned statement un citations and explanation		ois.1(a)(i) with regard to novelty, inventive step or industrial applicating such statement	bility;
1. Statement			
Novelty (N)	Claims	1-18	YES
Novelty (11)	Claims	None	NO
Inventive step (IS)	Claims	None	YES
· · · · · · · · · · · · · · · · · · ·	Claims	1-18	NO
Industrial applicability (IA)	Claims	1-18	YES
madana approximity (a.r.)	Claims	None	NO
Suppression in Highly Turbocharged Gast 'Bromberg') in view of US 4,312,310 A to a As per claim 1, Bromberg discloses a fuel gasoline engine powering the vehicle (see separate source of ethanol (see Section II, para [0001]). Bromberg does into the engine during vehicle deceleration shutting down the engine by stopping gas driver demand (col 2, In 20-26 and In 36-5 system as disclosed by Bromberg with the Bromberg is fuel conservation and an obveause of the seconditions to prevent engine knock (see Sengine restart to prevent engine knock. In during engine restart as one of the operation is to prevent engine knock.  As per claim 4, Bromberg discloses the sysection II, para [0006]). Bromberg does remissions. However, it would have been minimize hydrocarbon emissions.  As per claim 7, Bromberg further disclose As per claim 12, Bromberg further disclose the syminimize hydrocarbon emissions.  Claims 2, 9 and 10 lack an inventive step 6,358,180 B1 to Kuroda et al. (hereinafter As per claim 2, Chivilo discloses a control deceleration and idling and restarting the wherein the control system disables the sirequirement exceeds a selected level. Kut deceleration and idling when an auxiliary have been obvious to one of ordinary skill Kuroda, since both relate to the technolog down when the batteries are unable to per supplement exceeds as ended to the technolog down when the batteries are unable to per supplement exceeds as ended to the technolog down when the batteries are unable to per supplement exceeds as ended to the technolog down when the batteries are unable to per supplement exceeds as ended to the technolog down when the batteries are unable to per supplement exceeds as ended to the technolog down when the batteries are unable to per supplement exceeds as ended to the technolog down the ended t	coline/Ethanol I Chivilo et al. (I management e Abstract); a s. para (00031) not disclose a an and idling aroline flow into idline	system for operation of a spark ignition gasoline engine in a vehicle consource of gasoline for introduction into the engine (see Section II, para [0]; an injector for direct injection of the ethanol into a cylinder of the engine control system for shutting down the engine by stopping gasoline and ethalor of the engine during vehicle deceleration and idling and restarting the engine during vehicle deceleration and idling and restarting the engine vehicle is to shut down the engine during idle or deceleration.  Wherein the engine uses direct ethanol injection during a range of engine [0003]). Bromberg does not specifically disclose direct ethanol injection uld have been obvious to one of ordinary skill in the art to include ethanol injection during engine knock often occurs during restart and one of the objects of the engine uses direct ethanol injection to minimize hydrocarbon emiss of disclose direct ethanol injection during engine restart to minimize hydrocarbon emiss of disclose direct ethanol injection during engine restart to minimize hydrocarbon emiss of disclose direct ethanol injection during engine restart to minimize hydrocarbon emiss of disclose direct ethanol injection during engine restart to minimize hydrocarbon emiss of disclose direct ethanol injection during engine restart to minimize hydrocarbon emiss of disclose direct ethanol injection during engine restart to minimize hydrocarbon emiss of disclose direct ethanol, the engine during engine is not used and ethanol, E85, methanol, other alcohols have states direct ethanol injection could be be used to displace gasoline direct ethanol injection or substantial engine during down the engine by stopping gasoline flow into the engine during down the engine during d	inprising: a 2003]); a e (see
Please See Continuation Sheet			

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

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, In 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 (col 4, In 15-21). It would have been obvious to one of ordinary skill in the art to modify the system as disclosed by Bromberg with the port fuel injection and fuel film as taught by Taylor, since it is well known 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 (col 3, In 27-30 and In 66-67). It would have 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,

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 (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)

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

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, ln 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 (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 use in the art to modify the engine as disclosed taught by Kuroda and the disabling of the v since the disabling of the valves is well kno during deceleration and idle is an obvious	I by Bromberg with the shut do valves as taught by Moyer, sinc own in the art as an effective wa	12, In 54-56). It would wn during deceleration a all relate to the techi	have been obvious to or and idle and low voltage hology of improving fuel	ne of ordinary skill e restart motor as economy and
Claims 1-18 have industrial applicability as	defined by PCT Article 33(4) b	ecause the subject ma	atter can be made or use	d in industry.
-				

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

SP/Car

#### PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

SAM PASTERNACK CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 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)

100 4.92.00	Date of mailing (day/month/year) 25 FEB 2008
Applicant's or agent's file reference 2006734-0015	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/US07/74227	International filing date (day/month/year) 24 July 2007 (24.07.2007)
Applicant ETHANOL BOOSTING SYSTEMS, LLC	-

1.	$\boxtimes$		nt is hereby notified that the international search report and the written opinion of the International Searching Authority stablished and are transmitted herewith.
			mendments and statement under Article 19: Int 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 Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 338.82.70.
		For mor	re detailed instructions, see the notes on the accompanying sheet.
2.		The applica	ant is hereby notified that no international search report will be established and that the declaration under 2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3.		With regar	rd to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
		the pr	otest together with the decision thereon has been transmitted to the International Bureau together with the applicant's st to forward the texts of both the protest and the decision thereon to the designated Offices.
			cision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4.	Remi	nders	

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 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

Facsimile No. (571) 273-3201 Form PCT/ISA/220 (January 2004) Stephen K Cronin

Telephone No. (571) 272-4383

anying sheet)

FEB 27 2008 PATENT DEPARTMENT

# PCT

### INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2006734-0015	FOR FURTHER see Form PCT/ISA/220 ACTION as well as, where applicable, item 5 below.			
International application No. PCT/US07/74227				
Applicant ETHANOL BOOSTING SYSTEMS, LLC				
This international search report consists of It is also accompanied  1. Basis of the Report  a. With regard to the language, the important of the international at a translation of the of a translation furth	by a copy of each prior art document cited in the international search was carried out on the basis application in the language in which it was filed the international application into make for the purposes of international search le and/or amino acid sequence disclosed in the unsearchable (See Box No. II)  g (See Box No. III)	n this report.  s of: d, which is the language n (Rules 12.3(a) and 23.1(b))		
·	itted by the applicant.  , according to Rule 38.2(b), by this Authority a the date of mailing of this international search			
as suggested by the as selected by this A	authority, because the applicant failed to sugge authority, because this figure better characterize	-		

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

	-		
INTERNATIONAL SEARCH REPO	RT '	International applicati	on No.
		PCT/US07/74227	
A. CLASSIFICATION OF SUBJECT MATTER IPC: F02D 41/30( 2006.01);F02B 1/08( 2006.01)			
USPC: 123/1A,431,447,575		n.c	
According to International Patent Classification (IPC) or to both na	tional classification and I	PC	
B. FIELDS SEARCHED			
Minimum documentation searched (classification system followed t U.S.: 123/1A,300,304,431,447,478,575,577,198C,198A	oy classification symbols)		
Documentation searched other than minimum documentation to the	extent that such documer	nts are included in the	fields searched
	-		
Electronic data base consulted during the international search (name	e of data base and, where	practicable, search te	rms used)
Please See Continuation Sheet	• • • • • • • • • • • • • • • • • • •	<b>.</b>	·,
C. DOCUMENTS CONSIDERED TO BE RELEVANT  Category * Citation of document, with indication, where a	noropriate of the relevan	t nassages I	Relevant to claim No.
X US 2007/0119416 A1 (Boyarski) 31 May 2007 (31.0	• • •	• – –	1-23, 26, 42-48, 56
paragraphs [0066], [0107]-[0117], [0284]-[0318], cl			24.25,27-41,49-55
1,1			24,23,27-41,45-33
X US 2002/01393321 A1 (Weissman et al.) 3 October [0022]-[0046].	2002 (03.10.2002), figu	re 2, paragraphs	24-25, 27-56
			1-23, 26
Further documents are listed in the continuation of Box C.	See patent fa	mily annex.	
Special categories of cited documents:		published after the internati conflict with the application	onal filing date or priority to but cited to understand the
"A" document defining the general state of the art which is not considered to be of particular relevance	principle or the	ory underlying the invention	1
"E" earlier application or patent published on or after the international filing date	considered nove	rticular relevance; the clain el or cannot be considered t nent is taken alone	
"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)	"Y" document of pa	rticular relevance; the clain	en the document is
"O" document referring to an oral disclosure, use, exhibition or other means combined with one or more other such documents, such combination being obvious to a person skilled in the art			
"P" document published prior to the international filing date but later than the priority date claimed	"&" document mem	ber of the same patent fami	ly
Date of the actual completion of the international search  Date of mailing of the international search report  Output  Date of mailing of the international search report			eport
07 December 2007 (07.12.2007)  Name and mailing address of the ISA/US  Authorized officer			A/ 0 /
Mail Stop PCT, Attn: ISA/US	Stephen K Cronin	Name!	Heal s
Commissioner for Patents P.O. Box 1450 Alexandria Virginia 22313-1450	Telephone No. (571) 2	272-4383	2
Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201			501

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

From the INTERNATIONAL SEARCHING AUTH	ORITY			
To: SAM PASTERNACK CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110 W			PCT  UTTEN OPINION OF THE DNAL SEARCHING AUTHORITY	
			(PCT Rule 43bis.1)	
T Color Wilde Hardward Color Color Mark Hardward (Northward Hardward Color Col		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		24 July 2006 (24.07.2006)	
International Patent Classification (IPC)		on and IPC		
IPC: <b>F02D 41/30</b> ( 2006.01); <b>F02B 1/</b> USPC: 123/1A,431,447,575	(08( 2006.01)			
Applicant				
ETHANOL BOOSTING SYSTEMS, LL	С			
This opinion contains indications relations	ating to the following item	s:		
Box No. I Basis of the	opinion			
Box No. II Priority				
Box No. III Non-establi				
Box No. IV Lack of uni				
E	·			
Box No. VI Certain doc	uments cited			
Box No. VII Certain defe	ects in the international app	plication		
Box No. VIII Certain obs	ervations on the internation	nal 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 further options, see Form PCT/IS	SA/220.			
3. For further details, see notes to Form	3. For further details, see notes to Form PCT/ISA/220.			
Name and mailing address of the ISA/US	S Date of comple	tion of this opinion	Authorized officer	
Mail Stop PCT, Attn: ISA/US Commissioner for Patents	18 February 20	08 (18.02.2008)	Stephen K Cronin January Bull Telephone No. (571) 272-4383	
P.O. Box 1450 Alexandria, Virginia 22313-1450			Telephone No. (571) 272-4383	
Facsimile No. (571) 273-3201 Form PCT/ISA/237 (cover sheet) (April 20	07)		000	

International application No.	
PCT/US07/74227	

Box No. I Basis of this opinion				
1. 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)).				
2. 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))				
3. 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				
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 listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.				
5. Additional comments:				
3. Additional commonts.				
·				
Form PCT/ISA/237(Box No. I) (April 2007)				

FORD Ex. 1119, page 82 IPR2020-00013

International application No. PCT/US07/74227

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1. Statement		
Novelty (N)	Claims 1-56	YES
	Claims NONE	NO
Inventive step (IS)	Claims 1-56	
	Claims NONE	NO
Industrial applicability (IA)	Claims 1-56	YES
moustrial application (1A)	Claims NONE	
2. Citations and explanations:		
Claims 1-56 meet the criteria set out in PCT Article 3 invention.	3(2)-(3), because the prior art does not teach or	fairly suggest the claimed
Claim1-56 meet the criteria set out in PCT Article 33 be made or used in industry.	(4), and thus have industrial applicability becau	se the subject matter claimed can
	·	
·		•
		•

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

SPIJDLIJGG SKS

## PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: SAM PASTERNACK Choate, Hall & Stewart LLP	PCT		
Two International Place Boston, Massachusetts 02110 Amend Claim Cite Article 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		
17/3/20 - 1/2/04 - 3/1	(PCT Rule 44.1)		
Final Due Date 1813/108  Docket Administratior NH Date: 1019	Page of mailing 3 OCT 2008		
Applicant's or agent's file reference	FOR FURTHER ACTION See paragraphs 1 and 4 below		
2006734-0021			
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 search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.  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):			
international search report.	nts is normally two months from the date of transmittal of the		
Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 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) ad	ditional 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.			
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 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 date (in some offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed date (in some offices).			
In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is fired within 19			
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.			
Name and mailing address of the ISA/US  Authorized officer:			
Mail Stop PCT, Attn: ISA/US Commissioner for Patents	Blaine R. Copenheaver		
P.O. Box 1450, Alexandria, Virginia 22313-1450  Facsimile No. 571-273-3201  Telephone No. 571-272-7774			
Pacsimile (40, 5) 1-210-025.	4		

Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

# **PCT**

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION as well	see Form PCT/ISA/220 as, where applicable, item 5 below.			
2006734-0021		(Earliest) Priority Date (day/month/year)			
International application No.	International filing date (day/month/year)				
PCT/US2008/069171	PCT/US2008/069171 03 July 2008 10 July 2007				
Applicant ETHANOL BOOSTING SYSTEMS LLC					
according to Article 18. A copy is being	ten prepared by this International Searching A ng transmitted to the International Bureau.	Authority and is transmitted to the applicant			
This international search report consist  It is also accompanied by	s of a total of sheets. a copy of each prior art document cited in this	report.			
1. Basis of the report					
	ne international search was carried out on the b	easis of:			
the international ap	plication in the language in which it was filed				
of a translation furr	international application into nished for the purposes of international search	(Rules 12.3(a) and 23.1(b))			
b. With regard to any nucleon	otide and/or amino acid sequence disclosed i	n the international application, see Box No. 1.			
2. Certain claims were fou	2. Certain claims were found unsearchable (see Box No. II)				
3. Unity of invention is lac	3. Unity of invention is lacking (see Box No. III)				
4. With regard to the title,					
the text is approved as su	bmitted by the applicant				
the text has been established by this Authority to read as follows:					
5. With regard to the abstract,	to the discounting of				
	abmitted by the applicant	rity as it appears in Box No. IV. The applicant			
the text has been establis may, within one month f	rom the date of mailing of this international se	arch report, submit comments to this Authority			
6. With regard to the drawings,	A STATE OF THE STA				
	be published with the abstract is Figure No. 1				
as suggested by th		cost o figura			
	Authority, because the applicant failed to sugg				
	Authority, because this figure better character	izes the invention			
b none of the figures is to	be published with the abstract				

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

## INTERNATIONAL SEARCH REPORT

International application No. PCT/US2008/069171

Box No. I	Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)
This inten	national search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:
1.	Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
2.	Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
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.	Observations where unity of invention is lacking (Continuation of item 3 of first sheet)
This Inter	rnational Searching Authority found multiple inventions in this international application, as follows:
1.	As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.	As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.	As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4.	No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Remarl	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

