VORTEX SCRUBBER FOR CLEANING OF FLUE GASES
AT INDUSTRIAL ENTERPRISES

Description
Devices for wet cleaning of gases can provide a high level of cleaning commensurable with the level obtained by such highly efficient devices as bag collectors and electric filters. Depending on the purpose and operation conditions, vortex scrubbers can be produced as single devices or series. Gas output in such devices can be hundreds cubic meters per hour, and hydraulic resistance of one contact stage can vary from 40 to 150 mm of the water column.

The main element of the vortex scrubber is the vortex chamber. The high efficiency of the vortex scrubber is ensured by the developed interface, intense mixing, and high dispersion of the rotating gas-liquid layer.

Vortex scrubber efficiency, hydrodynamic resistance, drop entrainment, and degree of blocking by solid residue depend on design perfection and mainly on the swirler construction. The condition for efficient operation of this device is the formation of a uniform gas-liquid layer covering the entire inner surface of the swirler, which eliminates the possibility of gas skipping without contacting the liquid.

Technical appraisal and economic benefits
All devices put into practice demonstrated higher efficiency than those replaced: deeper cleaning, longer service life, significant reduction of hydraulic resistance, smaller amount of materials required for device production, and decreased required areas.

Wet scrubbers were fairly efficient in trapping anhydrous hydrogen fluoride. Previously, packed scrubbers were used for HF trapping in etching acid production. The packing layer 400 mm high was made of polyethylene tube fragments. For a gas flow rate of 16,000–20,000 m³ and initial hydraulic resistance of 120–130 mm of the water column, the device could operate continuously only for 2–3 months with efficiency of 72–74%. The packing became gradually clogged with solid residue, the resistance increased, and the device had to be stopped to change the packing. The new vortex scrubber has worked for a year without inspection. Monitoring devices showed the level of HF cleaning equal to 100% for a resistance of 20–25 mm of the water column.

Application area
Enterprises of thermal and power engineering and chemical industry.

Development stage
Two types of series vortex scrubbers with a total output of 800,000 m³/h are mounted for cleaning of flue gases from ashes at the Novosibirsk co-generation plant No. 4. Vortex scrubbers installed at some plants as absorbers and dust catchers efficiently clean flue gases from gaseous admixtures (chlorine, HF, HCl, ammonium, phosgene, etc.), solid particles, and droplets of various acids.

Patent situation
An application for a patent has been submitted.

Commercial offers
Investments for commercialization of the device. Joint development of a pilot sample.
**Estimated cost**
To be discussed. The vortex scrubber can be delivered both to Russian and foreign markets. For instance, the cost of the cleaning system for flue gases at the Novosibirsk co-generation plane No. 4, consisting of 32 modules (the price of each module is ~ 60,000 rubles) with auxiliaries of 1.2 million rubles, amounts to ~ 3.0 million rubles.

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