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INNOVATIVE LOGISTICS OF SMART AIRFIELD GROUND HANDLING TECHNOLOGIES (Innovative infrastructure components of a smart airfield ground handling technology complex for energy supply, backup energy storage, water supply and purification, water regeneration and recirculation, clean air supply, air regeneration and oxygen enrichment, and integrated issues of active real-time monitoring and control of these components and their interrelationships)

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Abstract

The article examines methodological approaches to the development of innovative technical solutions for smart homes, smart industrial facilities, and their infrastructure components, with particular attention to systems supporting airfield ground handling technologies. It emphasizes the importance of a comprehensive systems approach that integrates technical, technological, economic, environmental, and commercial considerations throughout the innovation process. The study also highlights the role of patent and licensing strategies and the assessment of the commercial potential of engineering solutions.

The article presents the concept of an autonomous modular energy-generating unit designed as a backup power source for smart building infrastructure. The proposed solution is based on a multistage energy conversion process, innovative fuel compositions, electromagnetic torque amplification, and planar low-speed electric generators to improve energy efficiency and operational reliability. The integration of advanced infrastructure technologies with intelligent control systems provides a foundation for commercially viable, energy-efficient, and environmentally sustainable engineering solutions for next-generation smart infrastructure.

Keywords: *Smart airfield ground handling technology complex; Innovative infrastructure components of a smart airfield ground handling technology complex; Components of a smart airfield ground handling technology complex for energy supply; Components of a smart airfield ground handling technology complex for backup energy storage; Components of a smart airfield ground handling technology complex for water supply and water purification; Components of a smart airfield ground handling technology complex for water regeneration and recirculation, and clean air supply; Integrated issues of active real-time monitoring and control of these components and their interrelationships; Innovative logistics of a smart home, a smart industrial facility, and their infrastructure components*

Introduction to the innovative logistics of smart homes, smart industrial facilities, and their infrastructure components

The process of developing a technical solution that constitutes an invention while also possessing commercial potential requires extensive analytical preparation, numerous comparative evaluations, and the identification of those parameters and characteristics that, under current conditions, are capable of attracting investor interest and generating the required level of market demand.

The era of isolated inventions that could be implemented independently and without reliance on integrated technologies or the interconnected conditions of modern life has passed. Contemporary technical solutions must take into account environmental and sustainability considerations, as well as the social aspects of their application.

Without a systematic approach and a clearly defined methodology, it is extremely difficult for inventors and technology developers to navigate this complex environment.

The first step is to evaluate the proposed technological solution and systematically compare its characteristics with those of existing technical solutions and technologies that have previously achieved, and continue to achieve, commercial success.

Market requirements are often highly subjective. Therefore, it is essential to establish the relationship between subjective market expectations and objective constraints associated with the performance limits of technological equipment, the availability of suitable materials, production costs, and the practical feasibility of manufacturing operations, while ensuring that these factors do not compromise the unique advantages and distinguishing features of the proposed invention.

It is recommended that the preliminary analysis be conducted according to the following framework.

Introduction

Characterization of the integrated nature of the proposed technology.

Analysis of the proposed technology to determine whether it is based exclusively on well-established and repeatedly validated physical principles and laws implemented in a compact integrated engineering or technological solution.

Analysis of the proposed technology and the device (or method) for its implementation to determine whether they can be applied in real industrial systems without any modification of their design or operating principles.

Analysis of the proposed technology to determine whether it utilizes only well-established and widely used components and their combinations.

Analysis of the proposed technology to assess the possibility of integrating novel components with well-established ones in various combinations formed during the proposed process through the properties and characteristics of the device used to implement the proposed technology.

Analysis of the proposed technology to evaluate its level of versatility and flexibility, enabling the implementation of flexible technological schemes within the same device or method used to realize the technology.

Analysis of the proposed technology to determine the possibility of incorporating, or the presence of, a system for process management, monitoring, and parameter control based on a minimum number of monitored and regulated process parameters that have a direct relationship with, and immediate influence on, the efficiency of both the process

itself and the device during its operation, while ensuring the required technological, energy, and environmental performance.

Process description

Possible components of the proposed technology and device.

Description of device design options, taking into account the possibility of integrated activation and improvement of the efficiency of its fundamental operating principles.

Description of the process advantages achieved through the operation of the proposed device due to the properties and characteristics of the device itself.

Description of well-established and tested technologies that preceded the development of the proposed technology and positively influenced its performance parameters and characteristics.