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				
	OS SEARCHED	ossification symbols)			
IPC(8) - F02I	cumentation searched (classification system followed by cla 3 77/04 (2008.04) 198A, 406.29, 435	assincation symbols)			
Documentati	on searched other than minimum documentation to the exten	nt that such documents are included in the	Telds searched		
Electronic da	ta base consulted during the international search (name of c	lata base and, where practicable, search ter	ms used)		
	DialogPro, IP.com				
C. DOCUI	MENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where app	ropriate, of the relevant passages	Relevant to claim No.		
Υ	US 7,225,787 B2 (BROMBERG et al) 05 June 2007 (05.	.06.2007) entire document	1-14, 18-30, 34-35		
Υ	US 2006/0102145 A1 (COHN et al) 18 May 2006 (18.05	.2006) entire document	1-14, 18-30, 34-35		
Υ	US 6,561,157 B2 (ZUR LOYE et al) 13 May 2003 (13.05	5,2003) entire document	6, 23, 35		
Α	US 3,557,763 A (PROBST) 26 January 1971 (26.01.1971) entire document		1-35		
Α	US 4,056,087 A (BOYCE) 01 November 1977 (01.11.1977) entire document		1-35		
Α	US 4,230,072 A (NOGUCHI et al) 28 October 1980 (28.10.1980) entire document		1-35		
Α	US 4,594,201 A (PHILLIPS et al) 10 June 1986 (10.06.1986) entire document		1-35		
А	US 5,179,923 A (TSURUTANI et al) 19 January 1993 (19.01.1993) entire document		1-35		
А	US 7,156,070 B2 (STROM et al) 02 January 2007 (02.0	1.2007) entire document	1-35		
А	US 2007/0119421 A1 (LEWIS et al) 31 May 2007 (31.05.2007) entire document		1-35		
A	US 2007/0125321 A1 (RITTER) 07 June 2007 (07.06.2007) entire document		1-35		
Furth	er documents are listed in the continuation of Box C.				
"A" docum	al categories of cited documents: nent defining the general state of the art which is not considered of particular relevance	"T" later document published after the inte- date and not in conflict with the appli the principle or theory underlying the	invention		
"E" earlier	application or patent but published on or after the international date	"X" document of particular relevance; the considered novel or cannot be considered when the document is taken alon	leted to illivolve an inventive		
document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other "Y" document of particular relevance; the			claimed invention cannot be		
i means	ment referring to an oral disclosure, use, exhibition or other s ment published prior to the international filing date but later than	considered to involve an inventive combined with one or more other such being obvious to a person skilled in the "&" document member of the same patent			
the pr	iority date claimed	Date of mailing of the international sea			
Date of the	e actual completion of the international search aber 2008	03 OCT 2008			
Name and	mailing address of the ISA/US	Authorized officer:			
Mail Stop P	CT, Attn: ISA/US, Commissioner for Patents 450, Alexandria, Virginia 22313-1450	Blaine R. Copenhe PCT Helpdesk: 571-272-4300	eaver		
	No. 571-273-3201	PCT Helpdesk: 5/1-2/2-4300 PCT OSP: 571-272-7774			

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

From the INTERNATIONAL SEARCHING AUTHORI'	TY			
To: SAM PASTERNACK Choate, Hall & Stewart LLP Two International Place			PCT	
Boston, Massachusetts 02110			ITTEN OPINION OF THE ONAL SEARCHING AUTHORITY	
			(PCT Rule 43bis.1)	
		Date of mailing (day/month/year)	3 OCT 2008	
Applicant's or agent's file reference 2006734-0021		FOR FURTHER A		
International application No. International Application No. PCT/US2008/069171	ternational filing date	(day:month/year)	Priority date (day-month-year) 10 July 2007	
International Patent Classification (IPC) or be	3 July 2008 both national classificat	ion and IPC	To only Look	
IPC(8) - F02B 77/04 (2008.04) USPC - 123/198A				
Applicant ETHANOL BOOSTING SYS	STEMS LLC			
1. This opinion contains indications relating to the following items:    Box No. 1   Basis of the opinion				
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 PCT OSP: 571-272-4300 PCT OSP: 571-272-7774				
Facsimile No. 571-273-3201 PCT OSP: 571-272-7774				

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

International application No. PCT/US2008/069171

Box	No. I	Basis of this opinion
1.	With re	gard to the language, this opinion has been established on the basis of:
	$\times$	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)).
2.		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))
3.		egard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been shed on the basis of:
	a. typ	e of material
	<u> </u>	a sequence listing
	L	table(s) related to the sequence listing
	h for	mat of material
	Ü.	on paper
	F	in electronic form
	c. tim	e of filing/furnishing
	L	contained in the international application as filed
	L	filed together with the international application in electronic form
	L	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 listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5	A dditi	onal comments:
٦.	Additi	onal comments.
1		

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

International application No. PCT/US2008/069171

Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability				
	The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of				
the	entire international application				
Clai	ms Nos. 15-17, 31-33				
because:					
	said international application, or the said claims Nos relate to the following ject matter which does not require an international search (specify):				
the	description, claims or drawings <i>(indicate particular elements below)</i> or said claims Nos. <u>15-17, 31-33</u>				
are	so unclear that no meaningful opinion could be formed (specify):				
Claims 15-17,	31-33 are multiple dependent claims not drafted in accordance with the second and third sentences of Rule 6.4(a).				
the by	claims, or said claims Nos are so inadequately supported the description that no meaningful opinion could be formed (specify):				
no N	international search report has been established for said claims Nos. 15-17, 31-33				
l l an	neaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:				
	furnish a sequence listing on paper complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable				
	to it.  furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.  pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under				
	Rule 13 ter. 1(a) or (b).				
pre An	neaningful opinion could not be formed without the tables related to the sequence listings; the applicant did not, within the scribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in nex C-bis of the Administrative Instructions, and such tables were not available to the International Searching Authority in orm and manner acceptable to it.				
the	tables related to the nucleotide and/or amino acid sequence listing, if in electronic form only, do not comply with the hnical requirements provided for in Annex C-bis of the Administrative Instructions.				
See	Supplemental Box for further details.				

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

International application No. PCT/US2008/069171

Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability;
	citations and explanations supporting such statement

	citations and expianations supporting such statement				
1.	Statement				
	Novelty (N)	Claims	1-14, 18-30, 34-35	YES	
	•	Claims	None	NO	
	Inventive step (IS)	Claims	None	YES	
		Claims	1-14, 18-30, 34-35	NO	
	Industrial applicability (IA)	Claims	1-14, 18-30, 34-35	YES	
		Claims	None	NO NO	

#### Citations and explanations:

Claims 1-5, 7-14, 18-22, 24-30, and 34 lack an inventive step under PCT Article 33(3) as being obvious over Bromberg et al. in view of Cohn et al.

Regarding claim 1, Bromberg et al. disclose a fuel management system for a spark ignition gasoline engine (Abstract) comprising: a gasoline engine (18); a source of gasoline (Fig. 4a); 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 cylinders of the engine (18); a fuel management control system (Col. 1, lines 45-50) for controlling injection of the second fuel into the cylinder so that it is provided in an amount needed to prevent knock (Fig. 3) as other conditions require; and a means for providing 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 as torque increases; and a means for providing fast burn. 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 2, 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 3, 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 4, 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 5, 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 7, 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 and the injector is located near the periphery. Cohn et al. show where spray of the second fuel is aimed toward an end gas on an exhaust valve side of the cylinder and an injector is located near the periphery (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

Regarding claim 8, Bromberg et al. and Cohn et al. disclose that as applied above. Bromberg et al. show where the time of the direct injection of the second fuel is adjusted to minimize the ethanol consumption (Col. 6, lines 48-52, Col. 10, lines 25-35).

Regarding claim 9, 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 10, 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 11, 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 10 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.

(Continued in Supplemental Box)

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

International application No. PCT/US2008/069171

#### Supplemental Box

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

Box \

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 of the engine (18); a fuel management control system (Col. 1, lines 45-50) for 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; 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 as torque increases; and a means for providing fast burn. 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)

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

International application No. PCT/US2008/069171

#### Supplemental Box

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

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 (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:

- 1. [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."
- [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 66.1bis(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/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)

From the INTERNATIONAL SEARCHING AUTHORITY

To: SAM PASTERNACK CHOATE, HALL & STUART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL

Hmend Clams	SEARCHING AUTHORITY, OR THE DECLARATION		
Docketed	(PCT Rule 44.1)		
Due 60606	Date of mailing (day/month/year) 0 6 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 (day/month/year) 14 November 2005 (14.11.2005)		
Applicant MASSACHUSETTS INSTITUTE OF TECHNOLOGY			
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	eaims 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 N	O, 34 chemin des Colombettes o.: (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	rch report will be established and that the declaration under the International Searching Authority are transmitted herewith.		
	ditional 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.			
	pplicant will be notified as soon as a decision is made.		
4. Reminders			
Shortly after the expiration of <b>18 months</b> 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 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 sliby  Colephone No. (703) 908-0861		
Facsimile No. (571) 273-3201 Form PCT/ISA/220 (January 2004)	(See notes on accompanying sheet)		
:	M APR 1 0 2006		

ATENT DEPARTMENT

# **PCT**

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 0492612-0406		Form PCT/ISA/220 are applicable, item 5 below.		
International application No. PCT/US05/41317	International filing date (day/month/year) 14 November 2005 (14.11.2005)	(Earliest) Priority Date (day/month/year) 18 November 2004 (18.11.2004)		
Applicant MASSACHUSETTS INSTITUTE OF TEC	HNOLOGY			
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				
may, within one month from  6. With regard to the <b>drawings</b> , a. the figure of the <b>drawings</b> to be  as suggested by the  as selected by this	d, according to Rule 38.2(b), by this Authority in the date of mailing of this international search published with the abstract is Figure No. 1 e applicant.  Authority, because the applicant failed to sugge Authority, because this figure better characterical search and suggestions.	th report, submit comments to this Authority.  - gest a figure.		

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

### INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/41317

A. CLAS IPC(8):	SIFICATION OF SUBJECT MATTER F02B 75/12( 2006.01)	<u> </u>			
USPC: 123/198A,575,1A,525 According to International Patent Classification (IPC) or to both national classification and IPC					
B. FIELI	OS SEARCHED				
	cumentation searched (classification system followed by 3/ 198A, 575, 1A, 525	classification symbols)			
Documentation NONE	on searched other than minimum documentation to the e	extent that such documents are included in	the fields searched		
Electronic da NONE	ta base consulted during the international search (name	of data base and, where practicable, search	ı terms used)		
C. DOC	JMENTS CONSIDERED TO BE RELEVANT				
Category *	Citation of document, with indication, where ap	propriate, of the relevant passages	Relevant to claim No.		
х	US 6,076,487 A (WULFF et al) 20 June 2000 (20.06. column 5, lines 3-6.		1,4,54		
A	US 4,495,930 A (NAKAJIMA) 29 January 1985 (29.0	01.1985), see entire document.	1-22,24-85		
A	US 4,402,296 A (SCHWARZ) 06 September 1983 (06.09.1983), see entire document. 1-22,24-85				
Further	documents are listed in the continuation of Box C.	See patent family annex.			
* 8	Special categories of cited documents:	"T" later document published after the inter			
	t defining the general state of the art which is not considered to be of relevance	date and not in conflict with the application principle or theory underlying the invertible with the application of the conflict with the application of the conflict with the application of the conflict with the application of the applicatio	ntion		
1	plication or patent published on or after the international filing date	considered novel or cannot be consider when the document is taken alone			
"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) "Y" document of particular relevance; the claimed invention cannot considered to involve an inventive step when the document is c with one or more other such documents, such combination beir			when the document is combined		
"O" documen	t referring 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					
	Date of the actual completion of the international search  Date of mailing of the international search report  Oc. ADD 2005				
	13 March 2006 (13.03.2006)  0 6 APR 2006				
Ma Co P.C Ale Facsimile Ne	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  Telephone No. (703) 398-0861				

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

From the INTERNATI	ONAL SEARCH	ING AUTHO	ORITY				
INTERNATIONAL SEARCHING AUTHORITY  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 A		
0492612-0							
Internation	al application No.	•	Internation	onal filing date	(day/month/year)	Priority date (day/month/year)	
PCT/US05	/41317			mber 2005 (14.1		18 November 2004 (18.11.2004)	
Į .	al Patent Classific		or both nati	ional classificati	ion and IPC		
	F <b>02B 75/12(</b> 2006 23/198A,575,1A,						
Applicant	23/170/1,3/3,1/1	,525					
MASSACI	HUSETTS INSTI	TUTE OF T	ECHNOLO	OGY			
1. This o	pinion contains ir	ndications rel	ating to the	e following item	15:		
	Box No. I	Basis of the	e opinion				
	Box No. II	Priority					
	Box No. III	Non-establ	ishment of	opinion with re	gard to novelty, inven	tive step and industrial applicability	
	Box No. IV	Lack of un	ity of inver	ntion			
	Box No. V	No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement					
	Box No. VI	Certain do	Certain documents cited				
	Box No. VII	Certain de	fects in the	international ap	pplication		
	Box No. VIII	Certain observations on the international application					
2. FUR	THER ACTIO	N					
Interr	national Prelimina	ary Examini nis one to be	ng Author the IPEA	ity ("IPEA") e and the chosen	xcept that this does	be considered to be a written opinion of the not apply where the applicant chooses an e International Bureau under Rule 66.1bis(b) ered.	
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 fi	urther details, see	notes to For	m PCT/ISA	J/220.			
				Date of compl	letion of this opinion	Authorized officer	
	Mail Stop PCT, Att Commissioner for F			13 March 200	6 (13.03.2006)	HENRY YUEN	
P.O. Box 1450 Alexandria, Virginia 22313-1450					. ,	HENRY YUEN Juginia sliby Telephone No. (703) 308-0861	
Facsimile	No. (571) 273-32	201	1005)			1 elepnone No. (703) 308-0861	
Form PCT/ISA/237 (cover sheet) (April 2005)							

International application No.

PCT/US05/41317

Box No. I Basis of this opinion
1. 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)).
2. With regard to any <b>nucleotide and/or amino acid sequence</b> disclosed in the international application and necessary to the claimed invention, 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.
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 listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:
Form PCT/ISA/237(Box No. I) (April 2005)

International application No. PCT/US05/41317

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement					
Novelty (N)	Claims 2,3,5-22,24-53,55-85	YES			
	Claims <u>1,4,54</u>	NO			
Inventive step (IS)	Claims 2,3,5-22,24-53,55-85	YES			
	Claims <u>1,4,54</u>	NO			
Industrial applicability (IA)	Claims 1-22,24-85	YES			
	Claims NONE	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)

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 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?

