JOURNAL OF ENGINEERING
annals OF
FACULTY OF ENGINEERING HUNEDOARA
TOME VI (year 2008), FASCICULE 1, (ISSN 1584 – 2665)

INSTALLATION FOR DETERMINING THE ROLLING FORCES

PINCA BRETOTEAN Camelia, TIRIAN Gelu Ovidiu

UNIVERSITY "POLITEHNICA" TIMIŞOARA
FACULTY OF ENGINEERING HUNEDOARA

ABSTRACT:
The experimental determinations of rolling forces inside the warm rolling cylinders are useful in case we have to guide and control the working stress. In case there are any high stress forces, they stress the rolling cylinders and cause damage and destroy them. This paper work refers to the installation used for establishing the rolling forces used for an experimental rolling-mill from the laboratory of Industrial Mechanical Systems, of the Faculty of Engineering from Hunedoara. The ideea of this installation can used to determine the rolling forces inside of the industrial rolling cylinders.
KEYWORDS:
installation, forces, rolling, tensiometer

1. INTRODUCTION

Rolling cylinders are used when working with complicated tensions, either mechanical or thermal. In order to calculate the mechanical tensions, specialists need to know anything about the forces involved into the rolling processing. Besides that, we have got to establish the rolling forces inside the warm rolling cylinders, which are useful in case we have to guide and control the working stress. In case there are any high stress forces, they stress the rolling cylinders and cause damage and destroy them.

This paper work refers to the installation used for establishing the rolling forces used for an experimental rolling-mill from the laboratory of Industrial Mechanical Systems, of the Faculty of Engineering from Hunedoara.

2. STRUCTURE ELEMENTS

In order to measure the experimental forces used with the experimental rolling-mill, we should establish that with the resistance translator tensiometer. This tensiometer is installed between the axial bushing from the top of the pressure screws and the bearings of the upper working cylinder of the experimental rolling device, [1]. Figure 1 represents a detail of the tensiometer which is a device meant for measuring the rolling forces.

If we know the mechanical features of the material, we establish the surface we need for the translator elastic body, [2]. If we know the value of this surface, we are able to design the translator's elastic body as we describe in figure 2.

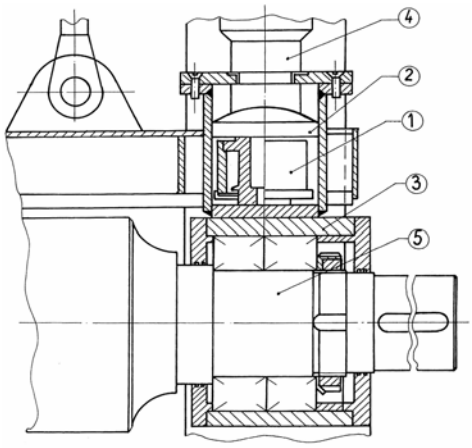

FIGURE 1. Tensiometer with resistance translators from the experimental rolling housing

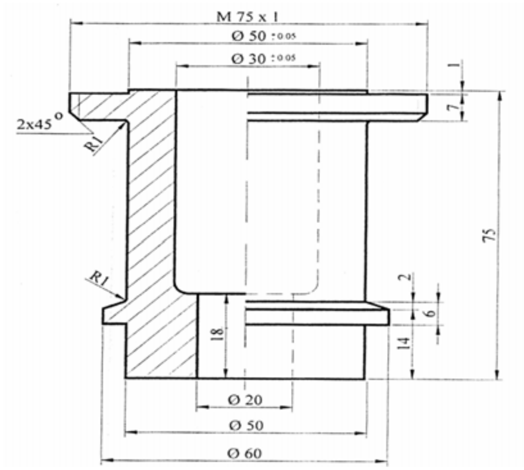

FIGURE 2. The design of the tensiometer elastic body

Because the place of the resistance translators tensiometer is damaged by the oil when using it for lubricating the pressure screws, and because of the temperature radiations of the half-processed rolling, the elastic body with tensiometer translators (who are connected to a metal box which is airtight at both ends) looks according to the image in figure 3. The tensiometer used for fitting inside the working housing is described in figure 4.

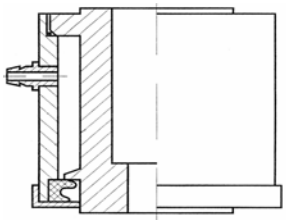

FIGURE 3. Fitting the elastic body into the tensiometer protection box

FIGURE 4. Fitting of the tensiometer for the working housing of the experimental rolling-mill

Cylinder 5 of the experimental rolling-mill transmits the rolling foe to the tensiometer 1. This tensiometer takes half the rolling force which is transmitted through the bearing 3, and it is situated underneath the axial bushing 2, which is placed inside the pressure screw 4. The tensiometer is situated inside a metal box which is locked up with a cross piece who connects it with the balancing springs of the upper cylinder.

According to the rolling drawing for a square section of 46 x 46 mm^2, which was obtained with the highest reduction and without restricting the breadth, we calculated the highest rolling force and the reaction of the bearings. According to the highest value of the rolling force, we are able to choose the material for the elastic body of the tensiometer. The material of the body is Arc 2 and has the following features:

- the longitudinal resilience module: E= 2,1 10^5 N/mm^2;
- the breaking tension σ_R = 1275 N/mm^2;
- the pouring tension σ_c = 1177 N/mm^2.

