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INCREASING THE MAINTENANCE WORK RATE OF LHB AND ICF WHEEL USING CNC MACHINE

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Abstract :- The aim of this paper is to reduce the manufacturing cost and to reduce the time of remanufacturing work on the rail wheels. There are two types of surface machining or reprofiling a rail wheel. They are **lathe machining process** and **cnc machining process.** In this paper, for our research and development of reprofiling a rail wheel, we are using the cnc machining process for the better result and the major need as reducing the time of reprofiling the surface of the wheels. In the paper the defective wheels are taken and are to be reprofiled to extend their service in the railways. The process done on the surface of the wheel is termed as **turning operation.** The defective wheels are set into the **cnc lathe machine** for the turning process. The input parameter of the cnc machine is feeded. The parameters are i)depth of cut ii)speed rate iii)feed rate. The time reducing and increasing the remanufacturing work rate of the defective wheels is the major role in this paper.

Key Words: **Reprofiling, turning operation, remanufacturing work, CNC machining**

1. INTRODUCTION

The Southern Railway headquatered at Chennai, is one of the 18 zones of Indian Railways. It is the earliest of the 18 zones of the Indian Railways created in independent India. It was created on 14April 1951 by merging three state railways, namely, the **Madras**and **Southern Maharatta Railway,** the **south Indian Railway Company.** A train wheel is a type of wheel specially designed for use on rail tracks. A rolling component is typically pressed onto an axle and mounted directly on a rail car. Wheels are cast or forged and are heat treated to have a specific hardness. New wheels are trued, using a lathe, to a specific profile before being pressed onto an axle. All wheel profiles need to be periodically monitored to ensure proper wheel-rail interface. Improperly trued wheels increasing rolling resistance, reduce energy efficiency and may create unsafe operation. A railroad wheel typically consists of two main parts: the wheel itself, and the tyre around the outside. A rail tire is usually made from steel and is typically heated and pressed onto the wheel, where it remains firmly as it shrinks and cools. Monobloc wheels do not have a resilient material, such as rubber between the and tire. Most train wheels have a conical geometry, which is the primary means of keeping the train's motion aligned with the track. Wheels used for road-rail vehicles are normally smaller than those found on other types of rolling stock. This is because the wheel has to be stored clear of the ground when the vehicle is in road-going mode. Such wheels can be as small as 245 mm (9.65 in) in diameter. In this, the train wheels are will beinspected for 18months from the date of manufacturing. At the time the defective wheels are to be machined for the remanufacturing work and return to the service. Initially the remanufacturing work is done on the lathe machine, at that time the lathe work for turning operation is desirable and more efficiency. Later that, CNC machines are discovered for the advanced technology. CNC machines are computerised machine to do the work as fast as lathe machine. CNC machines saves a lot of times for doing the work and also accurate work measuring is done. The important one in the CNC machine is to require a skilled worker and also must having the knowledge of technical work. The skilled worker should be good in NC codes, the NC codes are main part in the CNC machine to done a operation more efficient. The leading codes in CNC are preparatory codes termed as (G-code) and miscellaneous codes termed as (M-code).And for the direction movement the X&Y codes are used. Then the depth of material to be removed is done by the Z. Based on the performance the CNC machines are better than the normal lathe. There is a time difference between the normal lathe and CNC machines. Initially the trains defective wheels are reprofiled by a normal lathe machine, at the time the remanufacturing work rate is slower and the advantage on lathe machining is providing some more time to manufacturing the new wheels.To reduce the time of remanufacturing work rate CNC machines are used. The CNC machines are run by the skilled programmer. Already the reprofiling are done by the CNC machine with some parameters as depth of cut, feed rate, speed rate. There is some change in the already used parameters to increase the remanufacturing work rate of the wheels. This technique is applicable at the time of large number of remanufacturing rate is required.

Process:

The reprofiling of therail wheel is to extend the service life of the wheels to the railways. The reprofiling is done by the name of "turning". In this process the diameter of the wheel is reduced. The process is classified as Primary and Secondary stage.

