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Research on automatic cooling device of communication base station

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Abstract: *This paper improves a communication base station automatic cooling device, including a mobile device body driven by a peripheral mobile wheel. The device body includes a communication module responsible for data transmission and reception with other devices or networks, an intelligent module responsible for processing and analyzing data, providing intelligent services and functions, and an interactive module responsible for input and output with users. The power module responsible for providing electrical energy for the device is provided with a first through hole on the device body, the inner wall of the device body is fixed and connected with a first rectangular shell at the corresponding position of the first through hole, the inner wall of the first through hole is fixed and connected with a supporting rod at both ends of the symmetrical position, and the supporting rod is provided with a cooling mechanism for cooling inside the device body.*

Keywords: *Communication base station, Heat dissipation, Information transmission*

1. Project research background

The device body includes a communication module responsible for data transmission and reception with other devices or networks, an intelligent module responsible for processing and analyzing data, providing intelligent services and functions, an interaction module responsible for input and output with users, and a power module responsible for providing electrical energy to the device. The device body is provided with a first through hole, the inner wall of the device body and the first through hole corresponding position is fixed connected with a first rectangular shell, the first through hole inner wall at both ends of the symmetrical position is fixed connected with a support rod, the support rod is provided with a cooling mechanism for the internal cooling of the device body.

2. Research status at home and abroad

The automatic cooling device of the communication base station is an important component designed to ensure that the communication equipment can maintain an appropriate temperature during operation to prevent overheating from negatively affecting the performance and life of the equipment. The design and performance of these devices are directly related to the stability and reliability of the communication network.

At present, domestic and foreign scholars have carried out a lot of research on energy-saving technologies of base stations, mainly focusing on three aspects: hardware, software and network energy-saving [1]. Hardware energy saving is mainly to improve the hardware facilities of the base station, optimize the hardware network architecture design, and improve the energy conversion efficiency. Combining power modulation with high-efficiency amplifier can improve the conversion efficiency of power amplifier [2]. In order to improve the energy efficiency of the base station, energy is collected from renewable resources (wind and solar energy), and traditional energy consumption is reduced without sacrificing service quality, so as to provide solutions for the green development of the base station and minimize the cost of power consumption [3,4,5].

1) Thermal management technology research: Domestic communication equipment manufacturers and research institutions are committed to developing new thermal management technology to improve the automatic heat dissipation performance of communication base stations. This includes the use of more efficient cooling materials and designs to improve heat transfer and heat dissipation efficiency.

2) Air-cooled cooling system: In China, air-cooled cooling system is a common cooling method for

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communication base stations. Researchers are constantly improving the design of air-cooling systems to increase their efficiency and reduce energy consumption.

3) Intelligent control system: Some domestic research teams have carried out research on intelligent control systems to monitor and adjust the heat dissipation of communication base stations through sensors and automation technology. This helps to dynamically adjust the operation of the cooling equipment according to the actual situation.

Foreign research status:

1) Liquid cooling technology: Foreign research institutions and companies actively study and adopt liquid cooling technology, which uses liquid cooling media to dissipate heat, which is more efficient than traditional air-cooling systems.

2) Thermal simulation and modeling: Foreign researchers use thermal simulation and modeling tools to study the thermal performance of communication base stations. This helps to better understand the distribution of heat within the device, thereby optimizing the design of the cooling system.

3) Solar and wind heat dissipation: In some foreign regions, researchers have explored the use of renewable energy sources such as solar and wind power to provide power for communication base stations while achieving automatic heat dissipation. This helps reduce dependence on traditional energy sources and lower energy costs.

4) Intelligent and remote monitoring: Foreign research also focuses on the intelligence of communication base stations, optimizing heat dissipation through remote monitoring and automatic control. This helps reduce operating and maintenance costs.

In general, the research of automatic cooling device of communication base station is getting wide attention at home and abroad. At home, the emphasis is on improving the efficiency and intelligent control of traditional air cooling system; Foreign countries have explored more new liquid cooling technology and renewable energy power supply schemes. These studies are expected to improve the reliability, efficiency and sustainability of communication base stations.

3. Integrated System Design

3.1 Design of The Hardware in The System

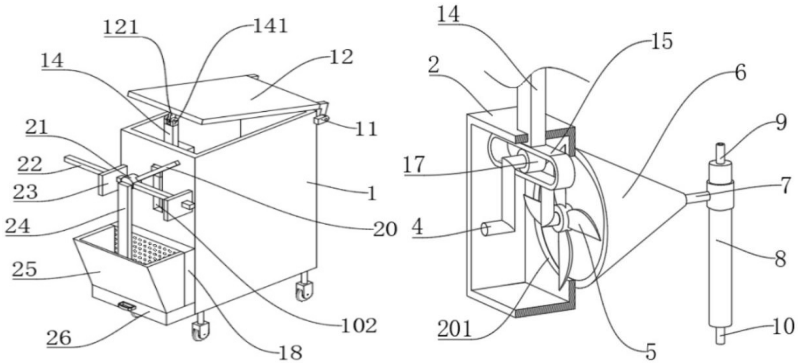

Figure 1: Overall design of the system

As shown in Figure 1, the device body comprises a communication module responsible for data transmission and reception with other devices or networks, an intelligent module responsible for processing and analyzing data, providing intelligent services and functions, an interactive module responsible for input and output with users, a power module responsible for providing electrical energy to the device, and a first pass hole is provided on the device body. The inner wall of the device body is fixed and connected with a first rectangular shell at the corresponding position of the first through hole, and the inner wall of the first through hole is fixed and connected with a supporting rod at a symmetrical position, and the supporting rod is provided with a cooling mechanism for cooling the inside of the device body;

The cooling mechanism comprises a N-shaped rod that runs through and rotates on the support rod and is driven by a power mechanism to rotate. The N-shaped rod is fixed on the outer profile of one end of the support rod and is connected with a fan blade that pumps external air. The first rectangular shell is

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provided with a second through hole on one side that is far from the equipment body. The first rectangular shell and the second through hole corresponding position is fixed connected with a conical shell for centralized air discharge, the power mechanism is energized motor.

