Research on Design of Orbital Suspension Chain Transportation System

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Abstract

The paper aims at the current situation that the transportation of steel components in different workshops can only be carried out manually. Two rail-type suspension chain transportation lines are used between the welding workshop, the spray-molding workshop, the spray-molding workshop and the finished workshop to fully automate the transportation. And process, reducing the labor intensity of transport personnel and improving construction efficiency. The research results of the thesis improve the space utilization rate, make the whole pipeline more complete, effectively improve the productivity and market competitiveness, and have broad application prospects and popularization and application value.

Keywords

Rail type, suspension chain, suspension carriage, transportation system.

1. Introduction

The orbital suspension chain transportation system is a three-dimensional space continuous operation conveying equipment with closed-loop characteristics. It highly reflects the mechatronics technology of the logistics transportation system, and is a flexible production integrating transportation, loading and unloading, process operation and other logistics links. The transportation system of the processing operation is mainly used for the continuous flow of the workpieces in the workshop or between the workshops. In the continuous flow of flowing water, various work operations can be performed on the workpiece, such as surface treatment of the workpiece, painting, drying, cooling, off-line of the finished product, etc., and can work under harsh environments (such as high temperature, harmful medium, etc.) 1]. This transportation system can make full use of the workshop space, and can cooperate with the ground operation to carry out three-dimensional reorganization of the production line according to a certain production cycle; it can effectively shorten the production cycle while improving product quality and production efficiency, and has a production level for the enterprise. Positive reinforcement effect. Therefore, the transportation system has been adopted by modern factories that are mass-produced, and is especially suitable for machining mechanical parts (most commonly used in casting, painting, final assembly, etc.), automobile manufacturing, food processing, home appliances, textiles, and chemicals. , rubber and building materials and other industries [2].

At present, the suspension chain transportation system is mainly composed of traction drive device, roller, transportation chain and its accessories (carriage, spreader, etc.), track, tensioning device and lubrication device [3]. The popular suspension chain transport equipment on the market has various types and structural forms; according to the type of steel components to be transported and the transportation method, it can be divided into general-purpose and light-type traction suspension chain transport systems, general-purpose and light-weight accumulation suspension. Chain transportation system [4]. The universal type can realize the movement of the workpiece, and can realize the turning,

lifting and process speed according to the process requirements; the accumulation type hanging conveyor can realize the complicated process of automatic stacking, unloading and resetting of the workpiece according to different needs [5].

2. Overall Design of Rail Suspension Chain Transportation System

2.1 Transportation System Research Analysis

For the production conditions and transportation status of steel components such as railings on the site, the rail-type suspension chain transportation system is used to continuously transport the workpieces in the workshop or between the workshops. In the continuous conveying process of the pipeline, the workpiece can be surface-treated, painted, dried, cooled, finished off-line and other processes, and can work in harsh environments (such as high temperature, harmful media, etc.). In addition, the transportation system also has the advantages of less power consumption, low noise, stable operation, easy operation, safe use, etc., which reduces the harm of various pollutions during the construction process to the human body, and allows the railing to continuously pass through the spray booth and High-temperature drying room, instead of manually completing various production processes, thereby improving workers' working conditions, continuous transportation equipment with space-closed lines, because it can fully utilize space and cooperate with ground operations, so in the furniture factory, It can be widely used in mass production and modern factories such as bicycle factories, hardware factories and automobile factories.

2.2 Overview of Field Conditions

The system is researched according to the following routes: researching the research status and development trend of the domestic and international rail suspension chain transportation system → analyzing and summarizing the actual situation of the construction unit and the space structure of the workshop and factory building, as well as the existing construction technology and personnel configuration. Design scheme→Research existing welding technology and coating technology and propose improvement schemes and measures→Research and design of rail suspension chain transportation system structure design and suspension slider parameterization analysis→Oriental workshop-to-transport system for enterprise units Carry out reasonable process layout setting → installation, commissioning and operation of the rail suspension chain transportation system and propose improvement and optimization measures → summarize and promote the application.

3. Transportation System Specific Design

3.1 Suspended Track Chain Conveyor

The rail suspension chain conveyor (shown in Figure 1) is operated on the overhead rail by a carriage coupled to the traction chain to drive the carrier to transport the articles. Overhead tracks can be flexibly arranged in the workshop according to production needs, forming a complex transmission line [20]. The suspension chain transportation system currently used can be divided into three types: lifting suspension chain transportation device, push suspension chain transportation device and towed suspension chain transportation device according to different types of functions.

3.2 Transportation System Device Structure Design

The rail suspension chain transportation system is composed of overhead rails, rollers, suspended conveyor chains, spreaders and traction power units as shown in Figure 2. The overhead track is intended to adopt a closed track section, and the roller is intended to be a bearing type composite roller; the traction member is a double hinge chain with rollers in both directions, and the traction chain forms a closed loop with the same horizontal track line through the horizontal redirecting device; The various types of booms are connected to the multi-hinged chain; the traction power unit is composed of a motor, a speed reducer and a chain drive.

