Patent # ***Application #***	**Title**	**Abstract**
4,786,485	Lignosulfonate-Modified Calcium Hydroxide for SO2 Control During Furnace Injection	A method is provided for removing sulphur-containing gases from fossil fuel-fired combustors comprising the step of introducing sorbent particles modified with lignosulfonates into the exhaust gases.
4,804,521	Process for removing sulfur from sulfur-containing gases	The present disclosure relates to improved processes for treating hot sulfur-containing flue gas to remove sulfur therefrom. Processes in accorda The government may own certain rights in the present invention pursuant to EPA Cooperative Agreement CR 81-1531.
4,822,381	Electroprecipitator with Suppression of Rapping Reentrainment	Apparatus and method are provided for reducing rapping reentrainment from a conventional electrostatic precipitator. Thus, the apparatus will include a conventional electrostatic precipitator having at least one main electrical section and, in sequence downstream of the main electrical section, a precharger and a reentrainment collector. The precharger has a tubular anode aligned with collection plates in the main electrical section and a corona discharge wire aligned with the corona discharge wires of the main electrical section. The reentrainment collector includes collection plates substantially shorter than the collection plates of the main electrical section with at least one corona discharge wire in each of the gaps between the collection plates. The secondary collection plates of the reentrainment collector are operated at a current density 75% or less of the current density at which the main collector plates are operated.
4,842,748	Methods for Removing Volatile Substances from Water Using Flash Vaporization	Methods for removing volatile organic substances from water employ flash vaporization techniques. The methods comprise providing water which contains volatile organic substances and is at a pressure of at least about 35 psig, releasing the water into a vacuum chamber maintained under a vacuum in the range of about 1 to about 5 psia, removing resulting vapors from the chamber, and collecting liquid water from the chamber. At least a portion of the volatile organic substances originally contained in the water are removed as vapors from the vacuum chamber.
4,882,309	Lignosulfonate-Modified Calcium Hydroxide for SO2 Control During Furnace Injection	A method is provided for removing sulphur-containing gases from fossil fuel-fired combustors comprising the step of introducing sorbent particles modified with lignosulfonates into the exhaust gases.
4,885,139	Combined Electrostatic Precipitator and Acidic Gas Removal System	The cost-effectiveness of sulfur oxides and particulate matter removal is improved by placing a sulfur oxides or other acidic gases removal system and a multi-stage electrostatic precipitator within a single housing. The sulfur oxides or other acidic gas removal system works by spraying a neutralizing slurry or solution into incoming flue gas to form neutral salts which dry in a reaction zone provided between the sulfur oxides or other acidic gas removal system and the electrostatic filtration module. This system also provides for simple retrofitting of existing systems to include SO.sub.2 or other acidic gas removal systems.
4,902,318	Inlet Apparatus for Gas-Aerosol Sampling	An inlet apparatus for gas-aerosol sampling comprises an elutriator column and an impactor member. The elutriator column comprises an inlet and an impact accelerator jet outlet, and the inner surface of the column is provided with a coating of polytetrafluoroethylene-containing polymer. The impactor member includes a housing which surrounds the impact accelerator jet outlet and an impactor surface arranged within the housing and opposite the impact accelerator jet outlet. The inner surface of the housing is also provided with a polytetrafluoroethylene-containing polymer coating

Page 1 of 37

Patent # ***Application #***	**Title**	**Abstract**
4,904,283	Enhanced Fabric Filtration through Controlled Electrostatically Augmented Dust Deposition	A simple electrostatically enhanced fabric filtration system for removing fine particulate matter or dust entrained in a gas flow, has a single, elongate, central, corona-generating electrode positioned within a cylindrical fabric filter, closed at one end, into which the particulate bearing gas flow is directed. In one embodiment, a grid-like cylindrical grounded electrode is disposed proximately outside the filter element and establishes a radially directed electrostatic field with the corona electrode. Particles passing through the corona acquire charges of like polarity and are subjected immediately to Coulombic forces driving them radially outward toward the filter fabric where they collect prominently near the filter element inlet, thus allowing easier passage to the gas further downstream. Other embodiments have a plurality of grounded electrodes attached to the inside of the filter element or as wires woven therethrough. Corona concentration near the filter element entrance by known techniques e.g., roughening, addition of points to, or by changes in cross-section of the corona electrode, can also
4,925,802	Method for stimulating biodegradation of halogenated aliphatic hydrocarbons	A method of biodegrading halogenated alipahtic hydrocarbons is disclosed comprising incubating the hydrocarbons with microorganisms capable of degrading halogenated aliphatic hydrocarbons together with a nontoxic, nongaseous substance that induces the biodegrading activity of said microorganisms. An example of the nontoxic, nongaseous substance is an aromatic amino acid, e.g. tryptophan.
4,959,315	Biodegradation of Chloroethylene Compounds (TCE)	A method of degrading chloroethylene compounds is disclosed comprising incubating microorganisms capable of degrading chloroethylene compounds by an aromatic degradative pathway together with the chloroethylene compounds under conditions such that the aromatic degradative pathway is active.
4,961,966	Fluorocarbon Coating Method	An inlet apparatus for gas-aerosol sampling comprises an elutriator column and an impactor member. The elutriator column comprises an inlet and an impact accelerator jet outlet, and the inner surface of the column is provided with a coating of polytetrafluoroethylene-containing polymer. The impactor member includes a housing which surrounds the impact accelerator jet outlet and an impactor surface arranged within the housing and opposite the impact accelerator jet outlet. The inner surface of the housing is also provided with a polytetrafluoroethylene-containing polymer coating.
5,007,404	Woodstove for Heated Air Forced Into a Secondary Combustion Chamber and Method of Operating Same	A resistance heater heats air forced by a fan into a woodstove secondary combustion chamber having an ignitor. The fan, heater and ignitor are controlled by a temperature sensor for gas flowing from a primary combustion chamber to a secondary combustion chamber. Two ignitors, extending through the stove back wall into the secondary combustion chamber, are controlled by the temperature sensor.
5,019,175	Method for the destruction of halogenated organic compounds in a contaminated medium	A method for the destruction of halogenated organic compounds contained in a contaminated medium comprises adding an aqueous solution of polyethylene glycol to the contaminated medium in an amount to provide from about 0.1 to about 20 weight percent of polyethylene glycol, based on the weight of the contaminated medium. An alkali metal hydroxide is then added in an amount of from about 2 to about 20 weight percent, based on the weight of the contaminated medium. The medium is then heated to substantially dehydrate the medium and then further heated at a temperature between about 100.degree. and 350.degree. C. to effect destruction of the halogenated organic compounds. An acid is then added to the medium in an amount sufficient to neutralize the same.

Page 2 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,021,229	Reduction of Chlorinated Organics in the Incineration of Wastes	A method of diminishing the amount of chlorinated organics released to the atmosphere in the incineration of wastes which includes injecting calcium-based sorbents into the flue gas at around 700.degree. C. to react with HCl to remove it from the flue gas to prevent it from forming the chlorinated organics.
5,039,350	Method for the decomposition of halogenated organic compounds in a contaminated medium	A method for the decomposition of halogenated organic compounds contained in a contaminated medium comprises adding an alkali metal carbonate or bicarbonate to the contaminated medium in an aqueous solution or in a solvent having a boiling point of at least 200.degree. C., or in the form of a solid dispersion or suspension. The medium is heated to dehydrate the medium and then is further heated at a temperature between about 250.degree. and 400.degree. C. to effect decomposition of the halogenated organic compounds. An acid is then added to the medium in an amount sufficient to neutralize the same.
5,047,221	Process for Removing Acid Components from Gas Streams	The present disclosure relates to improved processes for treating hot sulfur-containing flue gas to remove sulfur therefrom. Processes in accordance with the present invention include preparing an aqueous slurry composed of a calcium alkali source and a source of reactive silica and/or alumina, heating the slurry to above-ambient temperature for a period of time in order to facilitate the formation of sulfur-absorbing calcium silicates or aluminates, and treating the gas with the heat-treated slurry compounds. Examples disclosed herein demonstrate the utility of these processes in achieving improved sulfur-absorbing capabilities. Additionally, disclosure is provided which illustrates preferred configurations for employing the present processes both as a dry sorbent injection and for use in conjunction with a spray dryer and/or bagfilter. Retrofit application to existing systems is also addressed.
5,059,219	Electroprecipitator with Alternating Charging and Short Collector Sections	The novel ESP has a plurality of collector sections alternating in series with a plurality of prechargers (charging sections) with each collector section being preceded by a charging section. Each collector section contains a plurality of collection plates spaced by a distance d to define a plurality of gas flow lanes therebetween. Each gas flow lane contains 1-4 corona discharge wires aligned parallel to the gas flow. Each charging section contains a plurality of corona discharge electrodes alternating with anodes in an array transverse to the gas flow. Each collector section is much shorter than in the prior art, both in actual length and in relation to the length of the length of the charging section and the interplate spacing d.
5,064,526	Base-Catalyzed Decomposition of Halogenated Organic Compounds	A method for the decomposition of halogenated and non-halogenated organic contaminant compounds contained in a contaminated medium comprises adding an alkali or alkaline earth metal carbonate, bicarbonate or hydroxide to the contaminated medium in an aqueous solution or in a solvent having a boiling point of at least 200.degree. C., or in the form of a solid dispersion or suspension. The medium includes a hydrogen donor compound. The hydrogen donor compound may be originally contained in the medium or may be added to the medium. The medium further includes a catalytic source of carbon, for example, a carabohydrate, which will cause formation of a free radical hydrogen ion from the hydrogen donor compound. The medium is heated to dehydrate the medium and then is further heated at a temperature between about 200.degree. and 400.degree. C. to cause formation of the free radical hydrogen ion and effect reductive decomposition of the halogenated and non-halogenated organic contaminant compounds. An acid is then added to the medium in an amount sufficient to neutralize the same.

Page 3 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,071,755	Biodegradation of Aliphatic Chloroethylene Compounds (TCE)	A method of degrading halogenated aliphatic hydrocarbons is disclosed comprising incubating microorganisms capable of degrading halogenated aliphatic hydrocarbons by an aromatic degradative pathway together with the halogenated aliphatic hydrocarbons under conditions such that said aromatic degradative pathway is active.
5,100,643	Processes for Removing Acid Components from Gas Streams	
5,101,670	Automated proportional integrated sampling system	A sampling system for integrated proportional sampling of a fluid stream. The system includes a syringe-like sample container having an inlet/outlet at one end and a piston therein displaceable to fill and discharge the container. The inlet of the sample container is connectable to the fluid stream, for withdrawing samples to the container. Flow sensor means positionable in the fluid stream are provided for continuously measuring the flow rate of the stream and providing a continuous first control signal varying in accordance with the measured flow rate. Piston drive means withdraw the syringe piston at a rate in accordance with the first control signal, and limit means stop the withdrawing piston at a predetermined end point in its axial movement. The sample container is coupleable and uncoupleable as a unit from the system, to enable the container to be transferred and interconnected for discharge to a sample analyzer while maintaining the collected sample intact between its inlet/outlet and piston, and thereby out of contact with ambient air.
5,132,224	Biological Remediation of Creosote and Similarly-Contaminated Sites	This invention concerns a biological process for remediating creosote-contaminated sites or environment sites containing polycyclic aromatic hydrocarbons generally found in creosote-contaminated sites. The biological process comprises novel bacteria which can degrade recalcitant chemical compounds.
5,135,729	Lignosulfonate-Modified Calcium Hydroxide for SO2 Control During Furnace Injection	A method is provided for removing sulphur-containing gases from fossil fuel-fired combustors comprising the step of introducing sorbent particles modified with lignosulfonates into the exhaust gases.
5,179,933	Single Chamber Woodstove including gaseous Hydrocarbon supply	A single chamber wood stove has primary and secondary combustion zones in direct fluid flow communication with each other. Air from outside the stove is supplied to the primary and secondary combustion zones. Gaseous hydrocarbon fuel from a source located outside the stove is selectively supplied to the secondary combustion zone and is ignited by a glow plug in the secondary combustion zone in response to a signal derived by a temperature detector in the secondary zone. The gaseous hydrocarbon fuel flows to the secondary combustion zone at a rate in the range of about 0.25 to 3 cubic feet per hour. The fuel is supplied to the secondary zone when the secondary zone temperature is above carbon monoxide ignition temperature.
5,185,134	Reduction of Chlorinated Organics in the Incineration of Wastes	A method of diminishing the amount of chlorinated organics released to the atmosphere in the incineration of wastes which includes injecting calcium-based sorbents into the flue gas to react with HCl to form calcium-chlorine compounds to remove the HCl from the flue gas and prevent it from forming the chlorinated organics. The flue gas carries the sorbent from the injection zone to the reactive temperature zone quickly enough such that the sorbent is not exposed to temperatures which would degrade the effectiveness of the sorbent, the reactive temperature zone being in the range of 300.degree. C. to 900.degree. C.

