Comprehensive Monitoring and Research of Vertical Well Rigid Tank System

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Abstract

In order to solve the problems of wire rope overloading, tension unbalance, abnormal vibration of hoist container, kinking and wearing of tail rope during the operation of multi-rope friction hoist.This paper, Baodian coal mine as the background, a set of monitoring system that can monitor the operation status of the elevator in real time is studied, through the field test shows that its monitoring system to real-time monitoring to enhance the operation of the system.

Keywords

Multi-rope friction; overload; vibration; wear; monitoring.

1. Introduction

With the development of coal mine, multi-rope friction hoist has been widely used in vertical shaft rigid tank system due to its advantages of small size, light weight and large lifting capacity. [1] However, some problems still exist in actual operation, such as increasing the overload of the wire rope, unbalanced tension between the ropes, abnormal vibration of the container, kinking or wear of the tail rope, and ect. If these problems can not be dealt with promptly, it will lead to safety accidents, and it will cause some economic losses. Therefore, it is necessary to study a monitoring system that can monitor the vertical shaft rigid tank system in real time. In this paper, Yancon Group Baodian coal mine as the basis, the vertical shaft rigid tank system for comprehensive monitoring.

2. Monitoring system overall design

2.1 Dynamic monitoring system design requirements

(1) The signal collector on the skip can simultaneously acquire multiple tension sensors and vibration sensors and perform A / D conversion;

(2) It can adapt to harsh mine environment, collect and transmit module anti-magnetic anti-interference, and can prevent explosion;

(3) The use of multi-point wireless transmission, to ensure the reliability of data transmission;

(4) Has a good man-machine interface;

(5) Reduce the transmitter transmit power to ensure battery power supply time.

2.2 System design block diagram

Monitoring system mainly consists of lower computer signal acquisition and transmission devices, host computer receiving devices and human-computer interface composed of three parts. The start and end triggers are installed at the wellhead and at the bottom of the coal seam, ie when the skip runs to the trigger position it will trigger the lower machine to start running and stand by. When upgrading the system, the operator through the man-machine interface to the host computer "acquisition" command, the next crew began to wire rope tension, hoist container vibration, bottom of the pile of coal for data collection, and collected in the underground signal through the wireless communication to the host computer, the host computer receives the information and then transmitted to the IPC Machine, through the software processing and display up and storage. When you do not need to collect data, send "stop" command can be.

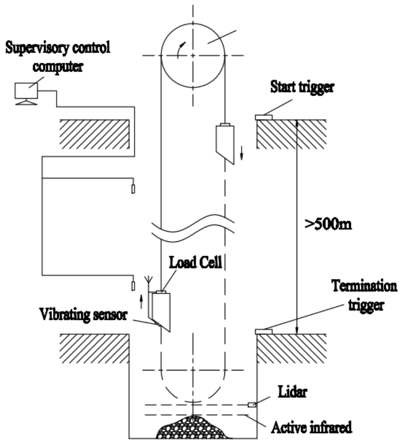


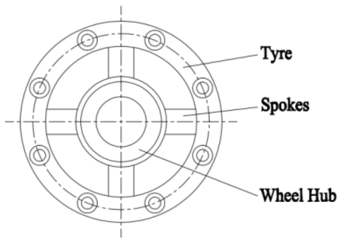
Fig.1 monitoring system overall design

3. Sensor selection and installation location

The sensor is the main tool for collecting information. The performance of the sensor directly affects the accuracy of the monitoring data. According to the actual situation of the mine, the appropriate sensor should be selected according to the following principles: ① high sensitivity; ② no distortion of the response; ③ within a certain range Output and input proportional relationship; ④ with reliability and stability; ⑤ economy; ⑥ high accuracy.

3.1 Load sensor

Existing load sensors are mainly resistive, inductive, capacitive and piezoelectric. Analysis of various types of sensors shows that inductive and piezoelectric by the larger environment, capacitance and piezoresistive range smaller, so the choice of strain-type load cell. Strain sensor with a simple structure, large range, anti-interference ability and other advantages [2], after considering the choice of spoke-type strain sensor, as shown in Figure 2 for the elastomer structure.



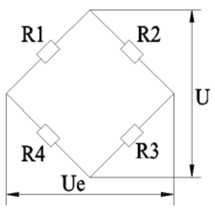


Fig.2 Load cell elastomer structure Fig.3 Strain gauge bridge

The strain gauges are arranged at the maximum deformation of the elastic body in the direction of 45 ° with respect to the neutral plane of the spokes. A strain gauge is attached on the upper surface and the sides of the adjacent two spokes, respectively, with a total of 4 resistances.R1 and R3 are pulled, R2 and R4 are pressed, the measuring circuit is the differential bridge 4 arm full-bridge circuit, as shown in Fig. 3.

