

Present Situation and Development of Vibrating Screen in China

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Abstract: in today's society, many industries will be applied to the vibrating screen, most of the vibrating screen is to grade or dehydrate the articles. Such as metallurgy, machinery, water conservancy, construction and building materials, railway and other departments, often in order to improve the accuracy of the goods, often use the vibrating screen to grade their goods. In the coal industry sector, the role of vibrating screen is not only grading, many vibrating screens are also used for dewatering or demineralization of coal, and even used for mud removal.

1. Introduction

With the development of China's innovative society and the progress of manufacturing industry, more and more high requirements are put forward for the vibration screening machinery in terms of variety, specification and product quality. The vibrating screen manufacturing industry can no longer compete at a low level. Instead, it should change the concept and growth mode, and the product structure should develop to the high end. Therefore, the vibrating screen is in rapid development.

2. Introduction

Speaking of the vibrating screen, perhaps for us ordinary people may have some strange, but for the people in the coal industry, is again familiar with the necessary tools. Vibrating screen is an important equipment widely used in coal, metallurgy, port, water conservancy and electric power industry to complete various technological processes. In coal preparation plants and screening plants in the coal industry, screening operation is mainly used in raw coal preparation and product processing, and plays an important role in realizing the rational utilization of coal resources, protecting the environment and creating economic benefits for coal enterprises. The application history of vibrating screen in the coal industry can be traced back to the 1960s. On the basis of absorbing foreign experience and independent innovation, the vibrating screen has been greatly improved in design technology, manufacturing process, variety specification, technical performance and structural strength, but there are also shortcomings. The application status and development trend are analyzed below.

3. Development of Vibrating Screen in China

The Chinese people are smart and industrious. It has a long history to screen the broken materials into different particles with a sieve machine. According to the literature of British coal industry, the screening of coal was mentioned in 1589. It was not until the second half of the 19th century that coal was widely screened in order to provide commercial coal with various particles to the market.

The fixed screen is an old screening machine. At that time, some fixed screens were made up of a number of wooden bars, also known as rod screens. Later, bar screens with transmission mechanisms appeared. This is the roller screen that is still in use today. In order to meet the needs of industrial production, cylinder screen, shaking screen and vibrating screen have also come out.

The development of screening machinery in China has also experienced several stages [2]. From the early 1950s to the mid-1960s, it was mainly introduced from the former Soviet Union and Poland, and the eccentric and single inertia circular vibrating screens were partially prevented. Such as Soviet made rotary screen, universal hanging screen; wave system wk type pure vibrating screen, etc.

Since the mid-1960s, China began to develop independently. The main achievements include DD series, ZD series single shaft vibrating screen, ZS, DS series double shaft vibrating screen, and resonance moving screen. So far, China has preliminarily mastered the technology of researching, designing and manufacturing medium and large-scale vibrating screen with complex structure.

Since the early 1980s, China has embarked on the road of opening up in an all-round way [3], and has successively introduced a complete set of process equipment from Fangezhuang, Xinglongzhuang, Qianjiaying, Xiqu, Jinyang, Antaibao coal preparation plants, among which the screening machinery includes VSK and VSL vibrating screens, type screening machines, and equal thickness machines, Series of dewatering screen, DSM type arc screen, oso type cyclone screen, etc., these foreign products greatly enrich the types of screening machinery in China. It promotes the further development of screening machinery in China. New materials, new technologies and new processes, such as nonmetal screen, block eccentric vibration exciter, hook rivet connection technology, have been widely used in China.

On the basis of introducing and absorbing foreign technologies, new round vibrating screens (such as YK and yr Series) and new linear vibrating screens (zk and ZKX Series) have been produced in China. In order to solve the problem of low efficiency in dry screening of wet fine materials, many new screening machines have been developed, such as probability screen, equal thickness screen, string screen, centrifugal screen, string tension screen and strengthening screen. We have made great progress in the development of high-efficiency rotary screen and high-frequency vibrating screen.

At the same time, the manufacturing level of screening machinery in China has also been greatly improved [4]. At present, some large and medium-sized state-owned manufacturing plants have set up research institutes to conduct special research on manufacturing technology, materials and parts, and have strong ability in new product development. Advanced equipment and technology are widely used in production, such as precision boring machine, CNC lathe and CNC cutting machine; Gas shielded welding, automatic submerged arc welding and shot peening pretreatment, safety national standard and ministry standard are used to inspect and test important parts and complete machine, etc.