Page 4 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,217,511	Enhancement of Electrostatic Precipitation with Electrostatically Augmented Fabric Filtration	An electrostatic precipitator includes a plurality of collector sections having parallel collection plates, defining gas flow lanes therebetween, and a bag filter section containing a plurality of parallel, elongated filter fabric bag elements. A plurality of corona discharge wires for charging solid particulates entrained in the gas flow entering the bag filter section are disposed parallel to and interspersed among the bag elements. Both the bag elements and the corona discharge wires within the bag filter section depend from a common plate member. Gas flow is from the outside of the bag elements to the inside and out through apertures in the supporting plate.
5,221,230	Paint Spraying Booth with Split-Flow Ventilation	A facility including a booth for solvent or paint application or drying process is provided with ventilation inlets and outlets to cause stratification of constituents such as VOCs or particulate in the booth. The ventilation air withdrawn from the booth is split into two air streams, one air stream contains a relatively low volatile organic compound (VOC) concentration, and the other a relatively high VOC concentration. The ventilation air from the low concentration stream is vented to the atmosphere (or alternatively back in the booth) and the ventilation air from the high concentration stream is conducted to a VOC emission control device. Thus, adequate VOC emission control is achieved, and the volume of air processed by the VOC emission control device is reduced, along with the corresponding VOC emission control costs.
5,228,335	Method and Apparatus for Detection of Catalyst Failure On-Board a Motor Vehicle Using a Dual Oxygen Sensor and an Algorithm	Dual oxygen sensors before and after the exhaust catalytic converter of a motor vehicle combined with a specialized algorithm to substantially continuously compare the real time electric output of the oxygen sensors and, in response to the comparison, output an indication of the activity of the catalyst and failure of the catalyst. The algorithm in substantially real time "monitors" the continuously changing oxygen content of the before and after catalyst exhaust stream and through a phase comparison or an integration process in the preferred embodiment makes the proper comparison for determination of catalyst acceptability or failure. With a microcomputer equipped motor vehicle the algorithm is suitable for on-board continuous monitoring of the exhaust catalyst for indication to the vehicle operator when catalyst failure occurs. Failure can be total catalyst failure or partial failure to a degree where Federal exhaust emissions regulations are no longer met. The algorithm includes filter subroutines to "filter" out momentary excursions of oxygen sensor output due to momentary excursions of overly rich air/fuel rati
5,233,933	Method of Reducing Transient Emissions from Rotary Kiln Incinerators and Container for Attaining the Same	Organic liquid-like hazardous waste is loaded with a sorbent in a container including interior and exterior compartments. The container is supplied to a rotary incinerating kiln. The waste is loaded in the container and the compartments are arranged so that the waste in the exterior compartment is initially vaporized in the kiln without the waste in the interior compartment mixing and being vaporized with the waste in the exterior compartment. The waste in the exterior compartment acts initially as a thermal and mass transfer barrier to prevent initial vaporization in the kiln of the waste in the interior compartment to substantially delay the vaporization of the waste in the interior compartment relative the vaporization time of waste in the exterior compartment and relative to the time when the waste in the interior compartment would have been vaporized if the container did not include the compartments.
5,236,672	Corona Destruction of Volatile Organic Compounds and Toxics	Apparatus and method for controlling volatile organic compounds and air toxics in a contaminated fluid flow through use of an excited species flow generated and introduced into the contaminated fluid flow to convert the contaminants into non-toxic compounds. Tungsten electrodes and an alternating current are used in the excited species generator.

Page 5 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,242,825	Biological Remediation of Creosote and Similarly-Contaminated Sites Using Pseudomonas Paucimobilis	This invention concerns a biological process for remediating creosote-contaminated sites or environment sites containing polycyclic aromatic hydrocarbons generally found in creosote-contaminated sites. The biological process comprises novel bacterium, Pseudomonas paucimobilis strain EPA 505 sc., which can degrade recalcitrant chemical compounds.
5,270,015	Process for Removing Sulfur From Sulfur Containing Gases	
5,272,428	Fuzzy Logic Integrated Control Method and Apparatus to Improve Motor Efficiency	The power efficiency of an electric motor driven load including an adjustable speed drive is improved through use of a fuzzy logic controller to provide a power efficiency signal. A fuzzy rule base controls sequential power changes based on a determination of the effect of previous changes to meet load demands on a reduced power input basis.
5,294,553	Method for the gravimetric determination of oil and grease	A non-halogenated solvent mixture for gravimetric determination of grease and oil in an aqueous or a solid matrix comprising a mixture of n-hexane and methyl tertiary-butyl ether present in a volume ratio of 80% to 20% respectively. A method of gravimetric determination of grease and oil in an aqueous or a solid matrix which comprises preparing a sample; extracting the same using this non-halogenated solvent mixture; distilling; evaporating and weighing the extraction residue.
5,318,937	Ruthenium-Containing Perovskite Materials, Catalysts and Methods	Perovskite materials have a composition of the formula La.sub.1-x Sr.sub.x Cr.sub.1-y Ru.sub.y O.sub.3 wherein 0.1.ltoreq.x.ltoreq.0.5 and 0.01.ltoreq.y.ltoreq.0.10. The materials are used in catalysts for carbon monoxide oxidation, unsaturated hydrocarbon oxidation and/or nitrogen oxide reduction.
5,322,052	Fireplace with Destruction of Products of Incomplete Combustion Enhanced by a Gaseous-Fueled Pilot Burner	Particulate emissions from a wood fire in a fireplace having a baffle for preventing the direct flow of fluid into the flue from the wood fire are reduced by locating a hydrocarbon gas pilot source in proximity to the baffle. Ignited gas from the pilot combines particulate emissions from the wood fire while they are in the fireplace and before they reach the flue. Air from outside of the fireplace is supplied into proximity with ignited pilot gas so the outside air and the ignited pilot gas mix. A flame sensor for the pilot controls the flow of gas to the pilot source and ignition of the pilot source.
5,333,511	Portable Controlled Air Sampler	A portable analyzer for obtaining samples from a monitored environment during different time intervals includes a pump energized by a rechargeable battery pack for drawing gas from the environment selectively into plural sample holding bags and an impact filter. The pump is programmed to control the time when the gas is drawn from the environment and for controlling the flow to the sample holders so that different ones of the sample holders are responsive to the materials at the same or different times. The pump may respond to electric pulses, causing pulses of air to be supplied to the sample holding bags. The pump derives pulses having a rate directly proportional to the number of pump cycles. The pump may also operate continuously with sampling of the gases being controlled electronically. Operation of the pump is prevented in response to the battery pack voltage dropping to a level such that the voltage is less than a predetermined value, necessary to provide a predetermined flow rate per pump cycle. Operation of the pump is also prevented if the gas flow rate drops below a predetermined

Page 6 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,396,744	Electrically Induced Radon Barriers	A system for forming a blocking layer of water-saturated soil surrounding the foundation of a building to be protected from ingress of radon gas or other soil gas contaminents. The system includes at least one set of parallel positive and negative electrodes positioned in the soil, adjacent and spaced from the foundation. Typically, the negative electrode will be positioned closest to the foundation. A low leve voltage is applied to the electrodes from a DC power source. One or more sets of such electrodes will be positioned in the soil surrounding the foundation or at least that portion of the foundation most susceptible to gas ingress.
5,401,481	Process for Removing Sulfur from Sulfur Containing Gases	The present disclosure relates to improved processes for treating acid gases to remove acid gas components therefrom. Processes in accordance with the present invention include preparing a calcium silicate hydrate sorbent in the form of a semi-dry, free-flowing powder, and treating the gas with the powdery sorbent, such as by injecting the sorbent into a stream of the gas. The powdery sorbents may be prepared by slurrying/drying or pressure hydration techniques. Examples disclosed herein demonstrate the utility of these processes in achieving improved acid gas-absorbing capabilities in both lab-scale and pilot plant studies. Additionally, disclosure is provided which illustrates preferred plant design configurations for employing the present processes using conventional dry sorbent injection equipment. Retrofit application to existing plants is also addressed.
5,406,805	Tandem Refrigeration System	A refrigeration system for providing cooling to two or more compartments utilizing respective first and second evaporators. During the initial operation of a cooling cycle, the refrigerant is utilized for cooling the compartment (such as a fresh food compartment) which is to be maintained at a higher temperature as compared with another compartment (such as a freezer compartment). Cooling can thus be achieved by operating a fan in the fresh food compartment, even where the refrigeration system has not yet reached steady state after the compressor initially begins operating. After cooling has been achieved in the fresh food compartment, the refrigerant in the system has reached a state suitable for cooling of the freezer compartment, and the fan for the freezer evaporator is turned on while the fan for the fresh food compartment is turned off. As a result, a relatively simply refrigeration system is provided which is more efficient than conventional arrangements, particularly single-stage refrigeration systems. A defrosting cycle can also be accomplished with the fresh food fan operating,
5,411,707	Vacuum Extractor incorporating Condenser Column	Methods and apparatus for vacuum distillation of samples suspected of containing pollutants are disclosed. The vacuum distillation apparatus contains a condenser for separating water and/or another common interfering contaminant. The distilled pollutants are assayed using a gas chromatograph/mass spectrometer.
5,425,802	Virtual Impactor for Removing Particulates from an Airstream and Method for Using Same	A virtual impactor that can remove essentially all of the particles from an airstream is disclosed. Also disclosed are a method of separating particles from the airstream using this virtual impactor, a method of concentrating the particulate matter in an airstream, and the concentrated airstream.
5,427,994	Lignosulfonate-Modified Calcium Hydroxide for SO2 Control During Furnace Injection	A method is provided for preparing particulate calcium hydroxide/calcium lignosulfonate sorbent by contacting calcium oxide with water.

Page 7 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,447,556	Sample Injection Apparatus and Method	An apparatus for sample concentration for gas chromatography and mass spectrometry for analysis for volatile organic compounds, including a hollow differential pressure switch to switch sample flow non-mechanically, and so that the gas chromatograph and apparatus may be used with different sample levels of volatile organic compounds by changing the timing and temperature parameters by changing the flow non-mechanically. The differential pressure switch preferably has a central helium port, a sample flow port, a sweep flow port, a vent end, and an assist/column flow end; an expansion volume chamber having an inlet tube, which is inserted through the assist/column flow end and extends to halfway between the helium port and sample port, a coiled piece of tubing, and an outlet tube; a primary collection trap coiled about a rod having an entry port for a cryogenic substance, an inlet end, a heater at the inlet end, and an outlet, wherein the expansion volume chamber outlet tube connects to the primary collection trap inlet end; and an assist/column interface having an inlet end connected to
5,451,249	Landfill Gas Treatment System	The gas stream which emanates from landfills is treated to produce a purified gas which is essentially a hydrocarbon such as methane which can be used as the fuel source in a fuel cell power plant, or can be used in other power plants which use natural gas as a fuel. The landfill gas passes through a system which removes essentially all of the hydrogen sulfide; water; organic sulfur and halogen compounds; and solid contaminants from the gas stream. The resultant purified gas stream can be cleanly flared; used to power an energy plant; or put to other useful purposes.
5,476,640	Low temperature destruction of toxics in pollutant air streams	Low temperature apparatus for the destruction of low volume time varying organic air toxins in air streams utilizing non-catalytic glass beads in parallel conduits heated by hot gas flow around the conduits and flowing the air stream through the conduits and controlling the hot gas flow in response to toxin levels in the air stream.
5,476,788	Solid Phase Bioremediation Methods Using Lignin-Degrading Fungi	A solid-phase bioremediation method utilizing naturally occurring lignin-degrading fungi. The method includes inoculating a field-contaminated, nonsterile soil or wood having a halogenated hydrocarbon contaminant with an inoculum containing one or more lignin-degrading fungi and a lignocellulosic substrate, and degrading the contaminant to less toxic degradation products.
5,487,829	Internal media cleaning device for aerobic fluidized bed reactors	An improved reactor for treatment of wastewater having an influent line for wastewater, and effluent line for treated wastewater, and an aerobic bed fluidized by wastewater from the influent line. The bed is located between the influent line and the effluent line and contains particulate media seeded with a layer of bacteria. The improved reactor consists of an internal particulate media cleaning means located between the bed and an outlet to the effluent line for creating turbulence which shears excess biomass from the particulate media within the cleaning means and permits controlled exit of the excess biomass from the cleaning means and the reactor while maintaining cleaned media within the reactor. The internal particulate media cleaning means has at least one cylindrical screen with a longitudinal passage therethrough. The screen is respectively engaged to an inner periphery of the reactor above and below an outlet to the effluent line by gaskets fixed on opposite ends of the screen. Air delivery means extend into the longitudinal passage for delivery of air to produce turbulence in a mixture of the

Page 8 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,495,912	Hybrid Powertrain Vehicle	Engine output speed is controlled for optimum efficiency by adjustment of input speed of a continuously variable transmission (CVT). Where power in excess of that provided by the engine is required, additional power is input to the drivetrain from a fluidic motor driven by fluid pressure stored in an accumulator. In driving conditions where the engine, operating at optimum efficiency, produces power in excess of that demanded by of the vehicle, the fluidic motor is reversed for operation as a pump and excess engine power is utilized to drive the pump and store energy in the accumulator in the form of fluid pressure. A CPU determines power output required of the engine as a sum of that indicated by a sensor which senses power demanded of the vehicle by a driver and an increment of power required to maintain the pressure of the accumulator above a threshold amount. An engine speed controller controls the rotary speed of the engine output, to produce the required total power output, by changing the input speed of the CVT. In order to maintain optimum engine efficiency, a
5,505,527	Anti-Lock Regenerative Braking System	A vehicular powertrain with regenerative braking includes a plurality of wheels and a brake pedal which, upon engagement, is activated first into a first zone of operation and then into a second zone of operation. A braking detector detects either a released state or an engaged state for the brake pedal and, if in the engaged state, detects if the pedal is in the first or the second zone of operation. Friction brakes brake a pair of the wheels, responsive to detection of the brake pedal within the second zone of operation. The hydraulic portion of the drivetrain includes an accumulator for storing hydraulic fluid under pressure and a reservoir for storing the hydraulic fluid at a lower pressure. A pump/motor is located in the high pressure line for operation as a motor to drive the drive wheels in a drive mode and for operation as a pump driven by the drive wheels in a braking mode. A prime mover has its inlet connected to the reservoir through a low pressure line and an outlet connected to the accumulator through a high pressure line and hydraulically drives said pump/motor in its motor mode. A controller
5,507,144	Lightweight, Safe Hydraulic Power System	A hydraulic accumulator system alternately stores energy in the form of gas pressure and converts the stored energy into work by gas expansion. The hydraulic accumulator system, by connection to drive wheels of a vehicle, can serve as a hydropneumatic powertrain for the vehicle. High-pressure and low-pressure fluid drive units are operable either in a motor mode or in a pump mode. A plurality of high-pressure liquid vessels and a plurality of low-pressure liquid vessels are connected in parallel between the fluid drive units and a gas reservoir, with the high-pressure fluid drive unit connecting with the high-pressure liquid vessels and the low-pressure fluid drive unit connecting with the low-pressure liquid vessels. A liquid reservoir supplies liquid to the fluid drive units when operating in the pump mode and receives liquid from the fluid drive units operating in a motor mode. A method of operating the system is also disclosed herein.
5,512,702	Method for In-Situ Immobilization of Lead in Contaminated Soils, Wasttes and Sediments Using Solid Calcium Phosphate Materials	Solid calcium phosphate materials are used for in-situ immobilization of lead contaminated soils, wastes, and sediments by mixing the solid calcium phosphate material with the lead contaminated material and leaving the mixture in place. The solid calcium phosphate material includes, for example, naturally occurring apatite, synthetic hydroxyapatite, dibasic calcium phosphate, or phosphate rock.
5,520,123	Intelligent afterburner injection control to minimize pollutant emissions	An intelligent oxygen injection control system for afterburners which minimizes transient incinerator pollutant emissions while simultaneously minimizing oxygen consumption. A fuzzy logic-based controller utilizes inputs from sensors that measure gas phase pollutant species such as hydrocarbons and carbon monoxide to control oxygen injection and thus minimize pollutant emissions while minimizing oxygen consumption.

