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THE PROCEEDINGS OF STRAIGHTENING OF STEEL CONCRETE FROM RINGS OF WIRES WITH INTERIOR SURFACE OF ROTATING DISC

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ABSTRACT
This paper presents the theoretical and practical aspects and solutions about suppressing the worn of bearing bushes used for straightening of wires and steel concrete from rings of wire on special machine, model TIMCO-Timisoara, Romania. The tests of straightening of steel concrete from ring wire had been made of wires with diameters between Ø 4- 14 mm, with the goal to improve the physics-mechanical properties of superficial case of wire, straightening and cutting at size of wires.
Keywords: concrete steel, ring wire, straightening.

1. INTRODUCTION

The straightening process of concrete steel from rings wire contains a variety of proceedings and methods of machining, with the goal of straightening concrete steel from rings with magnitude between Ø4 – Ø14 mm and to enhance the working properties and precision form of concrete steel. The reason in choosing the methods is influenced by harder of superficial case of wire that is resolved by successive mechanical forming process on special machine tools. The tools used for straightening of wires have the shapes of bushes which worked by friction of inner cylindrical surface (fig.1), with an adequate geometry [4,5]. The tool is doing a radial eccentric motion to semi-finished axis, which is executed a translation motion similar with feed of turning process. The machine tool has an influence by revolves and feeds rate, moments and forces allowable, by stiffness and accuracy of motions.

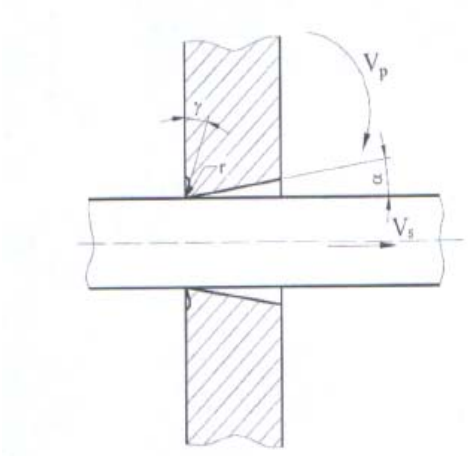

Figure 1. The geometry of bush.

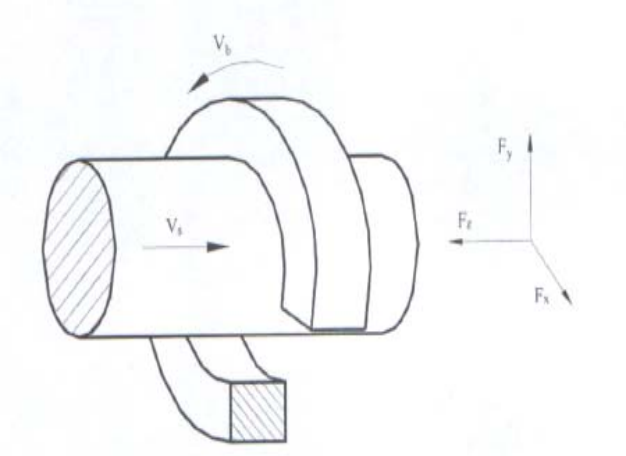

Figure 2. The straightening process with eccentric buses.

Because the straightening process is done on dray the attrition rate of tools is high. The process is going forward until the magnitude of attrition became a maximum due to resharpen tool. The rule for determination of attrition norm is imposed by the maximum allowable attrition depends of the type of

straining and the economical operation rate [3]. Above tool wear has a great influence some factors, such as:

- Between the speeds of bush $v_1, v_2 \cdots v_n$ and tool life $T_1, T_2 \cdots T_n$, at the general wear norm is a relation determined by Taylor:

$$v = C_1 / T^m \tag{1}$$

, where: m and C_1 are parameters depend of feed rate, depth of cut, work material, and tool life.

- The increase of feed due to decrease of tool life and growing the wear;
- The rise of eccentricity e, by increase of radius R of tool due to decrease of tool life;
- By rising relief angle α due to reduce of friction between workpiece and tool and the wear.
- By doing a fillet radius of tool due to reinforce the edge and increase the tool life. For an excessive fillet radius of edge tool can occur the rise of straining in elastic and plastic range and the magnitude of temperature, which determined a pour tool life.

After all these observations can be written a general tool life relation used for the straightening process of wires by rings:

$$T = \frac{C_T}{v^{x_v} s^{y_v} t^{x_v}} f\left(\alpha_n, \gamma_n, r_1, r, R, e, \sigma_c\right) \tag{2}$$

, where: $\alpha_n, \gamma_n, r_1, r, R, e, \sigma_c$, are parameters [1,3,7] of tool and concrete steel characteristics (σ_c).

