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Research Article

INDUSTRIAL APPLICATION OF DUST EQUIPMENT IN THE INDUSTRIAL WET METHOD WITH CONTACT ELEMENTS AND EXPERIMENTAL DETERMINATION OF ITS EFFICIENCY

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ABSTRACT

The article recommends the industrial application of a wet dust collection and gas cleaning device with a contact element sliding motion to determine its cleaning efficiency.

KEYWORDS

Consumption, rolling flow, wet method, contact element, rolling motion, liquid film, dolomite dust, air flow, gas flow.

INTRODUCTION

The main working factors influencing the cleaning process were identified in the experimental model of the wet-held dust collector, in which the developed contact element generates a flow of flux [1,2,3]. The gas velocity, gas flow, fluid flow, hydraulic loss, local resistance of the apparatus and cleaning efficiency of the apparatus were determined on the basis of experiments. The contact element that generates the current flowing into the apparatus is selected. Based on theoretical and experimental research, the initial

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requirements and technical tasks for the apparatus were developed.

Experimental tests to determine the effectiveness of dust gas cleaning were conducted at the training ground of the "Technological machines and equipment" department of Fergana Polytechnic Institute and the raw material production shop of JSC "Quartz".

The device was installed on the dolomite drying technological line of JSC "Quartz" in the dolomite dust removal network formed on the drying drum (Figure 2). Experimental tests were carried out to remove dolomite dust from the gas.

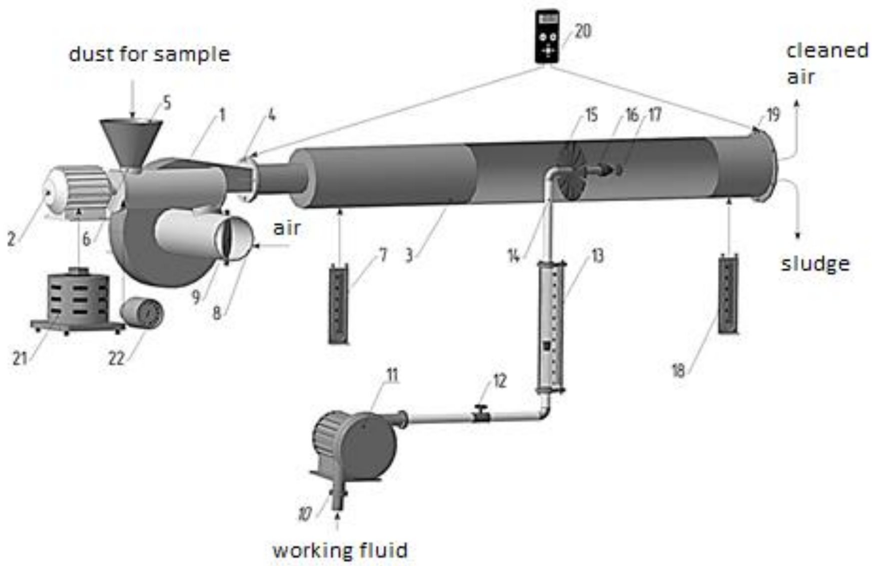

Figure 1. The wet powder in the overall appearance of the apparatus and method catching cleaner gas.

Workshop in raw materials dry dryer coming out wet processing methods in the apparatus of dust in dust contact dolomite elements catcher on experimental studies were conducted. Industry tests the following parameters a vortex into the gas stream flow form contact element the working structure of the world slope α=300; 450 and 600 the hole diameter of which secretes fluid shtutser dsh=2; 2,5 and 3 mm, the speed of the gas in the apparatus υg=7,07÷28,37 m/s, in the range of 70 to spend the apparatus by fluid 70÷189,2 l/hour will choose. The external environment temperature is 20±2 °C dry dryer the temperature of the gas flowing powder 65 dolomite to dust 65÷80 °C.

