Research on the Production of Special Clothing for Car Repair Workers, Taking into Account Human Ergonomic Characteristics

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ABSTRACT

The article presents the results of a study of the production of special clothing for car repairmen, taking into account the ergonomic features of a person. Regardless of what type of activity a person is engaged in and how dangerous production is, the worker is affected to one degree or another by many adverse external factors: meteorological, mechanical, chemical, and physical, biological. Therefore, special-purpose clothing plays a paramount role in protecting the health and life of workers. Recently, many small and large companies have emerged offering services for the manufacture of various kinds of special-purpose clothing. However, such products do not always meet accepted safety and quality standards.

Keywords: overalls, personal protective equipment, protective properties, reliability of overalls, flame retardant fabrics.

Introduction

The development of scientific and technological progress, transformations in the field of production at modern industrial enterprises, along with others, bring to the fore the task of optimally solving the issue of ensuring the safety of people in production, including by designing special clothing to protect people from the harmful effects of the production environment.

The problem of purposeful improvement of the range and quality of special clothing that adequately meets the range of needs of customer organizations in modern economic conditions is of particular importance.

Personal protective equipment (PPE) occupies a special place in the complex of measures to ensure the safety of workers and the prevention of occupational diseases [1].

Among the widely used PPE is special clothing, which is one of the necessary conditions for reducing the impact of dangerous and harmful production factors on a person and maintaining his high performance and health.

At present, a large scientific material has been accumulated, methods and criteria for the physiological and hygienic assessment of special clothing have been developed, a relationship has been established between the technical parameters of materials and overalls in general, the main methodological principles for its design and industrial manufacturing technology have been formulated in accordance with the requirements determined by the specific operating conditions of overalls [2-7].

The main part

To study the ergonomic indicators of dynamic compliance, it is necessary to select and justify the types of work actions. The choice of types of work movements for research on the ergonomic indicators of special clothing is to determine their rational set that most fully characterizes the totality of extreme labour movements for the considered group of professions of MCP mechanics (in our case, assembly and body production of the automotive industry) [8-11].

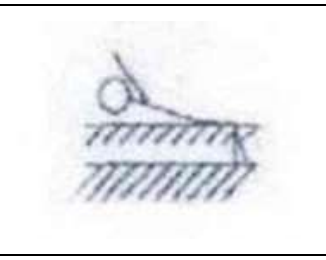
Based on the task, the rules for choosing the types of working movements for ergonomic studies were specified:

- allocation of types of movements, in which the maximum dynamic increase in dimensional features of the figure is achieved;
- the possibility of unifying the types of labour movements;
- the possibility of accurate reproduction of the types of working movements during the experiment.

It should be noted a characteristic feature of labour movements in the SKP related to the specifics of working postures: postures of "conditionally standing" and "tilt of the body" occur in constant motion at a speed equal to the speed of the main conveyor. According to the formulated rules, when developing the designs of shoulder special clothing, the movements of the body and arms in a standing position, when performing working movements in an inclined position and squatting or on a special pillow, are of particular interest, other types of body movements (walking from one object to another - locomotor, moving) are not associated with significant dynamic increases in the dimensional features of the figure in the region of the supporting surface. Using the above aspect, ten main (extreme) working positions were identified in the work when performing labour movements by a locksmith of the main conveyor (table 1).

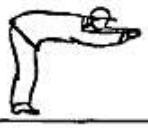
Table 1. Map of ergonomic photography of working movements

№	Movement scheme	Average time spent on each move per shift	№	Movement scheme	Average time spent on each move per shift
1		86576.85	6		8128.35
2		21809.25	7		5625.45
3		9930.6	8		4305.15

4		9088.2	9		2531.25
5		8634.6	10		1725.3

Analysing 10 selected poses out of 28 identified by the location of the upper and lower limbs relative to their position in space to the body, we conclude that the upper limbs concerning the body, in general, make movements in space in the "standing" and "sitting" positions: hands raised forward and up; even in an inclined position of the body, the arms also move forward and upward or simply forward [12-17].

