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INFORME

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Ciudad de Panamá, 21 y 22 de junio de 2018

INFORME SOBRE VIGILANCIA TECNOLÓGICA SOBRE EL USO MÁS EFICIENTE DE HIDRÓGENO EN VEHÍCULOS DE TRANSPORTE

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1. Introducción

Universidad Galileo firmo el convenio de cooperación interinstitucional con el Registro de la Propiedad Intelectual para la creación de un Centro de Apoyo a la Tecnología e Innovación -CATI-Galileo en junio de 2016. Desde entonces se han realizado varias actividades de formación y capacitación a docentes, estudiantes e investigadores de la Universidad.

Dentro de los servicios que el CATI-Galileo ha prestado desde su creación se encuentran búsquedas en el estado de la técnica, difusión de la propiedad intelectual, actividades específicas de formación como el Taller de Generación de Patentes dirigido a investigadores internos y externos, entre otros.

El objetivo específico del presente estudio de patentes es identificar el estado de la técnica del uso del hidrógeno como combustible, como una alternativa del uso de combustibles fósiles que están causando el cambio climático. El hidrógeno disminuye los gases de efecto invernadero, por lo que existe un interés creciente en continuar los estudios sobre hidrógeno como fuente de energía.

El Instituto de Recursos Energéticos de la Universidad Galileo realizó el proyecto HHO en vehículos de transporte público en donde utilizaron celdas electrolíticas de agua alcalina para generar gas hidrógeno, demostrando una disminución del 15% en uso de combustible Diésel, equivalentes a 227 galones en promedio mensual por cada bus. (Socarrás, 2016). http://www.galileo.edu/lp/ire/proyecto-hho/

2. Uso de la información de Patentes

El presente informe se elabora para servir de base a las diferentes Universidades, Centros de Investigación e inventores particulares para tomar decisiones estratégicas para definir líneas de investigación y desarrollo a nivel nacional. Los objetivos específicos son:

2.1. Identificar a través de la información de patentes, las últimas tendencias evolutivas en los cambios tecnológicos introducidos en los procesos y equipos para lograr el uso más eficiente del hidrógeno como combustible.

2.2. Evaluar adquisición de tecnología avanzada que resulten factibles de asimilar en el país, para optimizar los recursos disponibles para trazar estrategias de desarrollo.

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2.3. Mejorar la planificación estratégica a partir de la selección de las mejores alternativas asimilando el conocimiento ya publicado a través de las patentes.

2.4. Identificar nuevos mercados mediante el análisis de países de origen y de destino de las patentes.

3. Estrategias de búsquedas

Bases de datos utilizadas para la búsqueda

Patentscope	**https://patentscope.wipo.int/search/en/search.jsf** 15 de marzo 2017 10 de julio de 2017 8 de febrero de 2018
Clasificación Internacional de Patentes	http://cip.oepm.es/ipcpub/#refresh=page 15 de marzo 2017 10 de julio de 2017
Espacenet	https://worldwide.espacenet.com/ 15 de marzo 2017 10 de julio de 2017
The Lens	https://www.lens.org/lens/ 21 de Julio de 2017 8 de febrero de 2018
Patent inspiration	http://www.patentinspiration.com/ 27 de julio de 2017 8 de febrero de 2018
Intelligo	http://patentes.explora-intelligo.info/ 8 de febrero de 2018
PatBase	https://www.patbase.com 16 de marzo de 2018
Registro de la Propiedad Intelectual	http://www.rpi.gob.gt/portalrpi/ 26 de marzo de 2018

Criterios de búsqueda:
Clasificación Internacional de Patentes

C01B3/00 [2016.01]	**Hidrogeno; Mezclas gaseosas que contienen hidrógeno; Separación del hidrógeno a partir de mezclas que lo contienen; Purificación del hidrógeno** (producción de gas de agua o gas de síntesis a partir de materias carbonosas sólidas **C10J**) **[2006.01]**
H01M [2016.01] H01M8/00	**PROCEDIMIENTOS O MEDIOS, p. ej. BATERÍAS, PARA LA CONVERSION DIRECTA DE LA ENERGIA QUIMICA EN ENERGIA ELECTRICA [2]** ***Pilas de combustible; Su fabricación [2016.01]***
Palabras clave: Hydrogen AND Fuel	

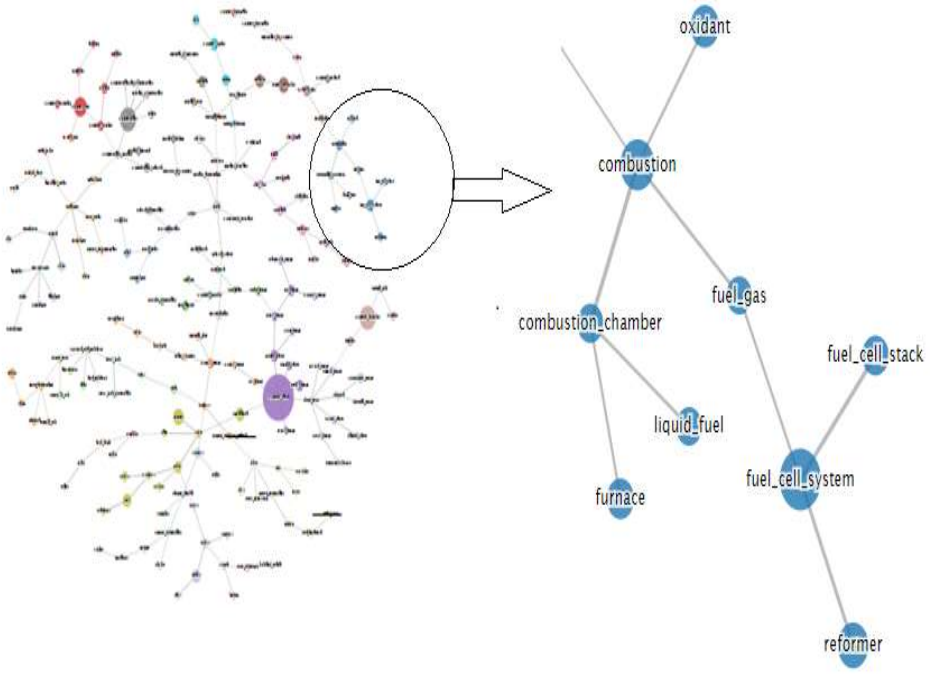
4. Resultados de la búsqueda

4.1. Búsqueda por palabras clave

La búsqueda por palabra clave ***Hydrogen,*** para evaluar el universo de patentes relacionadas con la temática de hidrógeno, la mayoría son del área química y farmacéutica.

Criterio de Búsqueda	Claims: Hydrogen
Patentscope	976, 341
The Lens	885, 243 Familias 423,891
Patent Inspiration	549,159 familias 290,268
Patbase	856,960
Intelligo	26,466

Se realizó una búsqueda de conceptos en Intelligo para establecer el universo de patentes con hidrógeno y poder establecer los conceptos objeto del presente estudio, encontrando que son las relacionadas al proceso de combustión, especialmente las de celdas de combustibles.



Se realizó una búsqueda con las palabras ***hidrogeno y combustible***, obteniendo los siguientes resultados, que reflejan el universo del presente estudio:

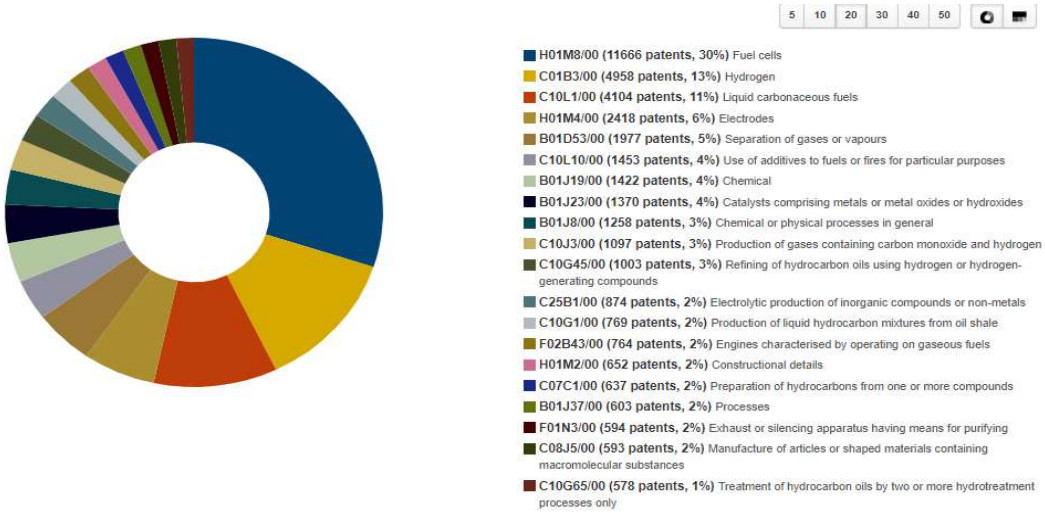
Criterio de Búsqueda	Claims: Hydrogen AND Fuel
Patentscope	39,847
The Lence	40,354
Patent Inspiration	37,153
Patbase	53,308

La gráfica que se muestra corresponde a los resultados obtenidos con la estrategia aplicada en Patentscope, en donde se observa que las principales clasificaciones corresponden a H01M y CO1B.

Options Table Graph Options bar pie Line

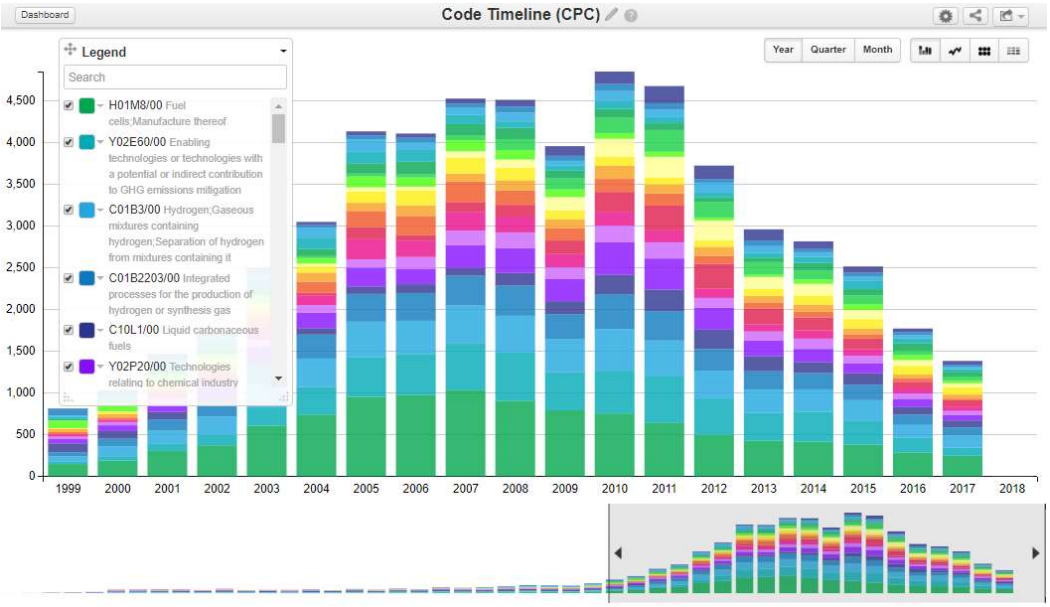
Countries		IPC		Inventor		Applicant		Pub Date	
Name	No	Name	No	Name	No	Name	No	Date	No
United States	17849	H01M	12602	Wellington Scott Lee	91	SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.	390	2007	2002
PCT	7287	C01B	6826	Horodysky Andrew G.	68	TOYOTA JIDOSHA KABUSHIKI KAISHA	326	2008	1974
European Patent Office	4331	C10L	5640	Edlund David J.	61	EXXONMOBIL RESEARCH AND ENGINEERING COMPANY	266	2009	2112
Canada	4323	B01J	5597	WELLINGTON, SCOTT LEE	56	Toyota Jidosha Kabushiki Kaisha	264	2010	1770
United Kingdom	3705	C10G	5043	UKAI KUNIHIRO	52	UOP LLC	235	2011	1702
Australia	1863	C07C	3409	Kim Ju-Yong	51	Mobil Oil Corporation	232	2012	1580
South Africa	282	B01D	3068	CHERPECK RICHARD E	50	EXXON RESEARCH ENGINEERING CO	214	2013	1573
Israel	197	F02B	1957	Cherpeck Richard E.	49	THE LUBRIZOL CORPORATION	201	2014	1330
ARIPO	6	C10M	1534	TAGUCHI KIYOSHI	49	General Electric Company	197	2015	1186
Republic of Korea	4	C10J	1426	CHERPECK, RICHARD E.	47	Hyundai Motor Company	183	2016	979
								2017	112

Se realizó la búsqueda en Patent Inspiration utilizando palabras clave ***hydrogen and Fuel*** en el campo de reivindicaciones, con los resultados obtenidos al aplicar la estrategia, las patentes recuperadas se relacionan con las diferentes alternativas según se muestra en el siguiente gráfico, las clasificaciones más destacadas son **Celdas de combustión, hidrógeno, combustibles carbonosos líquidos y electrodos.**



Se utilizó la misma estrategia en Patent Inspiration, para establecer la evolución de los códigos de la Clasificación Cooperativa de Patentes en el tiempo en donde podemos observar que la primera clasificación corresponde a **H01M8/00** que se refiere a celdas de combustión y su manufactura, seguido de la clasificación **Y02E60/00** que hace referencia a las tecnologías que contribuyen a disminuir las emisiones de gases con efecto invernadero[1].

[1] La Clasificación Cooperativa de Patentes creo una nueva clasificación **Y** para clasificar las tecnologías que contribuyen a disminuir el cambio climático.



Posteriormente se realizó la búsqueda combinando palabras clave con clasificación.

Criterio de Búsqueda	Claims: Hydrogen AND H01M	Claims: Hydrogen H01M and C01B	Claims: Hydrogen and Fuel H01M8/00 and C01B3/00
Patentscope	22,516	3,998	2,222
The Lens	8,724 Familias 4,986	--	313 Familia 142
Patent Inspiration	21,060 Familias 12,154	4,838	1662
Intelligo	26,146	64,330	26,147
Patbase	8,752	1657	3,251 Familias 515

Del análisis del cuadro anterior, se decidió utilizar la búsqueda combinada de Palabras clave: ***hidrógeno y combustible*** con la clasificación Internacional de patentes ***H01M8/00 y C01B3/00***, de PatBase y se analizó las 515 familias de patentes, que corresponden a un total de 3,251 patentes solicitadas en diferentes países en un total de 57 jurisdicciones. A continuación, se presenta el resumen del análisis de los resultados obtenido en PatBase.

TAC=(hydrogen and fuel) and IC=(H01M8/00 AND C01B3/00)

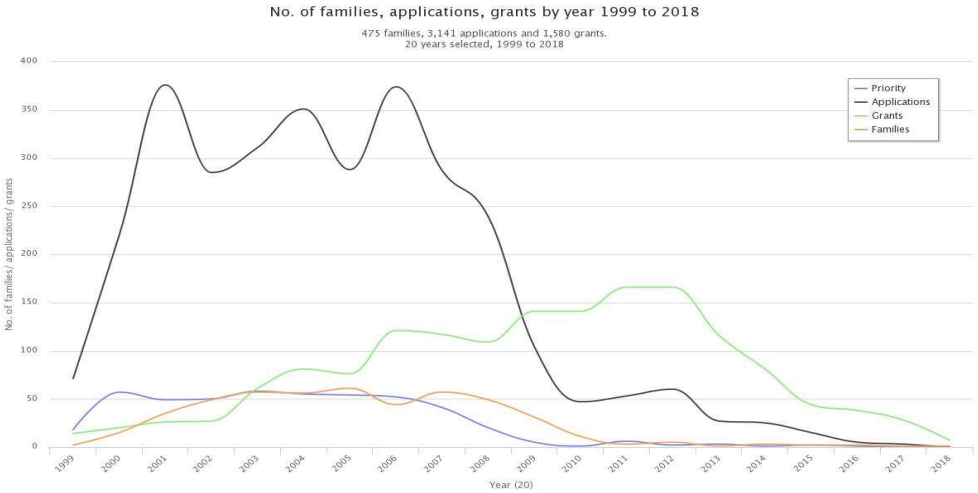
- *Patents*
- 57 Jurisdictions
- 24th January 1966 to 28th February 2018
- 52 years, 1 month, 4 days
- 259 assignees (192 with granted patents)

	Families	Applications
Totals	515	3,251
Grants	362 (70.29%)	1,658 (51%)

5. Análisis de la información a través de indicaciones de patentes

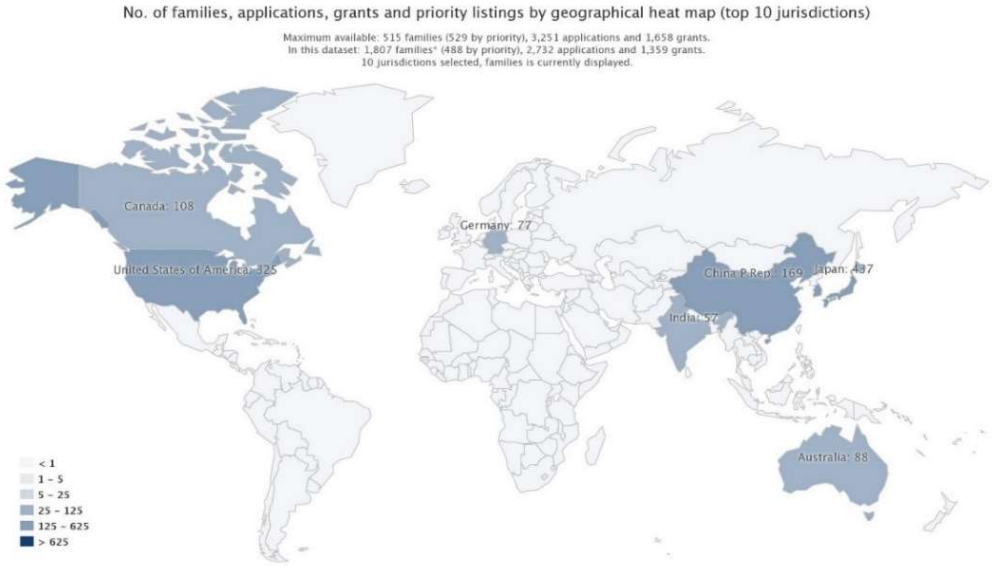
5.1. Tendencias Generales y Familias de Patentes

En el siguiente gráfico generado por PatBase se observa la tendencia desde el año 1999, en donde se observa un incremento de solicitudes de patente, línea negra, desde el año 2,000 al 2009, desde donde viene en descenso. La línea azul representa las fechas en que se presentaron las prioridades (primera solicitud de una familia de patentes) donde observamos una meseta desde el año 2000 al 2007 y luego inicia un descenso, este proceso es normal en muchas líneas de desarrollo, para dar un salto hacia nuevas soluciones que rompen con la trayectoria anterior. La línea verde representa las patentes concedidas con un punto máximo en el año 2012.

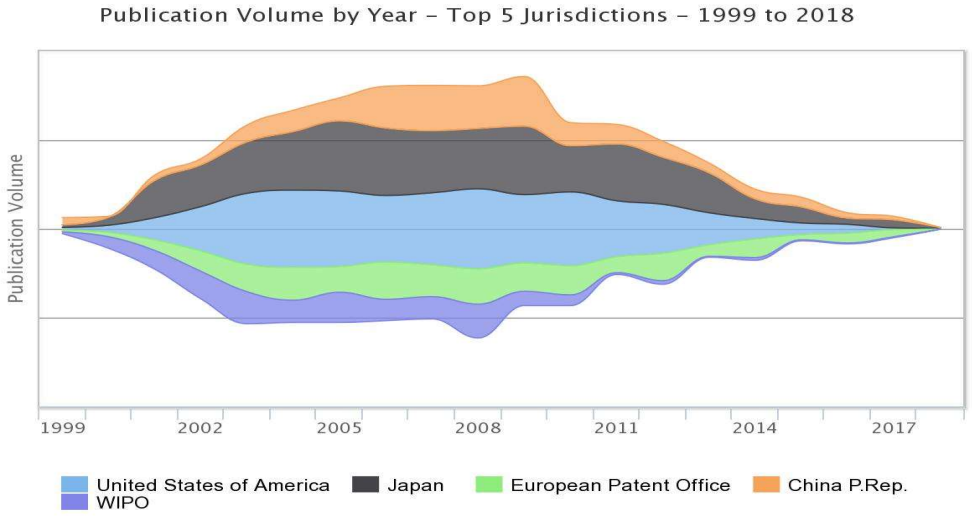


5.2. Análisis Geográfico

Con la estrategia de búsqueda los países de origen de las patentes son Japón, Estados Unidos, China, Canadá, Australia, Alemania e India, según el análisis obtenido en PatBase, este indicador nos muestra los países que más se dedican a la Investigación, Desarrollo e Innovación sobre este tema, no es de extrañar que sean los países en donde se encuentran las principales fábricas de vehículos a nivel mundial.

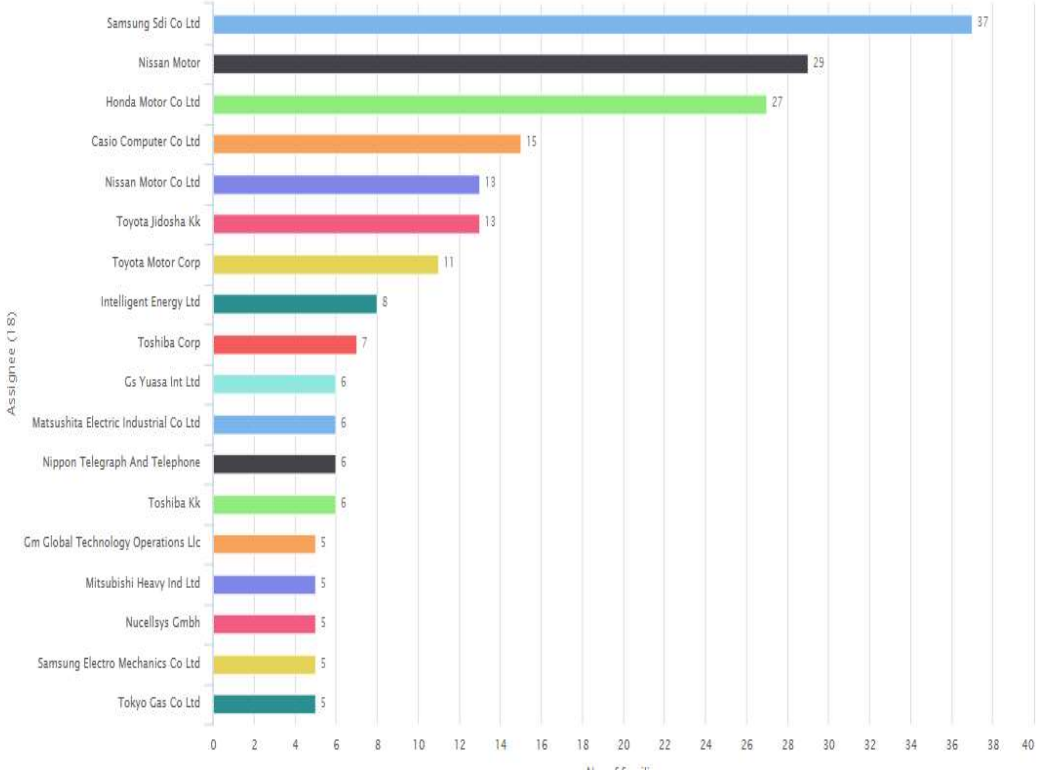


En el siguiente gráfico se muestra el volumen de las publicaciones por jurisdicciones, lo que nos indica los países con más mercado potencial sobre esta temática, ya que el indicador de cantidad de publicaciones muestra el interés que tienen los titulares nacionales y de terceros países en proteger sus invenciones sobre hidrógeno en estos mercados.