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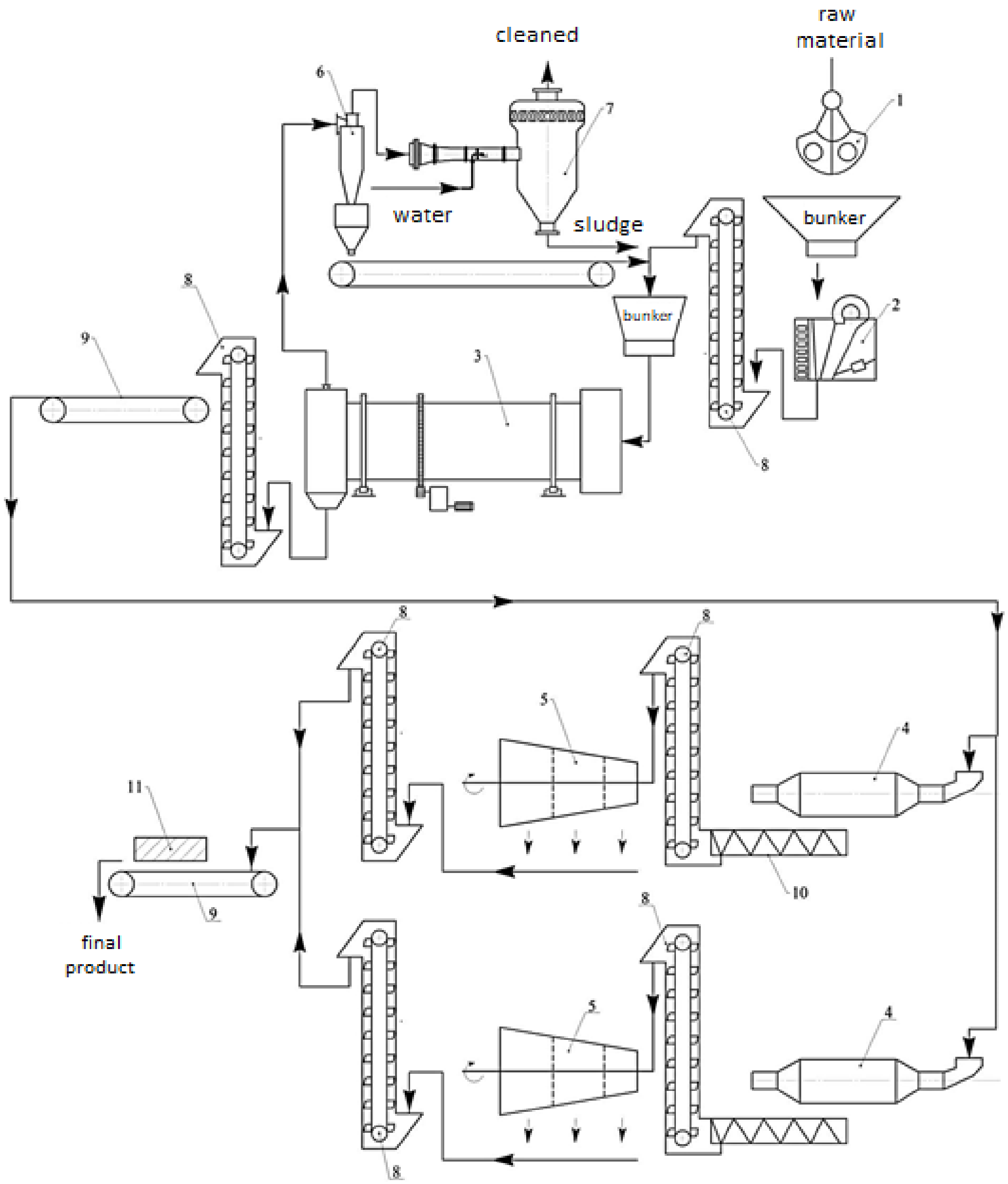

Figure 2. Dolomit technological line of drying of raw material.
1 - Bucket grapple; 2 - Jaw crusher; 3 - Drying drum; 4 - Ball mill; 5 - Sorting machine; 6 - Cyclone NIOGAS; 7 - Wet dust collector with contact element; 8 - Bucket elevator; 9 - belt conveyor; 10 - Screw conveyor; 11 - Magnetic separator;

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Given the multiplicity of experiments, the use of mathematical planning methods in determining the efficiency of hardware cleaning and energy consumption was determined [4,5,6]. According to it, the diameter of the nozzle hole (X1), fluid flow (X2), angle of inclination of the contact element blades (X3) and gas velocity (X4) were selected as the variables that have the greatest impact on the cleaning efficiency and energy consumption of the apparatus. marked. Table 1 shows the levels of the factors and the intervals of change.

Table 1. The levels of the factors of change and range

№	Factors	Unit of measure	Factor of the world character to be justified	Besides-browsing range	Factors sathlisettings		
					lower (-1)	main (0)	high (+1)
1.	Diameter of hole Shtuser	mm	X_1	0,5	2 mm	2,5 mm	3 mm
2.	Fluid consumption	m³/hour	X_2	0,054	0,07	0,124	0,178
3.	The contact angle of slope element parraklar	degrees	X_3	15°	30°	45°	60°
4.	Gas speed	m/s	X_4	10,61	7,07	17,68	28,3

Cleaning efficiency (Y1) and energy consumption (Y2) were taken as the criteria to be determined.

Assuming that the secondary polynomial fully illuminates the effect of variable factors on the determinants, the experiments were performed according to the HARTLI-4 plan [7,8,9].

