

# Feasibility Study on Unloading Method of Ash Storage Bin of Dust Removal System

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## Abstract

The ash in the blast furnace dust removal ash storage bin is usually sucked and transported away by the ash suction tanker, while the ash particles in the ash storage bin are extremely small, and under the action of its own weight and water vapor, it is easy to be hardened together, and it is difficult to be attracted by the ash suction tanker. We have conceived a boiling and unloading device for the ash storage bin of a dust removal system, which makes the dust in the ash bin boil, and then opens the electric butterfly valve to start suction. Therefore, the dust in the concentrated dust is raised, the work efficiency is improved, the energy consumption of the ash suction tanker is reduced, and the labor intensity of the operator is reduced.

## Keywords

Dust Removal System; Ash Storage Bin; Boiling; Ash Removal.

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## 1. Introduction

From the calculation of the material balance of the blast furnace, it can be seen that in the production process of the blast furnace, 1500~2000m<sup>3</sup> of gas will be produced for every 1 ton of iron produced. The blast furnace gas contains combustible gases CO and H<sub>2</sub>, and its calorific value is 2800 ~ 3800KJ/m<sup>3</sup>, which has a good use value. . However, part of the furnace dust escapes from the top of the furnace together with the gas. In order to meet the requirements of users, the gas must be dedusted before it can be used. In addition, the current blast furnace generally adopts high-pressure operation. The top gas residual pressure recovery turbine power generation device can recover the gas pressure energy and gas sensible heat, convert this part of the energy into mechanical energy through the turbine, and drive the generator to generate electricity. for electrical energy. This part of the energy is about 30% to 40% of the energy consumption of the blast furnace blower. While recovering energy, it can also improve gas quality and reduce noise pollution to the environment. Dust removal is mainly divided into bag dust removal and electrostatic dust removal.

Bag dust collector is a high-efficiency dust collector that uses various high-porosity woven fabrics or filter felts to capture dust particles in dust-laden gases. There are five main capture mechanisms: inertial deposition of dust particles on the surface of the bag, interception of large particles (diameter greater than 1μm) by the bag, diffusion of fine particles (diameter less than 1μm), electrostatic attraction and gravity sedimentation. First, a primary layer is formed on the surface of the bag, and then the primary layer composed of dust captures dust particles to achieve fine dust removal. When the dust collecting layer on the cloth bag reaches a certain thickness, the resistance increases. It is necessary to remove the dust collecting layer by means of back blowing. After back blowing, the cloth bag is put into use again. The pressure difference before and after backflushing is often used to judge whether the primary layer is damaged. Since the primary layer is retained, the dust removal efficiency can be maintained at a high level. The bag filter generally has several boxes, which take turns to remove dust and blow back, which can ensure the continuous completion of the dust removal

task, the dust removal efficiency can reach more than 99%, the resistance loss is less than 1000 ~ 3000Pa, and the dust content of the net gas can be reduced to Below 5mg/m<sup>3</sup>.

The electrostatic precipitator uses the corona electrode to discharge. Under the action of the high voltage (1.5 ~ 80,000 volts) between the two poles, the gas is ionized into positive and negative ions due to the uneven electric field, and the ions are attached to the dust particles. Under the action of the electric field, the charged dust particles move to the electrode, neutralize the opposite charge, and the dust particles are deposited on the electrode. When the deposition reaches a certain level, the electrode plate is hammered or vibrated, so that the dust particles are separated from the electrode plate and fall into the ash hopper.

Bag dust removal system and dry electrostatic dust removal system have the following advantages:

A No need to use water for cleaning and cooling, and there is no sewage recycling system, which fundamentally solves the problem of environmental pollution caused by sewage and sludge discharge, especially suitable for areas lacking water;

B dry dust collector has low resistance and high dust removal efficiency, up to 98%, and the dust content of gas after dust removal is less than 5mg/m<sup>3</sup>;

C has a wide range of applicability and is not limited by furnace capacity and furnace top pressure;

D. Dry dust removal system has high clean gas temperature, low moisture content, and no mechanical water, which increases the calorific value of gas and the theoretical combustion temperature, thereby reducing the fuel consumption of users;

E For the high pressure blast furnace, dry dust removal increases the calorific value of the top gas and reduces the pressure loss, which can increase the energy recovery rate by 35% to 45%;

F has a small footprint and low operating costs.