3. THE CALIBRATION OF THE INSTALLATION AND THE WORKING BLOCK SCHEME

In order to calibrate the tensiometer for measuring the rolling forces, we used a press and we gradually adjusted the compression forces; we measured the mili-volt tensions caused by a tensiometer bridge each time. The tensiometer bridge we used is a Wheatstone bridge – we used translators with resistance threads, and the electrical resistance is R = 586,6 Ω ± 0,2 %, while the constant value of the tensiometer sensitivity is k = 2,22 ± 1,5 % . The result of the calibration is described in Table 1.

Table 1.Calibration of the resistance translator's tensiometer for determining the rolling forces

No.	Application force F [N]	The electric tension u [mV]	No.	Application force F [N]	The electric tension u [mV]
0.	0	1.329	17.	$17\cdot 10^4$	7.220
1.	$1\cdot 10^4$	1.560	18.	$18\cdot 10^4$	7.500
2.	$2\cdot 10^4$	1.680	19.	$19\cdot 10^4$	7.840
3.	$3\cdot 10^4$	2.230	20.	$20\cdot 10^4$	8.120
4.	$4\cdot 10^4$	2.540	21.	$21\cdot 10^4$	8.250
5.	$5\cdot 10^4$	2.960	22.	$22\cdot 10^4$	8.440
6.	$6\cdot 10^4$	3.310	23.	$23\cdot 10^4$	8.720
7.	$7\cdot 10^4$	3.620	24.	$24\cdot 10^4$	9.000
8.	$8\cdot 10^4$	3.940	25.	$25\cdot 10^4$	9.330
9.	$9\cdot 10^4$	4.310	26.	$26\cdot 10^4$	9.700
10.	$10\cdot 10^4$	4.520	27.	$27\cdot 10^4$	10.15
11.	$11\cdot 10^4$	4.760	28.	$28\cdot 10^4$	10.38
12.	$12\cdot 10^4$	5.200	29.	$29\cdot 10^4$	10.62
13.	$13\cdot 10^4$	5.660	30.	$30\cdot 10^4$	10.90
14.	$14\cdot 10^4$	5.980	31.	$31\cdot 10^4$	11.10
15.	$15\cdot 10^4$	6.200	32.	$32\cdot 10^4$	11.55
16.	$16\cdot 10^4$	6.810	33.	$33\cdot 10^4$	12.02

The block scheme of the tensiometer made with resistance translators is described in figure 5.

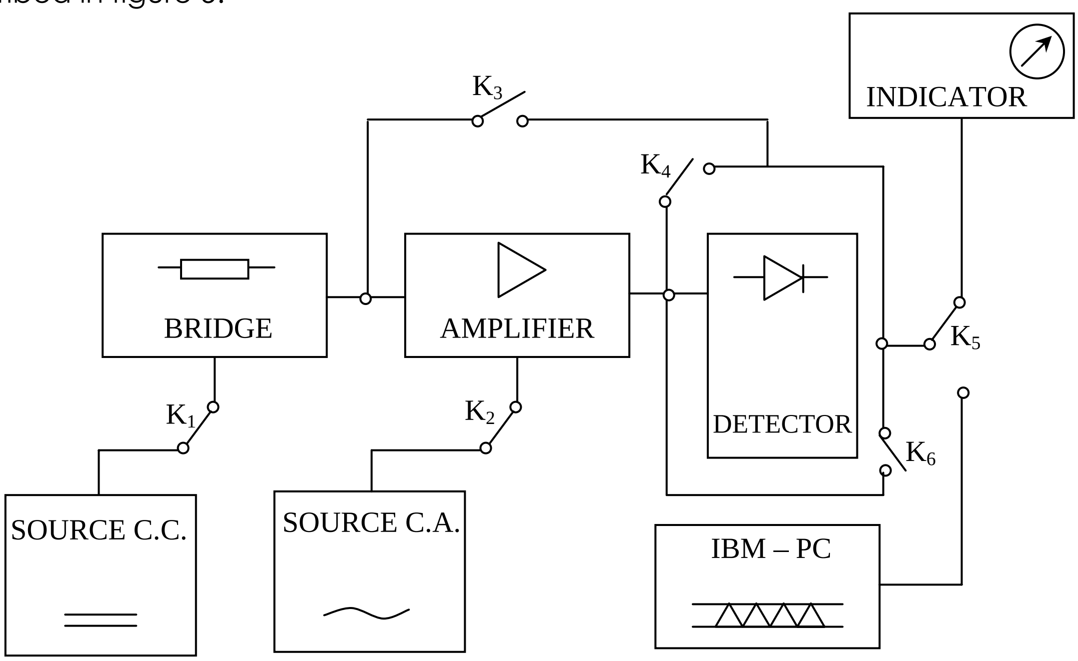

FIGURE 5. Block scheme of the resistance translators tensiometer

4. CONCLUSIONS

The installation we designed and made up allows us to measure the rolling forces during the rolling process, in case of the experimental rolling-mill from the laboratory of Industrial Mechanical Systems, from the Faculty of Engineering from Hunedoara. This installation could be used for measuring the rolling forces for the industrial rolling-mills.

There has been some research meant for establishing the behavior of the cylinders during the warm rolling process, in order to increase their working time.

REFERENCES / BIBLIOGRAPHY

[1.] TOADER ŞT, PINCA C., PLEŞA D. – Thermal fatigue of the hot rolling mill cylinders, Timişoara, ISBN 973-625-185-3, Romania, 2004

[2.] PLEŞA D. – Research about the way the cylinders work during the technological process of warn rolling was meant for increasing their lastingness - Docthoral Thessis, Petroşani, România, 2004