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EXPERIMENTAL DETERMINATION OF THE INDUSTRIAL APPLICATION AND DETERMINATION EFFICIENCY OF FLUID GASES CLEANING APPARATUS BY CONTACT ELEMENT METHOD

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A B S T R A C T	***K E Y W O R D S***
The article recommends the industrial application of a wet dust collection and gas cleaning device with a contact element sliding motion and to determine its cleaning efficiency.	consumption, rolling flow, wet method, contact element, rolling motion, liquid film, dolomite dust, air flow, gas flow
Мақолада контакт элементи уюрмали оқим ҳосил қилувчи ҳўл усулда чанг тозаловчи аппаратни саноатда қўллаш ва унинг тозалаш самарадорлигини аниқлаш режимлари тавсия этилган.	сарф, уюрмали оқим, ҳўл усул, контакт элементи, уюрмали харакат, суюқлик плёнкаси, доломит чанги, ҳаво оқими, газ оқими
В статье предложены режимы промышленного применения мокрого пылеуловителя при мокром способе, при котором контактный элемент	расход, перекатывающийся поток, мокрый способ, контактный элемент,

вращается, и определение эффективности его очистки.	перекатывающее движение, пленка жидкости, доломитовая пыль, воздушный поток, газовый поток

In the experimental model of the dust collector in the method of the developed contact element, the main operating factors affecting the corrosion process were identified (Fig. 1) [1,2,3]. The gas velocity, gas consumption, liquid consumption, hydraulic loss, local resistance and wear efficiency of the device were determined based on experiments. A contact element has been selected for the machine to generate an artificial reading. Preliminary requirements and technical instructions for the device were developed based on the conducted theoretical and experimental studies.
The experimental tests to determine the effectiveness of gas purification were conducted at the training ground of the "Technological Machines and Equipment" Department of Fargana Polytechnic Institute and at the raw material preparation workshop of "Kvars" AJ.
The device is installed in the network of dolomite dust generated in the drying drum in the dolomite drying technological line of "Kvars" AJ (Fig. 2). Experimental tests on dust extraction of dolomite dust in gas composition were conducted.

