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July 2025

Path to Sustainability

Harnessing Hydrogen

Recent developments

Curated and summarized - Industry and Patent news

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Parag Thakre (pthakre@dennemeyer.com)

Prachi Gupta (pgupta@dennemeyer.com)

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Preface

There is a major transformation taking place in the global energy landscape as countries try to reduce carbon emissions and mitigate the impact of climate change. Hydrogen, a clean and versatile energy carrier, is emerging as a promising solution for a sustainable future. Its applications are diverse, ranging from powering vehicles and generating electricity to fueling industrial processes. The hydrogen ecosystem is rapidly evolving, with innovations emerging across the entire value chain.

This monthly report is focused on **“Hydrogen as a fuel”** including applications in transportation, manufacturing industries and energy sector. This report is a free resource for anyone working in this domain including technologists, innovators, Intellectual Property (IP) managers, strategy makers, environmental enthusiasts, etc. The report contains curated insights and summaries of the latest news and key patents published in the last one month, including the latest products, business updates, collaborations, new innovations, and more.

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Key Insights this month

- The Toyota-Ohmium collaboration highlights a pivotal move to expand hydrogen use beyond mobility into decentralized energy systems like microgrids for data centers and remote infrastructure. This diversifies the market for fuel cell OEMs and energy companies, enabling expansion into off-grid, on-site power systems.

- HyVera and Gold H2 are offering innovative alternative methods for green hydrogen production, complementing traditional electrolysis approaches. HyVera's "Hydrogen-on-Demand" pellets enable instant, on-site generation without electricity, while Gold H2 uses microbes in old oilfields for ultra-low-cost subsurface production.

- Smoltek's Porous Transport Electrode (PTE) technology for Proton Exchange Membrane (PEM) electrolysers reduces iridium usage by up to 95%, marking a breakthrough in material efficiency. This innovation significantly lowers catalyst costs, enhancing the commercial viability of PEM electrolysers and accelerating their large-scale deployment in green hydrogen production.

- Many inventions that were published last month had major themes as below:

    - The hydrogen refueling system's pre-charging purification process is a critical innovation. By actively removing impurities before hydrogen enters the fuel cell, it directly addresses a major cause of degradation, thus significantly extending the fuel cell's lifespan.

    - The inventions introduce advanced sensing and simulation-based technologies to tackle the technical challenges of hydrogen leakage in both fuel cell vehicles and hydrogen infrastructure. By integrating multi-parameter sensors with real-time data analysis, they enable predictive leak detection, enhance thermal and pressure monitoring, and support automated safety responses, representing a significant advancement in the design of safer hydrogen systems.

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Industry News

Hydrogen Synergy

Toyota Kirloskar Motor and Ohmium collaborate on potential opportunities to develop green hydrogen solutions in India

Toyota Kirloskar Motor (TKM) and Ohmium International have joined forces to co-develop Green Hydrogen-based integrated power solutions in India. This collaboration leverages Ohmium's expertise in PEM (Proton Exchange Membrane) hydrogen technology and Toyota's leadership in fuel-cell technology to explore the feasibility of Green Hydrogen-driven power solutions, such as microgrids. This partnership aims to create viable, clean energy systems such as hydrogen-powered microgrids for applications in areas like data centers and remote locations. As part of the initiative, TKM will provide fuel cell modules and system integration support, while Ohmium will lead design and performance evaluation, aligning with India’s National Green Hydrogen Mission. This partnership reflects Toyota's broader efforts to expand Hydrogen applications beyond mobility.

Source: Ohmium

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Industry News

Next-Gen UAV

France’s XSun and H3 DYNAMICS join forces to develop world’s first solar hydrogen electric UAV

H3 Dynamics, a developer of aerospace hydrogen fuel cell systems, and XSun, a leader in solar-electric unmanned aerial systems (UAS), have announced a strategic partnership to create the world's first solar-hydrogen-electric UAS. Both companies, headquartered in France, are collaborating to develop an innovative "tri-brid" power system that combines solar energy, hydrogen fuel cell, and battery storage. This system utilizes smart power management to optimize energy use continuously. Solar PV cells integrated into the wings supply power when sunlight is available, batteries deliver peak power during take-off, and a miniaturized hydrogen fuel cell provides primary cruise power. This onboard microgrid boosts endurance for heavier UAS with Vertical, Short, and Horizontal Take-Off and Landing (VTOL, STOL, HTOL) capabilities.