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)

SPIRMO

### PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

SAM PASTERNACK CHOATE, HALL & STEWART LLP

TWO INTERNATIONAL PLACE MANY CLAWS BOSTON, MA 02110  DOCKETED  DIE ( 28.07	NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION (PCT Rule 44.1)			
Home Garage International Conference Internati	Date of mailing (day/month/year) 28 JUN 2007			
Applicant's or agent's file reference 0492611-0617 CH33	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				
The applicant is hereby notified that the international search 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 clai				
When? The time limit for filing such amendments is a 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.:				
For more detailed instructions, see the notes on the ac	ecompanying sheet.			
2. The applicant is hereby notified that no international search Article 17(2)(a) to that effect and the written opinion of the	h report will be established and that the declaration under e International Searching Authority are transmitted herewith.			
3. With regard to the protest against payment of (an) additi	-			
	n transmitted to the International Bureau together with the applicant's			
no decision has been made yet on the protest; the appl	5			
4. Reminders				
Shortly after the expiration of <b>18 months</b> 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> .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 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 office Stephen Kirk Cronin Telephone No. (703) 308-0861			

Facsimile No. (571) 273-3201 Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

# **PCT**

### INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

ernational application No. T/US06/12750	International filing date (day/month/year) 06 April 2006 (06.04.2006)	(Earliest) Priority Date (day/month/y 06 April 2005 (06.04.2005)
plicant ASSACHUSETTS INSTITUTE OF T	ECHNOLOGY	
	en prepared by this International Searching Anng transmitted to the International Bureau.  ts of a total of sheets.	uthority and is transmitted to the applic
It is also accompan	ied by a copy of each prior art document cited	in this report.
the internation a translation of of a translatior b. With regard to any nucleo Certain claims were four Unity of invention is lack With regard to the title, the text is approved as sub	omitted by the applicant.	ed. , which is the langua ch (Rules 12.3(a) and 23.1(b))
	ned by this Authority to read as follows:  ANCEMENT OF GASOLINE ENGINES	
With regard to the abstract, the text is approved as sub the text has been establish	ed, according to Rule 38.2(b), by this Authority	as it appears in Box No. IV. The applic
With regard to the drawings,  a. the figure of the drawings to b  as suggested by the day as selected by this	om the date of mailing of this international search the published with the abstract is Figure No. 3 the applicant. S Authority, because the applicant failed to suggests Authority, because this figure better characteriz	est a figure.
as suggested by the	ne applicant. s Authority, because the applicant failed to su	

### INTERNATIONAL SEARCH REPORT

International application No.

PCT/US06/12750

			PC1/0300/12/30			
A. CLASSIFICATION OF SUBJECT MATTER IPC: F02B 77/04(2006.01)						
USPC: According to	USPC: 123/198A,435,406.29,406.47,25C,559.1 According to International Patent Classification (IPC) or to both national classification and IPC					
B. FIELI	DS SEARCHED					
	cumentation searched (classification system followed l 23/198A,435,406.29,406.47,25C,559.1	by classification symbo	ls)			
Documentation NONE	on searched other than minimum documentation to the	extent that such docun	nents are included in	n the fields searched		
Electronic da NONE	ta base consulted during the international search (name	e of data base and, whe	re practicable, searc	h terms used)		
C. DOC	JMENTS CONSIDERED TO BE RELEVANT					
Category *	Citation of document, with indication, where a	appropriate, of the relev	ant passages	Relevant to claim No.		
X	US 6,513,505 B2 (WATANABE et al) 04 February 2			1,2,17,36		
A						
A	US 5,937,799 A (BINION) 17 August 1999 (17.08.1	999), column 8, lines 2	20-35.	1-51		
Further	documents are listed in the continuation of Box C.	See patent	family annex.			
	pecial categories of cited documents:  defining the general state of the art which is not considered to be of	date and not i		mational filing date or priority ation but cited to understand the ntion		
	olication or patent published on or after the international filing date	considered no	vel or cannot be consider	laimed invention cannot be red 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)		"Y" document of considered to combined with	involve an inventive step th one or more other such	documents, such combination		
"O" document	referring to an oral disclosure, use, exhibition or other means	being obvious	s 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					
Date of the actual completion of the international search  31 May 2007 (31.05.2007)  Date of mailing of the international search report  28 JIW 2007						
	Name and mailing address of the ISA/US  Authorized officer					
Mail Stop PCT, Attn: ISA/US Commissioner for Patents  Stephen Kirk Cronin						
Alex	P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201  Telephone No. (703) 308-0861					
i acomine NO.	. ( ) 1 1 / 2 1 / 2 / 2 / 2 / 2 / 2 / 2 / 2 /	L				

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

	From the INTERNATIONAL SEARCHING AUTH	ORITY			
	To: SAM PASTERNACK CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110			PCT	
			INTERNATION	ONAL SEARCHING AUTHORITY	
				(PCT Rule 43bis.1)	
	,		Date of mailing (day/month/year)	28 JUN 2007	
	Applicant's or agent's file reference		FOR FURTHER	ACTION	
	0492611-0617			See paragraph 2 below	
	International application No.	International filing date	(day/month/year)	Priority date (day/month/year)	
	PCT/US06/12750	06 April 2006 (06.04.20		06 April 2005 (06.04.2005)	
	International Patent Classification (IPC)	or both national classificat	ion and IPC		
	IPC: <b>F02B</b> 77/04( 2006.01) USPC: 123/198A,406.29,406.47,435,5 Applicant	59.1,25C			
$\bigcirc$	MASSACHUSETTS INSTITUTE OF THE	ECHNOLOGY			
	This opinion contains indications relations	ating to the following item			
		_	s:		
	Box No. I Basis of the	opinion			
	Box No. II Priority				
	Box No. III Non-establi	shment of opinion with re	gard to novelty, inver	ntive step and industrial applicability	
	Box No. IV Lack of uni	ty of invention			
		tatement under Rule 43bis y; citations and explanation		o novelty, inventive step or industrial atement	
	Box No. VI Certain doc	uments cited			
	Box No. VII Certain defe	ects in the international app	olication		
	Box No. VIII Certain obse	ervations on the internation	nal application		
$\bigcirc$	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 further options, see Form PCT/IS	A/220.			
	3. For further details, see notes to Form	PCT/ISA/220.		<u> </u>	
	Name and mailing address of the ISA/ US	Date of complet	ion of this opinion	Authorized officer	
	Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450	31 May 2007 (3	.	Stephen Kirk Crohin	
	Alexandria, Virginia 22313-1450		ľ	Telephone No. (703) 308-0861	
	Facsimile No. (571) 273-3201 Form PCT/ISA/237 (cover sheet) (April 200			J	

International application No.

PCT/US06/12750

$\boxtimes$	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 purpose international search (Rules 12.3(a) and 23.1(b)).
	regard to any <b>nucleotide and/or amino acid sequence</b> disclosed in the international application and necessary to the cl tion, 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.
	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 listing and/or table(s) relating thereto has beer or furnished, the required statements that the information in the subsequent or additional copies is identical to that application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additi	onal comments:
1	

International application No. PCT/US06/12750

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

	11 8	
1. Statement		
Novelty (N)	Claims 3-16,18-35,37-51	YES
	Claims <u>1.2.17,36</u>	NO
Inventive step (IS)	Claims 3-16.18-35,37-51	YES
	Claims <u>1,2.17.36</u>	NO
Industrial applicability (IA)	Claims 1-51	YES
	Claims NONE	No

#### 2. Citations and explanations:

Claims 1.2,17.36 lacks novelty under PCT Article 33(2) as being anticipated by Watanabe et al (US 6,513,505).

As to Claim 1, Watanabe et al discloses fuel management system for operation of a spark ignition gasoline engine comprising: a spark ignition engine 1; a source of gasoline; a source of anti-knock agent 9 which is a fuel; an injector 2 for direct injection of the anti-knock agent 9 into a cylinder 1a of the engine 1; and a fuel management control system 30 for controlling injection of the anti-knock agent 9 into the cylinder 1a to control knock, wherein the antiknock agent 9 has a heat of vaporization per unit of combustion energy that is at least three times that of gasoline. See col. 2, lines 12-20, col. 5, lines 45-66 and col. 6, lines 1-27 and Figs. 1-6.

As to Claim 2, Watanabe et al discloses fuel management system for operation of a spark ignition gasoline comprising: a spark ignition engine 1; a source of gasoline; a source of an anti-knock agent 9 which is a fuel an injector 2 for direct injection of the anti-knock agent 9 into a cylinder of the engine; and a fuel management control system 30 for controlling injection of the anti-knock agent 9 into the cylinder when engine torque is above a selected value or fraction of maximum torque where the value or fraction of maximum torque is a function of engine speed.

As to Claim 17, Watanabe et al discloses wherein the anti-knock agent is ethanol and where the amounts of air, ethanol and gasoline per cylinder per cycle are controlled so as to achieve a substantially stoichiometric fuel/air ratio.

As to Claim 36, Watanabe et al discloses fuel management system for efficient operation of a spark ignition gasoline engine comprising: a gasoline engine 1; a source of an anti-knock agent 9; an injector 2 for direct injection of both the anti-knock agent and the gasoline into a cylinder of the engine; and a fuel management control system 30 for controlling injection of the anti-knock agent into the cylinder to control knock.

Claims 3-16,18-35,37-51 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest wherein the maximum anti-knock agent energy fraction used during a drive cycle is between 30% and 100%.

Claims 1-51 meets 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

International application No.

PCT/US06/12750

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 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)



## 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.usplo.gov

APPLICATION NUMBER FILING OR 371(C) DATE FIRST NAMED APPLICANT ATTY. DOCKET NO./TITLE

12/329,729 12/08/2008 Daniel R. COHN

0492611-0883 (MIT11381) CONFIRMATION NO. 9459

PUBLICATION NOTICE

24280 CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON. MA 02110



Title:FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES

Publication No.US-2009-0084349-A1 Publication Date:04/02/2009

## 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

PTC/SB/81 (01-09)

Approved for use through 11/30/2011. OMB 0651-0035

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 displays a valid OMB control number.

### **Application Number** 12/329,729 **POWER OF ATTORNEY** Filing Date December 8, 2008 OR Daniel R. Cohn First Named Inventor **REVOCATION OF POWER OF ATTORNEY** FUEL MANAGEMENT SYSTEM FOR ... Title WITH A NEW POWER OF ATTORNEY Art Unit AND **Examiner Name** not yet assigned **CHANGE OF CORRESPONDENCE ADDRESS** Attorney Docket Number 0492611-0883

I hereby revoke all previous powers of attorney given in t	he above-ide	ntified application	on.
A Power of Attorney is submitted herewith.			
OR I hereby appoint Practitioner(s) associated with the following Cu Number as my/our attorney(s) or agent(s) to prosecute the appl identified above, and to transact all business in the United State and Trademark Office connected therewith:	ication		24280
OR I hereby appoint Practitioner(s) named below as my/our attorne to transact all business in the United States Patent and Tradem	y(s) or agent(s) t ark Office conne	to prosecute the ap ected therewith:	oplication identified above, and
Practitioner(s) Name		Registration	Number
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	}		00 00 00 00 00 00 00 00 00 00 00 00 00
Please recognize or change the correspondence address		e-identified app	olication to:
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OR .	24200		
The address associated with Customer Number:  OR	24280		
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Country Telephone	Email	T	
I am the:	Linai	,L	
Applicant/Inventor.			
Assignee of record of the entire interest. See 37 CFR 3.71.  Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted	herewith or filed	on	
SIGNATURE of Applica	nt or Assignee	of Record	1.71
Signature kaul Oli		Date	MARCH 12, 2009
Name DANIGA OBRIGO		Telephone	617 253 6966
Title and Company R HWAGER, WIT	st or their represen	tative(s) are required.	. Submit multiple forms if more than one
signature is required, see below*.		(-)	·
*Total of forms are submitted.			

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 3 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.

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

PTO/SB/96 (01-09)
Approved for use through 02/28/2009. OMB 0851-0031
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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(b)
Applicant/Patent Owner: Massachusetts Institute of Technology
Application No./Patent No.: 12/329,729 Filed/Issue Date: December 8, 2008
Titled: FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES
Massachusetts Institute of Technology , a educational institution
(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. the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)
the patent application/patent identified above, by virtue of either:
A. An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel, Frame, or for which a copy therefore is attached.
OR  B. A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:
A chain of title from the inventor(s), of the patent application/patent definitied above, is the content designed above, in the content designed above, it is the content designed above, in the content designed above, in the content designed above, it is the content designed above, in the content designed above, in the content designed above, and it is the content designed above, and it is the content designed above.    The content designed above abov
The document was recorded in the United States Patent and Trademark Office at  Reel, Frame, or for which a copy thereof is attached.  2. From:  To:
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The document was recorded in the United States Patent and Trademark Office at  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 the original owner to the assignee wa or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.  [NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division
accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]
The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.  Where IX, 2009
Signature DANIEL O'BRIEN INTELLECTUAL PROPERTY MANAGER TECHNOLOGY LICENSING OFFICE Title
Printed or Typed Name  Title  Printed or Typed Name  Title  Printed or Typed Name

This collection of information is required by 37 CFR 3.73(b). 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. 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.

### ASSIGNMENT

In consideration of One Dollar (\$1.00) and other good and valuable consideration, the receipt of which is hereby acknowledged, each of the undersigned **Daniel R. Cohn** of Chestnut Hill, Massachusetts; **Leslie Bromberg** of Sharon, Massachusetts; and **John B. Heywood** of Newton, Massachusetts; hereby

Sells, assigns and transfers to Massachusetts Institute of Technology having a place of business in 77 Massachusetts Avenue, Cambridge, Massachusetts, its successors, assigns and legal representatives, all hereinafter referred to as the ASSIGNEE, his/her entire right, title and interest for the United States and all foreign countries; in and to any and all inventions which are disclosed in the application for United States Letters Patent entitled "FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES" filed November 18, 2004, and given serial number U.S. 10/991,774 in and to said application and all divisional, continuing, substitute, renewal, reissue reexamination or other application for Letters Patent which has been or shall be filed in the United States or any foreign country on any of said inventions, and in and to all original and reissued patents which have been or shall be issued in the United States and all foreign countries on said inventions including the right to apply for patent rights in each foreign country and all rights to priority.

Agrees that said ASSIGNEE may apply for and receive Letters Patent for said inventions in its own name and when requested, without charge to but at the expense of said ASSIGNEE, agrees to carry out in good faith the intent and purpose of this Assignment by executing all divisional, continuing, substitute, renewal, reissue, reexamination and all other patent applications on any and all said inventions; by executing all rightful oaths, assignments, powers of attorney and other papers; by communicating to said ASSIGNEE all facts known to him/her relating to said inventions and the history thereof, and generally by doing everything possible which said ASSIGNEE shall consider desirable for aiding in securing and maintaining proper patent protection for said inventions and for vesting title to said inventions and all applications for patents and all patents on said inventions, in said ASSIGNEE.