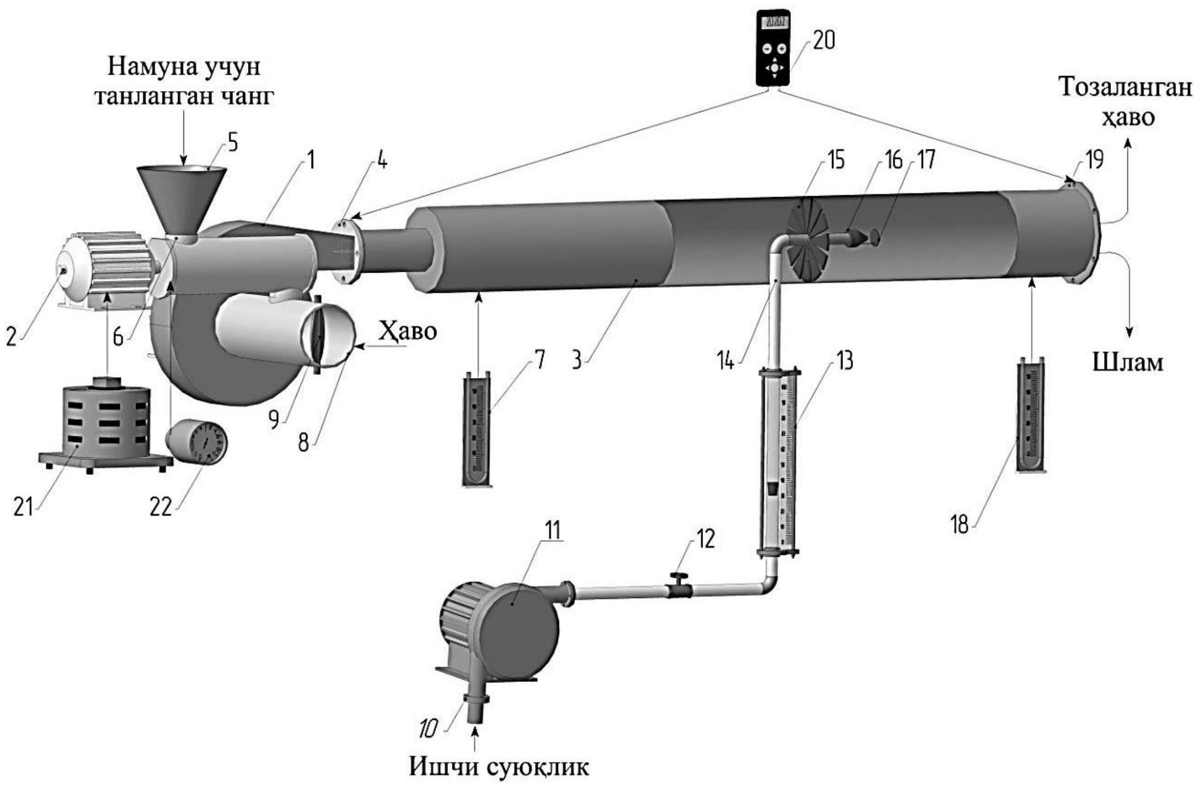
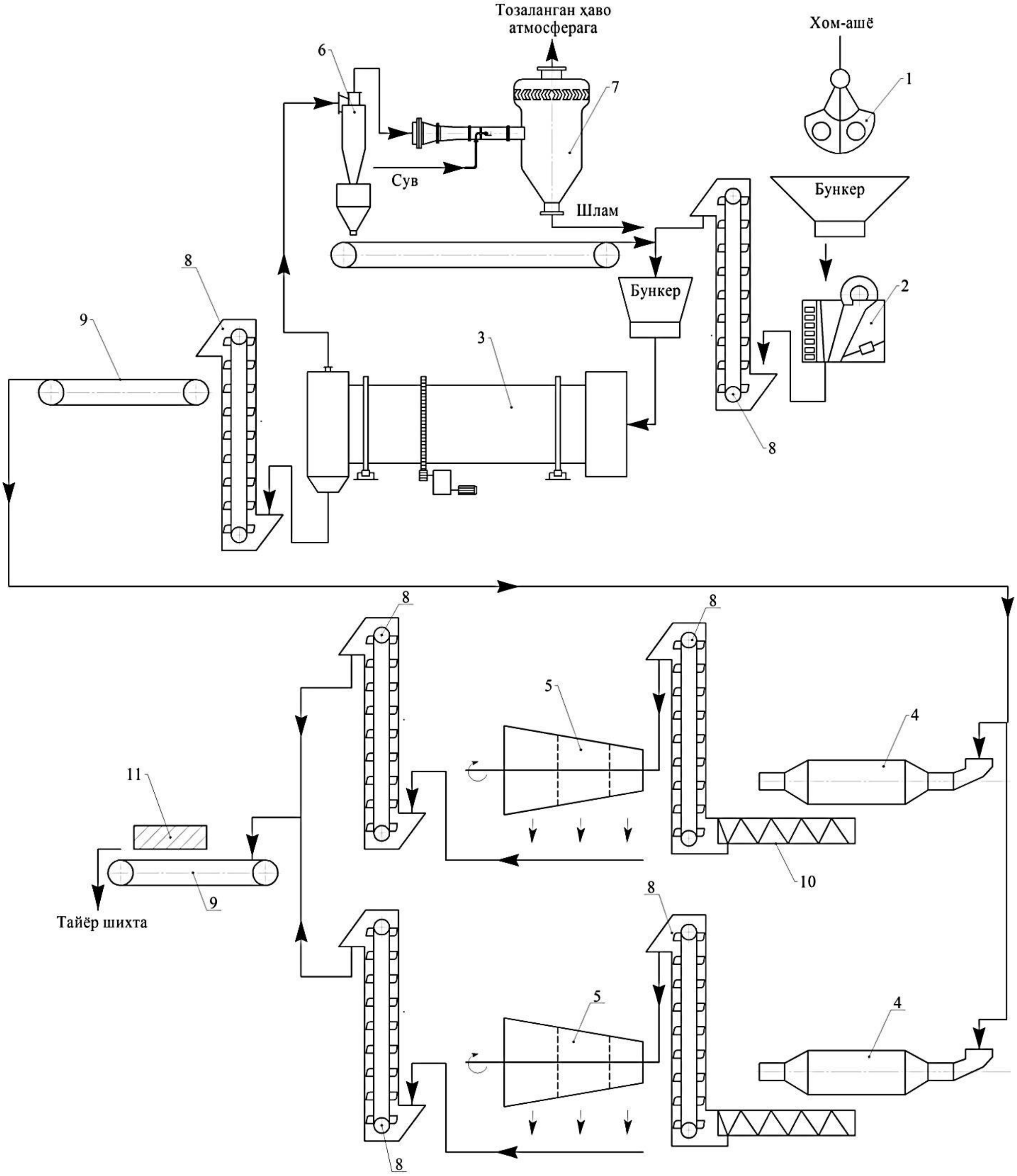