Characteristics of the proposed technology.

Sequential description of the technological stages of the proposed process.

Schematic diagram of the devices and components included in the industrial system using the proposed integrated technology.

Operating procedure of the proposed device, illustrated by its implementation in a real industrial system.

Operational characteristics of the proposed technology during the initial stages of application.

Operational characteristics of the proposed technology during the subsequent stages of application.

Methods for regulating the main operating characteristics of the proposed technology; the possibility of remote control of the regulation process; the main regulated parameters; feedback during regulation.

The main operating parameters of the proposed technology that determine its advantages over existing alternatives and technologies.

Description of the proposed process or the integrated nature of the proposed technology; advantages arising from the implementation of the proposed process or technology.

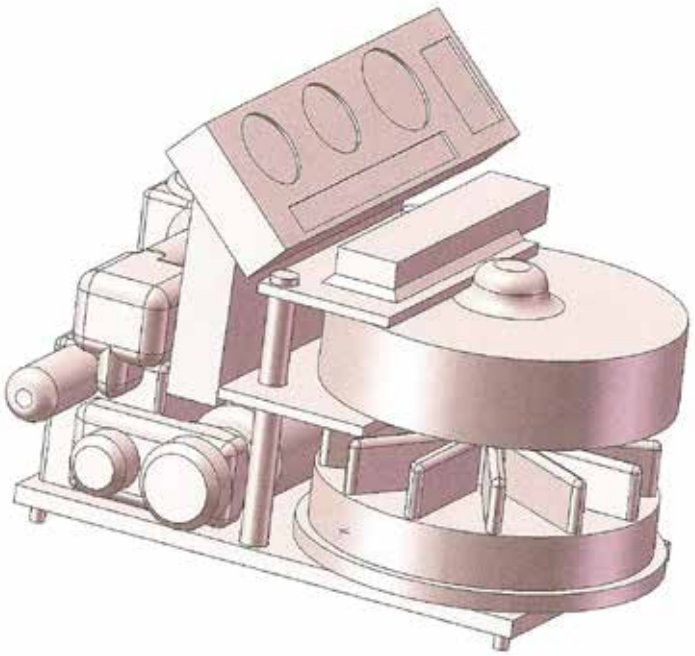
Expected and calculated characteristics of the proposed process.

Technical and commercial advantages of applying the proposed technology; its potential integrated nature and the impact of this aspect.

Working with the patent and licensing strategy flowchart.

After completing the above analysis, a sufficient amount of information may be accumulated to complete the patent and licensing strategy flowcharts.

Figure 1.



Depending on the complexity of the technical solution, the structure of the flowcharts may vary significantly. However, they will undoubtedly be more effective and reliable if, prior to their completion, a forecast is made of the future development of the field of technology to which the proposed technical solution or the subject of the future invention belongs.

A wide range of information tools is currently available for preparing such forecasts. Their analysis, combined with an understanding of the technical and commercial essence of the proposed invention, makes it possible to produce a sufficiently accurate forecast.

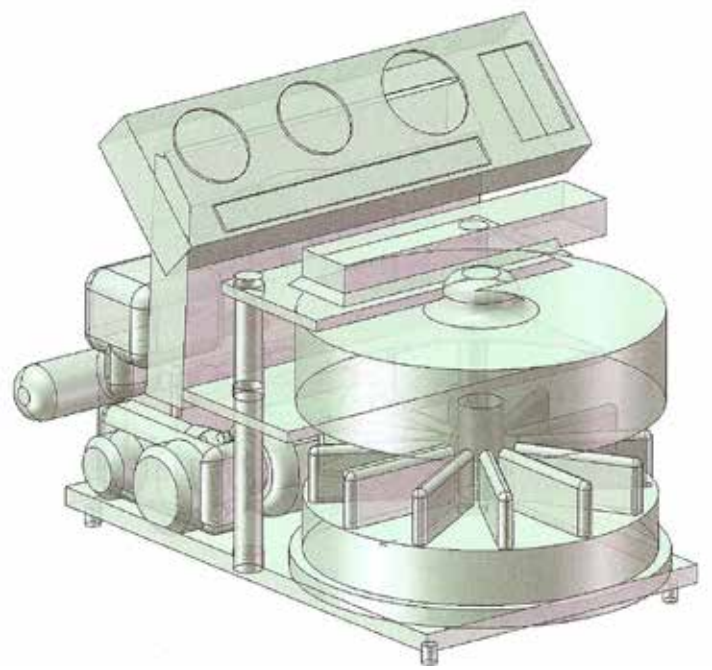
Thereafter, the initial sections of the patent and licensing strategy flowchart may be completed using the proposed template, and the planned implementation process can begin.