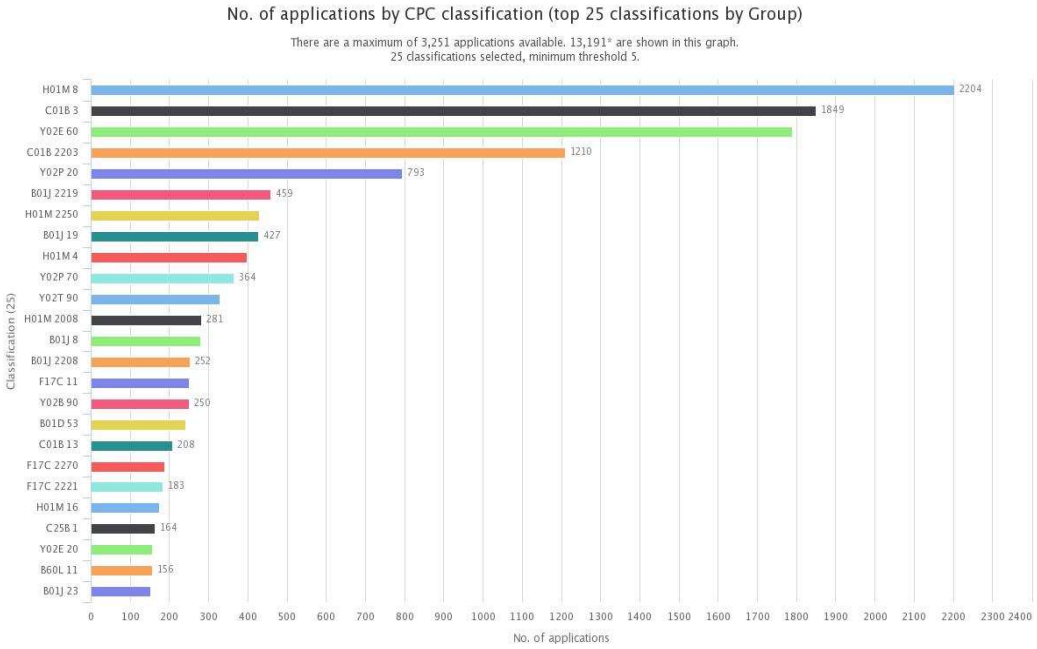
5.3. Principales titulares de las patentes

Los principales titulares de patentes sobre hidrógeno como combustible según los resultados obtenidos a través de PatBase son Samsung, Nissan Motor, Honda Motor, Casio Computer y Toyota.



5.4. Clasificación de la tecnología

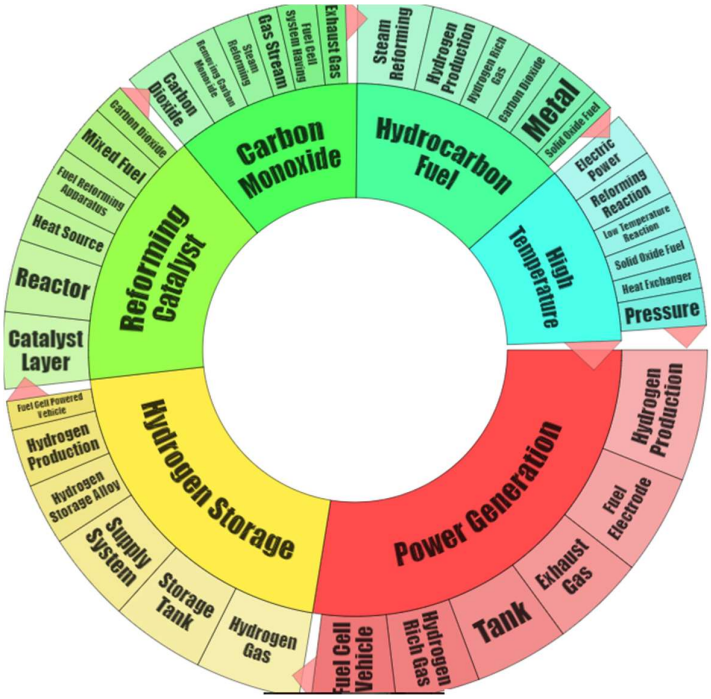
Las principales categorías de la Clasificación Cooperativa de patentes, según los resultados obtenidos a través de PatBase son:



6. Análisis de los resultados obtenidos

6.1. Análisis por palabras clave

El análisis de resultados de PatBase muestra los temas que en particular generan patentes sobre esta temática.



A continuación, se muestra las patentes más relevantes sobre cada tema seleccionado según los objetivos del presente estudio, se utilizó el traductor de Espacenet para presentar el resumen al español. En el número de patente o solicitud de patente se crearon hipervínculos a Espacenet para facilitar el acceso a la información.

6.1.1. Celdas de combustión para vehículos

US6536551B	Fecha de concesión 25/03/2003	HYDROGEN USING SYSTEM FOR INSTALLATION IN VEHICLE AND CONTROL METHOD FOR THE SYSTEM	TOYOTA JIDOSHA KK
Un sistema que utiliza hidrógeno para su instalación en un vehículo tiene un tanque de metanol que almacena metanol como fuente de hidrógeno, que es un combustible del sistema que utiliza hidrógeno, un tanque de agua que almacena agua, un reformador de metanol que produce un combustible de hidrógeno a partir de metanol y agua, una primera válvula electromagnética provista en un primer canal que conecta el tanque de metanol al reformador, una pila de células de combustible electrolítico de polímero que genera energía del combustible de hidrógeno suministrado por el reformador, una segunda válvula electromagnética provista en un segundo canal que conecta el reformador a la pila de pilas de combustible, una unidad de control electrónico que controla varias partes del sistema de uso de hidrógeno, etc. Cuando se produce un impacto en el vehículo, la unidad de control electrónico cierra el primer canal y el segundo canal cerrando a la fuerza la primera y la segunda válvulas electromagnéticas basándose en una señal de detección del sensor de impacto. Este sistema de uso de hidrógeno frena las reacciones de hidrógeno en el momento de un accidente o similar, mejorando así la seguridad del sistema.			
US2011223502 (A1)	**FECHA DE PUBLICACIÓN 2011-09-15**	FUEL REFORMING APPARATUS AND FUEL CELL SYSTEM	NISSAN MOTOR CO LTD
Un aparato de reformado de combustible incluye una porción empaquetada de catalizador que contiene catalizador de reformado de combustible (I) que tiene una tasa de conversión de hidrocarburo y un catalizador de reformado de combustible (II) excelentes que tienen una excelente tasa de formación de H2 + CO. Cada uno de catalizador (I) y catalizador (II) incluye especialmente rodio soportado sobre el mismo. Cuando el vehículo para el catalizador (I) es óxido de aluminio y el vehículo para el catalizador (II) es óxido de cerio, la eficiencia de generación de hidrógeno es excelente particularmente incluso en el arranque.			
JP2005293959A	Fecha de publicación 20/10/2005	HYDROGEN GAS MANUFACTURING POWER GENERATION SYSTEM AND ITS OPERATION METHOD	HONDA MOTOR CO LTD
Problema: Suministrar bien y eficientemente gas de hidrógeno a una celda de combustible estacionaria y un vehículo de pila de combustible, y usar el hidrógeno de manera económica. SOLUCIÓN: un sistema de generación de energía de fabricación de hidrógeno a nivel doméstico, equipado con un reformador, un dispositivo de purificación de hidrógeno, un tanque de generación de energía, para suministrar hidrógeno a la celda de combustible estacionaria, llenar tanques para suministrar hidrógeno a un vehículo de pila de combustible, y una ECU que controla el cambio de un objetivo para suministrar gas de hidrógeno al tanque de generación de energía y los tanques de llenado.			
US7867647B2	**Fecha de concesión 11/01/2011**	**Hydrogen generation device and fuel cell system including same**	TOYOTA JIDOSHA KK
En un dispositivo de generación de hidrógeno de acuerdo con la invención, los reformadores de PSR tienen una capacidad de calor más pequeña que la de los otros reformadores de PSR (“pressure swing reforming (PSR)”). Por lo tanto, la temperatura del catalizador alcanza una temperatura de inicio de reforma más rápidamente en los reformadores PSR que en los otros reformadores PSR. Cuando se inicia el dispositivo de generación de hidrógeno y se lleva a cabo la reacción de reformado, la mezcla de vapor de gasolina y vapor de agua se suministra de forma			

selectiva y preferencial a los reformadores de PSR de modo que la reacción de reformación se lleva a cabo en los reformadores de PSR.

US8404098B2	Fecha de concesión 26/03/2013	**Devices, Apparatus, Methods and Processes for Generating Hydrogen, Oxygen and Electricity from Chemical Compounds without Producing Undesirable By-Products**	DIAXIOM TECHNOLOGIES INC

Los dispositivos, aparatos, métodos y procesos están adaptados y dispuestos para producir eficientemente hidrógeno y oxígeno, mientras que al mismo tiempo producen electricidad. Ventajosamente, virtualmente no se producen subproductos no deseados, proporcionando así fuentes de combustibles y energía respetuosas con el medio ambiente. Mediante el uso cíclico y la reutilización de compuestos ácidos, y especialmente el ácido sulfúrico, el agua se procesa para producir hidrógeno, oxígeno y electricidad. Una o más de las salidas de hidrógeno, oxígeno y electricidad de los métodos, dispositivos y aparatos de la invención se pueden almacenar, o se pueden usar de muchas maneras, por ejemplo, en una celda de combustible para producir electricidad u otros productos de reacción adicionales. ; El hidrógeno y el oxígeno producidos por la invención se pueden combinar en un motor, como un motor de combustión interna, para alimentar un vehículo, mientras que la electricidad producida simultáneamente se puede usar para alimentar otras características del vehículo, como radios y equipos de comunicaciones, así como motores eléctricos comúnmente encontrados en vehículos híbridos. La invención también es ideal como fuente ideal de energía para usos donde la eficiencia y el uso cíclico de los recursos son primordiales, como para proporcionar electricidad y combustible para uso en el hogar y la industria.

JP5034567B2	Fecha de concesión 26/09/2012	**APPARATUS FOR GENERATING HYDROGEN AND FUEL CELL-POWERED VEHICLE EQUIPPED WITH THIS AS WELL AS HYDROGEN STORAGE MATERIAL**	NISSAN MOTOR CO LTD

PROBLEMA A RESOLVER: Proporcionar un aparato para generar hidrógeno que pueda almacenar un hidruro metálico de forma constante durante un largo período de tiempo con una estructura de aparato más pequeña. SOLUCIÓN: El aparato tiene un medio de suministro de líquido, para formar una película de óxido o una película de hidróxido sobre la superficie de un hidruro metálico al suministrar el hidruro metálico para liberar hidrógeno calentando y un líquido que contiene agua al hidruro metálico.

TW578324 B	Fecha de concesión 01/03/2004	**Zero/low emission and co-production energy supply station**	ZTEK CORP

La tendencia en las opciones de vehículos comerciales de transporte personal y ligero se dirige hacia vehículos eléctricos o de celdas de combustible con cero emisiones. La mejor manera de satisfacer su demanda de electricidad para recargar baterías o hidrógeno para operar celdas de combustible es mediante la producción in situ variable de electricidad e hidrógeno a partir del combustible de transporte convencional mediante un sistema de suministro de energía en el sitio que emplea un dispositivo de conversión. Este enfoque puede dar lugar a cambios mínimos en la infraestructura actual de la industria de estaciones de servicio de automóviles y camiones y puede evitar cualquier alteración en el funcionamiento normal de la industria de la energía eléctrica. El dispositivo híbrido de conversión de hidrógeno / electricidad in situ es un reformador y / o una pila de combustible. La salida del sistema puede variarse para satisfacer la demanda de combustible de hidrógeno para vehículos de pila de combustible o para proporcionar electricidad para cargar baterías usadas en los vehículos eléctricos. El sistema de suministro de energía distribuido en el sitio que utiliza un sistema de pila de combustible de óxido sólido a alta temperatura para la generación eléctrica y un sistema integral de reforma de vapor para la producción de hidrógeno son los enfoques más deseables.

US7939210B2	Fecha de concesión 10/05/2011	ELECTRIC AUTOMOBILE	GS YUASA CORP [JP]

Un automóvil eléctrico incluye una celda de combustible para la generación de energía mediante el suministro de hidrógeno y agente oxidante, un dispositivo generador de hidrógeno para generar un gas que contiene hidrógeno para ser suministrado a la celda de combustible y un motor impulsado por electricidad generada por la celda de

combustible. El dispositivo generador de hidrógeno genera gas que contiene hidrógeno descomponiendo un combustible compuesto orgánico, e incluye una membrana de partición conductora de protones, un electrodo de combustible provisto en una superficie de la membrana de partición para generar directamente el gas que contiene hidrógeno, un dispositivo para suministrar, al electrodo de combustible, agua y combustible que contiene compuestos orgánicos capaz de producir un protón como resultado de la oxidación electroquímica que puede pasar a través de la membrana de partición, un electrodo de oxidación proporcionado en la otra superficie de la membrana de partición, un dispositivo para suministrar el agente oxidante al electrodo oxidante, y un dispositivo para generar y recoger el gas que contiene hidrógeno.			
JP2006318870A	Fecha de solicitud 24/11/2006	**FUEL CELL SYSTEM AND FUEL CELL**	TOYOTA MOTOR CORP
PROBLEMA A RESOLVER: Proporcionar un sistema de pila de combustible capaz de suministrar energía eléctrica de manera estable y proporcionar una celda de combustible utilizada para ello. SOLUCIÓN: El sistema de pila de combustible 100 está equipado con un dispositivo de generación de hidrógeno 110 que comprende reactores 112, 114 que tienen un catalizador y capaz de conmutar reacción de reformado y reacción exotérmica, válvulas de tres vías SV1-SV7 para conmutar el paso del fluido suministrado al reactores 112, 114 y el paso de fluido expulsado de los reactores, y un medio de control 170 que conmuta las válvulas de tres vías SV1-SV7 para provocar la reacción de reforma en un reactor fuera de los reactores 112, 114 y la reacción exotérmica en el otro reactor , y la reacción de reforma y la reacción exotérmica alternativamente en los reactores; un tanque de hidrógeno 125 que contiene gas que contiene hidrógeno reformado y producido en el dispositivo de generación de hidrógeno 110; y una celda de combustible 120 que genera energía eléctrica con gas que contiene hidrógeno suministrado desde el tanque de hidrógeno.			

6.1.2. Producción de Hidrógeno

JP4272922B2	Fecha de concesión: 03/06/2009	**PURE HYDROGEN PRODUCTION DEVICE**	HONDA MOTOR CO LTD
PROBLEMA A RESOLVER: Proporcionar un dispositivo de producción de hidrógeno puro donde se puede realizar el llenado de hidrógeno a FCV (vehículo de pila de combustible) mientras se elimina la pulsación del hidrógeno gaseoso puro obtenido por un aparato PSA (adsorción de oscilación de presión). SOLUCIÓN: El dispositivo donde un gas reformado que contiene hidrógeno obtenido reformando combustible que contiene átomos de hidrógeno se refina mediante un método de adsorción por oscilación de presión se proporciona con: (a) un reformador 3 que tiene un catalizador de reformado que produce gas reformado rico en hidrógeno de corriente y combustible ; (b) un aparato de PSA 7 conectado al flujo descendente del reformador 3 y refinado del gas reformado para obtener hidrógeno gaseoso puro; (c) un tanque de hidrógeno de relajación de pulsación 8 que almacena el hidrógeno gaseoso puro con la pulsación obtenida del aparato de PSA 7; y (d) un tanque de hidrógeno a alta presión 12 conectado al tanque de hidrógeno de relajación de pulsación 8. El tanque de hidrógeno de relajación de pulsación 8 relaja la pulsación del hidrógeno gaseoso puro descargado del aparato de PSA 7, y el hidrógeno gaseoso puro en el que se relaja la pulsación se carga en el depósito de hidrógeno a alta presión 12 a través de un compresor 11.			
JP5233094B2	Fecha de concesión: 10/07/2013	**HYDROGEN GENERATION SYSTEM, FUEL CELL SYSTEM, AND FUEL CELL AUTOMOBILE**	NISSAN MOTOR CO LTD
PROBLEMA A RESOLVER: Proporcionar un sistema de generación de hidrógeno que se suprime en la cantidad de subproductos generados y genera una cantidad necesaria de hidrógeno. SOLUCIÓN: El sistema de generación de			

hidrógeno HGS está provisto de un contenedor (tanque) 21 que contiene un material de almacenamiento de hidrógeno 30 que genera gases de subproducto en una cantidad que depende de la temperatura, un medio de ajuste de temperatura (aparatos de calefacción y refrigeración) 22 que ajusta la temperatura en el contenedor 21, y un medio de control (controlador de generación de hidrógeno HGC / termómetro 25) que estima la cantidad de subproductos generados en el tanque 21 y controla los medios de ajuste de temperatura 22 de acuerdo con la cantidad estimada.

US6195999 B1	Fecha de concesión 06/03/2001	**Electrochemical engine**	GEN MOTORS CORP [US]

Un motor electroquímico para un vehículo comprende un tanque de almacenamiento que contiene material de retención de hidrógeno que absorbe y almacena reversiblemente hidrógeno a una temperatura de almacenamiento de hidrógeno y lo libera al calentarlo a una temperatura de liberación. Una pila de pilas de combustible que utiliza el hidrógeno liberado produce electricidad y subproductos de calor. Un circuito primario de flujo de refrigerante se extiende desde un radiador, a través de la pila de células de combustible y el tanque de almacenamiento, y de vuelta al radiador, y tiene una válvula de distribución de refrigerante intermedia entre la pila de células de combustible y el tanque de almacenamiento. Una línea de flujo de refrigerante de derivación se extiende desde la válvula de distribución de refrigerante al radiador. Durante la operación, el subproducto de calor de la pila de células de combustible se transfiere a través del circuito de flujo de refrigerante primario al tanque de almacenamiento para calentar el material de retención de hidrógeno y liberar hidrógeno para alimentar la pila de células de combustible. El motor electroquímico comprende además un generador de calor dentro de un bucle de flujo de refrigerante de sobre calentador que tiene una válvula de derivación intermedia entre el tanque de almacenamiento y el radiador operable para mantener el refrigerante dentro del bucle de flujo de refrigerante del sobre calentador y una bomba secundaria para hacer circular el refrigerante. El refrigerante en el circuito de flujo de refrigerante del recalentador se calienta mediante el generador de calor y se hace circular a través del tanque de almacenamiento para liberar adicionalmente gas de hidrógeno del material de retención de hidrógeno.

US 6797420 B2	Fecha de concesión 28/09/2004	**Power generation device and operation method therefor**	MATSUSHITA ELECTRIC IND CO LTD [JP]

La presente invención se refiere a un generador de energía eléctrica y su método de operación, que está equipado con un generador de hidrógeno, una celda de combustible de electrólito de polímero para generar energía eléctrica usando un gas rico en hidrógeno del generador de hidrógeno, un quemador para calentar el generador de hidrógeno un controlador de tasa de flujo para controlar la cantidad de suministro de un combustible encendido al quemador, una vía de comunicación que conecta el controlador de caudal y el quemador, una junta donde al menos un gas combustible residual de un electrodo de combustible de la celda de combustible y / o un gas generado de forma incompleta del generador de hidrógeno se combina en la ruta de comunicación, y un tubo de transferencia de presión para liberar la presión entre la junta y el controlador de la tasa de flujo en el controlador de la tasa de flujo; el controlador de la tasa de flujo controla la cantidad de suministro del combustible en combustión sobre la base de la presión mencionada anteriormente.

JP4957007B2	Fecha de concesión 20/06/2012	**HYDROGEN GENERATION SYSTEM, FUEL CELL SYSTEM, AND FUEL CELL VEHICLE**	NISSAN MOTOR CO LTD

PROBLEMA A RESOLVER: Proporcionar un sistema de generación de hidrógeno para generar gas hidrógeno bajo en concentración de amoníaco. SOLUCIÓN: En un sistema generador de hidrógeno, HGS incluye el sistema generador de hidrógeno 19 que consiste en un miembro de almacenamiento de hidrógeno 21 compuesto por una amida metálica que contiene un elemento metálico seleccionado de un elemento de metal alcalino y un elemento de metal alcalinotérreo, nitrógeno y hidrógeno, y un hidruro metálico seleccionado del elemento de metal alcalino y el elemento de metal alcalinotérreo, y de un tanque 20 para alojar este miembro de

almacenamiento de hidrógeno 21, la capa más externa 21a del miembro de almacenamiento de hidrógeno 21 frente a un puerto de inyección de hidrógeno (salida) 20a del tanque 20 está compuesto del hidruro metálico.			
US7132178B2	Fecha de concesión: 07/11/2006	**Hydrogen generator, fuel cell system and control method of hydrogen generator**	MATSUSHITA ELECTRIC IND CO LTD [JP]
Un generador de hidrógeno que incluye una unidad de suministro de materia prima que suministra una materia prima que contiene un componente de azufre y compuesto de un compuesto orgánico, una unidad de suministro de agua que suministra agua, un reformador que produce hidrógeno gaseoso, el reformador provisto de un catalizador de reforma para fabricar la materia prima y el agua sufre una reacción, y una unidad de eliminación de monóxido de carbono reduce el contenido de monóxido de carbono en el gas de hidrógeno producido en el reformador, en donde el catalizador de reformado está constituido por un vehículo compuesto por platino y se proporciona un óxido de metal.			

6.1.3. Celdas de combustión HHO

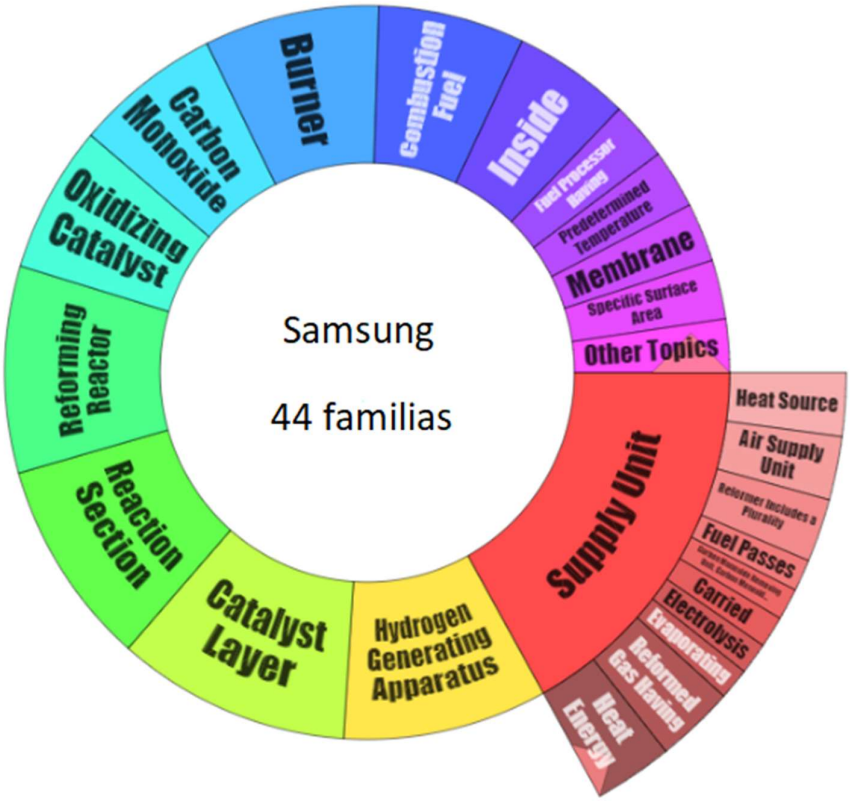
US9464553 B2	Fecha de concesión 11/10/2016	Power generation system	CLEAN POWER PROVIDERS LLC [US]
Un motor de combustión interna se enciende o utiliza una mezcla de combustible líquido e hidrógeno, para producir energía que se convierte en electricidad mediante un alternador, que posteriormente se utiliza para producir hidrógeno. El hidrógeno se produce mediante el uso de células generadoras de hidrógeno que descomponen el agua mediante la electrólisis y producen hidrógeno. La celda utiliza barras de ánodo insertadas en un tanque que contiene tubos de cátodo. Además, el tanque en sí también actúa como el cátodo ya que el tanque está conectado al extremo negativo de un circuito. Una corriente pasa de las barras de ánodo al cátodo a través del agua para producir hidrógeno. El hidrógeno se elimina por gas y se almacena en un depósito para ser utilizado en un motor de combustión interna como combustible. La energía necesaria para realizar la electrólisis se obtiene de un alternador y una turbina que es parte del sistema.			
US9267468 B2	Fecha de concesión 23/02/2016	HYDROGEN SUPPLEMENTAL SYSTEM FOR ON-DEMAND HYDROGEN GENERATION FOR INTERNAL COMBUSTION ENGINES	HNO GREENFUELS INC [US]
Se proporciona un sistema portátil de generación de hidrógeno bajo demanda para producir hidrógeno e inyectar el hidrógeno como un suplemento de combustible en la entrada de aire de los motores de combustión interna, más particularmente a los vehículos. El hidrógeno y el oxígeno se producen con una celda de combustible a bajas temperaturas y la presión del agua en un tanque de suministro. El hidrógeno y el oxígeno pasan a través del tanque de suministro para su distribución y preservación del agua. Los gases se mantienen separados por un divisor en el tanque y el nivel del agua en el tanque. En el caso de los motores de gasolina, el hidrógeno se dirige a la entrada de aire del motor mientras el oxígeno se ventila a la atmósfera. El dispositivo está opcionalmente alimentado por la batería del vehículo, una batería independiente, el calor residual del motor de combustión interna o la energía solar. El sistema utiliza un interruptor de vacío u otro sensor de motor que permite la alimentación del dispositivo y, por lo tanto, la producción de hidrógeno solo cuando el motor está en funcionamiento. Por lo tanto, a medida que se produce el hidrógeno, es inmediatamente consumido por el motor. No se almacena hidrógeno en, ni alrededor del vehículo.			

