## Enhance Your Business with Our Innovative Technology



### THERMAL ENERGY STORAGE DEVICE

### THERMAL BATTERY 2



Discover a unique opportunity to access cutting-edge patented technology, designed to revolutionize the waste treatment sector with the production of advanced biofuels

With our patent, we are ready to offer you a license that will allow you to fully exploit this innovation and dominate the market

## Patent Overview

### Nature of the Patent

A patent is an exclusive right granted to an invention, which prevents others from exploiting it without authorization. This is a valid legal tool to protect innovation.

### **Importance of the Patent**

The patent gives the owner control over the use of the invention and allows him to profit from it through the sale of licenses. It is essential to enhance and monetize innovation.

### Sale of Licenses

The sale of licenses allows third parties to use the invention covered by the patent in exchange for compensation. It is an effective way to expand the market and generate additional revenue.



## Patent Registration Process

### **Legal Protection**

Once granted, the patent provides the owner with legal protection against unauthorized use of the invention by others. It is essential for defending intellectual property rights.

### Patent application

The process begins with the submission of a patent application to the relevant Patent Office. It is essential to provide a detailed description of the invention and satisfy the patentability requirements.

### **Examination and Grant**

After submission, the Patent Office examines the invention to verify its novelty and applicability. If it meets the criteria, the patent is granted, giving the owner exclusive rights.



# Benefits for the Licensee:

### **Exclusive Access**

Gain exclusive access to technology that has already been tested and validated, allowing you to build new systems with a significant competitive advantage

### Savings on R&D costs

Drastically reduce development times and costs by accessing technology that is ready for commercialization.

### **Increase in Revenues**

Our technology has the potential to expand market share on the topic of waste treatment through a green process.

### **Full Support**

We offer technical support and consultancy throughout the implementation process, ensuring a smooth transition.



# Licensing strategies

### Exclusive

Grant a single exclusive license to a selected partner, ensuring a high level of control and visibility in the market.

### **Not Exclusive**

Offer non-exclusive licenses to multiple parties, allowing greater diffusion of the invention and greater generation of revenues.

### Sublicense

Allow a license holder to grant sublicenses to third parties, further broadening the scope and use of the invention.



## INVENTORS



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### ABSTRACT

Our patent includes an exclusive technology inherent to the accumulation of thermal energy, in particular to static thermal energy accumulation devices

This technology is the result of years of research in the field of thermal energy treatment and storage.



## VALIDATION OF EUROPEAN APPLICATION

### **ITALIAN PRIORITY**

COUNTRY	NUMBER	PRESENTATION DATE	GRANT DATE	PATENT NUMBER

QUESTION N. 102021000020384

PRESENTATION DATE:

29/07/2021

GRANT DATE:

20/09/2023

PATENT N. 102021000020384

## INTERNATIONAL APPLICATION VALIDATION

COUNTRY	APPLICATION DATE	PATENT STATUS	GRANT DATE	CONCESSION NUMBER
UNITED STATES				
CHINA				

**EXTENSION PCT** 

QUESTION N. PCT/IB2022/056993

> PRESENTATION DATE: 28/07/2022 GRANT DATE: 00/00/0000

## CERTIFICATES



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Documento informatico, redatto e firmato digitalmente ai sensi degli arti. 20 e 21 del D. Lgs. 82/2005 e s.m.i.

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## DESCRIPTION OF THE PATENT

The purpose of the present invention is to provide a thermal energy storage device capable of offering equal performance compared to devices with thermal storage material with high thermal diffusivity, and reduced construction and installation costs. Further purposes of the invention include a reduced need for maintenance, a high energy efficiency both during the charging and discharging phase, controllable charging and discharging times, a high exchange power / mass ratio of the system, a constant flow rate delivery to the user at a constant temperature (or, equivalently, a constant thermal power), and a great flexibility with respect to the possibility of series or parallel connection, and in general to the possibility of establishing a modular thermal storage battery with minimization of the phenomena of backmixing and entropy increase.

The purpose of the invention is achieved by a process having the characteristics forming the subject of the attached claims, which form an integral part of the technical instruction given here in connection with the invention.



## DESCRIPTION OF THE FIGURES

The invention will now be described with reference to the annexed figures, provided purely as a non-limiting example, in which:

- Figure 1 is a partially exploded perspective view of a thermal energy storage device based on the invention,
- figure 2 is a perspective view according to arrow II of figure 1,
- figure 3 is a cross-section view according to track III-III of figure 1,
- Figure 4 is a detailed view according to arrow IV of figure 3,
- Figure 5 illustrates a possible solution for connecting devices in a battery according to the invention, and
- Figures 6 and 7 are viewed enlarged according to arrows VI and VII in figure 5.



# PATENT DESIGNS



## PATENT DESIGNS



## PATENT DESIGNS





The state of the art offers numerous examples of thermal energy storage devices that use fluids such as water, diathermic oil or molten salts as storage material, and which typically include moving mechanical components for the handling and general management of storage fluids, which can themselves act as energy carrier fluids.

