Research on Optimizing Design for Diffuser-Tower Structure of Primary Fan in Shaft

S. Q. Chen *, H. Q. Wang, Y. C. Li

School of Energy & Safety Engineering, Hunan University of Science and Technology, Xiangtan 411201, China

Email: zunyichsq@163.com

Abstract

Diffuser-Tower (DT) is an equipment reclaiming energy of primary fan (PF) in shaft. The structure of DT is closely correlative to energy degradation of PF, however reasonable inner flow field is related to DT structure. Energy-waste of PF occupies 1/3 production energy-waste in mining industry, and ventilation of electric power wasted occupies 70% energy-wasted PF [1]. Main appraisal parameters of DT's performance are section enlarge ratio (SER), recovery ratio of static pressure (RSP), DT's diffusing efficiency (DDE) of PF, Local resistance ratio (LRR) evenness degree of velocity distribution in DT's outlet. The outlines of new type streamline DT are based on repeated addition to non-uniform paralleled plane airflow with sink flow with considering sunk practice of airflow after PF [2]. In the condition of same velocity in inlet and

Figure 1: The Graph of Distributing on Velocity in Outlet

Table 1: Main Performances of Four Type Diffuser-Tower

TYPE	SER	RSP	LRR	DDE
60 ° Slope	1.290	0.0142	0.5696	0.0243
DGLX Streamline	2.146	0.1044	0.6773	0.1336
Ref[3] Streamline	2.691	0.4162	0.4452	0.4832
New type Streamline	2.963	0.4466	0.4389	0.5044

flow rate, there are in turn simulated the flow fields of 60 ° slope DT, DGLX DT, Ref [3] streamline DT and new type streamline DT. See Table 1 results of In the condition of same needed flow rate on shaft ventilation system, new type streamline DT is easier to achieve saving-energy and degrading-consumption performance of PF because of owning larger section enlarge ratio to its self. DT's evenness degree of velocity distribution in outlet is also important appraisal index of DT's performance. See Figure 1 velocity distributions in four type DTs in outlet. It is necessary that the balance point should be probed into between addition of resistance and benefit of homogenization from flow deflectors in way of differentiation. Diffusing efficiency of DT is synthetically embodies from SER, LRR and recovery RSP. Diffusing efficiency is higher as it is easier to achieve saving-energy and degrading-consumption performance of PF. Diffusing efficiency is improved favorably compared designed new type streamline DT, which has such perspective of engineering practice, with other types DT. To some extent, the paper may guide and make reference to the design of DT.

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