Page 9 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,543,317	Microbial Degratation of Trichloroethylene, Dichloretkylines & Aromatic Pollutants	A novel bacterium named Pseudomonas cepacia PR1.sub.23 (formerly designated G4 5223 PR1) has the desirable property of constitutively degrading hazardous chemicals, for example trichloroethylene, 1,1-dichloroethylene, cis-1,2 dichloroethylene, trans-1,2-dichloroethylene, toluene, phenol, o-cresol, m-cresol, o-xylene, and benzene, to harmless chemical entities. This microbe, and mutants thereof which retain the constitutive degradation property of the parent, can be used in bioreactor and in situ processes for degrading hazardous chemical compounds. The nucleic acid sequences which encode the degradative peptides have also been isolated and sequenced. Cells transformed with the isolated nucleic acid also produce the peptides comprising the enzyme which can constitutively degrade these hazardous chemicals. The enzyme can be isolated from such microorganisms (those which naturally harbor the gene or those which are transformed with the gene) and applied to a sample having the hazardous chemical(s) or contaminant(s) in order to degrade the contaminant(s).
5,549,087	Combined Cycle Engine	A method of operation of an internal combustion engine to minimize NOx emission in exhaust gas involves detection of load on the vehicle engine as either a low load or a high load. While a low load is detected unthrottled air and a quantity of fuel providing for lean combustion are mixed with injection of fuel adjacent top dead center in the compression stroke. While a high load condition is detected, throttled air and a quantity of fuel governed by sensed oxygen content of the exhaust gas are mixed in an approximate stoichiometric ratio with injection of the fuel much earlier than injection at low load, preferably during the intake stroke.
5,562,079	Low-Temperature, Near-Adiabatic Engine	A novel, internal combustion engine includes a cylinder, a head closing one end of the cylinder and a piston slidably mounted in the cylinder for reciprocating motion, in the usual manner, which reciprocation is converted into rotary motion by, for example, a conventional crankshaft. The top surface of the piston, cylinder head and cylinder serve as walls defining a system chamber, with a pocket formed in one of the system chamber walls for receiving fuel and serving as a combustion chamber for localized combustion therein. In one disclosed embodiment, the cylinder is divided into two sections with thermal insulation, serving as a heat barrier, disposed between the two sections and the piston has a hollow interior containing one or more heat shields spanning the hollow interior. The method of operation involves injection of fuel into a restricted area within the chamber defined between the piston head, cylinder head and cylinder, e.g., the aforementioned pocket. Air and/or exhaust gas within the chamber surrounding the restricted area of localized combustion serves as thermal
5,577,522	Transportable Debris Washing System	A debris cleaning apparatus leaning for toxic waste sites is mounted on a trailer. The apparatus includes a chamber and a crane that lowers a basket drum, filled with contaminated debris, into the chamber. The drum is cylindrical and has journal shafts at either end which drop into bearings in the chamber. The drum can be coupled to a drive motor to rotate the drum during a washing operation in which the chamber is filled with heated detergent solution and agitated. The drum surface is perforated. The agitation is increased by pumping the detergent into eductors inside the chamber, each eductor including a nozzle and a venturi concentric with the nozzle; the jet entrains large amounts of detergent to create a high-volume turbulent flow inside the chamber. The chamber is then drained into a holding tank and the debris is sprayed with detergent from orifices drilled through the drum walls. The orifices are fed by headers and a manifold welded to the outside of the drum and supplied with detergent through a hollow pipe shaft. The pipe includes a clutch which turns the basket drum. After

Page 10 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,579,640	Accumulator Engine	A hydropneumatic powertrain includes a fluidic driver connected in parallel with first and second liquid tanks connected, respectively, with first and second gas vessels. The gas within each gas vessel is in fluid communication with the liquid within the corresponding liquid vessel. A prime mover drives a pump to pump liquid alternately into one of the two liquid tanks connected in parallel with the pump. Switch valving directs the discharge of the pump to either the first liquid tank or the second liquid tank, while the liquid tank not receiving liquid from the pump discharge is discharging its liquid, driven by expansion of gas within the corresponding gas vessel, to drive the fluidic driver which, in turn, drives the drive wheels of the vehicle. Each gas tank is equipped with a heater and a cooler whereby the gas vessel, in the compression portion of the cycle, is cooled while the other gas vessel is heated for expansion of the gas contained therein. Thus, the fluidic driver can be continuously driven by alternating discharges from the two liquid tanks.
5,601,791	Electrostatic Precipitator for Collection of Multiple Pollutants	A novel electrostatic precipitator includes an electrostatic collector section with discharge electrodes positioned between pairs of grounded collector electrodes, a gas entry port located upstream of said electrostatic collector section, and a transition section between the gas entry port and said electrostatic collector section into which an aqueous acid gas neutralizing agent is sprayed into a gas stream. An additional collector section may be interposed between the gas entry port and the point where the acid gas neutralizing agent is injected into the gas stream. The collector section may comprise alternating charging and short collection sections in which the grounded electrodes of adjoining charger and collector sections are connected. A liquid spray removes particulates collected on the grounded electrodes of the collector sections.
5,604,348	Measurement of Acid Sulfate Levels in Aerosols	A non-destructive unambiguous method of measuring the presence and level of acid sulfates, particularly ammonium bisulfate in air is disclosed including infrared energy absorbance measurements of particles deposited on the filter through which the air passes.
5,609,131	Multi-Stage Combustion Engine	The invention is a combustion method for operation of a multiple cylinder internal combustion engine in a cycle including intake, compression, expansion and exhaust strokes. A first amount of fuel is introduced into each of the cylinders with introduction initiated earlier than 45.degree. before top dead center of a combustion stroke. An amount of air significantly in excess of that providing a stoichiometric amount of oxygen, typically 2-3 times stoichiometry, is also introduced into each of the cylinders to produce a first mixture upon introduction of the fuel, which mixture is ignited to produce a first combustion event. Subsequent to substantial completion of the first combustion event but prior to top dead center in the same compression stroke (or shortly after top dead center in the expansion stroke), a second amount of fuel is introduced into each of the cylinders without introduction of additional air. The second amount of fuel, products of combustion from the first combustion event and oxygen-depleted air form a second mixture which is ignited to produce a second combustion event.

Page 11 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,611,300	Floating Piston, Piston-valve Engine	The present invention is an improved drive train which includes an engine having at least one power cylinder with a power piston mounted for reciprocating motion therein. The power piston is connected to a crank shaft in the usual manner for translation of the reciprocating motion of the power piston into rotation of the crankshaft, which in turn, is transmitted in the conventional manner to the drive wheels of the vehicle. Provision is made for the feed of fuel into a combustion chamber located within the power cylinder at one side of the power piston. Intake and exhaust valves, in fluid communication with the combustion chamber serve, respectively, to allow intake of air during an intake stroke of the power piston and exhaust of combustion products during an exhaust stroke of the power piston. A floating piston at least partially closes the combustion chamber opposite the power piston and is mounted for reciprocating motion relative to the combustion chamber. The reciprocating motion of the floating piston includes a pressure relieving stroke in which the floating piston moves away from the
5,614,410	Bioremediation of soil or groundwater contaminated with compounds in creosote by two-stage Biodegradation	A process for remediating contaminated soil or groundwater using a strain of Pseudomonas paucimobilis designated NRRL B-18512 is disclosed. Further, the process is a two stage sequential process wherein in the first stage bacteria which degrade low molecular weight polycyclic aromatic hydrocarbons, heterocyclic organic compounds and phenolics are used in a pretreatment step. However, the remaining high molecular weight compounds are treated in a second step of the process with the Pseudomonas paucimobilis strain since the strain is not inhibited by low molecular weight compounds because these are removed in the first pretreatment step. Therefore, repeated inoculation of the strain is not necessary and the overall process disclosed eliminates the inhibitory effects of the low molecular weight compounds. A Microorganism designated CRE1-13 is a useful strain for the pretreatment step in order to enhance activity and viability of the strain, Pseudomonas paucimobilis designated NRRL B-18512, useful for removing the remaining high molecular compounds in creosote from soil or groundwater. In addition Pseudomonas sp. strain SR-3 is also useful for removing high mol
5,617,823	Spark-Ignited Reciprocating Piston Engine Having a Subdivided Combustion Chamber	An internal-combustion engine includes a cylinder having an upper, generally planar bounding surface formed by an inner wall portion of a cylinder head; a fuel injection device and a spark plug held in the cylinder head and opening into the cylinder; a piston axially slidably disposed in the cylinder; a combustion chamber defined between the upper bounding surface of the cylinder head and the top piston face when the piston is in its upper dead center position; and an annular ridge situated on the top piston face. The annular ridge subdivides the combustion chamber into an inner partial combustion chamber and an outer partial combustion chamber surrounding the inner partial combustion chamber. The inner partial combustion chamber is situated in an effective range of the fuel injection device and the spark plug. Further, throughgoing apertures are provided in the annular ridge for maintaining a continuous communication between the inner and outer partial combustion chambers
5,619,937	Sorbent Melts for Toxic Metal Capture in Combustion Processes	A cloud or dispersion of a particulate flux is formed in a combustion zone for the purpose of capturing metallic vapor from the combustion gas by formation of a eutectic of the metal and the flux, as a melt on at least the surfaces of the dispersed flux particles. The flux particles are heated within the combustion zone to a temperature sufficient to form the eutectic melt. The preferred flux particles utilized in the invention include conventional metallurgical fluxes, e.g. calcium carbonate, sodium carbonate and magnesium carbonate.

Page 12 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,650,089	Refrigerant Compositions and processes for using same	The present invention pertains to binary azeotropic mixtures of either trifluoromethyl methyl ether and 1,1-difluoroethane or pentafluorodimethyl ether and cyclopropane. Methods of heat transfer with those mixtures also are taught.
5,652,485	Fuzzy logic integrated electrical control to improve variable speed wind turbine efficiency and performance	A control system utilizing fuzzy logic adaptive control to control the operation of a wind turbine driven electric power generator to control power generator speed and hence power frequency while maximizing the power output of the power generator. Wind turbulence effects are eliminated and airgap magnetic flux of the power generator is controlled.
5,711,020	Method for remediating environmental contaminants	A method and composition for the remediation of environmental contaminants in soil, sediment, aquifer material or water wherein contaminants are first reduced with a reducing agent found in sediment and are then oxidized to environmentally safe products. The composition includes a reducing agent, solubilized from sediment by a solvent, for reduction of environmental contaminants such as nitroorganics, halogenated hydrocarbons, cyano compounds, anisoles and metals
5,788,741	Virtual impactor process for removing particles from an air stream	A virtual impactor that can remove essentially all of the particles from an airstream is disclosed. Disclosed are a method of separating particles from the airstream using this virtual impactor, a method of concentrating the particulate matter in an airstream, and the concentrated airstream.
5,832,468	Method for improving process control by reducing lag time of sensors using artificial neural networks	An artificial neural network is used to predict the current state of a process based upon sensor measurements of the process variables at previous times. The output of the neural network provides the process control system with the predicted process state, thereby reducing the time lag of the sensors and providing improved control of the process.
5,858,763	Thermophilic Methanotrophs for High Temperature Oxidations	The invention is a consortium of thermophilic methanotrophic organisms in culture medium containing said consortium reproduced at temperatures of 50.degree. C. to 80.degree. C., said consortium being comprised primarily of ovoid or rod-shaped organisms. The consortium can be instilled into soil or water to degrade pollutants, especially hydrocarbons and substituted hydrocarbons
5,867,994	Dual-Service Evaporator System for Refrigerators	The disclosed refrigeration appliance includes a fresh-food compartment and a freezer compartment with a plenum or duct therebetween housing a single evaporator and at least one fan for establishing air flows through the plenum in opposite directions, an air flow pattern through the plenum and the fresh-food compartment alternating with an air flow pattern through the plenum and the freezer compartment. A condenser, a single compressor and a refrigerant circuit serve to complete the refrigeration system. One-way air valves are located at opposite ends of the plenum, on opposing sides of the fan, and provide communication between the food compartments and the plenum. Two one-way air valves are located at each end of the plenum, one in a wall of the freezer compartment and the other in a wall of the fresh-food compartment. The one-way air valves allow an air flow to be established, selectively, either through the plenum in the fresh-food compartment or through the plenum and the freezer compartment. Operating in a fresh-food compartment cooling mode, air from

