

# Feasibility Study on Preventing Blockage of Pressure-taking Pipe of Blast Furnace Gas Rising Pipeline

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## Abstract

The pressure detection device is a relatively important detection equipment in modern industrial and mining enterprises, and the pressure taking pipe is an indispensable part of the pressure detection device, so it is of great significance to ensure the normal operation of the pressure taking equipment. For this reason, based on the principles of economy, simplicity and practicality, combined with the objective reality of blast furnace pressure detection devices used in industrial and mining enterprises, we have designed a simple and reliable anti-blocking device for pressure-taking pipes of gas rising pipelines. The pipe installation method uses the pulse injection device to perform semi-automatic injection and cleaning of the pressure pipe of the gas rising pipeline.

## Keywords

Blast Furnace; Gas Riser; Pressure Detection; Pressure Tube; Anti-clogging.

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## 1. Introduction

In the blast furnace ironmaking process, the preheated air is blown in from the tuyere located at the lower part of the blast furnace, and the oxygen in the air reacts with the coke in the blast furnace at high temperature to generate CO, which is used to remove the oxygen in the iron ore and reduce the iron. , and the gas produced after the reaction is called coal gas. The components of blast furnace gas are mainly CO<sub>2</sub>, CO and N<sub>2</sub>, and contain water vapor and dust (main component Fe<sub>2</sub>O<sub>3</sub>). Important parameters, because the gas in the riser pipe does not pass through the dust removal device, the dust content is large, and it is accompanied by water vapor, and the original pressure detection device pressure pipe is directly connected to the gas pipeline, resulting in frequent blockage of the pressure pipe. The detection data is abnormal, it is difficult to clean the ash, and it seriously affects the normal production of the blast furnace. In order not to affect the pressure detection, it is necessary to manually clean the ash regularly. However, there is a large amount of gas leakage during manual ash cleaning, which has serious potential safety hazards. At the same time, the pressure detection data is abnormal. The shutdown of the TRT power generation unit directly affects the normal production of the blast furnace. [1].

The pressure detection of the blast furnace rising gas pipeline has the following characteristics: (1) The gas dust content is high; (2) It is accompanied by water vapor; (3) The ash cleaning gas leaks, which is a serious safety hazard (4) The inner diameter of the pressure induction pipe is small and easy to accumulate Ash.

## 2. Anti-clogging Device for Pressure Taking Pipe of Blast Furnace Gas Rising Pipeline

Drill a hole at the installation position of the original pressure pipe of the gas rising pipeline, weld the pressure pipe so that the pressure pipe is perpendicular to the horizontal plane, open a hole in the pressure pipe close to one third of the gas pipe, and weld the pressure pipe to make the pressure pipe

It is perpendicular to the rising gas pipeline, and the pressure-taking pipe is installed to the upper part of the gas pipeline, so that dust is not easy to block the pressure-taking pipe; an inspection ball valve is installed at one end of the pressure-taking pipe and the pressure-inducing pipe, which is convenient for maintenance and cutting off the gas; a pulse jet is installed on the platform close to the pressure-taking pipe. Blowing device, one end of the blowing pipe is connected to the upper part of the pressure taking pipe, and the other end is connected to the pulse blowing device, which is convenient for blowing and cleaning the pressure taking pipe. The device is supplied with air source; connect the control cable of the solenoid valve of the pulse injection device to the existing PLC control cabinet, and set the ash cleaning control button on the operation screen of the upper computer, which can implement semi-automatic ash cleaning. The anti-blocking device for the pressure taking pipe is simple, practical and reliable, not only can reduce the labor intensity of the staff, but also has high dust cleaning efficiency, long service life, convenient installation and adjustment and strong adaptability to harsh environments when used on site. The most important thing is that it can avoid the fluctuation of the furnace top pressure, effectively reduce the occurrence of blast furnace air reduction accidents, and reduce the number of shutdowns of the TRT residual pressure power generation device. [2].

