STUDIES ON MACHINE PARTS MADE OF WELDED CONSTRUCTION

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Abstract: *In this work it was analyzed a welded construction of a rollers which is part of a conveyor belt of a roll 84 inches. The roler taken under discussion is a roler that has an outer diameter of 89 mm and length of 504mm. The roller is accomplished up of a cylinder wherein spindles the axis of rotation are fixed with the help of some double disc by welds corner. Because it is known that the roller is requested by the concentrated force 5 kN, keeping account the dimensions of the elements and the material from which they are executed were determined requests that confronts the roler.*

Keyword: weld, machine parts, welded construction

1. INTRODUCTION

According to the literature, the design and technological design of welded structures occupy more than 75-80% of labor making for a device, machinery or a structure made by welding [1], [2] .

The design activity and design of welded structures technological consists of several stages: determining the technical and economic conditions on the welded construction; establishing the conditions for stress and exploitation, choice of shape and size of each piece of construction, of material quality elements, choice of welding process and quality class of weldment; final determination indications and transit Technology manufacturing of welded construction.

For preparation of manufacturing sequence of a welded construction it is necessary to respect the following steps: assembly drawing and welded parts drawings; manufacturing technology preparation and implementation of operations plans.

2. STRESS DETERMINATION AND CHECKING CALCULATION OF WELDINGS OF A ROLLER

In this paper we analyze welded construction of a conveyor roller. The roll is part of a 84 inches rolling conveyor [3], [4]. The conveyor belt has two types of rolls : upper rolls and lower rolls. The upper roller is a subassembly consisting of a cylinder (shell) in which a shaft is mounted, and at the ends are fixed boxes, bearings, felt rings and bearings caps. The lower roller is made of a cylinder (shell) in which the rotation axis spindles are secured by means of double disc with welds corner (figure 1). Also it is known that the rolling conveyor is requested by the concentrated force of 5 KN.

To do the calculation and verification of welds is necessary to establish first the grade of material. Thus, for cylinder (mantle) roll it is chosen a brand S235JR EN125-2 steel.

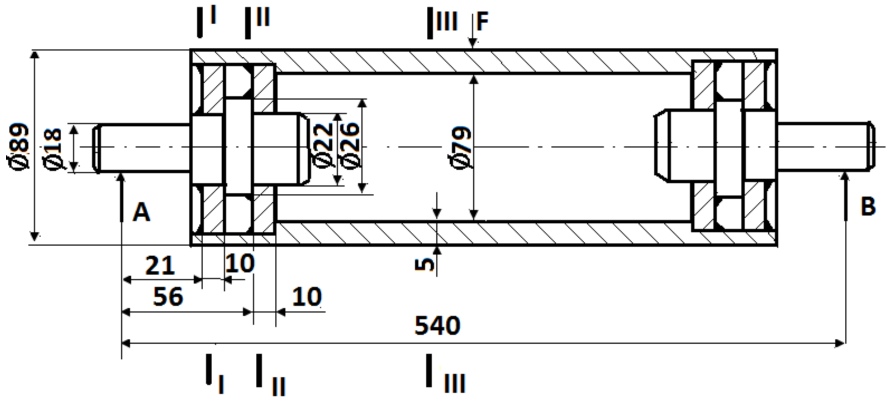

Fig.1. Rola transportorului cu bandă

Because the conveyor rollers working at temperatures of 10-15, will choose the grade of material like in the literature as follows: geometric form factor K = 1.4; functional importance factor S = 0.7 and loading factor B = 1.

In this case, the hazard ratio will be:

$$G = K \cdot S \cdot B = 1{,}0 \quad (1.1.)$$

For the roll shell will choose a S235JR EN125-2 steel , grade 2 of quality and for the drives ring will choose a S235JR EN125-2 steel grade1 of quality. For determining the request, we will consider the sizes of elements in I-I and II-II sections.

In section III-III, it is considered the general system of rollers like a simply leaning beam, static determined (fig.2).

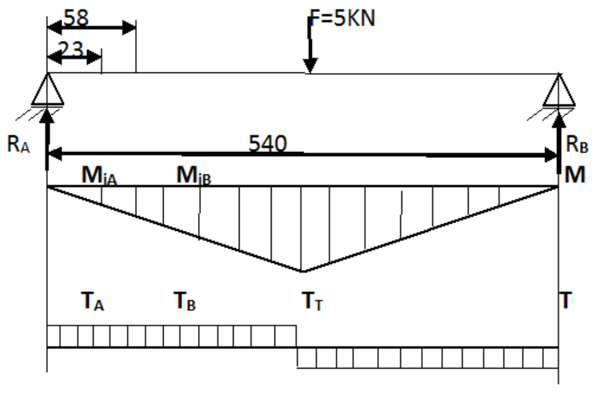

Fig. 2. Forces and reactions from sections,,III-III''

The reactions of A and B will be:

$$A = B = \frac{F}{2} = 2{,}5kN \qquad M_1 = F\frac{l}{4} = 5.\frac{0{,}540}{4} = 0{,}68kNm$$

$$M_2 = R_A \cdot 0{,}023 = 0{,}06kN \qquad M_3 = R_A \cdot 0{,}058 = 0{,}15kN \tag{1. 2}$$

$$T_1 = \frac{F}{2} = 2{,}5kN, \qquad T_2 = T_3 = T_1 = 2{,}5kN$$

When the roll has accelerated motion on the rollers acts an additional torsional stress which is:

$$M_{t\,\max} = 0{,}028kNm \tag{1.3}$$

Once calculated this, you can proceed to determine the sizes of the welds in sections ,,I-I'' and ,,II-II''.

