УДК 622.271

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DETERMINATION OF PARAMETERS AND DESIGN OF THE JET FEEDER HOPPER

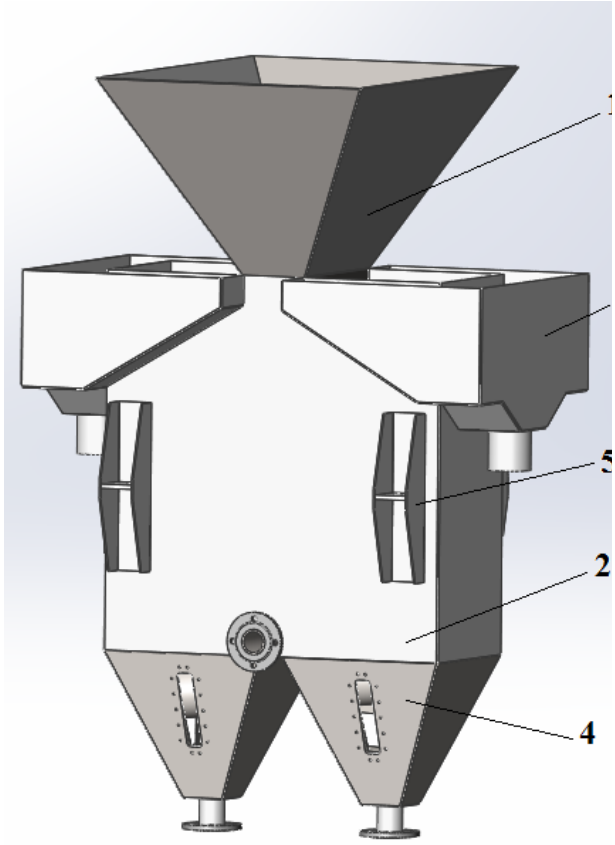

Figure – **The jet feeder hopper**:
1 – hopper feeder for basalt screenings;
2 – sorting box; 3 – sludge box; 4 – commodity basalt bunker; 5 – support bracket

Equipment based on a jet feeder hopper with a capacity of 8 m^3/h (figure) is recommended for hydraulic classification and transportation of basalt screenings with a grain size of up to 5 mm and can be used in the manufacture of equipment for a mining enterprise for processing basalt screenings. This method is also suitable for classifying other granular minerals by size and density, such as: artificial sands from rocks, labradorites, migmatites, dolomites, quartzites, as well as materials containing ilmenite, monazite, staurolite, and silicanite [1].

In the specified equipment, made on the basis of a hopper feeder for jet screening, basalt is sorted by size and density in a vertical flow of washing water moving counter to the flow of raw materials. Basalt screenings with a size of up to 5 mm are poured by a conveyor into a hopper for feeding basalt screenings with a size of up to 5 mm, from which the raw material is poured into a hopper for feeding by the pump. Together with the raw material, the jet feeder hopper is supplied with washing water in the form of jet streams from washing nozzles. The nozzles are fixed in the upper part of the jet feeder hopper. Basalt screenings mixed with water are supplied to the internal cavity of the jet feeder hopper where the raw material is met by a vertical flow of washing water. This flow is formed by nozzles installed on the flushing pipe. Under the influence of such a flow, the basalt screening grains are sorted by coarseness and density into a marketable product and sludge with sizes: 1 – less than 5 mm and more than 0.3 mm; 2 – less than 0.3 mm.

After such hydraulic classification, the basalt screening grains, with a size of less than 5 mm and more than 0.3 mm, move to the bottom of the jet feeder hopper and then the raw material is transported by a pump to supply commercial basalt screenings. Basalt screening grains with a size of less than 0.3 mm are supplied through sludge trays and drain pipes directly to sludge clarifiers.

The jet feeder hopper equipment is small in size, which means it is advisable to use it as part of the general processes of processing and transporting raw materials within the mining enterprise.

The design of the hopper jet feeder equipment with a capacity of 8 m^3/h is modular, so it is advisable to quickly assemble and dismantle it. The above equipment can provide installation of a jet feeder hopper in compact conditions of a modern mining enterprise for enrichment of basalt screenings.

The components of the jet feeder hopper equipment are connected by screw bolt connections. This installation method simplifies maintenance and adjustment of operating parameters, installation and dismantling work, and replacement of structural elements.

The equipment based on the jet feeder hopper is composed of the following assembled units: hopper feeder for basalt screenings 1; sorting box 2; sludge box 3; commodity basalt bunker 4; support bracket 5.

Composite elements based on the jet feeder hopper (picture), take into account the current DSTU standards. According to the complexity parameters, it is advisable to manufacture such designs of assembly elements at the facilities of machine-building enterprises in the Dnipro region. Such structural units of the jet feeder hopper equipment are designed to be used in operating mining enterprises, which is why they have an appropriate design that allows for their quick assembly and disassembly.

The flow diameter of the feeder hopper is calculated by the formula

$$D_{fd} = \sqrt{\frac{4Q_{fh}}{\pi\omega_{0,3}}} = \sqrt{\frac{4 \cdot 0{,}0067}{\pi \cdot 0{,}03}} = 0{,}532 \text{ м},$$

where $\omega_{0,3} = 0{,}03$ – hydraulic size for the calculated diameter of a basalt particle m/s;

Q_{fh} – jet feeder hopper capacity, m^3/sec.

The upward flow rate in the feeder hopper is calculated by the formula

$$v = \frac{Q_{fh}/2}{\frac{в_b}{1000} \cdot \frac{l_b}{1000}} = \frac{0{,}0067/2}{\frac{350}{1000} \cdot \frac{350}{1000}} = 0{,}027 \frac{м}{c},$$

where l_b – sorting box length, mm;

$в_b$ – sorting box width, mm:

The calculated velocity of the upward flow is with high probability equal to the hydraulic size of the calculated basalt particles, which means that the design parameters of the jet feeder hopper are selected correctly.

In this work, a SolidWorks solid model was developed, technological and design parameters of the jet feeder hopper were calculated, and the parameters of its components were substantiated.

References

1. Andrii Bondarenko, Viktor Kukhar and Assel Nurmanova (2024). Innovative technology and equipment for stone processing sludge recycling. IOP Conference Series: Earth and Environmental Science, 1348, 012037. DOI 10.1088/1755-1315/1348/1/012037.