ISSN: 2414-1895 DOI: 10.6919/ICJE.202207_8(7).0118

Feasibility Study on Diagnosis and Repair of Axle Crane Wheel Gnawing Rail

Liangliang Zhang

Zenith Steel Group Company Limited (Nantong), Nantong, Jiangsu 226000, China

Abstract

This paper mainly analyzes the reasons for the existence of bridge crane wheel gnawing rail, bridge crane in its running process gnawing rail situation and the impact and consequences caused by it, and various related aspects of the existing problems to give solutions and measures.

Keywords

Bridge Crane; Gnaw Rail; Analysis; Repair.

1. Summarization

Bridge crane is widely used in warehouses and workshops of enterprises. Bridge crane often in use after a certain time, because of its special working condition and frequent movement, will lead to different degrees of motion gnaw rail. In the process of crane operation, often caused by rail gnawing accidents, light may directly cause a period of time stagnation, heavy may cause machine damage, casualties and other possible malignant consequences.

2. Diagnosis Scheme of Wheel Gnaw Rail for Bridge Crane

There is usually a gap between the rim of the wheel and the side of the track. Under normal operation, they will not touch. But sometimes the wheel does not run in the center of the track, so that the wheel rim and the side of the track contact (friction) gnawing phenomenon. There are spots on the side of the track or inside the wheel rim, and when serious, there are burrs or iron filings on the traces. The clearance between rim and track of bridge crane changes obviously in a short distance. In the operation of bridge crane, the car body produces skew and the wheel goes off. When the big car runs, it will give out a loud "hiss" gnawing track sound. Gnaw track especially serious, the cart running will be issued "pit pit" sound, and even climb track. When the two tire rim of the crane wheel to the side of the track as a forced through the friction contact phenomenon is generally called gnawing rail. Crane gnaw rail processing is other cars or cars on the track in a relatively inclined state to continue to run to a certain speed after the product, the more serious gnaw rail, rim and track side abrasion traces are more huge, damage is also more rapid, and even iron spalling may occur. There are many forms of gnaw rail, sometimes only a wheel gnaw rail, sometimes present a few wheels at the same time gnaw rail, sometimes run back and forth with the same side of the gnaw rail or run back and forth respectively on both sides of the gnaw rail.

Gnaw rail running will directly lead to wheel wear into step shape, wheel wear is further accelerated, thus shortening the life of the wheel and track, so that the replacement period can not reach the need to replace other tracks or wheels; Gnaw rail will make the running resistance becomes increased 1,5~3.5 times, so that the operation control mechanism of the transmission equipment and motor overload, in serious cases, may even occur motor burn, drive shaft torsion and reducer gear cut off and other device accidents; Gnaw rail may cause strong shock shock vibration of crane running environment and harsh noise, and this kind of situation to a certain extent, also will directly affect the safety of the factory building structure and service life, thereby worsening the driver and the driver

ISSN: 2414-1895 DOI: 10.6919/ICJE.202207_8(7).0118

working environment, serious when gnaw rail may also lead to rim scaled the rail top, cause a derailment accidents.

Due to orbit on both sides of the support rail beam in the process of installing the train track for orbital tilt caused by moving orbit when to install the train on track support rail beam with orbital tilt, make its in driving wheels in the process of orbit, which can also occur transverse lateral and medial side of the drive wheels need to burnish, another inside the drive wheels need to grind the lateral. Track horizontal bending (require its side straightness is not greater than 3mm), when the span tolerance will produce gnaw rail, gnaw rail phenomenon is fixed on a line segment. Horizontal bending is known as the "snake" bending orbit, snake curved orbit with the installation of the above mentioned problems, but in the use of the orbit due to chew the horizontal lateral force, the lateral force causes rail lateral displacement, the holder of a fixed orbit is loose, fracture, fall off, thermal deformation under horizontal lateral force and temperature force under the action of the orbit, inward outward curve. This is the horizontal curvature of the orbit. And the influence of temperature, so that the track deformation, (because of the thermal expansion of the track $\triangle L=L0\alpha$ (T2-T1), the track is affected by temperature as high as 80-90 degrees Celsius, $\triangle L$ are greater than 11mm, therefore, the standard track joint gap has been unable to meet the requirements, due to the gap is not enough, resulting in the track top dead, and bending to the inside and outside on both sides. Track gauge is too large or too small (beyond the span standard value), too large, the outer rim gnaw; Too small, inside rim gnawing. Two pillar of different railway track at the same height on cross section in the lateral side rail surface height may vary too much (such as both sides of the pillar is not necessarily can vary more than 10 mm, other higher place on both sides of the place is not necessarily may differ size 15 mm), lateral height deviation, thus easy to cause high lateral called chew, another high lateral medial called on track. One end of the gauge is large, the other end is small, two tracks parallel degree is out of tolerance, in such a track running wheels. The gap between the rim and the track more and more small, until the inner rim gnaw, to run in the opposite direction, slowly improve, continue to run, the outer rim began to gnaw. Between the wheel track and in need of support rail beam or if there is no pressure on clearance in orbit need to install the pressure plate (commonly known as pressure rail) without compaction pressure, when a track wheel bearing properly, orbit can be maintained at a certain stress level, when a track can't normal bearing, is likely to appear constantly lateral orbital Sag, wheel to track reverse direction or lateral offset, forming an intermittent turn nibbling path.