One of the main problems of these devices is the need for relatively dense maintenance to maintain the efficiency of the device, the possibility of scale formation, the possible need to adopt auxiliary heaters for start-up operations in order to reduce the viscosity of the fluids.

On the side of (static) thermal energy storage devices in which the storage material is of the solid type, there are - for example - storage systems based on cement / concrete for thermodynamic plants.

The accumulation material consists of a concrete block made by casting, inside which the service/process pipes are embedded, which cross the entire block and relate to one or more manifolds installed at the ends.



A system of this type, although it does not require frequent maintenance and disassembly, and although it is very advantageous from an economic point of view, is limited by the poor thermodynamic performance of the storage material, in particular by a low thermal conductivity that gives rise to low thermal energy transfer rates (long charging and discharging times) and in a, albeit slow, degradation of the quality of the stored energy due to the thermal continuity between the various regions of the single, large mass of concrete.

Furthermore, it should be borne in mind that the very low thermal conductivity of cement translates into the impossibility of managing high thermal powers, i.e. large amounts of energy transferred in the unit of time, unless extensive exchange surfaces and large storage volumes are used.

The applicant has already addressed the above-mentioned problems in the Italian patent application for industrial invention no. 102017000091905 (IT '905 hereinafter), arriving at a technical solution in which the achievement of the desired performance had been associated with a single physical quantity characteristic of the thermal storage material alone: thermal diffusivity. IT '905 identifies confidence intervals for the thermal diffusivity of the thermal storage material that in fact exclude stone, refractory or cementitious materials.



The technical discussion developed in IT '905 basically highlights two aspects:

- a material with low thermal diffusivity is not very performing in terms of readiness in the transfer of thermal energy to and from the heat transfer fluid, although it may in principle have an adequate volumetric thermal capacity;
- A material with too high thermal diffusivity is not able to provide performance in line with the operation of a thermal storage unit, as it creates an imbalance between heat transfer properties (thermal conductivity) and storage properties or thermal inertia (density and specific heat) with a preponderance of the former, which would irreversibly shift the operating field towards pure heat exchange devices: excessive heat exchange readiness instead of a potentially modest volumetric heat capacity.

The thermal diffusivity values identified by IT '905 allow the proper functioning of the individual thermal storage device and a battery of such devices with reference to the performance specifications required by a generic user, i.e. the delivery of a constant thermal power for a given time duration (autonomy). This is achieved through the delivery of a constant flow rate of heat transfer fluid at a constant temperature (both assigned by the user).



When the thermal storage unit is discharged, it will transfer part of its internal energy to the heat transfer unit, which can be crossed by the heat transfer fluid destined for the user with a constant flow rate as long as the thermal storage unit has a sufficient residual "charge" (internal energy). This is generally valid, regardless of the nature, form and construction of the thermal storage unit and the heat transfer unit.

However, the inventors observed that a thermal energy storage device made in accordance with IT '905 requires the use of extremely expensive thermal storage materials, especially in the case of large-scale storage devices.

In other words, while offering good performance in terms of storage and release of thermal energy, the costs for the construction and implementation of such a storage device almost completely cancel out the benefits of the same, making more conventional solutions for the intake of thermal energy preferable to a heat transfer fluid.



### Scope

The invention was developed with particular reference to the supply of thermal energy storage devices capable of offering equal performance compared to devices with thermal storage material with high thermal diffusivity, and reduced construction and installation costs.

Further purposes of the invention include a reduced need for maintenance, a high energy efficiency both during the charging and discharging phase, controllable charging and discharging times, a high exchange power / mass ratio of the system, a constant flow rate delivery to the user at a constant temperature (or, equivalently, a constant thermal power), and a great flexibility with respect to the possibility of series or parallel connection, and in general to the possibility of establishing a modular thermal storage battery with minimization of the phenomena of backmixing and entropy increase.



# **Potential Users Interested**

#### **Factories and Manufacturers of**

- ✤ Boilers
- Process equipment for industry

### Industry:

- producers of technical gases (N2, CO2, O2, etc.)
- Chemical
- Pharmaceutical;
- ✤ agri-food
- ✤ paper mills;
- ✤ Refineries
- ✤ Tanneries
- Polymer, rubber and plastic manufacturers
- ✤ Electricity producers, thermal
- Cryogenic Implant Manufacturers
- Energy production and recovery
- Production of e-fuels



## Conclusions

### **Summary of Key Points**

Patenting and selling licenses offer unique opportunities to enhance innovation and generate revenue. Making the most of the benefits of an effective licensing strategy is critical.

### **Action for Enhancement**

To fully capitalize on patents and licensing, it is essential to develop and implement a targeted strategy, taking advantage of the various opportunities offered by the market.

### **Maximizing Profits**

Optimizing the use of patents and licenses allows you to maximize profits and effectiveness in the market, ensuring a position of competitive advantage.

