

A CONCEPTUAL APPROACH TO THE DEVELOPMENT OF DESIGN AND ERGONOMIC SOLUTIONS FOR SPECIAL PURPOSE CLOTHING

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Abstract: *The aim of the research: generalization and systematization of the components of the conceptual approach for the purpose of designing modern reliable and ergonomic protective products.*

Methodology. The methodological basis of the research is a comprehensive approach to the creation of protective clothing. The methods of system-structural analysis, classifications, generalization and comparison are used.

Results. The main components of the developed approach are the initial data for the development of specific requirements. These include the specifics of production and climatic conditions, the topography of the influence of dangerous and harmful production factors, the analysis of typical poses, movements and positions of workers, the study of the assortment of modern varieties of clothing and materials for its manufacture, the nature of injuries, the use of other means of personal protection and technical equipment, etc.

Conclusions. A conceptual approach to the design of modern protective ergonomic clothing was developed, its components were systematized, and their features were revealed

Key words: *constructive and compositional elements, military clothing, shape-forming elements, ergonomic clothing, serviceman.*

1. INTRODUCTION

The presence of industrial enterprises in Ukraine, their extremely high concentration in certain regions; the existence of large industrial complexes, most of which are potentially dangerous; a developed network of transport communications; a large number of energy facilities and the use of a large number of hazardous substances in production necessitate the effective organization of the protection system, including by designing new types of clothing to protect workers from various types of hazards [1].

The creation of safe working conditions and the implementation in Ukraine of the best European and world practices of industrial safety, occupational hygiene and the production environment is impossible without the design, manufacture and introduction of qualitatively new types of protective clothing for workers. Without in-depth scientific justification, defined methods and criteria for evaluating the parameters of protective clothing, it is difficult to expand the range of products, the need for which is constantly growing. The creation of protective clothing at the modern stage is a complex task due to the variety of conditions faced by the worker in the process of production. With the development of industrial production, the requirements for the quality of protective clothing are increasing, since it must ensure occupational safety, prevent the effects of harmful production factors, preserve the normal functional state of a person, his

capacity for work throughout the entire working time, be non-toxic, not cause irritating on the worker's body, withstand scientifically determined terms of operation. Each profession has its own specific requirements for protective clothing, which must be taken into account when designing it. In various aspects, the problem of creating personal protective equipment is taken care of by leading scientists and specialists [1]. However, the multifactorial and interdisciplinary nature of the development of the scientific foundations of the design of protective clothing, the steady trend toward the appearance of new textile protective materials on the world market and modern clothing manufacturing technologies preclude one-time solutions and comprehensiveness of the topic.

2. EXPERIMENTAL PART

Domestically produced protective clothing existing on the consumer market does not withstand the established period of operation for various reasons, does not provide adequate protection of workers from the declared types of hazards, does not fully meet the specific level of requirements put forward to it, creates additional risk factors, does not always ensure the implementation of the specific needs of the production environment, and also has an unreasonably high cost. The ergonomic imperfection of products for the protection of workers during their professional and industrial activities leads to physical overload due to the excessive weight of clothing, complications and limitations of the characteristic movements of the worker, inconsistency of the structural and technological solutions of the products to the operating conditions, and as a result, a violation of the thermal balance. At present, the relevance of a certain direction of research on the problem of developing effective protective clothing of various functional orientations seems indisputable, and this is confirmed by statistical data on the level of industrial injuries and employee mortality.

