Patent Awareness Program

Recognition Dinner
Fiscal Year 2014
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Fiscal Year 2014

September 30, 2015

Patent Awareness Program Objectives

- To foster the disclosure of inventions
- To raise the patent awareness of the staff
- To provide appropriate recognition to the creative inventors on our staff

Committee on Inventions

- Adam B. Cohen (Ex Officio Chair)
- Laurie Bagley (Co-Chair)
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- Philip C. Efthimion
- Charles A. Gentile
- Erik Gilson
- Terry E. Greenberg
- Robert Kaita
- Lewis D. Meixler (Co-Chair)
- Jaclyn Pursell
- Charles H. Skinner
- Michael D. Williams
- J. Randall Wilson
- Irving Zatz
- Andrew P. Zwicker
**Patent Issued**

**M-798 Systems and Methods for the Magnetic Insulation of Accelerator Electrodes in Electrostatic Acceleration U.S. Patent No 8,610,379**  
**Inventor:** Larry R. Grisham  
This invention provides systems and methods for the magnetic insulation of electrodes in electrostatic accelerators. The systems and methods of this invention should improve the performance of electrostatic accelerators by increasing the voltage gradient that can be held across a vacuum gap, and reducing the conditioning time required to achieve it. This is accomplished by flowing electric currents along accelerator electrodes to produce magnetic fields that envelope the accelerator electrodes and their support structures, so as to prevent very low-energy electrons from escaping and subsequently picking up energy from the accelerator’s electric field and initiating discharges.

**Patent Applications**

**M-831 Method to Reduce Neutron Production in Small Clean Fusion Reactors**  
**Inventor:** Samuel A. Cohen  
This invention describes a method to reduce neutron production of D-3He-fueled, steady state, small field-reserved configuration (FRC) fusion reactors using periodic, co-streaming, energetic ion beams generated by radio frequency waves. This method will lessen damage to and activation of reactor components and thus advance the development of fusion reactors for electrical power and propulsion applications by alleviating the need for both nuclear materials and tritium breeding technology testing programs.

**M-857 A Novel Objective for EUV Microscopy and EUV Lithography**  
**Inventors:** Manfred Bitter, Kenneth W. Hill and Philip Efthimion  
A novel device for extreme ultraviolet (EUV) spectroscopy, EUV microscopy, and EUV lithography at wavelengths below 100 nm. This new EUV device consists of two concentric, concave and convex spherical mirrors or multi-layer reflectors. By eliminating the astigmatism and other shortcomings of presently used optical systems, this new device could lead to substantial advancements and cost savings in EUV lithography at wavelengths ranging from 10 to 15 nm and the manufacture of next-generation integrated circuits.

**M-863 Fueling Method for Small, Steady-State, Advanced-Fuel FRC Fusion Reactors**  
**Inventors:** Samuel A. Cohen, Michael Buttolph and Daren Stotler  
This invention describes a new fueling method in which controllable, continuous streams of deuterium and helium-3 atoms are introduced into the core of small field-reversed-configuration (FRC) fusion reactors enabling steady-state power production.
Invention Disclosures

M-867 Radiative Liquid Lithium (metal) Divertor

Inventor: Masayuki Ono

Developing a reactor-compatible divertor has been identified as a particularly challenging technology problem for magnetic confinement fusion. The liquid lithium coating of the divertor surface provides a “sacrificial” layer to protect the substrate solid material from transient high heat flux and improved H-mode confinement, H-mode power threshold reduction and other plasma performance benefits. These promising results in NSTX and related modeling calculations motivated the development of the radiative liquid lithium divertor concept disclosed.

M-868 Method of Focusing Waves by Inhomogeneous Oscillations of the Underlying Medium

Inventors: Nathaniel J. Fisch, Ilya Y. Dodin

Disclosed is a new method of refracting electromagnetic and other waves in a dispersive medium by modulating the parameters of this medium by other waves. Possible uses include developing new types of adaptive lenses for focusing and/or refracting electromagnetic radiation or other waves.

M-869 Simulation-Based Method for Measuring Spatially Varying Properties of Neutral Atoms and Molecules in Plasmas

Inventor: Daren Stotler

This invention is a simulation-based method for extending the region of applicability of existing visible camera-based techniques for characterizing neutral atoms and molecules in plasmas. The method involves coupling an experimental diagnostic with a quantitatively accurate neutral transport simulation of the volume of interest. The principal unknown in the simulation, the magnitude of the source of neutral atoms or molecules, is calibrated from the experimental data. The end result of the process is a full characterization of the neutral population in that volume.