Figure 1. This is the general appearance of the vacuum cleaner.

Experimental studies were carried out on the dust collection of dolomite dust coming out of the drum dryer in the raw materials factory in the contact element dust collector. During the industrial tests, the following parameters are applied to the gas flow: the working body angle of the contact elements generating the flow is α=30o; 45o and 60°, the diameter of the liquid injection nozzle hole is dsh=2;

2.5 and 3 mm, the gas velocity in the device is in the range of υg=7.07÷28.37 m/s, the consumption of liquid supplied to the device is 70÷189.2 l/h. The temperature of the external environment is 20±2 °C, the temperature of the dust gas leaving the drum dryer is 65÷80 °C for dolomite dust.



1 – a jointed grapple; 2 – Oil grinder; 3 – Kuritish drumming; 4 – Charlie Teguermont; 5 – Sorting machine; 6 – Cyclone NIOGAZ; 7 - Dust collection device with a contact element; 8 – Elevator; 9 – Ribbon conveyor; 10 – screw conveyor; 11 – Magnetic separator;
Figure 1.2. Dolomite drying technological line of raw material department.

Taking into account the multifactorial nature of the experiments, it was decided to use the mathematical planning method to determine the efficiency of wear and tear of the device and energy consumption [4,5,6]. According to it, the diameter of the nozzle hole (X1), fluid consumption (X2), horizontal angle of the contact element blades (X3) and gas velocity (X4) selected as variable factors are the factors that have the most influence on the wear efficiency and energy consumption of the device, and the change ranges of the factors marked Table 1.1 shows the levels and ranges of changes of the factors.

Table 1.1 Factor levels and change intervals

№	Омиллар	Ўлчов бирлиги	Омил-ларни белги-ланиши	Ўзга-риш ора-лиғи	Омилларнинг сатҳлари		
					қуйи (–1)	асосий (0)	юқори (+1)
1.	Штуцер тешигининг диаметри	мм	X_1	0,5	2 мм	2,5 мм	3 мм
2.	Суюқлик сарфи	$м^3$/соат	X_2	0,054	0,07	0,124	0,178
3.	Контакт элемент парракларининг қиялик бурчаги	градус	X_3	15°	30°	45°	60°
4.	Газ тезлиги	м/с	X_4	10,61	7,07	17,68	28,3

Degradation efficiency (Y1) and consumed energy (Y2) were taken as defined mesons.

Assuming that the second-order polynomial completely describes the influence of changing factors on the determined mesons, the experiments were carried out based on the HARTLI-4 scheme [7,8,9].