Source: h3dynamics

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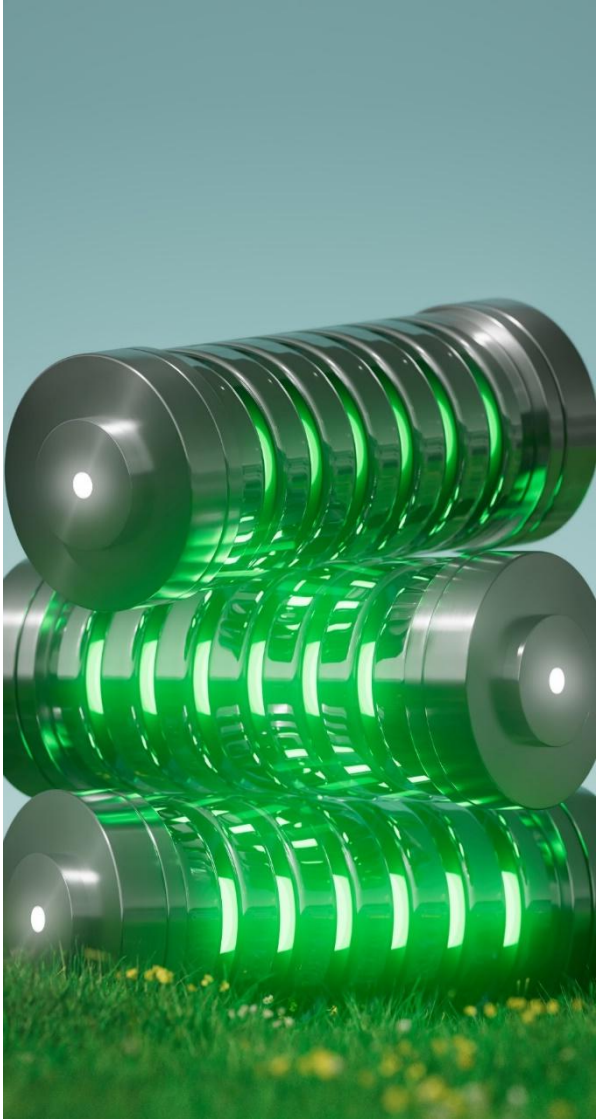
Industry News

On-Demand Green Hydrogen

HyVera launches green hydrogen-on-demand across Canada

HyVera Distributed Energy, a clean tech company, has partnered with U.S.-based EnviroGroup to bring hydrogen-on-demand (H2oD) technology to market, aiming to transform hydrogen production, distribution, and use across Canada. Central to its innovation is the patented eCatalyst (eCat) H2 pellet, which generates 99.999% pure green hydrogen instantly when combined with water, without electricity, heat, or rare earth materials. The process operates at ambient temperature and low pressure with minimal energy input, offering a highly energy-efficient alternative to electrolysis, which typically consumes around 43 kWh of electricity per kilogram of hydrogen. HyVera's modular Hydrogen Production Units (HPUs) enable on-site hydrogen generation for a range of applications, including clean transportation, ports, off-grid energy, and industrial operations.

Source: HyVera



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Industry News

Bio-Hydrogen Breakthrough

Gold H2 delivers first successful subsurface bio-stimulated hydrogen production field trial

Gold H2, a climate tech company, has achieved a world first by successfully demonstrating subsurface bio-stimulated hydrogen production in a California oilfield. This groundbreaking technology uses microbiology to generate clean hydrogen by stimulating microbes within depleted oil reservoirs, eliminating the need for new drilling, electrolysis, or energy-intensive surface infrastructure. The trial, supported by ChampionX LLC as the oilfield services provider, achieved an unprecedented 40% hydrogen concentration in the gas stream and validated the operational viability and scalability of the process. This innovation not only repurposes "climate liabilities" into hydrogen-producing assets but also aims for a low production cost of under $0.50/kg, offering a new, affordable pathway to decarbonization for industries and power grids.

Source: Gold Hydrogen

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Industry News

Sun-Powered Hydrogen

Beam-down breakthrough: how sunlight is fuelling the future of green hydrogen

CSIRO (Commonwealth Scientific and Industrial Research Organisation) has made a significant advancement in renewable energy by demonstrating a novel solar thermal technology capable of producing green hydrogen at industrial scale, specifically targeting hard-to-electrify sectors like steelmaking and iron production. This breakthrough utilizes a "beam-down" solar reactor at their Newcastle Energy Centre, which concentrates sunlight downward onto a platform. Inside the reactor, doped ceria metal oxide particles (developed by Niigata University) facilitate a chemical reaction that efficiently splits water into hydrogen and oxygen. This method offers a simpler, lower-energy alternative to traditional electrolysis, achieving over three times more hydrogen production than standard materials and a potential solar-to-hydrogen efficiency of over 20%.