6.2. Análisis de resultados por titulares

Para conocer las líneas de investigación desarrolladas sobre el hidrógeno, se muestran un análisis de las familias de patentes[2] en base a las palabras clave de cada familia, presentadas por los principales titulares: Samsung, Nissan, Honda, Toyota.

6.2.1. Samsung

En el anexo No. 1 se presenta una lista de los títulos de las 45 familias, en el siguiente gráfico se agruparon todos los resultados para Samsung Sdi Co Ltd, Samsung Electro Mechanics Co Ltd, Samsung Sdi Co y Smsung Electro Mech. Este gráfico agrupa las patentes por palabras clave observando que Samsung ha investigado más sobre Unidades de suministro de aire, fuentes de calor, electrólisis. Así como aparatos generadores de hidrógeno y catalizadores.



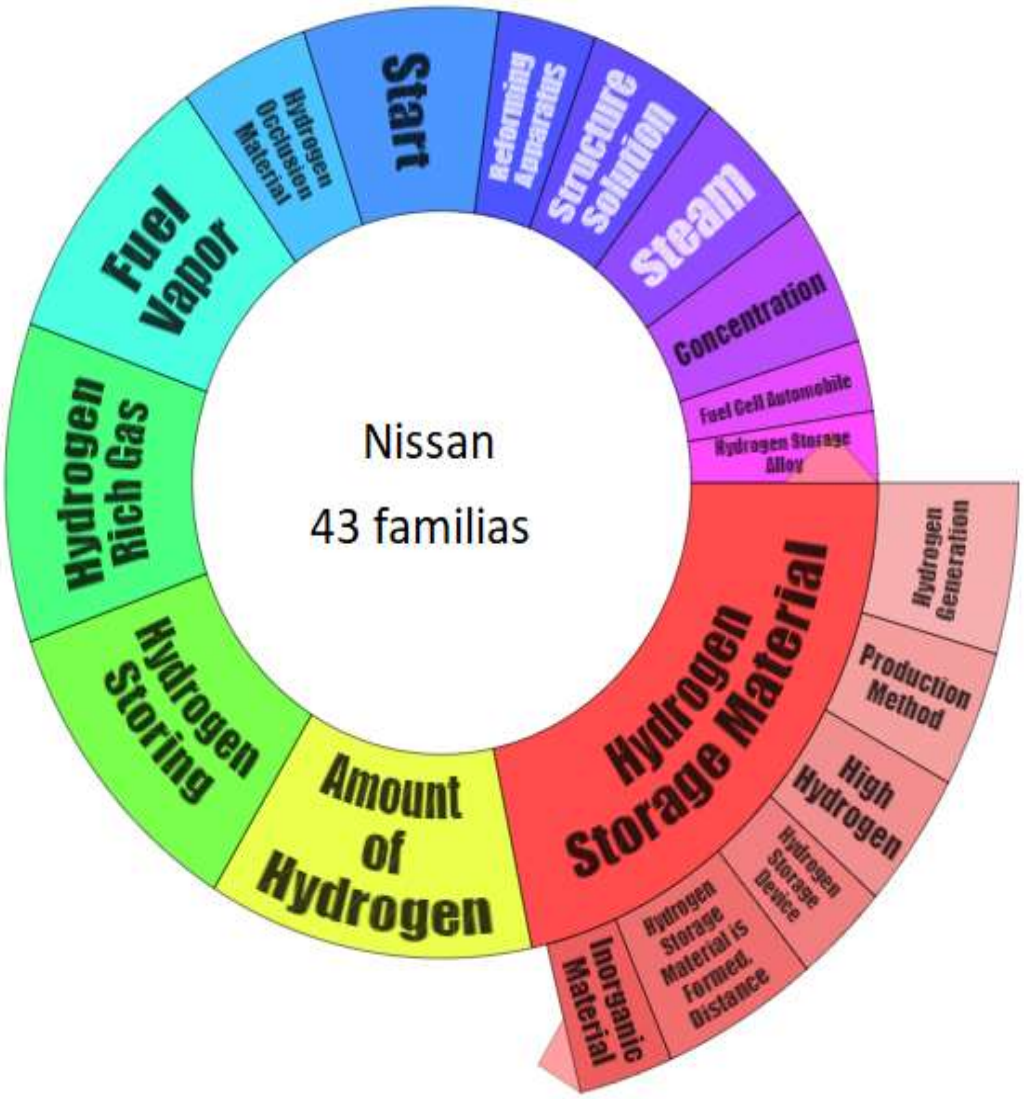
Se realizó un análisis de las principales clasificaciones de las 44 familias presentados por Samsung encontrando que las principales clasificaciones son C01B3/38 sobre producción de hidrógeno con catalizadores, H01M8/00 sobre pilas de combustible y B01J 7/00 equipos para la producción de gas. Así como la clasificación B01J sobre equipos para generación de gas.

[2] Las familias de patentes según el glosario de la OMPI son: "Un grupo de patentes equivalentes relacionadas con una invención específica forman una familia de patentes. Los miembros de una familia de patentes estrechamente relacionados tienen un número y una fecha de solicitud prioritaria comunes. Los miembros de las familias de patentes extensas son típicamente el resultado de relaciones complejas, pero comparten al menos una solicitud prioritaria común de países diferentes. O los miembros de familias de patentes extensas se pueden referir a relaciones resultantes de divisiones, de continuaciones o de continuaciones parciales".

Familias	Clasificación	Concepto
44	C01B	ELEMENTOS NO METALICOS; SUS COMPUESTOS
44	H01M	**PROCEDIMIENTOS O MEDIOS, p. ej. BATERÍAS, PARA LA CONVERSION DIRECTA DE LA ENERGIA QUIMICA EN ENERGIA ELECTRICA**
44	H01M 8/00	***Pilas de combustible; Su fabricación***
39	C01B 3/00	**Hidrógeno; Mezclas gaseosas que contienen hidrógeno; Separación del hidrógeno a partir de mezclas que lo contienen;**
38	H01M 8/06	·Combinación de pilas de combustible con medios para la producción de reactivos o para el tratamiento de residuos
36	H01M 8/04	*· Disposiciones o auxiliares, p. ej. para **controlar** la presión o para la circulación de **fluidos***
35	C01B 3/38	· · · · con catalizadores
32	B01J	PROCEDIMIENTOS QUIMICOS O FISICOS, p. ej. CATALISIS, QUIMICA DE LOS COLOIDES; APARATOS ADECUADOS
23	H01M 8/10	*·Pilas de combustible de electrolitos sólidos*
21	H01M 8/02	*·Partes constitutivas*
11	C01B 3/48	· · · · seguida por una reacción de vapor de agua con monóxido de carbono [2006.01]
10	C01B 3/26	· · · · con catalizadores
10	B01J 19/24	· Reactores fijos sin elementos internos móviles
10	B01J 7/00	**Equipos para la producción de gas**
9	C01B 3/02	· Producción de hidrógeno o de mezclas gaseosas que contienen hidrógeno
8	C01B 3/32	· · por reacción de compuestos orgánicos gaseosos o líquidos con agentes gasificantes, p. ej. agua, dióxido de carbono, aire
8	B01J 19/00	**Procedimientos químicos, físicos o físico-químicos en general**
7	B01J 8/02	· con partículas inmóviles, p. ej. en lechos fijos
6	B01J 8/04	· · pasando el fluido sucesivamente a través de dos o más lechos
5	C01B 3/36	· · · · con oxígeno o mezclas que contienen oxígeno como agentes gasificantes
5	H01M 8/18	·Pilas de combustible regenerativas, p. ej. baterías de flujo redox o pilas de combustibles secundarias
4	B01J 23/76	**Procedimientos químicos generales haciendo reaccionar un líquido con medios gaseosos distintos de los de en presencia de partículas sólidas; equipos especialmente adaptados a este efecto**
3	B01J 23/42	· · · Platino
3	B01J 23/72	· · Cobre

6.2.2. Nissan

En el anexo No. 2 se presenta una lista de los títulos de las 43 familias, de los resultados agrupados para Nissan Motor y Nissan Motor Co Ltd. El análisis por palabras clave muestra que Nissan ha investigado sobre Materiales para el almacenamiento de hidrógeno, métodos de producción de hidrógeno, almacenamiento de hidrógeno.

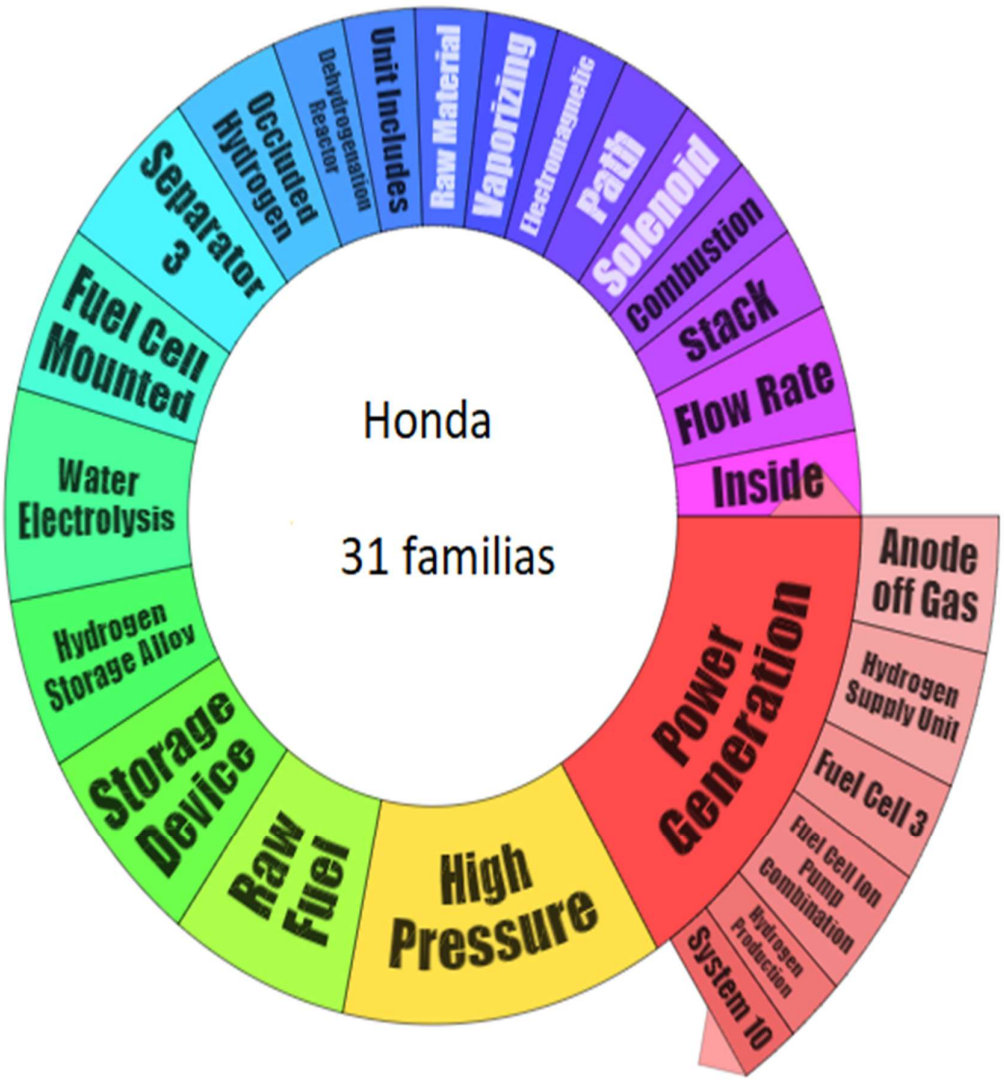


Se realizó un análisis por Clasificación Internacional de patentes en donde se observa que la mayoría de las patentes se encuentra en la clasificación C01B sobre producción de hidrógeno pro reacciones de compuestos orgánicos gaseosos y uso de catalizadores, y a partir del carbono. La clasificación H01M de baterías, dispositivos para el control de la presión, combinación de pilas con producción de reactivos. También podemos notar algunas tendencias en la clasificación F17C sobre patentes referentes a recipientes para contener o almacenar gases y la clasificación B01B sobre aparatos de ebullición y clasificación B01J sobre el uso de absorbentes.

Familias	Clasificación	Concepto
43	**C01B**	**ELEMENTOS NO METALICOS; SUS COMPUESTOS**
43	**C01B 3/00**	**Hidrógeno; Mezclas gaseosas que contienen hidrógeno; Separación del hidrógeno a partir de mezclas que lo contienen; Purificación del hidrógeno**
43	**H01M**	**PROCEDIMIENTOS O MEDIOS, p. ej. BATERÍAS, PARA LA CONVERSION DIRECTA DE LA ENERGIA QUIMICA EN ENERGIA ELECTRICA**
42	**H01M 8/00**	***Pilas de combustible; Su fabricación***
39	**H01M 8/04**	*· Disposiciones o auxiliares, p. ej. para **controlar** la presión o para la circulación de **fluidos***
27	**H01M 8/06**	·Combinación de pilas de combustible con medios para la producción de reactivos o para el tratamiento de residuos
23	**B01J**	PROCEDIMIENTOS QUIMICOS O FISICOS, p. ej. CATALISIS, QUIMICA DE LOS COLOIDES; APARATOS ADECUADOS
15	**C01B 3/38**	· · · · con catalizadores
13	**B01J 20/20**	·Composiciones absorbentes o adsorbentes sólidas o composiciones que facilitan la filtración; Sorbentes para cromatografía; Procedimientos para su preparación, regeneración o reactivación
12	**F17C**	**RECIPIENTES PARA CONTENER O ALMACENAR GASES COMPRIMIDOS, LICUADOS O SOLIDIFICADOS; GASOMETROS DE CAPACIDAD FIJA; LLENADO O DESCARGA DE RECIPIENTES CON GASES COMPRIMIDOS, LICUADOS O SOLIDIFICADOS**
12	**F17C 11/00**	Uso de disolventes o absorbentes de gases en recipientes
9	**B60L 11/18**	**Propulsión eléctrica por fuente de energía suministrada dentro del vehículo · que utilizan la energía suministrada por pilas primarias, pilas secundarias o pilas de combustibles**
9	**C01B 3/32**	· · por reacción de compuestos orgánicos gaseosos o líquidos con agentes gasificantes, p. ej. agua, dióxido de carbono, aire
8	**B60L**	**PROPULSION DE VEHICULOS PROPULSADOS ELECTRICAMENTE**
8	**C01B 31/00**	**Carbono; Sus compuestos**
8	**H01M 8/10**	*·Pilas de combustible de electrolitos sólidos*
7	**B01B**	EBULLICION; APARATOS DE EBULLICION
7	**B01B 1/00**	**Ebullición; Aparatos de ebullición para aplicaciones físicas o químicas**

6.2.3. Honda

En el anexo No. 3 se presenta una lista de los títulos de las 33 familias presentadas por Honda Motors Co Ltd. Se observa en el gráfico por palabras clave que la los generadores de energía con unidades de suministro de hidrógeno son las que más patentes ha generado, también el control de la alta presión de los gases y materiales para el almacenamiento de hidrógeno.

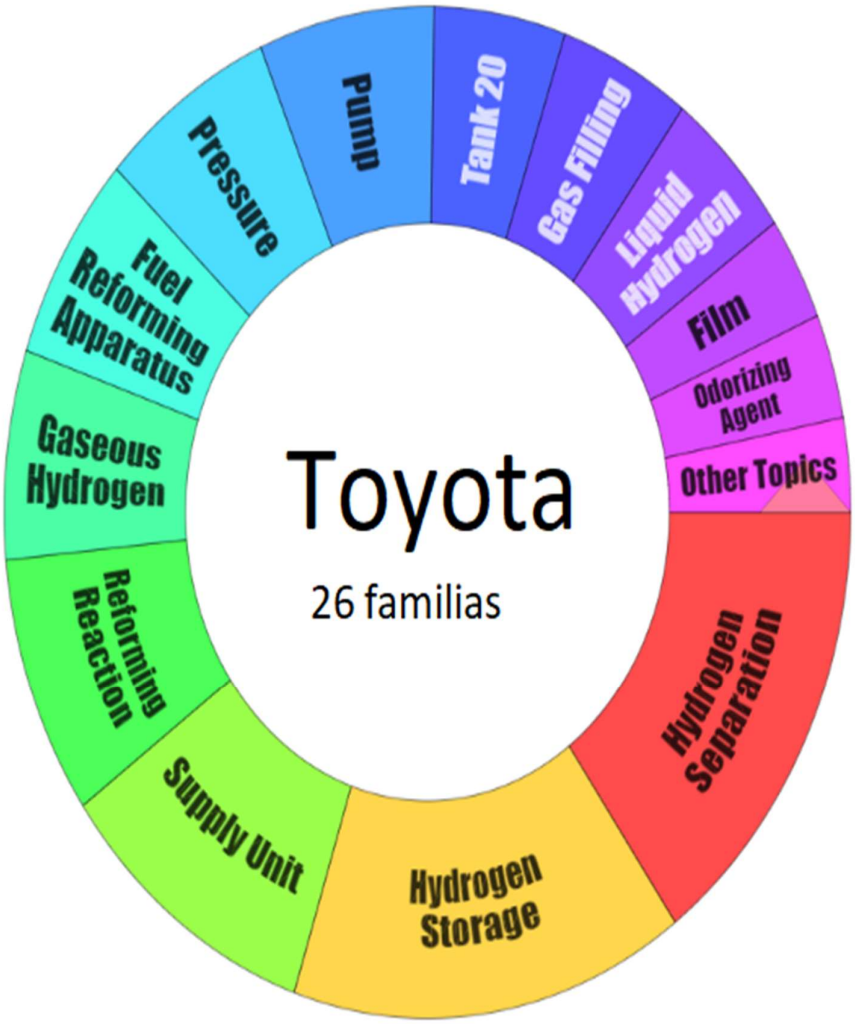


Se realizó un análisis por clasificación internacional de patentes encontrando que la clasificación más importante es la C01B sobre producción de hidrógeno pro reacciones de compuestos orgánicos gaseosos y uso de catalizadores. La clasificación H01M de baterías, dispositivos para el control de la presión, combinación de pilas con producción de reactivos y pilas de combustible de electrodos sólidos. También podemos notar algunas tendencias en la clasificación F17C de recipientes para contener o almacenar gases y para el llenado de gases comprimidos. Y la clasificación B60L sobre el suministro de energía eléctrica suministrada por pilas de combustibles.

Familias	Clasificación	Concepto
33	**C01B**	**ELEMENTOS NO METALICOS; SUS COMPUESTOS**
33	**C01B 3/00**	**Hidrógeno; Mezclas gaseosas que contienen hidrógeno; Separación del hidrógeno a partir de mezclas que lo contienen; Purificación del hidrógeno**
33	**H01M**	**PROCEDIMIENTOS O MEDIOS, p. ej. BATERÍAS, PARA LA CONVERSION DIRECTA DE LA ENERGIA QUIMICA EN ENERGIA ELECTRICA**
33	**H01M 8/00**	***Pilas de combustible; Su fabricación***
27	**H01M 8/06**	·Combinación de pilas de combustible con medios para la producción de reactivos o para el tratamiento de residuos
25	**H01M 8/04**	*· Disposiciones o auxiliares, p. ej. para **controlar** la presión o para la circulación de **fluidos***
14	**C01B 3/38**	· · · con catalizadores
13	**H01M 8/10**	*·Pilas de combustible de electrolitos sólidos*
11	**F17C**	**RECIPIENTES PARA CONTENER O ALMACENAR GASES COMPRIMIDOS, LICUADOS O SOLIDIFICADOS; GASOMETROS DE CAPACIDAD FIJA; LLENADO O DESCARGA DE RECIPIENTES CON GASES COMPRIMIDOS, LICUADOS O SOLIDIFICADOS**
7	**B60L**	Suministro de la energía eléctrica al equipo auxiliar de los vehículos propulsados eléctricamente
7	**B60L 11/18**	· que utilizan la energía suministrada por pilas primarias, pilas secundarias o pilas de combustibles
7	**C01B 3/32**	· · por reacción de compuestos orgánicos gaseosos o líquidos con agentes gasificantes, p. ej. agua, dióxido de carbono, aire
6	**C01B 3/56**	· · por contacto con sólidos; Regeneración de los sólidos usados
6	**F17C 5/06**	· para el llenado con gases comprimidos

6.2.4. Toyota

En el siguiente gráfico se muestran las 34 familias presentadas por Toyota Motor Corp. Y Toyota Jidosha KK. En el anexo No. 4 se presentan la lista de familias de patentes de Toyota. En el gráfico por palabras clave se observa que el mayor número de patentes se refieren a la separación del hidrógeno, almacenamiento de hidrógeno y unidades de suministro.



Al realizar el análisis por clasificación puede observarse la clasificación más importante es C01B sobre producción de hidrógeno por reacción con compuestos gasificantes con catalizadores y por contacto con sólidos y regeneración de sólidos y la clasificación H01M sobre producción de pilas de combustibles, con electrolitos sólidos, que funcionan con altas temperaturas. También observamos algunas tendencias en la Clasificación B60L sobre el suministro de energía eléctrica al equipo auxiliar de vehículos propulsados eléctricamente, que utilizan energía suministrada por pilas de combustibles. Y la Clasificación F02M sobre alimentación de motores de combustión con mezclas gaseosas.