Page 13 of 37

Patent # ***Application #***	**Title**	**Abstract**
5,887,674	Continuously Smooth Transmission	A drive train for a vehicle having front and rear wheels includes a fluidic motor and a pump interconnected in a continuous loop, with one conduit connected to the inlet of the fluidic motor to the outlet of the pump and a second conduit connecting the inlet of the pump to the outlet of the fluidic motor. A gas/liquid fluid accumulator is in fluid communication with the first conduit and a low pressure reservoir is in fluid communication with the second conduit. An engine, sized to match the average torque demanded of the vehicle, is employed to drive the pump. Sensors are included for detecting the pressure within the accumulator and the power demanded of the vehicle by the driver and, optionally, vehicle speed. A motor controller controls displacement of the fluidic motor in accordance with the sensed power demand and a pump controller controls displacement of the pump responsive to the signal for detected pressure.
5,916,438	Removal of Hydrogen Sulfide from an Anaerobic Digester Effluent Gas Stream	The effluent gas stream from anaerobic waste water treatment digesters is treated to remove trace amounts of hydrogen sulfide and other contaminants. The chemical equation involved relies on the reaction of hydrogen sulfide with oxygen to form water plus elemental sulfur. The removal system includes a variable control line for adding air to the effluent gas stream; a filter for removing solids, entrained liquids and bacteria from the oxygen-enriched gas stream; a blower for directing the filtered gas stream into a potassium promoted activated carbon bed wherein the above chemical reaction takes place; and sensors for measuring the content of oxygen and hydrogen sulfide at the entrance and exit of the activated carbon bed. When the hydrogen sulfide content of the exiting gas stream exceeds a predetermined level, the amount of air added to the gas stream is increased until the predetermined level of hydrogen sulfide is achieved in the exiting gas stream.
5,919,679	Method and apparatus for altering ionic interactions with magnetic fields	A method is presented for altering or affecting ionic interactions in systems containing an unhydrated ion, including cells and organisms, using magnetic fields. The method involves controlling the orientation and varying the intensity and fluctuation frequency of paired static and sinusoidally varying magnetic fields in such a way as to create certain magnetic interactions between ions and the molecules with which they are associated. Using the ion parametric resonance (IPR) model developed in the present invention, the magnetic fields can be adjusted to control precisely the desired orientation, intensity and fluctuation frequency of the magnetic fields.
5,972,301	Use of Sulfur to minimize Hexavalent Chromium Emissions from combustion sources	Formation of hexavalent chromium is reduced during incineration/combustion of materials containing hexavalent chromium by adding to the waste prior to or during combustion a small amount of sulfur. The sulfur can be added as elemental sulfur, as sulfur dioxide, or as high sulfur fuels or high sulfur waste.
5,974,822	Rotating-Disk Evaporative Condenser	A tank holds a pool of liquid coolant in which spaced, rotatable disks are partially submerged. An air flow is established over exposed portions of the disks, preferably parallel thereto, whereby coolant adhering to the disks upon rotating out of the coolant pool is partially evaporated and the disks and remaining adhering coolant have their temperature lowered and serve to cool the coolant pool upon reentry into the pool from the air space above. A fluid to be cooled is passed through tubes mounted in the tank, below the surface of the liquid coolant, parallel to the surfaces of the disks. Adjacent rows of tubes define spaces therebetween, each of which receives the submerged portion of at least one disk. The evaporative cooler may be used in a refrigeration apparatus in combination with a compressor and an evaporator.

Page 14 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,039,878	Recovery of volatile organic compounds from emulsion of volatile organic compounds in water by pervaporation	Volatile organic compounds (VOCS) can be removed from surfactant solutions using pervaporation with hydrophobic pervaporation membranes. This process can be used to remove volatile non-laqueous phase liquids from surfactant-based soil washing and soil flushing solutions for recovery of the volatile compounds and reuse of the surfactant. The process of the present invention can also be used to separate VOCs from industrial process streams containing surfactants for in-process recycling and reclamation of the VOCs and/or surfactants. In addition, the process of the present invention can be used to separate VOCs from industrial waste streams containing surfactants for waste volume reduction or for recovery/recycle of the VOCs and/or surfactant.
6,039,882	Remediation of environmental contaminants using metal and a sulfur containing compound.	A method and composition for the remediation of environmental contaminants in soil, sediment, aquifer material, water, or containers in which contaminants were contained, wherein contaminants are reacted with a remediating composition comprising a metal and a sulfur-containing compound to produce environmentally-acceptable, chemically reduced products. The method is useful for treating contaminants such as halogenated hydrocarbons, pesticides, chemical warfare agents and dyes. The remediating composition preferably contains comminuted, commercial grade iron and iron sulfide. The addition of an alcohol to the reactants enhances the rate of the remediation reaction, particularly for contaminants of soils and sediments.
6,063,305	Refrigerant compositions containing a hydrofluoropropane and a hydrofluorocarbon	Azeotropes of hydrofluorocarbons and hydrofluoroethers useful for use as refrigerants are disclosed. Zeotropes of hydrofluoropropanes and hydrofluoroethers with hydrofluorocarbons, hydrofluoroethers, and hydrocarbons useful as refrigerants are also disclosed. The invention also includes refrigeration and heating processes in which these refrigerants are useful.
6,063,590	Membrane Filter Agar Medium for Detection of Total Coliforms and E.Coli	An improved method for detection of total coliforms and E. coli comprising placing the target sample in a broth containing an ingredient that will encourage growth and repair of injured coliforms, at least one agent that suppresses growth of gram positive cocci and spore-forming organisms, at least one active agent that will suppress growth of non-coliform gram negative bacteria, and at least one chromogen or fluorogen has been used effectively and is cost effective. In the preferred embodiment, both a fluorogen and chromogen were used. Preferred methods include use of filter and/or plates containing the growth-promoting ingredients and the indicators
6,100,382	Method and Composition for Remediating Environmental Contaminants	A method and composition for the remediation of environmental contaminants in soil, sediment, aquifer material or water wherein contaminants are first reduced with a reducing agent found in sediment and are then oxidized to environmentally safe products. The composition includes a reducing agent, solubilized from sediment by a solvent, for reduction of environmental contaminants such as nitroorganics, halogenated hydrocarbons, cyano compounds, anisoles and metals.

Page 15 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,103,121	Membrane-based sorbent for heavy metal sequestration	A process is provided for making membrane-based sorbents with enhanced binding activity that are particularly useful for heavy metal sequestration. The process includes the step of selectively hydrolyzing a polyacetylated membrane in order to deacetylate a surface layer of said membrane and expose free hydroxyl groups. This is followed by the oxidizing of the hydroxyl groups to aldehyde groups. This is then followed by the attaching of a polycarboxylic acid such as a polyamino acid, polyalkenoic acid or polypeptide to the membrane through the aldehyde groups. Preferably, the hydrolyzing step is completed under alkaline conditions and the oxidizing step is completed using an aqueous solution of sodium periodate.
6,117,328	Absorbent-Filled Membranes for Prevaporation	Pervaporation membranes are used for removing volatile organic compounds from wastewaters. These pervaporation membranes are prepared by dispersing at least one hydrophobic adsorbent such as activated carbon uniformly into a polymer matrix.
6,139,742	Membrane-based sorbent for heavy metal sequestration	A process is provided for making membrane-based sorbents with enhanced binding activity that are particularly useful for heavy metal sequestration. The process includes the step of selectively hydrolyzing a polyacetylated membrane in order to deacetylate a surface layer of said membrane and expose free hydroxyl groups. This is followed by the oxidizing of the hydroxyl groups to aldehyde groups. This is then followed by the attaching of a polycarboxylic acid such as a polyamino acid, polyalkenoic acid or polypeptide to the membrane through the aldehyde groups. Preferably, the hydrolyzing step is completed under alkaline conditions and the oxidizing step is completed using an aqueous solution of sodium periodate.
6,148,656	Real-Time on-road vehicle emissions reporter. Portable Emissions Measurement	An on-board vehicle emissions testing system includes an instrument module adapted to be detachably connected to the exhaust pipe of a vehicle to provide for flow of exhaust gas therethrough. The instrument module includes a differential pressure probe which allows for determination of flow rate of the exhaust gas and a gas sampling tube for continuously feeding a sample of the exhaust gas to a gas analyzer. In addition to the module, the on-board emission testing system also includes an elastomeric boot for detachably connecting the module to the exhaust pipe of the vehicle, a gas analyzer for receiving and analyzing gases sampled within the module and a computer for calculating pollutant mass flow rates based on concentrations detected by the gas analyzer and the detected flow rate of the exhaust gas. The system may also include a particulate matter detector with a second gas sampling tube feeding same mounted within the instrument module.
6,152,988	Enhancement of Electrostatic Precipitation with Precharged Particles and Electrostatic Field Augmented Fabric Filtration	An electrostatic bag filter unit is formed of a plurality of sections arranged in series. One section is a bag filter section containing a plurality of parallel elongated filter fabric bag elements extending across and traverse to a gas flow path therethrough and a plurality of grounded, electrically-conductive support frames, each support frame being internal to and supporting one of the filter fabric bag elements. Optionally, the bag filter section may further include a plurality of non-discharging electrodes disposed parallel to and interspersed among the filter fabric bag elements. A filter precharger section is located immediately upstream of and contiguous with the bag filter section and is formed of a linear array of alternating corona discharge electrodes and grounded electrodes arranged perpendicular to the gas flow path.

Page 16 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,165,251	On-Line Gas Chromatograph with Sample Preparation, Concentration and Calibration Apparatus for Measuring Trace Organic Species from Combustor Flue Gas	Apparatus and method for periodic analysis of trace amounts of volatile organic compounds in a waste gas provide for feeding of a sample of a waste gas first to an organics concentrator which isolates the volatile organic compounds from the waste gas sample and prepares a concentrated sample for feed to a gas chromatograph. In normal operation, a waste gas is continuously sampled from the waste gas source to produce a continuous waste gas flow through a switching valve and out a vent. A portion of that waste gas flow is periodically diverted by the switching valve and routed to the organics concentrator. The switching valve also receives calibration samples containing known concentrations of the volatile organic compounds prepared in a gas blender. It periodically feeds the calibration samples to the organics concentrator and the gas chromatograph for calibration of the system.
6,170,524	Fast valve and actuator	A fast-acting valve includes a valve body and a spool slidably mounted within the valve body between first and second limit positions. Both the spool and the valve body have a flow passage which come into alignment with the valve spool at a position intermediate the first and second limit positions and spaced therefrom by a given distance. That given distance allows the spool member to accelerate in travel from the first and second limit positions to the valve open position so that the opening of the valve (and closing) occurs quite quickly. Reciprocating movement of the valve spool relative to the valve body can be provided by springs mounted in opposing ends of the valve body bore in cooperation with solenoids mounted on opposing sides of the valve body. The fast-acting valve may be modified into the form of poppet valve or a cartridge valve.
6,186,126	Phase Change Heat Engine	An automotive power plant includes an internal combustion engine and a heat exchanger for vaporizing fuel to the internal combustion engine utilizing heat from the combustion exhaust gas. The vaporized fuel may be fed to a combustion cylinder containing the compressed gas produced by a compression stroke. Alternatively, the vaporized gas may be fed to a dedicated expander for extracting work therefrom and then fed to the internal combustion engine.
6,189,493	Torque Balanced Opposed-piston Engine	An internal combustion engine having first and second synchronized subassemblies. The subassemblies are synchronized by a mechanical linkage of their crankshafts to provide identical timing between corresponding pistons in the two subassemblies.
6,197,940	Method for evaluating and affecting male fertility	A 22 kD sperm protein, SP-22, correlates with fertility and predicts fertility in males. The protein can be assayed to detect decreases in fertility resulting from exposure to toxicants and pollutants which are known or suspected to decrease fertility. If an antibody is generated to this protein, the antibody recognition by sperm in an epididymal sperm sample or ejaculate would reflect the fertility of the sample. This antibody can be used as a contraceptive to inactivate sperm, screen for toxicity, select animals for artificial insemination, and select men for assisted reproductive technologies. The protein itself can be inactivated by gene knockout, which is another approach to contraception, or the protein can be added to sperm from infertile men to make fertility techniques more feasible.

Page 17 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,202,416	Dual-Cylinder Expander Engine	An internal combustion engine is provided with an expansion cylinder and at least one combustion cylinder, preferably two or four combustion cylinders per expansion cylinder. An air-fuel mixture is ignited within the combustion cylinders to drive a combustion piston which, in turn, drives an engine crankshaft. The gaseous products of combustion are exhausted at a pressure substantially above atmospheric to an expansion cylinder wherein they are allowed to further expand against an expander piston to drive an expander crankshaft. Torque produced at the engine crankshaft and torque produced at the expander crankshaft are combined to drive vehicle wheels.
6,207,073	Remediation of environmental contaminants using metal and a sulfur containing compound.	A method and composition for the remediation of environmental contaminants in soil, sediment, aquifer material, water, or containers in which contaminants were contained, wherein contaminants are reacted with a remediating composition comprising a metal and a sulfur-containing compound to produce environmentally-acceptable, chemically reduced products. The method is useful for treating contaminants such as halogenated hydrocarbons, pesticides, chemical warfare agents and dyes. The remediating composition preferably contains comminuted, commercial grade iron and iron sulfide. The addition of an alcohol to the reactants enhances the rate of the remediation reaction, particularly for contaminants of soils and sediments.
6,216,462	High Efficiency Air Bottoming Engine	An air bottoming powertrain, suitable for use in automobiles includes an internal combustion engine, a compressor which receives gaseous working fluid and compresses it to an elevated pressure, a cooler For operating the compressor isothermally, an expander for deriving work from the compressed gas and a heat exchanger located in the compressed gas line for indirect heat exchange between the compressed working fluid and exhaust gas from the internal combustion engine. The expander may have a cylindrical barrel with a plurality of cylinders arranged in the circle and open at one end face of the cylinder barrel, which end face is sealed closed by a valve plate. The cylinder barrel and valve plate allow relative rotation therebetween to drive an output shaft, driven by compressed gas from the compressor. An alternative expander is a Scotch Yoke piston motor which includes plural paired and axially aligned cylinders on opposing sides of an output shaft. In the Scotch Yoke-type piston motor each cylinder is axially divided by a thermal brake into a thermally insulated outer portion and cooled
6,238,899	Method and apparatus for altering ionic interactions with magnetic fields	A method for altering or affecting ionic interactions in systems containing an unhydrated ion in a chemical or biological system comprising controlling the orientation and varying the intensity and fluctuation frequency of perpendicular or perpendicular and parallel paired static and sinusoidally varying magnetic fields so as to create magnetic interactions between ions and the molecules with which the ions are associated. Using the ion parametric resonance (IPR) model of the present invention, the magnetic fields can be adjusted to control precisely the desired orientation, intensity and fluctuation frequency of the magnetic fields.
6,300,121	Method for reducing Bio-Availability of Lead by a Lead-Sequestering Soil Bacterium	Bioavailability of lead and other heavy metals in the environment may be reduced by addition of microorganisms which sequester lead from the environment in the presence of phosphate. The microorganisms are highly mobile and are, therefore, capable of scavenging a material for lead, which they then sequester. The method basically consists of reducing bioavailability of lead in the environment by addition of Pseudomonas aeruginosa strain CHL004 (ATCC 55937) to said environment in the presence of phosphate which contains at least stoichiometric equivalent amounts of phosphate to lead.