M-870 The Double Well Mass Filter

Inventors: Renaud Gueroult, Jean-Marcel Rax and Nathaniel J. Fisch

Plasmas have long been used for separating elements. Rotating configurations are of particular interest, since centrifugal forces offer a direct ion separation scheme based on mass. This has led to the development of plasma centrifuges that produce radial separation of ions within a plasma column. Plasmas have the advantage of high rotational velocities compared to conventional centrifuges. The new rotating plasma filter configuration combines both radial separation and axial extraction, while only requiring a simple linear magnetic field topology. The double well mass filter has applications in nuclear waste remediation and nuclear fuel reprocessing.
M-871 Hybrid Molten Salt Reactor (HMSR): Method and System to Fully Fission Actinides for Electric Power Production Without Fuel Enrichment, Fabrication or Reprocessing

**Inventor:** Robert D. Woolley

This invention describes a reactor that integrates an external source of high-energy neutrons produced by either DT fusion or spallation with a critical fission molten salt reactor. With fission products continuously removed, the hybrid molten salt reactor completely fissions any supplied mix of actinide fuel. This eliminates the need for uranium fuel enrichment and results in a waste stream with no long-lived radioactive actinides, reducing the need for repositories. HMSR fuel can be spent nuclear fuel from light water reactors, excess plutonium, depleted uranium, mined thorium or mined uranium. Mined uranium energy utilization is increased from 1 percent in light water reactors to 100 percent in an HMSR.

M-872 Current Drive for Plasma via Vertically-Structured Permanent Magnet System

**Inventors:** Jackson Matteucci and Ali Zolfaghari

This invention describes using the rotation of permanent magnets to generate a plasma current with toroidal fusion confinement devices. This particular device strategically places two rings of magnets above and below the ferromagnetic core in order to maximize both the efficiency of the tokamak and the plasma current.

M-873 Current Drive for Plasma via Rotation of Superconducting Magnet System

**Inventors:** Jackson Matteucci and Ali Zolfaghari

This invention describes the placement of superconducting solenoid magnets around the circumference of a tokamak and the rotation of ferromagnetic pathways to induce an efficient toroidal current in toroidal magnetic confinement plasma devices.

M-874 Display of Very High Resolution Data

**Inventors:** Eliot Feibush, Michael Knyszek and Matthew Lotocki

This invention enables users to plot a very large number of data points relative to the number of display pixels in high resolution without losing significant information about the data. A user operating the system can set the threshold for highlighting locations on the plot that exceed a specific variance or range. Highlighted areas can be dynamically explored at the full resolution of the data.
M-875 Off-the-Shelf, Multi-Purpose, User-Configurable Signal Interconnection System

Inventors: Hans Schneider, John Dong and Gary Gibilisco
This invention is envisioned as a commercial, off-the-shelf, reconfigurable electronics signal interconnection system. The individual components are designed to maximize the flexibility in the user’s ability to combine the number and type of components suitable for their application. The components are designed to enable the user to configure the specific channel routing schemes desired. Advantages over existing technologies include a high channel count, small physical volume, low cost and confidence in monitoring the interconnection configuration.

M-876 Method of Control of Multiple Contraction in a Volume of Weakly Ionized Plasma by Standing Acoustic Wave Excitation

Inventors: Mikhail Shneider, Yevgeny Raitses and Igor Kaganovich
This invention is a process that uses a standing acoustic wave in a volume of weakly ionized plasma to control the initiation of contraction (the transition to a higher density plasma) in certain designated places—the nodes of the standing wave. Possible applications include plasma-assisted combustion.

M-877 Interferometric Method of Measuring the Parameters of Medium Oscillations

Inventors: Nathaniel J. Fisch, Ilya Y. Dodin
This invention describes a new interferometric method of measuring the parameters of an oscillating medium by measuring the phase shift of scattered waves. The new method extracts information about the parameters of oscillation. The invention could be used for designing a new type of interferometric equipment for plasma physics experiments.