Source: CSIRO

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Industry News

Iridium-Efficient Electrolysis

Unleasing the scale-up of green Hydrogen

Smoltek Hydrogen has developed a porous transport electrode (PTE) technology that significantly reduces the amount of iridium needed in PEM electrolysers by up to 95%, without sacrificing performance. This innovation uses vertically aligned carbon nanofibers grown on a porous titanium layer to increase the active surface area by 30 times, allowing nearly all the iridium catalyst to participate in the hydrogen production reaction. As a result, hydrogen can be produced using just 0.1 mg/cm^2. Compared to traditional Catalyst Coated Membranes (CCM), which bury expensive catalysts in thick, inefficient layers, Smoltek's approach makes the process far more efficient and cost-effective. By reducing reliance on precious metals and lowering the overall cost of electrochemical cells the most expensive component of PEM electrolysers Smoltek's PTE technology is helping make green hydrogen production economically viable at scale.

Source: Smoltek

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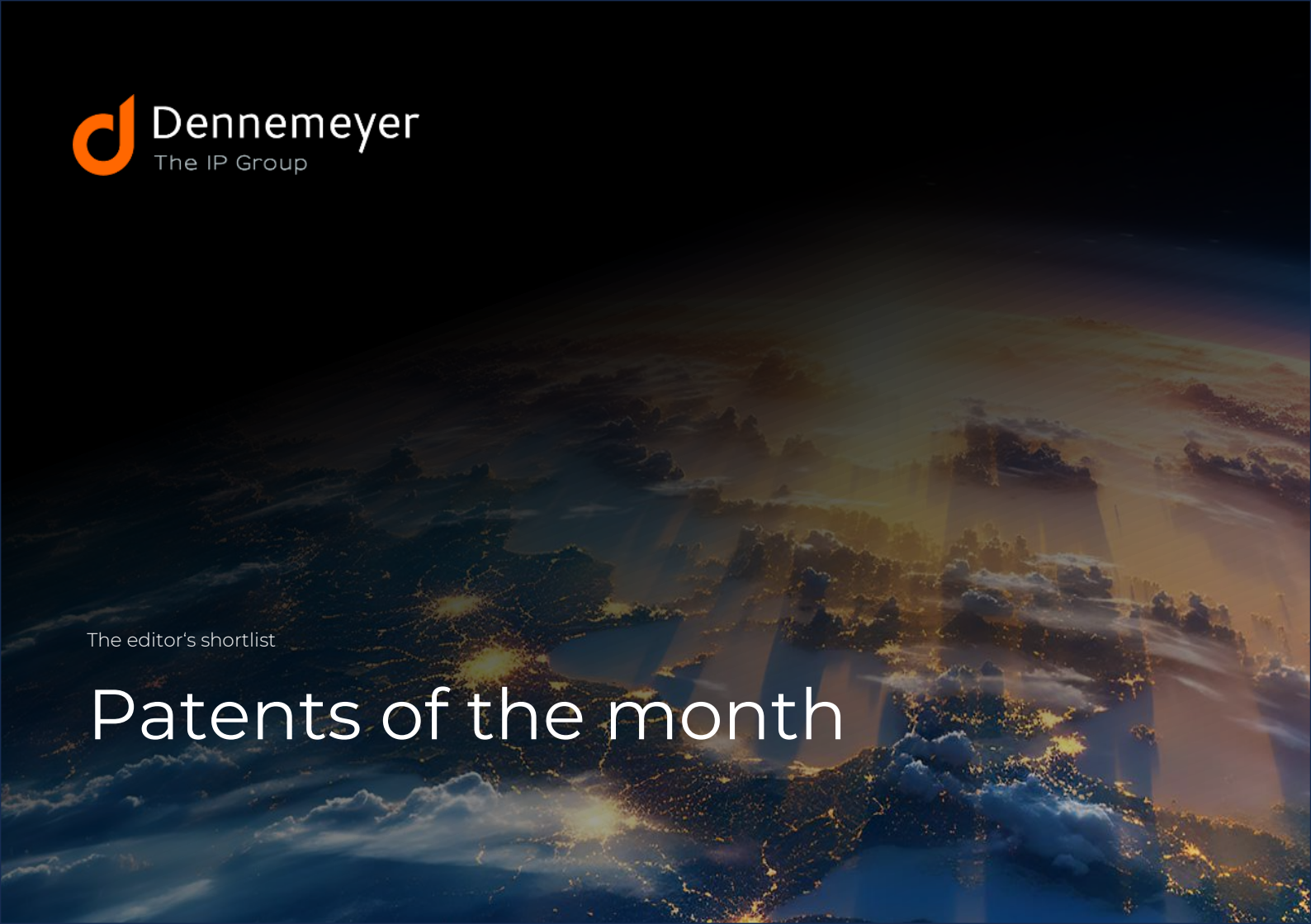