Familias	Clasificación	Conceptos
26	**C01B**	**ELEMENTOS NO METALICOS; SUS COMPUESTOS**
26	**H01M**	PROCEDIMIENTOS O MEDIOS, p. ej. BATERÍAS, PARA LA CONVERSION DIRECTA DE LA ENERGIA QUIMICA EN ENERGIA ELECTRICA
25	**C01B 3/00**	**Hidrógeno; Mezclas gaseosas que contienen hidrógeno; Separación del hidrógeno a partir de mezclas que lo contienen; Purificación del hidrógeno**
22	**H01M 8/00**	Pilas de combustible; Su fabricación
21	**H01M 8/06**	·Combinación de pilas de combustible con medios para la producción de reactivos o para el tratamiento de residuos
20	**H01M 8/04**	· Disposiciones o auxiliares, p. ej. para controlar la presión o para la circulación de fluidos
10	**H01M 8/10**	·Pilas de combustible de electrolitos sólidos
9	**C01B 3/38**	· · · · con catalizadores
7	**B60L**	Suministro de la energía eléctrica al equipo auxiliar de los vehículos propulsados eléctricamente
7	**B60L 11/18**	· que utilizan la energía suministrada por pilas primarias, pilas secundarias o pilas de combustibles
5	**F02M**	ALIMENTACION EN GENERAL DE LOS MOTORES DE COMBUSTION CON MEZCLAS COMBUSTIBLES O CONSTITUYENTES DE LAS MISMAS
5	**H01M 8/02**	*·Partes constitutivas*
4	**C01B 3/02**	· Producción de hidrógeno o de mezclas gaseosas que contienen hidrógeno
4	**C01B 3/32**	· · por reacción de compuestos orgánicos gaseosos o líquidos con agentes gasificantes, p. ej. agua, dióxido de carbono, aire
4	**F02M 21/02**	· con combustibles gaseosos
3	**C01B 3/56**	· · por contacto con sólidos; Regeneración de los sólidos usados
3	**H01M 8/12**	*· ·que funcionan a alta temperatura, p. ej. con electrolito de ZrO_2 electrolito*

7. CONCLUSIONES

1. El estudio muestra la evolución por el análisis de la información de patentes en el desarrollo de celdas de combustión actualizada, para que pueda servir de base a los centros de investigación de los países de la Red CATI-CARD en la toma de decisiones sobre futuras líneas de investigación en esta temática.

2. Las investigaciones sobre el uso del hidrógeno se incrementaron desde el año 2000 teniendo un punto máximo en el año 2007, la mayoría de las investigaciones se ha centrado en la producción de hidrógeno y en las celdas de combustión.

3. Con el análisis de la información se puede inferir por la cantidad de patentes que se genera en la temática que los países donde se invierte más en investigación, desarrollo e innovación sobre el uso del hidrógeno como combustible son Japón, Estados Unidos y China.

4. Los principales solicitantes de patentes sobre hidrógeno son Samsung, Nissan, Honda y Toyota.

5. Samsung ha presentado 44 familias de patentes relacionadas con celdas de combustión e hidrógeno, además 32 familias de patentes de la clasificación B01J sobre equipos de generación de gas y 10 familias B01J 7/00 de equipos para la producción de gas.

6. Nissan ha presentado 43 familias de patentes relacionadas con celdas de combustión e hidrógeno. Además 12 familias sobre la clasificación F17C sobre recipientes para contener o almacenar gases; 7 familias de la clasificación B01B sobre aparatos de ebullición y 23 familias de la clasificación B01J sobre el uso de absorbentes.

7. Honda ha presentado 31 familias de patentes relacionadas con celdas de combustión e hidrógeno, además de 7 familias que corresponde a la clasificación F17C de recipientes para contener o almacenar gases y para el llenado de gases comprimidos. Y 11 familias de la clasificación B60L sobre el suministro de energía eléctrica suministrada por pilas de combustibles.

8. Toyota ha presentado 26 familias de patentes relacionadas con celdas de combustión e hidrógeno, además ha presentado 7 familias que corresponden a la clasificación B60L sobre el suministro de energía eléctrica al equipo auxiliar de vehículos propulsados eléctricamente, que utilizan energía suministrada por pilas de combustibles. Y 9 familias en la Clasificación F02M sobre alimentación de motores de combustión con mezclas gaseosas.

ANEXO NO. 1
FAMILIAS DE PATENTES PRESENTADAS POR SAMSUNG

TITULAR	SAMSUNG	
MasterPN	**TI**	**AB**
JP2009158166A	DEHYDRATION METHOD AND DEHYDRATION SYSTEM FOR ALCOHOL-CONTAINING AQUEOUS SOLUTION ;	Source: JP2009158166A [EN] PROBLEM TO BE SOLVED: To provide a dehydration method and a dehydration system for an alcohol-containing aqueous solution, which improve throughput per unit time and improve energy efficiency without discharging carbon dioxide. SOLUTION: The dehydration method of an alcohol-containing aqueous solution includes: a first step of evaporating an alcohol-containing aqueous solution and obtaining its steam, by heat generated at the time of operating a fuel cell; a second step of obtaining a process liquid raised in an alcohol concentration by separating water component and a process liquid lowered in an alcohol concentration by separating alcohol component, by supplying the steam to a film capable of separating the steam to an alcohol component and a water component; and a third step of reusing hydrogen and oxygen formed by base electrolysis which is carried out to the process liquid lowered in an alcohol concentration by electricity generated at the time of operating the fuel cell, as fuel gas and oxidation gas of the fuel cell, respectively. ;
KR20070075040A	FUEL CELL SYSTEM HAVING WATER SUPPLY APPARATUS FOR REFORMER ;	Source: KR20070075040A [EN] A fuel cell system is provided to effectively condense, in a condenser, water vapor generated from a reforming step of hydrogen-containing fuel in a reformer and feed the condensed water to a reformer without operating a water pump, etc. The fuel cell system comprises: an electricity generator part(10) which generates electricity by an electrochemical reaction of hydrogen and oxygen; an air supply part which feeds oxygen-containing gas to the electricity generator part(10); a reformer(52) which produces reformed gas containing, as a main component, hydrogen to be supplied to the electricity generator part(10); and gas-liquid separators(62) which are provided between the electricity generator part(10) and the reformer(52) and capture water vapor to be generated from a production step of the reformed gas. ;
KR20080017991A	HEATING UNIT FOR REFORMER USED IN FUEL CELL, AND FUEL CELL SYSTEM COMPRISING SAME ;	Source: KR20080017991A [EN] A heating source part for a fuel cell reformer is provided to construct the heating source part in a simple structure and enable an oxidation catalytic reaction of fuel to be carried out even at a room temperature, and a fuel cell system comprising the heating source part for the fuel cell reformer is provided. A fuel cell system(100) comprises: a reformer(30) including a heating source part(35) for a fuel cell reformer, and a reforming reaction part(39) for generating hydrogen gas from the mixed fuel through a reforming catalytic reaction, the heating source part for the fuel cell reformer comprising an oxidation catalyst, and a mixed fuel supplied from the fuel supply part, the mixed fuel which is a mixture of carbon-based fuel and hydrogen; at least one electricity generating part(11) for generating electric energy through an electrochemical reaction of the hydrogen gas and an oxidizer; a fuel supply part(50) for supplying the mixed fuel into the reforming reaction part; and an oxidizer supply part(70) for supplying the oxidizer into the electricity generating part. ;
US2005191532A	REFORMER FOR FUEL CELL SYSTEM AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2005191532A [EN] A fuel cell system that includes at least one electricity generator that generates electric energy through electrochemical reaction between hydrogen and oxygen, a reformer that generates hydrogen gas by reforming fuel containing hydrogen and supplies the hydrogen gas to the electricity generator, a fuel supply unit which supplies the fuel to the reformer, and an oxygen supply unit which supplies oxygen to the electricity generator and the reformer. The reformer includes a double pipe lines that are arranged concentrically and have independent flow paths through which fuel passes, and catalytic layers that are formed in the flow paths, generate thermal energy through chemical catalytic reaction, and generate hydrogen gas from the fuel. ;
US2005191533A	REFORMER FOR FUEL CELL SYSTEM AND FUEL CELL SYSTEM HAVING THE SAME	Source: US2005191533A [EN] A reformer of a fuel cell system and a fuel cell system including a reformer are disclosed. The reformer includes a reformation unit comprising a pipe through which fuel passes. The pipe is formed from a material adapted to induce a catalytic reformation reaction in the pipe. The reformer includes a heat source unit for heating and evaporating the fuel by heating the pipe. The fuel cell system includes such a reformer, a stack for generating electricity through an electro-chemical reaction between oxygen and hydrogen, a fuel supply unit, and an air supply unit.

US2005191534A	FUEL CELL HEAT RECOVERING REFORMER AND SYSTEM ;	Source: US2005191534A [EN] A fuel cell system includes a reformer for reforming fuel and generating hydrogen gas. A stack generates electricity through an electrochemical reaction between the hydrogen gas and oxygen. A fuel supply unit supplies fuel to the reformer. An air supply unit supplies air to the reformer and the stack. The reformer includes a reformation reactor unit for generating the hydrogen gas and a heat-insulating unit including a vacuum area covering the reformation reactor unit and recovering heat generated from the reformation unit.
US2005193628A	FUEL CELL SYSTEM AND REFORMER THEREFOR ;	Source: US2005193628A [EN] A fuel cell system includes a stack for generating electrical energy by a reaction of the hydrogen and oxygen, a reformer for generating hydrogen gas from fuel through a chemical catalytic reaction by thermal energy, a fuel supply assembly for supplying fuel to the reformer, and an air supply assembly for supplying air to the reformer and the stack. The reformer includes a plurality of reactors having a channel, respectively, and being stacked.
US2005210748A	REFORMER AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2005210748A [EN] A reformer for a fuel cell system includes a reforming portion for converting fuel containing hydrogen into hydrogen-rich gas; and an adiabatic portion entirely covering the reforming portion, the adiabatic portion being composed of first and second adiabatic layers arranged opposing each other with at least one spacer interposed between the first and second adiabatic layers. As such, the fuel cell system has an effect of enhancing the adiabatic performance of a thermal reaction for producing reforming gas and distributing thermal residence stress uniformly on the surface of the reformer.
US2005238933A	FUEL PROCESSING DEVICE, FUEL CELL SYSTEM HAVING THE SAME, AND METHOD OF DRIVING THEREOF ;	Source: US2005238933A [EN] The present invention provides a fuel cell system that comprises a stack that generates electricity through a reaction between hydrogen and oxygen and a fuel processing device that is connected to the stack to generate the hydrogen from fuel and supplies the hydrogen to the stack. It further comprises a fuel supply unit that supplies the fuel to the fuel processing device and an air supply unit that supplies air to the stack and the fuel processing unit, respectively. The fuel processing device comprises a first reformer that generates byproducts along with the hydrogen through an electrolysis reaction of the fuel using electric energy and a second reformer that generates the hydrogen through a reformation reaction of the fuel using thermal energy. ;
US2005252002A	REFORMER FOR FUEL CELL SYSTEM, FABRICATION METHOD THEREOF, AND FUEL CELL SYSTEM COMPRISING THE SAME ;	Source: US2005252002A [EN] A reformer for a fuel cell system, a fabrication method thereof, and a fuel cell system are provided. The reformer includes a plurality of reaction substrates. The reaction substrates each have a reaction substrate body provided with a flow channel with micropores formed on the surface of the flow channel. In addition, a catalyst layer may be formed within the flow channel of the reaction substrate body. Since the reformer for a fuel cell system suggested in the present invention includes reaction substrates having micropores formed in the flow channel, it has a high specific surface area and high catalyst activity. Moreover, since the catalyst layer is formed by a deposition method, the reformer can be of a small proportion, occupying little space in the fuel cell system. ;
US2005252081A	REFORMER FOR FUEL CELL SYSTEM AND METHOD OF MANUFACTURING REACTION SUBSTRATE USED FOR THE SAME ;	Source: US2005252081A [EN] There is provided a reformer for a fuel cell system, the reformer comprising: a reforming unit having a reaction substrate in which a catalyst layer is formed in a plurality of flow channels for allowing fuel to flow and for generating hydrogen through a reformation reaction of the fuel using thermal energy. When viewing a cross-section perpendicular to the flow direction of the flow channels, the reaction substrate defines each flow channel by a bottom portion and a pair of wall portions extending from the sides of the bottom portion, and a joint between the bottom portion and the wall portion is formed in a rounded shape. There is also provided a method of manufacturing a reaction substrate used for a reformer for a fuel cell system, the method comprising: (a) preparing a substrate; (b) anisotropically etching the upper surface of the substrate and forming a channel pattern of which a bottom portion and a wall portion are perpendicular to each other; (c) isotropically etching the channel pattern and forming a flow channel of which the joints between the bottom portion and the wall portions are rounded; (d) forming a support layer on the surface of the flow channel; and (e) forming a catalyst layer on the support layer. ;
US2005271907A	REFORMER AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2005271907A [EN] There is provided a fuel cell system comprising: a stack for generating electric energy through a reaction between hydrogen and oxygen; a reformer for generating hydrogen from fuel through a catalytic reaction of the fuel using thermal energy and for supplying the generated hydrogen to the stack; a fuel supply unit for supplying the fuel to the reformer; and an oxygen supply unit for supplying oxygen to the reformer and the stack. The reformer comprises: a tubular reactor body; a heat source section which is formed in the inner space of the tubular reactor body and which generates thermal energy in a predetermined temperature range through an oxidation reaction of fuel; a reforming reaction section which is

		formed successive to the heat source section and which generates hydrogen from the fuel through a reforming reaction using the thermal energy; and a heat delivery unit which is provided in contact with the tubular reactor body and which delivers the thermal energy to the fuel supplied to the reforming reaction section. ;
US2005284022A	REFORMER FOR FUEL CELL SYSTEM AND FUEL CELL SYSTEM COMPRISING THE SAME ;	Source: US2005284022A [EN] A reformer for a fuel cell and a fuel cell system including the same are shown. The reformer includes a heat source for providing heat to evaporate a mixed fuel and having a predetermined flow path length through which the mixed fuel passes and a catalyst layer lining the internal surface of the flow path, and a reforming reactor for generating hydrogen gas from the mixed fuel through a chemical catalytic reaction by the heat and having a predetermined flow path length through which the mixed fuel passes and a catalyst layer lining the internal surface of the flow path. Either the heat source, or the reforming reactor, or both are formed from an alloy of a barrier layer forming metal and a mechanical strength enhancing metal. ;
US2006003202A	REFORMER AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2006003202A [EN] A fuel cell system including: a reformer for generating hydrogen from a fuel containing hydrogen; at least one electricity generator for generating electric energy through an electrochemical reaction between hydrogen and oxygen; a fuel supply unit for supplying the fuel to the reformer; and an oxygen supply unit for supplying oxygen to the reformer and the electricity generator. Here, the reformer includes a plurality of plates stacked to form at least one passage for allowing a material selected from the group consisting of the fuel and a gas to flow therethrough, and at least one catalyst layer formed on entire surfaces of the at least one passage. ;
US2006008398A	FUEL CELL SYSTEM, REFORMER USED FOR THE SAME, AND METHOD OF MANUFACTURING THE SAME ;	Source: US2006008398A [EN] A fuel cell system includes: a reformer for generating hydrogen from hydrogen-containing fuel; at least one electricity generator for generating electric energy through an electrochemical reaction of hydrogen and oxygen; a fuel supply unit for supplying the fuel to the reformer; and an oxygen supply unit for supplying the oxygen to the reformer and the at least one electricity generator. The reformer includes: a plurality of reaction sections, wherein at least one of the reaction sections has a channel; at least one cover plate; and a bonding joint between two of the reaction sections and between the at least one of the reaction sections and the at least one cover plate to couple the at least one of the reaction sections and the at least one cover plate to each other. ;
US2006008683A	REFORMER AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2006008683A [EN] There is provided a fuel cell system comprising: a reformer for generating a hydrogen gas stream from fuel through a catalytic chemical reaction using thermal energy; and a stack for generating electric energy through a reaction between the hydrogen gas stream and oxygen. The reformer includes: a first reaction section for generating thermal energy through an oxidation reaction of fuel during start-up of the fuel cell system; a second reaction section which communicates with the first reaction section and which generates the hydrogen gas stream from the fuel through a reforming reaction using the thermal energy; and a third reaction section which communicates with the first and second reaction sections, and which generates thermal energy through an oxidation reaction of carbon monoxide contained in the hydrogen gas stream, thereby reducing the concentration of carbon monoxide in the hydrogen gas stream. ;
US2006008684A	REFORMER, FUEL CELL SYSTEM HAVING THE SAME, AND METHOD OF MANUFACTURING THE SAME ;	Source: US2006008684A [EN] A fuel cell system includes: a reformer adapted to generate hydrogen from a fuel containing hydrogen through a chemical catalytic reaction using thermal energy; at least one electricity generator adapted to generate electric energy through an electrochemical reaction of hydrogen and oxygen; a fuel supply unit adapted to supply the fuel to the reformer; and an air supply unit adapted to supply oxygen to the reformer and the at least one electricity generator. The reformer includes a plurality of plates stacked with each other and forming at least one passage adapted to allow a fuel or a gas to flow therethrough and at least one catalyst layer coated on inner surfaces of the at least one passage. In the reformer, the at least one catalyst layer is formed to have a plurality of grooves extending substantially in a same direction as of the at least one passage. ;

US2006014056A	REFORMER AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2006014056A [EN] A fuel cell system comprises a reformer for generating hydrogen from fuel, at least one electricity generator for generating electric energy through an electrochemical reaction between hydrogen and oxygen, a fuel supply unit for supplying the fuel to the reformer and an oxygen supply unit for supplying oxygen to the electricity generator. The reformer includes a main body which has an inner space with a reformer inlet and a reformer outlet. A reaction section is disposed within the inner space of the main body. The reaction section includes a heat-generating element for generating thermal energy from externally applied energy such as electrical current. The heat-generating element has a corrugated structure with a catalyst layer formed on the surface. The corrugated structure defines a plurality of flow passages for the fuel and encourages both even flow distribution and turbulent flow. ;
US2006014061A	REFORMER AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2006014061A [EN] A reformer of a fuel cell system is provided. The reformer includes a reforming reaction section constructed with a plurality of pipelines having independent internal spaces to generate hydrogen from a fuel, and a housing assembly surrounding the reforming reaction section to circulate the fuel around an outer surface of the reforming reaction section to preheat the fuel before it is supplied to the reforming reaction section.
US2006051262A	REFORMER AND FUEL CELL SYSTEM HAVING THE SAME ;	Source: US2006051262A [EN] A fuel cell system is provided comprising: a reformer for generating hydrogen from hydrogen-containing fuel; and at least one electricity generator for generating electric energy through an electrochemical reaction of hydrogen and oxygen. The reformer includes a main body in which a plurality of reaction sections for generating hydrogen from hydrogen-containing fuel is integrally formed. A heating section is disposed in contact with the main body in order to supply different amounts of thermal energy to the plurality of reaction sections. ;
US2006154123A	BURNER FOR A REFORMER OF A FUEL CELL SYSTEM, AND REFORMER AND FUEL CELL SYSTEM WITH THE SAME ;	Source: US2006154123A [EN] A burner for a reformer of a fuel cell system includes a body having a catalyst inside thereof; and a heating member partially embedded within the catalyst to provide an auxiliary thermal source to the catalyst. ;
US2006165995A	CARBON-METAL COMPOSITE MATERIAL AND PROCESS OF PREPARING THE SAME ;	Source: US2006165995A [EN] A carbon-metal composite material which has improved conductivity, specific surface area, regularity, a shape which is easily controlled, and a process of preparing the same. The carbon-metal composite material which includes carbon and metal, has a sheet resistance of 8 mOmega/sq. or less under a pressure of 100 kgf/cm2, a specific surface area of 30 m2/g or greater, and shows an X-ray pattern having at least one peak at d-spacings of 6 nm or greater. ;
US2006234095A	PLATE TYPE REFORMER AND FUEL CELL SYSTEM INCLUDING THE REFORMER ;	Source: US2006234095A [EN] In a plate type reformer and a fuel cell system including the plate type reformer, the plate type reformer includes: a plate type combustion reactor including a distributing plate having a distributing chamber with a plurality of distributing holes adapted to supply an oxidizing agent, and a combustion plate having a combustion chamber with an oxidizing catalyst layer adapted to generate heat energy in response to the oxidizing agent supplied through the distributing holes of the distributing plate reacting with fuel; a plate type preheater including a channel adapted to introduce a mixed fuel of fuel and water is introduced, the plate type preheater adapted to preheat the mixed fuel with the heat energy generated in the plate type combustion reactor; and a plate type reforming reactor with a reforming catalyst layer adapted to generate hydrogen gas from the mixed fuel preheated by the plate type preheater, the plate type reforming reactor effecting a reforming reaction using the heat energy of the plate type combustion reactor. The plate type combustion reactor is arranged and stacked between the plate type preheater and the plate type reforming reactor and adapted to directly transfer the heat energy from the plate type combustion reactor to the plate type preheater and the plate type reforming reactor. ;
US2006292408A	FUEL CELL SYSTEM AND METHOD OF OPERATION THEREOF ;	Source: US2006292408A [EN] Disclosed are a fuel reforming system and a fuel cell system having the same, which comprises a reformer to generate a reformed gas mainly containing hydrogen from a hydrogen containing fuel; and a CO remover to remove carbon monoxide from the reformed gas, wherein a ratio of an opening area of an inlet to an opening area of an outlet ranges from 1:1.5 to 1:3. Thus, the opening area of the inlet for the reforming fuel is larger than that of the outlet for the reformed gas, so that the reformed gas is smoothly discharged from the reformer without stagnating in the channel, thereby enhancing the reforming efficiency of the reformer. ;

US2007020161A	CATALYST FOR REFORMER USED IN FUEL CELL SYSTEM, REFORMER, AND FUEL CELL SYSTEM COMPRISING SAME ;	Source: US2007020161A [EN] A catalyst for a reformer of a fuel cell system, a reformer for a fuel cell system including the catalyst, and a fuel cell system including the reformer are provided. The reformer includes a first reacting region that generates heat energy through oxidation of fuel and includes an oxidation catalyst having a Pd catalyst supported by an Al2O3 carrier and a Pt catalyst supported by an Al2O3 carrier, and a second reacting region that generates hydrogen gas from the fuel through a reforming reaction by the heat energy. The reformer includes at least two pipes each having an independent internal space and letting the fuel containing hydrogen pass therethrough. ;
US2007082238A	REFORMER AND FUEL CELL SYSTEM USING THE SAME ;	Source: US2007082238A [EN] A reformer that directly receives heat and performs an ATR catalyst reaction and an SR catalyst reaction. The reformer includes: a reforming reactor to reform hydrogen containing fuel into reformed gas having abundant hydrogen by performing an ATR catalyst reaction and an SR catalyst reaction; a heat source contacting one side of the reforming reactor and providing the reforming reactor with heat; and an air feeder to feed the reforming reactor with air by an air flow control unit. Thus, the ATR catalyst reaction featuring a relatively short preheating time is performed while the reformer is initially operated, so that hydrogen can be produced when the reformer is initially operated, thereby efficiently operating a fuel cell. ;
US2007092765A	HEATER FOR FUEL REFORMING REACTOR AND FUEL CELL SYSTEM USING THE SAME ;	Source: US2007092765A [EN] Disclosed is a fuel reforming system, which includes a heater to combustion fuel that mainly contains butane gas and a reformer to receive heat energy from the heater. The reformer produces reformed gas that mainly contains hydrogen from reforming fuel that mainly contains butane gas. An igniter has an electrode inserted into the burner. The igniter ignites the fuel such as butane gas. ;
US2007154366A	HYDROGEN GENERATOR HAVING DOUBLE BURNERS AND METHOD OF OPERATING THE SAME ;	Source: US2007154366A [EN] A hydrogen generator having double burners and a method of operating the samewhere the hydrogen generator includes a housing, a barrier wall to divide a space in the housing into a first chamber and a second chamber, a fuel reformer installed in the first chamber, a first burner installed in the first chamber to heat a fuel reformer, a shift reactor installed in the second chamber, a second burner mounted in the barrier wall to heat the shift reactor, and a first igniter and a second igniter respectively ignite the first burner and the second burner. ;
US2007166580A	FUEL REFORMING SYSTEM HAVING MOVABLE HEAT SOURCE AND FUEL CELL SYSTEM COMPRISING THE SAME ;	Source: US2007166580A [EN] A fuel reforming system and a fuel cell system including the same, the fuel reforming system including: a fuel reformer adapted to produce a reformed gas having hydrogen as a main component from a fuel containing hydrogen; a carbon monoxide (CO) remover adapted to remove carbon monoxide from the reformed gas; a heat source adapted to supply heat energy to the reformer and the CO remover; and a moving unit adapted to move the heat source between the fuel reformer and the CO remover. With this configuration, the fuel reformer and the CO remover can be directly heated by a heat source. Then, when the temperature of the CO remover reaches a catalyst activation temperature, the heat source can be moved to directly heat only the fuel reformer, thereby enhancing a reforming effect and a power generation efficiency of the fuel reforming system. ;
US2007190376A	CATALYST FOR A WATER GAS SHIFT FOR A FUEL CELL SYSTEM, A METHOD OF PREPARING THE SAME, AND A FUEL CELL SYSTEM INCLUDING THE SAME ;	Source: US2007190376A [EN] The water gas shift catalyst for a reformer of a fuel cell system where a supporter includes a clay and ZnO filled between layers of the clay; and an active material including CuO supported on the supporter. ;
US2007202366A	METHOD FOR STARTING HIGH TEMPERATURE POLYMER ELECTROLYTE MEMBRANE FUEL CELL STACK AND FUEL CELL SYSTEM USING THE SAME METHOD ;	Source: US2007202366A [EN] Disclosed are a method for efficiently starting a high temperature polymer electrolyte membrane fuel cell stack and a fuel cell system using the same method. The high temperature polymer electrolyte membrane fuel cell stack electrochemically oxidizes a fuel received from a fuel reformer to generate electricity, operates at high temperature, and does not require external steam. The method for starting the high temperature polymer electrolyte membrane fuel cell stack preheats the stack through a heating block coupled to the stack, senses the temperature of the stack, compares the sensed temperature of the stack with a reference temperature, and supplies off-gas from the fuel reformer to the stack according to the results of comparison. Thus, the conductive heat of the heating block and the high temperature off-gas of the fuel reformer are used in sequence, thereby reducing a cost and preventing the electrolyte membrane from being damaged. ;