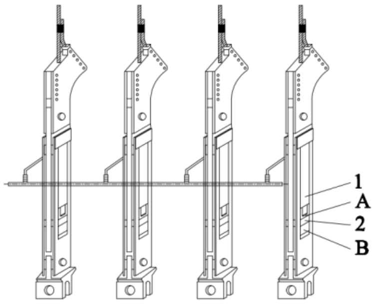


Fig.4 Load sensor placement

The location of the load cell as shown in Figure 4, there are two main placement, namely, A and B. A indicates that the load cell is disposed between the hydraulic cylinder 1 and the slider 2, and B indicates that the load cell is disposed between the slider 2 and the side panel.

3.2 Vibration sensor

Vibration sensors mainly detect the abnormal vibration of the container, in the choice of vibration sensors, mainly from the mine's actual situation. On the basis of following the principle of selection, we should try to meet the actual conditions of the mine. Taking into account the vibration sensor PCB-608A11 type accelerometer selection, such a sensor with a compact, compact, easy to carry, easy to operate and maintain.

The installation position of the vibration sensor is set in the middle of the lower part of the skip to prevent the falling coal from affecting the sensor to a certain extent.

3.3 Anti-coal dust sensor

Pile-up pile of coal, will cause the tail rope hold up, resulting in tail rope wear or kink. [3] Two-dimensional laser and infrared sensor joint protection system to achieve the two-tier protection of the tail rope.

The first layer of protection system using two-dimensional laser scanning radar system device, set at a distance of 100cm from the bottom of the tail rope. In operation, the radar system generates a scanning plane that detects if the coal dust touches the scanning plane and, when touched, alarms and activates the second protection system. The second layer of protection system uses an active infrared sensor system, as shown in Figure 5, set 40cm down from the bottom of the tail rope. When the stack is unprocessed and touches the infrared sensor system, the system will alarm and stop the elevator run.

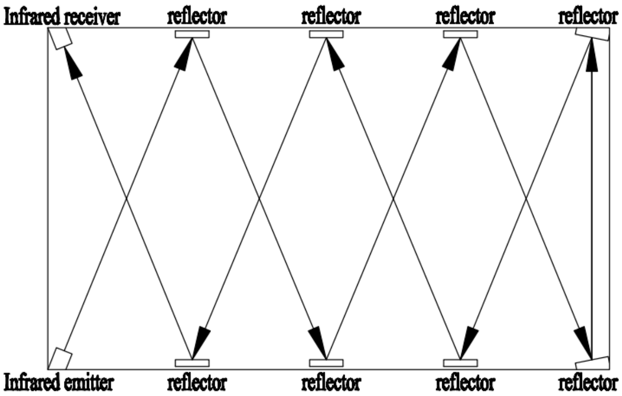


Fig.5 Active infrared sensor system

4. Field test

Taking the main shaft of Baodian Coal Mine of Yancon Group as the background, the monitoring system is tested. First, the functions of each monitoring system are tested, and then the functions of the monitoring system are tested simultaneously.

Wire rope tension monitoring system test, the main wire rope tension detection value and theoretical comparison of numerical analysis, while monitoring the value of the wire rope, man-machine interface can be real-time display of the rope tension and the rope tension value is too large or large tension difference alarm stop hoist operation. Vibration monitoring system to enhance the container test, mainly to enhance the tank in the fault part of the tank and the normal part of the vibration signal contrast analysis, human-computer interface can display real-time vibration acceleration signal and vibration alarm signal oversized. Tail rope protection monitoring system testing, when the coal reaches the detection plane can timely alarm, and send signals to the host computer, so that the host computer issued a corresponding instruction.

Finally, all monitoring systems are monitored simultaneously. In the main shaft of Baodian Coal Mine, the control system is tested. After testing, it can be seen that the monitoring system can show the lifting status of the main shaft hoisting system in real time.

5. Conclusion

In order to solve the problem of multi-rope friction hoist in the running process, this paper mainly studies a set of wire rope tension in multi-rope friction hoist in real time to enhance container vibration and prevent coal tail Rope wear monitoring system for measurement. Through on-site monitoring of the actual operation of the system shows that the normal operation of the monitoring system to real-time display of the main shaft to enhance the upgrading of the system and in the event of a failure to respond to the host computer in a timely manner.

References

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