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Analysis of possible causes of cracks initiation on barking drum

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ABSTRACT

During operation of barking drum equipment the cracks were identified on the input part of drums cylindrical shell'. On the basis of operator request the analysis of reasons of possible causes of crack initiation on drum shell has been realized. The analysis includes numerical computations of stress fields in the locations of stress concentrators resulting from loading of drum during operation as well as influence of vertical offset of drives to the stress state in drum shell. The residual stresses in selected locations of drum shell were determined by the hole-drilling method. On the basis of analysis new concept of drum shell strengthening has been proposed in order to ensure its further safe operation.

1. Introduction

The aim of the paper is to provide a solution to the problems that arose during operation of the barking drum. On the shell of the drum, a number of cracks were detected and the operator of the equipment was concerned about its condition. The analysis of stresses and states was carried out by the numerical and experimental methods of mechanics.

The debarking process has been used in the pulp and paper mills for over a century. The pile of logs fed into the drum is put into crosswise tumbling or rolling motion by rotating the drum, which is fitted with log prisms welded to inner side of the drum shell. While tumbling and rolling inside the drum, the logs rub and hit against each other and bark loosens from the log surface. The drum shell has a number of longitudinal loop-holes (bark slots) through which the loose bark should come out of the drum. In principle, the barking drum is a combination of a debarker and a bark separation unit [1,2].

The method of debarking has evolved from a batch debarking to a continuous debarking process. In batch debarking, the debarking drum is filled to a high degree while keeping the discharge gate closed and rotating the drum. The second method uses continuous charging and discharging of the barking drum, and this type of equipment is described in the paper.

2. Structure of barking drum, localization of cracks on drum shell

The barking drum (Fig. 1) serves for debarking of logs with the length varying from 2.5 m to 6.0 m [3]. The apparatus consists of a drum body, driving and supporting tyres, a discharge gate, housing and exhausting system. In the drum, wood logs with diameter up to 700 mm can be processed, maximum capacity of the equipment is 320 m^3 per hour, and angular velocity of the drum during debarking is about 5 rpm [4].

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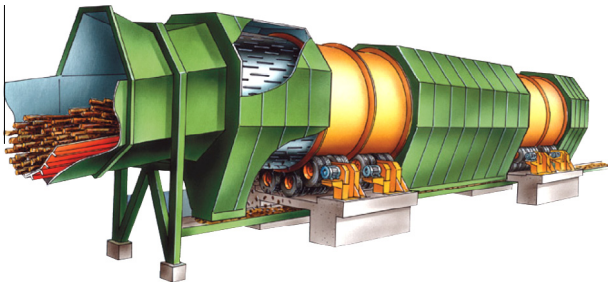

Fig. 1. Barking drum (from leaflet of producer) [3].

Fig. 2. System of rubber tyres for actuation of cylindrical drum shell.

The body of the drum is designed as a cylindrical shell and consists of two parts (front and rear), which are driven by the system of tyres (Fig. 2) with drives controlled by frequency changers. Rotation of the drum leads to debarking of logs inside the drum. In most cases, one block of drives consists of 16 tyres located on the circumferential and longitudinal directions of the drum cylinder (Fig. 1).

On the inner sides of both drum cylinders, 18 prisms are welded on their perimeters in the axial direction (Fig. 3). They serve for better debarking of logs during their rotation inside the drum. In the shell of the drum, loop-holes are created for bark removal (Fig. 3).

The body of the drum was made by welding of sixteen cylindrical shells where the last circumferential weld on the front (charging) part consisting of 10 cylindrical shells was done after positioning of the drum on the tyres, so that the inner prisms in the locations of the last circumferential weld of the front part of the drum were interrupted (Fig. 4).

Fig. 3. Longitudinal prisms welded to internal wall of drum shell.