Primary process:

- Bogie received in the repair shop
- De-wheeling of wheels from the bogie for remanufacturing the wheels
- Wheels are transferred to the wheel shop
- Initially the water jet process is carried out
- Water jet process is carried for the dust removing while in De-wheeling
- Then wheels are moved to the CNC machine

Secondary process:

- Problem identification in the wheels
- Setting the Optimum Parameters such as below:

  (i) Depth of cut

  (ii) Feed rate

  (iii) Speed rate

- Starting the turning operation on the defective wheels
- After the turning process is done the wheels are moved the testing
- Ultrasonic testing is carried on the wheels to identify the cracks
- If cracks occurs on the wheels on testing the wheel is rejected
- If there is no cracks the wheel is accepted

After the completion of these two process the wheels are to be reused in the railways. The rail wheels remanufacturing process is mainly to reduce the production cost and also increase the remanufacturing work rate more efficiently.

Machine tools and cutting tools for wheel reshaping:

In the Interoperability Technical Specifications relating to the "rolling stock" subsystem, developed according to the Directive 2008/57/CE and its annexes, there are established the parameters of the wheel profiles and it is specified the fact that the compliance assessments must be documented.

Fitting the wheel profile within the geometrical sizes established by regulations represents an important requirement for the railway traffic safety, essential for increasing the operational performance. It is theoretically proven [9] and by numerous experimental researches that the wheel and rail profiles influence the sustainability of the wheel-rail coupling when rolling, but also the passengers safety and their comfort by reducing the noise and vibration level [7].

Currently, several types of specialized machine tools such as horizontal or vertical lathes are used, with one or two main shafts. By applying the technological lathing process, the following types of machining are carried out: reshaping of a single wheel, simultaneous reshaping of both wheels mounted on axle, lathing of the wheel profile dismounted from the vehicle and lathing of the wheel profile without being dismounted from the vehicle.

Depending on the destination, several types of lathes were developed: mounted underground [7], fig. 3,a. or at ground level, placed on foundations. The first are generally used for rail wheel reshaping without dismounting the wheels from the vehicle.

i)Lathe mounted below the ground level

ii)Ground mounted lathe

Lathes for machining/reprofiling the rail wheels

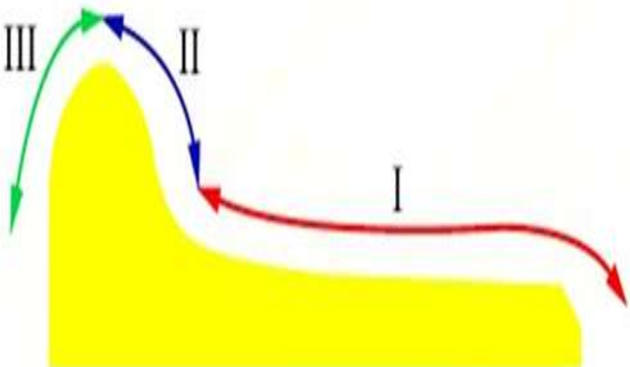
Ground-mounted lathes are used for machining the wheel/axle reprofiles that are not mounted on the vehicle. These lathes are intended for machining in the repair and maintenance workshops or those that manufacture the wheel set. In recent years it has been observed an increased interest for the automation of wheel reshaping process and measurement systems adapted on machine tools equipped with CNC.

The automation of the lathes and using equipments with advanced measurement systems represents a necessary modernization version of the technological processes that are applied in repair and maintenance workshops of the rolling stock. CNC equipments provide the achievement of several command and control functions of machine tools that involves coordinating the drives, establishing the number of passes, the control and limitation of movements on the controlled axes, the control of the generation movements (main, feeding), optimization of the machining parameters and display of the generated trajectory.

The main advantages of using numerically controlled lathes for reshaping the rail wheels are: it is eliminated the need of using a large number of expensive, rigid, difficult to execute and adjust templates; the numerical programs are flexible, they can be easily modified in order to move from one type of profile to another, the adjustment errors of the operator are eliminated, it is allowed the automation of the entire machining process. The major disadvantage of using this type of equipment is represented by the high costs of implementation, maintenance and repair compared to a common machine tool.