A smart home, and especially a smart industrial facility intended for the installation of equipment supporting airfield ground handling technologies, like any other building, requires a reliable, cost-effective, easy-to-manage, and independent backup energy source.

The following solution is proposed for this purpose: an autonomous modular energy-generating unit for installation within the infrastructure of a smart home as an independent backup power source. The unit is based on integrated engineering solutions aimed at reducing the consumption of organic fuels in internal combustion engines, achieving highly efficient energy conversion with increased output torque, and employing planar technology in the design of low-speed electric generators.

The proposed unit is designed according to the principle of sequential multistage energy conversion, in which different forms of energy are transformed step by step, with the equivalent power characteristics being progressively amplified at the output of each conversion stage.

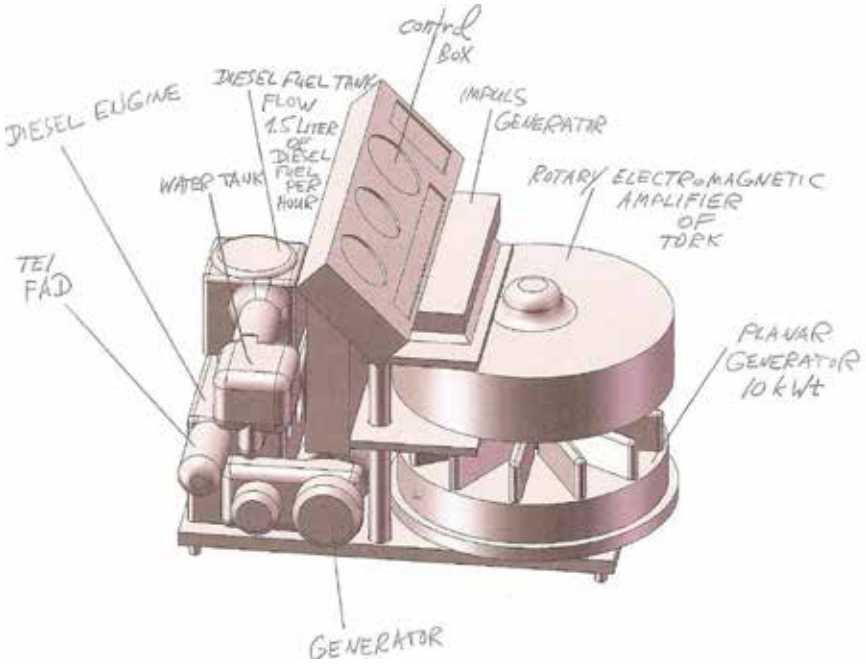
Figure 2.



1. The first stage of energy conversion involves transforming the energy released from the combustion of organic fuel into the mechanical rotational energy of the output shaft of an internal combustion engine, which serves as the primary energy conversion unit.

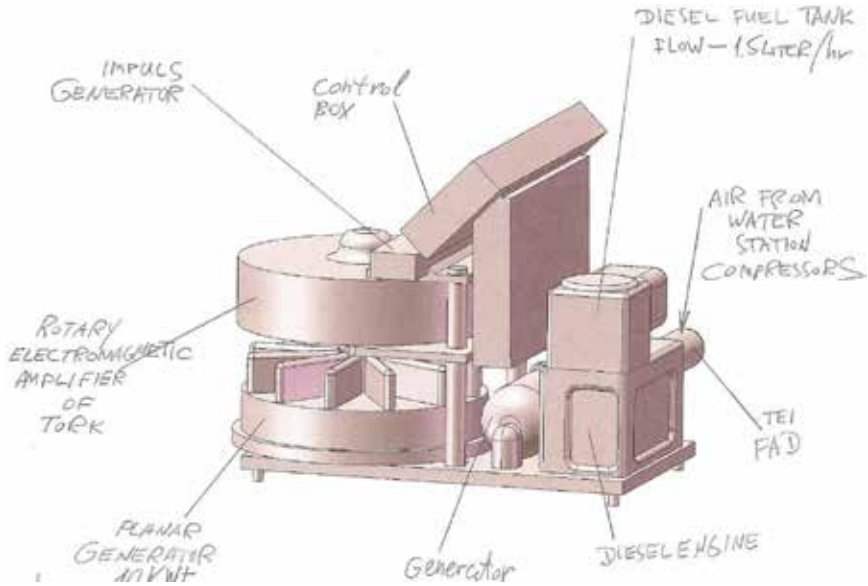
The energy efficiency improvement at this stage is achieved through the use of a fuel composite consisting of a hydrodynamically mixed and aerodynamically foamed fuel composition containing 70% ethanol and 30% synthetic water. The synthetic water is obtained from atmospheric moisture containing traces of ethanol vapor, another alcohol, or gas condensate. Alternatively, highly purified water may also be used.

