

PATENT OVERVIEW

Virgil Perryman has key patents in the areas of collection, storage, and application of thermal energy. These patents protect the technology used in the Perryman Troughs & Micro Panels, Perryman Battery™, and their applications. The patents have all been filed with the US patent office and offer global protection. The patents provide 20 years protection from the date of their final approval. The patents, an overview of their importance and an explanation of how they are interlinked are given below.

1. THERMAL ENERGY COLLECTION

Virgil Perryman holds two key patents in the field of thermal energy collection. These patents protect technology used in the Perryman Troughs and Perryman Micro Panels. The first is a foundation patent that describes a technology with the ability to capture 98-99% of thermal heat available from the solar spectrum. The second contains some important design efficiencies as regards how the system is configured.

1.1. SOLAR ENERGY COLLECTION AND STORAGE

Publication number: 20130233300

Abstract: A solar energy collection system that includes a reflector configured to reflect and focus a majority of solar energy from visible light and infrared spectra. The solar energy collection system also includes a light trap configured to receive concentrated solar energy from the reflector. The light trap includes a black body that is configured to absorb a majority of the concentrated visible light and infrared energy and convert the absorbed energy into thermal energy.

Type: Application

Filed: March 9, 2012

Publication date: September 12, 2013

Inventor: Virgil Dewitt Perryman

Global Protection under the Patent Treaty Organization (PTO) granted

A full listing of this patent can be seen here

<http://www.google.com/patents/US20130233300>.

Impact

All present forms of solar energy such as photovoltaic and solar thermal technology only collect a fraction of the energy created by the Sun, the visible spectrum and a small portion of ultra-violet and infrared. It has been well known within physics since the 1800s when infrared radiation was discovered by William Herschel that the vast majority of the energy contained in the solar spectrum is in infrared energy. Three or four times the potential energy of the sun has been effectively ignored to date. This technology corrects this and embraces this vast energy resource and uses it to improve the potential of solar energy as the primary source of renewable, green energy.

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Advantages

- Three to four times more energy can be collected on the same footprint of conventional solar energy harvesting.
- This technology drives the net efficiency of solar energy into the mid to high 90 percentile across the majority of the solar spectrum including secondary atmospheric infrared.
- Most types of solar thermal systems can be retrofitted and enhanced, in some cases tripling their efficiency.
- The cost of solar thermal can be driven down to not only energy equity with coal and gas but much cheaper.
- The smaller footprint and the much wider capture of the solar spectrum opens thousands of new locations that can be powered by solar energy.
- Because the mirrors reflect 98-99% of the thermal energy the substrate of the solar collectors can be economically made using more inexpensive plastics and composites. As a result, the cost of maintenance is reduced, weight is reduced without sacrificing strength, rust and corrosion are eliminated, and the effective lifespan of the collection equipment is measured in decades.
- No materials are used that have negative environmental impact in manufacturing or decommission, in fact the collector can be 100% recyclable.
- When integrated with solar storage, total energy independence is readily achievable today and years into the future.

1.2. NON-TRACKING SOLAR RADIATION COLLECTOR

Publication number: 20130255666

Abstract: A solar collection system that includes a double parabolic reflector and a light trap. The solar collection system also includes a lens configured to receive light from the double parabolic reflector and focus the reflected light into the light trap. The system may be configured to resist seismic activity and extreme weather conditions.

Type: Application

Filed: March 30, 2012

Publication date: October 3, 2013

Inventor: Virgil Dewitt Perryman

Global Protection under the Patent Treaty Organization (PTO) granted

A full listing of this patent can be seen here

<https://www.google.com/patents/US20130255666?cl=nl>.