Table 2. Extreme labour movements selected for ergonomic studies

The position of the hands relative to the body	working posture			
	Standing (conditionally)	Body tilt forward 90° or more	Squatting or on a stand	Sitting on a special cushion, tilting the body back
1	2	3	4	5
Arms are 180°	 1	 4	 7	 10
Arms are 90°	 2	 5	 8	-
Arms are 90° and bent at the elbow 90°	 3	 6	 9	-

From the initial position "standing, hands down" (Figure 1) (a=180°) in relation to the body of the body, the arms make movements from a=30° - 45°, then a=90° - 100°, then a=120

° - 140° and finish their movement at a = 160° - 180°. Basically, the hands move in space "forward and up" and less often - "through the sides up. "The arms are either extended straight or bent at an angle a = 90°. The legs (lower limbs) are either conditionally straight (in the knee area) when the worker moves in the "standing" or "tilted" position or bent in the knee area in the "sitting" position at an angle a=30°, a=90° between the thigh and lower leg. The location of the lower extremities (thighs) in relation to the body also changes from the angle a=180° in the "standing" position to the angle a=30° - 20° in the "sitting" and "inclined" positions [18-21].

Therefore, to study the ergonomic conformity of shoulder clothing in dynamics, it is advisable to choose to lift the arms forward and upward in the "standing" and "sitting" positions as an extreme working movement. The change in the angle between the upper limbs and the torso is the same, both in the "standing" and "sitting" positions, and in the "tilted" position. Poses No. 1 and No. 4 from the previously selected 10 basic working poses correspond best to the implementation of the experiment.

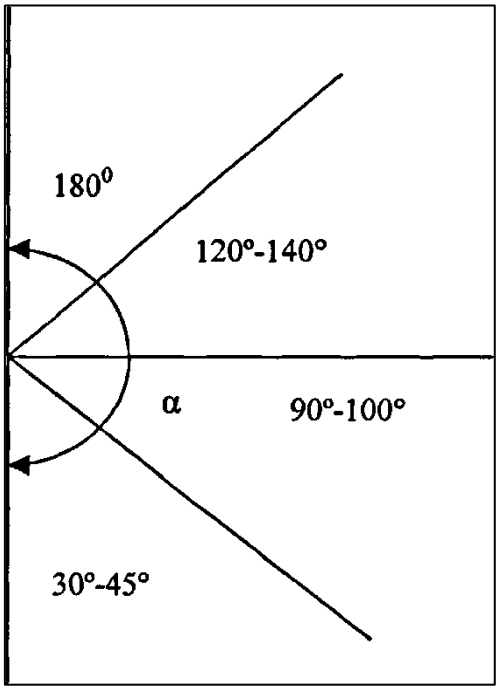


Figure 1. Scheme of the movement of the arms in relation to the body of the body

From the point of view of unifying the types of hand movements in relation to their location in relation to the body, the choice of informative types of movements is assumed [22-27].

For example, a characteristic of the extreme position of the hands relative to the human body, in which a certain labour action is performed (ceiling sticker inside the car body, etc.), can be used.

The position of the hands relative to the body of the human body - symmetrical and asymmetric when performing a working action - shows that in the first case, the "man-clothing" system will be in a more stressed state than in the second, because. in the asymmetric state of the position of the hands, the clothes move relative to the axis of symmetry of the human body, thereby compensating for the deficit in the width of the product (due to emerging dynamic effects). Therefore, symmetrical hand movements are the most informative for the study of the ergonomic parameters of special clothing, which was used in this work.

When analysing the working movements on the main conveyor, it was found that most often the movements of the hands are made when they are lifted through the front, and not through the sides.

Conclusion

The working posture and the extreme position of the hands relative to the human body quite informatively characterize the main labour movements of the mechanics of the MCP, because in this case, the greatest dynamic effect of the dimensional features of the figure will be achieved. Studies of labour movements and working postures were carried out in laboratory conditions with a fairly high degree of fidelity; the obtained values of dynamic increments are presented in the appendix. The conditions listed above made it possible to make a choice of labour movements for carrying out ergonomic studies in order to select the optimal design of the designed sets of workwear, which are classified according to the nature of the working postures and the extreme position of the hands relative to the body.

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