Page 18 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,301,888	Low emissions Diesel Cycle	A diesel-cycle engine with a unique exhaust gas recirculation system includes a plurality of cylinders with fuel feed for each of the cylinders and an intake manifold for distributing intake air to each of the cylinders for combustion of the fuel charges therein with generation of exhaust gas. The exhaust gas is discharged to ambient atmosphere through an exhaust line with a gas turbine therein. The gas turbine drives an intake compressor which serves to compress the intake air. An engine controller controls a valve regulating the amount of exhaust gas recirculation responsive to sensed concentration of an exhaust gas component. In another embodiment, an engine controller controls a valve regulating the amount of exhaust gas recirculation, responsive to sensed demand for torque and control of fuel injection quantity is responsive to sensed concentration of an exhaust gas component. An exhaust gas recirculation line recirculates a portion of the collected exhaust gas to the combustion chambers through an exhaust gas cooler which serves to cool the gas and separate out a condensate and particulate matter. A return line leading from the exhaust gas cooler to the exhaust line serves to discha
6,301,891	High Efficiency Air Bottoming Engine	An air bottoming powertrain, suitable for use in automobiles includes an internal combustion engine, a compressor which receives gaseous working fluid and compresses it to an elevated pressure, a cooler for operating the compressor isothermally, an expander for deriving work from the compressed gas and a heat exchanger located in the compressed gas line for indirect heat exchange between the compressed working fluid and exhaust gas from the internal combustion engine. The expander may have a cylindrical barrel with a plurality of cylinders arranged in the circle and open at one end face of the cylinder barrel, which end face is sealed closed by a valve plate. The cylinder barrel and valve plate allow relative rotation therebetween to drive an output shaft, driven by compressed gas from the compressor. An alternative expander is a Scotch Yoke piston motor which includes plural paired and axially aligned cylinders on opposing sides of an output shaft. In the Scotch Yoke-type piston motor each cylinder is axially divided by a thermal brake into a thermally insulated outer portion and cooled
6,306,301	Silica-based membrane sorbent for heavy metal sequestration	An apparatus providing for metal ion/nitrate entrapment comprises a chemically activated, microfiltration, composite polymer and silica-based membrane including a polyamino acid attached thereto through reaction of a terminal amine group of the polyamino acid with the membrane. A method for preparing such a chemically activated or polyamino acid functionalized membrane includes the steps of permeating the silica-based membrane with a solution of silane and a solvent so as to react methoxy groups of the silane with silanol groups of the membrane to incorporate epoxide groups and attaching a polyamino acid to the membrane by reacting a terminal amine group of the polyamino acid with one of the epoxide groups on the membrane.
6,306,621	Membrane Filter Agar Medium for Detection of Total Coliforms and E.Coli	An improved method for detection of total coliforms and E. coli comprising a broth containing an ingredient that will encourage growth and repair of injured coliforms, buffers to maintain a pH in the range of 6.5-8, at least one agent that suppresses growth of gram positive cocci and spore-forming organisms, at least one active agent that will suppress growth of non-coliform gram negative bacteria, and at least one chromogen or fluorogen has been used effectively and is cost effective. In the preferred embodiment, both a fluorogen and chromogen were used. Preferred methods include use of filter and/or plates containing the growth-promoting ingredients and the indicators.

Page 19 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,382,014	Real-Time on-road vehicle emissions reporter. Portable Emissions Measurement	An on-board vehicle emissions testing system includes an instrument module adapted to be detachably connected to the exhaust pipe of a vehicle to provide for flow of exhaust gas therethrough. The instrument module includes a differential pressure probe which allows for determination of flow rate of the exhaust gas and a gas sampling tube for continuously feeding a sample of the exhaust gas to a gas analyzer. In addition to the module, the on-board emission testing system also includes an elastomeric boot for detachably connecting the module to the exhaust pipe of the vehicle, a gas analyzer for receiving and analyzing gases sampled within the module and a computer for calculating pollutant mass flow rates based on concentrations detected by the gas analyzer and the detected flow rate of the exhaust gas. The system may also include a particulate matter detector with a second gas sampling tube feeding same mounted within the instrument module.
6,386,154	Pumped EGR System	An exhaust gas recirculation system for an internal combustion engine includes an exhaust manifold and at least one exhaust flow control valve located between the engine and the exhaust manifold. The exhaust flow control valve diverts a portion of the exhaust gas from each cycle of one cylinder and feeds that diverted portion to another of the cylinders through an exhaust gas recirculation passage, bypassing the exhaust manifold, whereby an exhaust stroke of a piston within the one cylinder serves to pump exhaust gas through the exhaust flow control valve in another cylinder.
6,387,652	Method for identifying and qualifying specific Fungi and Bacteria	Fungi and bacteria can be detected and rapidly quantified by using the nucleotide sequences taught here that are specific to the particular species or group of species of fungi or bacteria. Use of the sequences can be made with fluorescent labeled probes, such as in the TaqMan.TM. system which produces real time detection of polymerase chain reaction (PCR) products. Other methods of detection and quantification based on these sequences include hybridization, conventional PCR or other molecular techniques.
6,415,607	High Efficiency Air Bottoming Engine	An air bottoming powertrain, suitable for use in automobiles includes an internal combustion engine, a compressor which receives gaseous working fluid and compresses it to an elevated pressure, a cooler For operating the compressor isothermally, an expander for deriving work from the compressed gas and a heat exchanger located in the compressed gas line for indirect heat exchange between the compressed working fluid and exhaust gas from the internal combustion engine. The expander may have a cylindrical barrel with a plurality of cylinders arranged in the circle and open at one end face of the cylinder barrel, which end face is sealed closed by a valve plate. The cylinder barrel and valve plate allow relative rotation therebetween to drive an output shaft, driven by compressed gas from the compressor. An alternative expander is a Scotch Yoke piston motor which includes plural paired and axially aligned cylinders on opposing sides of an output shaft. In the Scotch Yoke-type piston motor each cylinder is axially divided by a thermal brake into a thermally insulated outer portion and cooled

Page 20 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,470,682	Low emissions Diesel Cycle	A diesel-cycle engine with a unique exhaust gas recirculation system includes a plurality of cylinders with fuel feed for each of the cylinders and an intake manifold for distributing intake air to each of the cylinders for combustion of the fuel charges therein with generation of exhaust gas. The exhaust gas is discharged to ambient atmosphere through an exhaust line with a gas turbine therein. The gas turbine drives an intake compressor which serves to compress the intake air. An engine controller controls a valve regulating the amount of exhaust gas recirculation responsive to sensed concentration of an exhaust gas component. In another embodiment, an engine controller controls a valve regulating the amount of exhaust gas recirculation, responsive to sensed demand for torque and control of fuel injection quantity is responsive to sensed concentration of an exhaust gas component. An exhaust gas recirculation line recirculates a portion of the collected exhaust gas to the combustion chambers through an exhaust gas cooler which serves to cool the gas and separate out a condensate and particulate matter. A return line leading from the exhaust gas cooler to the exhaust line serves to discha
6,470,732	Real-Time on-road vehicle emissions reporter. Portable Emissions Measurement	A real-time emissions reporting system includes an instrument module adapted to be detachably connected to the exhaust pipe of a combustion engine to provide for flow of exhaust gas therethrough. The instrument module includes a differential pressure probe which allows for determination of flow rate of the exhaust gas and a gas sampling tube for continuously feeding a sample of the exhaust gas to a gas analyzer or a mounting location for a non-sampling gas analyzer. In addition to the module, the emissions reporting system also includes an elastomeric boot for detachably connecting the module to the exhaust pipe of the combustion engine, a gas analyzer for receiving and analyzing gases sampled within the module and a computer for calculating pollutant mass flow rates based on concentrations detected by the gas analyzer and the detected flowrate of the exhaust gas. The system may also include a particulate matter detector with a second gas sampling tube feeding same mounted within the instrument module.
6,489,157	Medium for Cultivating Microorganisms	A medium for culturing microorganisms in the presence of Pb.sup.2+ uses as a phosphate component, an O-phosphate-L-amino acid, to provide a source of phosphate for the microorganisms so as to avoid precipitating lead.
6,544,418	Preparing and regenerating a composite polymer and silica-based membrane	A method for preparing and regenerating a chemically activated or polyamino acid functionalized membrane includes the steps of permeating the silica-based membrane with a solution of silane and a solvent so as to react methoxy groups of the silane with silanol groups of the membrane to incorporate epoxide groups and attaching a polyamino acid to the membrane by reacting a terminal amine group of the polyamino acid with one of the epoxide groups on the membrane. The membrane is regenerated after metal entrapment by utilizing helix-coil properties of polyamino acids.
6,544,419	Method of preparing a composite polymer and silica-based membrane	A method for preparing a chemically activated or polyamino acid functionalized membrane includes the steps of permeating a silica-based membrane with a solution of silane and a solvent so as to react methoxy groups of the silane with silanol groups of the membrane to incorporate epoxide groups and attaching a polyamino acid to the membrane by reacting a terminal amine group of the polyamino acid with one of the epoxide groups on the membrane.

Page 21 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,578,533	Controlled, Homogeneous charge compression-ignition engine	An engine has a plurality of combustion cylinders with a first piston reciprocably mounted in each of the combustion cylinders in the conventional manner. The engine head has, in communication with each of the combustion cylinders, a cylindrical recess containing a reciprocably mounted second piston. On the side of the second piston opposite the combustion chamber is a control chamber with inlets and outlets for controlling movement of the second piston. The second piston is used to increase the compression ratio without appreciably reducing the expansion ratio. Alternatively, the second piston may be used as a pump to pump fluid from the control chamber. In yet another alternative method of operation, the second piston can be driven outward within the cylindrical recess to an extent which varies in accordance with power demand, thereby varying the compression ratio in accordance with the power demand.
6,582,204	Fully-controlled, free-piston engine	A free-piston engine includes at least one dual piston assembly, each of which has a pair of axially opposed combustion cylinders and free-floating combustion pistons respectively mounted in the combustion cylinders for reciprocating linear motion responsive to successive combustions. A pumping piston extends from and is fixed to each of the combustion pistons and reciprocates within a hydraulic cylinder located between paired combustion cylinders. The paired combustion cylinders are rigidly connected by a cage for reciprocating movement in tandem.
6,619,325	Hydraulic Hybrid Accumulator Shut-Off Valve	A hydraulic accumulator is equipped with a novel shut-off valve. The shut off-valve includes a valve body having a cylindrical hollow with a valve seat surrounding one end. The main piston including a piston head has a central opening and is slidably mounted within the cylindrical hollow of the valve body. A poppet valve has a valve head which mates with the valve seat and a valve stem which extends through the central opening of the piston to guide axial movement of the poppet valve relative to the piston. A spring is mounted between the valve head and the main piston head for urging the valve head away from the piston head. A control valve moves the piston relative to the valve body between open and closed positions responsive to signals from a computer which signals valve closing upon determination that flow rate through the valve exceeds a maximum period. The spring between the poppet valve head and the piston head exerts a force approximately equal to that of a pressure drop across the poppet valve at a predetermined maximum flow rate.
6,651,432	Controlled Temperature Combustion Engine	A method of operating an internal combustion engine wherein intake ambient air is boosted to a higher pressure by passage through at least one compressor and then introduced into the internal combustion engine. Fuel is also introduced into the internal combustion engine for providing combustion in admixture with the air charge at a combustion temperature approximating a target value. Various engine operating parameters, inclusive of torque demand, e.g., accelerator pedal depression, are sensed and the boosted pressure is changed in a manner proportional to a change in the sensed torque demand so as to maintain the combustion temperature at approximately the target value, i.e., below 2100.degree. K.

Page 22 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,652,247	Fully controlled, free-piston engine	A free-piston engine includes at least one dual piston assembly, each of which has a pair of axially opposed combustion cylinders and free-floating combustion pistons respectively mounted in the combustion cylinders for reciprocating linear motion responsive to successive combustions. A pumping piston extends from and is fixed to each of the combustion pistons and reciprocates within a hydraulic cylinder located between paired combustion cylinders. The paired combustion cylinders are rigidly connected by a cage for reciprocating movement in tandem.
6,655,402	System and method for vacuum flushing sewer solids	A flushing system and method are provided for substantially reducing sewer solid accumulation in urban drainage systems such that their performance is optimized, their structural integrity is substantially maintained, and pollution of receiving waters is substantially minimized. The flushing system includes at least one flush reservoir that fluidly communicates with the urban drainage system and discharges wet weather flow to flush accumulated sewer solids therefrom. An air release valve on the at least one flush reservoir closes when it is substantially full to create a vacuum that is broken by drawing air through an air intake conduit in the at least one flush reservoir when the urban drainage system is drained to a predetermined level.
6,663,781	Contaminant Absorption and Oxidation via the Fenton Reaction	Contaminated water is treated by adsorbing contaminant onto a sorbent to concentrate the contaminant and then oxidizing the contaminant via the Fenton and related reactions. Iron is attached to the sorbent or can be added in solution with an oxidant. Both systems, iron attached to the sorbent or iron in solution, can be used to oxidize contaminants on or near the surface of the sorbent. The process can be used to treat contaminated water in above-ground and below-ground treatment systems.
6,670,145	Method for detection of total coliforms and E. coli	An improved method for detection of total coliforms and E. coli comprising a broth containing an ingredient that will encourage growth and repair of injured coliforms, buffers to maintain a pH in the range of 6.5-8, at least one agent that suppresses growth of gram positive cocci and spore-forming organisms, at least one active agent that will suppress growth of non-coliform gram negative bacteria, and at least one chromogen or fluorogen has been used effectively and is cost effective. In the preferred embodiment, both a fluorogen and chromogen were used. Preferred methods include use of filter and/or plates containing the growth-promoting ingredients and the indicators.
6,681,789	Fuel tank ventilation system and method for substantially preventing fuel vapor emissions	A fuel tank ventilation system and method are provided for substantially preventing fuel vapor emissions without significant increase in tank pressure. The system and method include a flexible bladder within the fuel tank that alternately deflates and inflates in response to a change in fuel vapor pressure and fuel volume.
6,719,080	Hydraulic hybrid vehicle	
6,752,105	Piston-in-Piston Variable Compression Ratio Engine	An improved apparatus for generating a variable compression ratio within an ICE includes a piston-in-piston assembly having an inner piston that is slidably mounted within an outer piston and coupled to an actuator. The actuator is further coupled to a fluid source, and a volume of fluid is selectively channeled into and out of the actuator to move the inner piston to selected positions corresponding to desired compression ratios. At top dead center, a top face of the outer piston maintains a substantially constant distance from an engine head assembly to minimize squish area variations.