4. Analysis on the Present Situation of Vibrating Screen in China

The vibrating screen can be divided into resonance vibrating screen and inertia vibrating screen according to whether it is close to or far away from resonance frequency. At present, the inertia vibrating screen is widely used in the screening operation of the coal industry. According to the

characteristics of the moving track of the screen surface, the inertial vibrating screen is divided into circular vibrating screen and linear vibrating screen. The circular vibrating screen is mainly used for preparation screening and final screening, and the linear vibrating screen is mainly used for dewatering screening, desliming screening and demineralization screening. The circular vibrating screen has been used in coal production for more than 40 years, mainly eccentric type and simple inertia type in the initial stage. The eccentric vibrating screen is not a complete elastic support, so the dynamic balance of the vibration system is not good, and the dynamic load transmitted to the foundation is large. However, when the simple inertial vibrating screen works, the center of the driving belt wheel is not fixed, the running stability is poor, and the service life of the transmission belt is low. Therefore, the circular vibrating screen currently used [5] is mainly of self centering type, and the structure of its vibration exciter is mostly eccentric type of belt wheel, mainly because of its simple spindle structure and easy processing and manufacturing.

Linear vibrating screen is developed on the basis of circular vibrating screen, also known as double axis inertial vibrating screen. In the initial stage, it is driven by a single motor and driven by gears, which makes the two shafts rotate relatively and synchronously to produce directional exciting force. In this working environment, the lubrication and sealing of gears are prone to problems, which affect the service life. Therefore, the linear vibrating screen driven by two motors and without forced transmission is mostly used at present. At present, the deficiencies of vibrating screen are mainly shown in the following aspects:

(1) The poor reliability is mainly manifested in the early failure of key components such as screen frame and vibration exciter, and the failure rate is high. As the vibrating screen works in several links of the washing process system, its failure will inevitably cause the whole process system to stop running. According to statistics, at present, the normal operation time of foreign famous brand vibrating screen is more than 3000h, and the overhaul period is more than 20000h. However, the reliability of domestic vibrating screen is mostly unsatisfactory. Compared with foreign products, the working process of original products is better, but the reliability of domestic products is poor. The manufacturing process control has an important influence on the reliability of the vibrating screen. According to statistics, among the main causes of failure, problems in product manufacturing account for about 60% - 64%. Other items causing failure rate are close.

(2) The bearing is easy to heat. In the working process of the bearing, the inner ring bears constant centrifugal force, while the outer ring load changes in a pulsating cycle. Therefore, the load is large and easy to generate heat, so the service life is low. This has become a common headache for domestic shaker manufacturers and users for many years, and it is also a constraint factor for strengthening the vibrating screen parameters. According to statistics, most of the vibration screen bearing life is less than 4000H. The main reason is that the material and structure of domestic bearing are deeply influenced by the former Soviet Union, the bearing capacity is low, and the vibration resistance is poor, so the application effect of domestic bearing on vibrating screen is not ideal. Most foreign products use special anti vibration bearing, and the working life can reach 20000 H. At present, there is no vibration resistant bearing in China. It is feasible for vibration screen manufacturers to select foreign bearing products to improve their product reputation. In addition, in order to facilitate loading and unloading, the manufacturer changed the matching grade of bearing and mounting hole, resulting in loose fit, which is also one of the reasons for short bearing life.

(3) The noise is high. At present, the noise of domestic vibrating screen is generally large, which is above 96dB, which makes the working environment of workers poor and can not hear the abnormal sound of equipment. The main source of noise is the vibration of screen frame side plate and bearing. In addition, the transmission gear, sieve plate, exciter box, friction between damping spring and support, transmission belt, etc. will produce large noise. Therefore, comprehensive noise

reduction is needed to achieve good results. After testing, if rubber plates are pasted on the side plate, feeding port and discharge port of the screen box, the vibration of the side plate can be effectively suppressed and the radiation noise can be reduced; the vibration and noise of the bearing can be reduced by damping treatment between the inner and outer sleeves of the bearing; the steel sieve plate can be replaced with polyurethane screen plate with small elastic modulus and low impact noise.