The editor's shortlist

Patents of the month

Green **Green patent indicator** powered by Octimine Dennemeyer IP Group

Patents of the month

Published in June 2025

Shortlisted and summarized by our analyst

- US2025206155A1 - System and method for controlling a fleet of fuel cell vehicles Green
  Assignee: Volvo Truck Corp (Sweden)
- US12331416B2 - Compression apparatus for hydrogen-containing gas utilizing an anode separator arrangement Green
  Assignee: Panasonic IP Management Co Ltd (Japan)
- US2025180170A1 - Hydrogen safety system Green
  Assignee: Honeywell International Inc (USA)
- US2025201887A1 - Fuel cell or electrolyser structure Green
  Assignee: Air Liquide SA (France)
- EP4059760B1 – System for storing hydrogen and aircraft comprising a system for storing hydrogen Green
  Assignee: Toyota Motor Corp (Japan)
- EP4576278A1 - Oxygen electrode catalytic layer for reversible, alkaline or anion exchange membrane electrochemical devices Green
  Assignee: Hydrolite Ltd (Israel)
- EP4562220A1 - Plant network including an electrolysis plant and a power supply source Green
  Assignee: Siemens Energy AG (Germany)
- DE102023213235A1 - Method and device for determining hydrogen consumption during operation of a fuel cell system Green
  Assignee: Robert Bosch GMBH (Germany)
- KR20250088114A - Hydrogen refueling system for preventing performance deterioration of hydrogen fuel cell
  Assignee: Individual Inventor (Korea)
- CN120220340A - Hydrogen leakage risk monitoring system and method for fuel cell power generation vehicle
  Assignee: Tongji University (China)

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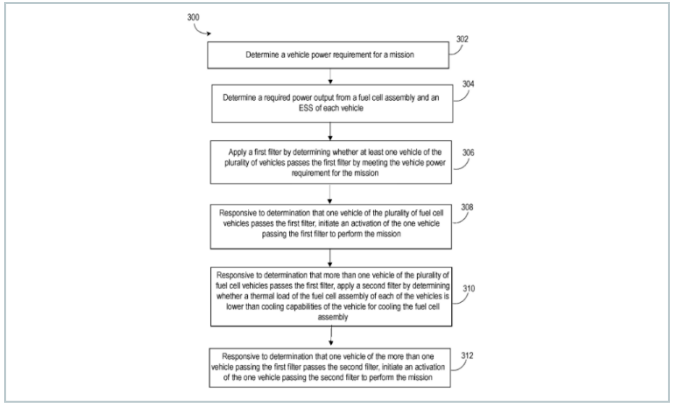
Latest patents

US2025206155A1 Green

System and method for controlling a fleet of fuel cell vehicles



Company name	Volvo Truck Corp (Sweden)
Inventors	Arya Pranav, Blanc Ricard, Merss Felipe
Priority date	28-Mar-2022
Publication date	26-Jun-2025

Summarized by Dennemeyer

This patent describes intelligently managing a fleet of fuel cell electric vehicles (FCEVs) by optimizing vehicle selection for specific missions. The core innovation lies in a multi-stage filtering process: first, vehicles are evaluated based on their ability to meet the mission's power requirements, considering factors like the planned route, vehicle characteristics, and the health and size of their fuel cell assembly and energy storage system. If multiple vehicles qualify, a second filter assesses whether a vehicle's fuel cell cooling capabilities can handle the mission's thermal load, taking into account the fuel cell's health and environmental factors. This reduces operating and maintenance costs, extends fleet longevity, and improves operational efficiency by dispatching the most suitable vehicle.

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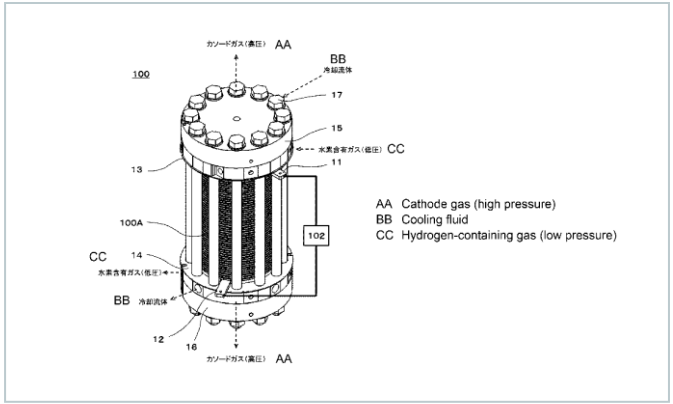
Latest patents

US12331416B2 Green

Compression apparatus for hydrogen-containing gas utilizing an anode separator arrangement

Company name	Panasonic IP Management Co Ltd (Japan)
Inventors	Sakai Osamu, Kita Hiromi, Kakuwa Takashi, Nakaue Takayuki
Priority date	25-Sep-2020
Publication date	17-Jun-2025



This patent presents an improved electrochemical compressor that produces high-pressure hydrogen more efficiently by solving temperature control issues caused by poor cooling channel design in traditional systems. The invention features an electrolyte membrane between an anode and a cathode, with separators on both sides and a voltage applier to drive proton movement. A key innovation is the integration of cooling fluid flow channels directly into the anode separator, eliminating the need for separate cooling plates and significantly enhancing thermal regulation. This streamlined design improves hydrogen compression efficiency and reduces system complexity, making it more viable for widespread hydrogen energy applications.