Page 23 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,755,975	Separation Process using Pervaporation and Dephlegmation	A process for treating liquids containing organic compounds and water. The process includes a pervaporation step in conjunction with a dephlegmation step to treat at least a portion of the permeate vapor from the pervaporation step. The process yields a membrane residue stream, a stream enriched in the more volatile component (usually the organic) as the overhead stream from the dephlegmator and a condensate stream enriched in the less volatile component (usually the water) as a bottoms stream from the dephlegmator. Any of these may be the principal product of the process. The membrane separation step may also be performed in the vapor phase, or by membrane distillation.
6,777,374	Process for photo-induced partial oxidation of organic chemicals, such as alkanes and aromatics, to alcohols, ketones and aldehydes using flame deposited nano-structured photocalalyst	Organic molecules are partially oxidized in that the gas phase on supported and immobilized photocatalysts deposited having a nanostructure. the photocatalysts are semiconductors such as titanium dioxide and are preferentially coated onto a substrate by flame aerosol coating.
6,779,339	Method For Nox Adsorber Desulfation In A Multi-Path Exhaust System	The method of treating a fuel lean exhaust containing NO.sub.X and SO.sub.2 includes splitting the exhaust into major and minor portions for flow through multiple flow paths each of which contains a particulate trap and an absorber containing a NO.sub.X oxidation catalyst and a nitrate absorbent. The major portion is passed through a flow path in the lean state at a first temperature to convert the NO.sub.X to nitrate and the SO.sub.2 to sulfate. After the first period of operation flows are switched so that one flow path receives a minor exhaust portion for a second period of time during which fuel is injected into that flow path along with diversion of a portion of exhaust from another flow path through a bypass. When during the second period of operation the particulate trap reaches a predetermined temperature, the flow path is opened to an increased exhaust flow to transfer heat from the particulate trap to the NO.sub.X absorber to bring the NO.sub.X absorber to a temperature suitable for sulfation, at which time fuel and a small portion of exhaust gas are again introduced in order to effect the
6,786,205	Hydraulically intensified high pressure fuel system for common rail application	A common rail intensifier fuel injection system includes a plurality of fuel injectors respectively associated with cylinders of an internal combustion engine. A common rail supplies fuel at an intensified pressure to the fuel injectors and receives the fuel at the intensified pressure, alternately, from at least two fuel pressure intensifying circuits. At least one of the fuel pressure intensifying circuits includes a fuel pressure intensifier having an operating chamber for receiving and discharging an operating fluid, and a fuel chamber of a diameter smaller than that of the operating chamber for receiving fuel at a low pressure from the fuel supply and discharging the fuel at the intensified pressure into one of the fuel pressure intensifying circuits. A control valve, in a first position, connects the operating fluid source with the operating chamber of the fuel pressure intensifier and, in a second position, connects the operating chamber of the fuel pressure intensifier with a drain. A controller switches the control valve between the first and second positions and switches the supply of fuel at the

Page 24 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,810,838	Individual cylinder coolant control system and method	A coolant system and method for control of cylinder temperature in a multiple cylinder internal combustion engine includes an inlet rail for receiving coolant from a pump, an outlet rail located on a side of the cylinder head opposite the inlet rail and a plurality of individual coolant flow passages extending within the cylinder head and connecting the inlet rail with the outlet rail. A control valve and an associated temperature sensor are provided within each of the coolant flow passages and a controller individually controls each of the control valves in accordance with a signal received from its associated temperature sensor. The control valves may be controlled to bring the temperatures detected by their associated temperature sensors into conformance with an optimum temperature predetermined for engine speed and/or engine torque load.
6,820,417	Exhaust aftertreatment system and method for an internal combustion engine	An exhaust aftertreatment system for use with an internal combustion engine includes at least one leg having a multi-stage NOx adsorber, with each NOx adsorber stage corresponding to a different temperature range of NOx adsorption. In a multi-pass aftertreatment system, a manifold has at least one inlet and a plurality of outlets. A plurality of legs are connected with a respective manifold outlet. Each leg has a NOx adsorber therein. At least one valve is positioned in association with at least one leg for at least partially opening and closing the at least one leg.
6,821,425	Biomass Concentrator Reactor	A gravity-flow Biomass Concentrator Reactor (BCR) is provided which uses a porous barrier having pore sizes averaging from about 1 to about 50 microns through which treated water permeates under the pressure of gravity. Solids suspended in water treated with the BCR are effectively retained and concentrated.
6,829,839	Electronic caliper for mouse ear and rat foot pad edema measurement	An electronic caliper includes fixed and movable caliper arms mounted on a common housing and having jaws at their free ends. One of the caliper arms is attached to the housing through a pivot pin for pivoting motion between a contact position and a disengaged position. A spring engages the movable arm at a point on a side of the pivot pin opposite the jaws. The spring is under tension so as to bias the contact pad carried by the distal end of the movable caliper arm toward contact with the pad mounted on the distal end of the fixed caliper arm. A non-contact electronic sensor is positioned facing a target disk carried by movable caliper arm at its innermost end within the housing. A plunger, located on the same side of the pivot pin as is the target disk, allows the movable caliper arm to be pivoted to its open position to allow for insertion and removal of the soft tissue to be measured.
6,855,498	In-situ hybridization probes for the detection of microsporidial species	The present invention provides in situ hybridization probes which include a marker and a nucleic acid molecule able to hybridize exclusively with only one species of Encephalitozoon. The nucleic acid molecule may be, for example, complimentary to segment 878-896 of 16S rRNA of Encephalitozoon hellem spores. Specifically disclosed probes are those including the following nucleotides: (1) 5'-ACT CTC ACA CTC ACT TCA G-3' (Seq. I.D. No. 1) which is species specific for Encephalitozoon hellem, (2) 5'-CAG ACC ACT ATC TGC A-3' (Seq. I.D. No. 2) which is species specific for Encephalitozoon cuniculi and (3) 5'-GTT CTC CTG CCC GCT TCA G-3' (Seq. I.D. No. 3) which is species specific for Encephalitozoon intestinalis. The assay of the present invention utilizes a sample such as surface, ground or drinking water, suspected of containing one of the aforementioned species as a target organism. The microorganisms contained in the sample are fixed in a conventional manner and the probe is then introduced wherein it specifically binds with the target microorganism, if present. The sample is then washed to remove the unbound probe and the bound probe is detected in a conventiona

Page 25 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,857,263	Low emission diesel combustion system with low charge-air oxygen concentration levels and high fuel injection pressures	This invention sets forth a commercially viable diesel combustion system that meets environmentally acceptable levels of NOx emissions (i.e. 0.2 g/bhp-hr or lower across a full map of engine speeds and loads) without the need for use of NOx aftertreatments, and simultaneously maintains engine-out PM emissions relatively close (e.g. with smoke levels at or below 3 BSN) to environmentally acceptable PM post-aftertreatment levels. The invention achieves these results by operating within a unique combination of parameters. These parameters comprise: (1) charge-air oxygen concentration below 16%, preferably between 10% and 15%, more preferably between 11% and 14%, and most preferably between 12% and 13.5% for virtually all engine operating conditions (but not necessarily at no-load or low load conditions), (2) fuel injection pressures at or exceeding 1800 bar, preferably exceeding 2100 bar, more preferably exceeding 2300 bar, and most preferably exceeding 2500 bar, at most engine speeds and loads, and (3) charge-air mass/fuel mass ratio between 25:1 and 45:1 for medium and high loads. Furthermore, the system is preferably run continuously slightly lean of stoichiometry, provid
6,881,364	Hydrophilic mixed matrix materials having reversible water absorbing properties	Polymer-ceramic mixed matrix compositions contain one or more organic polymers and a nano-sized dispersion of inorganic metal oxide particles which are dispersed throughout the composition. Materials have use in making membranes that act as transfer agents.
6,876,098	Methods of operating a series hybrid vehicle	The invention is directed toward methods for operating a series hybrid vehicle in a manner that responds to the operator's demand for power output, while maximizing engine efficiency and minimizing disruptions in vehicle drivability. According to principles of the present invention, when the driver of a series hybrid vehicle makes a demand for power output, whether the secondary power source(s) is supplied with secondary energy stored in an energy storage device(s), direct input energy generated by an engine(s), or both, depends on the amount of available secondary energy stored in the vehicle's secondary storage device(s) alone, and in combination with vehicle speed. During the time that the engine is used to generate secondary energy, the power efficiency level at which the engine is operated also depends on the vehicle speed and the amount of available secondary energy stored in the vehicle's secondary storage device alone, and in combination with vehicle speed. Further, in some embodiments, when the engine is not generating secondary energy, the engine is selectively turned off or idled in response to various operating conditions.
6,910,459	HCCI engine with combustion-tailoring chamber	An internal combustion engine is adapted for operation with homogeneous combustion and compression ignition. The engine includes plural cylinders with the piston in each cylinder defining the main combustion chamber and connected to a crankshaft for reciprocating motion rotatably driving the crankshaft. An auxiliary combustion chamber and an inlet passage are formed in the engine head for each of the cylinders with a control valve for controlling communication between the main combustion chamber and the auxiliary combustion chamber and an inlet valve for controlling communication between the main combustion chamber and the inlet passage. The inlet valve is driven with rotation of the crankshaft, while the drive for the combustion control valve is independent of angular position of the crankshaft and has its own controller for timing its opening and closing to provide controlled homogeneous combustion.

Page 26 of 37

Patent # ***Application #***	**Title**	**Abstract**
6,965,016	Method for evaluating and affecting male fertility	A 22 kD sperm protein, SP22, correlates with fertility and predicts fertility in males. The protein can be assayed to detect decreases in fertility resulting from exposure to toxicants and pollutants which are known or suspected to decrease fertility. In an antibody is generated to this protein, the antibody recognition by sperm in an epididymal sperm sample or ejaculate would reflect the fertility of the sample. This antibody can be used as a contraceptive to inactivate sperm, screen for toxicity, select animals for artificial insemination, and select men for assisted reproductive technologies. The protein itself can be inactivated by gene knockout, which is another approach to contraception, or the protein can be added to sperm from infertile men to make fertility techniques more feasible.
6,996,982	Method and device for switching hydraulic fluid supplies, such as for a hydraulic pump/motor	A spool valve includes a first valve port coupled to a fluid source at a first pressure range, a second valve port coupled to a fluid source at a second, lower, pressure range, and first and second output ports coupled to a hydraulic device. The valve includes a valve spool configured to selectively channel fluid from the first and second valve ports to the first and second output ports, respectively, while in a first position, from the second valve port to both the output ports while in a second position, and from the second and first valve ports to the first and second output ports respectively, while in a third position, and a check valve to permit one-way fluid passage from the second output port to the first valve port. The valve may include an anti-reverse check valve configured to prevent fluid from flowing into the valve via the first output port.
6,998,727	Methods of operating a parallel hybrid vehicle	The invention is directed toward methods for operating a parallel hybrid vehicle in a manner that responds to the operator's demand for power output, while maximizing engine efficiency and minimizing disruptions in vehicle drivability. According to principles of the present invention, when the driver of a hybrid vehicle makes a demand for power output immediately after a braking event, the power provided to meet the initial demand is from either an ICE or a secondary power source. Which power source is used, and when it is engaged and disengaged, depends on various vehicle operating conditions. Also, the ICE is selectively turned off and on in response to various operating conditions.
7,024,858	Multi-crankshaft, variable-displacement engine	An internal combustion engine for a vehicle provides variable displacement by selectively driving one or more engine crankshafts mounted within a single unitary engine block. In several embodiments the crankshafts are connected to a common output shaft with a one-way clutch between the common output shaft and at least one of the crankshafts. In one aspect starter gearing is independently associated with each of the first and second crankshafts and a starter is provided for selective engagement with the starter gearing of either of the crankshafts. In another aspect, an accessory drive for driving accessory systems of the vehicle receives power from any crankshaft which is operating, yet is isolated from any crankshaft that is not operating by a one-way clutch.

