1.3. Sulfur oxide emission reduction

1.3.2. Technologies of sulfur oxide emission reduction

1.3.2.6. Technology with circulating inert mass

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The described wet-dry technology with the hollow absorber has a significant drawback - it requires a large volume of the absorption zone, which provides a high degree of desulfurization at the simultaneous complete evaporation of water and exclusion of deposit formation on walls of the apparatus. However wet-dry process can be arranged in another way: a large amount of inert material is fed into furnace gases, and the reagent is applied on its surface. At that a mass of the inert material should not lose its particulate properties. A layout of this installation is shown in Fig. 1.43.

The installation includes an electrostatic precipitator (bag precipitator) *1*, feeding gas flue *2* with the zone of mixing a solid mass with the reagent *3*, constructed as a modified Venturi tube, a system of pneumatic conveying of the collected ash *4*, a line of the collected ash part return into the feeding gas flue *5* and a unit of the lime slurry *6* – a lime silo, a tank of preparation and storage of the slurry and a pump for feeding the slurry into furnace gases.

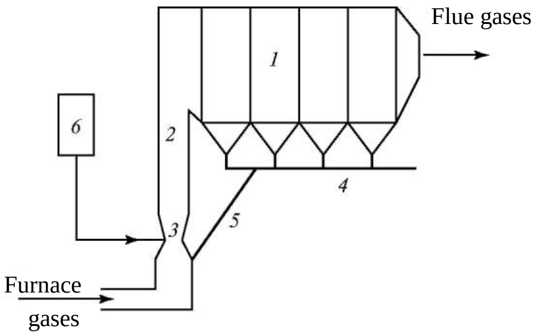

Fig. 1.43. A layout of the desulfurization installation with circulating inert mass

Table 1.20. **Desulfurization indicators with the hollow absorber-dryer**

Achievable desulfurization efficiency,%	95
Reduced sulfur content of fuel depending on a heat capacity of the boiler·, % · kg/MJ	According to GOST R 50831—95: up to 199 MW — 0,5…0,6; 200…249 MW — 0,4…0,45; 250…299 MW — 0,3; ≥ 300 MW — 0,3 According to requirements of the II Protocol to SO_2 ICTM (for solid fuel): 50…100 MW — 0,875; 100…500 MW — 0,875…0,175; ≥ 500 MW — 0,175
Reagent applied	Lump lime
Reagent toxicity	Toxic
Reagent excess factor	1,05...1,10
Produced waste	A mixture of sulphite and calcium sulphate with ash
An effect of desulphurization on the dust collector operation	Desulphurization reduces gas dust by 30 ... 35%
Specific area for equipment installation, m^2/kW	0,04... 0,05
Specific energy consumption, % of equivalent unit (boiler) capacity	0,7...1,0
Specific capital costs, U.S. $/kW of the installed capacity	60...80
SO_2 collection costs, U.S. $/t	200... 1400

Chemical reactions of the process are similar to those presented in it.1.3.2.3. Furnace gases from the boiler pass through Venturi tube, before which a part of the collected ash is additionally discharged into flue gases. In the throat of Venturi tube lime slurry is fed. The gas flue, leading in the ash collector, appears at one time as absorber, where sulfur dioxide is bound with calcium. Greater velocity in this gas flue provides a necessary mass transfer and sufficient abrasiveness of ash eliminates formation of deposits on walls of the flue. As a result, dry mixture of fly ash and desulfurization waste enters the ash collector. Circulation of the ash part leads to a sharp increase in a dust content of furnace gases before the gas purification installation, so the first field (or the first two fields) can operate in a regime close to locking of corona current by the volume dust charge. To eliminate this phenomenon at the gas flue-absorber outlet, the superposed mechanical ash collectors - battery or direct-flow cyclones are used.

Technology with the circulating inert mass is reasonable to apply in case of a high location of the ash collector, when between the collector and the boiler output zone there's a long vertical section.

Indicators of this technology applied to the unit of 200 MW are given in Tab. 1.21.

Table 1.21. **Characteristics of desulfurization with usage of circulating inert mass**

Achievable desulfurization efficiency, %	93
Reagent applied	Lump lime
Reagent toxicity	Toxic
Reagent excess factor	1,2... 1,3
Produced waste	A mixture of sulphite and calcium sulphate with ash
An effect of desulphurization on the dust collector operation	Desulphurization reduces gas dust by 30…35 %
Specific area for equipment installation, m^2/kW	0,0005
Specific energy consumption, % of equivalent unit (boiler) capacity	0,4
Specific capital costs, U.S. $/kW of the installed capacity	15 — without construction of the electrostatic precipitator; 42 — with construction of the electrostatic precipitator
SO_2 collection costs, U.S. $/t	280... 320