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WET DUST CLEANER RESEARCH OF HYDRODYNAMIC REGIME

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ABSTRACT

The article describes a device that generates a contact element current that purifies dusty gas in a wet manner. Theoretical research work on determining the total hydraulic resistance is presented. A calculation scheme of the device for theoretical calculation work is developed. The equations of hydraulic resistance affecting the fluid flow according to the nozzle hole and diameter of the calculation scheme are presented.

KEYWORDS

Wet method, spark flow, spark generator, contact element, dusty gas, toxic gas, air flow, gas flow, gas velocity, cyclone, dusty air, fan, cone mesh, disperser, biological microscope

Introduction

For the correct implementation of technological processes in manufacturing enterprises, industrial dusty gases must be cleaned of dust. Mixers, dispersers, and most mass transfer devices cannot function properly without effective gas and dust cleaning schemes [1,2,3]. Today The following methods are used to clean dusty gas mixtures.

Centrifugal force sedimentation; gravity sedimentation; sedimentation in electric and other force fields; filtration; wet gas purification.

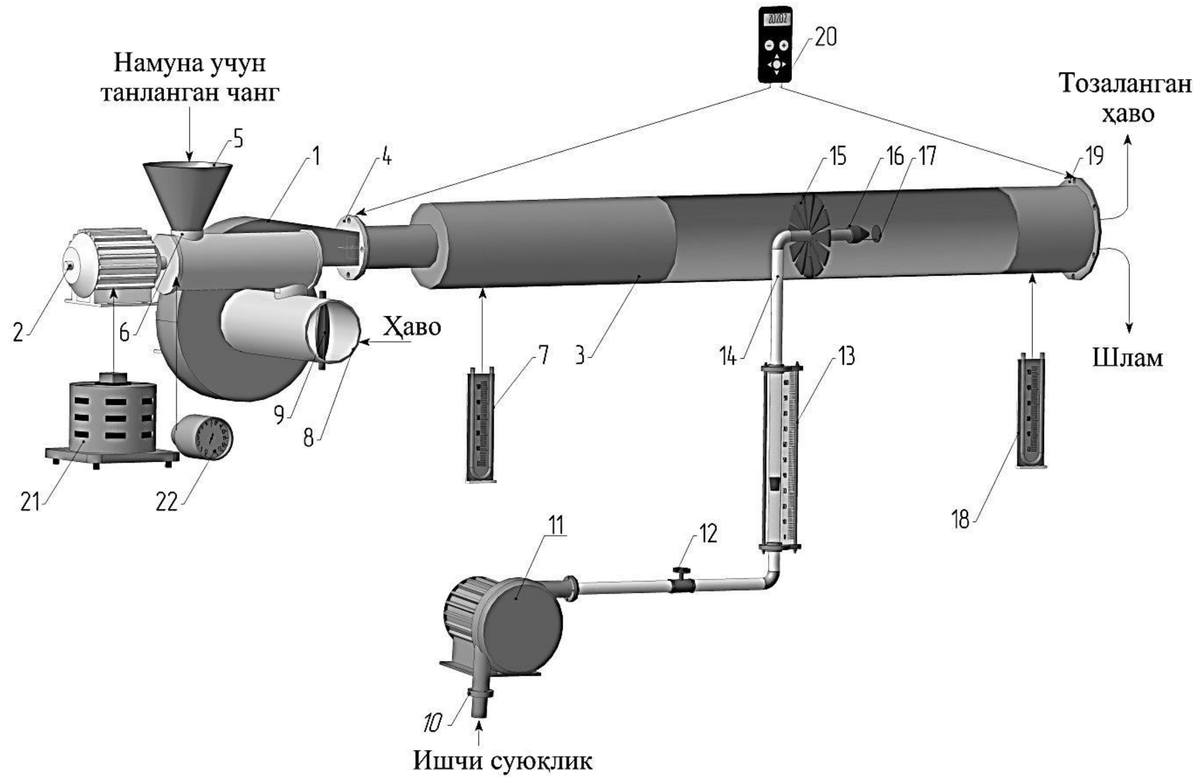
When analyzing these dust and gas cleaning methods, wet cleaning is the most effective. Currently, there is a trend towards widespread use of this method in industry, and many scientific research works are being conducted in this area [4,5].

For example, when using this type of device, the dust flow is in contact with the liquid in the form of drops or films. Due to the hydrophilic property, the dust adheres to the surface of the liquid and is removed from the device with it. In addition, it can capture very small particles (up to 0.1 μm) and has a high cleaning capacity (up to 99%). However, the formation of liquid sludge when using this type of device and the additional energy consumption for its re-cleaning require research and development in this area.

Dusty gas cleaning devices using the wet method are aimed at increasing the efficiency of dust and gas cleaning with low fluid consumption. This, in turn, allows for reduced energy consumption.

Based on the above, dusty gases Based on numerous research studies conducted on the designs of wet cleaning and neutralization devices and an analysis of their advantages and disadvantages, a structural scheme of a wet dust cleaning device has been developed. [6]Figure 1.

