Analysis on the Causes of Broken Rolls in Finishing Roller Rings of High-speed Wire Rod Mills

Keyword：
Rolling roll, re bar, High-speed Wire Rod Mills

Descroption：
The high-speed wire rod rolling mill ensures the cross-section accuracy of the product with its precise pass design, reasonable tension and looper control, non-twisting high-speed continuous rolling method, sufficient rolling mill rigidity and wear-resistant tungsten carbide roll ring with small roll diameter. , Because of its high rolling speed, the production efficiency has been greatly improved compared with ordinary rolling mills, and finally the production cost has been greatly reduced.
Tungsten carbide-based tungsten carbide roll rings are generally used in the finishing rolling of high-speed wire rod mills. Tungsten carbide tungsten carbide roll rings have good thermal conductivity, less hardness drop at high temperature, good thermal fatigue resistance, and wear resistance. It has the characteristics of high strength and high strength, so it is widely used in the finishing mill of high-speed wire rod mill.

Relate product: High speed steel roll

Brand: LMM Rolls

- **Brief introduction of tungsten carbide roller ring**

The tungsten carbide roll ring is produced by powder metallurgy and has nothing to do with steel or iron rolls in any way. It is a complex method of mixing refined tungsten carbide particles with a cement-like binder. The binder is usually cobalt, but in some applications, 0.5% to 1.0% of nickel and chromium are also added as binders, which will greatly improve the thermal fatigue and corrosion resistance of cemented carbide roll rings. Before being thermally sintered, it undergoes fine grinding, mixing and assembly, and is extruded when the powder is mixed and heated. The production of tungsten carbide carbide roll rings generally includes four types of hot pressing, cold pressing, hot isostatic pressing, and cold isostatic pressing. a process method. Among them, the roll ring produced by hot isostatic pressing has the best compactness, the highest strength and good wear resistance. However, because of its complicated process, the cost is higher than the other three.

With the increase of the speed of the high-speed wire rod mill and the accelerated rolling rhythm, in the actual production process, due to the lack of attention to the materials selected for the roll rings of each frame in the finishing rolling and the installation, cleaning and alignment of the inner roll rings of the finishing rolling. The use and maintenance of the ring is not enough, and the roll collapse of the inner ring of the finishing rolling often occurs, which will inevitably lead to unplanned shutdown, decrease in output, and increase in production cost, which seriously affects the benefits of the enterprise.

- **Analysis on the Causes of Broken Rolls in Finishing Roller Rings**

3.1 Improper selection of roll ring materials in finishing rolling

The current high-speed wire rod finishing mill is generally composed of 8 to 10 rolling mills. The rolling force and impact force of each rolling mill are different, and with the increase of rolling passes, the rotation speed of the roll ring will also be greatly increased, and the wear of the roll ring will also increase. Therefore, the rolling force, impact force and wear resistance of each stand should be fully considered when selecting the material of the roll ring of each stand. Otherwise, due to improper material selection, it will cause roll collapse in finishing rolling The occurrence of the phenomenon, and the cause of the roll collapse is not easy to pinpoint. As far as the rolling mills in the finishing rolling are concerned, the front stands have large rolling load and impact force due to the large section size and large deformation of the rolling stock. Therefore, the first few stands of the finishing rolling line The roll ring of the rolling mill should be considered to be made of materials with high strength index and good thermal fatigue resistance, and the wear resistance index should be placed in the second place; while the roll ring of the rear stand is subject to a small rolling load, and the impact force is small. If it is smaller, the wear resistance and thermal fatigue resistance of the roller ring should be given priority.

