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Automatic Neutral-section Passing Device Design of SS8 Locomotive

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Abstract

To solving the problem of the automatic neutral-section passing technology, it presents a new kind of system based on composite position system. The position system of it includes two parts, the global positioning system and radio frequency identification. It also analysis design scheme of all parts of the system and introduces the operating principle of it.

Keywords

Ocomotive, Neutral-section, Passing global positioning system.

1. Introduction

There is an electric phase separation zone with a length of about 30m every 20km to 25km on the domestic contact network. The traditional electric locomotive over-phase split technology is manual switching on the car, that is, in order to avoid towing arc damage to the power supply equipment, when the electric locomotive passes the phase split zone, the driver must operate according to the disconnection sign set on the line. The main problem of manual operation through the phase separation zone is: on the one hand, it affects the driving speed, on the other hand, it increases the labor intensity of the driver, and if the operation is negligent, it will pull the arc to burn the phase separation insulator. On quasi-high-speed and high-speed lines, locomotives have to pass dozens of phase-splitting points per hour. When frequently passing through the phase-splitting area, manual operation not only consumes the driver's energy and increases labor intensity, but also distracts the driver's attention too much. Driving safety is completely dependent on the attention and technical level of the locomotive driver. Without technical equipment protection, it is extremely unfavorable to driving safety. If the negligence is improperly operated or the lookout is not timely, it will pull the arc to split the phase insulator and even cause disconnection. Direct Endanger equipment and driving safety. For the high-slope heavy-load section, manual over-phase will cause the train to drastically slow down, extend the running time of the throat section, and reduce the line capacity. Therefore, the traditional manual switching method has been unable to adapt to the development of my country's electrified railways, in particular, it cannot meet the needs of speed-up and high-speed electrified railways[1].

At present, only a few countries in the world have researched and adopted automatic phase separation devices. There are basically three types of technical solutions: "automatic switching on the car", "automatic switching on the pole switch", and "automatic switching on the ground switch" [2]. my country has been studying phase-segment automatic switching devices since the 1980s. At present, only the Guangzhou-Shenzhen line adopts locomotive automatic phase-separation for the entire section. However, this system is not very satisfactory, and has many disadvantages, such as: locomotive positioning uses magnet induction positioning, if the magnet is lost, failure and other phenomena will directly affect the normal operation of the system, the reliability of the system is not high, so China's electric locomotive automatic over-phase technology still needs further research [3]. SS8 electric locomotive, as the main locomotive for passenger electric locomotives with further

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speed-up in my country's railways, has great prospects for promotion [4]. Aiming at SS8 electric locomotives, this paper designs this locomotive automatic phase separation system based on GPS (Global Satellite Positioning System) and CONFIDENT (Wireless Identification System) combined positioning.

2. Overall design of locomotive automatic over-phase system

The locomotive automatic phase separation system based on GPS (Global Satellite Positioning System) and RFID (Wireless Identifier) combined positioning consists of a locomotive positioning system and a main control system. The locomotive positioning system consists of a GPS navigation system and an automatic identification system.

3. Design of locomotive positioning system

3.1 GPS global satellite positioning system

In the 1980s, the advent of GPS satellite navigation systems made vehicle positioning technology unprecedented development. Since it was put into use, GPS has shown strong vitality in the field of navigation and positioning with its global, all-weather, low-cost and other advantages, and has been widely used in various fields. Since at any moment, any target on the earth can know its three-dimensional coordinates, three-dimensional speed and accurate time through the GPS system, a GPS receiver is installed on the vehicle, and the vehicle position, running speed and running direction can be learned in real time. Therefore, GPS should be one of the equipment selections to solve the positioning problem of electric locomotives.

The GPS locomotive positioning system of this system consists of a receiver and P87LPC764, and has the following functions:

(1) Receive GPS positioning information in real time (1 time/sec); search for line information in real time, and detect the boot speed.

(2) Automatically confirm the locomotive travel route.

(3) Automatically send card position information.