The pressure-taking pipe is redesigned according to the on-site installation requirements, and a new pressure-taking pipe is added, so that the pressure-inducing pipe on the near-pressure side of the pressure detection device is connected to the pressure-taking pipe, which can avoid direct blockage of the pressure-inducing pipe.

The inspection ball valve is to repair and cut off the use of gas and improve the safety factor of the on-site working environment.

The pulse blowing device is composed of a solenoid valve, a pulse valve, an air bag and a blowing pipe.

The pulse valve is controlled by a solenoid valve, the control cable of the solenoid valve is connected to the blast furnace PLC control cabinet, and the upper computer performs ash cleaning control through the PLC control system. [3].

The air bag is manufactured according to the injection requirements of the pulse valve, so as to ensure that the pulse valve is supplied with sufficient air source.

One end of the blowing pipe is connected to the pulse valve, and the other end is connected to the upper end of the pressure-taking pipe, so as to achieve the purpose of cleaning dust by pulse blowing.

The pulse jet cleaning will not cause abnormal detection data of the original pressure detection device.

### 3. Specific Implementation Cases

Take the gas rising pipeline of No. 7 blast furnace (850m<sup>3</sup>) of Zhongtian Iron and Steel Group No. 3 Iron Works as an example. In the pressure-taking pipe anti-blocking device of the utility model, the selection parameters of the pressure-taking pipe are determined as: stainless steel pipe  $\phi 25 \times 3$ ; the selection of the pressure-taking pipe maintenance ball valve is Q11F-16C/DN20; the selection parameters of the pressure-taking pipe are determined as; stainless steel Pipe  $\phi 18 \times 3/304$ , the selection of the pressure pipe maintenance ball valve is determined as Q11F-16C/DN15; the selection parameters of the electromagnetic pulse valve are determined as: DMF-Z-25/AC220V, the air bag is made according to the actual needs, and the original air source is selected. For some nitrogen packs, the gas source pressure is not less than 2MPa, the gas pack pressure gauge is a shock-resistant pressure gauge, the model is YN-100/0-4Mpa/M20\*1.5/1.5, the injection pipe is the same as the pressure pipe, which is convenient for Installation, the selection of the control cable of the pulse valve solenoid valve is KVV4\*1.5, the power supply is 220VAC; the access point is allocated in the original PLC control cabinet, and the solenoid valve control signal is connected to the PLC control system. [4].

After the installation of the on-site pulse injection device, the pressure-taking pipe and the pressure-inducing pipe is completed, it is necessary to make a cleaning control button on the operation screen

of the upper computer. After the installation is completed, open the ball valve of the nitrogen bag pipeline to provide the air source for the pulse device. When it is dusty, it is necessary to observe the pressure displayed on the air bag pressure gauge. When it is greater than 2MPa, operate the cleaning button on the upper computer to realize semi-automatic cleaning.

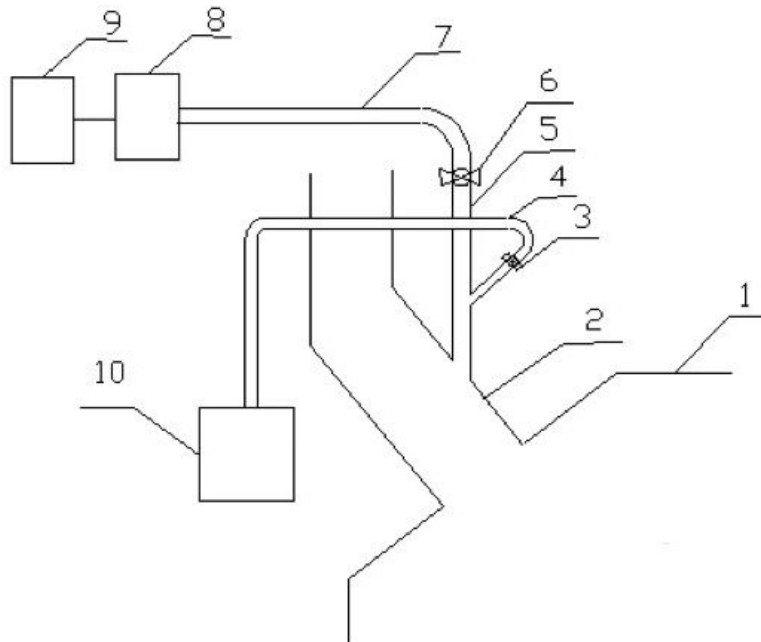
The present utility model will now be described in further detail in conjunction with the accompanying drawings. These drawings are schematic diagrams of the on-site pressure pipe anti-blocking device, which only illustrate the advantages of the present invention in a schematic way, and only show the structures related to the present invention.

