a stronger statement is also true. It is about the preservation of the principal corner minors' of the matrix H separation from zero in the similarity transformation using with not only the law-abiding condition but also the ρ-law-abiding of the same pair (R, H).

For any real numbers $r \geq 1$ and $\rho \in (0,1)$ let $\mathrm{R}_n(\rho, r) \subset \mathrm{R}_n$ be a set of lower triangular $n \times n$-matrices R with positive diagonal elements for which $\|R - E\| \leq r$ and $\det R \geq \rho$ are correct, i.e.

$$\mathrm{R}_n(\rho, r) := \{R \in \mathrm{R}_n : \|R - E\| \leq r, \det R \geq \rho\},$$

and a set of $n \times n$-matrices $\mathrm{H}_n(\rho, r) \subset \mathrm{M}_n$, for which $\|H - E\| \leq r$ and all the principal leading minors are not less than ρ, i.e.

$$\mathrm{H}_n(\rho, r) := \{H \in \mathrm{M}_n : \|H - E\| \leq r,\ \det(H)_k \geq \rho,\ k = \overline{1, n}\}.$$

<u>Definition 5.</u> Let $\rho \in (0,1)$ be a random fixed number. According to the definition from [2, p. 283] an *ordered pair* (R, H) on a set M_n^2 is *called* ρ*-law-abiding*, if $\det R \geq \rho$ and for any $j \in \{1, \ldots, n\}$ belonged to S_j, which are intermediate steps on the way from R to H, such inequalities as $\det S_j \geq \rho$ are correct.

<u>Theorem 2</u>. *Suppose $r \geq 1$ and $\rho \in (0,1)$. If a pair (R, H) for which $R \in \mathrm{R}_n(\rho, r)$ and $H \in \mathrm{H}_n(\rho, r)$ is ρ-law-abiding, then there exist such numbers as $\rho_1 = \rho_1(\rho, r) \in (0,1)$ and $r_1 = r_1(\rho, r) \geq 1$, for which $RHR^{-1} \in \mathrm{H}_n(\rho_1, r_1)$.*

Consclusion. The obtained results can be further used in the theory of controllability of asymptotic invariants of linear systems of ordinary differential equations in the study of global Lyapunov reducibility [2, p. 258 - 259] and even the global attainability [2, p. 253] of such systems.

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ASSESSMENT OF THE MATCHING OF THE RECOMMENDED GAS VELOCITIES IN CYCLONES TO THE ECONOMICALLY OPTIMAL ONES

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Gas cleaning in the chemical industry is a complex and urgent problem with a number of aspects. The economic aspects are the development of the methods and systems that can significantly improve the efficiency of extraction of the valuable components from raw materials, maximize the utilization of the products captured during the gas purification, increase the efficiency of equipment operation.The technological aspects are the introduction of the new methods and systems of gas purification in chemical production, based on the latest achievements of the world science and technology, the modernization of the inefficient gases separation units, the development of the highly efficient instruments and schemes of removal of gaseous and particulate contaminants from gas streams, unification and standardization of gas cleaning equipment, etc[1].

The aim of the study is to verify the applicability of the recommended conventional method of selection of cyclones values of gas velocities in modern economic conditions. According to this, the cost-optimal velocity values are calculated at the current prices for electricity and cyclones.

Material and methods. The method of Kouzov and Belevitsky [2], which takes into account both the design parameters of cyclones and operating costs, has been considered the best of the analyzed techniques for technical and economic optimization of cyclone dust collection plants [1,2,6,7].

The calculations have been carried out according to the method of Kouzov and Belevitsky for the cyclones of various types widely used in the CIS countries (CN-24, CN-15, CN-11).

The optimal diameter values for different types of cyclones and the corresponding gas velocities have been calculated in order to select the variants suitable for the comparison at the reduced costs.

The optimal diameter corresponding to the minimum of the reduced costs is determined by the formula (1) [2]:

$$D_{opt} = 0{,}49\tau \sqrt[3]{\frac{K_M K_H}{\xi P E \rho_г}}, \text{ m} \qquad (1)$$

where D_{opt} – optimum cyclone diameter, m.

The velocity of the gas in the cyclone is determined by the formula:

$$w = \frac{D_{opt}}{\tau}. \qquad (2)$$

After substitution of values in this formula, the corresponding values of gas velocities in cyclones at old and new prices have been found.

