APPLYING UNCONVENTIONAL TECHNOLOGIES TO OPTIMIZE THE MATERIAL FLOW CARRIED BY RUBBER BANDS

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Abstract: The present essay does not only embrace a purpose in itself – namely that of speciality, but it also approaches an important and actual issue, that of surface mining in Romania, which is also exhibited on a global energetic market and subject to an acute competition determined by multiple causes: competition with other alternative sources of power, competition with global mining, competition between units operating under different geomining conditions where distinct working methods are being used or even identical.

The solution proposed within this paper, namely the performance of an equipment for the instantaneous measurement of material discharge conveyed on high capacity bands by using ultrasonic sensors allows solving the problem of the already known excavated coal volume within the time unit, essential for the production pursuance for all machinery, for the costs assessment on the product unit and the tracing of each band's profitability on different scheduled sections.

1. INTRODUCTION

The method principle shall be studied which is based on the determination of instantaneous material section by means of 3 ultrasonic sensors, the measurement of band speed by means of the Hall effect transducer measuring drum recycling time. These data are taken and processed by local equipment. After processing by means of a software programs package in C++ Programming Language, the data obtained could be transferred to central equipment displaying the material discharge, the band status and the working time. The system also allows the control of programs package achievement. The solution proposed within this paper, namely the performance of an equipment for the instantaneous measurement of material discharge conveyed on high capacity bands by using ultrasonic sensors allows solving the problem of the already known excavated coal volume within the time unit, essential for the production pursuance for all machinery, for the costs assessment on the product unit and the tracing of each band's profitability on different scheduled sections. The constant display, within the shovelman cabin, of the excavated volume under the form of an instantaneous amount allows for the pursuance of band feeding, the elimination of non-productive moments and the information processing for determining profitability. The freight charges shall be widely reduced as the capacity increases, especially when the transport is done on a long length, due to loading at nominal rating of actuating motors which supposes a good power factor obtained naturally, achieving consumed power saving.

2. IMPLEMENTING THE SYSTEM FOR MEASURING THE FLOW IN THE TECHNOLOGICAL PROCESS

To achieve the implementation of equipment in the technological process we chose the equipment of SRc 1400 type from the quarry Jilt South within the CE Turceni. The proposed equipment for estimating the volume of excavated coal is composed of three blocks that function as a whole: USON (equipment for data acquisition in real time), LCD

(equipment for data presentation in real time) and UC (equipment for data processing in real time)

The experimental data collected by USON and serial delivered by UC which interprets the data and transforms the three sensors' response together with the bend velocity into a dynamic variable of the type "Volume of Excavated Coal".

These embodies only part of those displayed by the remote distance display devices, LCD. After starting the bend, one could notice that the device indicates a series of errors given by the so-called impulse band error appeared when starting the bands system. Interpolation procedure has four parameters entering and one minus. The first parameter is even mix tape (computer to ON_INIT () stored in the parameter RAM). The next three are just the distances from sensors to tape, these distances are decoded from the packet data communication via computer COM 1 serial interface.

Relatively instantaneous picture of the profile band - coal layer, as shown in Figure no. 1:

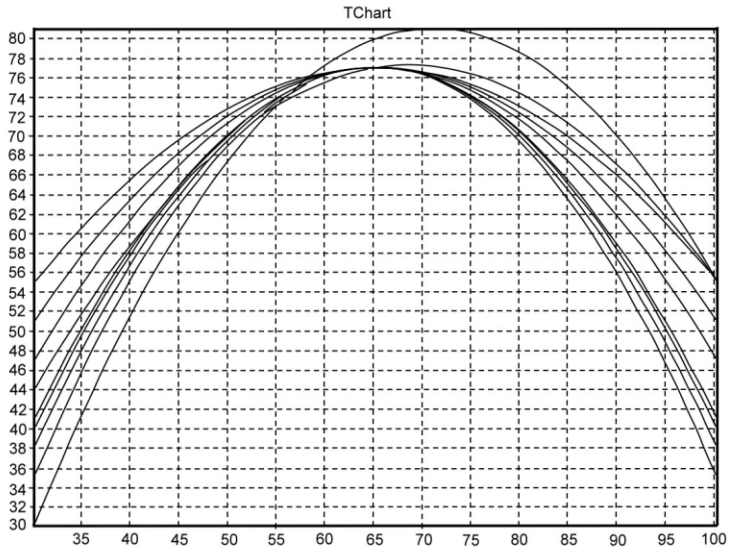

Figure 2. Relatively instantaneous picture of the profile band - coal layer

Applying the Lagrange interpolation method, the procedure returns the cross-sectional area in square meters occupied by the coal belt. Where one of the three sensors return a long distance, close to within 2% of distance bottom band - rod sensors, is considered the band at that point is slacking / sterile. In one case, all three sensors may have very close responses than 2% of distance mentioned above, where the cross-sectional area at that time very powerful time tends to zero, no longer requires a laborious calculation. The latter is just a particular case, but quite common in practice after the measurements and it is imperative to introduce the general algorithm. It was defined as the Lagrange procedure:

$$Instantaneous\ area = Lagrange\left(Tape\ configuration, ds_1, ds_2, ds_3\right) \quad (1)$$

where, ds_1, ds_2, ds_3 distances are even returned the sensors. The package is returned to the computer application identified two variables: time to make a full rotation (dt), and belt condition (sb), which may take two values ($go / stop$).

Applying the mathematical relation, $volume = base\ area * heigt$, it can thus estimate the vehicle volume coal conveyor belt. This volume is calculated amounted to a global variable defined by the program executed by the computer and constant conditions overcome a default configuration file.