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The less complicated a system is the greater is its potential to operate with a minimal of breakdowns and maintenance. Conventional trough systems in order to maximize their efficiency must follow both the sun's daily elevation and its seasonal azimuth. This requires a complex tracking system and a two axis focusing system. The latter creates the need for a substrate that can handle wind loads, adding weight and complexity to the solar harvesting system. Using the geometry of a double eclipse and aligning the troughs

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on an East to West track, allows this unique geometry to trap all of the sun's energy as it moves from sunrise to sunset. Only as the arc of the sun lowers and rises through the seasons is any adjustment needed.

Advantages

- Far less manufacturing cost for a stronger and more durable trough type collector.
- Far less installation cost, eliminating the need for expensive complicated foundations.
- These troughs in various sizes can be installed on structures, e.g. low load roofs, parking covers, floating platforms, homes, and apartments.
- Because one edge of these troughs is fixed on a robust hinge the trough can be locked down securely and can resist severe wind and storm conditions.
- Because of the simplicity of the design, troughs can be scaled from a few centimetres to many meters, without loss of efficiency.
- This same simplicity of design and scalability allow the troughs to be injected moulded, extruded, protruded, and made from various plastic and high strength composites.
- Factory mass production of prefabricated troughs of various sizes, reduces cost, allows for local input to reduce logistical as well as production costs and insures millions of inexpensive durable collectors can be delivered to the market place rapidly.

2. THERMAL ENERGY STORAGE

Virgil Perryman holds an important foundation patent that protects the technology used to store heat in the Perryman Battery™.

2.1. THERMAL ENERGY STORAGE AND DELIVERY SYSTEM

Patent number: 9115937

Abstract: A thermal energy storage and delivery system is disclosed. A core includes a thermal storage medium and a thermal transfer medium that transports thermal energy to and from the core. The core may be surrounded by multiple layers, where each layer is less dense the closer the layer is to the outside of the thermal storage and delivery system.

Type: Grant

Filed: January 30, 2012

Date of Patent: August 25, 2015

Inventor: Virgil Dewitt Perryman

Global Protection under the Patent Treaty Organization (PTO) granted

A full listing of this patent can be seen here

<https://www.google.com/patents/US9115937>.

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Storing energy as heat is perhaps the purest and most common forms of energy storage in the universe from our planet's core to the home oven. More energy can be stored in a smaller volume and longer as thermal energy than in any other form, this includes electrochemical batteries, pumped air and hydro, capacitors or flywheel. Storing thermal energy in its pure thermal form offers the most versatile applications of any energy storage.

Advantages

- Large storage units can store gigawatts of energy from electrical sources AC or DC as well as thermal sources, for many months. Further as there is no loss of efficiency the working life of the unit is measured in decades.
- Smaller scaled storage units can also store energy sourced from electrical or thermal sources and because of the high energy density can meet the complete needs of home, small and medium industry, office buildings, portable situations, and emergency situations in a compact inexpensive system that will last for decades with minimal maintenance.
- Various scaled storage units can provide tens of thousands of hours of energy for ships, ferries, aircraft, trains, conventional power plants, heavy equipment, heavy vehicles, public transportation and other applications at a fraction of the total cost of any other storage system.
- Manufacturing and eventual decommissioning of any of these thermal storage units has zero negative environmental impact.
- No strategic or rare materials are used in production, freeing these units from the geopolitical risks associated with many conventional batteries.
- The storage system can be used to retrofit existing thermal electric systems including coal and gas power plants, various power trains and engines, avoiding the expense of replacing equipment that still has operation life as well as making use of existing infrastructure such as grid lines, boilers, steam and gas turbine, generators condensing towers etc.

3. THERMAL ENERGY APPLICATION

Virgil Perryman holds two key patents in the application of thermal energy. The first is a patent that describes how the Perryman Battery™ can run a Brayton Cycle turbine using a solid state transfer of heat. The second describes how the heat in slag combined with the energy stored in a Perryman Battery™ can be used to break down and recover the constituents of the slag by-product from steel manufacturing, resulting in a significant improvement in the economics of running a steel mill.