2. THEORETICAL FUNDAMENTALS OF FRICTION PROCESS AT STRAIGHTENING

The straightening concrete steel process by rings with inner surface of bushes (fig.2) assures a translation motion of workpiece similar with feed, a turning motion of bushes around workpiece on eccentric circular trajectories with a constant angular speed on diameter workpiece. For this is necessary to have a high peripherical tool speed and a low workpiece speed. The mechanical straining is done in inner bush (fig.1), once of this is realized the clean of material by detaching the slag particles from the contact surface of concrete steel. For understanding the phenomena of straightening process it has been appealed to *"Pipe model of straining theory"* (fig.2) [7]. The differential balanced forces equation can be written:

$$\frac{d\sigma_r}{d_r} + \frac{\mu'}{h}\sigma_r - \frac{2\mu'}{h}\sigma_c = 0 \tag{3}$$

For $\sigma_r = 0$, $r = d/2$ and $p_z = -\sigma_r$. The solution of equation (3) in reduced form is:

$$p_z = \sigma_c\left[1 + \frac{2\mu'}{h}\left(d - r\right)\right] \tag{4}$$

At the end of straining when had been the values d_1 and h_1, the maximum value for force F_z is:

$$F_{z\max} = F_{z1} = \sigma_c A_0 \frac{h_0}{h_1}\left[1 + \frac{1}{3}\frac{\mu' d_1}{h_1}\right] \tag{5}$$

where the strength of straining is done by relation:

$$k_{wl} = \sigma_c\left[1 + \frac{1}{3}\frac{\mu' d_1}{h_1}\right] \tag{6}$$

By relation (6) can be observed high magnitudes of coefficient of friction μ' and σ_c due to a quick wear of bushes decreasing the tool life.

The "*Mechanical model of friction"* [1] used at straightening of wires and rods steel from rings is based on acting of friction physics phenomena inside of bearings. Between tool (bush), which is turning around the semi-finished on an eccentric circular trajectory and the semi-finished which is doing a longitudinal feed motion occurs the frictions. At straightening the semi-finished didn't fixed between two points that executed an axial sliding motion with slow feed, the warp tool has been compounded by successive tuning straightening bushes locked inside of rotating head and this turning is doing with a constant revolute around the semi-finished, which has a high external speed.
In fig.3 is depicted a rod section with weight *p* and radius *r* which is balance state under this weight and a normal reaction force *N* in rest point *C*, inside of bush with cylindrical form and a little great diameter such as rod diameter.

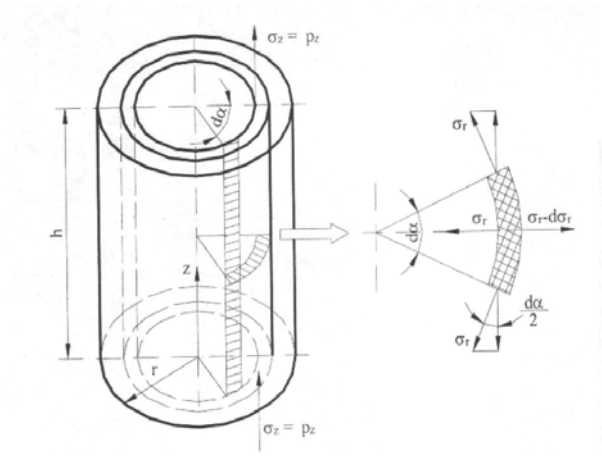

Figure 3. The inside stresses of rod section.

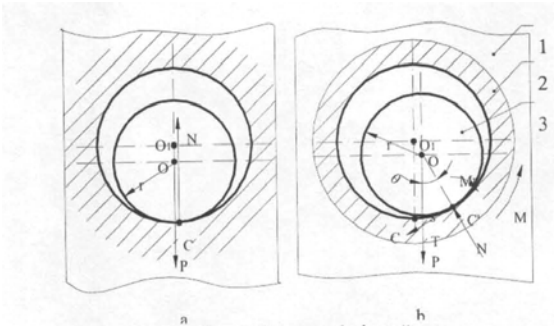

Figure 4. The inside friction of bush.

The mode which arisen the friction (fig.4) is similar with slide friction with difference that at wires and rod straightening is turning the bearing (straightening bush). Thus, after acting an external moment *M* to bush the contact point *C* is climbed on its wall with *CC'* distance (fig.4-b). The elements for suppress the forces are: couple moment M_r and friction force *T*. By balance equation of moments to point O_1 -center tool, respective for point *O* can be written:

$$M - M_r - TR = 0 \tag{7}$$

$$M - M_r - Tr = 0 \tag{8}$$

If, considering the both slide frictions having maximum values and by noted $S/R + \mu = \mu'$, where μ' is a friction coefficient inside of jointing and can be determined by experimental test, the moment M_f is:

$$M_f = \mu' \cdot RN \tag{9}$$

For decrease the magnitude of μ' is required to put between the contact surfaces a lubricant.