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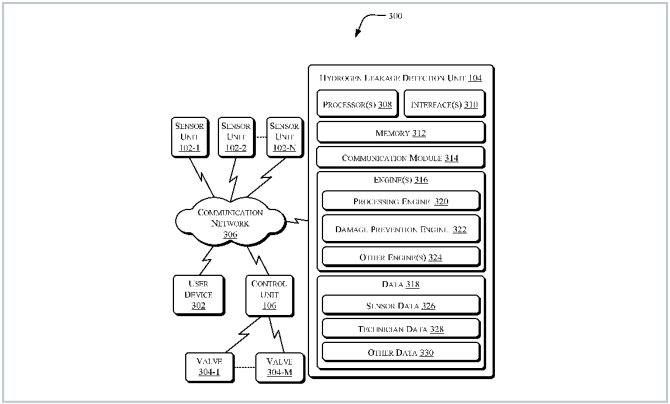
Latest patents

US2025180170A1 Green

Hydrogen safety system



Company name	Honeywell International Inc (USA)
Inventors	Pandey Amit, Narayanaswamy Hemalatha, Wankhede Sandeep, Kilpatrick Darrius Jamal
Priority date	01-Dec-2023
Publication date	05-Jun-2025

Summarized by Dennemeyer

This invention addresses the critical issue of hydrogen leakage in infrastructure such as storage tanks and pipelines, where current detection systems are often slow and reactive. Due to hydrogen's colorless, odorless, and highly diffusive nature, leaks can go unnoticed until damage occurs. The proposed system uses sensor units placed near different sections of a hydrogen amenity to monitor parameters like hydrogen concentration, temperature, pressure, humidity, and electrochemical deviations. These data are analyzed to detect both existing and probable future leakages, enabling faster responses such as halting hydrogen flow or dispatching service technicians. This proactive approach improves safety while reducing maintenance costs and the risk of catastrophic failures.

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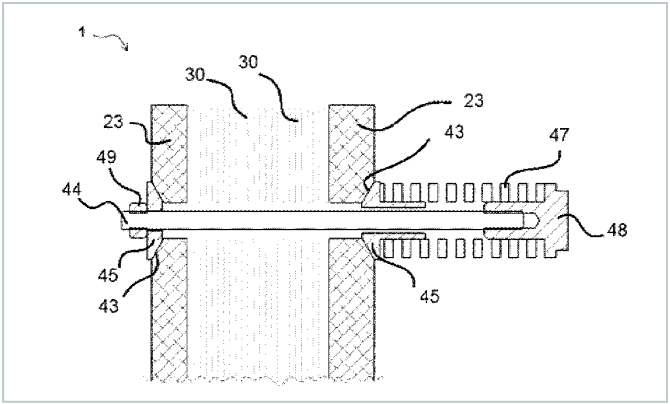
Latest patents

US2025201887A1 Green

Fuel cell or electrolyser structure



Company name	Air Liquide SA (France)
Inventors	Sirac Denis, Andre Johan
Priority date	23-Mar-2022
Publication date	19-Jun-2025

This invention provides an improved structural design for proton-exchange membrane fuel cells (PEMFCs) and electrolysers by addressing issues like tie rod buckling, insulation wear, and short circuits caused by misalignment. It introduces a tapered bearing surface and washer system that enables automatic realignment and maintains a consistent gap around the tie rod, reducing wear and preventing electrical contact. This ensures uniform clamping pressure, enhances mechanical stability under vibration, and supports integration of compensation members to handle dimensional changes in the stack. Additionally, it simplifies assembly and allows for better thermal and electrical performance by eliminating the need for excessive insulation components.

Summarized by Dennemeyer

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Latest patents

EP4059760B1 Green

System for storing hydrogen and aircraft comprising a system for storing hydrogen

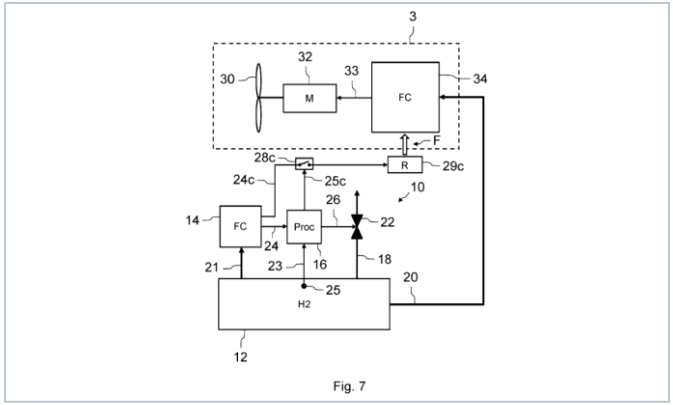

Fig. 7

Company name	Airbus Operations SAS (France)
Inventors	Landolt Jonathan, Raspati Olivier
Priority date	17-Mar-2021
Publication date	25-Jun-2025