When a bridge type crane by two driving wheel shaft diameter difference value is different, videotapes, each active steering wheel car distance also is likely to differ is too big, diameter smaller side may need to advance step by step (note that the slow line to drive the car speed may also differ too big), leading to the great distortion happened inside the body directly caused thereby Cars gnaw on tracks. Four active wheels of the same installation center design is not a rectangle of four parallel triangle, side two passive wheel installation center line at the same time should also parallel vertical line is not the same, whether they should be two active or passive wheel, when the installation of two passive wheel centerline is not in the same parallel vertical line, on the whole structure of the wheel Into serious gnaw rail, although the installation position of the wheel should be a ladder was more equal four parallel quadrilateral, but two active wheel installed on the centerline is not in the same parallel vertical four wheel top point to the same layout, diagonal render > d1 d2 gnaw rail of this article is the wheels in the same vertical position on the diagonal, the installation position of the wheel design It should still be an equal stepped quadrilateral top point arrangement. Wheel speed along the horizontal direction is parallel to the car wheels on both sides of the center line and the center line of the both sides of the track wheel tread surface along the horizontal direction between the running direction, and a horizontal Angle between the parallel car wheels on both sides along the direction of running speed of the "v" force can be decomposed into two directly pointing in the opposite direction of the binding force, one is for Vx force is parallel to the two ends of the car wheels and two sides of the track force, so that the whole car body can continue to move forward to move backward; An important feature is that the force perpendicular to the wheels on both sides of the parallel car has VY

ISSN: 2414-1895 DOI: 10.6919/ICJE.202207_8(7).0118

force on the track, which makes it slide horizontally inside the car body. When it exceeds the speed limit specified by the vehicle, other vehicles may directly accelerate and chew the track.

The disadvantage of the Angle deviation of the vertical rotation direction of the wheel is that the specified Angle "α" formed by the rotation of the whole wheel between the steering center of the steering tread and the vertical axis of the wheel lead, such as the value of the specified Angle beyond the design requirements of the wheel may directly lead to the whole wheel to gnaw rail. Vertical linear deflection radial error is one of the main formation reasons: due to the increased electric wheel radius of the continuous operation of guide rail, the original for the wheels run continuously guide radius is referred to as the "r", all of the wheels on the guide rail operation needed to go within a week of rail journey all called PI r, produce wheel vertical radial deflection after its runtime radius are all called "r 1 "when the electric wheel in the guide rail operation needed to go within a week of rail journey all called" PI r1 "every week the running of the wheel, wheel about multiple run continuously PI r1 - PI r = PI (r1 - r) week radial out-of-tolerance guide rail journey, this quantity is for guide lead wheel, but due to limit the length of the guide rail with the rim, can't really do the wheels Too much or ahead of time, and in electric cars will not form a gnaw rail. Vertical Angle deflection due to the active wheel axle direction more than tolerance direction lead to derailment caused by wheel gnawing rail, is a kind of driving wheel has come, have no direct relation with the passive wheel derailment, while passive wheel axle of the vertical Angle deflection direction of derailment is not will directly affect the occurrence of passive wheel gnawing rail, but from the movement of active wheels for bearing flexibility and uniform bearing The force and the close contact force range and friction area between the ground and the wheel track treaded by the wheel bearing can be considered comprehensively, and the vertical deviation deviation of the passive wheel axle may not be completely allowed to exceed this tolerance. Each pair of driving wheel if the Angle of the vertical and horizontal deflection in the opposite direction, and the two passive wheel in the direction of the vertical deflection and when can the strength should be equal, at this point that when the train enters high speed light load, a, b and c two rounds of the average radius of continuous running time and its value should be the same will have on at the same time. But after the start of the driving wheel bearing, a round of horizontal and vertical deflection is likely to further reduce the acceleration, the orbit radius can also further reduce the acceleration, due to the vertical and lateral deflection of b wheel may gradually reduce, orbit radius can also further reduce the acceleration, so both driving wheel in the same direction wheel vertical and lateral deflection when light from the wheel Unstable to gnaw rail, become the wheel load after the gnaw rail. Therefore, for the same set of bridge wheels (active or passive) foreign vertical and lateral wheel deflection correction mode internally are within a response or foreign lateral deflection at the same time, because foreign vertical and lateral internal wheel deflection correction methods in a bridge on the shelf of a group of vehicles at the same time, will likely greatly reduced to a set of wheels on the vertical and lateral internal foreign deflection.

