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COMPOSITE TECHNICAL SOLUTIONS AS THE MAIN TOOL OF TECHNOLOGICAL INTEGRATION. (Psychological Barriers and Composite Technical Solutions as an Inevitable and Fundamental Component in The Creation of Integrative Inventions)

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Abstract

The paper examines current trends in the formation of the innovation process, which now encompasses all areas of human activity – from energy and medicine to transport and industry. It emphasizes that modern technical solutions are increasingly acquiring a compositional character, representing a set of interrelated elements integrated into a unified engineering and technological system. The methodological principles for creating integrative inventions based on compositional solutions, as well as the specifics of their patent protection, are discussed. It is noted that successful commercialization is possible only when the principle of compositionality and a well-developed structure of a new technical solution are present, ensuring its integration into higher-level technological systems.

Keywords: *Implementation of new technologies; pronounced innovative character; innovation breakthrough; various technical and technological cultures; different levels of starting positions; operability of technical solutions; elements of composite design solutions; subjective factor of durability; reliability of a new product*

The introduction of new technologies, the use of new materials, and the replacement of traditionally accepted production methods with unconventional ones – which facilitate and are an essential condition for technological leaps or breakthroughs and for improving production efficiency – are now collectively referred to as the innovation process.

This process, under conditions of differing technical and technological cultures and varying levels of initial readiness for innovation, may differ significantly; however, the acute necessity for initiating such a process is undeniable.

In recent years, the economies of almost all industrially developed countries have adopted and continue to adopt an increasingly pronounced innovative character.

While at the early stages of this process innovation breakthroughs were of a local nature, primarily observed in high technology, microelectronics, and so-called nanotechnologies,

today the innovation process is becoming increasingly focused on classical, fundamental technologies – including energy, medicine, and transport – thus encompassing all essential spheres of human activity.

Entrepreneurs, striving to enhance the competitiveness of their products and technologies, are compelled to continuously seek new ways to improve efficiency, reduce energy intensity and energy costs, and increase environmental safety and economic stability within each individual enterprise or company.

Figure 1. *Figure 1 illustrates the evolution of one of the composite technical solutions that served as the basis for the development of a series of integrative inventions aimed at optimizing the Brayton thermodynamic cycle, with the prospect of its transition to a higher-level thermodynamic cycle*

New opportunities in the design and verification of the operability of technical solutions also introduce elements of composite design concepts, which are becoming key criteria and tools within the methodology of modern industrial design.

New opportunities for assessing the usefulness and feasibility (as well as the advisability) of modifying and upgrading existing technical solutions.

Very often, what is considered new is simply something well forgotten from the past. Therefore, when setting the objective and making a decision to initiate an innovative process aimed at synthesizing a new product, it is advisable to first verify whether any functional elements of the intended composition have already been invented.

Changing the rules and criteria of industrial design

If such or an equivalent solution is found, then the replacement of materials, the use of new components, and the integration of digital control and monitoring systems into the future composition may enable the creation of a new technological composition with the potential to integrate into a higher-level composite system.

The impossibility of successful commercialization without establishing the principles of compositionality and the compositional structure of a new technical solution

As practice shows, the possibility of selling or licensing autonomous technical solutions – if they are not initially linked to systems or solutions of a higher technological and qualitative level – is virtually zero.

Inventions of a compositional nature, which include at least a conceptual or schematic solution for integration into higher-level technological and structural systems, are implemented more confidently and within shorter timeframes. This is because the methodology and techniques of such integration are already present in the description and claims of the integrative and compositional technical solution, providing investors, buyers, or licensees with a clear framework for implementation.

Proposed techniques and methods for developing a compositional style in the creation of new innovative solutions.

Thus, the compositional formation of a technical solution represents an engineering and design approach focused on developing new technical concepts with regard to their potential integration into existing technological schemes and configurations.

Since the methodology of such integration can often be unique and possess significant novelty, the description and claims of a compositional invention – characterized by a multi-level architecture of causal relationships between composition components and their integration into design and technological linkages – largely determine the commercial success of these innovations.

Techniques and methods for transitioning from the created compositional foundation of a new technical solution to the basic framework of an integrative invention.

In many cases, an engineering and technological composition requires additional – and often fundamentally new – connections between its components and elements. In other words, even when a composition has a clearly defined engineering and technological structure in terms of its properties and composition, in order to transform it into a ready-to-use innovative product, it is necessary to identify versions of integration that enable the incorporation of the composition into the final, highly complex, and multi-level integrated product.

The possible versions of such integration may vary greatly; the essential point is that the final result of integration should lead to an unprecedented performance or quality leap that has not been previously achieved.

The impact of limitations on the number of claims in a patent on the reliability of protecting compositional technical solutions.

Restrictions on the number of patent claims generally complicate the reliable protection of an invented object. However, a properly developed principle of compositionality can, on the contrary, enhance the scope and strength of protection.

The ideal case is a system of causal relationships that makes it possible to achieve the declared effect only within the proposed system of compositional interconnections – with clearly defined conditions and features that determine the structure of the composition and the independent functions of each of its elements.

Given the constraints of patent form and length, it is reasonable to include in the compositional solution only those features and interrelations that do not affect the known independent characteristics and functions of the individual elements and components, but rather arise as a result of the formation of the composition itself, through the mutual functional influence of the composition's components on one another.

The impact of limitations on the number of patent claims on the reliability of protecting compositional technical solutions.

Limiting the number of claims in a patent application generally complicates the reliable protection of the invented object. However, a properly defined principle of compositionality can, conversely, enhance the scope and strength of protection.

The ideal case represents a system of cause-and-effect relationships that makes it possible to achieve the declared effect only within the proposed system of compositional interconnections, characterized by clearly defined conditions and features that determine the composition's structure and the independent functions of each element within it.

Given the limitations of patent form and space, it is reasonable to highlight in a compositional solution only those features and interrelations that do not affect the known independent characteristics and functions of the individual elements and components, but rather arise precisely as a result of forming the composition itself, within the mutual spheres of functional influence of the composition's components on each other.

It can be stated that with properly selected components of a composition – when they are subordinated within it to the requirements and properties of a newly created technological system – a new integrated system of characteristics, interrelations, feedbacks, and functions emerges. These are possible only within this composition and, moreover, demonstrate a tendency toward the evolution and refinement of intra-compositional connections.

It can be stated that, with properly selected components of a composition – subordinated within that composition to the requirements and properties of the newly created technological system – there arises a new integrated system of attributes, interrelations,

feedbacks, and functions that are possible only within this composition and, moreover, tend to evolve and refine the intra-compositional linkages over time.

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