This invention addresses the safety risk of hydrogen evaporation in aircraft storage tanks when the aircraft is parked and not using fuel. To prevent pressure buildup and potential explosions, it includes a hydrogen tank with a control unit powered by a built-in fuel cell. This self-sufficient setup continuously monitors tank pressure and automatically releases excess hydrogen through a controllable valve, thereby preventing dangerous overpressure conditions without relying on external power. This not only enhances safety by automatically managing gas release but also ensures reliable operation of the pressure control system as long as hydrogen is available in the tank.

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Latest patents

EP4576278A1 Green

Oxygen electrode catalytic layer for reversible, alkaline or anion exchange membrane electrochemical devices

Company name	Hydrolite Ltd (Israel)
Inventors	Kattan Mordechai, Ashdot Aviv, Tiurin Burshtein, Azra Charly David, Tal Gutelmacher Ervin
Priority date	18-Dec-2023
Publication date	25-Jun-2025

Summarized by Dennemeyer

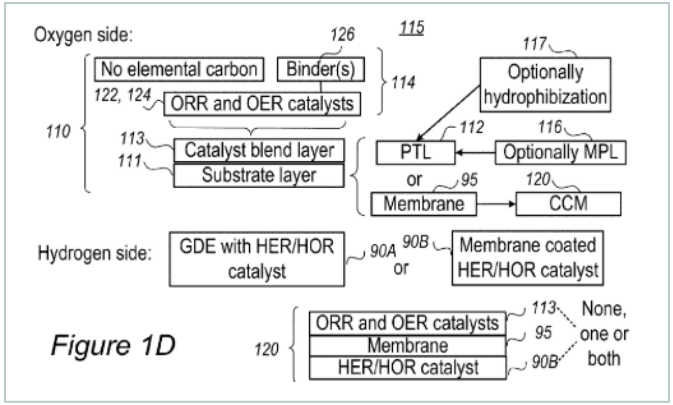

Figure 1D

This patent tackles a major issue in reversible electrochemical devices that use oxygen electrodes. Conventional electrodes rely on elemental carbon, which corrodes at high voltages during electrolyser operation, causing performance loss and shorter lifespan. The invention offers a novel solution by designing oxygen electrodes that are completely devoid of elemental carbon, both in the substrate and catalyst layers. Instead, the electrodes use a blend of catalysts platinum group metals for the oxygen reduction reaction (ORR) and nickel-based particles for the oxygen evolution reaction (OER) deposited on a non-carbon substrate, with optional polymer binders that are stable in alkaline environments. This configuration prevents carbon corrosion, allowing the electrode to function efficiently and durably in both fuel cell and electrolyser modes.

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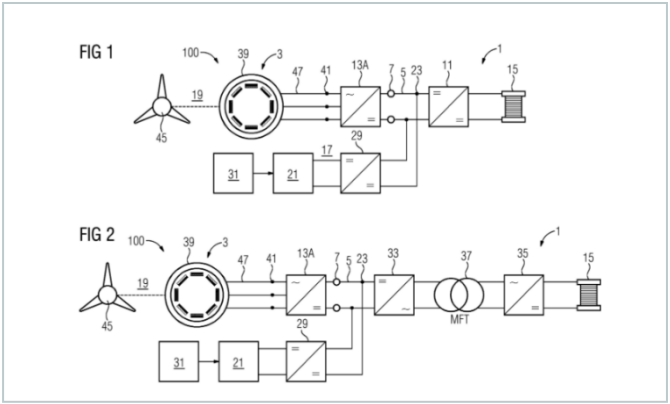
Latest patents

EP4562220A1 Green

Plant network including an electrolysis plant and a power supply source



Company name	Siemens Energy AG (Germany)
Inventors	Runser Thibaut, Schumann Sven, Bendig Marvin
Priority date	14-Oct-2022
Publication date	04-Jun-2025

Summarized by Dennemeyer

The patent addresses operational challenges in electrolysis plants powered by renewable energy sources like wind turbines, such as inefficiencies, reduced electrolyser lifespan, and frequent shutdowns due to fluctuating energy supply. To resolve this, the invention proposes a plant network integrating an electrolysis plant with a wind turbine-based power supply featuring a high-voltage DC output via a central DC supply line. A controllable energy storage system with a bidirectional DC-DC converter and battery enables management of three independent DC voltage levels for battery charging, high-voltage DC bus, and electrolyser operation. This setup ensures stable hydrogen production and reliable island-mode operation without relying on the public grid.

