

ILLIA BEDA

MODERN PRINCIPLES OF SMART INNOVATIVE DESIGN

*Integrated Smart Design and Innovation
through Algorithms and the Theory of
Inventive Problem Solving (TRIZ)*

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Illia Beda

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The growing multidimensional complexity of modern technology, particularly electronic and microelectronic systems, has fundamentally transformed the principles of their protection as objects of original, complex, and multifunctional intellectual property. In such systems, purely structural features, circuit solutions, or their combinations no longer fully define the essence of an invention. In contemporary conditions, these elements can often be realized in a functional system or prototype only under specific manufacturing, control, and organizational capabilities, which increasingly determine the key properties and viability of an invention.

The development of processor-based control systems further reinforces the role of algorithms, software, and feedback mechanisms as integral components of modern technical solutions. These elements have become inseparable from the inventive concept underlying advanced technological systems.

At the same time, modern design methodologies enable a comprehensive evaluation of innovative ideas and support the selection of optimal parameters, tools, and production equipment for the manufacture of complex innovative products, ensuring their technological feasibility and commercial relevance.

Keywords: *Design; Innovative design; Smart innovative design; Modern principles of smart innovative design; Key distinguishing features; Multidimensional technological complexity; Manufacturing technology; Manufacturing and organizational capabilities; Development of processor-based control systems; Integration into higher-level technological complexes; Equipment for the production of complex innovative products*

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Chapter 1. Systemic and Algorithmic Foundations of Modern Technological Innovation

The figure presents an example of constructing a design model of an innovative product with sectional views that enable simulation of the product's application during integration into higher-level technological complexes.



Figure 1. Example of a system design for diesel engine fuel activation

In addition, within a single unified process, both manufacturing drawings and graphical materials for a patent application are prepared. This approach makes it possible to implement multi-level quality control of the design.

Thus, within a single description it is both necessary – and, most importantly, feasible – to combine or integrate several different technologies. Both this integration itself and the identified potential channels and interconnections of such integration must be presented in the claims of the invention in a manner that prevents a patent examiner from questioning the

unity of all integrated distinguishing features of the prospective invention or from dividing it into a series of local technical solutions based on a single technological domain.

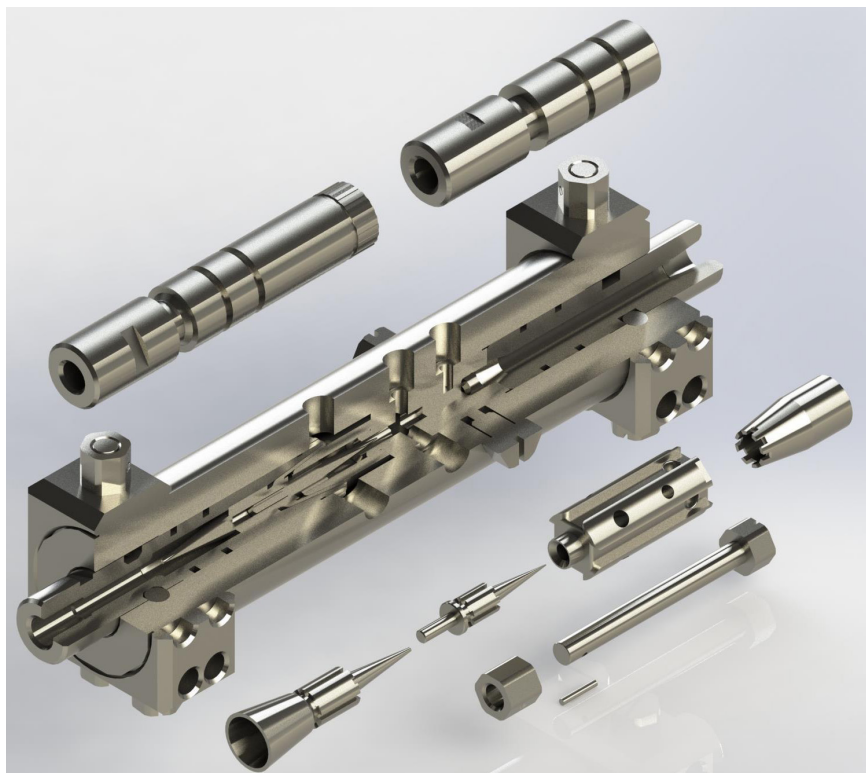


Figure 2. Design model of an innovative product for liquid fuel activation in an internal combustion engine

The influence of recently emerging technological fields – such as nanometrology, nanometallurgy, nanoceramics, nano-metal – ceramics, the widespread use of composite materials, and similar technologies – has fundamentally changed the approaches to qualifying technical solutions with respect to their compliance with the criteria of patentable inventions.