M-878 Mini Enclosure for Isolated Sample Transfer

Inventor: Charles H. Skinner
This invention is a compact device to prevent oxidation and/or contamination of an experimental sample during transfer between two instruments with controlled atmospheres. For example, samples might be prepared in a glove box with a chemically inert argon atmosphere and need to be transferred to an ultra-high vacuum surface analysis instrument without exposure to air. This usually involves specialized ‘vacuum suitcases’. The present invention is a cm-scale device that allows the sample to be easily transferred without any exposure to air.

M-879 Enhanced Efficiency of Otto and Diesel Cycles by Employing Spinning Gas and a Flywheel

Inventors: Vasily I. Geyko and Nathaniel J. Fisch
In conventional internal combustion engines, gas spinning is either not used at all or used only to increase turbulence and better fuel-air mixing. This invention describes a new method that employs greater rotation for energy storage in order to improve the thermal cycle efficiency. A flywheel could also be used to transfer the energy into rotation of the gas and extract it when needed.
M-880 Vacuum Viewport Protector
Inventors: Yuan Shi and Yevgeny Raitses
The disposable vacuum viewport protector provides an easy and economical solution to unwanted coating problems in vacuum systems. By simply removing the vacuum viewport protector, the viewports will be as clean as new when needed.

M-881 Sandwiched Orb/Grid Heat Exchanger
Inventor: Michael J. Duco
The design basis of the heat exchanger is that the most efficient geometrical shape to thermally stabilize structures during exposure to heat or to neutrons is a sphere. This invention incorporates the preferential geometry of the sphere into an endoskeletal structural heat exchanger thereby maximizing the surface area for cooling purposes.

M-882 Pinhole Scheme and Heavy Particle Aerosol as a Method to Improve Spinning Injection
Inventors: Vasily I. Geyko and Nathaniel J. Fisch
This invention describes an improved method of spinning gas in a cylinder. The advantage of spinning injection via the pinhole scheme is that it includes no movable parts. Heavy aerosol particles and heavy gas molecules could improve this method as well since it keeps the gas rotation subsonic and avoids turbulence. Heavy gas particles may in principle have many degrees of freedom and higher heat capacity that will increase the heat capacity of the overall mixture even more. Alternatively, using heavy particles retained in the cylinder by the pinhole technique may allow also for subsonic rotation.

M-883 NSTX-U Advances in Real-Time C++11 on Linux
Inventor: Keith Erickson
The National Spherical Torus Experiment Upgrade (NSTX-U) is breaking new ground with a new digital coil protection system (DCPS) that will serve as the main protection mechanism for the magnetic coils. It is written entirely in the C++11 programming language. It runs over 1,200 algorithms in a 5kHz control loop that determines whether or not to shut down operations before physical damage occurs. To accomplish this, NSTX-U engineers developed one-of-a-kind software tools, including two methods of real-time atomic synchronization, real-time schedulers, and a real-time-logging framework.

M-884 Short-Term Human Vision Protection from Intense Light Sources
Inventors: John C. Schmitt, Kevin Tritz, Enrique Merino
The primary objective of this invention is to minimize the sensitivity of the human eye to intense visible light by blocking or reducing the incident fluence of light before it can cause the eye to become insensitive to the light or temporarily blinded. Typical applications may be protecting pilots subjected to light from laser pointers or protecting workers in occupations that may expose them to temporary intense light sources.
M-885 NSTX-U Control System Upgrades  
Inventors: Keith Erickson, David Gates, Gregory Tchilinguirian, Stephan Gerhardt, John Lawson, Robert Mozulay, Paul Sichta  
This invention can serve as a control system for any fusion device, including ITER. The plasma control system currently calculates many complicated and disjointed algorithms every 200 microseconds, delivering the result in a heterogeneous set of outputs. This is easily expanded to handle any input we can conceive of, with output that can be delivered to many different kinds of target devices. The inputs can be any combination of signals, including digital, analog or even packets over the Ethernet. The system is designed to be flexible enough to run in any configuration.

M-886 NSTX-U Digital Coil Protection System Software Detailed Design  
Inventors: Keith Erickson, Gregory Tchilinguirian, Bill Davis  
This invention can serve as a protection system for anything that can be modeled as a system of equations that must stay within limits. Currently, the digital coil protection system calculates 1,200 equations every 200 microseconds, but this is easily expanded to much higher amounts in shorter times. The inputs can be any combination of signals including digital, analog or even packets over the Ethernet. The system is designed to be flexible enough to run in any configuration.