The machining precision of the profile is influenced by the precision of executing, clamping and adjusting the template and of the gauge and especially of the transducer with copying contacts.

According to the active part geometry of the tools, wheels and machining method, the longitudinal lathing is carried out with an insert fixed on the tool holder, having a length of 30 mm and the radius at the tip of the main cutting edge of 4 mm.



Zone	Cutting speed, v_c[m/min]	Cutting depth, a_p [mm]
I	30-70	0.3 – 1.8
II	50-100	0.5-2.0
III	50-100	0.5-2.0

This insert can be used for the roughing and semi-finishing machining of the Ist and IInd zones (fig. 6). The second tangential insert, with a length of 19 mm and a radius of 4 mm, is positioned perpendicularly to the largest insert and it is used to machine the IIIrd delimitation zone of the wheel. The cutting depth may range from ap: 0.3… 2 mm, depending on the condition of the surfaces that form the three zones I, II and III along the wheel width (fig. 6). In the table attached to the figure there are indicated some recommendations for the machining parameters to the lathing of the rolling surface profil

Methodology:

De-wheeling:

The wheels are removed from the BOGIES and transferred to the wheel shop for remanufacturing work. The wheels in the BOGIES are identified by the crack or the defect in the surface of the wheels.

Cleaning:

The wheels which received from the BOGIE are placed in the water jet for the removing of dust in the wheels. The wheels must be clean while in the turning operation.

Machining:

After the cleaning process the wheels are moved to the CNC machining for the turning operation. The turning operation is done by setting the parameters. The parameters are listed below:

i) Depth of cut

ii)Feed rate

iii)Speed rate

These three optimum parameters are the key tool for the CNC machine to provide a better turning operation on the surface of the wheel. In this paper we discussed about the changing parameters on the CNC machine other than the already followed.

Testing:

After the machining or finishing of reprofiling work on the wheels the wheels are moved to the next stage as testing. Here an Ultrasonic testing is carried on the reprofiled wheels for the detection of crack formation on the inner surface of the wheels. There is standard graph formation on the Ultrasonic machine for the defect detection based on the variation of the graph formation the defect can be identify. The defected wheels are rejected and the remaining wheels are in the service.

Reuse & Reassemble:

After the defect identification process the wheels are moved to the BOGIES for assembling. The remanufactured and assembled wheels are stay in the service.

The table tabulated below is already followed parameters in the wheelshop

Max. Depth of cut	Feed Rate	Speed rate
0.5 inch 13mm	0-0.08 in/rev 0-2 mm/rev	0-80 RPM variable

This data can be used for minimum remanufacturing of rail wheels and this kind of parameters cannot be used to produce a large amount of wheels per day and working hours may be increase in the same way the remanufacturing work can be affected. Based on the efficiency of machine compared with the remanufacturing rate the above parameters are not suited for a large remanufacturing rate

Based on the efficiency of the machine the new parameter chart can be prepared:

Max. Depth of cut	Feed rate	Speed rate
Min. 2mm Max.5mm	0-0.10 in/rev 0-3 mm/rev	0-100 RPM variable

This parameters are designed for the increasing the remanufacturing rate of corroded wheels in the LHB coaches wheel and are used in the current remanufacturing rate of wheels. This parameters helpful in increasing the remanufacturing rate and gives a more supply of wheels to coaches compared to the previous followed parameter. This parameter was deeply analysed by the previous used parameter in the CNC machine and will be used for remanufacturing increasing rate.

By following the above parameter the result can be done in the below order

Cutting speed while profiling	50-110 m/min
Productivity	36 wheels/8hrs

Conclusions

The paper analyses the importance of the profile shape and the rolling surface quality of the railway vehicle wheels in accordance with the European regulations in the field. The parametric drawing methodology of the wheel profile shown in this paper aims to improve the shaping/reshaping by the cutting process of the rail wheels in order to improve the operating behaviour of the wheel-rail coupling. Following the modeling stages of the rolling surface and CAM simulation ones until obtaining CNC code, it is ensured the creation of a database with complex information on the profile shape, recommendations of the working parameters depending on the tools and on the chosen machine tool.

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