3.2 Shaking and stacking of rolling stock in finishing rolling

3.2.1 The roller ring is not well matched with the rollers

The Morgan high-speed wire rod rolling mill has stricter requirements on the inner roll ring and roll matching of finishing rolling, because the Morgan high-speed wire rod finishing mill is collectively rotated by a 6000 kW variable frequency AC speed regulating main motor, and the gear transmission ratio between the stands is fixed. It is unchangeable, and it is impossible to adjust the speed of a single pass. Therefore, Morgan requires that the finishing mill should not only meet the gear transmission ratio between the stands, but also the outer diameter error of the roll ring in the same pass when matching rolls. To meet the requirements of ±0.05 mm, and at the same time, the roll diameter of any round piece stand is not allowed to be smaller than the roll diameter of the previous stand. If the roll diameter of the rolled oval piece is larger than the roll diameter of the previous round hole, the rolled piece will be rolled in the two stands. There is jitter between the stands, which eventually results in the stacking of steel between the two stands. During the stacking, the heat of the rolling stock is conducted to the roll rings of the two passes, resulting in an increase in the temperature of the roll ring and thermal stress concentration. The large difference between the water temperature and the roller ring temperature will cause the roller ring to break the roller.

3.2.2 Poor setting of roll gap

Since Morgan Company has strict requirements on the matching rolls of the inner roll ring in the finishing rolling, the operator is required to set the roll gap of each frame in the finishing

rolling in strict accordance with the roll gap value specified in the process regulations. It can be set to reduce the pile of steel caused by the poor setting of the roll gap between each frame, and reduce the impact force on the roll ring caused by the pile of steel and the concentration of thermal stress caused by the increase in the probability of the roll ring being broken. Production went smoothly.

3.2.3 The size of the finished rolling stock is not good

After the rolling stock leaves the pre-finishing mill, the size of the rolling stock is not good, especially the size of the rolling stock is too large, which often causes the impact force on the roll ring of the first stand of the finishing rolling mill to increase, the deformation increases, and the rolling force increases. At the same time , it also increases the rolling force of the first few stands of the finishing mill and causes the rolling stock to jitter between the first several mills, and finally increases the chance of the roll ring breaking in the first several mills of the finishing mill. Therefore, it is necessary to strictly Control the shape and size entering the finishing mill to be as close as possible to the size required by the rolling program. The dimensions of the entry section into the no-twist finishing mill are critical and ideally they are kept within ±1% to ±1.5% of the standard value.

3.3 The roller ring is subjected to excessive impact force due to the misalignment of the guide and guard installation

The guide guards of each frame in the finishing rolling should be installed so that the rolling piece can pass through the guides smoothly without impacting the roll ring. Therefore, after each replacement of the finishing rolling guide guards, a flashlight and a small mirror should be used to inspect the finishing rolling inside. The guide guards at the entrance and exit of each frame are checked to ensure that the guide guards of each frame are properly installed. If the guide guards are not installed properly, the rolling stock will cause an impact force on the roll ring each time the steel passes through, and eventually the roll ring will be impacted by the impact. If the force is too large, the roller ring will be broken. Every time the inner guides of the finishing rolling are replaced and the finishing mill is inspected, the alignment of the guides at the inlet and outlet of each frame in the finishing rolling should be checked to reduce the damage caused by the guide. The impact force on the roller ring caused by the poor alignment of the guard and the probability of the roller ring breaking the roller.

3.4 The cooling quality of the roller ring cooling water is not good

The roll ring cooling water system is an important aspect of all rolling operations, and its requirements are especially important when tungsten carbide roll rings are used. Insufficient cooling will cause hot cracks to increase and prematurely develop on the surface of the roll ring grooves. This will greatly reduce the service life of the roller ring. Tungsten carbide roller rings are expensive, so effective water cooling is very important. For best results, it is recommended that the water be as close as possible to the wire exit roller ring, while the roller ring hole It is also important that the full width of the model is covered by water.