Page 27 of 37

Patent # ***Application #***	**Title**	**Abstract**
7,014,429	High-efficiency, large angle, variable displacement hydraulic pump/motor	A variable displacement hydraulic/pump motor has a yoke with a pair of shafts aligned to define a yoke pivot axis and connected to a valve plate therebetween having intake and discharge apertures. A rotatable cylinder barrel has piston cylinders open at one end to receive a piston head and opening through fluid ports at another end, flush against the valve plate surface. A drive block is mounted on an input/output shaft for rotation about a central axis of rotation inclined at an angle relative to the longitudinal axis of the cylinder barrel which may be changed by a drive engaging the yoke at a point near its pivot axis. Loads on bushings supporting the yoke shafts are reduced by providing radially extending fluid ports in the shafts and in communication with the intake and discharge apertures of the valve plate.
7,025,042	Methods of operation for controlled temperature combustion engines using gasoline-like fuel, particularly multicylinder homogenous charge compression ignition (HCCI) engines	A multicylinder homogeneous charge compression ignition (HCCI) engine with a control system designed to maintain stable HCCI combustion during engine speed/load transitions by: (1) determining "combustion parameter" values such as the maximum rate of pressure rise for each cycle of each cylinder, (2) adjusting engine operating parameters (such as charge-air intake temperature, intake pressure (boost), or charge-air oxygen concentration) to effect a change in the combustion parameter value, (3) thereafter adjusting an engine "control parameter" (e.g., commanded fuel quantity) to each cylinder to maintain a desired target for the combustion parameter value, and (4) individually adjusting cooling, heating and/or fuel command to deviating cylinders to achieve uniform combustion. Additional strategies such as averaging of combustion parameter values and use of deadband regions in the control of HCCI combustion are also set forth.
7,047,741	Methods for low emission, controlled temperature combustion in engines which utilize late direct cylinder injection of fuel	A method is provided for close control and adjustment of in-cylinder oxygen concentration levels together with boost adjustments to minimize harmful emissions during transients in engines which utilize late direct cylinder injection of fuel. EGR flow rates are adjusted in a closed loop, linked fashion together with boost pressure changes during transients, to maintain intake charge-air oxygen concentration and boost levels within critical ranges for controlled temperature, low emission combustion. Changes in fuel feed into the cylinder are made to wait for or follow changes in the boost level of charge-air into the cylinder for combustion. Temporary fuel levels are not allowed to exceed desired fuel/oxygen ratios during transients, by controlling fuel feed responsive to the level of boost of charge-air being taken into the cylinder for combustion.
7,047,933	Low emission fuel for use with controlled temperature combustion, direct injection, compression ignition engines	A low emission, direct injection, compression ignition, internal combustion engine operates with reduced charge-air oxygen concentration levels to control localized peak combustion temperatures and reduce NOx formation. Low cetane fuel, below 43 cetane, and most preferably with a cetane rating below 30, is utilized with the combustion system to reduce smoke and PM formation simultaneously with the reduced NOx formation. In a preferred embodiment, FCC Naptha fuel, with a cetane rating below 30 and an end boiling point below 120 degrees Celsius, is used with the combustion system together with the reduced charge-air oxygen concentration levels to produce engine-out NOx emissions of 0.2 g/bhp-hr or lower, and PM emissions at 0.01 g/bhp-hr or lower, without the need for NOx (and potentially PM) aftertreatment. Potential commercial applications of the fuel and combustion system are discussed, including application to vehicle fleets, with novel methods of operating a vehicle fleet (and of providing fuel to such fleets) to meet motor vehicle emissions regulations at a reduced

Page 28 of 37

Patent # ***Application #***	**Title**	**Abstract**
7,121,304	Low permeation hydraulic accumulator	A hydraulic accumulator includes a rigid tank containing a flexible but non-elastic bladder formed of a metal foil and separating the interior of the tank into a gas space and a liquid space. The gas and liquid spaces respectively communicate with exterior sources of gas and liquid through fixtures provided on the accumulator tank. One of the fixtures is provided with an anti-extrusion valve to prevent the bladder from being forced out through the fixture. In one preferred embodiment the bladder is a bellows. In another preferred embodiment the accumulator tank is provided with a vent in communication with the liquid space within the tank to allow for venting of any gas separating from the liquid and accumulating within the liquid space.
7,108,016	Lightweight low permeation piston in sleeve accumulator	A lightweight, low permeation, piston-in-sleeve high pressure accumulator is provided. The accumulator includes a cylindrical composite pressure vessel with two integral rounded ends. A piston slidably disposed in a thin nonpermeable internal sleeve in the accumulator separates two chambers, one adapted for containing a working fluid and the other adapted for containing gas under pressure. Working fluid is provided in a volume between the nonpermeable internal sleeve and the composite pressure vessel wall. Further means are provided for withstanding harmful effects of radial flexing of the composite vessel wall under high pressures, and from stresses present in use in mobile applications such as with a hydraulic power system for a hydraulic hybrid motor vehicle. A method for pre-charging the device is also presented.
7,104,349	Hybrid powertrain motor vehicle with homogenous charge compression ignition (HCCI) engine, and method of operation thereof	A Homogenous Charge Compression Ignition (HCCI) engine is used in conjunction with a hybrid powertrain. Power production from the HCCI engine in operation may be decoupled from, or assisted in, responding to driver power demand. In this manner, the HCCI engine: (i) is relieved from the need to quickly adapt to changes in driver power demand, and/or (ii) is allowed to more slowly transition between power levels reflective of the vehicle power demands, with a secondary power source providing the more immediate power response to driver demands. In addition, driver power demand greater than what can be provided by the HCCI engine may preferably be met through the addition of power from the powertrain's reversible secondary power source (e.g. one or more reversible electric motor/generator(s) or reversible hydraulic pump/motor(s)), thereby avoiding the need for full load operation by the HCCI engine. In this manner, driver power demand may be met by the vehicle with commercially acceptable responsiveness, while simultaneously enabling the use of a highly efficient
09/549,604		
09/697,046		
09/866,793	Methods for isolating and using fungal hemolysins	Hemolysin isolated from hemolysin-producing fungi can be used to detect if a human or other animal has been exposed to a hemolysin-producing fungus. The method and proteins of the present invention can be used to screen humans and other animals for exposure to such fungi, as well as to produce vaccines for protecting humans and other animals that may be exposed to such fungi.
09/992,544	High-quality continuous particulate matter monitor	A system for monitoring an aerosol including a plurality of particles is provided. Each of the particles has a size. The system includes an impactor assembly to receive the aerosol at a first flow rate and remove an exhaust portion of the particles that are less than a minimum particle size or greater than a maximum particle size. A remaining portion of the particles is emitted at a second flow rate lower than the first flow rate. A first sensor measures a characteristic of the remaining portion of the particles.

Page 29 of 37

Patent # ***Application #***	**Title**	**Abstract**
10/021,443	Low permeation hydraulic accumulator	A hydraulic accumulator includes a rigid tank containing a flexible but non-elastic bladder formed of a metal foil and separating the interior of the tank into a gas space and a liquid space. The gas and liquid spaces respectively communicate with exterior sources of gas and liquid through fixtures provided on the accumulator tank. One of the fixtures is provided with an anti-extrusion valve to prevent the bladder from being forced out through the fixture. In one preferred embodiment the bladder is a bellows. In another preferred embodiment the accumulator tank is provided with a vent in communication with the liquid space within the tank to allow for venting of any gas separating from the liquid and accumulating within the liquid space.
10/085,421	Heated stainless steel emissions canister	An exhaust gas measurement system is provided that includes a probe to find a sample exhaust gas passageway for collecting exhaust gas. A stainless steel canister is fluidly connected to the probe for storing the exhaust gas. A pump fluidly interconnects the probe and the canister for transferring the exhaust gas from the probe to the canister. A pressure mass flow controller fluidly interconnects the probe and the canister and produces an exhaust gas flow measurement corresponding to the flow of the exhaust gas from the probe to the canister. A temperature sensor senses a temperature of the exhaust gas proximate to the pressure mass flow controller. The temperature sensor corrects the exhaust gas flow measurement based upon the temperature sensed. A pressure sensor senses a pressure of the exhaust gas proximate to the pressure mass flow controller. The temperature sensor corrects the exhaust gas flow measurement based upon the pressure sensed. The mass flow controller can be controlled by an external source to account for flow changes in the CVS system. A heating device heats the stainless steel canister and other components of the exhaust gas measurement syste
10/145,383	Hydrophilic mixed matrix materials having reversible water absorbing properties	The preparation and usefulness of polymer-ceramic mixed matrix composite materials comprising one or more organic polymers and a nano sized dispersion of inorganic metal oxide particles throughout the polymer(s) are described. The mixed matrix materials are used as mass transfer agents by fabricating the matrix materials into thin membranes and using them to dehydrate organic streams by pervaporation/vapor permeation separation processes. In addition, mixed matrix gels of similar composition are prepared in a variety of shapes and show a remarkable degree of reversible water absorbing properties. Mechanical and physical properties of the gels, such as extent of swelling in water, can be controlled by controlling the mixed matrix material composition.
10/147,322	Detection of microsporidial species using a quantitative real-time PCR assay	Microsporidial species can be detected in samples using real-time PCR dual-fluorescent assays with species-specific primer set and a dual fluorescent labeled hybridization probe. Cyclospora cayetanensis can be detected in samples using a real-time PCR dual-fluorescent assay with a primer set and dual fluorescent labeled hybridization probe.
10/264,321	Genetic testing for male factor infertility	Genetic testing for male infertility or damage to spermatozoa is accomplished by providing a microarray of DNA probes with a sample of spermatozoa to determine the mRNA fingerprints of the sample; and comparing the mRNA fingerprints of the sample with the mRNA fingerprints of normal fertile male spermatozoa.

Page 30 of 37

Patent # ***Application #***	**Title**	**Abstract**
10/279,907	Vacuum distillation automatic sampler	A plurality of samples can be analyzed sequentially in any desired order by intruding the samples into an automatic sampler, the automatic sampler including a plurality of sample ports connected to a holder, a connector, a valve, and a seal. The connector if each sample holder is attached to the valve by a transfer line, and each sample port is connected to a common manifold. A vacuum pump is activated to volatilize the samples sequentially through the common manifold to a vacuum distiller. The order of the samples volatilized is controlled by a microprocessor. Once the sample has been volatilized, the vapors are condensed and sent to an analytical device.
10/293,362	Medium for cultivating microorganisms	A medium for culturing microorganisms includes at least one compound which can be used as a source of phosphorus for microorganisms but which at least one compound will not precipitate Pb.sup.2+ ions, so that the medium does not form a precipitate in the presence of up to about 25 mM Pb.sup.2+ ions. Preferred compounds are O-phospho-L-amino acids. A buffer may be included in the medium. The medium is particularly well suited for remediating lead contaminated site by bioremediation.
10/379,992	High-efficiency, large angle, variable displacement hydraulic pump/motor	A variable displacement hydraulic/pump motor has a yoke with a pair of shafts aligned to define a yoke pivot axis and connected to a valve plate therebetween having intake and discharge apertures. A rotatable cylinder barrel has piston cylinders open at one end to receive a piston head and opening through fluid ports at another end, flush against the valve plate surface. A drive block is mounted on an input/output shaft for rotation about a central axis of rotation inclined at an angle relative to the longitudinal axis of the cylinder barrel which may be changed by a drive engaging the yoke at a point near its pivot axis. Loads on bushings supporting the yoke shafts are reduced by providing radially extending fluid ports in the shafts and in communication with the intake and discharge apertures of the valve plate.
10/395,893	Process for the biodegradation of hydrocarbons and ethers in subsurface soil by introduction of a solid oxygen source by hydraulic fracturing	A bioremediation of subsurface soil formations contaminated with hazardous wastes is achieved by hydraulic fracturing of the subsurface soil formation with simultaneous introduction of sodium percarbonate coated with polyvinylidene chloride as a solid oxygen source (SOS) for establishing colonies of the biodegrading bacteria within the fractures of the soil formation.
10/402,870		
10/448,417	HCCI engine with combustion-tailoring chamber	An internal combustion engine is adapted for operation with homogeneous combustion and compression ignition. The engine includes plural cylinders with the piston in each cylinder defining the main combustion chamber and connected to a crankshaft for reciprocating motion rotatably driving the crankshaft. An auxiliary combustion chamber and an inlet passage are formed in the engine head for each of the cylinders with a control valve for controlling communication between the main combustion chamber and the auxiliary combustion chamber and an inlet valve for controlling communication between the main combustion chamber and the inlet passage. The inlet valve is driven with rotation of the crankshaft, while the drive for the combustion control valve is independent of angular position of the crankshaft and has its own controller for timing its opening and closing to provide controlled homogeneous combustion.

Page 31 of 37

Patent # ***Application #***	**Title**	**Abstract**
10/455,914	Resource management planning	In one embodiment, a resource management planning system that includes a web server having access to digital imagery of geographic areas and geospatial information associated with the digital imagery, computer programming for compiling geospatial information for a site selected from the digital imagery, and computer programming for generating a conservation plan identifying resource problems for the site and identifying practices that when implemented are expected to solve the resource problems. In another embodiment, the system includes computer programming for generating a nutrient management plan identifying nutrient management practices for agricultural operations on a selected site in which nutrients are applied to the land and/or animal waste or other bio-nutrients are handled.
10/456,438	Resource management planning	One method embodiment for resource management planning includes compiling regulatory requirements applicable to a resource, identifying the resource conditions that satisfy the compiled requirements, developing a computer implemented tool for selecting management practices that will satisfy the identified conditions when implemented, and all regulatory agencies interested in the compiled regulatory requirements agreeing that the selected management practices will satisfy the identified conditions when implemented. In one embodiment, a computer readable medium includes instructions thereon for making all regulatory requirements applicable to an agricultural resource available to an agricultural producer through a single source and then selecting management practices that will satisfy the regulatory requirements when implemented. In another embodiment, a computer readable medium includes instructions thereon for generating a resource management plan that addresses all regulatory requirements applicable to a resource.
10/456,615	Resource management planning	In one embodiment, a resource management planning system includes a web server having access to digital imagery of geographic areas and geospatial information associated with the digital imagery, computer programming for compiling geospatial information for a site selected from the digital imagery, and computer programming for generating a resource management plan for the site based on the geospatial information. In one embodiment, a method for resource management planning includes associating geospatial information with digital imagery of geographic areas, compiling geospatial information for a site selected from the digital imagery, defining a planning unit within the site, defining characteristics of the planning unit, and generating a resource management plan for the planning unit based on defined characteristics.
10/620,726.	Opposing pump/motors	Two motors are arranged on opposing sides of a common shaft, drive plates of the pump/motors being rigidly coupled to each other, for example by being in hard contact with opposing sides of the shaft. By providing hard contact between the pump/motor drive plates and a common shaft, the drive plates and shaft act as a substantially solid element under compression, thereby substantially canceling axial loads generated by the pump/motors directly through the shaft. Residual axial loads are handled via bearings positioned on the shaft adjacent the drive plates in such a manner that the drive plates are in light contact only with the bearings. As a result, friction experienced by the bearings is substantially reduced as compared to conventional systems, thereby improving the efficiency of the system. To further reduce loads on the bearings, the pump/motors are arranged to ensure that they generate radial forces in a direction that is opposite to that of a separation force generated by a torque transferring device carried on the shaft and transmitted to the bearings. A common housing