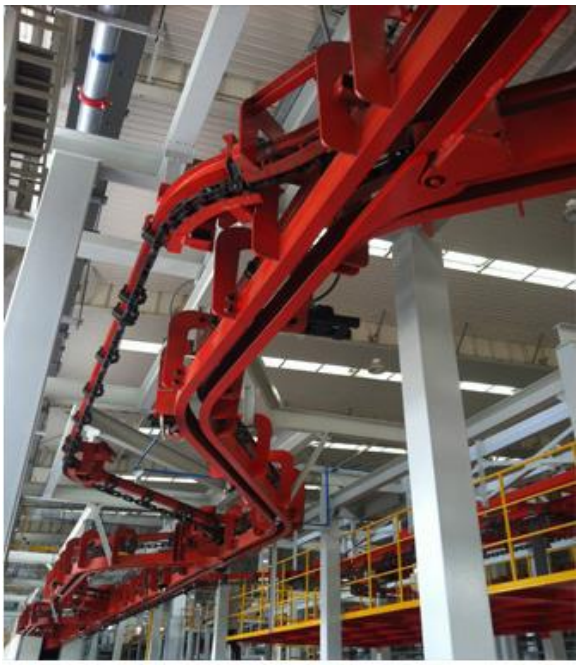

Fig. 1 Schematic diagram of site layout

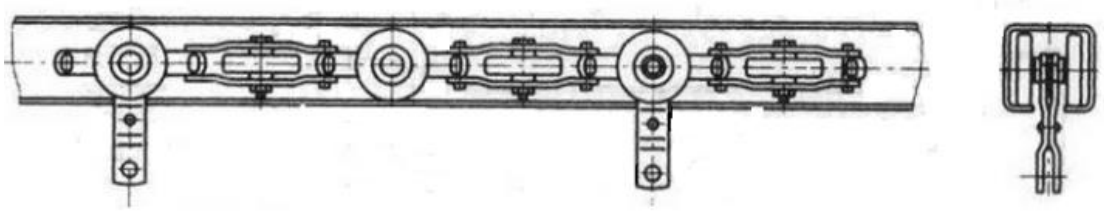

Fig. 2 Schematic diagram of rail-type suspension chain transport system

3.3 Principle Analysis

The traction power unit is disposed on one side of the load rail and is the power source of the entire suspension chain transportation system; the overhead rail constitutes a closed loop, which can be directly fixed on the roof, the wall and the pillar or other special components; The suspension rods of the form are connected with the multi-hinged chain, and the suspension members and the rollers, the hooks and the like together form a carriage; the carriages are equally connected on the traction chain and run on the overhead rail under the traction; the reverse chain is directly installed on the On the spreader, the traction force is provided by the traction power unit, and the traction carriage rolls on the overhead track to transport the components. The entire structural design greatly simplifies the construction of the rail suspension chain transport system and reduces the height of the transport track. Not only is the transport system itself easy to manufacture, the cost is low, and the height of the entire transport equipment is greatly reduced, thereby reducing the entire suspension chain transport system. Manufacturing costs. The rail-type suspension chain transportation system adopted by the system has a simple and solid structure, and has the characteristics of closed transportation, space bending arrangement, and stable transportation.

4. Simulation Analysis of Transportation System

4.1 Simulation Analysis of Reset Acceleration

The orbital suspension chain transportation system is modeled as a research whole, and the stress intensity and strain of the suspension chain system are analyzed. Based on the overall analysis of the suspension chain, the stress and strain of the roller and the spreader under hoisting conditions are analyzed. The three-dimensional analysis model established in this paper is close to the actual situation,

and fully considers the properties of the hanging chain material. The analysis results have certain authenticity, and the result can show the hanging chain in actual work. The distribution of force has certain reference value in actual engineering construction, and the model is imported into ANSYS, as shown in Figure 3.

The suspension chain connection structure is a bilaterally symmetrical structure, and the suspension chain can be regarded as constant under the condition of slow running. Considering the constancy of the expected force of the suspension chain structure, we only need to stress at a certain moment when analyzing the model. The analysis of the force at one moment satisfies the purpose of the analysis, which not only satisfies the purpose of the research but also reduces the time spent on model analysis.

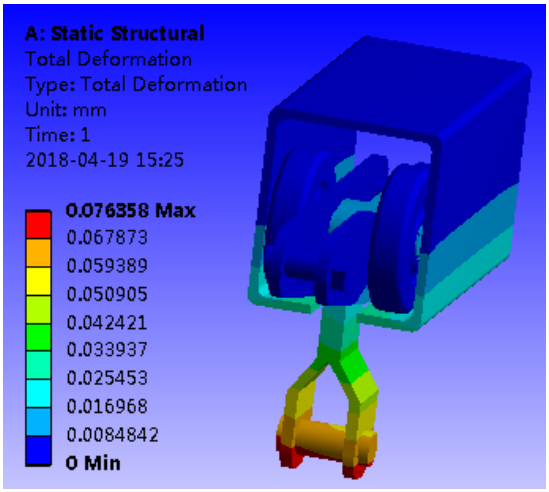

Fig. 3 Total deformation cloud

It can be seen from the analysis chart that the stress on the suspension chain as a whole is small, the maximum stress is 11.069 MPa, and the maximum contact area is caused by the minimum contact area between the spreader and the roller shaft and the roller and the track due to the hoisting. The position is the inner position of the contact between the spreader and the roller shaft and the position of the roller in contact with the track; the shape variable of the system is also small, the maximum value is 0.076358, indicating that the system hardly deforms during the working process, completely meeting the structural requirements, due to Under the action of the bolt pre-tightening force, the axial displacement of the baffle can be known. When the suspension system is hoisted, the maximum position of the strain occurs at the position where the spreader and the roller shaft are in contact. In summary, when the suspension chain system is in operation, the contact structures do not undergo deformation and stress interference to meet the design requirements.

5. Conclusion

Based on the research status and development trend of the track-type suspension chain conveyor equipment at home and abroad, this transportation system starts from the practical problems of solving the engineering, and deeply studies the relevant construction technology of the analysis of the rail suspension chain transportation system, and proposes corresponding Improvement measures; in-depth study of the structural composition and design of the device of the orbital suspension chain transportation system, parametric analysis of the suspension carriage and the passage analysis of the transmission line; through the analysis of the construction scheme, the designed orbital suspension chain transportation system The process layout is set up, and finally the rail suspension chain transportation system is installed and debugged, and the actual application effect on the site is analyzed.

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