Research on Automatic Control Filling System

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ABSTRACT

With the development of information technology, digital mines has become a development goal of the mining enterprises in recent years. The equipment intelligent, automation production, management information mining mode of production is being extended gradually, the digital management system of filling has become an important project of digital mined development. This paper studies the remote automatic filling process control, material concentration and flow rate of the real-time monitoring technology, to develop a suitable metal mines filled automatic control system. The system is applied in a copper mine enterprises. The test results show that the system realizes the production equipment and process for remote status monitoring and management, optimize the number of staff, reduce labor intensity and improve packing efficiency, to achieve a continuous and stable mine production.

INTRODUCTION

With the demand of mineral products is increasing rapidly, the exploration of the mineral resources leads to environmental deterioration and disaster, it has become to a nasty problem of environment and society. Therefore environmentalists have mine filling as one necessary step of mining in an ecology idea and make full use of waste materials in mine filling, people should make best use of the mineral resources and protect our prospective resource, decrease the waste products from the mine to an utmost degree, solve the problem of mining environment and ecological damage basically[1-3].

With the wide application of modern mining industry of the technology of computer and automation, from equipment modernization, automation production, management information, unmanned and humanizing mining mode of production is being extended gradually, and the construction of digital mines has become a development goal of the mining enterprises in recent years, the digital management system of filling has become an important project of digital mined development.

This paper discusses the application of automatic control of mining filling system fundamentally[4-6]. Through the automatic control system (including the filling process, filling sand silo making slurry concentration, sand silo slurry making system, automatic ash control, filling concentration, stirring barrel level) studies, analysis of the realization of the principle of mine filling station automatic control system. It tells the story of a gold filling station through the use of PLC to achieve the program control to realize the digital management, and integration and monitoring management to achieve through the network platform, the realization of dispatching monitor the control process, avoid wrong operation.

THE STRUCTURE OF THE FILLING SYSTEM

The filling automation control system consists of management layer, network communication layer and field device layer. The operation mode includes three kinds of remote centralized control, remote single control and local operation.

The system is mainly composed of two monitoring stations, a video display, a PLC master station, communication components, execution mechanism, concentration meter, flowmeter, pressure sensor, material level meter, pumps and valves. There is high digital network camera in the key position, conducive to the operators intuitively grasp the situation at any time.

The data collected will be uploaded to the software management platform, by calculating the ratio of raw materials, automatic control field actuator, satisfy the flow and concentration of technical requirements, to achieve the whole process of monitoring and management on the preparation of filling slurry system. The system network topology is shown in figure 1.