US2007269691A	REFORMER WITH OXYGEN SUPPLIER AND FUEL CELL SYSTEM USING THE SAME ;	Source: US2007269691A [EN] A reformer comprises an oxygen supplying unit that supplies oxygen having a high purity, a combustion reacting unit that burns oxygen and a combustible fuel, a reforming reacting unit that converts a hydrogen-containing reforming fuel into a reforming gas comprising molecular hydrogen using heat generated from combustion reacting unit, and a carbon monoxide removing unit that removes carbon monoxide contained reforming gas. Accordingly, the present invention is capable of more rapidly generating hydrogen having a high purity from an initial startup of a fuel cell in a reformer. ;
US2008010900A	REFORMER BURNER ;	Source: US2008010900A [EN] A reformer burner that includes a fuel supply tube through which a fuel is supplied and a fuel supply chamber that surrounds the fuel supply tube and has a plurality of atomizing holes to atomize a fuel into a combustion chamber of a reformer. ;
US2008038603A	FUEL PROCESSOR HAVING DESULFURIZER WITH SULFER SENSOR, FUEL CELL SYSTEM INCLUDING THE FUEL PROCESSOR, AND METHOD OF OPERATING THE FUEL CELL SYSTEM ;	Source: US2008038603A [EN] A fuel processor and a fuel cell system which have a desulfurizer with multiple sensors, and a method of measuring an adsorbent state in of an adsorbent the desulfurizer The desulfurizer determines the saturation state of the adsorbent using a signal difference between at least two sensors installed adjacent to an inlet and an outlet of the desulfurizer. The desulfurizer provides an accurate determination of the saturation of the adsorbent, and can be used to determine when the adsorbent should be changed. Two desulfurizers can be alternatively used to allow for a consistent fuel flow. ;
US2008044699A	FUEL PROCESSOR HAVING CARBON MONOXIDE REMOVING UNIT AND METHOD OF OPERATING THE SAME ;	Source: US2008044699A [EN] A fuel processor having a CO removal unit including an apparatus for warming a CO shifter, is provided. A method of using the fuel processor is also provided. The fuel processor includes a reformer that extracts hydrogen gas from a raw fuel by reacting the raw fuel with water. A burner heats up the reformer to a temperature suitable for extracting the hydrogen gas. A CO shifter removes CO produced during the extraction reaction from the hydrogen gas, and a medium path line in which a heat exchange medium disposed therein absorbs heat from the reformer and passes the heat to the CO shifter. A fuel processor having the above structure can greatly reduce the time required to increases the temperature of the CO shifter to an appropriate operating temperature at an early stage of start up, since a rapid heating of the CO shifter is possible using the heat exchange of steam. ;
US2008096062A	REFORMER OF FUEL CELL SYSTEM AND METHOD OF CONTROLLING THE SAME ;	Source: US2008096062A [EN] A reformer for a fuel cell system, and a method of controlling the reformer. The reformer includes a cylindrical reforming catalyst; a burner disposed inside of the reforming catalyst and comprising a plurality of nozzles to direct flames at the reforming catalyst; a nozzle covering element to selectively cover a portion of each of the nozzles; a combustion fuel supply valve to change the amount of a combustion fuel that is supplied to the burner; and a controller that controls the nozzle covering units and the combustion supply valve. The method of controlling the reformer includes: moving the nozzle covering element to cover a decreasing portion of each of the nozzles in response to an increasing amount of the combustion fuel being supplied to the burner; and moving the nozzle covering element to cover a increasing portion of each of the nozzles in response to a decreasing amount of the combustion fuel supplied to the burner. ;
US2008187801A	FUEL OXIDIZING CATALYST, METHOD FOR PREPARING THE SAME, REFORMER INCLUDING THE SAME, AND FUEL CELL SYSTEM INCLUDING THE SAME ;	Source: US2008187801A [EN] A fuel oxidizing catalyst, a method of preparing the same, and a reformer and a fuel cell system including the same. In one embodiment, the fuel oxidizing catalyst for a fuel cell includes CeO2, MO (wherein M is a transition metal), and CuO. In this embodiment, the fuel oxidizing catalyst has a relatively high (or excellent) catalytic activity for a fuel oxidizing catalyst reaction and performs a fuel oxidizing catalyst reaction at a relatively low temperature even though it does not include a noble metal. ;
US2008193809A	HYDROGEN GENERATING APPARATUS AND FUEL CELL POWER GENERATION SYSTEM ;	Source: US2008193809A [EN] An aspect of the present invention features a hydrogen generating apparatus. The apparatus can comprise an electrolyzer that is filled with an aqueous electrolyte solution containing hydrogen ions; a first electrode that is accommodated in the electrolyzer, submerged in the aqueous electrolyte solution, and generates electrons; a second electrode that is accommodated in the electrolyzer, submerged in the aqueous electrolyte solution, and receives the electrons to generate hydrogen; and a control unit that is disposed between the first electrode and the second electrode, and controls the amount of electrons transferred from the first electrode to the second electrode. The hydrogen generating apparatus according to the present invention can control the amount of hydrogen generation by controlling the amount of the electric current between electrodes according to the demand of a user or a fuel cell. Therefore, the present invention can be applied to a mobile device, in which power consumption varies depending on circumstances. ;

US2008199744A	HYDROGEN GENERATING APPARATUS, FUEL CELL POWER GENERATION SYSTEM, METHOD OF CONTROLLING HYDROGEN GENERATING QUANTITY AND RECORDED MEDIUM RECORDED PROGRAM PERFORMING THE SAME ;	Source: US2008199744A [EN] The present invention discloses a hydrogen generating apparatus that is capable of controlling the amount of hydrogen generation. The hydrogen generating apparatus in accordance with an embodiment of the present invention has an electrolyzer, which is filled with an aqueous electrolyte solution containing hydrogen ions, a first electrode, which is accommodated in the electrolyzer, is submerged in the aqueous electrolyte solution, and generates electrons, a second electrode, which is accommodated in the electrolyzer, is submerged in the aqueous electrolyte solution, and receives the electrons to generate hydrogen, a switch, which is located between the first electrode and the second electrode, a flow rate meter, which measures an amount of hydrogen generation in the second electrode, and a switch controller, which receives a set value, compares the amount of hydrogen generation measured by the flow rate meter with the set value, and controls an on/off status of the switch. The amount of hydrogen generation can be controlled by use of on/off time and/or on/of frequency of the switch. ;
US2008206613A	REFORMER FOR FUEL CELL, AND FUEL CELL SYSTEM COMPRISING THE SAME ;	Source: US2008206613A [EN] A reformer for a fuel cell system includes a heating source for generating heat by a reaction of a fuel and an oxidant using an oxidizing catalyst, and a reforming reaction part for generating hydrogen by a reforming catalyst reaction. The oxidizing catalyst includes a solid acid, including a strong acid ion and an inorganic oxide, and a platinum-based metal. The reformer for a fuel cell system can start a fuel oxidation catalyst reaction at a low temperature with the heating source having a simplified structure. ;
US2008268306A	HYDROGEN GENERATING APPARATUS FUEL CELL POWER GENERATION SYSTEM ;	Source: US2008268306A [EN] A hydrogen generating apparatus and a fuel cell power generation system are disclosed. The hydrogen generating apparatus may include: an electrolyte bath, which contains an electrolyte solution; a first electrode, which is coupled to one side within the electrolyte bath, and which is configured to generate electrons; and a second electrode, which is coupled to the one side within the electrolyte bath with a predetermined distance from the first electrode, and which is configured to generate hydrogen using the electrons and the electrolyte solution. The apparatus can be structured to have electrodes and conductive coating layers secured to the inside of the electrolyte bath, to reduce resistance between the electrodes and an external circuit and facilitate the movement of electrons. ;
US2008268312A	DESULFURIZING DEVICE FOR FUEL CELL AND FUEL CELL SYSTEM INCLUDING THE SAME ;	Source: US2008268312A [EN] A desulfurizing device for a fuel cell includes a dehydrating element for absorbing moisture in a hydrocarbon fuel, and a desulfurizing element for absorbing a sulfur compound included in the hydrocarbon fuel that flows out of the dehydrating element. In another embodiment, the desulfurizing device for a fuel cell includes a dehydrating element for absorbing moisture included in a fuel, and a desulfurizing element. The desulfurizing element absorbs a sulfur compound included in the fuel flowing out of the dehydrating element if temperature of the desulfurizing element is below a predetermined temperature, and the desulfurizing element desorbs a sulfur compound included in the desulfurizing element whenever the desulfurizing element is heated above the predetermined temperature. ;
US2008318096A	HYDROGEN GENERATING APPARATUS AND FUEL CELL POWER GENERATION SYSTEM ;	Source: US2008318096A [EN] A hydrogen generating apparatus can include an absorbent layer that absorbs an aqueous solution, a metal membrane deposited on either side of the absorbent layer such that the absorbent layer is interposed between the metal membranes, and a support layer formed on one side of one of the metal membranes that transports hydrogen generated by a reaction between the aqueous solution and the metal membrane. A batch type reaction may thus be implemented between the aqueous solution and the metal membranes, so that the reaction can be controlled to provide an even rate of hydrogen generation. Possible disturbances to the reaction resulting from by-products can be prevented, and since there is no additional equipment required, the volume and weight of the fuel cell power generation system can be reduced, and the extra power consumption by the additional equipment can be avoided. ;
US2009081499A	ELECTROLYTE SOLUTION FOR HYDROGEN GENERATING APPARATUS AND HYDROGEN GENERATING APPARATUS COMPRISING THE SAME ;	Source: US2009081499A [EN] The invention provides an electrolyte solution for hydrogen generating apparatus including water; at least one ionizing compound; and at least one cation exchange resin, as well as a hydrogen generating apparatus that includes the electrolyte solution. The electrolyte solution for hydrogen generating apparatus according to the invention can increase the time and amount of hydrogen generation by reducing an amount of metal hydroxide generation. ;

ANEXO NO. 2
FAMILIAS DE PATENTES PRESENTADAS POR NISSAN

Titular	NISSAN	
MasterPN	**TI**	**AB**
FR2886766B	SYSTEME DE PILE A COMBUSTIBLE PERFECTIONNE ET PROCEDE DE PRODUCTION D'EAU ASSOCIE	Source: FR2886766A [EN] The system has a fuel cell (1) supplied by oxygen and hydrogen, and a reformer (2) equipped with a burner (3) delivering hydrogen to the cell. A water condensation unit (4) collects gas from the cell and the burner to extract water from the gas and to deliver the water to the reformer. The condensation unit has a condenser (25) communicating with a heat recuperator (24) including an input to receive the gas from the cell in the input. The recuperator cools the gas from the cell or the burner, and a coolant circulation loop (28) cools the condenser. An independent claim is also included for a method for the production of water for a fuel cell system embarked at an edge of a motor vehicle
JP2002134144A	FUEL CELL SYSTEM FOR TRAVELING BODY ;	Source: JP2002134144A [EN] PROBLEM TO BE SOLVED: To reduce the pressure of gas supplied to the first side of a hydrogen separation membrane and achieve miniaturization of a compressor. SOLUTION: In this fuel cell system for a traveling body, anode gas from a fuel cell 10 is circulated to the hydrogen separation membrane 8a while reformed gas is supplied to the hydrogen separation membrane 8a and hydrogen passing through the hydrogen separation membrane 8a is supplied to the fuel cell 10. The hydrogen separation membrane 8a is divided into a first side chamber 81, to which the reformed gas is supplied and a second side chamber 82 from which the hydrogen passing through the hydrogen separation membrane 8a is extracted. A steam generating means 14 for cooling the hydrogen and generating steam by waste heat of the hydrogen is disposed downstream of the second side chamber 82. The steam from the steam generating means 14 is supplied to the second side chamber 82. ;
JP2002352838A	FUEL CELL SYSTEM FOR MOBILE BODY ;	Source: JP2002352838A [EN] PROBLEM TO BE SOLVED: To prevent a liquid-phase fuel, which occurs when the fuel gas generated at an evaporation part just after system start-up is condensed at a piping part, from guided into a fuel reforming part. SOLUTION: A fuel cell system comprises an evaporation part 1 where a fuel is evaporated to generate a fuel gas, a fuel reforming part 2 where the fuel gas generated at the evaporation part 1 is reformed to generate a hydrogen- rich reformed gas, and a fuel cell part 4 where the hydrogen-rich reformed gas generated at the fuel reforming part 2 and the gas containing oxygen supplied separately from an air supply device 3 are reacted with each other to generate power. A steam separator 6 is provided in the middle of a piping connecting the evaporation part 1 to the fuel reforming part 2, to prevent the fuel condensed at the piping part from flowing into the fuel reforming part 2. ;
JP2003068338A	CONTROLLER OF FUEL REFORMING SYSTEM FOR MOVING BODY ;	Source: JP2003068338A [EN] PROBLEM TO BE SOLVED: To provide a control method for a reforming system to suppress the phase difference between the fuel input and output of an evaporator. SOLUTION: The reforming system for a moving body comprises: a fuel reformer 103 which forms a reformed gas composed mainly of hydrogen from water vapor, vapor of gaseous fuel or liquid fuel and oxygen; an evaporator 102 which converts water and liquid fuel to water vapor and vapor of liquid fuel; combustion apparatuses 107 and 701 which form a high temperature gas to heat the evaporator 102; and a means of supplying fuel to the fuel reformer 103; and comprises: a fuel flow adjustor 704 to adjust the fuel amount supplied to the combustion apparatus 701; a bypass control valve 703 to adjust the amount of the combustion gas flow bypassing the evaporator 102 and passing through a bypass 702; and a means of controlling the both in accordance with an acceleration rate and load required by the moving body. ;

JP2003068346A	REFORMER OF FUEL CELL ;	Source: JP2003068346A [EN] PROBLEM TO BE SOLVED: To provide a reformer capable of less loading on a fuel cell at the start and shortening the start time. SOLUTION: In the reformer of the fuel cell provided with an evaporator 3 for evaporating the material, a catalytic burner 4 for heating the evaporator, a reformer 1 for generating a reformed gas including hydrogen to react fuel vapor from the evaporator and air, and a start burner 5 for supplying high temperature material vapor to the reformer at the start, it supplies air heated to a high temperature by introducing air into the heat exchanger at the start to a vapor pipe 13 downstream and the reformer, and provides the material to the evaporator after the vapor pipe and the reformer are heated to a high temperature, providing heat exchangers (3, 15) for heating air by a heat source of the catalytic burner. ;
JP2003077484A	FUEL CELL AUTOMOBILE ;	Source: JP2003077484A [EN] PROBLEM TO BE SOLVED: To improve the fuel gas purge control of a fuel cell automobile mounted with a fuel cell system. SOLUTION: When the fuel cell automobile enters a closed place such as a tunnel, the fuel gas (hydrogen gas) purge control, which maintains the generation performance of the fuel cell, is controlled so that the hydrogen concentration in the closed space may become smaller than the reference value, in accordance with the form of the closed space and the driving condition of the vehicle, while detecting the form of the closed space. ;
JP2003142140A	FUEL CELL SYSTEM AND FUEL CELL VEHICLE ;	Source: JP2003142140A [EN] PROBLEM TO BE SOLVED: To provide a fuel cell system and a fuel cell vehicle capable of shortening the starting time and reducing the energy required to make starting by performing reforming of the fuel without using water vapor. SOLUTION: A reforming reactor (ATR) 2 reforms a propane fuel using air (oxygen) and carbon dioxide (CO2), and produces a reformed gas containing hydrogen and carbon monoxide. The body 3 of a solid oxide fuel cell has an air electrode 4 supplied with the air and a fuel electrode 5 supplied with the reformed gas. A carbon dioxide collector 6 collects carbon dioxide selectively from the gas exhausted from the fuel electrode 5, while a pump 7 feeds by pressure the carbon dioxide collected by the collector 6 back to the reforming reactor 2. ;
JP2003168465A	FUEL CELL SYSTEM ;	Source: JP2003168465A [EN] PROBLEM TO BE SOLVED: To provide a fuel cell system, which can shorten the warmingup time, without enlarging the system. SOLUTION: It has an oxygen supply system 22, which supplies air to a cathode electrode of the fuel cell 1 by a compressor 5, a fuel supply system 24, which supplies the hydrogen rich gas generated according to a reforming catalyst, with which the reformer 12 has been filled up, to the anode electrode of the fuel cell 1, a branched road 23, which is branched from the lower stream of the compressor 5 and supplies air to the reformer 12, and the change valves 7 and 8, which distribute the air from the compressor 5 to the oxygen supply system 22 and the branched road 23. The warming-up of the reformer 12 is performed by supplying all the air, which has been compressed by the compressor 5 and, of which the temperature has been risen to the reformer 12. ;
JP2003197236A	FUEL CELL SYSTEM ;	Source: JP2003197236A [EN] PROBLEM TO BE SOLVED: To improve the response at the time of evaporating methanol and water, which are introduced into a reformer, using the combustion heat of off-gas in a burner with respect to the reform system of the fuel cell. SOLUTION: If the load of the fuel cell increases, the amount of hydrogen consumption in the fuel cell is temporarily reduced for example, by reducing the introduced amount of hydrogen to a fuel electrode, or by reducing the introduced amount of air to an air electrode, the consumption amount of hydrogen is made drop down temporally to make the combustion amount of heat in the burner increase, and to make the combustion heat amount in the burner increase. By this, it becomes possible to supply the fuel supplied to a reform part, and the quantity of heat required for evaporating water promptly without making problems, such as a temperature fall in the combustion part, and the like. ;
JP2003272680A	FUEL CELL SYSTEM AND FUEL CELL VEHICLE ;	Source: JP2003272680A [EN] PROBLEM TO BE SOLVED: To provide a fuel cell system that can achieve a good balance of heating and generation. SOLUTION: In the fuel cell system which uses as a fuel the hydrogen-rich gas generated by a reformer 6, each flow rate of the fuel, air, and water that are supplied to the reforming device is controlled in accordance with the generated energy and heating value demanded, in the standby mode wherein the generated energy demanded from the fuel cell 9 is smaller than the prescribed value. When the demanded generated energy is small and heating value is large, the volume of the air is increased and oxidation reaction is made in the reformer 6, and heating inside the generating system 1 is promoted. At this time, by reducing the passage area inside the

		reforming catalyst layer 6a, the possibility of having high temperature locally is prevented. ;
JP2004292187A	HYDROGEN OCCLUSION MATERIAL, HYDROGEN OCCLUSION BODY, HYDROGEN STORING DEVICE, FUEL CELL VEHICLE AND MANUFACTURING METHOD OF HYDROGEN OCCLUSION MATERIAL ;	Source: JP2004292187A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen occlusion material that has a high hydrogen occlusion ability using a tubular molecule. SOLUTION: The hydrogen occlusion material has a side wall comprised of an atom bound material having a plurality of atoms arranged in a sheet-like state, for example, the tubular molecule such as a single layer carbon nanotube and is constituted so that a cleavage part 12 is formed at the end part. According to this, hydrogen is easily introduced within the tubular molecule. ;
JP2004313906A	HYDROGEN STORAGE MATERIAL, HYDROGEN STORAGE BODY, HYDROGEN STORAGE DEVICE, FUEL-CELL VEHICLE, AND METHOD FOR MANUFACTURING HYDROGEN STORAGE MATERIAL ;	Source: JP2004313906A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage material having an enhanced hydrogen-storing performance by utilization of a carbon material represented by a carbon nanotube, and a manufacturing method for the hydrogen storage material. SOLUTION: The hydrogen storage material is composed of molecules wherein spaces are constituted of sheets having six-membered rings of carbon atoms. The hydrogen storage material is subjected to a heat reaction in a stream of fluorine gas to add fluorine to the molecules, and then the material is soaked in an organic solvent and washed. ;
JP2005041742A	HYDROGEN OCCLUSION MATERIAL, HYDROGEN STORING DEVICE, HYDROGEN STORING SYSTEM, FUEL CELL VEHICLE AND MANUFACTURING METHOD OF HYDROGEN OCCLUSION MATERIAL ;	Source: JP2005041742A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen occlusion material having high hydrogen occlusion ability, a hydrogen storing device, a hydrogen storing system, a fuel cell vehicle and a manufacturing method of the hydrogen occlusion material. SOLUTION: The hydrogen occlusion material is obtained by mixing a raw material with a carbon layer spacing control material and sintering it. The carbon layer spacing control material regulates the distance between the carbon layers of the hydrogen occlusion material and the hydrogen occlusion material has a structure in which diffraction peak (2?) by the X-ray diffraction analysis using CuKa ray as X-ray source appears at 7-18 degrees. ;
JP2005095795A	HYDROGEN STORAGE MATERIAL, HYDROGEN STORAGE TANK, HYDROGEN STORAGE SYSTEM, FUEL CELL-DRIVEN VEHICLE AND METHOD FOR MANUFACTURING HYDROGEN STORAGE MATERIAL ;	Source: JP2005095795A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage material having high hydrogen storage capability, a hydrogen storage tank, a hydrogen storage system, a fuel cell-driven vehicle and a method for manufacturing the hydrogen storage material. SOLUTION: This hydrogen storage material is formed by layering a plurality of atom-bonded bodies each of which is obtained by aligning two or more kinds of atoms in a sheet-like shape. One or more atoms are arranged between the adjacent layers of each of the atom-bonded bodies as a spacer to regulate the distance between the adjacent layers. ;
JP2005125304A	HYDROGEN STORAGE MATERIAL, HYDROGEN STORAGE BODY, HYDROGEN STORAGE DEVICE, FUEL CELL VEHICLE, PRODUCTION METHOD FOR HYDROGEN STORAGE MATERIAL, AND PRODUCTION METHOD FOR HYDROGEN STORAGE DEVICE ;	Source: JP2005125304A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage material with a high hydrogen storage capacity, a hydrogen storage body, a hydrogen storage device, a production method of the hydrogen storage material, and a production method for the hydrogen storage device. SOLUTION: The hydrogen storage material is formed by laminating a plurality of atom layers mainly comprising six-membered rings mainly comprising carbon atoms. In the direction of lamination of the atom layers, a plurality of band-like structures 11 and 12 each formed by gathering atom layers are present; and the band-like structures 11 and 12 are laminated so as to form a gap 13 in a slit shape. ;
JP2005132639A	METHOD AND SYSTEM FOR MODIFYING HYDROCARBON FUEL ;	Source: JP2005132639A [EN] PROBLEM TO BE SOLVED: To provide a means for increasing the hydrogen concentration in a reformed gas and reducing the carbon monoxide concentration. SOLUTION: In a method for reforming a hydrocarbon fuel, a gas containing the hydrocarbon fuel and hydrogen peroxide is fed to a catalyst to produce a hydrogen-rich gas. Here, the number of oxygen atoms contained in the gas corresponds to 25-75 percent of that required for complete oxidation of the hydrocarbon fuel, and less than or equal to 50 percent of the oxygen atoms contained in the gas exist as oxygen molecules (O2). ;