(4) Manufacturing with poor precision plays an important role in the formation of products. Usually, the success of a product is 70% in design and 30% in manufacture. But for the vibrating screen, the past experience has proved that the role of manufacturing is at least 50%. Among them, manufacturing materials, manufacturing technology, production equipment and other problems are the main reason for the gap between China's vibrating screen and international well-known products. The concrete performance is that the overall geometry of screen frame is irregular, there are many defects, rough processing and large welding deformation. This phenomenon is also related to the lack of enterprise management.

(5) With the construction of large-scale coal preparation plant and the reconstruction and expansion of old coal preparation plant, the requirement of large-scale vibrating screen becomes more and more urgent, but this demand is in contradiction with the manufacturing capacity of vibrating screen manufacturers. At present, most of the large-scale linear screen with the area of more than 27m² still need to be imported from abroad. Domestic manufacturers have introduced the manufacturing technology of large-scale screen from abroad, but the effect is not ideal. The problems mainly focus on the lack of key equipment and development capacity for manufacturing large-scale screen machine, which makes it difficult to guarantee the structural strength of the screen machine, low manufacturing accuracy and low service life.

(6) Due to the working characteristics of the vibrating screen, such as screen, bearing and other parts, it is necessary to replace them regularly. The replacement of domestic screen parts is time-consuming and laborious, which affects the production. Foreign brands of screen machines do better, such as the screen is compressed with hydraulic system, replacement is only required to lift the hydraulic system can be completed, convenient use and maintenance of the equipment.

5. Prospect of Machine Tools in China

At present, the development direction of vibration screening machinery [8]: to large-scale development; to heavy-duty, super heavy-duty development; to the new-type screening machine based on the development of a new direction of screening equipment; to the development of standardization, serialization, generalization; to space; to the development of screening machine for difficult to screen materials. The development strategies of vibration screening machinery in China are as follows: To study advanced screening theory and develop new screening machinery; to develop large, heavy and super heavy screening equipment; to study screening machinery for difficult to screen materials; to strengthen the research on Key Technologies of screening equipment, such as studying vibrator with new structure and adopting new vibration form, so as to fundamentally solve some key problems which are difficult to solve at present Question.

Specifically, the development status of comprehensive screening machinery, coal vibration screen has the following development trend.

(1) The development to standardization, serialization and generalization mainly includes the standardization, serialization and generalization of vibrating screen varieties, vibrator, screen frame side plate, screen plate, beam, transmission shaft and other equipment. This is an effective way to design, organize specialized production, ensure quality and reduce cost.

(2) The modernization process of large-scale industrial development promotes the expansion of

enterprise scale and the improvement of production capacity. In the past, coal preparation plants with a production capacity of 2-3 million T / a were large-scale, but now the coal preparation plants with a production capacity of 12 million T / a are not rare. Therefore, a large screen machine with large capacity and high screening efficiency is needed. With the introduction of dynamic design method and modernization of manufacturing means, the structure of large screen will be more reasonable, and the period of trouble free operation will be further extended.

(3) The development of high vibration intensity is to improve the vibration parameters of the vibrating screen, which have an important impact on the processing capacity and screening efficiency of the screen machine. In addition to the high-frequency screen, the vibration frequency and vibration intensity used by foreign advanced screening machines are 980r / min and 4.5-7a²/gn.

(4) The so-called ideal motion mode means that in the vertical direction, the amplitude of the feeding end is greater than that of the discharging end, while in the length direction, the velocity of the material from the feeding end to the discharging end decreases. The advantage of this kind of ideal screen surface movement mode is that it can improve the efficiency of each section and the whole machine, and create a good screening environment.

6. Conclusion

With the development of China's innovative society and the progress of manufacturing industry, more and more high requirements are put forward for the vibration screening machinery in terms of varieties, specifications and product quality. The vibrating screen manufacturing industry can no longer compete at a low level. It should change the concept and growth mode, and develop the product structure to the high-end. Efforts should be made to improve the reliability of the vibrating screen equipment and provide good technical services. Washing enterprises provide high quality products.

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