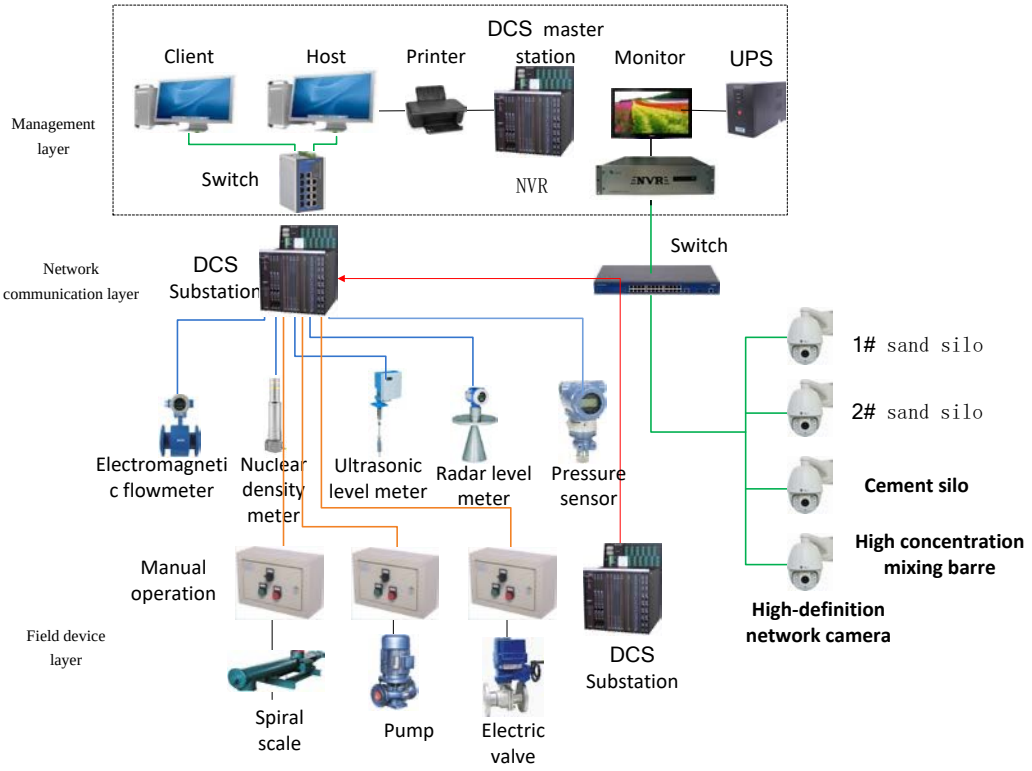

Figure 1. Topological structure

FILLING PROCESS

The automatic filling control system mainly realizes the tailings pipeline control, vertical sand bin level detection, tailings sand measurement, sand silo slurry and aggregate delivery control, the proportion of cement filling control, filling slurry dry ore metering and concentration control etc.. The control center show monitoring data, including filling flow, aggregate flow, flow, flow of cement tailings, set the alarm value, generate daily, monthly, annual report.

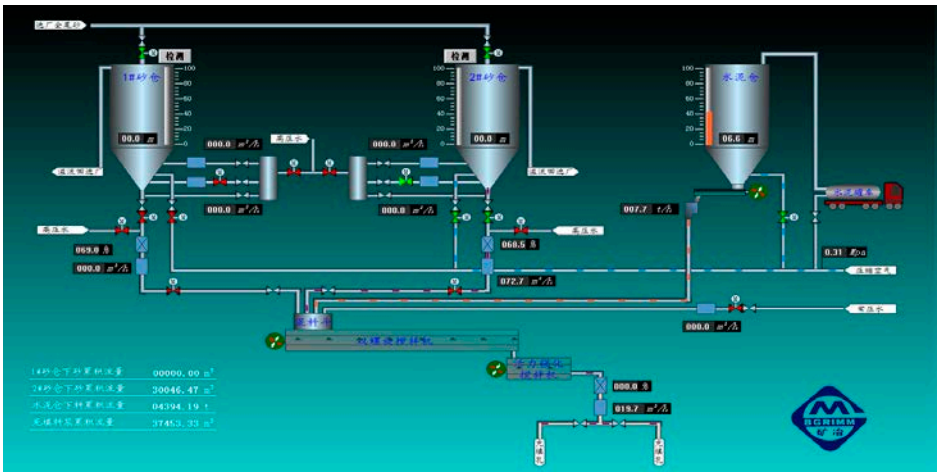

Figure 2. The diagram of filling process

Filling automatic control system function is as follows:

- Control of tailings transportation pipeline

Concentrator tail sand transported to the vertical filling station, installation of electric knife gate valve, remote control of tailings material.

- Liquid level detection of vertical sand bin

In order to prevent the full bin of the vertical sand silo, the liquid level meter and the camera are installed at the top of the sand bin, which is real time dynamic monitoring of sand storage level.

- Tailing dry sand measurement

The system automatic calculates the dry sand content by the monitoring data from concentration meter and flow meter on the bottom of the sand bin. If the dry sand content deviation with setting value, the system will regulate pneumatic hose valve to control emissions into the tailings mixing funnel.

- Quantitative control of aggregate transportation

PLC control system adjusts the vibrofeeder frequency to achieve quantitative feeding. Remote opening belt conveyor, using the belt electronic scale to measure the aggregate.

- Proportional control of filling cement

According to the sand ratio, dry sand content and sand content, calculate the amount of cement. Through the special control algorithm to control the frequency of the cement screw conveyor, adjusting the amount of cement feeding, using the existing micro powder measurement. The radar level gauge is used to monitor the cement material level at the top of the cement silo

- Dry ore weight measurement and concentration control of filling slurry

To a certain extent, the quality of filling slurry concentration of filling high concentration, poor mobility, stope surface roughness. Low concentration, backfill segregation, impact strength of the filling body. According to the technological requirements, the filling slurry concentration control should be controlled within a reasonable range. According to the data measured by the filling pipeline concentration meter and the flow meter, the amount of dry aggregate can be calculated after the

calculation of the control system. If the measured concentration deviation of the set value, adjust the opening of the hopper gate valve to ensure that the concentration in a reasonable range.

CONCLUSION

This paper put forward the automatic filling control system, recommend to have been in labor intensive mechanized primary level, management extensive, to promote to the mechanization degree is low and long time in labor intensive, rough type management, the technology, equipment and backward mining enterprises is weak, in order to promote its digital construction, gradually realize the “digital”, “nobody”, “automation”.

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