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INNOVATIVE TOOL OF TECHNOLOGICAL INTEGRATION (Composite Technical Solutions as an Inevitable Foundational Component for the Creation of Integrative Inventions and as the Main Instrument of Technological Integration)

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Abstract

The introduction of new technologies, the use of new materials, and the replacement of traditionally accepted production methods with unconventional ones that contribute to and are an essential prerequisite for a technological leap or breakthrough, as well as for improving production efficiency, are today referred to as the innovation process. This process, under conditions of diverse technical and technological cultures and varying initial levels for the commencement of initiated innovation processes, may differ significantly; however, the acute necessity for the initiation of such processes is undeniable. Psychological barriers associated with the need to combine classical solutions with the latest developments within an innovative project, and classical composite technical solutions serve as an inevitable fundamental component for the creation of integrative inventions that utilize composite technical solutions as the principal instrument of technological integration.

Keywords: *Technological integration; Composite technical solutions; Innovative integration tool; Traditionally accepted production methods; Various technical and technological cultures; Psychological barriers; Technological breakthrough; Initiated innovation process; Main instrument of technological integration; Thermodynamic cycle; Optimization of the thermodynamic cycle*

Change in the Rules and Criteria of Industrial Design

The first quantum computer has been introduced, joining the global race for *quantum supremacy*. The innovative 20-qubit computer utilizes advanced superconducting technology. *Quantum supremacy* refers to the level of performance achieved by a quantum computer that enables it to solve problems requiring computational power practically unattainable by conventional supercomputers. As of today, quantum supremacy has been achieved only

for specific model tasks by several quantum computers, yet the development of quantum computing continues worldwide. All developed nations participate in this global competition, with the United States and China being recognized leaders. Israel has now joined this race as well.

The development of quantum computing encompasses not only the creation of quantum computers but also the establishment of infrastructure for access to computational capacities, the development of software, and the capability to use quantum computers in conjunction with conventional supercomputers.

"Quantum technologies must fundamentally expand human capabilities across a wide range of fields. In recent years, the United States has advanced initiatives in robotics, autonomous systems, cybersecurity, and artificial intelligence, integrating them into business domains, including cooperation with startups and academic institutions."

"The presentation of the first quantum computer is an important milestone. This is not a standalone initiative but part of a broad strategy to promote breakthrough technologies across various sectors. All these efforts are elements of a strategic plan for the development of quantum computing, aimed at maintaining technological leadership, preserving the competitiveness of the high-tech industry, and ensuring sustainable economic growth."

Laboratories engaged in quantum computer development are now focusing on the design, modeling, integration, and adaptation of practical applications for superconducting quantum computers. This work implies close cooperation with companies and research institutes worldwide, positioning the developer as a leader in the field of quantum computing.

This honorable status, which provides a significant competitive advantage, is reinforced by close coordination among government institutions, academia, and industry.

"The research team working on this ambitious project is among the best. The collaborative and interdisciplinary nature of this project will yield significant research outcomes and strengthen scientific and technological standing."

"Quantum technologies are intended to fundamentally enhance human capabilities in a wide spectrum of areas," stated the CEO of the developing company.

In recent years, the company has advanced a number of initiatives in robotics, autonomy, cybersecurity, and artificial intelligence, integrating them into business directions – some in cooperation with startups and academic institutions.

The strength of industry depends on partnerships between academia, startups, industry, and government institutions.

Technologies are studied in academic circles and applied in industry, serving as a powerful multiplier.

Experts have noted that the quantum computer continues to evolve and possesses enormous technological potential.

It should be recalled that the smallest unit of information storage in a traditional computer is the bit, which can take on only one of two values: 0 or 1.

When solving a problem, a conventional computer performs a large number of sequential operations with bits.

For complex tasks, this process can take a considerable amount of time.

Quantum computers, on the other hand, operate with qubits (quantum bits), which, in addition to 0 or 1, can assume both values simultaneously.

In performing computations, quantum computers do not sequentially iterate through all possible combinations, as conventional computers do, but rather execute calculations instantaneously.

The introduction of new technologies, the use of new materials, and the replacement of traditionally accepted production methods with unconventional ones that facilitate and are an indispensable condition for a technological leap or breakthrough and an increase in production efficiency are now commonly referred to as the innovation process.

This process, under conditions of differing technical and technological cultures and varying levels of starting positions for the initiation of innovation processes, may differ significantly; however, the acute need to begin such a process is beyond question.

In recent years, the economies of nearly all industrially developed countries have acquired and continue to exhibit an increasingly pronounced innovative character.