3. THE EXPERIMENTS

The skeleton diagram of straightening machine and cut off concrete steel by rings type "TIMCO"-Timisoara, Romania [8] is depicted in fig.5, where: *1,2*-chain of wheel; *3*-shift of involve roller; *4*-pulling roller; *5*-mobil cutter; *6*-stated cutter; *7*-spindle with eccentric; *8*-flyweel; *9*-lever; *10*-engaged lever; *CA*-involve group; *ME*-electric motor; CFE_m-electromagnetic coupling; *RT*-gear hob reducer; *Em*-electromagnet; *SD*-straightening drum; *J*-drain; *L*-restriction; *C*-cam.
The pulling and involve mechanism is compounded by straightening drum and pulling roller group. The straightening drum is compounded in general by a dram which is involve by main action motor with a revolve of 1600 rev/min. Inside of drum is mounted three moving bearings with screws to drum axe in parallel plane which are perpendicular on axe, difference between them with 90^0 or 120^0. The semi-finished is pulling off through bearings and formed in zigzag shape, by successive of

consecutive presses because of drum turning, which given straightening process (fig.6, where: *1*-concrete steel; *2*-straightening drum with five straightening rollers; *3,4*-pulling rollers; *5*-cutter).

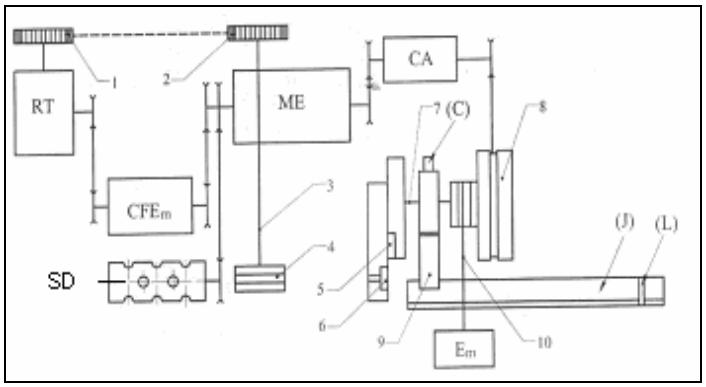

Figure 5. The skelton diagrame of straightening machine

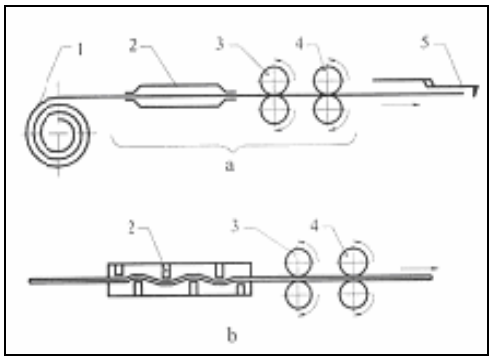

Figure 6. The straitening process flow.

For suppress the friction and wear rollers at straightening machine is required using lubricate at straighten concrete steel with a solution of dispersion talc powder and dextrina or water with lime [4], talc and dextrina or oleate of natrium with lime, borax in relevant contents, the compunds of solution is compatible with hidration goupe and hydrolize of cement from concrete, which being not necesary overoperatios of clan and conserving.

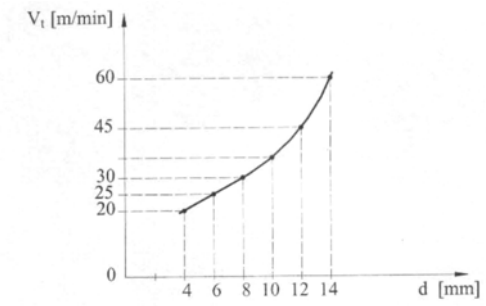

Figure 7. The experimental diagram of speeds turning to diameter of straghtening rollers.

The straightening machine of concrete steel having at drum revolve of 1600 rev/min an external speed of straightening bushes in range of 20-60 m/min dependig on diameter of concrete steel (fig.7), which is variable with the wear bushes in time. The pulling speed of rollers is 0.78 m/s to assure a high productivity and raising bushes durability at straightening operation of wires and concrete steel.

4. CONCLUSIONS

The straightening concrete steel process by rings with inner surface of bushes is made on special straightening and cut machine by successive straightening rollers with relevant speed of straitening bushes depending on concrete steel diameter (fig.7). For avoid excessive wear of straightening rollers is required using a lubricant, which increase tool life and quality surface of semi-finished material.

5. REFERENCES

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