JP2005166271A	REFORMED FUEL CELL SYSTEM FOR MOVABLE BODY ;	Source: JP2005166271A [EN] PROBLEM TO BE SOLVED: To provide a fuel cell system quickly responding to a load increase to a fuel cell. SOLUTION: The system is provided with a reforming system 2 reforming hydrogen-rich reformed gas and the fuel cell 1 generating power with hydrogen in the reformed gas and oxygen. It is also provided with a secondary battery 6 for compensating an output for an output response delay of the fuel cell 1, a motor 5 driving a vehicle with the outputs from the fuel cell 1 and the secondary battery 6, a combustor 4 combusting inflammable gas in the reformed gas, and an evaporator 3 heating gasoline and water with heat generated at the combustor 4. In the case a request load as detected by an accelerator increases, an output is compensated from the secondary battery 6, an amount of hydrogen used by the fuel cell 1 is decreased, and the inflammable gas is made combusted by the combustor 4 by that much to heat the increased gasoline and water. ;
JP2005302640A	FUEL REFORMING SYSTEM FOR VEHICLE ;	Source: JP2005302640A [EN] PROBLEM TO BE SOLVED: To provide a fuel reforming system for a vehicle having high energy efficiency and quickly corresponding to the variation of reforming amount. SOLUTION: In the fuel reforming system for the vehicle equipped with a reforming reactor 1 producing hydrogen-rich reformed gas, a shift reactor 2 reducing carbon monoxide in the reformed gas, and a selective oxidation reactor 3, a water jacket 12 storing water for cooling a brake part 10 of the vehicle and a liquid-vapor separation tank 5 supplying water to the water jacket 12 and turning back again water heated with the brake part 10 in braking are installed. Water vapor in the liquid-vapor separation tank 5 is supplied to the reforming reactor 1. ;
JP2006021161A	HYDROGEN STORAGE MATERIAL, HYDROGEN STORAGE TANK, HYDROGEN STORAGE SYSTEM, FUEL CELL VEHICLE, AND PRODUCTION METHOD FOR HYDROGEN STORAGE MATERIAL ;	Source: JP2006021161A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage material having a high hydrogen storage capability, a hydrogen storage tank, a hydrogen storage system, a fuel cell vehicle, and a method for producing the hydrogen storage material. SOLUTION: The hydrogen storage material comprises a compound defined by formula (I), wherein R1 and R2 denote each a same or different optional substituent group and X denotes an oxygen atom or a hydroxy group, as a hydrogen dissociation catalyst carried on a carrier. ;
JP2006026567A	HYDROGEN OCCLUSION MATERIAL, HYDROGEN STORAGE TANK, HYDROGEN STORAGE SYSTEM AND FUEL CELL VEHICLE ;	Source: JP2006026567A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen occlusion material having enough hydrogen occlusion capacity. SOLUTION: The hydrogen occlusion material is composed of a graphite intercalation compound which interposed atoms are arrayed between graphene layers to form and occludes hydrogen between graphene layers, wherein when approximating a potential D of a hydrogen molecule and a graphene to Leonard = Jones pattern [kJ/mol], a ratio D0/R0 of the minimum value D0[kJ/mol] of the potential D to a distance R0 [nm] where the potential D is 0, is greater than or equal to 3 and less than or equal to 10. ;
JP2007000856A	HYDROGEN STORAGE MATERIAL, ITS PRODUCING METHOD, HYDROGEN STORAGE BODY, HYDROGEN STORAGE APPARATUS AND FUEL CELL-POWERED CAR ;	Source: JP2007000856A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage material usable repeatedly, a method for producing the hydrogen storage material, a hydrogen storage body, a hydrogen storage apparatus and a fuel cell-powered car. SOLUTION: The hydrogen storage material contains: a metal hydride 2 containing an alkali metal aluminum hydride or an alkali metal borohydride; a metal compound 3 which is any of a metal compound group containing a compound of a transition metal of group 3, group 4 or group 5, a compound of a rare earth metal and a hydrogen storage alloy and is added to the metal hydride; and an inorganic material 4. ;
JP2007073302A	FUEL REFORMING SYSTEM ;	Source: JP2007073302A [EN] PROBLEM TO BE SOLVED: To provide a fuel reforming system with improved temperature follow-up property of a reformer against change of reformed gas. SOLUTION: The fuel reforming system is provided with the reformer 6 generating the reformed gas containing hydrogen from hydrocarbon based fuel, a burner 10 adjusting the temperature of the reformer 6 by the heat obtained by burning a part of hydrogen-rich gas generated from the reformed gas, and an SCSOF 9 located at upper stream side of the burner 10 in flowing direction of the hydrogen-rich gas, generating power by mixed gas of the hydrogen-rich gas and the air. ;
JP2007117847A	HYDROGEN STORAGE MATERIAL, MANUFACTURING METHOD OF THE STORAGE MATERIAL, HYDROGEN ABSORBING MATERIAL, HYDROGEN STORING APPARATUS AND FUEL CELL CAR ;	Source: JP2007117847A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage material allowing repeated use, a manufacturing method of the storage material, a hydrogen absorbing material, a hydrogen storing apparatus and a fuel cell car. SOLUTION: The hydrogen storage material 1 comprises: a material 2 consisting of a group of metal elements selected from alkali metal and alkaline earth metal elements, nitrogen and hydrogen; and at least 2 weight percent of an inorganic material 3. ;

JP2007207682A	HYDROGEN GENERATION SYSTEM, FUEL CELL SYSTEM, AND FUEL CELL VEHICLE ;	Source: JP2007207682A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen generating system to generate hydrogen gas low in ammonia concentration. SOLUTION: In a hydrogen generating system HGS including the hydrogen generating system 19 which is consisting of a hydrogen storing member 21 composed of a metal amide containing a metal element selected from an alkaline metal element and an alkaline-earth metal element, nitrogen, and hydrogen, and a metal hydride selected from the alkaline metal element and the alkaline-earth metal element, and of a tank 20 to house this hydrogen storing member 21, the outermost layer 21a of the hydrogen storing member 21 facing a hydrogen ejection port (exit) 20a of the tank 20 is composed of the metal hydride. ;
JP2007216922A	FUEL SUPPLY DEVICE ;	Source: JP2007216922A [EN] PROBLEM TO BE SOLVED: To provide a fuel supply device which promotes reaction of chemical hydride stored in a reaction vessel without consuming additional electric power. SOLUTION: The fuel supply device is provided with: the reaction vessel 1A for generating hydrogen gas by reacting chemical hydride; and a fixation member 10 for mounting the reaction vessel 1 to a vehicle body. The fixation member 10 includes an insulator 19 interposed between the reaction vessel 1 and the vehicle body. ;
JP2007229588A	HYDROGEN STORAGE MATERIAL, ITS MANUFACTURING METHOD, HYDROGEN ABSORBER, HYDROGEN STORAGE APPARATUS AND FUEL CELL-POWERED VEHICLE ;	Source: JP2007229588A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage material, its manufacturing method, a hydrogen absorber, a hydrogen storage apparatus and a fuel cell-powered vehicles. SOLUTION: The hydrogen storage material 1 contains a mixed composition of a particulate inorganic material (a first inorganic material) 7 for releasing hydrogen when heated to room temperature or higher with a linear inorganic material (a second inorganic material) 8 having the thermal conductivity higher than that of the particulate inorganic material 7. ;
JP2008018362A	HYDROGEN OCCLUSION MATERIAL, HYDROGEN OCCLUSION BODY, HYDROGEN STORAGE DEVICE, AND FUEL CELL VEHICLE ;	Source: JP2008018362A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen occlusion material having high hydrogen occlusion ability, a hydrogen occlusion body, a hydrogen storage device, and a fuel cell vehicle. SOLUTION: The hydrogen occlusion material 1 comprises a six-membered ring containing carbon atoms as a main body, and has molecular layers L1, L2laminated approximately in parallel having apertures H1a, H1b, H2aand H2bwith a size of the diameter or more of the six-membered ring and a molecule chain C1ato C1fto link with the net face of the atoms of the neighboring molecule layers L1, L2at the discreted position. ;
JP2008037731A	HYDROGEN GENERATION SYSTEM, FUEL CELL SYSTEM, AND FUEL CELL AUTOMOBILE ;	Source: JP2008037731A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen generation system which is suppressed in the amount of by-product gases generated and generates a necessary amount of hydrogen. SOLUTION: The hydrogen generation system HGS is provided with a container (tank) 21 which holds a hydrogen storage material 30 which generates by-product gases in an amount which depends on the temperature, a temperature adjustment means (heating and cooling apparatus) 22 which adjusts the temperature in the container 21, and a control means (hydrogen generation controller HGC/thermometer 25) that estimates the quantity of by-product gases generated in the tank 21 and controls the temperature adjustment means 22 according to the estimated quantity. ;
JP2008162858A	HYDROGEN GENERATION SYSTEM, FUEL CELL SYSTEM, AND FUEL CELL-POWERED CAR ;	Source: JP2008162858A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen generation system, in which a required amount of hydrogen can be obtained while reducing the amount of a by-product gas to be produced. SOLUTION: The hydrogen generation system HGS is provided with: a vessel (a tank) 21 in which a hydrogen storage material 30 for producing a temperature-dependent amount of the by-product gas is housed; a pressure regulating means (a pressure regulating valve) 23 for regulating the pressure in the vessel 21; and a control means (a hydrogen generation controller HGC, a pressure gauge 26) for estimating the amount of the by-product gas to be produced in the vessel 21 and controlling the pressure regulating means 23 on the basis of the estimated amount of the by-product gas. ;
JP2008222449A	APPARATUS FOR GENERATING HYDROGEN AND FUEL CELL-POWERED VEHICLE EQUIPPED WITH THIS AS WELL AS HYDROGEN STORAGE MATERIAL ;	Source: JP2008222449A [EN] PROBLEM TO BE SOLVED: To provide an apparatus for generating hydrogen which can store a metal hydride steadily for a long period of time with a smaller apparatus structure. SOLUTION: The apparatus has a liquid supplying means 130, 131 for forming an oxide film or a hydroxide film on the surface of a metal hydride by supplying the metal hydride for releasing hydrogen by heating and a liquid containing water to the metal hydride. ;

US2001014414A	FUEL CELL SYSTEM AND METHOD OF CONTROLLING THE SAME ;	Source: US2001014414A [EN] A fuel cell system and a method of controlling the same, wherein the fuel cell system includes a fuel cell 20, a reformer 12, a combustor 14, a combustor temperature controller 44 that controls output temperature of the combustor at a target temperature, and a reformed gas ingredient concentration presumption unit 32 that produces a presumed output representing ingredient concentration of reformed gas by using given parameters. The combustor temperature controller 44 produces a parameter correction data to correct the given parameters such that the output temperature of the combustor is controlled at the target temperature in quick response to variations in the output temperature of the reformer. ;
US2002029522A	HYDROGEN-RICH GAS SUPPLY DEVICE FOR FUEL CELL ;	Source: US2002029522A [EN] To generate hydrogen-rich gas which is supplied to a fuel cell stack (2) of a fuel cell power plant, a reformer (1) generates reformate gas comprising hydrogen from methanol, and a carbon monoxide oxidizer (3) oxidizes carbon monoxide from the reformate gas by an action of a catalyst incorporated therein. A valve (10) which supplies hot gas, and a valve (18) which supplies air are provided. When the catalyst temperature is lower than a predetermined temperature, hot gas is supplied from the valve (10) to the oxidizer (3). Due to the heat of oxidation of carbon monoxide by the air supplied by the valve (18) and the high temperature of the hot gas, the temperature of the catalyst rises rapidly after start-up of the power plant. ;
US2002131907A	FUEL REFORMING SYSTEM ;	Source: US2002131907A [EN] The invention presents a fuel reforming technique for a mobile fuel cell system capable of obtaining a reformed gas composition usable in fuel cell 200 even if vapor temperature supplied from an evaporator 102 into a fuel reformer 107 varies significantly. This system comprises means 601, 602 for detecting the flow rate of fuel vapor and oxygen to be supplied into the fuel reformer 107, and means 600 for detecting at least temperature of fuel vapor to be supplied into the fuel reformer, temperature of oxygen, and temperature of mixed gas of fuel vapor and oxygen, in which the ratio of the flow rate of fuel vapor and the flow rate of oxygen is corrected on the basis of the signal value of the temperature detecting means, and oxygen is supplied depending on the corrected ratio. ;
US2003211021A	FUEL REFORMING SYSTEM ;	Source: US2003211021A [EN] A fuel cell power plant comprises a fuel reforming system (1). The fuel reforming system (1) comprises a vaporizer (7) which vaporizes liquid fuel and supplies fuel vapor to a reformer (9). The vaporizer (7) heats injected fuel so as to vaporize it by a heating elements (7A), and supplies it to the reformer (9) via a fuel vapor supply passage (32) comprising a first valve (17). In a standby mode of the vaporizer (7) when the first valve (17) is closed, surplus fuel and heat energy in the standby state are recovered by providing a recovery passage (19, 20) which recovers fuel in the vicinity of the heating elements (7A) to the fuel tank (6) without allowing it to flowing into the vapor supply passage (32). ;
US2004161360A	HYDROGEN STORAGE MATERIAL, METHOD FOR PRODUCING THE SAME, HYDROGEN STORAGE TANK, HYDROGEN STORAGE SYSTEM, AND FUEL CELL VEHICLE ;	Source: US2004161360A [EN] A hydrogen storage material of the present invention comprises a plurality of planar molecular layers stacked, and a particle being inserted into the planar molecular layers to define an interlayer distance between the planar molecular layers. Because the hydrogen storage material of the present invention has a sufficient hydrogen storage capacity, it is possible to realize a fuel cell vehicle capable of storing a sufficient amount of hydrogen to attain a long-distance drive. ;
US2004247957A	HYDROGEN STORAGE MATERIAL AND METHOD FOR PRODUCING THE SAME ;	Source: US2004247957A [EN] A hydrogen storage material of the present invention includes graphite formed of graphene, and has a characteristic feature such that the orientation of crystal planes of the graphene is disordered. Hence, hydrogen can be stored into a large number of gaps between the layers of graphene, and it is possible to realize a fuel cell vehicle capable of storing a sufficient amount of hydrogen to attain a long-distance drive. ;
US2005123812A	FUEL CELL SYSTEM AND ITS CONTROL METHOD ;	Source: US2005123812A [EN] A fuel cell system comprises a reformer (8) which produces reformate gas containing hydrogen using gas containing oxygen and raw material vapor, and a fuel cell (9) which generates power by reacting hydrogen in the reformate gas with oxygen. A controller (21) determines whether or not excess hydrogen has been produced by the reformer (8), and when it is determined that excess hydrogen was produced, burns the excess hydrogen to keep the reformer (8) warm. ;

US2006037308A	FUEL VAPORIZING DEVICE ;	Source: US2006037308A [EN] Hydrogen-rich reformate gas is produced by a fuel reformer (2) from fuel vapor containing hydrocarbon, which is produced by a fuel vaporizer (6), by means of a partial oxidation reaction and a steam reforming reaction. A fuel injector (8, 9) supplies fuel to the fuel vaporizer (6), and an air injector (8 a) supplies air to the fuel vaporizer (6). A glow plug (13) partially oxidizes the air-fuel mixture inside the fuel vaporizer (6). By controlling the air supply amount in relation to the fuel supply amount to obtain an excess air factor corresponding to a predetermined rich air-fuel ratio, a part of the air-fuel mixture in the fuel vaporizer (6) is partially oxidized, and the remaining fuel vapor is heated by the oxidation heat. As a result, the partial oxidation reaction and steam reforming reaction in the fuel reformer (2) are performed with a favorable balance. ;
US2006225346A	FUEL REFORMING SYSTEM ;	Source: US2006225346A [EN] In a fuel reforming system (32) of a fuel cell system (1), which includes a reformer (7) generating hydrogen-containing gas to be an electromotive fuel and a combustor (6) generating combustion gas, the combustor (6) has two combustion parts including a main combustion part (20) and a sub-combustion part (18), a fuel pre-vaporization part (19) between the two combustion parts and a main fuel injection valve (16) and a sub-fuel injection valve (15) which supply the fuel to the respective combustion parts. In start-up of the fuel cell system (1), predetermined amounts of fuel and air for generating heat quantity required in the fuel pre-vaporization part (19) are subjected to lean combustion in the subcombustion part (18), the fuel to be combusted in the main combustion part (20) is pre-vaporized in the fuel pre-vaporization part (19) by use of the combustion gas from the subcombustion part (18), and the pre-vaporized fuel obtained by the pre-vaporization and air are subjected to premixed lean combustion in the main combustion part (20). ;
US2008248355A	HYDROGEN STORAGE MATERIAL, HYDROGEN STORAGE STRUCTURE, HYDROGEN STORAGE, HYDROGEN STORAGE APPARATUS, FUEL CELL VEHICLE, AND METHOD OF MANUFACTURING HYDROGEN STORAGE MATERIAL ;	Source: US2008248355A [EN] A hydrogen storage material including: molecular layers L1 to Li+2 which are stacked on one another in parallel and mainly composed of six-membered rings having carbon atoms; and protrusions Pr1a to Pri protruding from atomic planes of adjacent molecular layers L1 to Li+2 by lengths of not more than interlayer distances d1 to di+2 of the adjacent molecular layers. ;
US2010288243A	HYDROGEN STORAGE MATERIAL, PRODUCTION METHOD OF THE HYDROGEN STORAGE MATERIAL, HYDROGEN SUPPLY SYSTEM, FUEL CELL, INTERNAL COMBUSTION ENGINE AND VEHICLE ;	Source: US2010288243A [EN] A hydrogen storage material includes: a first storage material body (1) which stores hydrogen; and a second storage material body (2) which stores hydrogen, and coats a surface of the first storage material body (1). A hydrogen equilibrium pressure (HP) of the second storage material body (2) is lower than that of the first storage material body (1) at the hydrogen generation temperature of the first storage material body (1). ;
US2011223502A	FUEL REFORMING APPARATUS AND FUEL CELL SYSTEM ;	Source: US2011223502A [EN] A fuel reforming apparatus includes a catalyst packed portion containing therein fuel reforming catalyst (I) having excellent hydrocarbon conversion rate and fuel reforming catalyst (II) having excellent H2+CO formation rate. Each of catalyst (I) and catalyst (II) especially preferably includes rhodium supported thereon. When the carrier for catalyst (I) is aluminum oxide and the carrier for catalyst (II) is cerium oxide, the hydrogen generation efficiency is excellent particularly even at start-up. ;
WO07088923A1	HYDROGEN GENERATION SYSTEM, FUEL CELL SYSTEM, AND FUEL CELL VEHICLE SYSTEME DE GENERATION D'HYDROGENE, SYSTEME DE PILE A COMBUSTIBLE ET VEHICULE DE PILE A COMBUSTIBLE ;	Source: WO07088923A1 [EN] Disclosed is a hydrogen generation system (HGS) comprising a hydrogen storage material (30) wherein the equilibrium point of hydrogen generating reaction changes according to physical conditions of the hydrogen generating reaction, a supply means (tank) (21) for containing the hydrogen storage material (30) and supplying hydrogen generated from the hydrogen storage material (30) to the outside, and a control means for controlling the amount of hydrogen supplied from the supply means (21) by controlling the physical conditions

ANEXO NO. 3
FAMILIAS DE PATENTES PRESENTADAS POR HONDA

Titular	HONDA	
MasterPN	**TI**	**AB**
JP2001026401A	HYDROGEN SUPPLY SYSTEM-FOR EQUIPMENT USING HYDROGEN AS FUEL ;	Source: JP2001026401A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen supply system structured relatively compact, excellent in starting equipment and capable of performing stable operation. SOLUTION: The hydrogen supply system 1 for the equipment using hydrogen as the fuel has an electrolyzer 3 generating pure hydrogen by the electrolysis of water to supply hydrogen to the equipment 2 using hydrogen as the fuel, a vortex tube 5 for separating hydrogen generated in the electrolyzer 3 into hydrogen having a high temp. and low temp. hydrogen having lower temp. than that of the high tamp. hydrogen and a hydrogen reservoir capable of occluding the high temp. hydrogen and the low tamp. hydrogen from the vortex tube 5 and releasing the occluded hydrogen to supply the equipment 2. The hydrogen reservoir is composed of a 1st reserving part 11 provided with a 1st hydrogen occluding material MH1 having a high temp. with respect to the occlusion and the release of hydrogen and a 2nd reserving part 72 provided with a 2nd hydrogen occluding material MH2 having a low tamp. with respect to the occlusion and the release of hydrogen. ;
JP2001213602A	HYDROGEN SUPPLY SYSTEM FOR DEVICE USING HYDROGEN AS FUEL ;	Source: JP2001213602A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen supply system in which transfer of hydrogen from a first storage system to a second storage system can be quickly and sufficiently done and hydrogen can be delivered from the second storage system at a low tempera ture. SOLUTION: This hydrogen supply system 1 comprises a reformer 3 and a hydrogen storage system 43. The hydrogen storage system 43 comprises a first storage section 44 having a first hydrogen absorber MH1 characterized by absorbing at a low pressure and releasing at a high temperature and a second storage section 51 having a second hydrogen absorber MH2 characterized by absorbing at a high pressure and releasing at a low temperature. Between the hydrogen absorption pressure P1 and hydrogen releasing temperature T1 of the first hydrogen absorber MH1 and the hydrogen absorption pressure P2 and hydrogen releasing temperature T2 of the second hydrogen absorber MH2, there are established the relationships of P1T2. Hydrogen from the reformer 3 is absorbed in the first storage section 44, then the absorbed hydrogen is released and transferred to the second storage section 51 and absorbed. At the start-up of the fuel cell, the absorbed hydrogen is released from the second storage section 51 and fed to the fuel cell 2. ;
JP2001213606A	HYDROGEN SUPPLY SYSTEM FOR DEVICE USING HYDROGEN AS FUEL ;	Source: JP2001213606A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen supply system which can avoid the situation such as shortage of occluded hydrogen in the first storage section by frequent transferring of hydrogen from the first storage section to the second storage section. SOLUTION: This hydrogen supply system 1 comprises a reformer 3 and a hydrogen storage system 43. The hydrogen storage system 43 comprises a first storage section 44 having a first hydrogen absorber MH1 easily absorbing hydrogen, and a second storage section 51 having a second hydrogen absorber MH2 easily releasing hydrogen. Hydrogen from the reformer 3 is absorbed in the first storage section 44, and the hydrogen obtained by releasing the absorbed hydrogen is transferred to the second storage section 51 and absorbed there. At the start-up of the fuel cell 2, the occluded hydrogen in the second storage section 51 is released and supplied to the fuel cell 2. Provided that the maximum amount of occluded hydrogen in the second storage section 51 is 'a', the above-mentioned hydrogen transfer is performed under the condition of b>a, where 'b' is the amount of occluded hydrogen in the first storage section 44. ;

