The fail-free operation of the mean $P_3(\tau)$ in time is a product of the probability of fail-free operation of each of n-elements

$$P_3(\tau) = \prod_{i=1}^{n} P_i(\tau) = \prod_{i=1}^{n} \left[\exp(-\lambda_i \tau)\right] \qquad (4)$$

where $P_i(\tau)$ is the function of reliability of the i-th element; λ_i is the intensity of failures of the individual element.

The proposed conceptual approach has sharply increased the requirements to the depth and the level of monitoring of the level of risk in the use of PPE at all stages – design, manufacturing, operation, utilization. Numerical values of the level of risk for each component make it possible to determine the sequence of the introduction of individual elements of transformation into the internal structure of protective products and to develop effective protective sets of PPE for performing of the work in certain hazardous working conditions.

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WAYS TO INCREASE THE EFFECTIVENESS OF DUST CAPTURE BY DUSTING CHAMBERS

Most of the technological processes of industrial processing of minerals (iron ore, coal, granite, etc.) is accompanied by the formation of dust (classification by size, crushing and disintegration, transportation, washability). As a result of contact with the human body, industrial dust can cause various diseases (allergic reactions, cataracts, pneumoconiosis). In order to reduce the dustiness of air in industrial premises, dust extraction sites are localized with the help of aspiration shelters with the removal of dusty air into dust treatment plants.

In aspiration shelters of technological equipment for the processing of iron ore, air pollution can be: at grinding – up to 350-400 mg/m^3; when crushing in jaw crusher – up to 900-1000 mg/m^3, in a cone crusher – up to 700-800 mg/m^3; when working mills – up to 90-120 mg/m^3; at work of dry magnetic separators – up to 150-200 mg/m^3; in case of overloading from conveyors, feeders, screens – up to 500-600 mg/m^3, from crushers – up to 3000-5000 mg/m^3.

Cleaning of aspiration air from dust occurs in dust collecting devices of different design and depends on the properties and value of the dust collected, the required degree of purification, the temperature of the air being cleaned, etc.

The dusting chamber is the simplest dust removal device in which the air flow is pollinated with low velocity, which results in the gravitational deposition of dust particles.

The advantages of dusting chambers are: simplicity of construction and operation; reliability and durability; possibility of arrangement with other elements of aspiration systems and possibility of application in both stationary and mobile installations; insignificant hydraulic resistance (up to 200 Pa).

Disadvantages of dusting chambers are: low efficiency of precipitation of fine fractions of dust from the gas or air mixture; large overall dimensions at high air flow; catching predominantly heavy and large particles.

The geometric dimensions of the dusting chambers determine the time of the flow of polluted air in them.

The dimensions of the empty dusting chambers are determined based on the given air flow and the minimum size of the particles to be caught. The ratio of length and height of the camera is determined by the ratio of the velocity of the polluted air flow and the rate of soaring (sedimentation) of the particle. Moreover, the smaller the velocity of the motion of the polluted air flow and the height of the dust removal chamber and its length, the smaller the rate of soaring (sedimentation) of the particles, that is, the smaller particles can settle in the chamber.

Dusting chambers should be used at the first stage of purification of gas or air for deposition of large and heavy particles.

The calculation of the size of the dust extraction chamber is reduced to the determination of the area of precipitation of dust particles, that is, the area of the bottom of the chamber and its walls. In this case, take a number of assumptions: the dust is evenly distributed over the section of the chamber, both in concentration and in dispersion; the dust consists of spherical particles, the sedimentation of which is completely subject to the Stokes law; the speed of the air through the section of the chamber is taken uniform; the result of the convection flow and the turbulence of the air flow to the dust particles is zero; settled dust does not come from the camera.

The efficiency of catching dust particles with the help of gravitational sedimentation in the chambers can be increased by reducing the height of their fall. This can be done by placing a horizontal or sloping plate (shelf) into the cavity of the dust exhausting chamber, which transforms it into a group of small parallel chambers.

It is also possible to reduce the height of the fall (sedimentation) of dust particles by placing in the middle of the chamber special guide plates to direct the polluted air flow to the bottom of the dust removal chamber and to reduce the speed of its movement. By reducing the air velocity and the downward deviation of dust particles, due to collision with the guide plates and with each other, they coagulate forming aggregates that are better settled under the action of gravity.

In some designs of dusting chambers the equipment of chain or wire curtains and deflecting partitions, vertical or horizontal screens is foreseen to increase their efficiency. This allows, in addition to the gravitational effect, to use the effect of inertial sedimentation of dust particles in the flow of air through various obstacles.

In addition to the above methods, it is possible to increase the efficiency of dust clearing of dusting chambers by changing the parameters of dust particles. According to Stokes's law, the rate of soaring (sedimentation) of a dust particle is directly proportional to the square of its radius. Thus, when aggregating the particles, it is possible to achieve an increase in the speed of their soaring (sedimentation) and to increase the efficiency of the chamber at its constant geometric dimensions.

One of the ways of coagulating dust particles is the placement of various obstacles in the flow of dusty streams that create an electrostatic effect in the flow of air moving in the chamber, for example, the fibers curtain of nylon and polyvinyl chloride. In addition to the electrostatic effect on the dusty flow, the fiber curtains contribute to the mechanical coagulation of particles, as well as dust emissions due to the loss of energy of the moving dust particles during its impact on the fiber. Dust particles pass between fibers and, coagulating on them, under the action of gravity, settle down to the bottom of the chamber.

On the basis of the research of various designs of dusting chambers it can be concluded that it is expedient to develop a new design of a dusting chamber of high efficiency with spaced-in cells in the middle of the chamber with nylon and polyvinyl chloride filtration for the purification of aspiration air in order to improve the sanitary and hygienic working conditions of the workers of the ore dressing mills and the mines.

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INFLUENCE OF FACE ADVANCE RATE ON OUTGASSING TREATMENT IN DEGASSING SYSTEMS

The productivity of degassing systems plays an essential role at the increase of face advance rate on the increase of gassing in mine openings and boreholes. Efficiency of degassing of the tapped sources at growth of face advance rate can both increase and diminish [1]. For example, at a flow of degassing system 70 m³\min and increase of face advance rate from 2 to 5,3 m per day of the 2nd western longwall face l_2^B of mining plant named after the newspaper “Izvestiya” has led to common (cumulative) gassing from 20 to 55 m³\min, the amount of coopted methane increased from 10 to 40 m³\min. Efficiency factor of degassing witnessed an increase from 55 to 70%.

When in operation the 6th panel longwall face l_7 of mining plant number 13-bis, the flow of degassing system dis not exceed 10 m³\min. Rate increase of face advance from 1,8 to 5,6 m per day was associated with the growth of methane release out of tapped sources from 3,5, to 17,5 m³\min. The flow of methane deviated by the