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EFFECT OF TECHNOLOGICAL CONDITIONS OF THERMAL TREATMENT ON THE OPERATING PARAMETERS WORK SURFACES ROLLER BEARINGS

The article deals with the causes of defects working surfaces of rollers rolling bearings as cracks appear mostly during thermal processing. Defects in the form of a roller bearing cracks occur mainly during thermal processing, so you need to explicitly follow the requirements for hardening. Thus, to ensure the quality of the surface layer of the working surfaces of bearings should have clear guidelines regarding the peculiarities of thermal operations.

Defect crack, tapered roller, rollerbearning.

The one of the important problems in engineering is the precision machining. Machines durability is highly dependent on the accuracy of the size and shape of their parts on condition of normal operating conditions as well as on the quality of their working surfaces.

Improvement of geometric accuracy form of conjugate rollers surfaces will increase the actual bearing surface which contributes to increase the durability and service term of their parts.

The quality of the surface that is characterized by physical and mechanical properties of the surface layer and its roughness determines the fatigue strength of parts.

The up today scientific and practical problem is to improve accuracy of the rollers shape and size as well as to provide work surfaces with required properties that increase resistance to deterioration and fatigue strength.

The rollers manufacturing is a technologically difficult process. It includes such operations as punching, heat treatment, machining, connection with other details. While the above mentioned operations are processed there may appear a number of the surface layer defects which lead to the destruction of conjugate surfaces and may cause a loss of a whole node.

Thermal operation methods as well as mechanical methods are also of great importance in rollers bearings processing.

Heat treatment it is a process when metals and alloys are heated and subsequently cooled in accordance with specific laws. The aim of heat treatment is to change metals and alloys properties after the internal structure changes which had happened ander the influence of high temperature. The purpose of heat treatment is to relieve internal tension, to increase strength, hardness, ductility and toughness of the metal.

As a result of heat treatment strength and hardness increases and ductility of structural and instrumental steels and alloys decreases. Hardening quality depends on the temperature and heating rate, holding time and cooling. The main parameters of tempering is heating temperature and cooling rate.

During thermal operations such defects as cracks, deformation and distortion, decarbonization, soft spots and low hardness may occur.

Hardening cracks is an incorrigible defect formed during the heat treatment. They are the result of large internal strains.

Cracks occur as a result of the wrong heating (overheating) and high cooling speed of details, the construction of which has sharp surfaces transitions, rough strokes that remain after machining, sharp angles, thin walls, etc.

Hardening cracks are usually located at the corners of rollers and are of arched or tortuous shapes.

Deformation and distortion of components occur as a result of uneven structural and volume related changes that cause the occurrence of internal metal strains during heating and cooling.

In the course of theoretical and experimental studies the analysis of the surface layer of tapered roller bearings and roller and the thermal operations effect on the formation of operational characteristics was made.

Experimental studies have established that defects in the form of cracks on the working surfaces of roller bearings occur mostly during the thermal treatment.

The rollers manufacturing is a technologically difficult process. It includes such operations as punching, haltuvannya, heat treatment, machining, connection with other details.. Finished products are stored and maintained and their parameters can undergo some changes. In the process of manufacturing operations metal of products changes [1].

During the production and processing rollers have got deformations in the form of cracks. The nature of these cracks forms the basis of research in this article. During the study ШХ15 steel was used.

Steel is malleable alloy of iron and carbon and sometimes with alloying elements also. Carbon content is less than 2.14%. This is the most common structural material [2]. Carbon in this alloy is in the form of chemical compounds with iron which is called cementite (Fe_3C). The carbon content of 6.67% corresponds to 100% cementite.

Methods flaw that provide detection of surface and subsurface defects are visual, capillary, magnetic, electromagnetic which are combined under the term surface methods. Reflection and transmission are the ultrasonic methods used, echo amplitude and shady methods are used most often.

Internal defects of volume type (slag, pores etc.) are also detected in the same way regardless of the direction of radiation or ultrasonic emission. Slightly open planar type defects (cracks, etc.) are better detected by radiation monitoring where the radiation is directed along the plane of the defect, while in ultrasonic testing the radiation is directed perpendicular to the defect plane.

