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Analysis and Discussion on the Anti-blocking Method of the Receiving Grid

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Abstract

During the charging process of the blast furnace, due to the influence of the environment and the weather, the raw materials are wet. When discharging, the raw materials stick to the grid and cannot be discharged normally. Blocking and accumulation of materials often occur, usually requiring manual clearing. When blocked, the mesh will be worn, reducing the service life of the mesh. We conceived a new type of semi-automatic self-cleaning grid device. During the cutting process, the grid is always in a vibrating state, so it is difficult to accumulate material on the grid, which reduces the labor intensity of the operator.

Keywords

Blast Furnace Charging; Receiving Hopper; Grid; Vibration; Anti-blocking.

1. Introduction

The equipment that sends the charge directly to the top of the blast furnace is called a feeder. The requirements for the feeding machine are: to have enough feeding capacity, not only to meet the normal production needs, but also to quickly catch up with the feeding line under the condition of low feeding line. In order to meet this requirement, under normal circumstances, the operation rate of the feeder should generally not exceed 70%, and the work should be stable and reliable, with the greatest degree of mechanization and automation. [1].

The feeding machine mainly has three feeding methods: tank type, feeding truck type and belt conveyor. The tank conveyor was a commonly used feeding method before the 1930s and 1940s. Due to the upward heavy tank and the downward light tank, if the speed is fast, the hanging material tank will swing continuously, so the feeding capacity is low, and it has been completely replaced by the feeding car type feeding machine. At present, almost all of the high protection above $1000m^3$ are fed by belt conveyors. However, due to site limitations or small furnace capacity, there are still some blast furnaces that use feeding trucks. [2].

1.1 Inclined Bridge Car Feeder

The inclined bridge feeder type feeder generally consists of three parts: feeder, inclined bridge and poplar roll machine. It is suitable for blast furnaces with a volume of about $1000m^3$ and below. The volume of the feeding truck is determined according to the volume of the blast furnace, which is generally 0.7% to 1.0% of the volume of the blast furnace.

Most of the inclined bridges use truss structures, and the inclination angle depends on the number of railway lines and the plane layout, generally 55°~65°. The inclined bridge is provided with two fulcrums, the lower end is supported on the wall of the feeder pit, and the upper end is supported on the gantry-shaped frame set up from the ground.

The winch is the equipment that pulls the trolley to walk on the inclined bridge. It is mainly composed of a drive motor, a reduction box, a drum, a steel rope, a safety device and a control system. It requires safe and reliable operation, good speed regulation performance, accurate parking at the end position, and automatic operation. [3].

There are various forms of feeding systems for feeding trucks. Under-trough transport weighing systems with belt conveyor transport and weighing funnel weighing are generally used. The main principle of the design is: bulk raw materials or materials that are difficult to transport should be placed above the material truck pit as much as possible to reduce reverse transportation and directly load them into the material truck. Generally, a coke tank is set above the feeder pit, and the coke is sieved into the coke weighing funnel. After being weighed, it is directly loaded into the feeder according to the feeding procedure. In addition, there is also a form in which a large sinter trough is set above the feeder pit, and the sintered ore is directly loaded into the feeder through the ore centralized weighing funnel; there are also forms in which lump ore, pellets or miscellaneous ore troughs are set above the feeder pit . The materials far away from the top of the feeder pit are screened by the vibrating screen set below the feeder trough, and the materials that meet the particle size requirements are sent to the weighing funnel through the belt conveyor, and then loaded into the feeder truck after weighing, and those that do not meet the requirements are transported to the powder silo. [4].

1.2 Belt Conveyor Feeding System

In recent years, due to the large-scale blast furnace, the feeder-type feeder has been unable to meet the requirements of blast furnace production. For example, a 3000m³ blast furnace, the feeder pit will be more than 5 floors deep, and the wire rope will be thickened to the extent that it is difficult to curl. Whether to increase the amount of each feeding or increase the number of feedings, as long as the feeding is intermittent, it will be very uneconomical. Therefore, the newly built large blast furnace and some medium and small blast furnaces all adopt the belt conveyor feeding system, because it continuously feeds the material, it can easily increase the belt speed and width to meet the blast furnace requirements. The advantages of the belt conveyor feeding system are:

(1) Large blast furnaces have more than two tap holes and tap yards. There is insufficient space near the blast furnace, so facilities such as ore storage tanks are required to be farther away from the blast furnace. The belt conveyor feeding system is just suitable for this requirement.

(2) The feeding capacity is large, which is more efficient and flexible than the inclined bridge feeder, and the damage rate of the charge is low, and the intermittent feeding is changed to continuous feeding.

(3) Save investment and save steel. The use of belt conveyors to replace expensive winches and motor units not only reduces the weight of the equipment, but also simplifies the control system.