In most iron and steel enterprises in my country, the use of cloth bags for dust removal is still the majority. After the bag is dedusted, the dust will be transported to the centralized ash bin, and then transported away by vehicles. In the current situation, in order to meet the environmental protection requirements, most ash transport trucks use ash suction tankers. For example, in blast furnaces, the ash in the dust-removing ash storage bin is usually sucked and transported away by the ash suction tanker, but the ash particles in the ash storage bin are extremely small, and are easily compacted together under the action of its own weight and water vapor, and it is difficult to be attracted by the ash suction tanker. . Usually when this happens, the operator beats the silo body, so that the ash is slowly sucked away. On the one hand, this method damages the silo body, on the other hand, it increases the working time and greatly reduces the work efficiency. It also increases the energy consumption of the ash suction tanker.

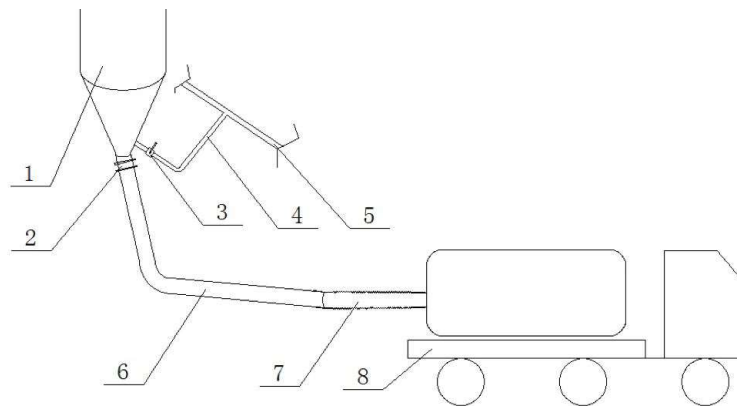
## **2. Boiling Ash Unloading Device for Ash Storage Bin of Dust Removal System**

In order to solve the technical problem that in the blast furnace dust removal device in the prior art, the ash particles are extremely small, and under the action of its own weight and water vapor, it is easy to be hardened together, and it is difficult to be attracted by the ash suction tanker. The boiling ash unloading device includes a blast furnace ash storage bin, an ash suction tanker, an ash conveying pipe and a rubber pipe with cloth. It is communicated with one end of the cloth rubber pipe, and the other end of the cloth cloth rubber pipe is communicated with the ash suction tank on the ash suction tanker. The boiling ash discharge device includes a compressed air conveying device and an air conveying pipe. It is communicated with the compressed air conveying device, the other end of the gas transmission pipe is communicated with the blast furnace ash storage warehouse, and the connection between the other end of the gas transmission pipe and the blast furnace ash storage warehouse is close to the ash outlet at the bottom of the blast furnace ash storage warehouse. A manual ball valve is provided, and an electric butterfly valve is provided on the ash conveying pipe.

The gas pipeline adopts  $\phi 32$  seamless pipe, and the manual ball valve adopts DN25 ball valve.

The middle part of the gas transmission pipe has a bending structure, and the bending structure is the lowest point on the gas transmission pipe.

Specific operation description: The device consists of a seamless pipe and a ball valve. One end of the gas transmission pipe is connected to the compressed air of the pipe network (compressed air conveying device), and the other end is connected to the bottom of the blast furnace ash storage bin, which is near the blast furnace ash storage bin. A manual ball valve is installed on the gas pipeline of the ash suction tanker. Before the ash suction tank truck absorbs ash, open the manual ball valve to make the dust in the blast furnace ash storage bin boil, and then open the electric butterfly valve to start ash suction, and the dust passes through the electric butterfly valve-ash conveying pipe-clamp Cloth the rubber tube, and then enter the ash suction tanker. The ash suction tanker works for about 10 minutes and closes the manual ball valve. When the compressed air is passed into the blast furnace ash storage bin, the dust that is compacted or even hardened by its own weight can boil, which solves the problem that the dust is difficult to suck out. While improving the work efficiency, it reduces the energy consumption of the ash suction tanker and reduces the operator's burden. Labor intensity.



**Figure 1.** is a schematic diagram of the boiling ash unloading device in the ash storage bin of the dust removal system

In the picture: 1. Blast furnace ash storage bin, 2. Ash suction tanker, 3. Ash conveying pipe, 4. Cloth rubber, 5. Compressed air conveying device, 6. Gas conveying pipe, 6.1. Bending structure, 7. Manual ball valve, 8, electric butterfly valve.

### 3. Conclusion

The ash in the blast furnace dust-removing and ash storage bin is very small. Under the action of its own weight and water vapor, it is easy to be hardened together, and it is difficult to be sucked away by the ash suction tanker. Faced with such a predicament, we have conceived a boiling and unloading device for the ash storage bin of the dust removal system, which can make the dust in the ash bin boil. Butterfly valve-ash conveying pipe-cloth rubber pipe, and then enter the ash suction tanker, which improves the work efficiency, reduces the energy consumption of the ash suction tanker, and reduces the labor intensity of the operator.

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