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URGENT PROBLEMS OF THE WORKING ENVIRONMENT IN THE FOUNDRY

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Summary. In the article implemented the research of the harmful factors of the working environment of machine building enterprises with various casting techniques.

Key words: casting, harmful and dangerous factors, intensity, dust, gases.

INTRODUCTION

In Ukraine, a quarter of employees work in conditions that do not meet sanitary-hygienic standards. The social insurance fund's statistics about compensation payment for the loss of efficiency from accidents and occupational diseases each year is 520 million UAH., nonrecurrent payments established by diagnosis "occupational disease" – about 160 million UAH., additional payments to pensions – about 150 mln. [Krishen, 2006].

The number of enterprises also increases, labor conditions on which are harmful to the health of the workers [Timoshina 2010]. In many foundry enterprises workers are under the influence of dangerous and harmful production factors, exceeding the maximum allowable concentration and maximum allowable levels in the working areas. The prolonged exposure of these factors on the labourer may lead to the lower efficiency and aggravation of health.

PUBLICATIONS ANALYSIS

The analysis of the literary sources showed that the respiratory organs diseases of the dust etiology prevalent in different countries: Ukraine, Russia and other CIS countries, Europe. In Ukraine, from 1992 to 2009 the number of diseases of respiratory organs is the highest in comparison with other diseases [Timoshina 2010]. The breakdown of respiratory diseases over the years shown in the fig. 1.

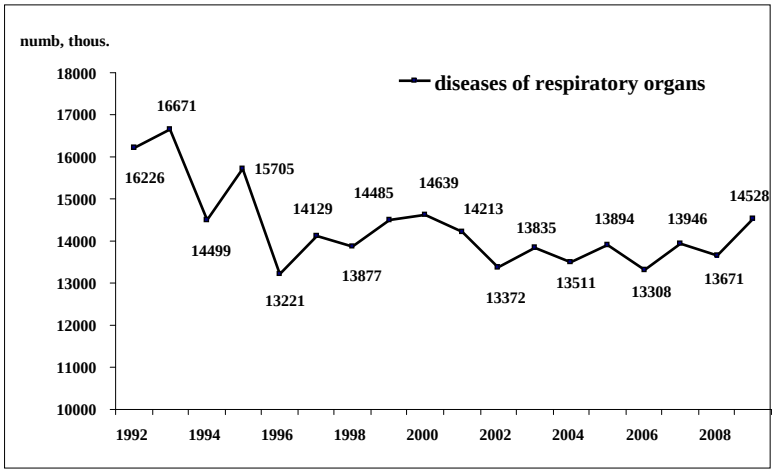

Fig.1. The number of diseases of respiratory organs on years

The reduction of the number of diseases occurred in 1996. Further, the number of cases varies within the limit from 13000 to 15000 cases, despite the economic crisis and the decrease in production. In 2009, the number of respiratory diseases is 14528 cases (in 2008 - 13671 cases), namely there was a trend of growth. Diseases of respiratory organs occupy a leading position in the structure of occupational diseases. The high risk of the dust diseases is proper to many industrial sectors (except coal-mining), including the foundry.

The occupational diseases is part of an overall morbidity of the population. The diseases of respiratory organs also prevalent in the structure of occupational diseases – 36,2%, the vibration diseases – 25,8%, the diseases of musculoskeletal system – 10,3%. With the help of researches and analysis of the causes of occupational morbidity in Ukraine established that working conditions are the major factor of occupational diseases, and mechanical engineering and metallurgy place the second largest number of cases [Kundiev 2007].

The problem of occupational diseases considered in the following papers. Rabenda Andrzej Stefan researched the patterns of influence of industrial harmful factors on the health of workers in Poland. He explored the risk of the dust diseases of electric welders, foundry workers and weavers.

In the work of Dmitry Pavlovich Pertsev was established the system of preventive measures in the production of castings in the permanent metal molds. The author considers that the principal harmful factor at the casting in permanent metal molds is heating microclimate against the background of the harmful influence of industrial noise. The additional production harmful factors are the dust and gas pollution of the working zone with substances whose content is many times higher than the maximum allowable concentration.

As of day, the working conditions of the modern foundry are not enough studied, as well as industrial harmful and danger factors at different ways of casting. The

prevention of the danger occurrence (the growth of occupational diseases, injuries) can be achieved through a comprehensive analysis of the working conditions at each workplace, each particular enterprise of any form of property that is problem of today.