M-887 Concept for Reducing Hall Thruster Chamber Wall Erosion with Lithium Vapor Shielding  
Inventors: Robert Kaita, Michael Jaworski, Igor Kaganovich, Yevgeny Raitses  
Hall thrusters have been established as a compact and reliable means for satellite applications. Erosion of the surfaces of such thrusters, however, has been a serious factor in limiting their lifetimes. Replacing eroded surfaces by replenishing them is generally unattractive because of the mechanical complexity and added weight that could be required. This invention addresses these concerns using a lightweight material (liquid lithium) in a porous medium that when heated, draws the lithium to the thruster surface without any mechanical components. The ensuing vapor cloud of lithium then allows the heat to dissipate.

M-888 Approach to Fast Liquid Metal Flow Up a Magnetic Field Gradient  
Inventor: Richard Majeski  
Electrical and magnetic field (J x B) forces can be used to support flowing liquid metal against gravity. In a tokamak, the radial magnetic field gradient implies that JxB decreases inversely as the major radius, for constant current density in the liquid metal. This field gradient produces a pressure gradient along the support wall, which pushes the liquid metal towards the low field side. The invention describes a technique to reduce or reverse this effective pressure gradient by adjusting the electrical conductivity of the supporting wall to increase or decrease the fraction of current carried by the wall relative to the liquid metal.
M-889 Multi-Stage Plasma Switch

Inventors: Yevgeny Raitses and Igor Kaganovich

A multi-stage plasma switch consists of two or more current-conducting plasma regions in which plasma properties are controlled by a self-biasing and applied magnetic field. The magnetic field topology is crafted in such a way that it allows reduction of the ion-induced erosion of the electrodes.

M-890 Adjustable Portable Tensile Testing Machine

Inventor: Michael Viola

This invention describes a load-testing device that allows users to apply a load or force to any item. Additionally, this device allows users to operate the item while the load is applied to provide both static as well as dynamic capacities. The load-testing machine is adjustable to accommodate various desired loads and is also portable, allowing tests to be performed at various locations.

M-891 Electrical Detector for Liquid Lithium Leaks around Demountable Pipe Joints

Inventors: Jacob Schwartz, Michael Jaworski

This system is designed to detect leaks of liquid lithium from around demountable pipe joints. Demountable pipe joints such as vacuum fittings are likely spots for a leak in any system transporting fluids. Since liquid lithium reacts with air, water, concrete and other common materials, it is important to quickly detect a leak. The system will partially contain the leak and is designed to help the lithium cool down and solidify, thereby lowering reactivity. The leak detector system supports multiple channels, with a digital output for each channel.

M-892 Use of Liquid Electrodes for Magnetohydrodynamic Power Generation Applications

Inventor: Michael Jaworski

The use of liquid electrodes in magnetohydrodynamic (MHD) power generation applications is proposed as a means of extending the lifetime of the electrodes in these systems. Previous studies utilized various metals, metal alloys and ceramic materials as electrodes but all suffered from erosion processes in the harsh gas stream used in MHD power generation. This invention describes a liquid electrode that can be used to achieve significantly longer life than a solid electrode as well as avoid fouling due to contamination. Extending the life of the component improves the economic viability of the overall concept. Liquid walls can also be used in high-temperature heat exchangers.
Inventors FY14

- Manfred Bitter
- Michael Buttolph
- Samuel Cohen
- Bill Davis
- Ilya Dodin
- John Dong
- Michael Duco
- Philip Efthimion
- Keith Erickson
- Eliot Feibush
- Nathaniel Fisch
- David Gates
- Stefan Gerhardt
- Vasily Geyko
- Gary Gibilisco
- Larry Grisham
- Renaud Gueroult
- Kenneth Hill
- Michael Jaworski
- Igor Kaganovich
- Robert Kaita
- Michael Knyszek
- John Lawson
- Matthew Lotocki
- Richard Majeski
- Jackson Matteucci
- Enrique Merino
- Robert Mozulay
- Masayuki Ono
- Yevgeny Raitses
- Jean-Marcel Rax
- John Schmitt
- Hans Schneider
- Jacob Schwartz
- Yuan Shi
- Mikhail Shneider
- Paul Sichta
- Charles Skinner
- Daren Stotler
- Gregory Tchilinguirian
- Kevin Tritz
- Michael Viola
- Robert Woolley
- Ali Zolfaghari