(4) Communicate with the main controller once every second, send locomotive running information and driving speed to it, and store the fault information sent by the main controller into the flash memory.

(5) Correct the diameter of the wheel according to the speed adjustment information.

(6) Detect speed pulses in real time.

(7) Power-down detection of input power.

(8) Automatically save line data and speed data after power off.

(9) Identification of locomotive up and down.

(10) Fault alarm.

3.2 Automatic identification system

The automatic identification system of this automatic phase separation system selects the CONFIDENT automatic identification system of American TAGMASTER company. The CONFIDENT automatic identification system based on microwave technology has a ring-shaped polar microwave field. Since microwaves can penetrate wood, paint, dust, and most non-ferromagnetic materials, even if there is a metal body near the communicator antenna or card, the card can still be reliably identified when it is moving at high speed. Tested by authoritative organizations, it is proved that the product complies with IEC standards. Ensure that the system can work normally under harsh electromagnetic interference. It is mainly composed of communicator S1500 and radio frequency identification card [5].

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Communicator S1500 is a reading and writing workstation that operates at 2.45 GHz and has a ring-shaped polar information field. Specially used to read and write radio frequency identification cards, and communicate with tags through built-in antennas. The reading distance of the communicator is related to the type of card, the transmitting power of the communicator and the setting value of sensitivity. Generally speaking, the communicator S1500 can read the CONFIDENT RFID card within 4 meters, and the recognition accuracy rate is up to 100%. The transmitting power and receiving sensitivity of the communicator can be adjusted by software instructions. The S1500 communicator has a motion detection function that can detect vehicles, people, and even smaller moving objects.

The model of the RFID card is MarkTag S1455. It is an industrial-grade high-speed RFID tag that works at 2.45GHz frequency. It can be read from a distance, and when multiple tags are in the information field, it can also be read smoothly. S1455 is specially designed for harsh environment and high temperature environment, adaptable temperature is -40℃-100℃, and the reliability is very high. It is suitable for the tracking and identification of heavy industry production lines, outdoor containers, trains, trucks, and other freight vehicles. The adaptation temperature is -40℃-200℃. Each label is permanently programmed with an 8-digit decimal identification number at the factory. The identification number is unique. The identification number has a 32-bit checksum, which is used to check the identification number to exclude the possibility of substitution due to reading errors when the tag is too far away from the communicator or multiple tags are located in the communicator's information field at the same time. The label has a built-in environmentally friendly lithium battery. The lithium battery is specially designed with long life and high temperature resistance. To ensure a long reading distance and a high reading speed. The life of the lithium battery is 6 years.

4. Main control system design

The main controller selects the M series programmable controller (PLC) of Singapore Electric Research International Pte Ltd (TRI) as the core, namely T100MD-1616+. This is a very powerful programmable controller (PLC) with built-in firmware. This programmable controller (PLC) is a new generation of mechatronics automatic control device with a microprocessor as the core. It is a computer technology. , Control technology, and communication technology [6]. It adds a complete set of Tbasic commands to deal with important and complex calculation tasks that are difficult to complete with traditional ladder diagram language, and it has strong flexibility. Combined with the designed peripheral circuits: power supply part, signal processing circuit, opening control circuit, closing control circuit, handwheel control circuit, this controller mainly has the following functions: The controller mainly has the following functions:

(1) Receive and process the information sent by the GPS positioning system from the serial port.

(2) Determine whether the speed signal is too large or too small and send it to the GPS positioning system for wheel diameter adjustment.

(3) Monitor the OK signal from GPS positioning system and CONFIDENT automatic identification system.

(4) Real-time detection of various analog signals

(5) Real-time processing of card number signal sent by CONFIDENT automatic identification system.

(6) Upflow and downflow control.

(7) Opening and closing control.

(8) Fault alarm.

5. Conclusion

The automatic over-phase system of locomotive designed in this paper has the advantages of high control precision and good efficiency of locomotive power, and has good application prospects.

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