Hereby requests the Honorable Commissioner of Patents and Trademarks to issue said Letters Patent to said ASSIGNEE.

Covenants with said ASSIGNEE that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been made to others by him/her, and that full right to convey the same as herein expressed is possessed by him/her.

	Chenze
IN WITNESS WHEREOF, I hereto set m	ny hand and seal at Bararala,
this 7th day of February, 200	of cb MIT Teel Licensus ofe.
•	Daniel R. Wh
	Daniel R. Cohn
	2/7/05
Witness	Date
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IN WITNESS WHEREOF, I hereto set m	here Bara Ve
IN WITNESS WHEREOF, I hereto set m	y hand and seal at mit Tech Licensus ofe
this Mh day of Rhowy, 200	y hand and seal at Mont Darala mit tech Lesasus ofe Lesho Brownbey
	Jesho Browney
	Leslie Bromberg
	2/7/05
Witness	Date
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Page 2 of 3

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Atty Docket No.0429611-0598

IN WITNESS WHEREOF, I he	reto set my hand and seal at Meri Bara la.
this 7th day of Februar	n, 2008. Of mit Tech. Licensing ofe.
	John B. Heywood
	2/7/05
Witness	Date
Address	
Witness	Date
Address	

Electronic Ac	knowledgement Receipt
EFS ID:	5199851
Application Number:	12329729
International Application Number:	
Confirmation Number:	9459
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES
First Named Inventor/Applicant Name:	Daniel R. COHN
Customer Number:	24280
Filer:	Sam Pasternack/Daniel Peters
Filer Authorized By:	Sam Pasternack
Attorney Docket Number:	0492611-0883 (MIT11381)
Receipt Date:	22-APR-2009
Filing Date:	08-DEC-2008
Time Stamp:	16:46:47
Application Type:	Utility under 35 USC 111(a)

## Payment information:

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	MIT_11381_POA.pdf	82943	no	1
	,		a5db1a4e9bb2eae14fa7aef3f9ed7bd248d d2b50		
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Information:					

2	Assignee showing of ownership per 37 CFR 3.73(b).	MIT_11381_EstRATA.pdf	<b>212470</b> 99d87366f89e4c3c0137202912ead21f0dcf 7f0d	no	4
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Information:					
		Total Files Size (in bytes):	2:	95413	

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.



## UNITED STATES PATENT AND TRADEMARK OFFICE

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

 APPLICATION NUMBER
 FILING OR 371(C) DATE
 FIRST NAMED APPLICANT
 ATTY. DOCKET NO./ITILE

 12/329,729
 12/08/2008
 Daniel R. COHN
 0492611-0883

24280 CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110 CONFIRMATION NO. 9459
POA ACCEPTANCE LETTER



Date Mailed: 04/30/2009

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/22/2009.

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.

/gbien-aime/

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

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

APPLICATION NO. FILING DATE FIRST NAMED INVENTOR ATTORNEY DOCKET NO. CONFIRMATION NO. 12/329,729 12/08/2008 Daniel R. COHN 0492611-0883 9459 24280 7590 08/25/2009 EXAMINER CHOATE, HALL & STEWART LLP HUYNH, HAI H TWO INTERNATIONAL PLACE BOSTON, MA 02110 ART UNIT PAPER NUMBER 3747 NOTIFICATION DATE DELIVERY MODE 08/25/2009 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)
	12/329,729	COHN ET AL.
Office Action Summary	Examiner	Art Unit
	Hai H. Huynh	3747
The MAILING DATE of this communication app Period for Reply	ears on the cover sheet with the c	orrespondence address
A SHORTENED STATUTORY PERIOD FOR REPLY WHICHEVER IS LONGER, FROM THE MAILING DA  - Extensions of time may be available under the provisions of 37 CFR 1.13 after SIX (6) MONTHS from the mailing date of this communication.  - If NO period for reply is specified above, the maximum statutory period w  - 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).	ATE OF THIS COMMUNICATION 36(a). In no event, however, may a reply be timediately and will expire SIX (6) MONTHS from cause the application to become ABANDONE	J. nely filed the mailing date of this communication. D (35 U.S.C. § 133).
Status		
1)⊠ Responsive to communication(s) filed on <u>08 De</u>	ecember 2008.	
,— · · · · · · · · · · · · · · · · · · ·	action is non-final.	
3) Since this application is in condition for allowar		secution as to the merits is
closed in accordance with the practice under <i>E</i>		
Disposition of Claims		
4)⊠ Claim(s) <u>1-32</u> is/are pending in the application.		
4a) Of the above claim(s) is/are withdraw		
5) Claim(s) is/are allowed.		
6)⊠ Claim(s) <u>1-32</u> is/are rejected.		
7) Claim(s) is/are objected to.		
8) Claim(s) are subject to restriction and/or	election requirement.	
Application Papers		
9) The specification is objected to by the Examine	r.	
10) The drawing(s) filed on is/are: a) acce	epted or b) objected to by the E	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 correcti	on is required if the drawing(s) is obj	ected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Ex	aminer. 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 a) ☐ All b) ☐ Some * c) ☐ None of:	priority under 35 U.S.C. § 119(a)	-(d) or (f).
<ol> <li>Certified copies of the priority documents</li> </ol>	s have been received.	
<ol><li>Certified copies of the priority documents</li></ol>	s have been received in Applicati	on No
<ol><li>Copies of the certified copies of the prior</li></ol>		ed in this National Stage
application from the International Bureau	· · · · · · · · · · · · · · · · · · ·	
* See the attached detailed Office action for a list of	of the certified copies not receive	d.
Attachment(s)		
1) Notice of References Cited (PTO-892)	4) Interview Summary	
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3) ☑ Information Disclosure Statement(s) (PTO/SB/08)	Paper No(s)/Mail Da 5) Notice of Informal P	
Paper No(s)/Mail Date <u>3-9-09</u> .	6) Other:	

U.S. Patent and Trademark Office PTOL-326 (Rev. 08-06)

Office Action Summary

Part of Paper No./Mail Date 20090819

Application/Control Number: 12/329,729 Page 2

Art Unit: 3747

## **DETAILED ACTION**

## **Double Patenting**

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-32 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 74-98 of copending Application No. 11/840,719. Although the conflicting claims are not identical, they are not patentably distinct from each other because they have the same scope.

This is a <u>provisional</u> obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 102

Application/Control Number: 12/329,729 Page 3

Art Unit: 3747

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Cohn et al (6,655,324).

Cohn et al teaches a spark ignition engine; a first means for introducing the fuel from the first source into the engine; a second means for direct injection of the liquid from the second source into the engine, wherein during part of the engine operating time, the engine receives both the fuel from the first source and the liquid that is directly injected from the second source; and a fuel management system which varies the relative amount of the liquid from the second source that is introduced into the engine so as to prevent knock, wherein the fuel management system employs information from a knock detector and uses closed loop control to control the amount of directly injected liquid from the second source; and wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

## Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hai H. Huynh whose telephone number is (571) 272-

Application/Control Number: 12/329,729 Page 4

Art Unit: 3747

4844. The examiner can normally be reached on Monday through Thursday from 7:30

am to 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Stephen Cronin can be reached on (571) 272-4536. 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.

/Hai H. Huynh/

Primary Examiner, Art Unit 3747

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	Application/Control No.	Applicant(s)/Patent Under Reexamination
Index of Claims	12329729	COHN ET AL.
	Examiner	Art Unit
	Hai H Huynh	3747

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## INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99) Application Number 12329729 Filing Date 2008-12-08 First Named Inventor Daniel R. Cohn Art Unit 1797 Examiner Name not yet assigned Attorney Docket Number 0492611-0883

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Application Number		12329729
Filing Date		2008-12-08
First Named Inventor Danie		I R. Cohn
Art Unit		1797
Examiner Name	not ye	et assigned
Attorney Docket Number		0492611-0883

EXAMINER SIGNATURE								
Examiner Signature	/Hai Huynh/ (08/19/2009)	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.

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

## Application/Control No. Search Notes 12329729 Examiner Hai H Huynh Applicant(s)/Patent Under Reexamination COHN ET AL. Art Unit 3747

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Class	Subclass	Date	Examiner								
123	1A	8/19/09	HHH								
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123	431	8/19/09	HHH								
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SEARCH NOTES		
Search Notes	Date	Examiner
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Class	Subclass	Date	Examiner

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Leslie BR	COHN ROMBEI	RUL , Chestnut H RG, Sharon, OD, Newton	ill, MA; MA;							
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	First Named Inventor Daniel R. Cohn		I R. Cohn
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Art Unit		1797		
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Filing Date		2008-12-08		
First Named Inventor Danie		R. Cohn		
Art Unit		1797		
Examiner Name	not ye	t assigned		
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First Named Inventor	Danie	R. Cohn
Art Unit		1797
Examiner Name	not yet assigned	
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Filing Date		2008-12-08
First Named Inventor	Danie	R. Cohn
Art Unit		1797
Examiner Name	not yet assigned	
Attorney Docket Number		0492611-0883

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## **EAST Search History**

## **EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	121	knock\$3 same (correct\$3 or adjust\$3) same (fuel near inject\$3) same (first or primary or main) same (second\$3 or auxiliary)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/08/19 13:29
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L3	13	("3106194"   "4480616"   "4541383"   "4721081"   "4958598"   "6076487"   "6508233"   "6513505"   "6575147"   "6799551"   "6892691"   "6990956"). PN. OR ("7314033"). URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/08/19 13:38
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L5	67	knock\$3 same (correct\$3 or adjust\$3) same (fuel near inject\$3) same alcohol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/08/19 14:34
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# ATTORNEY'S DOCKET NUMBER: 0492611-0883 (MIT-11381) IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

1<sup>st</sup> Inventor: Daniel R. Cohn Confirmation No.: 9459

Serial No: 12/329,729 Art Unit: 3747

Filed: December 08, 2008 Examiner: Hai H Huynh

Title: Fuel Management System for Variable Ethanol Octane Enhancement of

**GASOLINE ENGINES** 

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

Sir:

#### RESPONSE TO NON-FINAL OFFICE ACTION UNDER 37 C.F.R. § 1.111

Applicant hereby submits the following Response to the Non-Final Office Action mailed August 25, 2009. Applicant respectfully requests consideration and entry of this Response.

Listing of Claims begin on page 2.

Remarks begin on page 6.

of 7 Attorney Docket No.: 0492611-0883 (MIT-11381)

4388083v3

#### LISTING OF CLAIMS

1. (Original) A spark ignition engine system for which fuel is introduced into the engine from a first source and a liquid is separately introduced into the engine from a second source by direct injection comprising:

a spark ignition engine;

a first means for introducing the fuel from the first source into the engine;

a second means for direct injection of the liquid from the second source into the engine, wherein during part of the engine operating time, the engine receives both the fuel from the first source and the liquid that is directly injected from the second source; and

a fuel management system which varies the relative amount of the liquid from the second source that is introduced into the engine so as to prevent knock, wherein the fuel management system employs information from a knock detector and uses closed loop control to control the amount of directly injected liquid from the second source; and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

**2.** (Original) The engine system of claim **1**, wherein the engine is turbocharged or supercharged.

3. (Original) The engine system of claim 1 or 2, wherein the liquid from the second source is alcohol.

**4.** (Original) The engine system of claim **3**, wherein the alcohol is methanol.

5. (Original) The engine system of claim 3, wherein the alcohol is ethanol.

**6.** (Original) The engine system of claim **1** or **2**, wherein the liquid from the second source is an alcohol–water mixture.

7. (Original) The engine system of claim 1 or 2, wherein the liquid from the second source includes water.

**8.** (Original) The engine system of claim **1** or **2**, wherein the fuel from the first source is gasoline and the liquid from the second source includes water.

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9. (Original) The engine system of claim 1 or 2, wherein the liquid from the second source is injected so as to result in a non-uniform distribution in the engine cylinder.

10. (Original) The engine system of claim 9, wherein the liquid from the second source is injected so as to be more concentrated near the periphery of the engine cylinder, and

wherein the liquid from the second source includes alcohol, and

wherein the alcohol energy fraction is sufficiently high to prevent knock but the alcohol energy fraction is reduced as compared to the situation using a uniform distribution.

11. (Original) The engine system of claim 1 or 2, wherein the fuel management system employs a microprocessor for control of the relative amount of liquid from the second source that is directly injected into the engine using information from a knock sensor, and

wherein the relative amount of the liquid from the second source increases with increasing torque, and

wherein the fuel management system minimizes the amount of directly injected liquid from the second source that is used over a drive cycle.

- 12. (Original) The engine system of claim 11 further including open loop control with a look up table.
- 13. (Original) The engine system of claims 1 or 2, wherein spark retard is used and is varied according to the consumption of the liquid from the second tank.
- **14.** (Original) A spark ignition engine system into which fuel is introduced into the engine from a first source using a first fuel injector and a liquid from a second source is introduced into the engine using a second fuel injector comprising:
  - a spark ignition engine;
  - a first fuel injector for introducing fuel into the engine from the first source;
- a second fuel injector for introducing the liquid from the second source into the engine wherein during part of the engine operating time, the engine receives both the fuel from the first source and the liquid from the second source; and
- a fuel management system which varies the relative amount of the liquid from the second source that is introduced into the engine so as to prevent knock, wherein the fuel management

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system uses closed loop control to control the amount of liquid from the second source and

employs information from a knock detector, and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

15. (Original) The engine system of claim 14, wherein the fuel from the first source is port

fuel injected.

16. (Original) The engine system of claim 14 or 15, wherein the liquid from the second source

is alcohol.

17. (Original) The engine system of claim 16, wherein the alcohol is methanol.

**18.** (Original) The engine system of claim **16**, wherein the alcohol is ethanol.

19. (Original) The engine system of claims 14 or 15, wherein the liquid from the second

source is an alcohol-water mixture.

20. (Original) The engine system of claims 14 or 15, wherein the liquid from the second

source includes water.

21. (Original) The engine system of claims 14 or 15, wherein the fuel from the first source is

gasoline and the liquid from the second source includes water.

22. (Original) The engine system of claims 14 or 15, wherein the fuel management system

employs a microprocessor for control of the relative amount of liquid from the second source

that is directly injected into the engine using information from a knock sensor, and wherein

the relative amount of liquid from the second source increases with increasing torque, and

wherein the fuel management system minimizes the amount of directly injected liquid from

the second source that is used over a drive cycle.

23. (Original) The engine system of claim 22 further including open loop control with a look

up table.

24. (Original) The engine system of claims 14 or 15, wherein spark retard is used and is varied

according to the consumption of the liquid from the second tank.

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25. (Original) The engine system of claims 14 or 15, wherein the engine is turbocharged.