PURPOSE AND RISING OF THE TASK OF RESEARCHES

The purpose of the work is to research both traditional and new casting technologies, analysis of harmful and danger factors of the production environment, the analysis of the harmful factors on the each jobsite.

BASIC DIVISION

At present, developed the following methods of casting: casting in sand-clay molds, casting on the gasified models, casting in the vacuum-film form, casting with the cold-thicken compounds (CTC), casting with the water-glass compounds (WGC), casting with the hot-thicken compounds (HTC), the die casting, the shell casting, the rotary casting, the pressure die casting, the freeze crystallization casting, the magnetic form casting, the die casting under controlled gas pressure, the graphite mold casting, the ceramic mold casting, the suspension casting, and others [Efimov 1991, Ivanov 1990, Speransky 1995, Golofaev 2001, Budanov 2006, Kechin 2002]. All processes are attended by various industrial harmful and danger factors.

The work executed experimentally based on laboratory researches [Bachovska 1966, Vershinin 1992, Leita 1980.], on the analysis of working conditions maps, on the results of jobsites review and literary data. It was made an integrated assessment of harmful and danger factors of the most common modern foundry technologies in iron-casting and steel-casting workshops, of the holding company “Luganskteplovoz”, Lugansk casting-mechanical plant and other enterprises.

The workers in the labor process, usually undergo to the influence of several harmful and danger factors of the surrounding production environment. The influence of each of them is different. The industrial harmful factor passing the maximum allowed level and the maximum allowed concentration, and prolonged action, can become the danger factor [Gandzyuk 2004]. Therefore, on the first stage identified and studied the harmful factors, which exceed the maximum allowed concentration and level. Also, there were identified the most typical danger factors for the foundry industry. The intensity of the factors determined on the exceeding the maximum allowed concentration and level. The research results presented as the characteristics of the intensity of the harmful and danger factors, which are contained in the author’s paper [Shinkareva 2010].

The paper presents the results of 24 methods of casting. It was set the percentage of the each method of casting in the mechanical engineering in Ukraine. The analysis of the intensity of the following industrial harmful factors: dust, gases, aerosols, excessive heat, noise, vibration, electromagnetic radiation, physical overload, neuropsychic stress. The most intensive danger factors were revealed: sparks, spatter, high voltage electrical circuits, moving machinery.

In the examined work [Shinkareva 2010] for each casting method can determine the amount of the intensive production factors. They create unfavorable conditions on the each jobsite. For example, while the casting in sand-clay molds arise 10 intensive factors, while the casting on the gasified models – 7, while the continuous casting – 2. During the continuous casting add 4 more moderate factors, and 8 minor factors. The use of the casting in sand-clay molds in Ukraine is 60%, and continuous casting – 0,9%, namely, the new technologies did not receive the wide development yet. The produced researches [Shinkareva 2010] confirm that the foundry – one of the most dangerous sectors of the mechanical engineering.

The use of the modern technology eliminates some of the intensive factors, but appear new harmful factors. For example, the electromagnetic radiation – while the casting in magnetic forms, the release of the hydrogen fluoride, the carbon monoxide and carbon dioxide – during the thermal decomposition of the synthetic sealing film with the vacuum-filming method of casting. The significant emission of the toxic gases occurs in the process of drying the rods and forms in the use of the organic binder, as well as by pouring the metal. The complex influence on the health of employee of the listed harmful factors requires a more careful study.

For the full characteristics of the danger of the foundry was conducted the research of appearance of the harmful and danger factors on the main technological jobsites. The results are presented in the authors' work “The research of the harmful factors of the foundry at various stages of the process” [Shinkareva 2010]. The analysis of the job hazards was conducted at the major jobsites in the technological lines for 24 methods of casting. In 18 of the 24 ways prevail the intensive harmful factor – the dust: while the casting in sand-clay molds, the dust is on the 11 jobsites, while the casting on the gasified models, the dust is on the 13 jobsites, while the investment casting is on the 12 jobsites, while the full-mold casting is on the 10 jobsites, and etc. The analysis of the harmful and danger factors at the various operations of the technological process [Shinkareva 2010] on the each workplace established that during the preparation of the molding materials from the 24 methods of casting in 17 is the basic harmful factor – the dust. They are such processes as the casting in sand-clay molds, the casting on the gasified models, the casting on the vacuum-filming forms, the casting with the use of the cold-thicken compounds, the water-glass compounds, the hot-thicken compounds, the shell and ceramic casting, the die casting under controlled gas pressure, etc. During the preparation of the molding sand in the 17 methods is the harmful factor – the dust (gases in the 15 ways), during the preparation of the core mixtures, the dust is in 18 methods (gas in the 17 methods) as well as the manufacture of the half-forms and rods, models and core boxes, during the shakeout of castings, the separation of the runners and rods, the cleaning, the main harmful factor is the dust. Consequently, the conducted analysis showed that the main intensive harmful factor of the foundry are dust, gases, heat. Most of the operations in the manufacture of the castings are accompanied by the dust concentration which is in several times higher than the maximum allowed concentration.