To reduce the impact of uncontrollable factors on the criteria to be determined, the sequence of experiments was determined using the 1/17 view of the random number table. To determine the dolomite dust treatment efficiency and optimal parameters of energy consumption, the experiments were repeated 5 times separately. The arithmetic mean values of the experimental results were selected. A multi-component gas analyzer ANKT-410 was used to determine the level of purification. The results of the experiments are presented in Table 2.

The efficiency of dolomite dust treatment and its energy consumption of it depend on many influencing factors.

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Table 2. The results of the experiments

X_1	X_2	X_3	X_4	Y_1	Y_2
d_{sh} mm	$Q_{cthe\ pile}$ m³/hour	α, degrees	υ_g, m/s	η, %	K_{Next}, kj/1000 l have³
2	0,07	30°	28,3	95,63	191,4
3	0,07	30°	28,3	95,95	196,4
2	0,178	30°	7,07	99,89	260,6
3	0,178	30°	7,07	99,89	282,3
2	0,07	60°	7,07	94,87	121,5
3	0,07	60°	7,07	95,86	131,6
2	0,178	60°	28,3	99,22	453
3	0,178	60°	28,3	99,65	457
2	0,124	45°	17,68	99,87	296,4
3	0,124	45°	17,68	99,91	303,5
2,5	0,07	45°	17,68	95,78	166
2,5	0,178	45°	17,68	99,92	361,2
2,5	0,124	30°	17,68	99,48	291
2,5	0,124	60°	17,68	99,78	271
2,5	0,124	45°	7,07	99,89	180
2,5	0,124	45°	28,3	99,45	222,6
2,5	0,124	45°	17,68	99,89	301

RESULTS

The following regression equations, which adequately represent the evaluation criteria, were processed in accordance with the HARTLI-4 program of the PLANEX program.

According to it:

The efficiency of dolomite dust removal in the apparatus is determined by the following regression equation,%

The energy required for the dolomite dust removal process in the apparatus is determined by the following regression equation, kJ/1000 m3. The analysis of the obtained regression equations (equations 1-2) shows that all factors have a significant impact on the evaluation criteria. In addition, fluid flow, dusty gas velocity, nozzle hole diameter, and contact element inclination angle appear to be complexly related to the factors under study. The experimental results were processed and evaluation criteria in the appropriate order to the following equations representing adekvat regressiya "planex thermal" software Hart a-4 were taken on the program [10,11]. According to it:

Hardware in the dust of dolomit cleaning efficiency regressiya determined by the following equation, %

$$Y_1=+99,827+0,187X_1+2,031X_2+0,145X_3-0,217X_4+0,067X_1X_1-0,085X_1X_2+0,166X_1X_3+0,000X_1X_4-1,963X_2X_2+0,200X_3X_3-0,386X_2X_4-0,186X_3X_3+0,000X_3X_4-0,145X_4X_4$$

Hardware dolomite dust is determined by the following equation for the cleaning process regression term spending energy, KJ/1000 m³

$$Y_2=+269,154+4,793X_1+97,683X_2-0,017X_3+21,267X_4+36,397X_1X_1+1,329X_1X_2-1,579X_1X_3-2,863X_1X_4+0,000X_2X_2+41,471X_2X_3+39,104X_2X_4+17,397X_3X_3+3,913X_3X_4-62,386X_4X_4$$

The analysis of the obtained regression equations (equations 1.1-1.2) shows that all factors have a significant impact on the evaluation criteria. In addition, fluid flow, dusty gas velocity, nozzle hole diameter, and contact element inclination angle appear to be complexly related to the factors under study.

To determine the factors influencing the processes under study, i.e., the cleaning efficiency of the apparatus and the optimal values of energy consumption, the regression equations were solved for the dolomite dust removal process. At the same time, the condition that the efficiency of dolomite dust removal is higher than 98.9% was adopted in accordance with the requirements of GOST-62-198-142 and GOST-67-198-142. This task was solved on the PC "Pentium IV" using the Excel program "search for solutions", the optimal values of the variables in encoded form were obtained and the coded values were converted to natural values. Thus, the optimal parameters of the apparatus for the dust removal process selected for the sample have been standardized and can be written as follows. In the process of cleaning dolomite dust:

- Diameter of nozzle hole, dsh = 2.6 mm;
- Fluid consumption, Qliquid = 0.138 m3/h.
- The angle of inclination of the contact element blades, α = 440
- Dust gas velocity, υ = 20.4 m/s;

CONCLUSION

From the experimental studies it can be concluded that at these values of the variables, the energy consumption of the device was 2.8 kW/h, the cleaning efficiency was 99.46% and the hydraulic resistance was 1250.7 Pa. According to the results of the experiment, the cleaning efficiency was 5.43% higher for dolomite dust than for existing wet cleaning equipment, the consumption of liquid for cleaning 1 m3 of air was 2.5 times lower and the energy consumption was 0.8 times lower. The results obtained in the experiments fully met the technical requirements for this type of device.

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