JP2001268721A	HYDROGEN SUPPLY DEVICE FOR VEHICLE EQUIPPED WITH FUEL CELL ;	Source: JP2001268721A [EN] PROBLEM TO BE SOLVED: To determine hydrogen amount to replenish according to the required amount of hydrogen for a cell and supply hydrogen to the fuel cell promptly. SOLUTION: This hydrogen supply device 1 is provided with a reform device 3 generating hydrogen out of materials including alcohol and gasoline and supplying hydrogen to the fuel cell 2 on a vehicle, a hydrogen storing device 47 capable of storing hydrogen generated by the reform device 3 for supplying it if the required amount of hydrogen for the fuel cell 2 cannot be supplied by the reform device 3, first means 65, 66 for determining the required amount of hydrogen for the fuel cell 2, and second means 60, 64 for determining the amount of hydrogen discharged from the hydrogen storing device 47 based on information from the first means 65, 66. The hydrogen storing device 47 involves a first storing part 48 equipped with hydrogen storing alloy MH2, and a second storing part 50 storing gaseous hydrogen discharged from the hydrogen occluding material MH2 and supplying it to the fuel cell 2. ;
JP2001289396A	HYDROGEN STORAGE ALLOY STORING CONTAINER CAPABLE OF QUICK RELEASE ;	Source: JP2001289396A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage alloy storing container capable of quickly supplying hydrogen from a reservoir during high loading, such as during starting or accelerating a fuel cell or a hydrogen engine. SOLUTION: The hydrogen storage alloy storing container capable of quick release, having a hydrogen gas access from which hydrogen is supplied for storing hydrogen into a hydrogen storage alloy in the container and the stored hydrogen is released, comprises a hydrogen storage alloy sheet formed by filling or applying a hydrogen storage alloy powder into a metal porous material of a sheet electrically resistant exothermic material and laminated and stored in the hydrogen storage alloy container. ;
JP2001289397A	HYDROGEN STORAGE ALLOY STORING CONTAINER ;	Source: JP2001289397A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen storage alloy storing container capable of quickly supplying hydrogen from a reservoir during high loading, such as during starting or accelerating a vehicle in which a fuel cell or a hydrogen engine is mounted. SOLUTION: The hydrogen storage alloy storing container capable of quick release, having a hydrogen gas access from which hydrogen is supplied for storing hydrogen into a hydrogen storage alloy in the container and the stored hydrogen is released, comprises a hydrogen storage alloy sheet formed by filling a hydrogen storage alloy powder and a low melting point alloy powder into a metal porous material and laminated and stored in the container. ;
JP2001347982A	FUEL CELL-MOUNTED MOTORCYCLE ;	Source: JP2001347982A [EN] PROBLEM TO BE SOLVED: To realize a fuel cell-mounted motorcycle optimally disposed with a fuel cell, a reformer, a secondary batter or the like. SOLUTION: In this motorcycle 10, a fuel tank 31 storing methanol, the reformer 32 reforming the methanol into hydrogen, the fuel cell 33 and a motor 41 are disposed below a mainframe 27 to lower the gravity center of the motorcycle 10. The fuel tank 31, the reformer 32 reforming the methanol into hydrogen, the fuel cell 33 and a motor unit 40 are disposed below the mainframe 27. ;
JP2002061797A	HALOGEN STATION ;	Source: JP2002061797A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen station convenient and useful for a fuel cell- mounted vehicle. SOLUTION: The hydrogen station 1 comprises a water electrolytic device 2; hydrogen storage tanks 31-33 having hydrogen storage materials capable of storing and discharging hydrogen manufactured by the water electrolytic device 2; and a heating means 4 to heat a hydrogen storage tank 32 after storage of hydrogen by the exhaust heat of the water electrolytic device 2 and increasing the internal pressure of the tank 32. ;

JP2003130291A	HYDROGEN FILLING DEVICE ;	Source: JP2003130291A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen filling device for protecting a PEFC and a hydrogen absorbing alloy from being poisoned by reducing the density of impurities contained in hydrogen. SOLUTION: This hydrogen filling device used for a fuel cell vehicle having a hydrogen filling passage 1 for filling hydrogen to an MH hydrogen tank 7 comprises a bypass passage 2 branched from the hydrogen filling passage 1 to fill hydrogen to the MH hydrogen tank 7, a hydrogen separator 3 having a hydrogen permeable membrane 3b, filling the hydrogen passed through the hydrogen permeable membrane 3b to the MH hydrogen tank 7, and discharging the hydrogen not having passed through the hydrogen permeable membrane 3b which is installed in the bypass passage 2, and a selector means 6 for selectively switching a flow passage for hydrogen led into the hydrogen filling passage 1 to the hydrogen filling passage 1 or the bypass passage 2. ;
JP2003212508A	METHOD OF CONTROLLING SUPPLY OF WATER IN REFORMING SYSTEM ;	Source: JP2003212508A [EN] PROBLEM TO BE SOLVED: To improve the transient response of a reforming system. SOLUTION: In a method of controlling supply of water in the reforming system provided with a reformer 2 for producing a hydrogen enriched gas by gasifying raw material and reforming, a shifter 4 for removing carbon monoxide contained in a production gas produced with the reformer 2 by a shift reaction and a main injector 13 for supplying water to the raw material and fuel, the humidity of the production gas is detected with a humidity sensor 27 and the supply quantity of water with the main injector 13 is controlled corresponding to the detected humidity. ;
JP2004352510A	PURE HYDROGEN PRODUCTION DEVICE ;	Source: JP2004352510A [EN] PROBLEM TO BE SOLVED: To provide a pure hydrogen production device where the filling of hydrogen to FCV(fuel cell vehicle) can be performed while pulsation is removed from pure gaseous hydrogen obtained by a PSA (pressure swing adsorption) apparatus. SOLUTION: The device where a hydrogen-containing reformed gas obtained by reforming fuel containing hydrogen atoms is refined by a pressure swing adsorption method is provided with: (a) a reformer 3 having a reforming catalyst producing hydrogen-rich reformed gas from stream and fuel; (b) a PSA apparatus 7 connected to the downstream of the reformer 3 and refining the reformed gas to obtain pure gaseous hydrogen; (c) a pulsation relaxation hydrogen tank 8 storing the pure gaseous hydrogen with pulsation obtained from the PSA apparatus 7; and (d) a high pressure hydrogen tank 12 connected to the pulsation relaxation hydrogen tank 8. The pulsation relaxation hydrogen tank 8 relaxes the pulsation of the pure gaseous hydrogen discharged from the PSA apparatus 7, and the pure gaseous hydrogen in which the pulsation is relaxed is filled into the high pressure hydrogen tank 12 via a compressor 11. ;
JP2005285525A	COGENERATION SYSTEM ;	Source: JP2005285525A [EN] PROBLEM TO BE SOLVED: To effectively use anode off-gas exhausted from a fuel cell in a cogeneration system. SOLUTION: The cogeneration system 1 is provided with a hydrogen manufacturing apparatus 2 provided with a combustor 2b and manufacturing hydrogen rich gas from raw fuel, a fuel cell 4 generating power with the hydrogen as fuel, an anode off-gas circulating path 25 circulating the anode off-gas exhausted from the fuel cell 4 to the fuel cell 4 again, an exhaust processing apparatus 5 processing the anode off-gas to be able to be exhausted, a heat storing apparatus 6 provided with an additional heating burner 6b, an anode off-gas conducting path 26 by which the anode off-gas can be conducted from the anode off-gas circulating path 25 to the combustor 2b, the exhaust processing apparatus 5 and the additional heating burner 6b and a flow path switching apparatus 28 switching the conducting destination of the anode off gas to the combustor 2b, the exhaust processing apparatus 5, and the additinal heating burner 6b according to the state of operation. ;

JP2005293959A	HYDROGEN GAS MANUFACTURING POWER GENERATION SYSTEM AND ITS OPERATION METHOD ;	Source: JP2005293959A [EN] PROBLEM TO BE SOLVED: To well and efficiently supply hydrogen gas to a stationary fuel cell and a fuel cell vehicle, and economically use the hydrogen gas. SOLUTION: A household hydrogen gas manufacturing power generation system 10 is equipped with a reformer 16, a hydrogen purification device 20, a power generation tank 32 for supplying hydrogen gas to the stationary fuel cell 36, filling tanks 34a, 34b for supplying hydrogen gas to a fuel cell vehicle, and an ECU 44 controlling switching a target for supplying hydrogen gas to the the power generation tank 32 and the filling tanks 34a, 34b. ;
JP2006002896A	HYDROGEN SUPPLY DEVICE ;	Source: JP2006002896A [EN] PROBLEM TO BE SOLVED: To provide hydrogen supply technology for suppressing the energy consumption of a hydrogen supply device when supplying hydrogen to an on-vehicle fuel tank. SOLUTION: The hydrogen supply device 10 comprises a medium pressure hydrogen producing part 13 for producing and storing medium pressure hydrogen, wherein supply pressure for fully filling the on-vehicle fuel tank 12 is called high pressure and preset supply pressure lower than the high pressure is called medium pressure, a prediction part 14 for predicting the supply pressure required for the next filling in accordance with information from a vehicle 11, high pressure forming part 15 for applying pressure to the medium pressure hydrogen to form high pressure hydrogen when the supply pressure predicted by the prediction part 14 is high pressure, a control part 16 for executing serial control of operating the medium pressure control part 13 in accordance with information from the prediction part 14, operating the high pressure forming part 15 as required and filling the on-vehicle fuel tank 12 with the medium pressure hydrogen or the high pressure hydrogen in accordance with the supply pressure predicted by the prediction part 14. Since the supply pressure is predicted by the prediction part and the high pressure forming part is operated only when required, the wasting use of energy in supplying hydrogen is prevented. ;
JP2007048599A	HYDROGEN SUPPLY METHOD ;	Source: JP2007048599A [EN] PROBLEM TO BE SOLVED: To simply and economically supply hydrogen to a fuel cell vehicle, and to downsize and simplify an equipment as a whole. SOLUTION: When a first hydrogen pressure in a hydrogen supply tank 20 and a second hydrogen pressure in a vehicle-mounted hydrogen tank 24 are detected, and if it is judged that a pressure difference between the first and the second hydrogen pressures is larger than specified one, the hydrogen in the hydrogen supply tank 20 is supplied to the vehicle-mounted hydrogen tank 24 by the pressure difference. On the other hand, if the pressure difference is judged to be smaller than the specified pressure, the hydrogen is supplied to the vehicle-mounted hydrogen tank 24 by a pressure of hydrogen generated by operating a water electrolysis device 16. ;
JP2007278467A	HIGH PRESSURE GAS FILLING SYSTEM ;	Source: JP2007278467A [EN] PROBLEM TO BE SOLVED: To restrain a temperature rise in a filled tank, and to recover the pressure energy or the like of high pressure gas to be filled when filling the high pressure gas in the filled tank. SOLUTION: A hydrogen filling system 10a which is a high pressure gas filling system fills hydrogen gas of high pressure into a hydrogen tank 18 provided in a fuel cell vehicle 16a, from a hydrogen storage tank 14 provided in a hydrogen filling station 12a. A turbine 42 driven by the pressure energy or the like of the flowing hydrogen gas is provided at an intermediate part of a passage through which the hydrogen gas flows from the hydrogen storage tank 14 to a hydrogen tank 18 in the hydrogen filling system 10a. ;
JP2009114012A	ION PUMP SYSTEM AND ITS OPERATION METHOD ;	Source: JP2009114012A [EN] PROBLEM TO BE SOLVED: To enable to prevent the occurrence of abnormalities in a system, in particular in an emergency stop operation during a hydrogen production mode as much as possible. SOLUTION: The ion pump system 10 is provided with a reforming apparatus 12 for producing a reformed gas by reforming a raw fuel, a FC-ion pump 14 having a power generation mode and a hydrogen production mode, and a controller 16 connected to the FC-ion pump 14 and for controlling the whole of the ion pump system 10. Wherein an anode side inlet flow passage 38, an anode side outlet flow passage 40, cathode side inlet flow passage 48 and cathode side outlet flow passage 54 are

		connected to the FC-ion pump 14, and normal close type electromagnetic valves 42, 46, 50 and 56 are arranged to these passages. And there is provided a cathode side outlet branched flow passage 58 branched from the cathode side outlet flow passage 54, and a relief valve 62 and a normal open type electromagnetic valve 60 that is located in the upstream of the relief valve 62 are disposed in the cathode side outlet branched flow passage 58. ;
JP2009117170A	HYDROGEN AND POWER GENERATING SYSTEM, AND LOAD FOLLOWING POWER GENERATION METHOD THEREIN ;	Source: JP2009117170A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen and power generating system in which power generation amount of a fuel cell-ion pump combination unit is made to vary following the load fluctuations and excellent gas reforming reaction can be performed stably and certainly. SOLUTION: The hydrogen and power generating system is provided with: a reforming device 12 which reforms a raw fuel made of mainly hydrocarbon and generates a reformed gas and has a first catalyst combustor 20 as a heat source; a fuel cell-ion pump combination unit 14 having a hydrogen generation mode and a power generation mode; an anode side exit passage 40 which supplies an anode off-gas exhausted from the fuel cell-ion pump combination unit 14 to the first catalyst combustor 20; an anode off-gas branch passage 40a branched from the anode side exit passage 40; and a flow-rate control valve 42 and a second catalyst combustor 44 arranged in the anode off-gas branch passage 40a. ;
JP2009120421A	HYDROGEN PRODUCTION METHOD IN HYDROGEN PRODUCTION POWER GENERATION SYSTEM ;	Source: JP2009120421A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen production method which enables a hydrogen production mode to start smoothly and efficiently by rapidly purging an oxidant gas even when the oxidant gas remains at a cathode side. SOLUTION: The hydrogen production method comprises a process for starting the reforming operation of a reformer, a process for interpreting whether an oxidant gas is remaining or not at the cathode side of a fuel cell-ion pump combination, a process for purging the oxidant gas by supplying a gas remaining in a PSA mechanism when the oxidant gas is interpreted to remain at the cathode side, and a process for supplying the modified gas from the reformer to the anode side of the fuel cell-ion pump combination and for simultaneously starting the hydrogen production mode by applying voltage in between a pair of electrodes, when the oxidant gas is interpreted as not to be remaining at the cathode side. ;
JP2009221045A	POWER GENERATION AND HYDROGEN GENERATION SYSTEM ;	Source: JP2009221045A [EN] PROBLEM TO BE SOLVED: To provide a power generation-hydrogen generation system that can be efficiently operated. SOLUTION: The power generation-hydrogen generation system 1 is equipped with: a power generation-hydrogen pump co-assembly 40 that generates hydrogen gas from a reformed gas as a source material or generates electric power; a hydrogen gas supply device 24 that sequentially supplies the generated hydrogen gas to a hydrogen tank; a hot-water supply device 29 that supplies hot water by using waste heat accompanying the power generation of the power generation-hydrogen pump co-assembly 40; and an inverter 23 that transforms the electric power generated by the power generation-hydrogen pump co-assembly 40, sells the power to a commercial power supply 9 side and outputs the power to an electric load of a dwelling 7. When the hydrogen tank of a fuel cell vehicle 8 is connected to the hydrogen gas supply device 24, an operation control ECU 3 predicts the supply amount of hydrogen gas required by the hydrogen tank and a supply completion time and decides, on the basis of the predicted supply amount of hydrogen gas and the predicted supply completion time, whether the power generation-hydrogen pump co-assembly 40 carries out generation of hydrogen gas or generation of power. ;

US2002060100A	FUEL-CELL-POWERED FOUR-WHEEL AUTOMOBILE ;	Source: US2002060100A [EN] A tank is disposed beneath a floor for storing methanol and water. A reforming unit is disposed beneath the floor for generating hydrogen from methanol and water supplied from the tank. A fuel cell is disposed beneath the floor for generating electricity from an electrochemical reaction of hydrogen generated by the reforming unit and oxygen in air. A secondary battery is disposed beneath the floor for storing electricity generated by the fuel cell. In this way, mechanisms for generating electricity from air, methanol, and water are centralized. ;
US2002170504A	RAW FUEL VAPORIZING APPARATUS, METHOD OF VAPORIZING RAW FUEL, AND FUEL CELL SYSTEM EQUIPPED WITH RAW FUEL VAPORIZING APPARATUS ;	Source: US2002170504A [EN] A raw fuel vaporizing apparatus comprising: a vaporizer for vaporizing liquid raw fuel; a raw fuel introducing device for introducing the liquid raw fuel into the vaporizer; a catalyst combustor into which fuel and air are supplied for catalytic combustion, the catalyst combustor generating heat in the presence of a catalyst and supplying the resulting heat to the vaporizer to vaporize the liquid raw fuel; a fuel introducing device for introducing the fuel into the catalyst combustor; an air introducing device for introducing the amount of the air suitable for catalytic combustion into the catalyst combustor; a heat transferring gas introducing device introducing heat transferring gas into the catalyst combustor to transfer heat retained by the catalyst combustor to the vaporizer; and a controller increasing the amount of the heat transferring gas through the heat transferring gas introducing device when the amount of vapor generated in the vaporizer is increased. ;
US2004131901A	HYDROGEN SUPPLY UNIT ;	Source: US2004131901A [EN] A hydrogen supply unit is provided that can efficiently supply hydrogen gas both to a fuel cell used as a stationary electric power supply and to a fuel cell used as a mobile electric power supply. The hydrogen supply unit includes a reformer 5 that reforms a source gas to generate hydrogen gas, a first storage device 7 that stores hydrogen gas and supplies the hydrogen gas to a first fuel cell 2, and a second storage device 8 that stores hydrogen gas and supplies the hydrogen gas to a second fuel cell 3. For the storage device 8, there is arranged a compressor 13 that pressurizes hydrogen gas. For both storage devices 7 and 8, there is arranged a purifier 6 between the reformer 5 and both storage devices so that both storage devices store purified hydrogen gas. The storage device 7 utilizes a hydrogen absorbing alloy, and releases hydrogen gas by taking advantage of the waste heat of the reformer 5 or the waste heat of the fuel cell 2. The hydrogen gas stored in the storage device 8 is pressurized to 10 to 70 MPa. The hydrogen supply unit includes a remaining amount detecting sensor 14 for hydrogen gas that detects the remaining amount of the hydrogen gas in the storage device 8, and a control device 15 that feedback controls the reformer 5 on the basis of the above described remaining amount of the hydrogen gas. ;
US2004146760A	HYDROGEN SUPPLY UNIT ;	Source: US2004146760A [EN] A hydrogen supply unit which generates electric power by use of a fuel cell and concurrently generates hydrogen, taking as its object the efficient generation of hydrogen from a source gas. The hydrogen supply unit 1 comprises a reformer 2 for reforming natural gas, a fuel cell 3 for generating electric power by use of the reformed gas from the reformer 2, and a purifier 4 for purifying hydrogen from the exhaust gas discharged from the fuel cell 3. The purifier 4 comprises a PEM 9 for conducting purification on the basis of the membrane separation method, and a PSA 11 for conducting purification by use of the pressure swing adsorption method. In the present invention, the reformed gas from the reformer 2 is used, without being subjected to purification, for the electric power generation in the fuel cell 3, and the purifier 4 purifies hydrogen from the exhaust gas discharged from the fuel cell 3. The offgas from the PEM 9 is used in a heater 8, and the offgas from the PSA 11 is used in the fuel cell 3. Consequently, the amount of the hydrogen burnt in the heater 8 is reduced as compared to the prior art, and hence the electric power generation and the hydrogen generation can be performed by using more efficiently the hydrogen contained in the source gas. ;

US2004191592A	THERMOELECTRIC CONVERSION APPARATUS ;	Source: US2004191592A [EN] A thermoelectric conversion apparatus having a high thermoelectric conversion efficiency comprises: a dehydrogenation reactor for generating hydrogen and acetone by an endothermic dehydrogenation reaction of isopropyl alcohol in the presence of a dehydrogenation catalyst and heat from a heat source, and a fuel cell which generates electricity by an electrochemical reaction of the hydrogen and the acetone produced by the dehydrogenation reactor. A module is constructed by integrating the dehydrogenation reactor and an electricity generating layer constituting the fuel cell into a stack. ;
US2005014104A	FIRING FURNACE AND FIRING METHOD ;	Source: US2005014104A [EN] The present invention provides a firing furnace (100) comprising a combusting means (2) for combusting a fuel (11), a firing furnace main body (1) for firing a member to be fired and exhausting a combustion gas, and a methane reforming device (3) for reacting a reforming material (23) composed of a methane sub fuel for reformation (21) and steam (22) with a methane reforming catalyst (6) filled therein while heating the same by the combustion gas for producing a reformed gas (24) containing hydrogen and carbon dioxide, capable of cutting back the fuel cost. ;
US2005053813A	COMBINATION FUEL CELL AND ION PUMP, AND METHODS AND INFRASTRUCTURE SYSTEMS EMPLOYING SAME ;	Source: US2005053813A [EN] A combination fuel cell and hydrogen or oxygen pump includes an electrochemical cell comprising an anode inlet for receiving fuel, an anode outlet for exhausting fuel, a cathode inlet for receiving oxidant, a cathode outlet for exhausting oxidant, and first and second electrical connectors. A controller is operable for applying an electrical load to the electrochemical cell for generating electricity, and for applying an electrical potential to the electrochemical cell for purifying hydrogen or purifying oxygen. Methods and infrastructure systems are also disclosed. ;
US2007000016A	GAS COOLING METHODS FOR HIGH PRESSURE FUEL STORAGE TANKS ON VEHICLES POWERED BY COMPRESSED NATURAL GAS OR HYDROGEN ;	Source: US2007000016A [EN] At a high pressure hydrogen or compressed natural gas vehicle refuel depot, the thermal energy (heat) generated by from the high flow rate of the high pressure refueling gas is evacuated from the on board fuel tank[s] of consumer vehicles eliminating the need for refueling pre treatments such as a slow fill, secondary precooling, and pressure overfill otherwise used to achieve a full vehicle tank refill. In an example, a high pressure fuel depot refilling line is operatively interconnected to an on board vehicle tank having a gas flow circuit wherein the refuel gas itself is circulated within the on board tank to absorb the compression heat of refueling and then to an external radiator before being released into the tank. ;
US2007042241A	ENERGY STATIONS ;	Source: US2007042241A [EN] An energy station includes a generating unit and a separate remotely located dispensing unit. The generating unit includes a housing having an electrolyzer for generating hydrogen and a storage unit for storing hydrogen from the electrolyzer. The dispensing unit includes a housing for dispensing hydrogen from the generating unit. The generating unit is located at a first location and the dispensing unit is located at a second location away from the first location. For example, the generating unit may be located outside the building and the dispensing unit may be located inside a garage. Also disclosed is a generating unit having a fuel cell for supplying electricity to the building and a heat exchanger for supplying heat to the building. ;
US2009117421A	METHOD OF OPERATING HYDROGEN AND POWER GENERATING SYSTEM ;	Source: US2009117421A [EN] If the combination fuel cell and ion pump is judged to be operating in a hydrogen generation mode, an input amount of electricity supplied to the combination fuel cell and ion pump is controlled, so as to control an amount of refined hydrogen generated thereby. If the combination fuel cell and ion pump is judged to be operating in an electricity generation mode, an output amount of electricity supplied from the combination fuel cell and ion pump is controlled, so as to control an amount of electricity generated thereby. The input amount of electricity supplied to the combination fuel cell and ion pump, or the output amount of electricity supplied from the combination fuel cell and ion pump, is corrected based on the temperature of a combustor. ;