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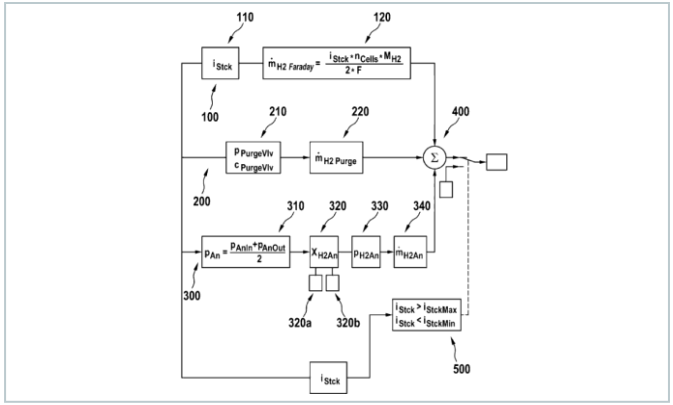
Latest patents

DE102023213235A1 Green

Method and device for determining hydrogen consumption during operation of a fuel cell system

Company name	Robert Bosch GMBH (Germany)
Inventors	Buehler Simon, Carre Maxime
Priority date	21-Dec-2023
Publication date	26-Jun-2025



This invention is about a new way to quickly and accurately measure hydrogen consumption in a fuel cell system, to improve range prediction and prevent vehicle breakdowns. It works by calculating hydrogen consumption from three main sources: first measuring the electric current the fuel cell produces (using Faraday's law), extra hydrogen is released during cleaning (called purging), and when small amounts leak through the fuel cell's membrane without making electricity. This comprehensive approach, potentially including additional residual effects, significantly enhances the precision and reliability of hydrogen consumption monitoring. This helps drivers know exactly how much range they have left, which makes hydrogen-powered vehicles safer and more reliable.

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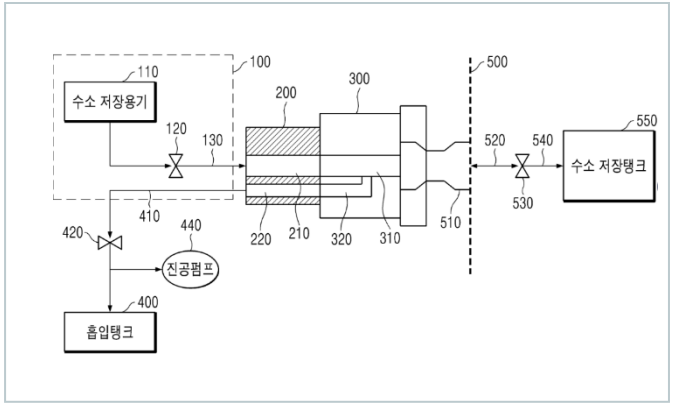
Latest patents

KR20250088114A

Hydrogen refueling system for preventing performance deterioration of hydrogen fuel cell



Company name	Individual Inventor (Korea)
Inventors	Kim Jae-Yun, Jang Jun-cheol
Priority date	08-Dec-2023
Publication date	17-Jun-2025

This invention presents a novel hydrogen charging system aimed at preventing performance deterioration in hydrogen fuel cells caused by contamination from air and impurities during refueling. To address this issue, the system incorporates an “air suction” mechanism within the dispenser. Once the dispenser is connected to the vehicle’s receptacle and before hydrogen charging begins, a control unit opens a suction valve, activating an air suction unit, potentially equipped with a vacuum pump, to extract any atmospheric substances and impurities from the connection space, hoses, and pipes. This pre-charging purification process ensures that only high-purity hydrogen reaches the fuel cell, thereby significantly extending its lifespan, enhancing vehicle performance, and supporting the broader adoption of hydrogen fuel cell vehicles.

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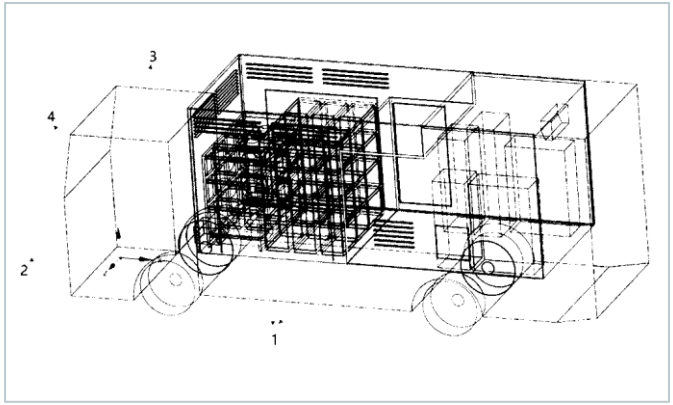
Latest patents