3.2 Specific Design Scheme

The device body includes a communication module responsible for data transmission and reception with other devices or networks, an intelligent module responsible for processing and analyzing data, providing intelligent services and functions, an interaction module responsible for input and output with users, and a power module responsible for providing electrical energy to the device. The device body is provided with a first through hole, the inner wall of the device body and the corresponding position of the first through hole is fixed connected with a first rectangular shell, the inner wall of the first through hole at both ends of the symmetrical position is fixed connected with a support rod, the support rod is provided with a cooling mechanism for the internal cooling of the device body;

The cooling mechanism also comprises a conical shell running through one end of the first rectangular shell to the inner wall and is fixed connected with an intake pipe, the intake pipe running through one end of the conical shell and is fixed connected with a vortex tube to cool the air, the top of the vortex tube is fixed connected with a cold air tube, and the bottom of the vortex tube runs through the equipment body and is fixed connected with a hot gas tube.

Wherein, the device body near the top of the two sides of the symmetric position are fixed connected with a first connecting seat, two of the first connecting seat of the opposite surface through and rotation connected with a cover plate, the device body is also provided with a reciprocating swing of the cover plate heat dissipation mechanism.

The heat dissipation mechanism also comprises a cylindrical block rotating on the outer profile of the N-shaped bar, and an oval frame sliding on the outer profile of the cylindrical block, and the bottom of the lifting rod runs through the first rectangular shell and is fixed with the oval frame.

Wherein, the outer contour of the equipment body is fixed connected with the first pass hole corresponding position to prevent external dust into the equipment body inside the filter screen, the equipment body is also provided with an auxiliary mechanism to scrape the dust on the equipment body, the auxiliary mechanism includes the equipment body is provided with a rectangular through slot on one side near the filter screen. The inner wall of the rectangular through groove is sliding connected with a first slider, and one end of the first slider is fixed connected with a lifting rod, and the first slider is fixed connected with a fixing rod away from the lifting rod.

The auxiliary mechanism also comprises a second sliding block connected on the fixed rod, a moving rod is fixed in the symmetrical position on both sides of the second sliding block, and a support plate that enables the second sliding block and the moving rod to move horizontally and reciprocally is fixed in the symmetrical position on both sides of the device body near the first pass hole. One end of the two moving rods away from the second slider passes through the support plate and is sliding connected, and the other end of the second slider away from the fixed rod is fixed connected with a scraping plate for scraping the dust on the surface of the filter screen.

One end of the filter screen away from the body of the device is fixed connected with a conical frame, the bottom of the conical frame is fixed connected with a storage box for centralized storage of dust, and the storage box and the conical frame can be detachable connected, the bottom of the scraper is fixed connected with a triangular rod that evenly stores dust inside the storage box.

Compared with the prior art, the invention has the following beneficial effects:

Through setting the cooling mechanism, the N-shaped rod is driven by the motor to rotate in a fixed axis on the support rod, and the fan blade set on the N-shaped rod draws the external air from the fan blade into the interior of the equipment body through the intake pipe set on the conical shell, and the vortex tube set on the intake pipe centrally disintegrates the external air into the interior of the vortex tube along with the conical shell. It can make the vortex tube cool the air through the cold air tube arranged on the vortex tube, so that the cold air tube will be discharged to the inside of the equipment body, which can cool the internal communication module of the equipment body, avoid the damage of the internal communication module of the equipment body under long-term work, and thus improve the safety.

When the heat dissipation mechanism is set, when the oval frame pushes the lifting rod to move near

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the cover plate, the lifting rod pushes the cover plate to swing away from the device body. In this way, the cover plate releases the seal on the device body, and the hot air near the top of the device body is discharged to the outside of the device body, and the heat dissipation is carried out inside the device body.

By setting the auxiliary mechanism, through the second slider set on the fixed rod, the moving rod set on the second slider supports the moving rod through the support plate, and the second slider is tilted on the fixed rod, and the fixed rod moves up and down, so that the second slider and the moving rod move horizontally and reciprocally. With the horizontal reciprocating movement of the second slider, the scraper can move reciprocating on the surface of the filter screen, so that the scraper can scrape the dust on the surface of the filter screen, so as to avoid the dust clogging the filter screen, and further improve the cooling of the device.

When in use, the communication module: connects to the headset through Bluetooth, connects to the Internet through Wi-Fi, and makes close payment through NFC;

Intelligent module: Control the device through voice recognition, unlock the device through face recognition, and provide personalized recommendations through machine learning;

Interactive module: operate the device through the touch screen, speak instructions through the microphone, play music through the speaker;

Power module: provides power to the device through the battery;

Cooling module: Cools the communication module.

4. Conclusion

This paper designs an automatic cooling device for communication base station. The existing cooling equipment and technology have many shortcomings and deficiencies, which are solved through the cooperation of the above institutions. The existing technology is difficult to cool down the communication module, which is easy to cause damage to the communication module under the action of high temperature, and then lead to safety accidents. To sum up, the automatic cooling device of the communication base station designed in this paper has certain practical significance and certain promotion value.

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