US2013164648A	FUEL-USING SYSTEM ;	Source: US2013164648A [EN] An electromagnetic main stop valve which is opened by an electromagnetic force of a solenoid with energization of a valve body in a valve-closing direction by energizing unit is provided in a hydrogen tank. A current sensor and the accelerator opening-degree sensor for detecting a use gas flow rate in a fuel cell stack are provided. A pressure sensor for detecting a pressure in the hydrogen tank is provided. The control device sequentially sets the electromagnetic force of the solenoid so that a valve-opening amount is such an amount as to supply a use gas flow rate to the fuel cell stack based on detection values of the current sensor or the accelerator opening-degree sensor, and the pressure sensor. When the flow rate of hydrogen gas flowing into a gas supply path increases due to a hydrogen gas leak, the main stop valve is automatically closed. ;
US2015184804A	CONTROL METHOD FOR FUEL FILLING SYSTEM ;	Source: US2015184804A [EN] A control method for a hydrogen filling system is provided. A hydrogen filling system (S) includes a vehicle (V) that sends unique information (V, MC) of the hydrogen tank and detected values (T, P) of sensors, and a station (9) that determines a filling mode based on this information (V, MC, P, T), and fills hydrogen to the tank in this determined mode. A station ECU (95) calculates predicted values (T', P') of the temperature and pressure inside of the hydrogen tank during filling of hydrogen based on the unique information (V, MC), continuously confirms whether the detected values (T, P) of the sensors and the predicted values (T', P') match while filling fuel, and in the case of an inconsistency between the detected values and predicted values being confirmed, interrupts filling of fuel in the filling mode determined based on the unique information. ;
US6797418B	FUEL PROCESSOR FOR FUEL CELL ;	Source: US6797418B [EN] On the basis of the temperature detected by a temperature detecting sensor, a control section determines whether the fuel processor in a warm up state or a stationary running state. In the machine-warming state, adjusting/supplying unit controls the S/C ratio of the water/fuel mixed gas so as to be lower than that in a stationary running state of the fuel processor. The quantity of water supplied to a vaporizing section is decreased so that the heat quantity required to create the water/fuel mixed gas can be reduced. Thus, the heat quantity used to warm the vaporing section pan be increased, thereby permitting the time for warming the fuel processor to be shortened. Further, even when the water/fuel-mixed gas is reformed to create a reformed gas, excessive water vapor is not left in the reformed gas. Therefore, condensation of water vapor does not occur within the fuel processor. ;

ANEXO NO. 4
FAMILIAS DE PATENTES PRESENTADAS POR TOYOTA

Titular	TOYOTA	
MasterPN	**TI**	**AB**
JP2002089792A	HYDROGEN STORING DEVICE, FUEL CELL SYSTEM PROVIDED THEREWITH AND MOVABLE BODY ;	Source: JP2002089792A [EN] PROBLEM TO BE SOLVED: To improve energy efficiency by efficiently using thermal energy at the time of filling a hydrogen storage tank with hydrogen. SOLUTION: Dew water generated on a surface of the hydrogen storage tank 40 when filling hydrogen into the hydrogen storage tank 40 is collected by a dew water collecting portion 50 composed of a water collecting portion 52, a filter 54 for ion-exchange filtering, and a dew water storage tank 56 storing water. The dew water stored in the dew water storage tank 56 is replenished as water for a thermal exchange medium of a battery temperature adjusting device 34, and supplied into an electrolysis portion 7 generating hydrogen by electrolysis water. The hydrogen generated by electrolyzing is supplied to a fuel cell 30 when the fuel cell 30 is operated, and filled into the hydrogen storage tank 40 when the fuel cell 30 is not operated. Consequently, thermal energy at filling the hydrogen storage tank 40 with hydrogen can be effectively used to improve energy efficiency. ;
JP2004026582A	HYDROGEN GAS-GENERATING SYSTEM ;	Source: JP2004026582A [EN] PROBLEM TO BE SOLVED: To supply a highly pure hydrogen gas to a hydrogen-using system by performing efficient and prompt dehydrogenation of a hydrocarbon fuel, to improve efficiency of the hydrogen-using system, and to realize weight-saving and downsizing. SOLUTION: The hydrogen gas-generating system is equipped with a particulate catalyst 12 scattered within an inert gas, a feeding device 14 which sprays decalin onto the catalyst 12, a reaction tank 10 having a propeller 16 for stirring the inert gas and a storage and separation tank 30 which separates and discharges a hydrogen gas generated through dehydrogenation of the decalin supplied to the catalyst 12. ;
JP2004051391A	APPARATUS FOR PRODUCING GASEOUS HYDROGEN ;	Source: JP2004051391A [EN] PROBLEM TO BE SOLVED: To make an apparatus for producing gaseous hydrogen small-sized by supplying high purity gaseous hydrogen to hydrogen use equipment using hydrocarbon/unsaturated hydrocarbon reaction to improve the efficiency of the hydrogen use equipment and the use efficiency of fuel. SOLUTION: The apparatus for producing gaseous hydrogen is provided with a storage tank 10 for storing decalin which is raw fuel, a catalyst 18, a heater 22 for heating the catalyst and a decalin recovery apparatus 24 and a naphthalene recovery apparatus 26 and further, provided with a reaction separation tank 20 for carrying out a dehydrogenation reaction of decalin supplied from the storage tank 10 on a heated catalyst 18 to produced naphthalene and gaseous hydrogen, separating unreacted decalin (which is not dehydrogenation reacted), naphthalene produced in the dehydrogenation reaction and gaseous hydrogen produced in the dehydrogenation reaction respectively by the decalin recovery apparatus 24 and the naphthalene recovery apparatus 26 and discharging gaseous hydrogen. ;
JP2004076959A	WARMUP JACKET AND FUEL CELL SYSTEM ;	Source: JP2004076959A [EN] PROBLEM TO BE SOLVED: To provide a fuel cell system and a fuel-cell car reducing energy loss for smooth start at low temperatures, while being excellent in responsiveness to load changes. SOLUTION: A warmup jacket 65 for hydrogen pump covers a hydrogen pump 60 requiring warmup operation and warms up the hydrogen pump 60. The warmup jacket 65 has a hydrogen storage material built in to generate heat by storing hydrogen and to absorb heat upon releasing the hydrogen. For warmup operation, hydrogen is introduced to heat the hydrogen storage material, with the generated heat transferred to the hydrogen pump 60. After the warmup operation, the heat generated in the hydrogen pump 60 is transferred to the warmup jacket 60 to heat the built-in hydrogen storage material to release the hydrogen for regenerating operation.

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JP2004182531A	FUEL REFORMING APPARATUS AND FUEL CELL POWERED VEHICLE ;	Source: JP2004182531A [EN] PROBLEM TO BE SOLVED: To improve starting characteristics of a fuel reforming apparatus. SOLUTION: The fuel reforming apparatus is equipped with: a vaporizing unit (50) which vaporizes source fuel to generate source fuel gas; a reforming unit (60) which reforms the source fuel gas with steam to produce hydrogen-rich fuel gas; and a CO reducing unit (70) which reduces the concentration of CO included in the fuel gas. The reforming unit (60) and the CO reducing unit (70) have containers (61, 71) to house individual catalysts, with the bottoms (61a, 71a) of the containers tilted from the horizontal plane and having drain holes (64, 74) in the bottoms (61a, 71a) to discharge the liquefied source fuel or condensed water remaining in the containers (61, 71), respectively. When the source fuel gas remaining in the reforming unit (60) or in the CO reducing unit (70) is liquefied in the apparatus during the system is stopped, it can be drained at the next time of starting the system, and this improves the starting property on starting the system. ;
JP2005243603A	FUEL CELL SYSTEM ;	Source: JP2005243603A [EN] PROBLEM TO BE SOLVED: To provide a fuel cell system in which with a simple structure, energy efficiency can be improved and which can be driven stably and in which the fuel cell can be utilized effectively when power generation is not required. SOLUTION: The fuel cell system comprises a reformer 2 which produces hydrogen contained reformed gas Ga from a reforming fuel F and a fuel cell 3 which performs power generation utilizing the hydrogen contained reformed gas Ga. The fuel cell 3 has an anode passage 32, a cathode passage 33, and an electrolyte body 31. The electrolyte body 31 is made by laminating a hydrogen separation metal layer 311 and a proton conductor layer 312, and has an anode electrode and a cathode electrode. The cathode passage 33 is connected by a cathode off-gas line 46 and a hydrogen storage means 92 which is capable of storing hydrogen is connected to the cathode off-gas line 46. A short circuit means 91 which can short-circuit these electrically is provided between the anode electrode and the cathode electrode. ;
JP2006156088A	HYDROGEN SEPARATION FILM MODULE SYSTEM ;	Source: JP2006156088A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen separation film module system which can remove hydrogen remaining in a hydrogen separation film without oxygen remaining in the hydrogen separation film. SOLUTION: The hydrogen separation film module system comprises: a fuel cell 6 having the hydrogen separation film made of a metal; and an internal combustion engine 2 and a selector valve 4 which supply an gas including oxygen to the hydrogen separation film; where the internal combustion engine 2 reduces an oxygen concentration of the gas including oxygen. The oxygen concentration of the gas including oxygen is reduced by the internal combustion engine 2, and the gas including oxygen is supplied to the fuel cell 6. This removes hydrogen remaining in the hydrogen separation film of the fuel cell 6. In addition, the fact that the oxygen concentration in the gas including oxygen is low prevents oxygen from remaining in the hydrogen separation film. As a result, oxidation of the hydrogen separation film is prevented. ;

JP2006290652A	HYDROGEN GENERATING APPARATUS AND FUEL CELL SYSTEM ;	Source: JP2006290652A [EN] PROBLEM TO BE SOLVED: To make the restartability good after stopping operation, with high durability. SOLUTION: Jetting devices capable of supplying cooling air for cooling a fuel cell is provided in a reforming reactor, and when the operation is stopped, the cooling air is supplied from the jetting devices 27, 24 to purge above a catalyst. Thereby, residual components remaining in the reforming reactor which has been stopped are discharged to the outside of the reactor. ;
JP2006318870A	FUEL CELL SYSTEM AND FUEL CELL ;	Source: JP2006318870A [EN] PROBLEM TO BE SOLVED: To provide a fuel cell system capable of stably supplying electric power and to provide a fuel cell used for it. SOLUTION: The fuel cell system 100 is equipped with a hydrogen generation device 110 comprising reactors 112, 114 having a catalyst and capable of switching reforming reaction and exothermic reaction, three-way valves SV1-SV7 for switching the passage of fluid supplied to the reactors 112, 114 and the passage of fluid exhausted from the reactors, and a control means 170 switching the three-way valves SV1-SV7 to cause reforming reaction in one reactor out of the reactors 112, 114 and the exothermic reaction in the other reactor, and the reforming reaction and the exothermic reaction alternately in the reactors; a hydrogen tank 125 housing hydrogen-containing gas reformed and produced in the hydrogen generation device 110; and a fuel cell 120 generating electric power with hydrogen-containing gas supplied from the hydrogen tank 125. ;
JP2007001798A	HYDROGEN FUEL-SUPPLYING SYSTEM AND FUEL CELL SYSTEM ;	Source: JP2007001798A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen fuel-supplying system capable of supplying the fuel gas which is obtained by a reforming reaction and contains hydrogen to a fuel cell while corresponding to load change, and also to provide a fuel cell system which is provided with the above hydrogen fuel-supplying system and follows the output variation of a fuel cell as a whole. SOLUTION: In a reactor composing the hydrogen fuel-supplying system, a reforming process and a regeneration process are alternately performed. The reforming process comprises generating a hydrogen-containing fuel gas by reforming a supplied raw material, and the regeneration process comprises performing the catalytic combustion of a gas mixture prepared by mixing a supplied air for combustion and a gas for regeneration in a mixing space 84 to elevate the temperature lowered in the reforming process to a reformable level. The fuel gas generated in the reforming process is consumed in the fuel cell. When the reduction of hydrogen consumption is required during the operation of the reforming process accompanied by load degradation of the fuel cell, the supply amount of a reforming raw material is lowered, and a flow-keeping gas for keeping the flow of in-system gas of the reactor and fuel cell is introduced to quickly change to the state according to raw material prorogation. ;
JP2009073688A	HYDROGEN SUPPLY UNIT, FUEL CELL SYSTEM, AND FUEL CELL CAR ;	Source: JP2009073688A [EN] PROBLEM TO BE SOLVED: To provide a hydrogen supply unit which can stably release a necessary amount of hydrogen and has a favorable energy efficiency, a fuel cell system equipped with the same, and a fuel cell car mounting the system. SOLUTION: The hydrogen supply unit 10 is equipped with a hydride-containing structure 5 whose sectional shape in one direction is formed in a constant shape, and heating means 1, 2 configured so as to be movable in one direction. ;
JP2011007229A	GAS TANK AND GAS FUEL VEHICLE ;	Source: JP2011007229A [EN] PROBLEM TO BE SOLVED: To miniaturize and simplify a gas storage system.SOLUTION: In a second gas tank 20 as an auxiliary tank mounted in a gas fuel vehicle 1 including a first gas tank 10, the maximum pressure value of the second gas tank 20 is smaller than the maximum pressure value of the first gas tank 10, and the valve 21 of the second gas tank 20 is composed of a fusible plug valve and a main stop valve. In the gas fuel vehicle including the second gas tank 20, it is preferable that a sub receptacle 3 connected to the valve 21 of the second gas tank 20 is formed with a release valve for releasing the

		remaining hydrogen to the atmosphere when the second gas tank 20 is replaced.
US2001026777A	HYDROGEN GENERATING SYSTEM ;	Source: US2001026777A [EN] The invention constructs a system which vaporizes a liquid raw material in a vaporizing section and steam-reforms the vaporized raw material in a reforming section to generate hydrogen. A pressure regulating valve for regulating the pressure in the vaporizing section is disposed at anywhere from the vaporizing section to downstream of the reforming section. When a hydrogen requirement is increased, the pressure regulating valve is controlled to decrease the pressure in the vaporizing section. The pressure reduction makes it possible to promote vaporization in the vaporizing section such that the rate of generation of steam can be improved. Moreover, during start-up of the system, the control mode is changed to open the pressure regulating valve, thereby limiting the rate of increase in pressure just after the generation of reformed gas has started. ;
US2001031387A	COMBUSTION HEATING DEVICE, FUEL REFORMING APPARATUS INCLUDING COMBUSTION HEATING DEVICE, AND FUEL CELL SYSTEM ;	Source: US2001031387A [EN] A combustion heating device for heating a fluid to be heated includes a fuel supply device that supplies the fuel to the device, and a vaporizing device that burns a portion of the fuel supplied by the fuel supply device, and vaporizes a remaining portion of the fuel by using heat generated through combustion of the portion of the fuel. The combustion heating device further includes a first air supply device that supplies air to be used for combustion of the portion of the fuel by the vaporizing device, and a second air supply device that supplies air to be used for combustion of the remaining portion of the fuel vaporized by the vaporizing device. A fuel reforming apparatus incorporating the combustion heating device as vaporizing section, and a fuel cell system including the fuel reforming apparatus are also provided. ;
US2002031450A	DEVICE AND METHOD FOR CONTROLLING REFORMER ;	Source: US2002031450A [EN] A control device suitably heats reformate fuel so as to obtain high-quality reformate gas by stabilizing the temperature of a reforming portion regardless of load fluctuations. The control device is suitable for use with a reformer that includes a heating portion for heating up reformate fuel, which is to be gasified in a reforming reaction, with the aid of the heat generated by heat fuel. At least one of the amount of heat fuel and the amount of an oxidizer for burning the heat fuel is determined based on an amount of reforming reaction requirement. ;
US2003134167A	FUEL CELL FUEL SUPPLY SYSTEM AND MOBILE BODY ;	Source: US2003134167A [EN] An electric vehicle 10 with fuel cells 30 mounted thereon has a fuel tank 20 that stores a fuel therein, and a connector receptor 40 that is connected to the fuel tank 20 and is open to the surface of the vehicle body. A connector of a predetermined hydrogen supply device is fitted in and attached to the connector receptor 40, so that a supply of fuel is fed from the hydrogen supply device to the electric vehicle 10. The connector receptor 40 is provided with a fuel lid for covering over the connector receptor 40. When it is determined that the fuel cells 30 are in a working state, the fuel lid is not opened in response to input of an opening instruction of the fuel lid in the course of fuel supply. When it is determined that the fuel lid is open, on the other hand, operation of the fuel cells 30 is not started in response to input of a starting instruction of the fuel cells 30 in the electric vehicle 10. This arrangement of the invention enhances the safety of fuel supply to any system with fuel cells. ;
US2004214055A	DRIVE CONTROL OF POWER SYSTEM INCLUDING FUEL CELLS ;	Source: US2004214055A [EN] A power system of the invention includes fuel cells and a fuel gas generation system that generates a fuel gas to be supplied to the fuel cells. At the time of stopping supply of hydrogen, the fuel gas generation system selectively uses a stop process that replaces hydrogen in a hydrogen separator unit with the air for removal of hydrogen and a pause process that allows hydrogen to remain in the hydrogen separator unit. The stop process is selected when the fuel gas generation system stops the supply of hydrogen for a long time period. The pause process is selected when the fuel gas generation system temporarily stops the supply of hydrogen. The arrangement of the invention desirably shortens a restart time

		of the fuel gas generation system and reduces a potential energy loss. ;
US2005014038A	APPARATUS FOR HYDROGEN SEPARATION AND FUEL CELL SYSTEM ;	Source: US2005014038A [EN] The object of the invention is to prevent reduction of hydrogen permeability and deterioration of a hydrogen separation member in a hydrogen separation device that uses an oxygen-containing as like a cathode off gas as a purge gas. A hydrogen separation device 50 includes a reformed gas passage 51, a purge gas passage 52, and a hydrogen separation membrane 53. A supply of a reformed gas flows through the reformed gas passage 51. A cathode off gas discharged from cathodes of fuel cells 60 flows through the purge gas passage 52 to carry hydrogen transmitted through the hydrogen separation membrane 53 to anodes of the fuel cells 60. A specific section of the hydrogen separation membrane 53 close to the supply of the cathode off gas has enhanced heat resistance. This structure effectively prevents deterioration of the hydrogen separation membrane 53, even when hydrogen transmitted through the hydrogen separation membrane 53 reacts with unreacted oxygen remaining in the cathode off gas to locally raise the temperature in the vicinity of the specific section close to the supply of the cathode off gas. ;
US2008160367A	HYDROGEN GENERATION DEVICE AND FUEL CELL SYSTEM INCLUDING SAME ;	Source: US2008160367A [EN] In a hydrogen generation device according to the invention, PSR reformers have a heat capacity smaller than that of the other PSR reformers. Therefore, the temperature of the catalyst reaches to a reforming-start temperature more quickly in the PSR reformers than in the other PSR reformers. When the hydrogen generation device is started and the reforming reaction is carried out, the mixture of gasoline vapor and water vapor is selectively and preferentially supplied to the PSR reformers so that the reforming reaction is carried out in the PSR reformers. ;
US2008171242A	REFORMER, METHOD FOR CONTROLLING PUMP IN FUEL CELL SYSTEM, AND CONTROL UNIT ;	Source: US2008171242A [EN] An object is to provide a reformer, a method for controlling a natural gas pump in a fuel cell system, and others, capable of selectively changing a flow rate between for system start-up and for normal operation thereof. In the method for controlling a natural gas pump in the fuel cell system comprising a reforming unit, a combustion unit, a fuel supply unit, a fuel pump for combustion; a fuel pump for reforming, and a first shutoff valve placed in a second fuel line, the reformer of the invention comprises a bypass line that connects the first fuel line to the second fuel line. ;
US2009084085A	EXHAUST GAS PURIFICATION SYSTEM AND METHOD FOR PURIFYING EXHAUST GAS ;	Source: US2009084085A [EN] An exhaust gas emitted from an engine (10) that contains nitrogen oxides is supplied to the cathode of a fuel cell (20), and a hydrogen-rich gas generated by the hydrogen gas generator (30) is supplied to the anode of the fuel cell (20). In the fuel cell (20), the nitrogen oxides are decomposed and electricity are generated by an electrochemical reaction between hydrogen and the nitrogen oxides. A hydrogen-separation membrane fuel cell, which operates at a temperature that is substantially the same temperature as that of the exhaust gas emitted from the engine (10) is used as the fuel cell (20). ;
US2009308489A	IN-VEHICLE HYDROGEN STORAGE APPARATUS ;	Source: US2009308489A [EN] An in-vehicle hydrogen storage apparatus has a hydrogen gas filling passage connected from a hydrogen gas filling port up to the storage device that stores a hydrogen gas to be supplied to a fuel cell, and an odorizing agent supplying device that supplies an odorizing agent to hydrogen gas in at least one of the inside of the storage device and the inside of the hydrogen gas filling passage. ;

US2010003559A	HYDROGEN SUPPLYING APPARATUS AND METHOD FOR CONTROLLING HYDROGEN SUPPLYING APPARATUS ;	Source: US2010003559A [EN] A hydrogen supply apparatus includes a hydrogen supply path by which hydrogen released from a hydrogen tank reaches a hydrogen supply target, a branching path from the hydrogen supply path, in which a part of hydrogen released from the hydrogen tank flows, addition means for adding an odorizing agent to the hydrogen flowing in the branching path, a buffer tank storing the hydrogen to which the odorizing agent is added by the addition means, and supplying means for supplying the odorizing agent treated hydrogen in the buffer tank to the hydrogen supply path. ;
US5678410A	COMBINED SYSTEM OF FUEL CELL AND AIR-CONDITIONING APPARATUS AND ABNORMALITY DETECTION UNIT AND CONTROL UNIT USED IN THE COMBINED SYSTEM ;	Source: US5678410A [EN] The present invention provides a combined system for activating a fuel cell with hydrogen absorbed and stored in a hydrogen-storage alloy to drive an electric vehicle and for conditioning the air with the hydrogen absorbed and stored in the hydrogen-storage alloy. The combined system of the invention sucks hydrogen out of the hydrogen-storage alloy by a compressor. The combined system of the invention cools the air with a cooling power generated in discharge of hydrogen from the hydrogen-storage alloy and heats the air with a heat generated in absorption of hydrogen into the hydrogen-storage alloy. The combined system preferably includes a heat storage tank disposed in a conduit of a heating medium for storing an excess of a cooling power caused by a variation in an amount of hydrogen required for the fuel cell. Alternatively, the combined system has a secondary battery which is charged with an excess power of the fuel cell and discharges to make up for a deficient power of the fuel cell. ;
US5712052A	FUEL CELL GENERATOR AND METHOD OF THE SAME ;	Source: US5712052A [EN] The fuel cell generator system of the present invention effectively cancels catalyst poisoning in fuel cells so as to improve the performance of fuel cells. In the fuel cell generator system of the invention, a carbon monoxide sensor is arranged in the middle of a gaseous fuel supply conduit, which connects fuel cells with a reformer for converting methanol and water to a hydrogen-rich gaseous fuel. An electronic control unit of the fuel cell generator system reads the carbon monoxide sensor to input a concentration of carbon monoxide D included in the gaseous fuel (step S250). When the carbon monoxide concentration D obtained is greater than a preset level D0, the electronic control unit increases the air flow fed to a partial oxidizing unit of the reformer (step S270). This accelerates the reaction in the partial oxidizing unit for oxidizing carbon monoxide to carbon dioxide, thereby lowering the concentration of carbon monoxide included in the gaseous fuel. ;
US6536551B	HYDROGEN USING SYSTEM FOR INSTALLATION IN VEHICLE AND CONTROL METHOD FOR THE SYSTEM ;	Source: US6536551B [EN] A hydrogen using system for installation in a vehicle has a methanol tank that stores methanol as a source material of hydrogen, which is a fuel of the hydrogen using system, a water tank that stores water, a methanol reformer that produces a hydrogen fuel from methanol and water, a first electromagnetic valve provided in a first channel connecting the methanol tank to the reformer, a polymer electrolyte fuel cell stack that generates power from the hydrogen fuel supplied from the reformer, a second electromagnetic valve provided in a second channel connecting the reformer to the fuel cell stack, an electronic control unit that controls various portions of the hydrogen using system, etc. When an impact occurs on the vehicle, the electronic control unit shuts the first channel and the second channel by forcibly closing the first and second electromagnetic valves based on a detection signal from the impact sensor. This hydrogen using system curbs reactions of hydrogen at the time of an accident or the like, thereby further improving safety of the system.