Figure 3.



2. The second stage of energy conversion involves transforming the mechanical rotational energy of the output shaft of the internal combustion engine into electrical energy with predetermined electrical characteristics.

Figure 4.



3. The third stage of energy conversion involves generating electrical current pulses with predetermined parameters.

4. The fourth and most important stage of energy conversion involves transforming the current pulses into torque at the output shaft of the torque converter–amplifier. The amplification effect is achieved through two factors. The first factor is kinematic, and it involves the use of a rotary converter that transforms linear motion into rotational motion, thereby eliminating dead centres and the energy losses associated with overcoming them. The second factor is electromagnetic, and it involves the use of armoured electromagnets with a specially designed magnetic circuit and a specially designed solenoid, together with additional structural advantages resulting from the combination of the core and the planar design of the solenoid coil.

5. All these advantages determine the efficiency of electromagnets belonging to the category of so-called WARM OR COLD magnets, which generate a pulling or pushing force an order of magnitude greater than the equivalent electrical energy consumed to produce it.

6. The fifth stage of energy conversion involves transmitting torque to the shaft of a planar low-speed generator and producing electrical energy as the final output of the unit.

7. The use of a planar low-speed generator makes it possible to utilize the power characteristics of the electromagnets in their most efficient operating mode, since the lower the operating frequency of the electromagnet, the longer its operating cycle, and the more time is available for the restoration of the magnetic properties of the combined magnetic circuit.

8. All of the fundamental technical solutions incorporated into the proposed unit possess substantial novelty and constitute inventions. These include:

– The use, as the fuel mixture for the internal combustion engine, of a mixture consisting of an organic component and an inorganic component.

– The use of hydrodynamic activators, operating on the Bernoulli principle, for mixing the organic and inorganic components of the fuel mixture within a continuously flowing stream of the organic component.

– The use of aerodynamic activators, operating on the Bernoulli principle, for foaming the composite–compound fuel mixture within a continuously flowing stream of the fuel mixture.

References, Patent, and Licensing Information

Oguni, T., et al. *Secondary Battery and Manufacturing Method Thereof*. United States Patent Application No. 20210104744, Kind Code A1, April 8, 2021.

Oikawa, M. *Battery Electrode and Method for Manufacturing the Same*. United States Patent Application No. 20210104719, Kind Code A1, April 8, 2021.

Shelton IV, F. E., et al. *Modular Battery Powered Handheld Surgical Instrument and Methods Therefor*. United States Patent Application No. 20210100579, Kind Code A1, April 8, 2021.

Seki, H., et al. *Secondary Battery, Battery Pack, Vehicle, and Stationary Power Supply*. United States Patent Application No. 20210091416, Kind Code A1, March 25, 2021.

Londarenko, Y. Y. *Multi-Layer Battery Configurations*. United States Patent Application No. 20210091402, Kind Code A1, March 25, 2021.

Lane, R. C. *High Voltage Battery Module Parallel Cell Fusing System*. United States Patent Application No. 20210091363, Kind Code A1, March 25, 2021.

Balaram, H., et al. *Battery Pack with Attached System Module*. United States Patent Application No. 20210091360, Kind Code A1, March 25, 2021.

Dou, S., et al. *Lithium-Ion Battery and Apparatus*. United States Patent Application No. 20210075063, Kind Code A1, March 11, 2021.

Nakayama, T. *Non-Aqueous Electrolyte Secondary Battery*. United States Patent Application No. 20210075060, Kind Code A1, March 11, 2021.

Lee, J., et al. *Secondary Lithium Battery Anode and Secondary Lithium Battery Including Same*. United States Patent Application No. 20210075015, Kind Code A1, March 11, 2021.

Park, B. Y., et al. *Prelithiated and Methods for Prelithiating an Energy Storage Device*. United States Patent Application No. 20210075008, Kind Code A1, March 11, 2021.

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