While at the early stages of this trend technological breakthroughs had a local character and were observed mainly in high-tech fields, microelectronics, and so-called nanotechnologies, today the innovation process has become increasingly directed toward classical, fundamental technologies – energy, medicine, and transport – thus encompassing all key areas of human activity.

Entrepreneurs, in order to enhance the competitiveness of their products and technologies, are compelled to continuously seek new paths to improve efficiency, reduce energy consumption and intensity, increase environmental safety, and achieve economic stability within each enterprise or company. New opportunities in the design and testing of technical solutions have also introduced elements of composite design approaches, which are becoming key criteria for tools and methodologies in industrial design.

The situation has changed fundamentally with the use of artificial intelligence and artificial neural networks.

Scientists at **Intel Corporation** have developed algorithms that allow different AI models to work together. The elimination of the "language barrier" between systems accelerates performance by a factor of 2.8. Until recently, each AI model used its own unique set of tokens, understandable only to itself. This created a barrier to interoperability among systems developed by different companies.

Major technology corporations had previously employed the *"on-the-fly decoding"* method, in which a small, fast model makes an initial assessment of a request, while a larger and slower model verifies and corrects the response. However, this approach only works with models that "speak" the same digital language.

The new solution consists of two main algorithms.

The first allows models to translate their output data into a universal format understandable by all systems. The second forces models to focus on tokens with identical meaning across different systems – similar to words such as "banana" or "internet," which sound nearly identical in various human languages. These shared tokens become the starting point for decoding. The results exceeded researchers' expectations. Instead of information loss during "translation," the new algorithms accelerated the performance of large language models by an average of 1.5 times, and in the best cases – by 2.8 times. The algorithms have already been made publicly available on the **Hugging Face Transformers** platform and have become part of the standard toolkit for efficient AI performance.

This solution is particularly important for **edge devices** – smartphones, drones, and autonomous vehicles – that must rely on limited computing power in the absence of an Internet connection.

In the case of a self-driving vehicle, faster data processing can prevent a catastrophe. The study marks a new stage in the development of **collaborative AI**, where developers can freely combine the best features of different models, creating more efficient and accessible solutions for millions of users worldwide.

Not long ago, product durability was considered one of the most important criteria defining its commercial value. Today, with the constant reduction of time between the release of a new product and the introduction of an even newer one, this period has become so short that, within the framework of the innovation process, it often makes little sense to focus efforts and resources on excessive durability – whose lifespan would exceed the interval between the start of production and the market launch of its next-generation successor.

Which exceeds the period between the start of operation of an existing product and the market release of a newer or upgraded one. Since this period may vary significantly for different types of products, the very concept of durability becomes temporally blurred and, as an inventive objective, is no longer a critical factor.

There is also a subjective aspect of durability that must be taken into account.

Established perceptions of product longevity across various product types determine many commercial factors, including the quantity of goods demanded – and therefore sold – as well as their actual market price.

Imagine that a technical solution has been found that significantly increases a product's durability. In this case, such a factor would reduce the quantity of products required while maintaining the existing price level that consumers are willing to pay. This, in turn, leads to decreased sales volumes for manufacturing companies, placing them in a position where

they must choose – either to accept the innovation or to do everything possible to block its implementation and adoption.

As practice shows, these companies most often choose the latter, blocking the innovation; and in this process, the only party that loses is the inventor, the one who has created something that the market itself refuses to accept.

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Appendix 1.

United States Patent Application **20060250934**
Kind Code **A1**
November 9, 2006

Three-dimensional optical information carrier and a method of manufacturing thereof

Abstract

A three-dimensional optical information carrier is presented. The information carrier comprises formatting marks disposed on the nodes of a three-dimensional lattice formed by the intersection of equiangular spaced radial planes, equidistantly spaced cylindrical spiral tracks and virtual recording planes.

Appendix 2.

United States Patent Application **20070288947**
Kind Code **A1**
December 13, 2007

SWING ARM OPTICAL DISC DRIVE

Abstract

Disclosed is a swing type optical disc drive. The drive includes a disc rotating on a disc support and a swing arm pivoted at one of its ends and having a distal end communicating with an encoder. The pivot point and a point on distal end define a swing axis of the arm. The disc further includes an optical system mounted on the arm such that optical axis of the system is parallel with the swing axis and both axes lie in the same plane. A cam actuator imparts a swinging motion to the arm. The swinging motion of the arm positions the plane with the optical axis and the arm axes such that the plane is always tangent to a reading/recording track of the disc.

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