The composition theory in design and the industrial equipment design

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Abstract. The author offers (explains) his vision of the composition notion in engineering. Since the time of William Morris, his motto “for the connection of arts and crafts” has been raising doubts concerning the compatibility of these concepts. But the well-known formula “Ugly is not for sale” forced a human to relate more deeply on the creative process when creating machinery and machines in which he had already seen more than just mechanical parts connections. Therefore, the harmonization of the rich and complex world of the objective forms is the main task of the social tasks of our time. The article is devoted to the use of the composition theory laws (problems of tectonics, proportionality and scale) in the design of industrial process equipment.

Introduction
The relevance of the research. The role of aesthetics and the culture of manufacturing industrial goods is currently steadily increasing worldwide. Under these circumstances the theoretical analysis of design in general and industrial design in particular is updated.

The object created by the designer has its own characteristics due to a particular culture, historical conditions and time frame.

In the world of the design theory many scientific works have appeared. Among the modern representatives of the design theory, deeply and consistently studying the essence, the history of the emergence and development of design include such authors as: Somov Yu. S. "Composition in technology", Bystrova T. Yu. "The phenomenon of things in design: philosophical and cultural analysis", Koveshnikova N.A. "Design: history and theory"; Mikhailov A.S. “Industrial design as a type of design and artistic activity in the developed industrial production of the 20th century”, V. Yu. Medvedev "The Essence of Design";

However, the modern world requires additional research in this area, especially in industrial design, because the general technical progress of mankind depends on it.

Purpose, tasks, methods of work
The purpose of the study is to identify problems and trends in the development of industrial design with the help of scientific and philosophical analysis of the essence, structure and history of a given area of project activity.

To achieve this goal, it is necessary to solve the following tasks:
1. To identify the essential content of industrial design in the context of industrial civilization with the help of the system of philosophical categories: subject, object, relationship, activity.
2. To analyze the structure of industrial design on the activity methodological concept basis.
3. To consider the historical development of the design activity as a change in a person’s world view and his relationship to things and show the relationship between existing problems and human activities due to culture, world view and aesthetic ideas.
4. To carry out the philosophical analysis of the system “Nature - Human – Thing” to identify the specifics of these relationships and to improve the design activity, where the relationship between the designer and the consumer is mediated by the object of the design activity - the thing.
5. To identify the problems of modern industrial design and identify trends in its modernization due to the changes in cultural and value orientations, worldviews, scientific and technical inventions.
6. To consider the modern directions of the industrial design development related to the education and training of specialists in this field, software and financial support, state support, the creation of a national design color that should organically and systematically transform the design activities.

The object of the study is the problematic area in the industrial design, caused by the ties breakdown in the “Nature-Human-Thing” system.

The subject of the research deals with the methods of solving the industrial design problems related to the cultural and aesthetic impact on the subjects and objects of design activity by means of education, environmental education, public policy.

Now the industrial enterprises of Russia face the acute problem of developing not only a quality product, but also an outwardly attractive one, which will not cause hostility from the potential consumers.

Thus, the design contributes to the convergence of the material environment and man, society as a whole.

**Theory of composition in the design and design of industrial equipment**

The foundations of the design theory originated in the middle of the XIX century, long before the emergence of design as a profession. English art theorist John Ruskin introduced (1857) the concept of aesthetically valuable products. He emphasized: “What has been created hastily, will perish hastily; and is eventually the most expensive; the art of everyday things is fundamental to the hierarchy of the arts; machine production cripples the manufactured thing, its manufacturer and its consumer”.

![Figure 1](image_url). The layout of the cast iron boiler E-1, 6-0, 9GN using unified nodes. Joint project with the Finnish energy company “Tempere”. Structural designers: B.P. Podoba, Yoni Putkonen. Designer: A.D. Popov.

The technique of the composition in technology over the past decade has acquired a relatively clear character, but its structure has not been formed as a system yet. This also applies to the terminology used in this field of activity, it is also constantly being clarified.
The links between the main categories of composition in engineering, the laws, the means of harmonization, the place and significance of these connections and many other components of the theory are in constant improvement. Since everything similar from the adjacent areas was used in the design and its theory: from architecture and art on the one hand and from technology on the other hand, the serious discrepancies started appearing eventually, since the specificity of the shaping in technology is largely determined by the particular, very specific connections between a technological object and a human. At the same time in architecture the functional processes and effects of the structure on the form, other technological factors, as well as the sciences serving the technology cannot provide the theory composition system of its concepts, methods, techniques, and identify a number of laws related to the harmonious organization forms in the art. Like any scientific discipline, the composition theory is based on categories reflecting the most common essential relationships and the relationships of the phenomena under consideration. Tectonics and the three-dimensional structure are in the composition of such categories. Tectonics is a visible reflection of the material structural work in a shape. For example, the cast supporting structure must be so clearly expressed in shape that there should be no doubt that it is casting and not a welded structure.