The water pressure of the roller ring cooling water system is normally required to be 0.4~0.6MPa. If the water pressure is too high or too low, it will affect the cooling effect of the roller ring. If the water pressure is higher than 0.6MPa, the water will bounce up after being sprayed into the slot. , resulting in poor cooling effect on the roller ring, so that the heat of the roller ring slot is not taken away in time, resulting in the broken roller of the roller ring. If the water pressure is lower than 0.4 MPa, the speed of the roller ring is high, and the cooling water of the roller ring will be The roller ring grooves form a layer of vapor layer, so that the cooling water of the roller ring cannot break through the vapor layer formed in the roller ring grooves, and cannot take away the heat of the roller ring grooves in time, resulting in an increase in the temperature of the roller ring and resulting in broken rollers. .

If there is a problem with the roller ring cooling water, such as the blockage of the water nozzle or insufficient cooling water, it often leads to thermal failure of the roller ring, resulting in the dispersion of carbides in the roller ring, and ultimately affecting the service life of the roller ring. Due to the problem of the roller ring cooling water, it is inevitable If this is used as an aspect of the inspection of the finishing rolling operator, the finishing rolling operator can check the surface temperature of the roll ring of each stand by hand during each shutdown inspection to determine The cooling effect of the cooling water of each frame of the roller ring. In this way, the cooling quality of the cooling water of each frame of the roller ring can be found in time, and the occurrence of broken rollers caused by the poor cooling quality of the cooling water can be avoided.

3.5 The installation temperature of roll shaft, taper sleeve and roll ring is too low

The roll shafts of each roll box in the finishing mill are supplied with oil by a special lubrication system. Its main function is not only to lubricate the parts that need to be lubricated in the finishing mill, but also to heat the various components in the roll box to ensure that the rolls The components in the box operate continuously and effectively at the appropriate temperature. The temperature of the oil when the special lubrication system leaves the oil tank is generally around 40°C. After circulation, the temperature of the roll shaft can reach about 25°C. In this way, when the roll ring is installed on the roll shaft, it will not be caused by the roller shaft and the cone. The temperature difference between the sleeve and the roller ring is large, which causes the stress between the roller shaft and the tapered sleeve roller ring to be too large and the roller ring collapses. Especially in the north, due to the large temperature difference between day and day, the temperature of the roll shaft drops sharply after the lubrication system of the finishing mill is stopped. To the roll shaft, after a period of production, due to the circulation of the lubrication system, the temperature of the roll shaft will continue to rise, resulting in thermal expansion of the roll shaft, resulting in increased interference between the roll shaft and the taper sleeve, the taper sleeve and the roll ring. This will cause the roll ring to fall off or the roll ring to collapse. Therefore, especially for the northern high-speed line rolling mill, appropriate insulation and heating measures should be taken for the storage of the cone sleeve and the roll ring. Install heating in the storage room to ensure that the cone sleeve and roller ring reach the appropriate temperature before pre-installation.

At the same time, it is also necessary to ensure that after the special lubrication system of the finishing mill is stopped, after running for a period of time, the roll ring is installed on the roll shaft by pouring boiling water on the roll shaft to make the temperature of the roll shaft reach a suitable temperature, so as to avoid the damage of the roll shaft and the roll shaft. The phenomenon of roll collapse caused by the large temperature difference between the cone sleeve and the roll ring.

3.6 Roller ring installation trolley problem

The roller ring installation trolley plays an important role in the roller ring installation process. If there is a problem with the roller ring installation trolley, the working pressure of the trolley cannot meet the standard requirements during installation, resulting in the roller ring and the taper sleeve, the taper sleeve and the roll shaft. The interference force between the two is not enough. After rolling for a period of time, the taper sleeve will fall off automatically, which will eventually cause the roll ring to collapse. It is also not advisable to increase the original 6800PSI to above 7100PSI. After the pressure of the roll ring installation trolley is increased, the interference force between the roll ring and the taper sleeve, the taper sleeve and the roll shaft will increase, which will cause the roll ring to collapse. roll. In the production process, the maintenance and maintenance of the roller ring installation trolley should be strengthened.

