Research on the Development of Machine Intelligent Manufacturing of Ceramic Products in the Era of Industry 4.0

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Abstract

Objective: To analyze the relationship between machine and ceramic products in the process of industrial revolution, and explore the development direction of ceramic products manufacturing in the era of industry 4.0. Methods: Ceramic product manufacturing was divided into design, production and logistics by case analysis and literature research, and the specific forms of ceramic product manufacturing in industry 4.0 era were discussed. Conclusion: The coming of the era of industry 4.0 is bound to have a profound impact on ceramic products manufacturing, and has an important guiding significance for the strategic transformation of ceramic products intelligent manufacturing.

Keywords

Industry 4.0; Ceramics; Machine intelligent manufacturing.

1. INTRODUCTION

"Industry 4.0" is the fourth industrial revolution led by machine intelligent manufacturing. The advent of the era of industry 4.0 has also brought about a huge change, machine automation gradually developed into intelligent, digital and network, this change makes the development of ceramic products facing great challenges but also to meet new opportunities. How to create a 4.0 mode of ceramic design while keeping up with The Times with industrial upgrading and scientific and technological progress is a problem worth pondering. With the passage of time and the development process of society, from the mechanization era of Industry 1.0 to the automation era of industry 3.0, the development of industrial revolution changes the mode of production, lifestyle, behavior and thinking mode, while the ceramic industry is also seeking new development direction. Nowadays, China's ceramic manufacturing is facing a severe test, no matter the inheritance, development and innovation of machine manufacturing mode or handicraft production are imminent.

2. THE RELATIONSHIP BETWEEN THE DEVELOPMENT PROCESS OF INDUSTRIAL REVOLUTION AND THE MANUFACTURE OF CERAMIC PRODUCTS

In the industrial 1.0 era and industrial 2.0 era, machines driven by steam engine and electric power replaced manpower to a certain extent, digested part of the labor force, and ceramic products initially entered large-scale standardized and mechanized production. The production of ceramic products from clay to porcelain clay, and then from porcelain clay to fired porcelain has realized division of labor and cooperation. In contrast, the traditional form obviously can not meet the requirements of the times. In addition, there are still some problems: less ceramic product styles and low quality of design talents; Ceramic enterprises lack the consciousness of

logistics management and regard the management and operation of ceramic logistics as only an auxiliary activity; The logistics informatization construction is backward, the communication channel is not smooth, the level of information collection and processing is low, the damage rate is high, and the safety factor is low. These problems will affect the development of ceramics to a certain extent. In the industrial 3.0 era, with the emergence of electronic technology and it technology, the scale, standardization and automation of ceramic manufacturing have been greatly improved. Although the ceramic industry is still based on the production end and large-scale ceramic product manufacturing system, it pays more attention to concise, unified and standardized modeling in design methods, and puts forward higher requirements for the modeling and practical functions of ceramic products. Introduce advanced logistics technology (GPS, GIS) to realize the visualization of logistics process, save logistics time and cost, and track and supervise ceramic goods in the whole process. Radio frequency technology helps to identify goods and improve the speed. For example, the speed and quantity of storage, processing, transportation and packaging of ceramic raw materials have been significantly improved, the

damage rate of ceramic goods has been reduced and the safety factor has been enhanced.

In general, machine manufacturing tends to be optimized and standardized with the changes of the times. Ceramic production and machine automation are on the rise with the promotion of digital technology, and labor force is getting less and less involved. Logistics speed, transportation volume and automation show an increasing trend with the process of the industrial era, among which the growth trend of logistics speed is obvious.

3. THE CERAMIC PRODUCTS MANUFACTURING IN INDUSTRY 4.0 ERA

Industry 4.0 era has changed the cooperation structure among ceramic manufacturers, suppliers and developers, and the three have entered a more networked and intelligent situation. This paper analyzes ceramic product design, production and logistics from three aspects:

3.1. The Design of Ceramic Products

On the one hand: pay attention to cultivate the sensitivity of product research and development personnel to digitalization. Enterprises to ceramic product research and development personnel on the machine intelligence awareness and technology training, improve the necessary digital experiments, so that they have a certain understanding and application of high-end scientific and technological equipment. In the era of industry 4.0, the digitalization of information and the interactive characteristics of users are used to develop new marketing methods, such as live broadcast sales, microblog marketing and search engine marketing. In the era of industry 4.0, the degree of machine intelligence is becoming more and more perfect. Machines, algorithms and intelligence can solve many technical problems of ceramics. On the other hand, the intervention of system architecture, network access technology, optimized software assets and generic support technology forms the intelligent machine logic with quantifiable data. Designers can represent the harmonizing and computing power control equipment, the design of virtual space, simulate the way consumers use behavior and, finally, a real role in consumer groups, such as 3 d printing ceramic, is a good way to help the design of the preliminary demonstration, the cost savings as well as the product of the net effect of a certain measure.