To minimize the influence of uncontrolled factors on the measured mesons, the sequence of experiments was determined using the 1/17 version of the random sequence table. In order to determine the efficiency of dolomite dust removal and acceptable parameters of energy consumption, the experiments were repeated 5 times separately. Arithmetic mean values of experimental results were selected. A multi-component ANKT-410 brand gas analyzer was used to determine the level of pollution. The obtained experimental results are presented in table 1.2.

Table 1.2 The dependence of dolomite dust removal efficiency and energy consumption on many influencing factors

X_1 $d_ш$, мм	X_2 $Q_{сую}$, $м^3$/соат	X_3 α, градус	X_4 $\upsilon_г$, м/с	Y_1 η, %	Y_2 $K_{кэа}$, кЖ/1000$м^3$
2	0,070	30°	28,3	95,63	191,4
3	0,070	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	0,070	60°	7,07	94,87	121,5
3	0,070	60°	7,07	95,86	131,6
2	0,178	60°	28,3	99,22	453

3	0,178	60º	28,3	99,65	457
2	0,124	45º	17,68	99,87	296,4
3	0,124	45º	17,68	99,91	303,5
2,5	0,070	45º	17,68	95,78	166
2,5	0,178	45º	17,68	99,92	361,2
2,5	0,124	30º	17,68	99,48	291
2,5	0,124	60º	17,68	99,78	271
2,5	0,124	45º	7,07	99,89	180
2,5	0,124	45º	28,3	99,45	222,6
2,5	0,124	45º	17,68	99,89	301

The following regression equations, which adequately represent the evaluation criteria, were processed according to the results of the experiment using the HARTLI-4 program of the "PLANEX" program. According to him:

The efficiency of cleaning dolomite dust in the device is determined according to the following regression equation, %

Y1=+99.827+0.187X1+2.031X2+0.145X3-0.217X4+0.067X1X1-0.085X1X2+
+0.166X1X3+0.000X1X4-1.963X2X2+0.200X3X3-0.386X2X4-0.186X3X3+
+0.000X3X4-0.145X4X4 (1.1)

The energy consumed in the apparatus for the process of dolomite dust cleaning is determined according to the following regression equation, kJ/1000 m3

Y2=+269,154+4,793X1+97,683X2-10,017X3+21,267X4+36,397X1X1+
+1,329X1X2-1,579X1X3-2,863X1X4+0,000X2X2+41,471X2X3+39,104X2X4+
+17,397X3X3+3,913X3X4-62,386X4X4 (1.2)

From the analysis of the obtained regression equations (equations 1.1-1.2), it can be seen that all factors have a significant impact on the evaluation criteria. In addition, fluid consumption, dust gas velocity, nozzle hole diameter and contact element inclination angle have a complex relationship with the studied factors.

Regression equations were solved for the dolomite dust cleaning process in order to determine the factors affecting the researched processes, that is, the cleaning efficiency of the equipment and the optimal values of energy consumption. In this case, the condition of dolomite dust removal efficiency being higher than 98.9% was accepted according to GOST-62-198-142 and GOST-67-198-142 requirements. This task was solved on PC "Pentium IV" using Excel program "solution search" (poisk reshenia), optimal values of variable factors in coded form were obtained, and coded values were transferred to natural values.

Thus, the optimal parameters of the apparatus for the dust removal process selected for the sample were brought to the standard state and can be written as follows.

In the process of cleaning dolomite dust:

diameter of the nozzle hole, dsh=2.6 mm;

liquid consumption, Qcuyu=0.138 m3/h.

Slope angle of contact element blades, a=44o dust gas velocity, y=20.4 m/s;

It can be concluded from the experimental studies that at these values of the variable factors, 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 [10,11]. According to the results of the experiment, it was found that the cleaning efficiency is 5.43% higher for dolomite dust than the existing wet cleaning devices, the liquid used for cleaning 1 m3 of air is 2.5 times less, and the energy consumption is 0.8 times less. The results obtained in the experiments fully satisfied the technical requirements for this type of equipment.

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