3.1. NON-COMBUSTION ENERGY SOURCE AND CONFIGURATION FOR BRAYTON CYCLE HEAT ENGINES

This patent covers the concept of the use of solid state transfer of heat into a heat exchanger to drive a turbine as opposed to using combustion fuels. This is important as it

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means the Perryman Battery™ will extend the use of Brayton Cycle turbines for the next 20 years or so.

Publication number: 20130247585

Abstract: A Brayton cycle heat engine includes a compressor, a combustion chamber, and a turbine. The Brayton cycle heat engine also includes a heat exchanger positioned at least partially within the combustion chamber. The heat exchanger is configured to deliver thermal energy to the combustion chamber from an external source, heating air entering the combustion chamber from the compressor, where the air exits the combustion chamber and drives the turbine.

Type: Grant

Patent number: 9470148

Filed: March 21, 2012

Issued: October 18, 2016

Publication date: September 26, 2013

Inventor: Virgil Dewitt Perryman

A full listing of this patent can be seen here

<http://www.google.com/patents/US20130247585>.

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One of the major barriers to moving from conventional energy sources to alternative and renewable energy sources is the abandonment of infrastructure that still has usable life and value. This is especially the case with gas turbines, which with proper maintenance can last 50 years. The original cost of this equipment is significant particularly when you factor in installation. For example, power providers are understandably reluctant to walk away from the millions or even billions of dollars their investment in these turbines represent. This technology will allow any gas turbine to use a direct heat source to create the propulsive force needed to drive the turbine.

Advantages

- Any gas turbine can be retrofitted and the retrofit is easily reversible. In many types of turbine both direct thermal and combustion can co-exist allowing the user to switch back and forth.
- Application such as turbine engines for aircraft, ships, trains and military vehicles can be retrofitted.
- Combined cycle system operates as if combustion is being used.
- The working life of existing turbines can be greatly extended as the abrasive effects of by-products of combustion are eliminated.
- Net efficiency of energy to work is increased as the delivery of the thermal energy is consistent and not effected by the characteristic of combustion.
- The retrofit is simple and relatively inexpensive.
- Noise is dramatically reduced, if not eliminated, as there are no violently burning gases.

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- In aviation and other mobile applications the fuel is heat, only the battery weight must be considered and in all cases this weight is less than or comparable to conventional fuels. As the energy is used from a Perryman Battery™ there is no weight difference and so the load on the turbine is constant and predictable.
- Potential use of this technology combined with the thermal storage technology of a Perryman Battery™ could double the range, as compared to conventional fuels, and eliminate the noise at airports, with generators, and with heavy equipment thereby offering a totally green alternative without the need to replace existing fleets or equipment.

3.2. DRY PROCESSING OF, AND THERMAL RECOVERY FROM, SLAG

This patent concerns the transfer of heat and the potential to use the Perryman Battery™ to improve the efficiency and economics of industries with waste products such as slag as generated in the production of steel.

Publication number: 20130154168

Abstract: Apparatuses, systems, and methods discussed herein facilitate processing of, and thermal recovery from, material such as slag. A disk assembly is configured to process material. One or more heat exchangers are configured to extract heat that is already present in the material, heat generated during processing, or both. A thermal transfer system is configured to transfer heat away from the disk assembly, away from one or more heat exchangers, or both.

Type: Application

Filed: December 15, 2011

Publication date: June 20, 2013

Inventor: Virgil Dewitt Perryman

A full listing of this patent can be seen here

<https://www.google.com/patents/US20130154168>.

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The heat in slag and the energy stored in a Perryman Battery™ can be used to break down and recover the constituents of the slag by-product from steel manufacturing, resulting in a significant improvement in the economics of running a steel mill.

Advantages

- The economic value of slag if broken down into its constituent parts is greater than the economic value of steel produced.
- This technology would mean that many steel mills which are currently considered not to be economic could now become profitable and viable.