Speaking about defects removal should be borne in mind that many defects are allowed in small amounts in the product and do not require removal (pores, slag, stratification, etc.). The operating conditions are to be taken into acount.

The action of quenching medium (water, oil) can be described in the following way. In the first stage when the product is dipped into the quenching environment there is formed the superheated steam (steam jacket) around the product. A cooling of a product is relatively slow because of the steam jacket layer. This is a stage of pellicle boiling. Then the steam shirt gets torn and coolant begins to boil on the product surface. This is a stage of bubble boiling. At this second stage the product cooling is fast. When the surface temperature of the product is below the liquid boiling point the liquid doesn't boil and product cooling gets slower. This is the third stage the stage of convective heat transfer. The wider the interval of bubble boiling phase the more intensivly hardening liquid cools steel.

In the process of quenching heating and tempering the following defects as cracks, deformation and distortion, decarbonization, soft spots and low hardness can appear.

Hardening cracks are irreparable defect formed during the heat treatment. They are the result of large internal strains.

Cracks occur as a result of the wrong heating (overheating) and high cooling speed in details, the construction of which has sharp surfaces transitions, rough strokes that remain after machining, sharp angles, thin walls, etc. Hardening cracks are usually located at the corners of rollers are of arched or tortuous shape.

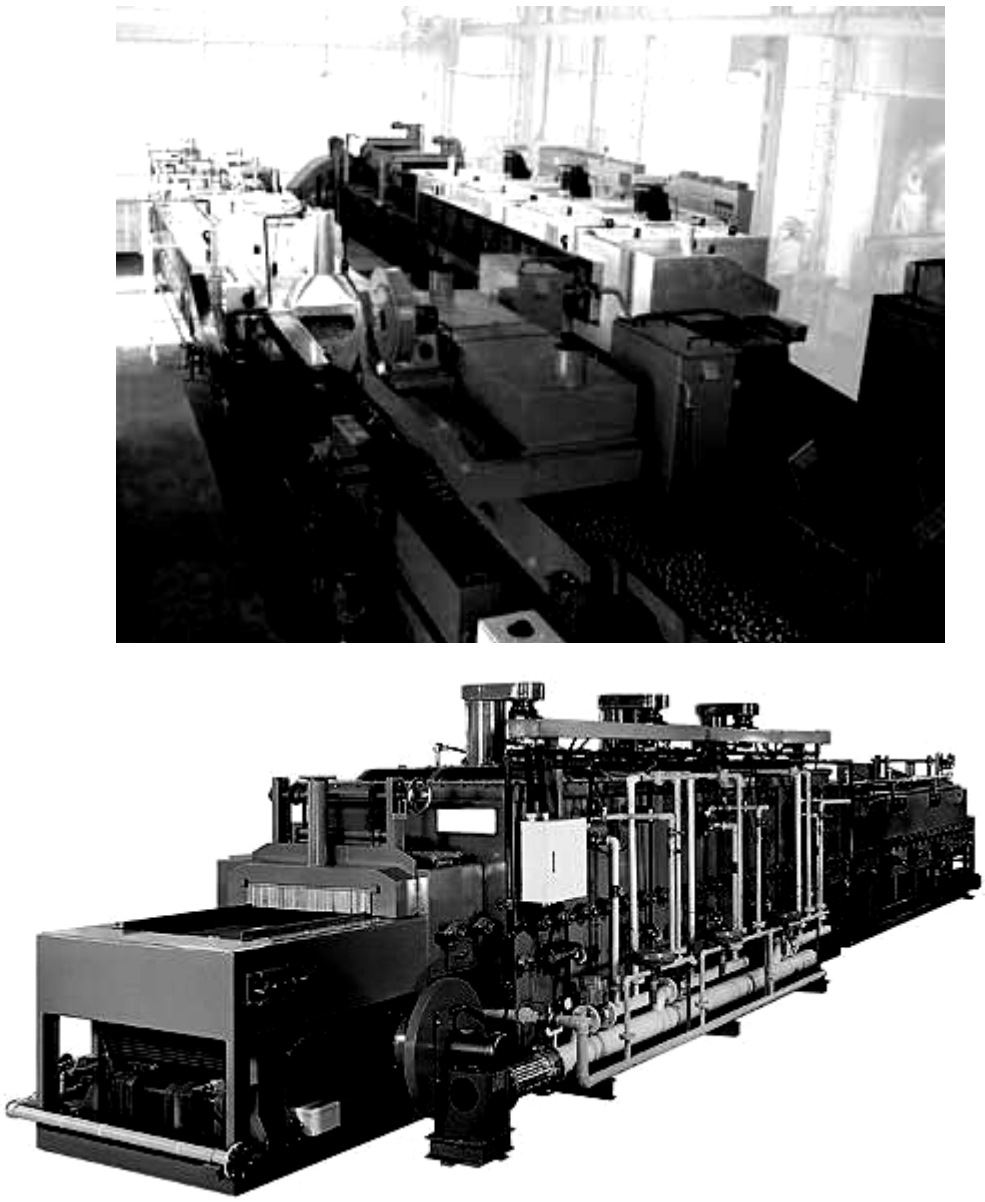
Deformation and distortion of components occur as a result of uneven structural and volume related changes that cause the occurrence of internal metal strains during heating and cooling.