3.2. The Production of Ceramic Products

On the one hand, technical personnel should not only have the knowledge of ceramic technology and mechanical application, but also be familiar with the function of machine production equipment. They should also have the ability to deal with the data of ceramic products on the spot, the problems in information transformation, and good interpersonal

management ability and information management ability. On the other hand: to achieve collaborative cooperation between ceramic market, ceramic research and development, ceramic production, ceramic management and ceramic communication. Ceramic production 4.0, focusing on ceramic machine intelligent production system and process. The controllability of the production process is improved through information physics system (cps), Internet of Things technology, VR technology and software technology, and various information is comprehensively controlled to ensure that all production processes of ceramic products are in the optimal state, so as to guide the transformation of the ceramic industry from manufacturing to intelligence. Such as Germany LAEIS company shuttle kiln automatic control system, full alarm device and automatic cutting system. Through computer remote control, automatic adjustment is carried out according to the preset sintering temperature curve and computer feedback detection data, and the whole sintering process is finally completed.

3.3. The Logistics of Ceramic Products

On the one hand, the digital and intelligent development of ceramic logistics information has become more and more strict for ceramic logistics talents. Ceramic logistics technicians not only need to be familiar with logistics equipment Internet platform and application system, but also need to understand, analyze and manage the Internet system data. Ceramic logistics 4.0 is bigger storage equipment and faster mobile equipment. Logistics equipment Internet platform and application system established after intellectualization and mechanization of logistics equipment. Containers use a variety of sensors to collect comprehensive data of transportation environment and specific locations. Such as ceramic logistics optimization model: ceramic raw materials two-level distribution network structure is to solve the ceramic raw materials distribution of high efficiency and cost saving method. According to the specific needs of users, ceramic machine logistics 4.0 can send real-time images, status, location to customers, and find out the cause of damage in time. Ceramic logistics 4.0 is different from the idea that enterprises attach importance to product production and despise logistics transportation management in the past, so that the ceramic logistics industry closely follows the development of ceramic production, ceramic marketing, such as ceramic e-commerce, and the whole process is more perfect.

4. DEVELOPMENT PATH OF CERAMIC PRODUCTS UNDER THE BACKGROUND OF INDUSTRY 4.0 ERA

4.1. The Combination of Virtual and Reality

When the machine intelligent manufacturing and intelligent mode of ceramic products develop to a certain extent, the cloud design is a new ceramic business design mode. With the rapid development of machine informatization and intelligence, machine intelligence technology has gradually penetrated into the production chain and various production links of ceramic handicrafts. Robot designers assist designers to analyze data and make basic design drawings. Ceramic designers have more information data for virtual design experiments. Industry 4.0 ceramic product design presents the characteristics of continuity, high density and high dynamic. Cloud design combines virtual scenes, virtual users, and virtual ceramic product design with real data. The arrival of Industry 4.0 era makes the boundary between machinery and ceramic technology present a polarization trend.

4.2. Intelligent Customization and Personalized Production

The combination of artificial intelligence and machine intelligence has become a digital system, and personalized needs and mass customization have gradually become the dominant trend of the market. Ceramic products manufacturers increase the added value of products as much as possible in the manufacturing process. The continuous refinement of the classification

of consumer groups makes the definition orientation of products clearer and the function more prominent. Personalized production can start from many aspects, such as the combination of various materials and the modeling innovation of products. Under the intelligent machine manufacturing system, raw materials such as clay, quartz sand and production equipment such as crushing machinery, jaw crusher are connected by intelligent communication technology (RFID) to effectively allocate resources to realize the intelligent production of ceramic products. Intelligent analysis is carried out according to the needs of consumers, and then ceramic materials are prepared. Intelligent control equipment is used to produce ceramic products that meet the personalized needs of consumers. Therefore, ceramic product designers should clarify the design objectives of ceramic products and different products for the crowd, emphasize the design concept of open integration, strengthen the modular, digital and machine intelligent construction, understand the individual differences of consumers, and carry out experimental personalized design.

4.3. Intelligent Service and Humanity

Industry 4.0 era is a highly intelligent era, ceramic logistics process intelligent, ceramic logistics mode intelligent, ceramic logistics management mode intelligent, ceramic logistics manufacturing system intelligent. Build a professional intelligent network of ceramic material distribution service, improve the ceramic material distribution service. Under the construction of intelligent production and distribution services, ceramic enterprises have a faster response speed, greater flexibility for professional distribution of ceramic raw materials, and a more stable response to the changing market demand.

5. CONCLUSION

China in the 13th Five-Year Plan "to build a new industrial system" proposed to "speed up the construction of manufacturing power, the implementation of" Made in China 2025 ", promote the production mode to flexible, intelligent, fine transformation ", highlights the national new industrialization development strategy needs and revitalize the made in China 2025 to the actual needs of design. Ceramics are an important medium for exporting Chinese culture. In the face of the arrival of Made in China 2025, through the discussion of the future direction of ceramic product manufacturing, clear talent training objectives, ceramic product machine intelligent manufacturing and handicraft human production has important guiding significance.

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