Developed device To study the effect of hydraulic resistance on cleaning efficiency and energy consumption, its hydrodynamics were theoretically studied. Figure 2 shows the calculation scheme of the device.



1- fan ; 2-electric motor; 3- metal pipe ; 4,10,19 - flanges; 5-powder loading device; 6-supply; 7,18 - Prandl tube; 8-powder gas inlet pipe; 9- slide ; 11-pump; 12- valve; 13-r a t o meter; 14-water delivery pipe; 15-gas flow regulator contact element; (swivel) 16- liquid nozzle; 17- water deflector; 20- anemometer; 21- LATR; 22 - tachometer.

Figure 1. General view of the device.

The device acting on the fluid can be written as follows

$$\Delta P_{сую} = P_{к} + P_{ш} \quad , \text{Pa} \qquad (1)$$

in this: $P_{к}$ – is the geometric pressure inside the pipe through which the liquid flows, and is determined by the following equation.

$$P_{к} = \rho g H \text{ , Pa} \qquad (2)$$

in this: ρ – density of the liquid, kg/m ^{3}; g – acceleration of gravity, m/s ^{2}; H – liquid level height, m;

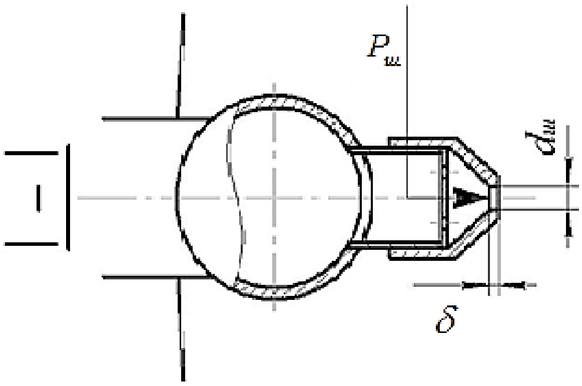
$P_{ш}$ – is the pressure loss when the fluid flows through the hole, which is determined by the Darcy – Weisbach equation[7].

$$P_{ш} = \zeta_{ш} \frac{\vartheta_c^2 \cdot \rho_c}{2}, \text{ Pa} \tag{3}$$

in this: ϑ_c – the velocity of the liquid flowing out of the hole, m/s; $\zeta_{ш}$ – the coefficient of resistance to the flow of the liquid through the nozzle hole, which depends on the thickness of the nozzle hole δ and the hole diameter d_{sh}.

In this case, to determine the velocity of the fluid flowing through the nozzle of the device, $P_к$ we apply Bernoulli's equation, assuming that the pressure in the pipe and the pressure at the nozzle $P_{ш}$ are equal. In this case, equation (4) can be written as follows:

$$\rho_c g H = \zeta_{ш} \frac{\vartheta_c^2 \cdot \rho_c}{2}, \text{ Pa} \tag{4}$$



1. Figure 2. The coefficient of resistance of the Shtüsser calculation scheme

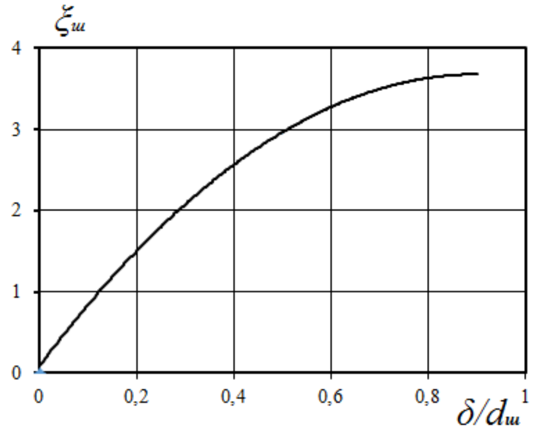


Figure 1.3. Dependence of *P* sh on δ and *d* k.

From the resulting equation (4), we determine the fluid velocity, m/s:

$$\vartheta_c = \sqrt{\frac{2(\rho_c gH)}{\rho_c \zeta}} = \sqrt{\frac{2gH}{\zeta}} \text{ ,m/s} \qquad (5)$$

From equation (5), it is possible to determine the flow rate of fluid flowing through the device's nozzle hole.