**26.** (Original) The engine system of claims **14** or **15**, wherein the engine is supercharged.

27. (Original) A turbocharged or supercharged spark ignition engine system which uses both port fuel injection of gasoline from a first source and direct fuel injection of alcohol from a second source comprising:

a spark ignition engine;

a turbocharger or supercharger;

means for port fuel injection of gasoline from the first source;

means for direct fuel injection of alcohol from the second source, wherein during part of the engine operating time, the engine is fueled both by gasoline that is port fuel injected and alcohol that is directly injected; and

a fuel management system which increases the relative amount of alcohol in the engine with increasing torque so as to prevent knock, wherein the fuel management system employs information from a knock detector and uses closed loop control to control the amount of directly injected alcohol, and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

28. (Original) The engine system of claim 27, wherein the alcohol is methanol.

**29.** (Original) The engine system of claim **27**, wherein the alcohol is ethanol.

**30.** (Original) The engine system of claim **27**, wherein the alcohol is mixed with water.

**31.** (Original) The engine system of claim **27**, wherein the fuel management system employs a microprocessor for control of the relative amount of alcohol from the second source that is directly injected into the engine using information from a knock sensor.

32. (Original) The engine system of claim 31, wherein the fuel management system minimizes the amount of directly injected alcohol from the second source that is used over a drive cycle.

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#### REMARKS

Claims 1-32, of which claim 1, 14 and 27 are independent in form, are presented for examination. Applicants make no amendments to the claims with this Response. Applicants respectfully request a timely Notice of Allowance.

The Examiner provisionally rejected claims 1-32 on the ground of non-statutory obviousness-type double patenting as unpatentable over claims 74-98 of co-pending application No. 11/840,719. Applicants respectfully request that the Examiner hold this rejection in abeyance.

#### Claim Rejections: Claims 1-32

Claims 1-32 were rejected under 35 U.S.C. 102(e) as anticipated by Cohn *et al*. (6655324).

Claims 1-32 are directed to a spark ignition engine system having, *inter alia*, a second fuel injector for introducing <u>liquid</u> from a second source into the engine.

Cohn *et al.* is directed to a high compression ratio, <u>hydrogen</u> enhanced gasoline engine system. Cohn *et al.* does not teach a second fuel injector for introducing a <u>liquid</u> from a second source into the engine. Although column 8, lines 1-4 discusses "other mixtures involving natural gas propane, ethanol and methanol", these is no explicit teaching that those natural gases be in liquid form. As Cohn *et al.* is silent as to the state of the natural gases, there is no teaching of introducing a liquid from a second source.

Accordingly, Applicants respectfully request that the rejection over Cohn *et al.* be withdrawn.

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### **CONCLUSION**

In view of the foregoing remarks, Applicants submit that all claims pending in this application, namely claims 1-32 are in condition for allowance and early indication thereof is respectfully requested.

Respectfully submitted, CHOATE, HALL & STEWART LLP

Date: October 19, 2008 /Sam Pasternack/

Sam Pasternack Registration No. 29,576

CHOATE, HALL & STEWART LLP Intellectual Property Two International Place Boston, MA 02110

Phone: (617) 248-5000 Fax: (617) 502-5002 patentdocket@choate.com

Electronic Acknowledgement Receipt					
EFS ID:	6285866				
Application Number:	12329729				
International Application Number:					
Confirmation Number:	9459				
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES				
First Named Inventor/Applicant Name:	Daniel R. COHN				
Customer Number:	24280				
Filer:	Sam Pasternack/Adele E. Kalogeris				
Filer Authorized By:	Sam Pasternack				
Attorney Docket Number:	0492611-0883				
Receipt Date:	19-OCT-2009				
Filing Date:	08-DEC-2008				
Time Stamp:	15:49:54				
Application Type:	Utility under 35 USC 111(a)				

# **Payment information:**

Submitted with	Payment	no	no						
File Listing:									
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)				
1	Miscellaneous Incoming Letter	MIT-0883-Transmittal.pdf	72140	no	1				
'	Miscellaneous meorning Letter	Will 6003 Haristilitai.pai	a8056f4f43a18b806432f30c69fbd8b57de2 2a88						
Warnings:									
Information:									

2	Amendment/Req. Reconsideration-After	MIT-0883-Response.pdf	122356		7			
	Non-Final Reject		ba44ff8a357a239a141f481fdc9f42f127f138 a4		,			
Warnings:	Warnings:							
Information:	Information:							
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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.

## ATTORNEY'S DOCKET NUMBER: 0492611-0883 (MIT-11381) IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

1st Inventor: Daniel R. Cohn Confirmation No.: 9459

Serial No: 12/329,729 Art Unit: 3747

Filed: December 08, 2008 Examiner: Hai H Huynh

Title: Fuel Management System for Variable Ethanol Octane Enhancement of

**GASOLINE ENGINES** 

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

Sir:

#### **TRANSMITTAL**

Enclosed are the following documents:

- 1. Response to Non-Final Office Action (7 pages); and
- 2. This Transmittal (1 page).

If any fees are required to be paid or if any overpayment has been made, please charge or credit same to Deposit Account No. 03-1721 referencing Attorney Docket Number 0492611-0883.

> Respectfully submitted, CHOATE, HALL & STEWART LLP

Date: October 19, 2008 /Sam Pasternack/

Sam Pasternack

Registration No. 29,576

CHOATE, HALL & STEWART LLP **Intellectual Property** Two International Place Boston, MA 02110

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P	PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						pplication or	Docket Number 29,729	Fil	ing Date 08/2008	To be Mailed
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	FOR	N	JMBER FIL	.ED NUM	/BER EXTRA		RATE (\$)	FEE (\$)		RATE (\$)	FEE (\$)
	BASIC FEE N/A N/A (37 CFR 1.16(a), (b), or (c))			N/A			N/A				
	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),		N/A		N/A		N/A			N/A	
	TAL CLAIMS CFR 1.16(i))		mir	us 20 = *			x \$ =		OR	x \$ =	
	EPENDENT CLAIM CFR 1.16(h))	IS	m	inus 3 = *			x \$ =			x \$ =	
	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).										
	MULTIPLE DEPEN	NDENT CLAIM PR	ESENT (3	7 CFR 1.16(j))							
* If 1	he difference in col	umn 1 is less than	zero, ente	r "0" in column 2.			TOTAL			TOTAL	
APPLICATION AS AMENDED - PART II OTHER THAN (Column 1) (Column 2) (Column 3) SMALL ENTITY OR SMALL ENTITY											
AMENDMENT	10/19/2009	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)		RATE (\$)	ADDITIONAL FEE (\$)
ME	Total (37 CFR 1.16(i))	* 54	Minus	** 54	= 0		X \$26 =	0	OR	x \$ =	
II I	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0		X \$110 =	0	OR	x \$ =	
√ME	Application S	ize Fee (37 CFR 1	.16(s))								
_	FIRST PRESEN	NTATION OF MULTIF	LE DEPEN	DENT CLAIM (37 CFF	R 1.16(j))				OR		
							TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	
		(Column 1)		(Column 2)	(Column 3)						
L		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)		RATE (\$)	ADDITIONAL FEE (\$)
Z Z	Total (37 CFR 1.16(i))	*	Minus	**	=	1	x \$ =		OR	x \$ =	
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Attorney Docket Number	1138 107294			
Examiner Name	HALH, HUYNH			
Art Unit	3747			
Title	FUEL MANAGMENT SYSTEM FOR VARIABLE ETHANOL			
First Named Inventor	Daniel R. Cohn et al.			
Filing Date	12/08/2008			
Application Number	12/329729			

I hereby revoke all pre-	vious powers of attorney	given in the a	bove-ident	lified application	on.		
A Power of Attorney is submitted herewith.							
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I am the:  Applicant/Inventor.							
OR Assignee of record of	of the entire interest. See 37 C	FR 3.71.		herewith			
Statement under 37	CFR 3.73(b) (Form PTO/SB/9	6) submitted here	vith or filed a	n_Herewitti			
	- SIGNATUR	E of Applicant or	Assignee of	f Record			
Signature	Jamus O'Pon	en		Date	12/29/2009		
	eniel O'Brien			Telephone	617.258.7148	-	
	Manager Massachus						
NOTE: Signatures of all the inv signature is required, see below	rentors or assignees of record of to	he entire interest or t	heir representa	stive(s) are required	. Submit multiple forms if	more than one	
Total of forms are submitted.							

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STATEMENT UNDE	STATEMENT UNDER 37 CFR 3.73(b)						
Applicant/Patent Owner: Daniel R. Cohn et al.							
Application No./Patent No.: 12/329729	Filed/Issue Date: 12/08/2008						
Titled: FUEL MANAGEMENT SYSTEM FOR VARIABLE ET ENGINES							
Massachusetts Institute of Technology , a Non-pr	rofit						
	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;							
an assignee of less than the entire right, title, and interest (The extent (by percentage) of its ownership interest is	an assignee of less than the entire right, title, and interest in (The extent (by percentage) of its ownership interest is%); or						
3. the assignee of an undivided interest in the entirety of (a c	complete assignment from one of the joint inventors was made)						
the patent application/patent identified above, by virtue of either:							
An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 022373 , Frame 0203 , or for which a copy therefore is attached.							
B. A chain of title from the inventor(s), of the patent applicati	on/patent identified above, to the current assignee as follows:						
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Reel Frame	or for which a copy thereof is attached.						
2. From:	То:						
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Additional documents in the chain of title are listed on a							
As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.							
[NOTE: A separate copy (i.e., a true copy of the original assi accordance with 37 CFR Part 3, to record the assignment in t	ignment document(s)) must be submitted to Assignment Division in the records of the USPTO. <u>See</u> MPEP 302.08]						
The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.							
Same o Brun	12/30/2009						
Signature	Date						
Daniel O'Brien	IP Manager						
Printed or Typed Name	Title						

This collection of information is required by 37 CFR 3.73(b). 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 pathering, 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 bowden, 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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Filing Date

Application Number

First Named Inventor

12/329729

12/08/2008

Daniel R. Cohn et al.

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AND	Art Unit	3747 HAIH, HUYNH		
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SHANGE OF CORRESPONDENCE ADDRESS	Attorney Docket Number	11381, 107294		
I horabu garatia all ancière de la companya de la				
I hereby revoke all previous powers of attorney given i	n the above-identified	application.		
A Power of Attorney is submitted herewith.  OR  I hereby appoint Practitioner(s) associated with the following Number as my/our attorney(s) or agent(s) to prosecute the aidentified above, and to transact all business in the United S and Trademark Office connected therewith:  OR  I hereby appoint Practitioner(s) named below as my/our attorneys.	pplication tates Patent	91197		
to transact all business in the United States Patent and Trad	lemark Office connected the	rewith: egistration Number		
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SIGNATURE of Applicant or Assignee of Record

NOTE. Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one

Date

12/30/2009

Telephone 617.258.7148

Samuel O'Ponen

IP Manager Massachusetts Institute of Technology

Daniel O'Brien

Signature

signature is required, see below\*.

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PAGE 12/17 \* RCVD AT 12/30/2009 10:02:18 AM [Eastern Standard Time] \* SVR:USPTO-EFXRF-6/15 \* DNIS:2738300 \* CSID:617 258 6790 \* DURATION (mm-ss):06-44

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	STATEMENT U	JNDER 37 CFR 3.73(b)
Applicant/Patent Owner: Daniel		
		Filed/Issue Date: 12/08/2008
Titlec: FUEL MANAGEMEN ENGINES	NT SYSTEM FOR VARIABLE	E ETHANOL OCTANE ENHANCEMENT OF GASOLINE
Massachusetts Institute of Tec		on-profit
(Name of Assignee)		(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.
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B. A chain of title from the	inventor(s), of the patent appli-	fication/patent identified above, to the current assignee as follows:
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The undersigned (whose title is sup	l	at on behalf of the assignee.
- gamel or	min	12/30/2009
Signature		Date
Daniel O'Brien		IP Manager
Printed or Typed Name		Title

This collection of Information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to fite (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 an dors 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. DC 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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PAGE 13/17 \* RCVD AT 12/30/2009 10:02:18 AM [Eastern Standard Time] \* SVR:USPTO-EFXRF-6/15 \* DNIS:2738300 \* CSID:617 258 6790 \* DURATION (mm-ss):06-44

**POWER OF ATTORNEY** 

OR

REVOCATION OF POWER OF ATTORNEY

12/08/2008

Daniel R. Cohn et al.

6172531850

DEC 3 a 2009

FUEL MANAGMENT SYSTEM FOR VARIABLE ETHANGL

PTO/SB/81 (01-09)
Approved for use through 11/30/2011, OMB 0651-0035
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 displays a valid OMB control number 12/329729

Filing Date

Application Number

First Named Inventor

#### WITH A NEW POWER OF ATTORNEY Art Unit AND HAI H. HUYNH Examiner Name CHANGE OF CORRESPONDENCE ADDRESS 11381. 107294 **Attorney Docket Number** I hereby revoke all previous powers of attorney given in the above-identified application A Power of Attorney is submitted herewith. OF I hereby appoint Practitioner(s) associated with the following Customer 91197 Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent X and Trademark Office connected therewith: I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: Practitioner(s) Name Please recognize or change the correspondence address for the above-identified application to: The address associated with the above-mentioned Customer Number X OR The address associated with Customer Number: OR Firm of Individual Name Address State City Country Email Telephone am the Applicant/Inventor. Assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) (Form PTC/SB/96) submitted herewith or filed on SIGNATURE of Applicant or Assignee of Record 12/30/2009 Lamel O'Panen Date Signature Telephone 617.258.7148 Daniel O'Brien Name IP Manager Massachusetts Institute of Technology NOTE: Signatures of all the eventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below". forms are submitted. \*Total of

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file land 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 3 minutes to complete. USPTO to process) an application formating 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. Alexandra, VA. 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS CAPPLETES, SEND VO. Commercial P.O. Box 1450. Alexandria, VA. 22313-1450. ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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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 displays a valid OMB control number.