3. Bridge Crane Wheel Gnaw Rail Repair Scheme

Firstly, the trolley girder of the crane is started to the other two ends of the cab, and the elevation of each horizontal camber of the trolley girder is measured, and the curve of the horizontal camber and the slope force of the main girder is determined after the change of each main girder. During the measurement, due to the transverse vertical and height transverse deflection deformation caused by the movement of the wheel bridge frame, the measured wheel's transverse vertical and height transverse deflection length exceeds the error (the actual allowable transverse deviation length should be much larger than 1/400 of the actual measured wheel's vertical length). The plumb tread axis of the wheel is the axle center, and there seems to be an Angle between the plumb axis of the wheel, which changes the transverse rolling radius of ordinary automobile tires. Due to the large deformation of the beam of bridge structure, the bridge beam transverse high level direction, leading to a pair of wheel and driving wheel to scroll in the direction of the same height of a pair of vertical and horizontal scroll wheel deflection, and the deflection of the rolling direction phase at the same time, also is in the wheel light formed when a, b two active wheel lateral run the added value of the rolling radius

ISSN: 2414-1895 DOI: 10.6919/ICJE.202207_8(7).0118

and completely equal Gnaw rail, therefore, not directly, but after the wheel bearing, a round of transverse vertical and horizontal scroll wheel deflection increases further intensifies, b wheel lateral vertical and horizontal scroll wheel deflection increased gradually reduce, the formation of two active wheel lateral rolling radius is not running so the added value of not completely equal, transverse gnaw rail wheel could be so. Different positions of the two active wheels are measured, and the measurement data are shown in Table 1.

Table 1. Measuring data of driving wheel

Number of measurement	1	2	3	4	5	6	7
Driving wheel 1 (mm)	2	2.6	3.5	2.3	4	3.4	4.1
Driving wheel 2 (mm)	-3.1	-4.3	-2.5	-3.8	-4.3	-5.2	-4.6

The connecting bolts of several groups of carts wheel group are disassembled at the same time, and the connecting bolts of two active wheel couplings are disassembled at the same time. Each group of wheels has a total of 4 sets of fixing bolts. After all loosens, only remove the group and reserve 1 group inside and outside. Began to use hydraulic one thousand jins bumps up balance beam, when top to bottom left all wheel cart track rail surface 80 mm stop jack-up, make good tooling in advance from the side insert the bottom of the balance beam, pull down inside and outside the reserve set bolt, landed the balance beam to the carrying capacity of 8 tons of small tanks, one out from the side, with early in its upper suspension chain blocks 5 tons Lift and place on one side of the walking platform, with solid wood at the bottom to prevent tipping.

The hydraulic jack pressure relief, so that several groups of wheels bottom and cart track plane spacing is 5mm to stop, and then manually loosen the fixed bolts of 4 groups of trolley, so that the bottom of the wheel and cart track contact, and then adjust the straightness of several groups of wheels.