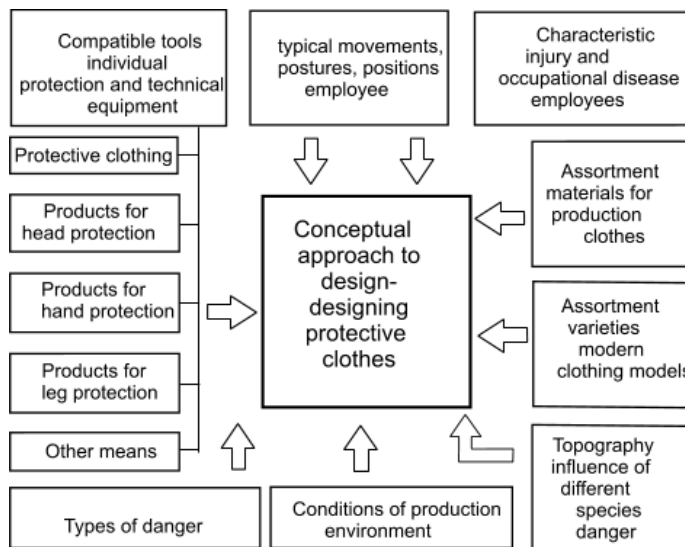
3. RESULTS

The question of the creative concept occupies a central place in the problems of modern design and planning, it is a common creative attitude that constitutes the essence of project culture. The concepts that exist in the design of clothes, as a rule, are in line with the main design problems of their time and are connected with the general trends of changing the way of life. The modern specificity of clothing design is that concepts at the stages of sketching, working design and production are embodied primarily in visually perceptible forms. The main principles of one of the main concepts of functionalism were functionality, expediency and universality of forms [2].

Based on the developed conceptual approach to the design of modern protective clothing of various functional orientations for production workers (Fig. 1), the main stages of its design are highlighted:

- study of the conditions of the production environment, analysis of various effects of danger, the degree of their intensity, duration, repetition; physiological reactions of the body to their general and local effects; analysis of information about the used equipment, technical equipment/apparatus, gear; dimensions of the working area, etc.;
- analysis of typical poses, movements and positions of employees when they perform professional and industrial activities of varying intensity, changes in body structure, behavior and their physical and mental state, etc.;

- development of the topography of the influence of various types of danger/factors of the surrounding environment that arise during the performance of production activities, determination of individual zones/areas of destruction of the product;
- analysis of the assortment of foreign and domestic production of varieties of modern models of protective clothing for workers of various professions;
- analysis of the assortment of modern materials for the production of protective products, their comparative evaluation according to various indicators for further justified selection in the specified areas, the relationship between the characteristics of textile materials and the structural and technological parameters of protective clothing;
- methodology for researching the determined characteristics of materials and clothing, conducting experimental studies and their comparative analysis of the results to justify the choice of a rational structure of the package under the conditions of the action of dangerous factors of the production environment;
- determination of completeness and compatibility of products necessary for employees; structuring of the general and local scheme of a multi-layer package of materials for various environmental conditions and difficulty of work;
- analysis and justified choice of types and methods of connecting parts of protective clothing for workers, selection of sewing accessories and threads;
- determination of the features of the manufacturing technology of functional adaptive clothing;
- development of specific requirements for workers' protective clothing and materials for its manufacture;
- design of constructive and technological solutions for models of modern protective clothing, taking into account specific requirements for the product, in



particular, the possibility of regulating the comfortable microclimate of the under-clothing space; correspondence of the constructive and technological solution of clothing to the figure and its change; appropriate membership of the product to operating conditions, etc.;

- the formation of design and technological solutions for the creation of an assortment of heat-protective clothing for a given set of productions, taking into account technical, economic and consumer indicators.

The methodology of

Figure 1: Components of a conceptual approach to the design of protective clothing

designing modern protective products for workers in various industries is based on determining the conditions and topography of the influence of dangerous and harmful factors, taking into account the characteristic movements, postures and positions of the body when performing production activities; reasoned selection of textile materials with defined characteristics; analysis of used equipment, technical equipment/apparatus. Based on the analysis of the above information, specific requirements are developed for a specific type, functional purpose of protective clothing and materials, accessories for its production. Structural and technological solutions of special clothing in the expected conditions of operation must first of all provide the maximum possible level of protection of the worker and at the same time meet other requirements.

In order to perform their functions according to their purpose and degree of protection, protective clothing must minimize hazards and at the same time be acceptable in physiological and ergonomic aspects.

4. CONCLUSIONS

A conceptual approach to the design of protective ergonomic clothing was developed, its components were established, and their features were revealed. The main components, which are the initial data for the development of requirements, include the specifics of production and climatic conditions, the topography of the influence of dangerous and harmful production factors, the analysis of typical poses, movements and positions of workers, the study of the assortment of modern varieties of clothing and materials for its manufacture, the nature of injuries, the use other means of personal protection and technical equipment, etc.

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