The examination of the air pollution state on the iron foundry of the holding company “Luganskteplovoz” showed that in the working area during the preparation of the molding and core sands, the content of the dust was 8,16 mg/ m^3, that exceeds the maximum allowed concentration which is equal to 2 mg/m^3, on the molding area, the

content of the dust equals 10,7 mg/m^3, during the castings shake-out – 10,3 mg/m^3, which is coordinate with the data of the works [Ivanov, 1990, Speransky 1995].

The long-term inhalation of such air may lead to the development of such occupational disease as pneumoconiosis [Basakov 2003, Artamonov, 2004]. The development of this disease directly depends from the extent of dispersion of the dust [Strizhko 1996, Demchenko, 2010], the qualitative structure of the dust and the degree of the dust content in the air, length of service, as well as the number of other factors, such as excessive heat, noise, weight and strength of the labor process, the presence of other harmful substances in the working area.

The analysis of the listed ways of casting on the isolation of harmful gases [Shinkareva TA, 2010] established that: while the casting in the sand-clay molds (gases isolated on 11 technological processes), on the gasified models (on 10), casting with the cold-thicken compounds (on 9), casting with the water-glass compounds (on 9), casting with the hot-thicken compounds (on 10), the chill casting (on 8), and the shell casting (on 11), and etc. The analysis of the jobsites in the 24 methods of casting revealed that the most dangerous from the point of isolation of gases are: on the molding sand jobsites (in the 14 from the 24 methods of casting) and on the core sand jobsites (in 16 from the 24 methods of casting), the manufacture of half-forms and rods (in 15 from the 24 methods), drying of half-forms and rods (in 12 out of 24), and the castings shakeout from the mold (in 23 methods).

During the melting and it's overheating, the casting into the molds, hardening and cooling it in the form also isolate the large amount of gases [B.S. Ivanov, 1990, B.S. Speransky, 1995], which depends on the choice of the casting method and the furnace. During the melting in the induction furnaces, the main harmful factors are the excessive heat, gases and electromagnetic radiation, during the melting in the cupolas, the main harmful factors are the dust, fumes, the excess heat, during the melting in the electroarc furnaces, the harmful factors are the graphite dust, the excessive heat, gases, noise.

Thus, from the study of the variety of harmful and danger factors, the most intensive, which are often found in all ways of casting are the dust, gases, the heat. Obviously, in the foundry on the jobsites occur the set of adverse factors, which have harmful effects on the health and the efficiency of the labourer. Hygienic standards are still the main tool for evaluating the safety of the health of the workers, and exceeding of such standards is considered as the breach of the health legislation. Measures to protect the employee nowadays is shorter working day, week, additional days to the vacation, early retirement, additional payments for the unhealthy working conditions, the assignment of preventive nutrition, insurance, and etc. However, the influence of the harmful and danger factors can cause the disturbance of the workers health, even if these factors satisfy the maximum allowed conditions and level. Unfortunately, in the foundry industry during the crisis, the compliance of the standards is impossible task for the most enterprises.

CONCLUSIONS

The fight with the dust and other harmful factors is in progress mainly just after their formation and their release into the air. To solve the problems of improving the working conditions on the foundry workers jobsites seems necessary the following:

• study of the physical and chemical content of the intensive harmful dust factor and the process of the dusting;

• study of the chemical content of the isolated gases;

• the conduct of the researches of other intensive factors;

• the development of the technical means intended for the creation of a hygienically safe working conditions.

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АКТУАЛЬНЫЕ ПРОБЛЕМЫ СОСТОЯНИЯ ПРОИЗВОДСТВЕННОЙ СРЕДЫ В ЛИТЕЙНОМ ПРОИЗВОДСТВЕ

Татьяна Шинкарева, Анатолий Гедрович, Анатолий Голофаев

Аннотация. В статье проведено исследование вредных факторов производственной среды машиностроительных предприятий при различных литейных технологиях.

Ключевые слова: литье, вредные и опасные факторы, интенсивность, пыль, газы.