The following figures display the evolutions of production capacities within the envisaged periods of time. The material has been excavated by the 03 excavator of the SRc 1400-30/7 type, from the quarry Jilt South within the CE Turceni functioning in quarry faces containing sterile layers with high thickness (g > 5m) and coal layers with relatively small thickness (which means that layers 8 and 9 have g = 0,75 - 1,5 m). The capacity peak reached on the 23.09.2011 characterizes the operating of the equipment of SRc 1400 type for the first level of sterile, a high thick layer of sandy sterile material which favours the equipment operation at a very big capacity, due to a very good loading of buckets and implicitly of the conveyer belt.

The figure 2 shows in detail the functioning of the equipment during the interval 20 – 30.09.2011 on a nine-day period, while sterile/coal is being excavated selectively in working faces containing sterile thick layers allowing obtaining high capacities, the peak being reached on the 24.09.2011.

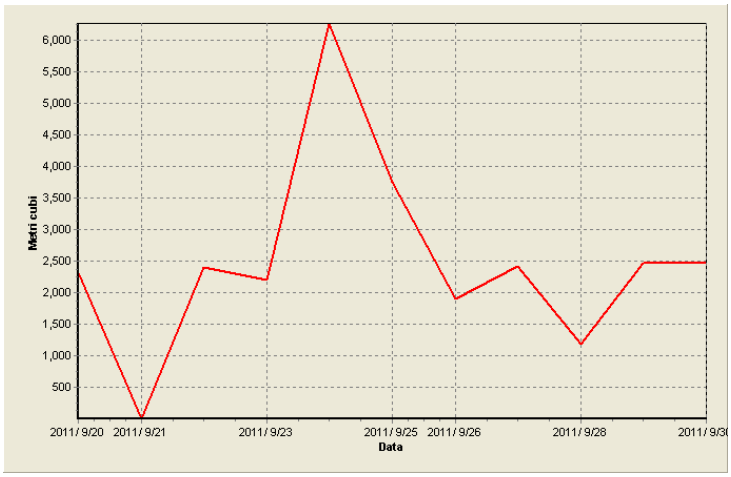

Figure 2

During the period 1.10.2011 – 26.10.2011, corresponding to figures 3 and 4 the equipment is excavating sterile in very thick layers

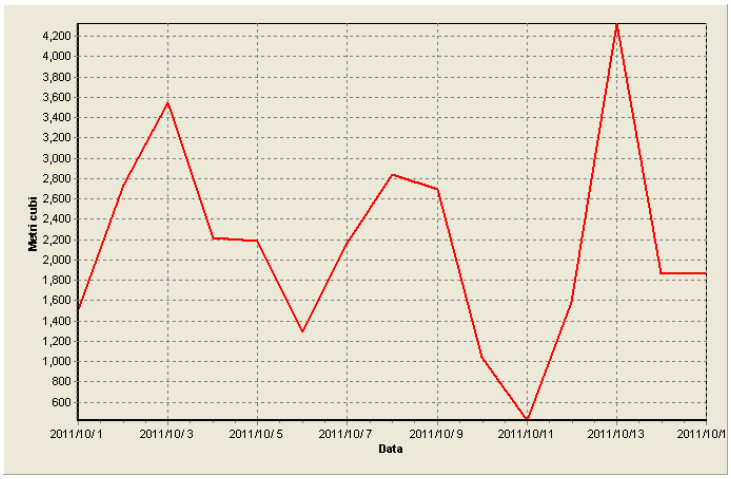

Figure 3

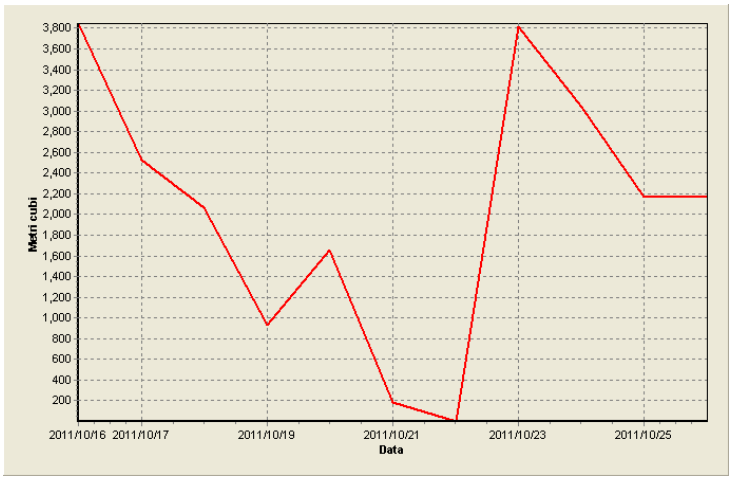

Figure 4

The capacity peaks are reached within faces containing dry sterile and sandy material, and the days when small values of the capacity are being measured, the machinery is excavating humid and soft material, this fact being associated problems related to the wear and tear of the stub teeth on the cutting buckets.

3. CONCLUSIONS

The solution implying the use of equipment provided with ultrasonic sensors allows solving the problem of the already known excavated coal volume within the time unit, which is essential for the production pursuance for all machinery, for the costs assessment on the product unit and the tracing of each band's profitability on different scheduled sections. The freight charges shall be widely reduced as the capacity increases, especially when the transport is done on a long length, due to loading at nominal rating of actuating motors which supposes a good power factor obtained naturally, achieving consumed power saving.

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