For heat treatment of rollers and balls used units which include: Rotary kiln with the boot device, a quenching tank with screw conveyor located under the stove, washer screw type mashine, deliver drum types oven and cooling installation. These units with electric impact are under index SBZA. As an example of such unit an aggregate SB3A-2, 12.5 / 3 can be used (Picture. 1).

Drum electric furnace BAU-2,5 12. / 9 type unit has sealed welded casing to which boxes with rollers set in muffles on both sides are attached by bolts. Furnace muffle is made of heat resistant cast steel with spiral coils inside which is rotated by electric motors what makes possible to change speed muffles in the required limits. The controlled atmosphere called endohaz. Is used in muffles. There are two heat zones with automatic temperature control in the furnace. Quenching tank consists of a welded casing, inside of it there is an auger drum set in that rotates being hold by two pillars.

Drum drive is electromechanical. Washing machine also has got a screw drum. Moving inside the drum parts are first washed in the shower 3% solution of caustic soda and by water later.

Delivery oven BTP-6.12 / 3 type unit has welded casing with two covers. Furnace casing consist of double metal walls with insulating material inside. Heating of parts in the oven is made by hot air. There is receiving funnel on the load side connected by a sloped tray with a oven drum. Drum kiln is rotated by the electric motor that makes possible to regulate drum speed. There is one thermal zone in holding furnace were the temperature is regulated automatically. Parts from holding furnace are put to the conveyor belt conveyor through the loading chute entering.



Picture 1. Aggregate processing rollers and ball bearings

Loading of parts (rollers and balls with a diameter up to 25mm) is made by bootable drum into which they enter by in parts. The entire device consists of a hopper, covered by a shyber and a pipe. Details are coming into the funnel continuously and parts supply from the crater through the blow pipe into the camera and muffle is regulated by adjustable gates. The latter are driven by kernels on a signal from the command staff. Details are promoted through the muffle and the end of the core muffles fall through the window in a quenching tank and then go through all the equipment parts of the unit.

Hardening cracks occur mainly during the parts cooling process while quenching as a result of internal strains. They can also occur after quenching on details that has not been dispensed for a long time, which reduces internal strains.