Page 32 of 37

Patent # ***Application #***	**Title**	**Abstract**
10/657,249	Stabilized enzymes for detecting and monitoring chemical toxins	Organophsophorus or carbamate compounds can be detected using the enzyme acetylcholinesterase for which these compounds are inhibitors wherein the enzyme is immobilized in a sol-gel or in a membrane.
10/663,561	Detecting hormonally active compounds	Purified nucleic acids that are responsive to estrogenic or androgenic agents and derived from fish have been cloned and sequenced. cDNAs that correspond to these nucleic acids are placed on an array containing a set of control genes. Using labeled cDNA probes generated from RNA isolated from control fish and fish exposed to estrogenic compounds, expression levels of the genes responsive to estrogenic compounds are measured. The arrays are useful for monitoring the presence of estrogenic contaminants that are hormonally active in the environment, as well as for screening compounds with estrogenic activity.
10/665,634	Methods for low emission, controlled temperature combustion in engines which utilize late direct cylinder injection of fuel	The present invention provides a method for close control and adjustment of in-cylinder oxygen concentration levels together with boost adjustments in such a way as to minimize harmful emissions during transients in engines which utilize late direct cylinder injection of fuel. In this invention, EGR flow rates are adjusted by means of an EGR control valve in a closed loop, linked fashion together with boost pressure changes during transients, to maintain intake charge-air oxygen concentration and boost levels within critical ranges for controlled temperature, low emission combustion. Furthermore, in order to minimize harmful emissions during rapid transient changes in operating conditions, changes in fuel feed into the cylinder are made to wait for or follow changes in the boost level of charge-air into the cylinder for combustion. This addresses a problem in diesel engines, during acceleration, of having temporary fuel levels in excess of desired fuel/oxygen ratios during transients, with the result of increased PM levels from insufficient oxygen for rapid, complete combustion. In this invention,
10/672,732.	Methods of operating a series hybrid vehicle	The invention is directed toward methods for operating a series hybrid vehicle in a manner that responds to the operator's demand for power output, while maximizing engine efficiency and minimizing disruptions in vehicle drivability. According to principles of the present invention, when the driver of a series hybrid vehicle makes a demand for power output, whether the secondary power source(s) is supplied with secondary energy stored in an energy storage device(s), direct input energy generated by an engine(s), or both, depends on the amount of available secondary energy stored in the vehicle's secondary storage device(s) alone, and in combination with vehicle speed. During the time that the engine is used to generate secondary energy, the power efficiency level at which the engine is operated also depends on the vehicle speed and the amount of available secondary energy stored in the vehicle's secondary storage device alone, and in combination with vehicle speed. Further, in some embodiments, when the engine is not generating secondary energy, the engine is selectively turned off or idled in response to various operating conditions.
10/681,376	Contaminant adsorption and oxidation via the fenton reaction	Contaminated fluids are treated by adsorbing contaminant onto a sorbent to concentrate the contaminant and then oxidizing the contaminant via the Fenton and related reactions. Iron is attached to the sorbent or can be added in solution with an oxidant. Both systems, iron attached to the sorbent or iron in solution, can be used to oxidize contaminants on or near the surface of the sorbent. The process can be used to treat contaminated water in above-ground and below-ground treatment systems, as well as contaminated gases.
10/698,358		

Page 33 of 37

Patent # ***Application #***	**Title**	**Abstract**
10/713,113	Method for detection for total coliforms and E. coli	An improved method for detection of total coliforms and E. coli comprising a broth containing an ingredient that will suppress growth of non-coliform gram negative bacteria, and at least one chromogen or fluorogen has been used effectively and is cost effective. Preferred methods include use of filter and/or plates containing the growth-promoting ingredients and the indicators.
10/731,985	Method and device for switching hydraulic fluid supplies, such as for hydraulic pump, motor	A spool valve includes a first valve port coupled to a fluid source at a first pressure range, a second valve port coupled to a fluid source at a second, lower, pressure range, and first and second output ports coupled to a hydraulic device. The valve includes a valve spool configured to selectively channel fluid from the first and second valve ports to the first and second output ports, respectively, while in a first position, from the second valve port to both the output ports while in a second position, and from the second and first valve ports to the first and second output ports respectively, while in a third position, and a check valve to permit one-way fluid passage from the second output port to the first valve port. The valve may include an anti-reverse check valve configured to prevent fluid from flowing into the valve via the first output port.
10/733,696	Methods of operation for controlled temperature combustion engines using gasoline-like fuel, particularly multicylinder homogenous charge compression ignition (HCCI) engines	The present invention provides a multicylinder homogeneous charge, compression ignition (HCCI) type engine, also known as a premixed charge compression ignition (PCCI) engine, with a control system designed to maintain stable, efficient, low emission HCCI combustion during engine transitions from one speed/load operating point to another speed/load operating point. HCCI combustion control in the invention is obtained by adjusting specified "engine operating parameters" that influence the crank angle location of the combustion event (viz., charge-air intake temperature, intake pressure (boost), charge-air oxygen concentration, engine cooling, and engine compression ratio), in coordination with adjustments in fuel quantity, by the following preferred method: (1) determining an existing "combustion parameter" value such as the maximum rate of pressure rise (MRPR), for each cycle of each cylinder, (2) adjusting an engine operating parameter of the engine to effect a change in said combustion parameter value, (3) thereafter adjusting an engine "control parameter" (e.g., commanded
10/767,547	Hydraulic actuator control valve	An actuator includes a piston within a cylinder, the cylinder having a first fluid port in communication with an open side of the piston, and a second fluid port in communication with a shaft side of the piston. The piston travels in a first direction, toward the shaft side of the piston and in a second direction, toward the open side of the piston. The actuator includes a valve circuit configured to selectively couple the first fluid port with a high-pressure fluid source when piston travel in the first direction is desired, and with a low-pressure fluid source when piston travel in the second direction is desired. The valve circuit is further configured to couple the second fluid port to the high-pressure fluid source when piston travel is desired in the first or second direction, and to close the first and second fluid ports when no piston travel is desired.

Page 34 of 37

Patent # ***Application #***	**Title**	**Abstract**
10/769,459	Hydraulic hybrid vehicle with integrated hydraulic drive module and four-wheel-drive, and method of operation thereof	A vehicle includes an integrated drive module coupled to an axle thereof. The module includes a hydraulic motor configured to provide motive power at an output shaft, and a differential for distributing the motive power to right and left portions of the axle. The hydraulic motor and the differential are encased within a common housing. The vehicle may include a second integrated drive module having, within a housing, a second hydraulic motor (or multiple hydraulic motors), and a second differential coupled thereto and configured to distribute motive power to right and left portions of a second axle. The second module may also include a transmission within the same housing. The transmission may be a two speed or other multi-speed transmission. The second module is configured to operate in neutral while power demand is below a threshold, and to engage while the power demand exceeds the threshold. The second module may be configured to remain engaged for full-time four-wheel-drive operation.
10/795,797	Efficient pump/motor with reduced energy cost	A bent axis pump/motor includes a back plate positioned within a casing, and a check valve positioned in the back-plate, the check valve configured to control passage of fluid from within the casing to an interior of the back plate. A yoke, coupled to the back plate, includes trunnions, positioned within respective apertures in the casing, upon which the yoke rotates. Bearings, occupying less than the complete circumference of the respective trunnion, are positioned between each of the trunnions and respective inner walls of the apertures. Trunnion apertures, for passage of fluid, are positioned in a portion of the circumference not occupied by the respective bearing. A valve positioned within the casing selectively couples high- and low-pressure fluid to the trunnions. Fluid supply channels, formed integrally with the casing, transmit fluid from the valve to the trunnions via fluid apertures provided within the apertures in the casing.
10/806,479	Hydrophilic cross-linked polymeric membranes and sorbents	Hydrophilic cross-linked polymeric membranes, when prepared according to the process of the present invention, are unique in character in as much as the steady state permeability of the membrane has been altered by blending and cross-linking polyalkyl amines and polyalcohols. To obtain desired results, the compositions must contain at least 10% polyalkyl amines, with preferred amounts of polyalkyl amines in the composition being in excess of 40%, with over 50% polyalkyl amine concentration by weight being most preferred.
10/820274	Hydraulic machine having pressure equalization	A hydraulic machine includes a valve plate, with first and second fluid ports in a surface thereof. A cylinder barrel is rotatably coupled to the valve plate. A plurality of cylinders is formed in the cylinder barrel, such that, as the barrel rotates, each cylinder is coupled to the first and second fluid ports, sequentially. First and second pressure relief ports are formed in the surface of the valve plate between the first and second fluid ports at top- and bottom-dead-center, respectively. A cross-port bore is formed in the valve plate, placing the first and second pressure relief ports in fluid communication with each other. As each cylinder rotates to top-dead-center, an opposite cylinder rotates to bottom-dead-center. The respective cylinders are coupled to the first and second pressure relief ports, such that differential pressure in the cylinders is equalized.

Page 35 of 37

Patent # ***Application #***	**Title**	**Abstract**
10/828,971	Large angle sliding valve plate pump/motor	A pump/motor includes a back plate having first and second fluid ports configured to be differentially pressurized, first and second reaction plates rigidly coupled to the back plate, and a valve plate slideably coupled to the back plate and having first and second fluid feed channels configured to receive fluid from the first and second fluid ports. A plurality of hold-down pistons is positioned in respective hold-down cylinders formed in the valve plate. Each of the hold-down pistons is configured to be biased, by pressurized fluid in the respective hold-down cylinder, against a surface of one of the reaction plates. A barrel, having a plurality of drive cylinders, is rotatably coupled to the valve plate. Drive pistons positioned in the drive cylinders are biased against a thrust plate by pressurized fluid in the drive cylinders. The thrust plate is coupled to an output shaft of the pump/motor.
10/887,325	Vehicle on-board reporting system for state emissions test	In a vehicle on-board reporting system for state emissions tests, the vehicle is provided with a removable media storage device 40 and a radio responder device 42 mounted in the vehicle for transmitting data to and from a remote location. A user interface 32 is mounted in the vehicle and connected to a control module 20 which includes a vehicle identification number 29, diagnostic facilities 22 for receiving data from emission related sensing devices on the vehicle and for determining a malfunction from the received data, an erasable/recordable non-volatile memory 26 for storing diagnostic trouble codes and facilities 30 responsive to a user request for reading the vehicle identification number and the stored diagnostic trouble codes and transmitting the vehicle identification number and emissions information to an output of the control module. The user interface includes a message display 34 and user data entry facilities 36 for sending the user request to read and output the stored diagnostic trouble codes and for selectively connecting one of the removable media storage
10/897,387	Contraceptives based on SP22 and SP22 antibodies	Oral, topical and injectable contraceptives, which are based on sperm protein 22 kDa (SP22) polypeptides and antibodies and infertility diagnostics are provided.
11/130,893	Opposing pump/motors	Two motors are arranged on opposing sides of a common shaft, drive plates of the pump/motors being rigidly coupled to each other, for example by being in hard contact with opposing sides of the shaft. By providing hard contact between the pump/motor drive plates and a common shaft, the drive plates and shaft act as a substantially solid element under compression, thereby substantially canceling axial loads generated by the pump/motors directly through the shaft. Residual axial loads are handled via bearings positioned on the shaft adjacent the drive plates in such a manner that the drive plates are in light contact only with the bearings. As a result, friction experienced by the bearings is substantially reduced as compared to conventional systems, thereby improving the efficiency of the system. To further reduce loads on the bearings, the pump/motors are arranged to ensure that they generate radial forces in a direction that is opposite to that of a separation force generated by a torque transferring device carried on the shaft and transmitted to the bearings. A common housing

Page 36 of 37

Patent # ***Application #***	**Title**	**Abstract**
11/058,690	Methods of operating a series hybrid vehicle	The invention is directed toward methods for operating a series hybrid vehicle in a manner that responds to the operator's demand for power output, while maximizing engine efficiency and minimizing disruptions in vehicle drivability. According to principles of the present invention, when the driver of a series hybrid vehicle makes a demand for power output, whether the secondary power source(s) is supplied with secondary energy stored in an energy storage device(s), direct input energy generated by an engine(s), or both, depends on the amount of available secondary energy stored in the vehicle's secondary storage device(s) alone, and in combination with vehicle speed. During the time that the engine is used to generate secondary energy, the power efficiency level at which the engine is operated also depends on the vehicle speed and the amount of available secondary energy stored in the vehicle's secondary storage device alone, and in combination with vehicle speed. Further, in some embodiments, when the engine is not generating secondary energy, the engine is selectively turned off or idled in response to various operating conditions.
11/233,822	Independent displacement opposing pump/motors and method of operation	A hydraulic machine includes first and second opposing motors. Displacement of the first and second motors is controlled such that while the sum of the displacements of the first and second motors is below a threshold, the displacement of the first motor is substantially equal to the sum, and the displacement of the second motor is substantially equal to zero. While the sum of the displacements is above the threshold, the displacement of the first motor may be substantially equal to the displacement of the second motor, either as a displacement percentage or as a displacement volume. The first motor may be equal in capacity, or smaller than the second motor.
11/173,920	Efficient bypass valve for multi-stage turbocharging system	A turbocharger system includes first and second turbines arranged such that exhaust gas passes through the first turbine then the second turbine. A bypass channel is configured such that exhaust gas entering the channel passes only through the second turbine. A valve positioned in the bypass channel regulates the flow of gas therethrough. The valve accelerates a stream of gas and focuses the stream toward the second turbine such that a large part of the added velocity of the stream is preserved as it enters the second turbine. Operation of the valve may be controlled so as to maintain the valve in a closed position while exhaust gas pressure above the first turbine pressure is below a first threshold, to progressively open the valve as the pressure increases above the first threshold, and to maintain the valve in a full-open position while the pressure is above a second threshold.

Page 37 of 37