3.7 The taper sleeve and roller shaft are seriously worn

During the cleaning process of the cone sleeve and the roller shaft, since the iron oxide scale, rust, oil stain and fine particles on the surface of the cone sleeve and the roller shaft are not cleaned, the iron oxide scale, rust and fine particles on the cone sleeve and the roller shaft will cause the cone sleeve to be damaged. and accelerated wear of the roll shaft. The oil residue on the cone sleeve, roll ring, and roll shaft will reduce the friction between the cone sleeve, roll ring, and roll shaft, and eventually cause the roll ring to fall off or collapse. Due to the residual iron oxide scale and fine particles between the cone sleeve and the roll shaft, the cone sleeve and the roll shaft will be worn after running for a period of time. However, Morgan requires that the contact surface between the taper sleeve and the roll shaft should reach more than 85%, otherwise, the contact surface between the taper sleeve and the roll shaft will not be in good contact, so that the taper sleeve will withdraw, causing the roll ring to collapse. Therefore, it is necessary to use it regularly. Use blue powder to inspect the contact surface of the taper sleeve and the roll shaft to ensure that the contact surface of the taper sleeve and the roll shaft reaches more than 85% and avoid the occurrence of roll ring collapse. The size of the 1:12 mm roll shaft cone head should meet the tolerance size required by the drawing to ensure that the contact surfaces are in good contact.

When the taper sleeve is worn to a certain extent, it needs to be repaired to ensure a good contact surface of the taper sleeve. Its outer surface and the inner hole of the roller ring should be closely matched to the actual degree. The diameter is allowed to be tight to 0.005 mm and loose to 0.035 mm. The close fit between the outer surface of the sleeve and the inner hole of the roller ring enables the hydraulic thrust of the hydraulic trolley to build up pressure between

the outer surface of the tapered sleeve and the inner hole of the roller ring, rather than the expansion of the tapered sleeve that can eliminate the outer surface of the tapered sleeve and the inner hole of the roller ring. the radial clearance between.

In addition to the reasons analyzed above, the cleaning of the roll ring, the installation quality and the handling of the roll ring, and the density of the roll ring processing are also the reasons for the broken roll of the roll ring, which should also be paid great attention.

Our factory has received good results by analyzing the reasons for each roll ring broken and taking corresponding effective measures, reducing a lot of economic losses for the enterprise, and also bringing considerable economic benefits to the enterprise.

- **Conclusion**

4.1 The number of crushing rolls in the finishing rolling is reduced from 3~4 pieces per month to 1~2 pieces per half year. The average price of each roll ring is calculated at 7,000 yuan, which can reduce the direct economic loss of about 300,000 yuan per afternoon. .

4.2 Every time the roll is broken, the roll ring should be replaced. If there is no matching roll ring to replace, then all the roll rings in the finishing rolling should be replaced. If there is a matching roll ring, Assuming that it takes 10 minutes to replace each pair of roll rings, the unplanned downtime due to broken rolls is 480 minutes each year, and the time it takes to roll a piece of steel is assumed to be 2 minutes, so the annual production of 240 less rolls Wire rods, the assumed selling price of each wire rod is calculated at 4,000 yuan, and the annual output value is less than 960,000 yuan. It can be seen from the above calculation that the direct and indirect economic losses caused by the roller ring crushing roller to the enterprise are as high as 1.3 million yuan each year. .

4.3 Strengthening process management and technical management, effectively controlling the occurrence of broken rolls in the finishing rolling, and strictly controlling the number of broken rolls in the finishing rolling inner rolls, can the enterprise produce large-scale output, reduce production costs, increase machine-hour output, and reduce non-productivity. One of the important links in planning downtime. Only in this way can the high-speed and high-production capacity of the high-speed wire rod mill be more effectively used, the output can be steadily increased, the company's products can gain a firm foothold in the fierce market competition, and the company can create a higher economy. benefit.