Air-Independent Fuel Combustion Energy Conversion

Patent #7,430,866

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Patent Overview

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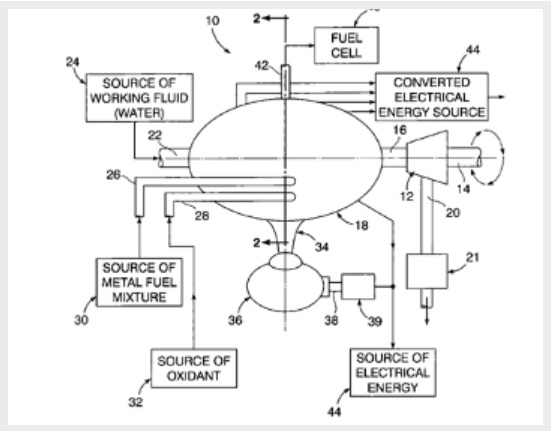


Key Features

- The Air-Independent Fuel Combustion Energy Conversion System relates to combustion of fuel to generate propulsion energy within a seawater environment.
- The system includes a power turbine, from which a propulsion drive shaft extends to mechanically impart rotational energy to propellers of a propulsion unit.
- The rotational energy output from the turbine to the shaft is derived from pressurized steam delivered through a steam line from a steam chamber enclosure.
- The system uses advantages associated with aluminum and magnesium fuel mixtures while avoiding problems associated with air-independent combustion systems.

Technical Information

- The combustor is connected by a funnel extending from the combustion chamber to a collector within which a liquid combustion byproduct such as a eutectic cordierite oxide ($Mg_2Al_4Si_5O_{18}$) is received as a result of the fuel mixture combustion.
  - Such byproduct oxide has a significantly lower melting point than other metal oxides.
- Under selective control, the liquid combustion byproduct is solidified, cooled, and discharged from the collector—without signature detectability—into the vessel's seawater environment and without contamination.
- An energy conversion system comprising:
  - A steam chamber for sustaining a combustion reaction;
  - A supply of working fluid for said combustion reaction;
  - A working fluid infeed line attached to the supply of working fluid and attached to the steam chamber for supplying the working fluid to the steam chamber;
  - A supply of oxidant for said combustion reaction;
  - An oxidant infeed line attached to the oxidant supply and the steam chamber, to supply oxidant to the steam chamber;
  - A supply of $Mg_2Al_4Si_5$ for fuel in said combustion reaction
  - A fuel infeed line attached to the supply of $Mg_2Al_4Si_5$ and attached to the steam chamber, to supply $Mg_2Al_4Si_5$ to the steam chamber;
  - A steam line attached to the steam chamber for directing steam generated by said combustion reaction, away from the steam chamber; and
  - A turbine attached to the steam line for converting steam heat generated by said combustion reaction into mechanical energy.

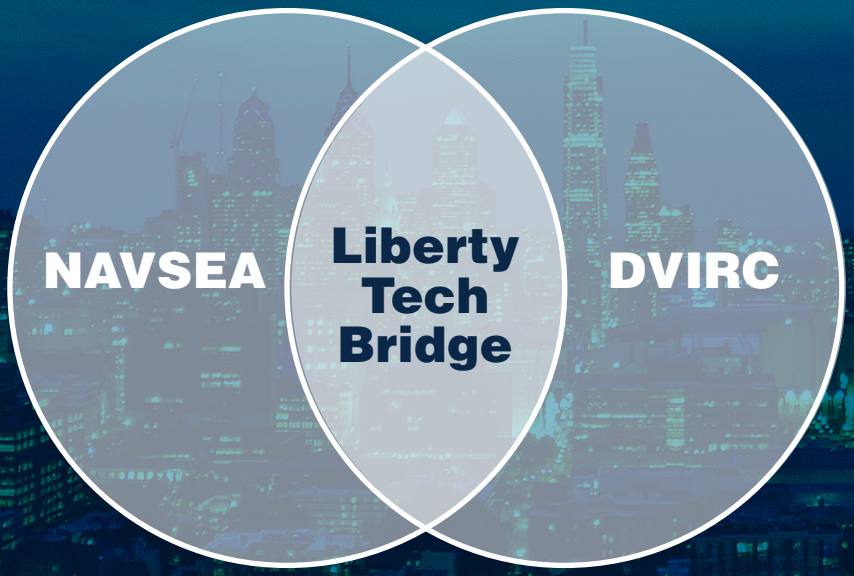
Potential Markets

This section provides insights into market size, trends, and barriers to entry for the commercial applications of the technology, as well as recommendations for deeper market research. Potential markets include use in Ship Manufacture, Boat Building, and Personal Watercraft.