Assemble the good pad iron sheet and wheel group together on the ground, adjust the horizontal deviation of each wheel group less than 0.1%, and then tighten the fixing bolt of the wheel. Adjust the horizontal deviation out of tolerance of a single wheel, and adjust the installation Angle of the fixing bolts of the rotating bearing box; Adjust the horizontal deflection difference of cart single side wheel after assembly, at the outer side of the wheel distance from cart track center about 150mm, a 0.5mm diameter steel wire is fixed longitudinally along the running direction of cart, which is used as a reference to adjust the horizontal deflection of each set of wheels to steel wire less than or equal to 1mm, and the internal and external displacement of cart track less than or equal to 2mm; Tighten the fixed bolts of each wheel and end beam. At this time, it should be checked whether there is any change in the horizontal deflection of all the wheels after tightening. If it meets the requirements, the positioning plates of the fixed bolts are fixed by electric welding, and the coupling of the active wheels is fixed by other construction personnel.

When carrying out the above operation of replacing and adjusting the wheel, try not to replace the bearing box every time the wheel or bearing is replaced, because the bearing box is eccentric and each wheel set has been adjusted and marked with positioning bolts when installed. The role of eccentric bearing box is used when the wheel gnaws the rail after the bridge deformation, so as to avoid the disadvantages that cannot be solved when the wheel gnaws the rail when the bridge deformation. After installation and adjustment, the offset of the wheel was remeasured. The measurement data is shown in Table 2.

Table 2. Measuring data of driving wheel

Number of measurement	1	2	3	4	5	6	7
Driving wheel 1 (mm)	0.6	0.7	1.2	0.8	0.6	0.5	0.9
Driving wheel 2 (mm)	-1.1	-1	-0.7	-0.9	-1.3	-1.2	-1

ISSN: 2414-1895 DOI: 10.6919/ICJE.202207_8(7).0118

After repair, the gnaw deviation of active wheel 1 and 2 at the same position is 1.7mm at the minimum and 1.9mm at the maximum, which meets the requirement of ≤2 mm.

4. The Significance of Diagnosis and Repair of Axle Crane Wheel Gnawing Rail

So when the wheel gnawing rail, not only a possible impact on the efficiency and quality of construction, more seriously to the bridge crane itself poses a dangerous threat. Therefore, the wheel gnawing rail selection is suitable for matching the wheel repair method, can as much as possible to maintain the superior technical performance of the bridge crane, reduce the impact of adverse factors in various aspects, complete the improvement of the construction technology level. In practice, we should fully clear bridge crane wheel rail gnawing specific problems and reasons, according to the actual situation, through some scientific technical way and the effective measures to solve the wheel repair, reasonable use all kinds of effective technical methods and means, strengthen the inspection and maintenance, so we can radically reduce and reduce all kinds of accidents the probability of improving the use value and play a role of bridge crane wheel.

5. Conclusion

To sum up, the result of adjusting the elevation of wheel axis and track meets the technical requirements and achieves the expected goal. In the actual correction work we should choose to take what kind of main beam correction method, the future will directly greatly affect the electric crane main beam after gnawing rail of the main beam correction effect, the cost of correction, the overall appearance of the decorative quality of the main beam and electric crane safety protection performance. Therefore, we should choose reasonable and correct surgical adjustment and reasonable correction correction methods, master the technical advantages, indications and scope of various correction methods, so that we can correctly and reasonably carry out surgical correction, and achieve more ideal surgical adjustment and reasonable correction correction effect. At this point, the wheel gnaw rail repair work is over, the whole repair process is completed. Save a lot of mechanical equipment purchase, installation and maintenance costs, for the enterprise's production laid a good time, to ensure the smooth production.

References

[1] YU Chuyong. Analysis of Bridge Crane Girder Deformation Repair Technology [J]. China High-tech Enterprise, 2011:5-8.

[2] Wu Anfu. Inspection and Repair of Bending Deformation of Main Girder of bridge Crane [J]. Library and Information Guide, 2002, 12:7.

[3] Chen Yongji, Hu Haixia, LIANG Jiejin. Double girder bridge Crane Main beam Bending Repair and Reinforcement Technology [J]. Hoisting and Conveying Machinery, 2015(7):9-10.

[4] Han Bin, Shan Xinxin. Bridge Crane girder deformation and Repair method [J]. Chemical Management, 2016, 6:7-8.

[5] Li Jiaqiang, Zhou Xu, Li Qingguo. Research on Manufacturing and Production Technology of Bridge Crane [J]. China High-tech Enterprises, 2013(29):11-13.

[6] GB/T3811-2008. Code for design of cranes.