As shown in Figure 1, this picture is a schematic diagram of the anti-blocking device for the pressure pipe of the gas rising pipeline. According to this schematic diagram, the installation of the pressure pipe can successfully realize the control of the dust removal of the pressure pipe. After it is put into use, the dust removal effect of the pressure pipe is good.

As shown in Figure 2, this figure is a schematic diagram of the pulse injection device. According to this figure, the pulse control device can be installed to perform effective injection.

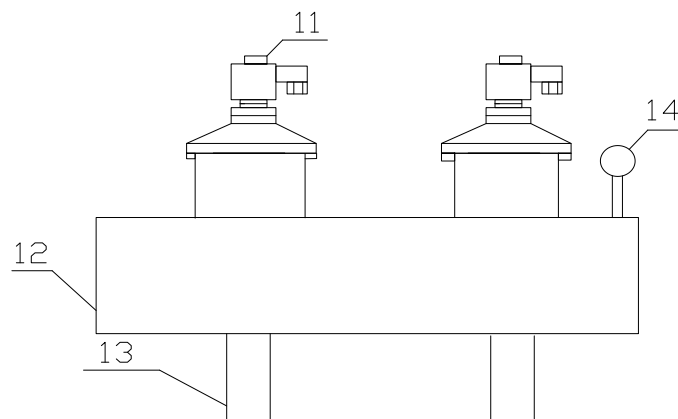
Figure 3 shows the schematic diagram of the structure of the pulse device, which is easy to install.

To sum up, the utility model is an anti-blocking device for the pressure taking pipe of the blast furnace gas rising pipeline, which can not only reduce the labor intensity of the staff, eliminate the hidden danger of gas poisoning caused by manual ash cleaning, but also effectively avoid the The fluctuation of furnace top pressure caused by manual ash cleaning greatly reduces the number of shutdowns of the TRT power generation unit, and at the same time, it can avoid the occurrence of blast furnace air reduction and air shutdown accidents caused by furnace top pressure fluctuations.



1, Blast furnace body 2, Rising gas line 3, Near pressure side inspection ball valve 4, Impulse tube 5, Pressure tube 6, Pressure pipe inspection ball valve 7, Blow pipe 8, Pulse device 9, Host computer 10, Pressure detection device

**Figure 1.** Schematic diagram of the anti-blocking device for the pressure taking pipe of the blast furnace gas rising pipeline



11, The electromagnetic valve 12, Air bag 13, Blow pipe 14, Pressure gauge

**Figure 2.** Schematic diagram of pulse valve

#### 4. Conclusion

The anti-clogging device for the pressure-taking pipe of the gas rising pipeline designed by us is simple, practical and reliable. It can not only reduce the labor intensity of the staff, but also has high dust cleaning efficiency, long service life, convenient installation and adjustment. It has the advantages of strong adaptability to harsh environments, etc. The most important thing is that it can avoid the fluctuation of furnace top pressure, effectively reduce the occurrence of blast furnace air reduction accidents, and reduce the number of shutdowns of TRT residual pressure power generation units.

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