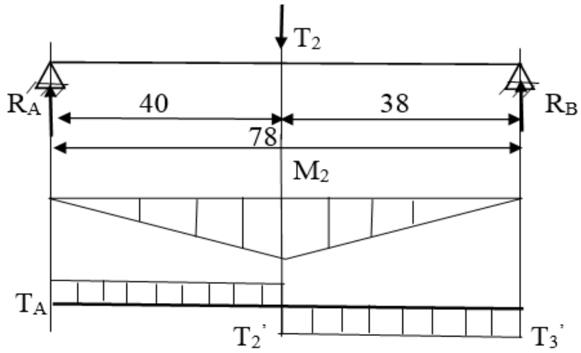

Fig.3. Forces and reactions from sections ,,I-I,, și ,,II-II,,

Because the roll axes are fixed in its shell through two welded with welding corner can consider that these claims are without bending. In this case, the forces in real plane are shown in figure 3 and determined by relations:

$$T'_2 = \frac{R_A \cdot 78}{38} = \frac{2{,}5 \cdot 78}{38} = 5{,}13kN \quad si \quad T'_3 = T'_2 - R_A = 5{,}13 - 2{,}5 = 2{,}63kN \tag{1.4}$$

For checking of sections ,,I-I" and ,,II-II'' starts from the fact that both contain the same corner welds. In section ,,I-I'' stress elements are:

$$T'_2 = 5{,}13kN \quad si \quad M_{t2} = 28 \cdot 10^3 N \cdot mm \tag{1.5}$$

It will do the calculations to verify the weld from A-A section which is connecting shaft to the annular disc. In this case it will be considered that the shear force is taken fully of welding. The tangential stress, in these circumstances, it will be determined using relations:

$$\tau_{T'_2} = \frac{T'_2}{A_{cs}} = \frac{5{,}13kN}{424{,}12mm^2} = 12{,}1\ N/mm^2 \quad si \quad \tau_{M_2} = \frac{M_{t2}}{W_{2cs}} = \frac{28\cdot 10^3\,Nmm}{2498{,}3mm^3} = 11{,}2\,N/mm^2$$

$$A_1 = \left(R^2 - r^2\right)\cdot\pi = (16^2 - 11^2)\cdot\pi = 424{,}12mm^2 \tag{1.6}$$

$$W_1 = \frac{\pi}{32\cdot D}(D^4 - d^4) = \frac{\pi}{32\cdot 32}(32^4 - 22^4) = 2498{,}3mm^3$$

The resultant tangential stress is given by:

$$\tau_{r.cs} = \tau_{T'_2} + \tau_{M_2} = 23{,}3\ N/mm^2 \tag{1.7}$$

Because we have a dynamic loading and fatigue is not a request, it follows that [5], [6]:

$$R_\sigma = 0 \quad \text{and} \quad \sigma_{acs} = 60\ N/mm^2 \tag{1.8}$$

The safety factor is:

$$c_\tau = \frac{\tau_{acs}}{\tau_{cs}} = \frac{60}{23{,}3} = 2{,}6 > c_a = 2 \tag{1.9}$$

Further calculation will be checking calculation for weld section A-A , which connects the annular disc to roll shell, so : $T'_2 = 5{,}13kN \quad si \quad M_{t2} = 28\cdot 10^3\,N\cdot mm$.

It is calculated:

$$\tau_{T'_2} = \frac{T'_2}{A_{cs}} = \frac{5{,}13kN}{992{,}74mm^2} = 5{,}17\ N/mm^2 \quad si \quad \tau_{M_2} = \frac{M_{t2}}{W_{2cs}} = \frac{28\cdot 10^3\,Nmm}{14555{,}3mm^3} = 1{,}92\,N/mm^2$$

$$A_1 = \left(R^2 - r^2\right)\cdot\pi = (41.5^2 - 38.5^2)\cdot\pi = 753.98mm^2 \tag{1.10}$$

$$W_1 = \frac{\pi}{32\cdot D}(D^4 - d^4) = \frac{\pi}{32\cdot 83}(83^4 - 77^4) = 14555{,}3mm^3$$

The resultant tangential stress resultant is given by:

$$\tau_{r.cs} = \tau_{T'_2} + \tau_{M_2} = 7{,}1\,N/mm^2 \tag{1.11}$$

Because $\sigma_{acs} = 60\ N/mm^2$, resulting safety factor:

$$c_\tau = \frac{\tau_{acs}}{\tau_{cs}} = \frac{60}{7{,}1} = 8{,}45 > c_a = 2 \qquad (1.12)$$

In this way are determined the welding sizes and the requests size for cross-section of the roller.

3. CONCLUSION

After all these calculation resulting the welds sizes corresponding to stresses to which the rolls are subjected for feeding tread band of the 84 inches rolling conveyor.

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