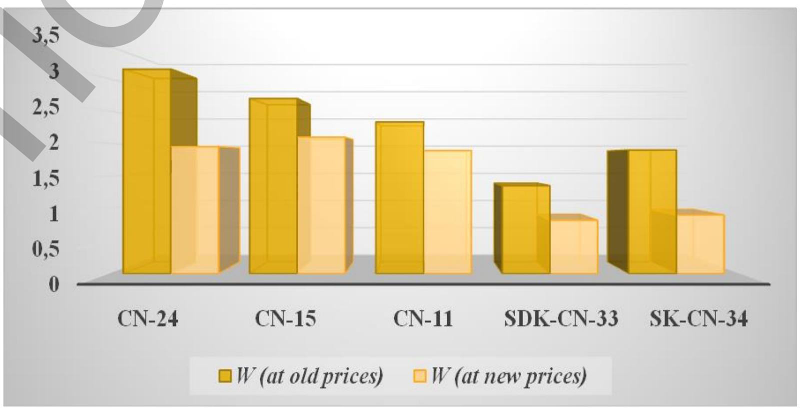

Fig. 1. Comparison of the values of velocities of the gas for the cyclones of different types using the old and new prices for electricity.

Reduced costs were determined by the formula (3):

$$C = \left(\frac{5{,}25\rho_{г}\xi PED^2}{\tau^2} + \frac{1{,}27K_M K_H \tau}{D}\right) Q \text{ RUB / year,} \qquad (3)$$

where $\rho_{г}$ – gas density, kg / m^3;
ξ – coefficient of resistance of the cyclone with a snail on the exhaust pipe;
PE – the price of electricity, $ /kW·h;
D – cyclone diameter, m;
τ – conditional deposition time, s;
K_M – the ratio of capital expenses, RUB/m^2;
K_H – regulatory capital efficiency ratio;
Q – capacity of the cyclone unit for gas, m^3/s.

The construction-technological and technical-economic indicators of the cyclone are related to each other in equation (3), that is, the given equation is its technical and economic model.

The technical and economic calculation based on the optimization technique has showed that the use of a technically highly effective group of cyclones (SDK-CN-33, SK-CN-34) is not technologically justified. Only three of the initially selected five of the cyclones fit on techno-economic considerations.

The capital cost factors K_M, determined on the basis of the 1982 prices used at the time of development of the optimization technique, have been recalculated taking into account the cost of cyclones for 2018. In the physical sense, we can assume that it expresses a "reduced" thickness of the metal.

Findings and their discussion. Technical and economic optimization of cyclone dust collection plants is an urgent scientific and technical task.

The cyclones with economically optimal diameters have been selected as the result of the calculations, that is, corresponding to the minimum of the reduced costs, and the optimal values of gas velocities have been calculated at current electricity prices.

The calculations based on current prices have showed that the velocities calculated according to the recommended at present conventional simplified method of selection of cyclones [2] at the current prices are much higher (≈1,4 times) than the economically optimal ones and, therefore, need to be adjusted. It is necessary to use a more accurate method of selecting the optimal size (number and diameter) of cyclones, for example, [2], when assessing them.

Conclusion. The use of outdated data and methods will lead to economic as well as energy losses, as the cyclone's hydraulic resistance and energy consumption for gas purification are proportional to the gas velocity in the second degree.

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ON PROPERTIES OF QUASINORMAL FITTING CLASSES

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All groups considered in this paper will belong to the class $\mathfrak{E}$ of all finite groups. Our notation and terminology are standard [1].

A Fitting class $\mathfrak{F}$ is a class of groups closed under normal subgroups and products of normal $\mathfrak{F}$-subgroups. From the definition of a Fitting class, it follows that for any nonempty Fitting class $\mathfrak{F}$ every group G possesses a unique maximal normal $\mathfrak{F}$-subgroup which is called $\mathfrak{F}$-radical of G and is denoted by $G_{\mathfrak{F}}$. If H is a subgroup of a group G and $H \in \mathfrak{F}$ with the property that $H = T$ whenever $H \le T \le G$ and $T \in \mathfrak{F}$, we call H an $\mathfrak{F}$-maximal subgroup of G. Recall, that an $\mathfrak{F}$-injector of a group G is a subgroup V of G with the property that $V \cap N$ is an $\mathfrak{F}$-maximal subgroup of N for all subnormal subgroups N of G.

Let $\mathfrak{S}$ be a class of all soluble finite groups. A Fitting class $\mathfrak{F}$ is called soluble if $\mathfrak{F} \subseteq \mathfrak{S}$.

Investigations of the structure of Fitting classes and characterizations of $\mathfrak{F}$-injectors and $\mathfrak{F}$-radicals of soluble groups are related to the study of Fitting classes with normal $\mathfrak{F}$-injectors (see works of D. Blessenohl and W. Gaschütz [2], A. R. Makan [3] and P. Lockett [4]).

Let G and H be groups. Then $G \, wr \, H$ denote the regular wreath product of G with H.

By generalizing the concept of normal Fitting class, P. Hauck [5] defined the so called quasinormal Fitting classes.