At the same time, the shape of each product can be viewed from the point of view of a certain interaction of all its elements with each other and with space - as a three-dimensional structure, in some cases, simple and concise, in others - complex. But, regardless of the volume-spatial structure complexity degree, the system of connections of all its elements is crucial for achieving the true harmony along with tectonics. Thus, a well-organized volume-spatial structure of an industrial product and its structural clarity are the most important components of harmony [2]. As a harmonic whole, the composition of any industrial product has many properties and qualities. Properties and qualities can be divided into major, defining the form, and minor, less significant ones. So, the composition of the product can be built on the contrast between the complex, rich in shadows structure of the open part of the mechanism. The main quality of such a composition is contrast - the opposition of simple and complex beginnings. The above-mentioned qualities, structural clarity and organization of the volume-spatial structure, are the proportionality, scale, compositional balance, unity of character of the all elements form, coloristic and tonal unity. All these listed qualities together provide a kind of complex quality of composition - the harmonious integrity of the form. Form harmony in the technique is achieved by using special means, which in the design are called means of composition. These are the proportions, scale, contrast, nuance, rhythm, metric repetitions, the form nature, the use of color and tone, the material texture and plastic which is directly related to the cut-off form structure. Proportionality is the result of proportioning the whole and all its parts; the scale has been achieved by competently working through all the elements of the form on a person, since only a person can be considered a measure, giving things the right scale.

Figure 2. The modular method of assembling the structure of a gas-turbine station of a new generation GT-CHP-009. Structural designers: B.A. Anurov, V.E. Kurbatov, A.G. Bondarenko. Designer: A.D. Popov
Such an important quality of the composition as plasticity, is associated with the organization of the surface relief and the cut-off structure [1]. The composition agents should be used consistently. The designer cannot resort to proportions, then to scale, then to rhythm or contrast - usually he uses most of the tools at the same time and the basis of the composition is developed in this way. Only at the final work stages there is a need for nuances, polishing and clarifying the form nature, etc., but even this most subtle means use is thought out by the designer in the initial, sketch stage, as well as the use of color, tone or texture. The composition tools play a particularly important role in the structure of the theory, since they are a kind of toolkit in the creative work of the design engineer and the designer. Design is a special area of creativity with its professional techniques and methods of work. This part of knowledge is connected with the methodology of artistic design, and is acquired not only with the help of special methodical literature, but mainly in the process of the work itself, in the course of accumulating practical experience. Considering the individual properties and qualities of the composition, delving into the analysis of its means in a number of places it is necessary to consider the techniques and methods of the artistic design, in particular, the artistic and design analysis, the choice of the basic idea of the composition and its consistent implementation at all working stages.

Figure 3. The method of aggregation in the layout of the steam generator APV-4. Joint project with the Finnish energy company “Tempere”. Structural designers: B.P. Podoba, Yoni Putkonen, A.S. Ivitsky. Designer: A.D. Popov.

In general, the problem of developing design methods in design still remains relevant and can only be solved by increasing the theoretical level of technical aesthetics as a science. The study of all components of the complex process of design creativity should lead to a better understanding of this process as a whole. In understanding the nature of the composition, there are, of course, some nuances. It can be argued, for example, that the composition of this machine is incorrect in principle, but this does not mean that its form is not organized at all [3].

Summary
Composition is the organization of the form, taking into account both functional, structural and technological factors, as well as a number of regularities dictated by the requirements of form harmonization. Shaping is the process of creating the shape of the product, based on the consideration of the most important objective factors, as well as the composition laws. The process of shaping develops from the two sides - from the engineering development of the machine, from its layout in accordance with the specified technical requirements and conditions, on the one hand, and on the other hand - with the design development of the form in accordance with the composition laws [4]. Thanks to the well-implemented coordination, both directions of shaping at a certain moment start functioning together. But the entire design process should be constantly monitored by a design engineer who adjusts the design proposals and developments in a particular project.

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