				STAT	EMENT UND	ER 37 CF	R 3.7	3(b)		
Apı	olicant/	Patent Owi	ner: Daniel R. C	ohn et al.						
			nt No.: 12/32972			Filed/1	ssue C	Date: 12/08	/2008	
Title		FUEL MA	NAGEMENT SY	STEM FOR	VARIABLE E	THANOL	OCTA	NE ENHA	NCEMENT O	F GASOLINE
Ma	ssach	usetts Inst	itute of Technol	ogy	, a Non-p	orofit				
	me of As					of Assignee	eg,cor	peration, partner	rship, university, g	overnment agency, etc.
sta	tes tha	titis:	•							
1.	X	the assign	nee of the entire r	ight, title, and	interest in;					
2.		an assign (The exte	ee of less than th nt (by percentage	e entire right.	title, and interes thip interest is	st in	_%); c	or		
3.		the assign	nee of an undivide	ed interest in th	ne entirety of (a	complete a	assign	ment from or	ne of the joint i	nventors was made)
the	paten	application	n/patent identified	above, by virt	ue of either:					
Α.	An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 022373 Frame 0203 or for which a copy therefore is attached.							nt was recorded in , or for which a		
OR B		A chain o								ssignee as follows:
!		1. From:					To:			
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		3. From:				<u> </u>	Го			
			The document w	as recorded in	the United Stat	tes Patent	and Tr	rademark Off	ice at	
			Reel		Frame		·	or for which	h a copy there	of is attached.
	П	Addition	al documents in th	ne chain of title	are listed on a	supplemen	ntal sh	eet(s).		
Σ	or	concurrent	y is being, submit	ted for recorda	ition pursuant to	37 CFR 3	.11			ner to the assignee was,
	(No	OTE: A sep cordance w	arate copy (i.e., a ith 37 CFR Part 3	true copy of , to record the	the original assi assignment in t	ignment do the records	of the	nt(s)) must b USPTO. <u>Se</u>	e submitted to e MPEP 302.0	Assignment Division in [8]
Th	e unde	-	nose title is supplie				if the a	ssignee.		
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Da	niel O	'Brien							IP Manager	
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Title

This collection of information is required by 37 CFR 3 73(b). 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 gainering prepaning, 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 anoror suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patient and Trademark Office. U.S. Department of Commerce, P.O. Bos 1450, Alexandria, VA. 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS 10 THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Bos 1450, Alexandria, VA. 22313-1450.

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PAGE 13/17 \* RCVD AT 12/30/2009 9:54:47 AM [Eastern Standard Time] \* SVR:USPTO-EFXRF-6/4 \* DNIS:2738300 \* CSID:6172531850 \* DURATION (mm-ss):04-46

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.	
12/329,729	12/08/2008	Daniel R. COHN	0492611-0883	9459	
	7590 01/12/201 LL & STEWART LLP	EXAMINER			
TWO INTERNATIONAL PLACE			HUYNH, HAI H		
DOSTON, MA	BOSTON, MA 02110		ART UNIT	PAPER NUMBER	
			3747		
			NOTIFICATION DATE	DELIVERY MODE	
			01/12/2010	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)					
	12/329,729	COHN ET AL.					
Office Action Summary	Examiner	Art Unit					
	Hai H. Huynh	3747					
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 3 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 earned patent term adjustment. See 37 CFR 1.704(b).							
Status							
1)⊠ Responsive to communication(s) filed on 19 Oc	ctober 2009.						
·= ·	action is non-final.						
3) Since this application is in condition for allowar		secution as to the merits is					
closed in accordance with the practice under <i>E</i>							
Disposition of Claims							
4)⊠ Claim(s) <u>1-32</u> is/are pending in the application.							
4a) Of the above claim(s) is/are withdraw							
5) Claim(s) is/are allowed.							
6)⊠ Claim(s) <u>1-32</u> is/are rejected.							
7) Claim(s) is/are objected to.							
8) Claim(s) are subject to restriction and/or	election requirement.						
Application Papers							
9) The specification is objected to by the Examine	r.						
10) The drawing(s) filed on is/are: a) acce	epted or b) objected to by the E	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 correcti	on is required if the drawing(s) is obj	ected to. See 37 CFR 1.121(d).					
11)☐ The oath or declaration is objected to by the Ex	aminer. 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 a) All b) Some * c) None of:	priority under 35 U.S.C. § 119(a)	-(d) or (f).					
1. Certified copies of the priority documents	s have been received.						
2. Certified copies of the priority documents	s have been received in Applicati	on No					
<ol><li>Copies of the certified copies of the prior</li></ol>	ity documents have been receive	ed in this National Stage					
• •	application from the International Bureau (PCT Rule 17.2(a)).						
* See the attached detailed Office action for a list of	of the certified copies not receive	d.					
Attachment(s)							
1) X 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 5) Notice of Informal P						
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date	5)  Notice of Informal P 6)  Other:	aton Application					

U.S. Patent and Trademark Office PTOL-326 (Rev. 08-06)

Office Action Summary

Part of Paper No./Mail Date 20100104

Application/Control Number: 12/329,729 Page 2

Art Unit: 3747

#### **DETAILED ACTION**

#### Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-32 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 74-98 of copending Application No. 11/840,719. Although the conflicting claims are not identical, they are not patentably distinct from each other because they have the same scope.

This is a <u>provisional</u> obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

#### Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hai H. Huynh whose telephone number is (571) 272-

Application/Control Number: 12/329,729 Page 3

Art Unit: 3747

4844. The examiner can normally be reached on Monday through Thursday from 7:30 am to 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Cronin can be reached on (571) 272-4536. 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.

/Hai H. Huynh/ Primary Examiner, Art Unit 3747

#### Applicant(s)/Patent Under Application/Control No. Reexamination 12/329,729 COHN ET AL. Notice of References Cited Art Unit Examiner Page 1 of 1 3747 Hai H. Huynh

#### U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	Α	US-7,178,503 B1	02-2007	Brehob, Diana D.	123/304
*	В	US-7,581,528 B2	09-2009	Stein et al.	123/431
*	O	US-2009/0043478 A1	02-2009	Labonte, Daniel Joseph	701/103
*	О	US-2009/0308367 A1	12-2009	Glugla, Chris Paul	123/575
*	Е	US-2008/0228382 A1	09-2008	Lewis et al.	701/111
	F	US-			
	O	US-			
	Н	US-			
	_	US-			
	J	US-			
	K	US-			
	L	US-			
	М	US-			

#### FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY Country Name		Classification	
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#### NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	х	

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

**Notice of References Cited** 

Part of Paper No. 20100104

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.

	Application/Control No.	Applicant(s)/Patent Under Reexamination			
Index of Claims	12329729	COHN ET AL.			
	Examiner	Art Unit			
	Hai H Huynh	3747			

<b>~</b>	Rejected	-	- Cancelled		Non-Elected		Α	Appeal		
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CLAIM				DATE		
		ļ		 DATE		 
Final	Original	08/19/2009				
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	5	~	✓			
	6	✓	✓			
	7	✓	✓			
	8	✓	✓			
	9	✓	✓			
	10	✓	✓			
	11	✓	✓			
	12	✓	✓			
	13	<b>✓</b>	<b>√</b>			
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	26	<b>√</b>	✓			
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U.S. Patent and Trademark Office Part of Paper No.: 20100104

# Application/Control No. Search Notes 12329729 Examiner Hai H Huynh Applicant(s)/Patent Under Reexamination COHN ET AL. Art Unit 3747

SEARCHED					
Class	Subclass	Date	Examiner		
123	1A	8/19/09	HHH		
123	198A	8/19/09	HHH		
123	431	8/19/09	HHH		
123	575	8/19/09	HHH		
123	435	8/19/09	HHH		
update	search	1/4/10	HHH		
123	299, 300, 305, 559.1	1/4/10	HHH		

SEARCH NOTES						
Search Notes	Date	Examiner				
EAST	8/19/09	HHH				
	1/4/10	HHH				

INTERFERENCE SEARCH					
Class	Subclass	Date	Examiner		

U.S. Patent and Trademark Office Part of Paper No.: 20100104

# **EAST Search History**

# **EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	4	((first or main or primary) near inject \$3) same ((second\$3 or auxiliary) near inject\$3) same knock \$3 same control\$4 same (air\$1fuel near ratio)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 14:40
L2	1	("7314033").PN.	USPAT	OR	OFF	2010/01/04 14:45
L3	2	"11840719"	US-PGPUB; USPAT	OR	OFF	2010/01/04 14:46
L4	1	(12/329729).APP.	US-PGPUB; USPAT	OR	OFF	2010/01/04 14:51
L5	26	2006/0102146	US-PGPUB; USPAT	OR	OFF	2010/01/04 14:55
L6	28	2006/0102145	US-PGPUB; USPAT	OR	OFF	2010/01/04 14:55
L7	1	("6655324").PN.	USPAT	OR	OFF	2010/01/04 15:10
L8	50	((first or main or primary) near inject \$3) same ((second\$3 or auxiliary) near inject\$3) same knock \$3 same control\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:11
L9	2	((first or main or primary) near inject \$3) same ((second\$3 or auxiliary) near inject\$3) same knock \$3 same control\$4 same alcohol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:12
L10	4	((first or main or primary) near inject \$3) same ((second\$3 or auxiliary) near inject\$3) same knock \$3 same control\$4 same ethanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:13

L11	1	((first or main or primary) near inject \$3) same ((second\$3 or auxiliary) near inject\$3) same knock \$3 same control\$4 same methanol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:13
L12	2662	((123/431) or (123/299) or (123/305) or (123/198A) or (123/1A)).CCLS.	USPAT	OR	OFF	2010/01/04 15:27
L13	4	11 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:27
L14	1	11 and I9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:27
L15	1	I1 and I10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:27
L16	0	I1 and I11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/01/04 15:27
L17	1	("6655324").PN.	USPAT	OR	OFF	2010/01/04 16:08

## **EAST Search History (Interference)**

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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 PALEARDIA, Virginia 22313-1450 www.uspho.gov

ATTY. DOCKET NO./TITLE APPLICATION NUMBER FILING OR 371(C) DATE FIRST NAMED APPLICANT

12/329,729

12/08/2008

Daniel R. COHN

11381 . 107294

**CONFIRMATION NO. 9459** POA ACCEPTANCE LETTER

91197 **Technology Licensing Office** Masachusetts Institute of Technology Five Cambridge Center Kendall Square Cambridge, MA 02142-1493

Date Mailed: 01/12/2010

#### 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.

	/vvan/		
_			

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



#### UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER FILING OR 371(C) DATE FIRST NAMED APPLICANT ATTY. DOCKET NO./TITLE

12/329,729 12/08/2008

Daniel R. COHN 0492611-0883

24280 CHOATE, HALL & STEWART LLP TWO INTERNATIONAL PLACE BOSTON, MA 02110 CONFIRMATION NO. 9459 POWER OF ATTORNEY NOTICE



Date Mailed: 01/12/2010

#### NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

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

• The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/vvan/						
Office of Data Management	Application Assistance Unit (571)	272-4000	or (571)	272 <sub>-</sub> 4200	or 1-888-786	:_010 <sup>-</sup>

page 1 of 1

PTO/S8/25 (07-09)
Approved for use through 07/31/2012, OMB 0651-0331
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 11381.107294
In re Application of: Daniel R. Cohn et al	
Application No.: 12/329729	
Filed: December 08, 2008	
For: FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLII	NE ENGINES
The owner*, Massachusetts institute of Technology of 100 percent interest in the instate except as provided below, the terminal part of the statutory term of any patent granted on the instant application date of the full statutory term of any patent granted on pending reference Application Number on August 17, 2007, as such term is defined in 35 U.S.C. 154 and 173, and as the term of any papelication may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending hereby agrees that any patent so granted on the instant application shall be enforceable only for and during granted on the reference application are commonly owned. This agreement runs with any patent granted binding upon the grantee, its successors or assigns.	ation which would extend beyond 11/840719 filed atent granted on said reference reference application. The owner such period that it and any patent
In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on t extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of any papilication, "as the term of any patent granted on said <b>reference</b> application may be shortened by any ter grant of any patent on the pending <b>reference</b> application," in the event that: any such patent: granted on the gexpires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent juin whole or terminally disclaimed under 37 CFR 1.321, has all daims canceled by a reexamination certificate terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to	ntent granted on said reference minal disclaimer filed prior to the bending reference application: insdiction, is statutorily disclaimed in, is reissued, or is in any manner
Check either box 1 or 2 below, if appropriate.	
For submissions on behalf of a business/organization (e.g., corporation, partnership, university, gove etc.), the undersigned is empowered to act on behalf of the business/organization.	rnment agency.
I hereby declare that all statements made herein of my own knowledge are true and that all state belief are believed to be true: and further that these statements were made with the knowledge that willful made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States statements may jeopardize the validity of the application or any patent issued thereon.	false statements and the like so
2. The undersigned is an attorney or agent of record. Reg. No. 29576	
Aon Pastink Signature	January 25, 2010 Date
Sam Pasternack	
Typed or printed name	
	817.258.7171
	Telephone Number
Terminal disclaimer fee under 37 CFR 1.20(d) is included.	
WARNING: Information on this form may become public. Credit card information is be included on this form. Provide credit card information end authorization on F	
"Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this statement. See MPEP § 324.	
This collection of information is required by 37 CFR 1 321. The information is required to obtain or retain a benefit by the pub 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 process.	lic 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, prepaning, 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.

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

#### **ATTORNEY DOCKET NO.: 11381.107294**

### IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Daniel R. Cohn et al. Examiner: HAI H. HUYNH

Serial No.: 12/329729 Art Unit: 3747

Filing Date: December 8, 2008 Confirmation No.: 9459

Title: FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE

ENHANCEMENT OF GASOLINE ENGINES

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

Dear Sir:

#### Response to Office Action

Applicant hereby submits the following response to the Non-final Office Action mailed January 12, 2010. Applicant respectfully requests consideration and entry of this response.

The Listing of Claims appears on page 2.

#### **Listing of Claims**

- 1. (Original) A spark ignition engine system for which fuel is introduced into the engine from a first source and a liquid is separately introduced into the engine from a second source by direct injection comprising:
  - a spark ignition engine;
  - a first means for introducing the fuel from the first source into the engine;
- a second means for direct injection of the liquid from the second source into the engine, wherein during part of the engine operating time, the engine receives both the fuel from the first source and the liquid that is directly injected from the second source; and
- a fuel management system which varies the relative amount of the liquid from the second source that is introduced into the engine so as to prevent knock, wherein the fuel management system employs information from a knock detector and uses closed loop control to control the amount of directly injected liquid from the second source; and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

- 2. (Original) The engine system of claim 1, wherein the engine is turbocharged or supercharged.
- 3. (Original) The engine system of claim 1 or 2, wherein the liquid from the second source is alcohol.
- 4. (Original) The engine system of claim 3, wherein the alcohol is methanol.
- 5. (Original) The engine system of claim 3, wherein the alcohol is ethanol.
- 6. (Original) The engine system of claim 1 or 2, wherein the liquid from the second source is an alcohol-water mixture.
- 7. (Original) The engine system of claim 1 or 2, wherein the liquid from the second source includes water.

- 8. (Original) The engine system of claim 1 or 2, wherein the fuel from the first source is gasoline and the liquid from the second source includes water.
- 9. (Original) The engine system of claim 1 or 2, wherein the liquid from the second source is injected so as to result in a non-uniform distribution in the engine cylinder.
- 10. (Original) The engine system of claim 9, wherein the liquid from the second source is injected so as to be more concentrated near the periphery of the engine cylinder, and wherein the liquid from the second source includes alcohol, and

wherein the alcohol energy fraction is sufficiently high to prevent knock but the alcohol energy fraction is reduced as compared to the situation using a uniform distribution.