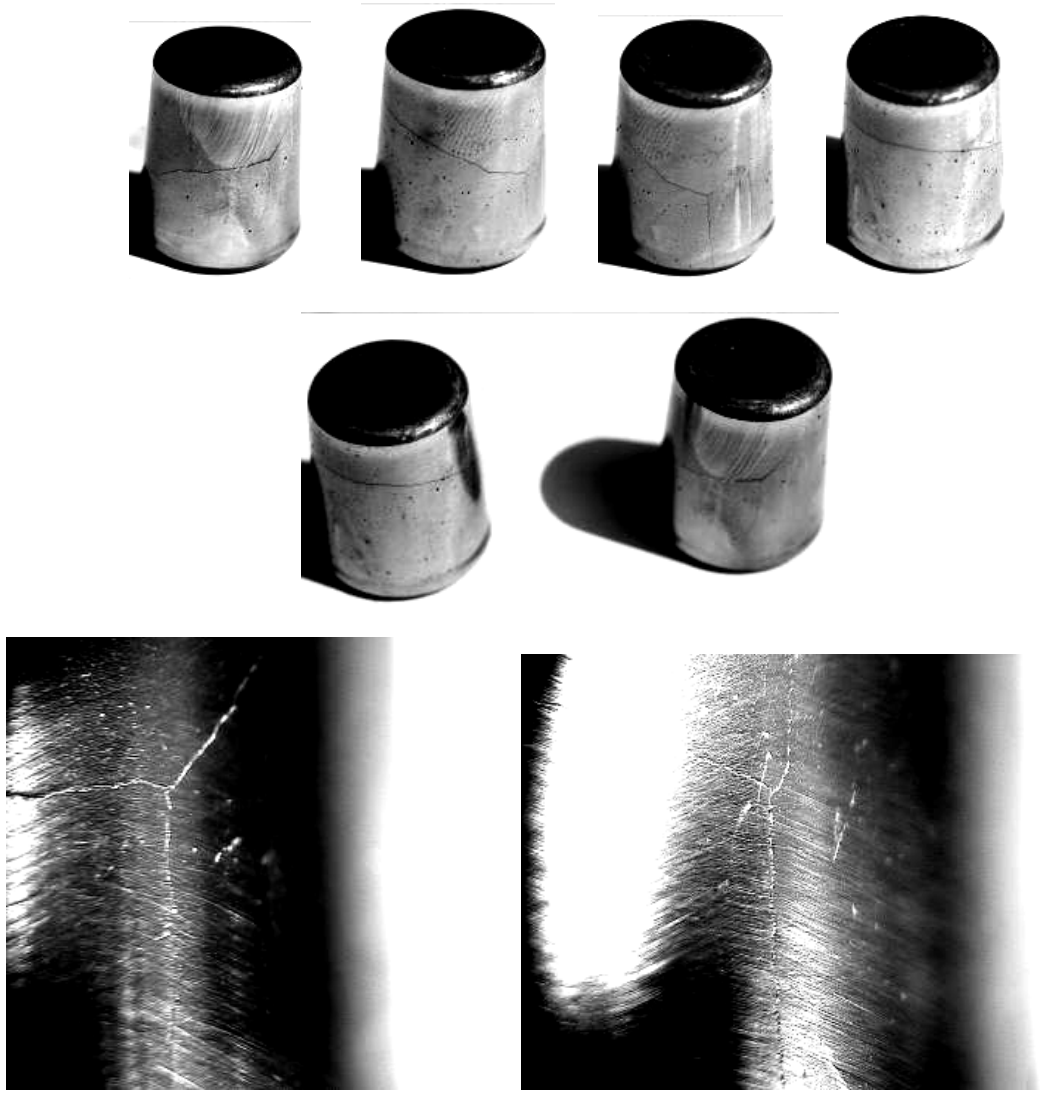
High and uneven internal strains when parts rigidity is low causes their distortion. If there are weakened sections in details there can also occur cracks. The most probable place for hardening cracks is a place with a sharp change in cross section, sharp corners and undercuts.

Simple configuration detail (eg, cylindrical) with good surface condition can also got cracks on during quenching. In this case the cracking may be caused by defects in the material (slag inclusions, flock), forging cracks or failure of parts heat treatment.

An essential feature of hardening cracks is the uncertainty of their focus on the workpiece surface. They are easily examined by magnetic control even by low magnetization because the

material of hardened parts has quite high values of residual induction and coercive force to cracks no matter if they are big or small they can almost always be detected on the workpiece surface.

Hardening cracks give intense, dense deposition of powder in the form of broken, twisted lines that go in different directions. Crisp and relief drawings of precipitated powder that are obtained above quenching cracks let us to distinguish them among other defects. Example identifying the most common hardening cracks is shown on Picture. 2.



Picture 2. Cracks occurred after thermal treatment rollers processing.

Conclusions.

Roller bearings defects in the form of cracks occur mainly during thermal processing that is why it is essentials to follow strictly the hardening requirements. If cracks appear it is necessary whether to change the technology of hardening or a worker who performs this operation or an engineer who calculated the rollers thermal modes processing improperly. Thus to ensure the quality of the surface layer of the bearings working surfaces it is necessary to have clear guidelines regarding the peculiarities of thermal operations.

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