$$Q_c = 3600\,\pi R^2 \vartheta_c \text{ , m}^3\text{/hour} \qquad (6)$$

References

1. Xonazarov, Roʻzmuxammad. "CHANGLI GAZLARNI HO ʻL USULDA TOZALOVCHI QURILMA GIDRODINAMIKASI." Educational Yield Insights & Breakthroughs 1.2 (2025): 36-42.
2. Yuldashev, Bilol, Xushnudbek Xomidov, and Sardorbek Nurmatov. "Konus setkali chang tozalovchi qurilma uchun chang namunalarining dispers tarkibi taxlili: Annotatsiya. Ushbu maqolada bonus setkali chang ushlovchi qurilma uchun chang namunalarining disperse tarkibi taxlili ko'rib chiqilgan." Потомки Аль-Фаргани 4 (2023): 66-69.
3. OʻGʻLi, Xomidov Xushnudbek Rapiqjon, et al. "Konus setkali chang tozalovchi qurilma uchun chang namunalarining dispers tarkibi taxlili." Al-Farg'oniy avlodlari 1.4 (2023): 66-69.
4. Нурматов, Сардорбек Хасанбой Ўғли, et al. "БАРБОТАЖЛИ АБСОРБЦИЯ ҚУРИЛМАСИДА ГАЗ ЁСТИҒИНИ ТАДҚИҚ ҚИЛИШ УСУЛИ." Строительство и образование 4.5-6 (2023): 287-295.
5. Nurmatov, Sardorbek, and Axrorjon Mamadaliyev. "BARBOTAJLI EKSTRAKTORNING ARALASHTIRISH ZONALARIGA GAZ UZATUVCHI TESHIKLARIDAGI GAZ TEZLIKLARINI TAXLIL QILISH." Академические исследования в современной науке 3.21 (2024): 135-140.
6. Khusanjonov, A., B. Siddiqov, and J. Asqarov. "CALCULATION-EXPERIMENTAL METHOD OF RESEARCH OF EFFICIENCYADORLIK INDICATORS IN ITS MANAGEMENT BY CHANGING THE WORKING CAPACITY OF THE ENGINE USINGSALSAL CHARACTERISTICS." Экономика и социум 4-1 (2021): 161-164.
7. Rapiqjon oʻgʻli, Xomidov Xushnudbek, et al. "DETERMINING THE EFFICIENCY OF USING AND CLEANING THE ROTOR-FILTER DEVICE IN NEUTRALIZING HYDROGEN-FLUORITE (2HF) GAS." American Journal of Interdisciplinary Research and Development 29 (2024): 7-15.
8. Isomidinov, Azizjon, Khursanov Boykuzi, and Akhror Madaliyev. "Study of Hydraulic Resistance and Cleaning Efficiency of Gas Cleaning Scrubber." International Journal of Innovative Analyses and Emerging Technology 1.5 (2021): 106-110.
9. Karimov, Ikromali, Khursanov Boykuzi, and Akhror Madaliyev. "Volume-Surface Diameters of Drops in Barbotaj Extractor." International Journal of Innovative Analyses and Emerging Technology 1.5 (2021): 94-99.
10. Akhmadjonovich, Ergashev Nasimbek, Isomidinov Azizjon Salomidinovich, and Ovloyorov Xaydarali Aliyorovich. "EXPERIMENTAL DETERMINATION OF THE INDUSTRIAL APPLICATION AND DETERMINATION EFFICIENCY OF FLUID GASES CLEANING

APPARATUS BY CONTACT ELEMENT METHOD." American Journal of Technology and Applied Sciences 7 (2022): 72-78.

11. Isomidinov, Azizhon Salomiddinovich, and Ahror Nizomiddinovich Madaliev. "Hydrodynamics and aerodynamics of rotor filter cleaner for cleaning dusty gases." LI INTERNATIONAL CORRESPONDENCE SCIENTIFIC AND PRACTICAL CONFERENCE" INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION". 2018.
12. Akhmadjonovich, Ergashev Nasimbek, et al. "Liquid gases transmission medium tozalovchi inertial hydrodynamic scrubber." American Journal of Business Management, Economics and Banking 7 (2022): 1-7.
13. Uktamovich, S. R., et al. "Research of resistances affecting the working fluid in a rotor-filter device." Innovative Technologica: Methodical Research Journal 3.11 (2022): 8-15.
14. Akhmadjonovich, Ergashev Nasimbek, Isomidinov Azizjon Salomidinovich, and Ummatov Rustambek Bektoshevich. "INTENSIFICATION OF DUST GAS CLEANING PROCESS." American Journal of Technology and Applied Sciences 7 (2022): 67-71.
15. Tojimatovich, Karimov Ikromali, Madaliyev Akhror Nizomiddinovich, and Isomidinov Azizjon Salomidinovich. "Hydrodynamics of Rotary Apparatus of The Wet Method of Dust Cleaning." European Journal of Emerging Technology and Discoveries 1.2 (2023): 24-30.
16. Azizjon, Isomidinov, and Xomidov Xushnudbek. "STUDY OF HYDRAULIC RESISTANCE OF ROTOR-FILTER APPARATUS." Механика и технология 1.14 (2024): 229-236.
17. Исомидинов, Азизжон Саломидинович. "РОТОР–ФИЛЬТРЛИ АППАРАТНИНГ ОПТИМАЛ ПАРАМЕТРЛАРИНИ МАТЕМАТИК МОДЕЛЛАШТИРИШ." Uzbek Scholar Journal 16 (2023): 71-78.
18. Akhmadjonovich, Ergashev Nasimbek, Isomidinov Azizjon Salomidinovich, and Ummatov Rustambek Bektoshevich. "INTENSIFICATION OF DUST GAS CLEANING PROCESS." American Journal of Technology and Applied Sciences 7 (2022): 67-71.
19. O’ktamovich, Siddiqov Rasuljon, and Akbarov Adham Axadovich. "SILLIQ TURBULIZATORLI QUVIRLARDA ISSIQLIK ALMAShINISh JADALLIGINI TADQIQ ETISh." Science Promotion 1.1 (2023): 209-212.