11. (Original) The engine system of claim 1 or 2, wherein the fuel management system employs a microprocessor for control of the relative amount of liquid from the second source that is directly injected into the engine using information from a knock sensor, and

wherein the relative amount of the liquid from the second source increases with increasing torque, and

wherein the fuel management system minimizes the amount of directly injected liquid from the second source that is used over a drive cycle.

- 12. (Original) The engine system of claim 11 further including open loop control with a look up table.
- 13. (Original) The engine system of claims 1 or 2, wherein spark retard is used and is varied according to the consumption of the liquid from the second tank.
- 14. (Original) A spark ignition engine system into which fuel is introduced into the engine from a first source using a first fuel injector and a liquid from a second source is introduced into the engine using a second fuel injector comprising:
  - a spark ignition engine;
  - a first fuel injector for introducing fuel into the engine from the first source;
- a second fuel injector for introducing the liquid from the second source into the engine wherein during part of the engine operating time, the engine receives both the fuel from the first

source and the liquid from the second source; and

a fuel management system which varies the relative amount of the liquid from the second source that is introduced into the engine so as to prevent knock, wherein the fuel management system uses closed loop control to control the amount of liquid from the second source and employs information from a knock detector, and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

- 15. (Original) The engine system of claim 14, wherein the fuel from the first source is port fuel injected.
- 16. (Original) The engine system of claim 14 or 15, wherein the liquid from the second source is alcohol.
- 17. (Original) The eugiue system of claim 16, wherein the alcohol is methanol.
- (Original) The engine system of claim 16, wherein the alcohol is ethanol.
- 19. (Original) The engine system of claims 14 or 15, wherein the liquid from the second source is an alcohol-water mixture.
- 20. (Original) The engine system of claims 14 or 15, wherein the liquid from the second source includes water.
- 21. (Original) The engine system of claims 14 or 15, wherein the fuel from the first source is gasoline and the liquid from the second source includes water.
- 22. (Original) The engine system of claims 14 or 15, wherein the fuel management system employs a microprocessor for control of the relative amount of liquid from the second source that is directly injected into the engine using information from a knock sensor, and wherein the relative amount of liquid from the second source increases with increasing torque, and wherein the fuel management system minimizes the amount of directly injected liquid from the second source that is used over a drive cycle.

- 23. (Original) The engine system of claim 22 further including open loop control with a look up table.
- 24. (Original) The engine system of claims 14 or 15, wherein spark retard is used and is varied according to the consumption of the liquid from the second tank.
- 25. (Original) The engine system of claims 14 or 15, wherein the engine is turbocharged.
- 26. (Original) The engine system of claims 14 or 15, wherein the engine is supercharged.
- 27. (Original) A turbocharged or supercharged spark ignition engine system which uses both port fuel injection of gasoline from a first source and direct fuel injection of alcohol from a second source comprising:
  - a spark ignition engine;
  - a turbocharger or supercharger;
  - means for port fuel injection of gasoline from the first source;
- means for direct fuel injection of alcohol from the second source, wherein during part of the engine operating time, the engine is fueled both by gasoline that is port fuel injected and alcohol that is directly injected; and
- a fuel management system which increases the relative amount of alcohol in the engine with increasing torque so as to prevent knock, wherein the fuel management system employs information from a knock detector and uses closed loop control to control the amount of directly injected alcohol, and

wherein the engine is operated with a substantially stoichiometric fuel/air ratio.

- 28. (Original) The engine system of claim 27, wherein the alcohol is methanol.
- 29. (Original) The engine system of claim 27, wherein the alcohol is ethanol.
- 30. (Original) The engine system of claim 27, wherein the alcohol is mixed with water.
- 31. (Original) The engine system of claim 27, wherein the fuel management system employs a microprocessor for control of the relative amount of alcohol from the second source that is directly injected into the engine using information from a knock sensor.

32. (Original) The engine system of claim 31, wherein the fuel management system minimizes the amount of directly injected alcohol from the second source that is used over a drive cycle.

#### <u>Remarks</u>

In response to the office action, enclosed herewith is a terminal disclaimer disclaiming the terminal portion of copending application number 11/840,719.

Since the only rejection is based on a provisional obviousness-type double patenting rejection, it is submitted that the enclosed terminal disclaimer places this application in condition for allowance.

Respectfully Submitted,

Sam Pasternack

Registration No.: 29576

Massachusetts Institute of Technology

Five Cambridge Center

Room NE25-230

Cambridge, MA 02412-1493

617.258.7171

Date: January 25, 2010

7

Electronic Acknowledgement Receipt				
EFS ID:	6869975			
Application Number:	12329729			
International Application Number:				
Confirmation Number:	9459			
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES			
First Named Inventor/Applicant Name:	Daniel R. COHN			
Customer Number:	91197			
Filer:	Sam Pasternack/Anna Yem			
Filer Authorized By:	Sam Pasternack			
Attorney Docket Number:	11381 . 107294			
Receipt Date:	25-JAN-2010			
Filing Date:	08-DEC-2008			
Time Stamp:	11:14:24			
Application Type:	Utility under 35 USC 111(a)			

# **Payment information:**

Submitted wi	th Payment	no			
File Listin	g:				
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer Filed	1138110729oa.pdf	23533	no	1
,	Terminal Disclaimer Fried	11301107230a.pu	0b4b6ac98e74438873369241a75699bed2 e04f14		, 
Warnings:					

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing Information: 43452 7 2 Miscellaneous Incoming Letter 11381107294resp.pdf nο ff7bc4b14f941a0445da6b41fb411e5ef519 Warnings: The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing Information: Total Files Size (in bytes): 66985

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.

Application Number	Application/Co	ntrol No.	Applicant(s)/Patent Reexamination	under		
	12/329,729		COHN ET AL.			
Document Code - DISQ		Internal D	ocument – DC	NOT MAIL		
TERMINAL DISCLAIMER	☐ APPROVI	ED	⊠ DISAPP	ROVED		
Date Filed : 1/25/10	This patent is subject to a Terminal Disclaimer					
Approved/Disapproved by:						
Felicia D. Roberts						
See TD Checklist for explanation						

U.S. Patent and Trademark Office

Rev. 05/19/09	Doc. Code: DISQ.CKLIST				
TERMINAL DISCLAIMER INFORMA	L CHECKLIST				
<b>APPL. S.N.:</b> 12/329,729	DATE:				
EXAMINER:	ART UNIT:				
PARALEGAL: /FELICIA ROBERTS/	MAIL ROOM DATE:				
NUMBER OF TD(s) FILED: 1					
INSTRUCTIONS: The paralegal has reviewed the submitted TD with the result of you agree, please use the appropriate form paragraphs identified by this informapplicant about the TD. If you disagree, please contact a QAS.  THIS CHECKLIST IS AN INFORMAL INTERNAL CHECKLIST ONLY.	mal memo in your next Office action to notify				
THIS CHECKLIST IS AN INFORMAL, INTERNAL CHECKLIST ONLY APPLICANT. IT WILL BE SOFT SCANNED AND NOT VIEWABLE TO					
☐ The TD is PROPER and has been accepted and recorded. (See FP 14.23.)					
The TD is NOT PROPER and has not been accepted for the reason(s) check	ed below. (See FP 14.24.)				
☑ The disclaimer fee under 37 CFR 1.20(d) in the amount of \$ 70.00 has not been submitted, nor is there any pre authorization in the application to charge to a deposit account. (See FP 14.24 and 14.26.07.)					
☐ The LIE has not processed fee for TD (the Paralegal should ask LIE to proce	ess the fee).				
☐ The TD does not satisfy 37 CFR 1.32(b) (3) in that the person who signed the TD has not stated either: (a) the extent of his/her ownership interest, or (b) the extent of the business/organization entity's ownership interest on whose behalf the person signed. (See FPs 14.26 and 14.26.01.)					
☐ The TD lacks the – enforceable only during the period of common ownershi 37 CFR 1.321(c). (See FP 14.27.01).	p – clause needed to overcome a double patenting				
☐ The TD lacks 37 CFR 1.321(d) statement for joint research agreement under waiver and enforceability provisions of 37 CFR 1.321(d). (See FP 14.27.01					
☐ TD is directed to a particular claim(s); this is not acceptable, since the disclapatent to be granted, MPEP 1490. (See FPs 14.26 and 14.26.02).	aimer must be of a terminal portion of the entire				
☐ The person who signed the terminal disclaimer:					
failed to state his/her capacity to sign for the business/organization entity	y. (See FP 14.28.)				
is not recognized as an officer of the assignee. (See FP 14.29.)					
does not have power of attorney, and thus, is not of record. (See FP 14.2	9.01.)				
(Note: PoA can be given to a customer number, wherein all practitioners listed established by a list of practitioners, the list may not comprise more than 10 practition of record, cannot sign the TD unless it is established that the representative is assignee.)	ctitioners. A representative of the assignee, who is				
☐ The TD is not supported by evidence of chain of title to the assignee signing documentary evidence of a chain of title from the original inventor(s) to the documentary evidence was, or concurrently is being, submitted for recordat such documentary evidence is recorded in the Office. 37 CFR 3.73(b). (See	assignee and a statement affirming that the ion; or (b) the reel and frame number(s) where				

## TERMINAL DISCLAIMER INFORMAL CHECKLIST – page 2

Application No .

NOTE: This documentary evidence or the specifying of the reel and frame number may be found in the TD or in a separate paper submitted by applicant.)
☐ The TD is not supported by adequate evidence of chain of title to the assignee signing the TD, because the person who signed the submission under 37 CFR 3.73(b):
has failed to state his/her capacity to sign for the business entity. (See FPs 14.30.02 and 14.16.02
is not recognized as an officer of the assignee. (See FP 14.30.02 and 14.16.03)
(Note: On the submission under 37 CFR 3.73(b), the signature of an attorney or agent registered to practice before the Office is not sufficient, unless the attorney or agent is authorized to act on behalf of the assignee.)
☐ The TD is not signed (See FPs 14.26 and 14.26.03)
☐ The serial number of the application (or the number of the patent) which forms the basis for the double patenting is not identified (i.e., missing or incorrect) in the TD. (See FP 14.32)
☐ The serial number of the application being examined (or the number of the patent under reexam or reissue) is not identified or incorrect. (See FPs 14.26 and 14.26.04 or 14.26.05)
☐ The TD is not signed by all owners. See FPs 14.26 and 14.26.06.
☐ The period disclaimed is incorrect or not specified. (See FPs 14.24, 14.27.02 or 14.27.03)
Other

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

91197 7590 05/28/2010

Technology Licensing Office Masachusetts Institute of Technology Five Cambridge Center Kendall Square Cambridge, MA 02142-1493 EXAMINER
HUYNH, HAI H
ART UNIT PAPER NUMBER
3747

DATE MAILED: 05/28/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/220 720	12/09/2009	D 'ID COIN	11291 107204	0.450

TITLE OF INVENTION: FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE 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	\$755	\$300	\$0	\$1055	08/30/2010

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. 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 THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. 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:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

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

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE 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.

Page 1 of 3

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

#### 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 or <u>Fax</u> (571)-273-2885

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 actifications.

maintenance fee notificat	ions.						
CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)				Note: A certificate fee(s) Transmittal. apers. Each addition ave its own certificate	of mailing This certifonal paper ate of ma	g can only be used for icate cannot be used for , such as an assignmen iling or transmission.	r domestic mailings of the or any other accompanying nt or formal drawing, must
91197	7590 05/28	/2010	11				
Technology Licensing Office Masachusetts Institute of Technology Five Cambridge Center			I S a tu	hereby certify that tates Postal Servic ddressed to the M ransmitted to the U	Certificate this Fee( e with suf Iail Stop SPTO (57	of Mailing or Transn s) Transmittal is being ficient postage for firs ISSUE FEE address 1) 273-2885, on the da	deposited with the United t class mail in an envelope above, or being facsimile te indicated below.
Kendall Square Cambridge, MA	02142-1493						(Depositor's name)
Cambridge, WIA	02142-1473						(Signature)
			L				(Date)
APPLICATION NO.	FILING DATE		FIRST NAMED INVENT	OR	ATTO	RNEY DOCKET NO.	CONFIRMATION NO.
12/329,729	12/08/2008	•	Daniel R. COHN			1381 . 107294	9459
TITLE OF INVENTION:	FUEL MANAGEMEN	T SYSTEM FOR VARIA	ABLE ETHANOL OCT	ANE ENHANCEM	ÆNT OF	GASOLINE ENGINE	s
APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DU	PREV. PAID IS	SUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0		\$1055	08/30/2010
EXAMI	NER	ART UNIT	CLASS-SUBCLASS				
HUYNH,	HAI H	3747	123-431000				
"Fee Address" indi- PTO/SB/47; Rev 03-0; Number is required.  3. ASSIGNEE NAME AN PLEASE NOTE: Unle recordation as set forth (A) NAME OF ASSIG	ND RESIDENCE DATA ess an assignee is ident in 37 CFR 3.11. Comp	'Indication form ed. Use of a Customer  A TO BE PRINTED ON ' ified below, no assignee eletion of this form is NO	data will appear on the T a substitute for filing (B) RESIDENCE: (CI	atively, ngle firm (having a or agent) and the n uttorneys or agents. be printed.  type) e patent. If an ass an assignment. TY and STATE O	s a membames of u If no nam	er a 2p to p to lee is 3lentified below, the do	ocument has been filed for up entity
4a. The following fee(s) a	re submitted:	41	b. Payment of Fee(s): (P A check is enclose Payment by credit	Please first reapply d. card. Form PTO-20	any prev	riously paid issue fee s	
5. Change in Entity Stat  a. Applicant claims	us (from status indicated SMALL ENTITY statu		☐ b. Applicant is no l	onger claiming SM	IALL EN	ΓΙΤΥ status. See 37 CF	FR 1.27(g)(2).
NOTE: The Issue Fee and interest as shown by the re	l Publication Fee (if requecords of the United Sta	uired) will not be accepte tes Patent and Trademark	d from anyone other that c Office.	n the applicant; a r	egistered :	attorney or agent; or the	e assignee or other party in
Authorized Signature				Date			
This collection of informa an application. Confident submitting the completed this form and/or suggestic Box 1450, Alexandria, Vi Alexandria, Virginia 2231 Under the Paperwork Red	13-1450.						by the USPTO to process) g gathering, preparing, and he you require to complete trument of Commerce, P.O. or Patents, P.O. Box 1450, number.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

OMB 0651-0033

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE



#### 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.usplo.gov

APPLICATION NO. FILING DATE		FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/329,729	12/08/2008	Daniel R. COHN	11381 . 107294	9459
91197 75	90 05/28/2010		EXAM	IINER
Technology Licer	nsing Office		HUYNH	I, HAI H
Masachusetts Instit	tute of Technology		ART UNIT	PAPER NUMBER
Five Cambridge Co Kendall Square Cambridge, MA 02			3747 DATE MAILED: 05/28/201	0

#### 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 3 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 3 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.