Potential Markets	Market Insights
Ship Building The construction of ships and other floating vessels.	**Market Size/Trends** • The global Shipbuilding market size was valued at $142 billion in 2020 and is expected to expand at a CAGR of just over 3% until 2030 to reach $195 billion. • This growth is mainly due to increased maritime shipping volume as a result of international trade agreements, gross domestic product (GDP), increased demand for cargo transportation via ships, and enhanced automation in marine transport. **Barriers to Entry – High:** • The shipbuilding market is consolidated, with several players accounting for significant amounts of market share. • Fluctuations in transportation and inventory costs could hamper industry growth.
Boat Building Production of recreational boats.	**Market Size/Trends** • The global Boat Building market will grow from $32 billion in 2022 to $35 billion in 2023, a CAGR of 8.0%. • Increasing demand for recreational boats is anticipated to drive growth in the boat-building market. **Barriers to Entry – Medium:** • Environmental concerns associated with the use of certain materials (e.g., exotic woods, plastics, and resins) during boat manufacturing are expected to limit the growth of the boat building market.

Potential Markets (cont.)

Potential Markets	Market Insights
Battery industry A source of electric power consisting of one or more electrochemical cells.	**Market Size/Trends** • The global Battery market size was valued at $104 billion in 2022 with an expected CAGR of 15.8% from 2023 to 2030. • The high use of uninterruptible power supply (UPS) devices for continuous power supply in the healthcare, chemical, and oil and gas sectors is expected to propel the growth of the battery industry. • Lithium-ion batteries are expected to capture a significant portion of the lead acid battery market due to their low energy density and lightweight profile. • There is a growing number of battery manufacturers in the U.S. **Barriers to Entry – High:** • Constraints exist related to the ability to source lithium, nickel, and other material needed to manufacture batteries.
Electric Vehicles (EV) Vehicle that can be powered by an electric motor that draws electricity from a battery	**Market Size/Trends** • The global Electric Vehicle market was estimated to be $163 billion in 2020, and is projected to reach $823 billion by 2030 (a CAGR of 18.2% from 2021 to 2030). • Electric vehicles convert more than 50% of the electrical energy from the grid to power at the wheels, whereas the gas-powered vehicles only manage to convert about 17%–21% of the energy stored in gasoline. • The demand for fuel-efficient vehicles has increased recently due to rising fuel costs. • EVs outperform conventional vehicles, providing higher fuel economy, low carbon emission and maintenance, the convenience of charging at home, enhanced ride comfort, high performance, and reduced engine noise. **Barriers to Entry – High:** • Lack of charging infrastructure, high manufacturing costs, and range anxiety and serviceability are the factors expected to hamper growth of the EV market.
Personal Watercraft Production of jet skis and all other small, motorized watercraft.	**Market Size/Trends** • The global Personal Watercraft Market was valued at approximately $1.8 billion in 2022 and is expected to grow at a CAGR of 6.5% from 2023 to 2029, reaching approximately $2.8 billion. • The rise of outdoor recreational activities, increasing awareness of the health benefits of exercise and being in nature, and the influence of social media and popular culture are impacting this growth. • Four-stroke engines have also contributed to market growth, as these engines are more efficient and environmentally friendly than their two-stroke counterparts. • Increasing tourism in the Asia-Pacific region is also influencing growth. **Barriers to Entry – Medium:** • Cost (fuel, insurance, storage, and maintenance) remains a barrier for personal watercraft. • Lack of skilled and experienced professionals is also a constraint for the Personal Watercraft market.



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