No matter what kind of material is fed, it will eventually enter the blast furnace through the receiving hopper. However, due to the influence of the environment and the weather, the raw materials are wet. When discharging, the raw materials stick to the grid and cannot be unloaded normally. Blocking and accumulation often occur, which usually requires manual clearing. Manual clearing is a dangerous operation and requires two People walking together will cause waste of human resources. At the same time, the grid will be worn out when the block is cleared, which reduces the service life of the grid. On the other hand, when the block is cleared, it will cause dust and damage the environment.

2. Receiving Grid Anti-blocking Device

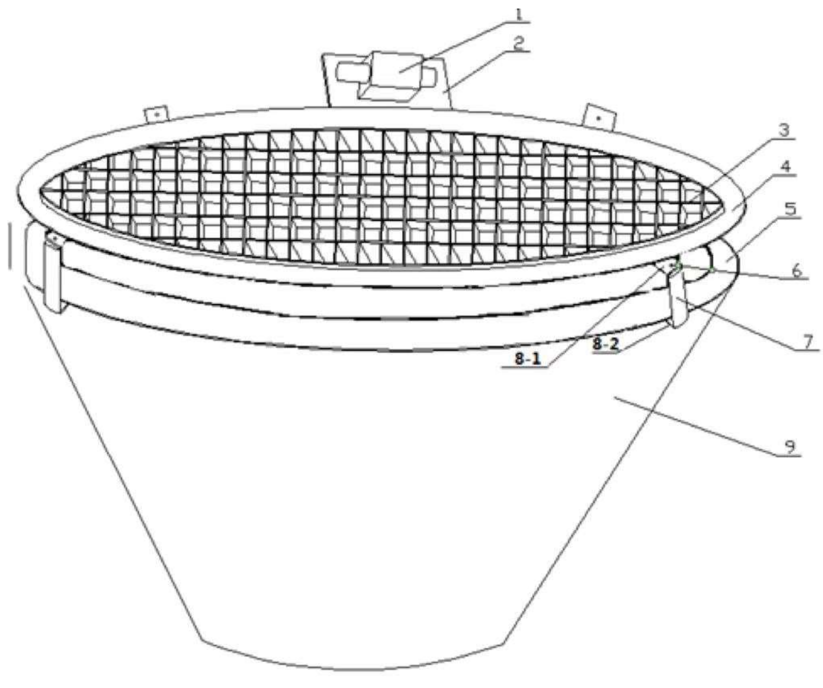
We conceived a device to prevent blockage by vibrating the grid, specifically a new type of semi-automatic self-cleaning grid device. It is characterized in that: it includes a blocking net, the blocking net includes a grid net, and a ring-shaped outer frame arranged around the grid net and fixedly connected with the grid net; a receiving hopper located under the blocking net, and the distance between the receiving hopper and the blocking net, And at least 3 rubber springs are evenly arranged between the two, one end of the rubber spring is in elastic contact with the annular outer frame, and the other end of the rubber spring is in elastic contact with the receiving hopper; it also includes a device installed outside the ring. A vibration motor base plate on the frame and a vibration motor mounted on the vibration motor base plate and used to drive the net to vibrate. When working, turn on the vibration motor first, and then unload; after finishing unloading, turn off the vibration motor. Because the grid is always in a vibrating state during the cutting process, it is difficult to accumulate material on the grid.

The top end surface of the receiving hopper is provided with an annular base, and at least three lower fixing plates are evenly arranged on the annular base, and the lower fixing plate is provided with through holes penetrating the upper and lower end surfaces of the lower fixing plate.

The annular outer frame is provided with an upper fixing plate opposite to the lower fixing plate, and the upper fixing plate is provided with through holes penetrating the upper and lower end surfaces of the upper fixing plate.

The rubber spring is provided with a through hole in the axial direction, the rubber spring is arranged between the upper fixing plate and the lower fixing plate, and the three are simultaneously movable through the upper fixing plate through hole, the lower fixing plate through hole and the rubber spring. Bolted connection in the spring through hole, the bolt is equipped with a nut. The bolts pass through the lower fixing plate, the rubber spring, and the upper fixing plate, so that the rubber spring is fixed and the lattice grid is overhead at the same time.

Further, in order to prevent material leakage or other large debris from falling into the receiving hopper, the shape and size of the annular outer frame and the annular base are the same.



1. Vibration motor, 2. Vibration motor base plate, 3. Lattice network, 4. Ring frame, 5. Ring base, 6. Bolt, 7. Rubber spring, 8-1. Upper fixing plate, 8-2. Lower fixing plate, 9. Receiving hopper.

Figure 1. is a schematic diagram of the anti-blocking device for the receiving grid

3. Conclusion

We conceived a device to prevent blockage by vibrating the grid, specifically a new type of semi-automatic self-cleaning grid device. It is characterized in that: it includes a block net, the block net includes a lattice net, and an annular outer frame arranged around the lattice net and fixedly connected with the lattice net. When working, turn on the vibration motor first, and then unload; after finishing unloading, turn off the vibration motor. Because the grid is always in a vibrating state during the

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feeding process, it is difficult to accumulate material on the grid, which reduces the labor intensity of the operator and ensures the stable production of the blast furnace.

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