	Application No.	Applicant(s)			
Notice of Allowability	12/329,729	COHN ET AL.			
Notice of Allowability	Examiner	Art Unit			
	Hai H. Huynh	3747			
The MAILING DATE of this communication appeal 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 RIOF the Office or upon petition by the applicant. See 37 CFR 1.313	(OR REMAINS) CLOSED in this appropriate communication GHTS. This application is subject to	plication. If not included will be mailed in due course. <b>THIS</b>			
1. $\square$ This communication is responsive to <u>Terminal Disclaimer f</u>	iled 1-25-10.				
2. The allowed claim(s) is/are <u>1-32</u> .					
3. ☐ Acknowledgment is made of a claim for foreign priority ur  a) ☐ All b) ☐ Some* c) ☐ None of the:					
1. Certified copies of the priority documents have					
2. Certified copies of the priority documents have					
3. Copies of the certified copies of the priority do	cuments have been received in this	national stage application from the			
International Bureau (PCT Rule 17.2(a)).					
* Certified copies not received:					
Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.					
4. A SUBSTITUTE OATH OR DECLARATION must be subm INFORMAL PATENT APPLICATION (PTO-152) which give					
5. CORRECTED DRAWINGS ( as "replacement sheets") mus	et be submitted.				
(a) ☐ including changes required by the Notice of Draftspers	on's Patent Drawing Review ( PTO-	948) attached			
1) ☐ hereto or 2) ☐ to Paper No./Mail Date					
<ul><li>(b) ☐ including changes required by the attached Examiner's Paper No./Mail Date</li></ul>	s Amendment / Comment or in the C	office action of			
Identifying indicia such as the application number (see 37 CFR 1 each sheet. Replacement sheet(s) should be labeled as such in t					
6. DEPOSIT OF and/or INFORMATION about the depo attached Examiner's comment regarding REQUIREMENT					
Attachment(s)	- <b>-</b>				
1. Notice of References Cited (PTO-892)	5. Notice of Informal P	'''			
2. Notice of Draftperson's Patent Drawing Review (PTO-948)	6. ☐ Interview Summary Paper No./Mail Dat				
Information Disclosure Statements (PTO/SB/08),     Paper No./Mail Date	7. ☐ Examiner's Amendr				
4.   Examiner's Comment Regarding Requirement for Deposit	8.  Examiner's Stateme	ent of Reasons for Allowance			
of Biological Material	9.				
/Hai H. Huynh/ Primary Examiner, Art Unit 3747					

U.S. Patent and Trademark Office PTOL-37 (Rev. 08-06)

Notice of Allowability

Part of Paper No./Mail Date 20100525

#### Applicant(s)/Patent Under Application/Control No. Reexamination 12/329,729 COHN ET AL. Notice of References Cited Art Unit Examiner Page 1 of 1 3747 Hai H. Huynh U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	Α	US-2009/0076705 A1	03-2009	Colesworthy et al.	701/103
	В	US-			
	C	US-			
	D	US-			
	Е	US-			
	F	US-			
	G	US-			
	Ι	US-			
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	K	US-			
	L	US-			
	М	US-			

#### FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
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#### NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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U.S. Patent and Trademark Office PTO-892 (Rev. 01-2001)

**Notice of References Cited** 

Part of Paper No. 20100525

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.

	Application/Control No.	Applicant(s)/Patent Under Reexamination
Issue Classification	12329729	COHN ET AL.
	Examiner	Art Unit
	Hai H Huynh	3747

		ORIG	SINAL							INTERNATIONAL	CLAS	SIF	CAT	ION
	CLASS	;		SUBCLASS	i	CLAIMED NON-CLAIME			-CLAIMED					
123			431			F	0	2	В	7 / 02 (2006.01.01)				
		ROSS REF	EDENCE	F 0 2			М	25 / 14 (2006.01.01)						
		NO33 KEI	EKENCE	(5)			0	2	В	13 / 00 (2006.01.01)				
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×	Claims renumbered in the same order as presented by applicant							СР	'A [	] T.D.	☐ R.1.47				
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	1		17												
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NONE		Total Clain	ns Allowed:
(Assistant Examiner)	(Date)	3	2
/Hai H Huynh/ Primary Examiner.Art Unit 3747	5-25-10	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office Part of Paper No. 20100525

# **EAST Search History**

## **EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	(((first or primary) and second\$3) near inject\$3) same knock \$3 same close \$2loop same stoichiometric	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/25 09:41
L2	0	(((first or primary) and second\$3) near inject\$3) same knock \$3 same close \$2loop	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/25 09:42
L3	0	(((first or primary) and second\$3) near inject\$3) same knock \$3 same (closed near loop)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/25 09:42
L4	12	(((first or primary) and second\$3) same inject\$3) same knock \$3 same (closed near loop)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/25 09:43
L5	2776	((123/1A) or (123/27GE) or (123/525) or (123/431) or (123/575) or (123/198A)).CCLS.	US-PGPUB; USPAT	OR	OFF	2010/05/25 09:51
L8	5	14 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/25 09:53

# **EAST Search History (Interference)**

Operator	Ref#	Hits	Search Query	DBs	Default	Plurals	Time Stamp
					Operator		

L6	17	((123/1A) or (123/27GE) or (123/525) or (123/431) or (123/575) or (123/198A)).CCLS.	UPAD	OR	OFF	2010/05/25 09:52
L7	4	(((first or primary) and second\$3) same inject\$3) same knock\$3 same (closed near loop)	USPAT; UPAD	OR	OFF	2010/05/25 09:52

5/25/10 9:53:55 AM

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	Application/Control No.	Applicant(s)/Patent Under Reexamination
Index of Claims	12329729	COHN ET AL.
	Examiner	Art Unit
	Hai H Huynh	3747

<b>✓</b>	Rejected	-	Cancelled	N	Non-Elected	Α	Appeal
=	Allowed	÷	Restricted	I	Interference	0	Objected

Claims	renumbered	in the same	order as pr	esented by a	oplicant		☐ CPA	□ т.	.D	R.1.47		
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Final	Original	08/19/2009	01/04/2010	05/25/2010								
	1	✓	✓	=								
	2	✓	✓	=								
	3	<b>√</b>	✓	=								
	4	<b>√</b>	✓	=								
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	30	✓	✓	=								
	31	✓	✓	=								
	32	<b>√</b>	<b>√</b>	=								

U.S. Patent and Trademark Office Part of Paper No.: 20100525

# Application/Control No. Search Notes 12329729 Examiner Hai H Huynh Applicant(s)/Patent Under Reexamination COHN ET AL. Art Unit 3747

	SEARCHED								
Class	Subclass	Date	Examiner						
123	1A	8/19/09	HHH						
123	198A	8/19/09	HHH						
123	431	8/19/09	HHH						
123	575	8/19/09	HHH						
123	435	8/19/09	HHH						
update	search	1/4/10	HHH						
123	299, 300, 305, 559.1	1/4/10	HHH						
		5/25/10	HHH						

SEARCH NOTES		
Search Notes	Date	Examiner
EAST	8/19/09	HHH
	1/4/10	HHH
	5/25/10	HHH

	INTERFERENCE SEARCH		
Class	Subclass	Date	Examiner
above	search	5/25/10	HHH

U.S. Patent and Trademark Office Part of Paper No.: 20100525

#### PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail

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Commissioner for Patents
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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 notifications.

CURRENT CORRESPONDE	NCE ADDRESS (Note: Use Blo	ock 1 for any change of address)	) i	ce(s) Transmittal, The papers, Each addition	is certificate cannot be us	d for domestic mailings of the ed for any other accompanying nment or formal drawing, must
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Cambridge, MA	02142-1495		Loranza	al.	2-	(Signature)
					6/16/10	(Date)
APPLICATION NO.	FILING DATE		FIRST NAMED INVENT	OR	ATTORNEY DOCKET NO	D. CONFIRMATION NO.
12/329,729	12/08/2008		Daniel R. COHN		11381 . 107294	9459
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EXAMI	NER	ART UNIT	CLASS-SUBCLASS			
HUYNH,	HAI H	3747	123-431000			
CFR 1.363).  Change of correspond dycess form PTO/SB  "Fee Address" indicates and pto/SB/47; Rev 03-0; Number is required.  AASSIGNEE NAME AN PLEASE NOTE: Unkarecordation as set forth (A) NAME OF ASSIG	cation (or "Fee Address" 2 or more recent) attach  ND RESIDENCE DATA ess an assignee is identi in 37 CFR 3.11. Comp  SNEF.  MSHHULL a ate assignee category or	rige of Correspondence  Indication form ed, Use of a Customer  TO BE PRINTED ON The deletion of this form is NOT the Customer  Tuchnology categories (will not be presented)	(1) the names of up or agents OR, altert (2) the name of a s. registered attorney 2 registered patent listed, no name will PHE PATENT (print or data will appear on th T a substitute for filing (B) RESIDENCE: (C)	ingle firm (having as a or agent) and the nam attorneys or agents. If be printed.  Type)  e patent. If an assign an assignment.  ITY and STATE OR 6	an member a 2	e group entity  Government
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ř	o small entity discount p of Copies		The Director is her	card. Form PTO-2038 reby authorized to cha eposit Account Numb	rge the required fee(s), an	y deficiency, or credit any se an extra copy of this form).
a. Applicant claims	us (from status indicated SMALL ENTITY statu	s. See 37 CFR 1.27.			LL ENTITY status. See 3	
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Authorized Signature	Jan 10	Dlimbe Shrnack			June 16,	
nn application. Confidenti submitting the completed his form and/or suggestic Box 1450, Alexandria, Vi Alexandria, Virginia 2231	iality is governed by 35 application form to the ons for reducing this bur irginia 22313-1450. DO 13-1450.	U.S.C. 122 and 37 CFR USPTO. Time will vary den, should be sent to the NOT SEND FEES OR (	1.14. This collection is depending upon the in the Chief Information Of COMPLETED FORMS	estimated to take 12 idividual case. Any cofficer, U.S. Patent and TO THIS ADDRES	minutes to complete, included in the comments on the amount of Trademark Office, U.S. I	(and by the USPTO to process) uding gathering, preparing, and of time you require to complete Department of Commerce, P.O. ner for Patents, P.O. Box 1450, actrol number.
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PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

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This collection of information is required by 37 CFR 1.363. 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 5 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. Depar tment of Commerce, P.O. Box 1450, Alex andria, VA 22313-1450. DO NOT SEND COMPLETE D FORMS TO THIS A DDRESS. SEND TO: Mail Stop M Correspondence, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Electronic Patent Application Fee Transmittal										
Application Number:	12329729									
Filing Date:	08-Dec-2008									
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES									
First Named Inventor/Applicant Name:	Daniel R. COHN									
Filer:	Sam Pasternack/Anna Yem									
Attorney Docket Number:	11381 . 107294									
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	1510	1510					
Publ. Fee- early, voluntary, or normal		1504	1	300	300					

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

Electronic Acknowledgement Receipt						
EFS ID:	7822599					
Application Number:	12329729					
International Application Number:						
Confirmation Number:	9459					
Title of Invention:	FUEL MANAGEMENT SYSTEM FOR VARIABLE ETHANOL OCTANE ENHANCEMENT OF GASOLINE ENGINES					
First Named Inventor/Applicant Name:	Daniel R. COHN					
Customer Number:	91197					
Filer:	Sam Pasternack/Anna Yem					
Filer Authorized By:	Sam Pasternack					
Attorney Docket Number:	11381 . 107294					
Receipt Date:	16-JUN-2010					
Filing Date:	08-DEC-2008					
Time Stamp:	10:34:34					
Application Type:	Utility under 35 USC 111(a)					

# **Payment information:**

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$1810
RAM confirmation Number	8165
Deposit Account	192553
Authorized User	O'BRIEN,DANIEL

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.
1	Issue Fee Payment (PTO-85B)	11381107294fee.pdf	151134	no	1
'	issue ree rayment (F10-636)	1136110/2941ee.pui	2584c3b41f286409851a163625ac8c9538c7 e31e	110	1
Warnings:					
Information:					
2	Change of Address	11381107294add.pdf	68598	no	1
2	Change of Address	11301107294add.pdf	bce83cd11982cb7ca942a6065fdecb3e561 7c77a	110	
Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	32061	no	2
	ree worksheet (110 075)	rec imo.pai	c740629e501931783cd8273d0167c525d4d 83fea	110	
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Information:					
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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.

PTO/SB/08a (08-08)

Approved for use through 08/31/2008. OMB 0651-0031

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	Application Number		12329729		
INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99)	Filing Date		2008-12-08		
	First Named Inventor	Danie	niel R. Cohn		
	Art Unit		1797		
	Examiner Name	not ye	t yet assigned		
	Attorney Docket Numl	ber	0492611-0883		

	U.S.PATENTS				Remove	
Examiner Cite Initial*			Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	
	1	6340015		2002-01-22	Benedikt et al.	
	2	6536405		2003-03-25	Rieger et al.	
	3	6745744		2004-06-08	Suckewer et al.	
	4	6748918		2004-06-15	Rieger et al.	
	5	6755175		2004-06-29	McKay et al.	
	6	6955154		2005-10-18	Douglas, Denis	
	7	7013847		2006-03-21	Auer, Gerhard	
	8	7077100		2006-08-18	Vogel et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /HHH/ EFS Web 2.1.4



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Bib Data Sheet

**CONFIRMATION NO. 9459** 

<b>SERIAL NUMBER</b> 12/329,729	10/00/000		CLASS 123	GRO	GROUP ART UNIT 3747		ATTORNEY DOCKET NO. 11381 . 107294	
Leslie BROMB John B. HEYW  ** CONTINUING DA This applicatio which is a CON  ** FOREIGN APPLIC	N, Chestnut Hill, MA; ERG, Sharon, MA; /OOD, Newton, MA;  IA ***********************************	9 08/17/2 004 PAT	7,314,033	0,004				
Foreign Priority claimed 35 USC 119 (a-d) condition met Verified and Acknowledged Ex	STATE OR COUNTRY MA	DRA	SHEETS TOT CLA 3 32		MS	INDEPENDENT CLAIMS 3		
ADDRESS 91197								
<b>TITLE</b> FUEL MANAGEMEN ENGINES	T SYSTEM FOR VARIA	BLE ETH	HANOL OCTAI	NE EN	HANCE	MENT C	OF GA	SOLINE
FILING FEE FEES: Authority has been given in Paper RECEIVED No to charge/credit DEPOSIT ACCC 1841 No for following:					1.1 time )	6 Fees ( 7 Fees ( 8 Fees ( ner	Proce	essing Ext. of



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P.O. Box 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

 APPLICATION NO.
 ISSUE DATE
 PATENT NO.
 ATTORNEY DOCKET NO.
 CONFIRMATION NO.

 12/329,729
 07/27/2010
 7762233
 11381 . 107294
 9459

91197 7590 07/07/2010

Technology Licensing Office Masachusetts Institute of Technology Five Cambridge Center Kendall Square Cambridge, 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 3 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):

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