CN120220340A

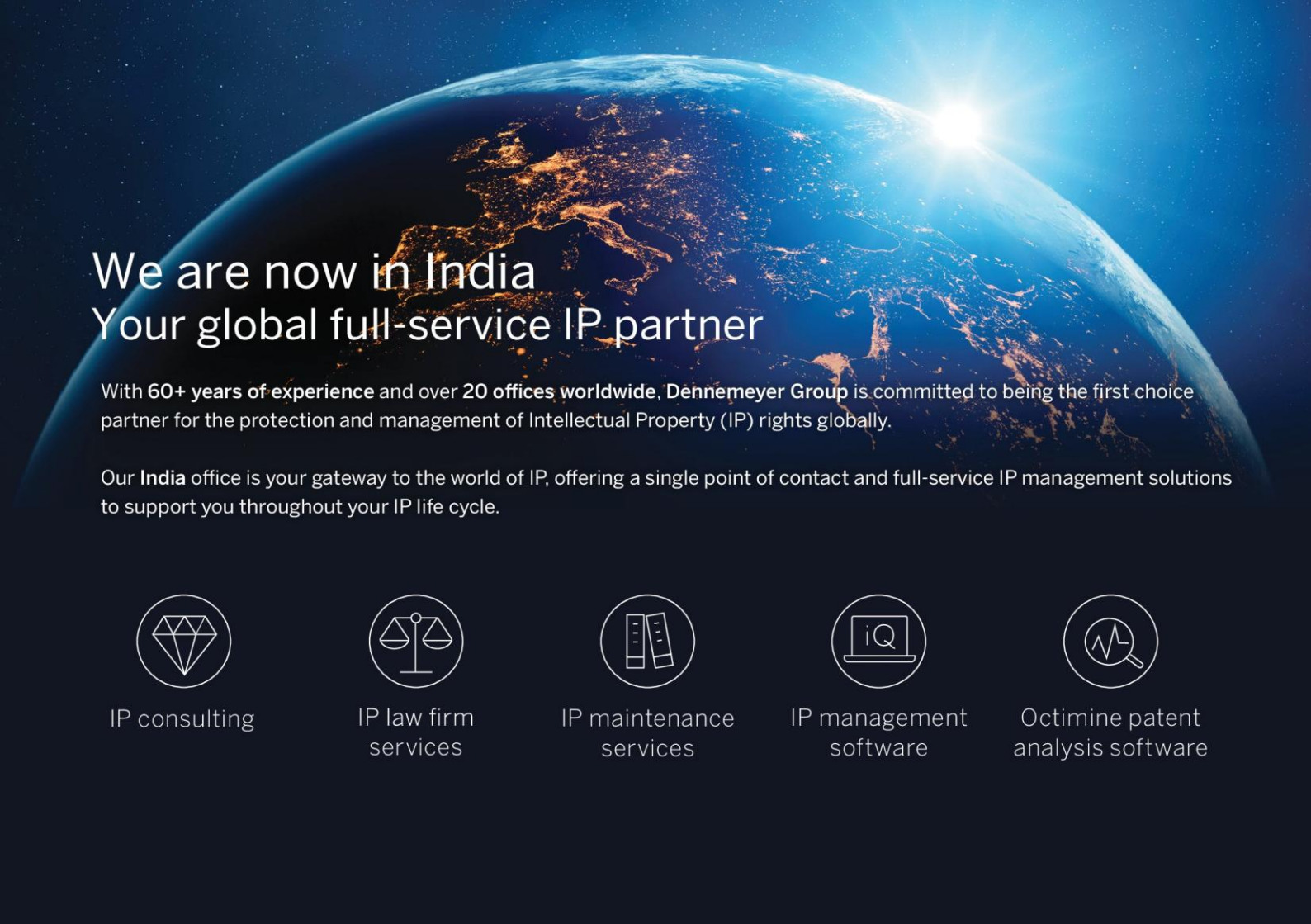
Hydrogen leakage risk monitoring system and method for fuel cell power generation vehicle



Company name	Tongji University (China)
Inventors	Gao Yuan, Liang Bowen, Wang Ziheng, Wang Tianwen, Cao Jianghan, Gu Bowen
Priority date	31-Mar-2025
Publication date	27-Jun-2025

Summarized by Dennemeyer

This patent aims to improve the safety of hydrogen-powered vehicles by detecting leaks early, before they become dangerous. Traditional methods would only detect hydrogen leaks after they had already happened, which made it hard to prevent accidents. The invention addresses this problem by using sensors inside the vehicle to continuously monitor hydrogen levels and detect the exact location of any potential leak. A computer simulation then shows how the hydrogen would spread in the air. Based on this, it calculates the risk level, and the safe distance needed to avoid danger. If a risk is found, it sends out a warning through sounds and displays. This early warning system gives people time to react, helping to avoid explosions or injuries and making hydrogen vehicles much safer to use.



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Bengaluru
info-india@dennemeyer.com

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