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ANALYSIS OF EXISTING METHODS OF CONTROL OF THE GRANULOMETRIC COMPOSITION OF BULK MATERIALS

A comparative analysis of unfavorable methods for controlling the granulometric composition of bulk materials is performed. The revealed advantages and disadvantages of existing solutions and their impact on the effectiveness of the application.

Nowadays, a number of methods are used at metallurgical enterprises to determine the granulometric composition of bulk materials. The most widely used sieve analysis, during which the maximum size of particles take the size of the opening of the sieve, which remains about 50% of the material by weight. The construction of such sieve analyzers is complicated, and their work is accompanied by considerable noise. In addition, such a method requires considerable time and human resources and results in a delay in obtaining documented data.

Along with the classical methods of controlling the granulometric composition of bulk materials, there are others. First, for the control of granulometric composition of metallurgical materials, tools were developed and research was done on the possibility of using microwave technology and the principle of radar(radiolocation) [1]. Signal processing is carried out in real time using an analog-to-digital converter card and special software. Characterize the characteristics of the signals and their spectra, which carry information about the granulometric composition of the material. In work [2], a pneumatic classification of bulk materials and an system for its realization were proposed.

Laser methods are proposed for the testing laboratory of the Technischen University Bergakademie Freiberg Technischen University Bergakademie Freiberg and the company Nihon Kohe (Japan) for the analysis of the granularity and size of the granules of bulk materials [3]. So, in order to obtain data on the granulometric composition of the agglomerate, Japanese researchers offer to use a device for measuring the primary crushing energy at the site of crushing heat. For precise control and stabilization of conditions of agglomeration without time delay at the site of heat fragmentation, a device is installed for measuring the energy of primary crushing of agglomerate. On the basis of the obtained data, granulometric composition and other properties of agglomerate are calculated [4].

Research and production association "Dneprochemetavtomatika" has developed a meter with an indicator of the average grain size deviation, which controls the granular chords using an pulse sensor, for automating the control of the size of granular material. The meter performs a stereological reconstruction of the average diameter of the granules under controlled chords [5]. Granulometry "PIK-074" [6] is used in the conditions of grinding of complexes of copper-nickel and iron-bearing ores of concentrating factories, as well as to control the granulometric composition of aluminum hydroxide in high temperature conditions (50 ... 70 ° C).

Research and Production Complex "Yugtsvetmetavtomatika" "Russian Federation" uses a device with a weight measuring device [7] to control the size of bulk materials, the signal from which is fed to the input of the spectrum analyzer, and at the output form a signal in the form of peaks of the intensity of the spectral density, which transforms into signals, which are proportional to the content of individual fractions in the material layer. The general requirements for methods of granulometric control and analysis are the simplicity of the method and equipment, providing the necessary sensitivity, accuracy and speed of control, overview about information [8].

Methods that largely satisfy such requirements include optoelectronic methods, the advantage of which is the efficiency of obtaining information, processing data in real time, improving working conditions. Therefore, the most promising methods of controlling the granulometric composition of bulk materials should be recognized optoelectronic methods using a computer for image processing.

There is a device for automatic stability control of the granulate [9], where a group of grains is selected from the granulate stream and distributed on a flat surface such that each grain is separated from other grains. Then, by automatic processing of the image, one characteristic grain is selected and the measuring press is directed to it.

At the VNR plant (Australia), for the analysis of the size of the ore-fuel materials processed in blast furnace number 6, use a system for measuring particle parameters (PPM8 system), developed by the Institute of Industrial Automation. The basis of the system is a television camera, between which lens and the screen, which is highlighted, there passes a bulk material (ore, agglomerate, coke). The system uses the visual representation of the material as it falls due to the effect of gravity between the camera and the light source. On the video monitor are displayed certain classes of the size of the bulk material [10].

Similarly, one of the Japanese factories [11] regulates the granulometric composition of the charge materials loaded to the blast furnace. From the ore bin select a sample of material, which is fed to the belt conveyor, and then dumped from it. Falling is observed with the help of a television camera. According to the granulometric composition, the degree of opening of the castle of a monolithic bunker is regulated. In another system [12] images from the camera are transferred to the analyzer, which calculates the average size of the pieces, compares it with the necessary, on the basis of which regulates the speed of the agglomerate tape. A system for measuring the size of particles and zones of molten blast furnace blast furnaces [13] provides the reception and recording of a television image of the surface of the charge and the processing of the obtained results.

So, the advantages of methods of granulometric analysis based on optical electronics are high sensitivity and reproducibility during providing selective control [14].A significant disadvantage of the above optical methods is the lack of efficiency, as well as the need for the manufacture and installation of special equipment - sampler. In addition, the main problem of granulometric analysis remains the continuous control directly on the production process line, which allows timely classification of bulk materials by size classes and assess their quality. In this connection, the task arises to develop an optoelectronic method based on the receipt and processing of images of controlled bulk material without the use of a sampler, directly in the technological flow and evaluation of its granulometric composition. The receipt of objective and timely information on the distribution of the lumped material in terms of the size classes and the amount of trifles will improve the quality management of the products being produced, identify and promptly eliminate the arising violations in the production process. Installing the television camera directly above the conveyor will allow for reliable analysis of the top layer of agglomerate, which is about 7 ... 10% of the total material that is on the conveyor belt, while the sample taken for laboratory analysis is about 0,0014%.

Conclusions. Given the multifactor of the technological process, it is necessary to recognize the necessity of using methods to increase the reliability of information on the basis of its processing and logical analysis with the help of optoelectronic systems. To develop an optoelectronic method for controlling granulometric composition of a charge, knowledge of its main technological characteristics and their dependence on granulometric composition is required.

According to domestic and foreign literature, an analysis has been performed of existing methods and systems for controlling the granulometric composition of bulk materials of agglomeration production. Mechanical, optical, laser and sound systems for determining the size of fractions were considered, as well as the selected optical systems as the most promising ones.

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