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MEASURING AND CONTROL SYSTEMS FOR THE EFFICIENCY OF HANDLED MATERIAL ON HIGH CAPACITY DRIVING BANDS BY USING ULTRASONIC SENSORS

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Summary: The method principle 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. The solution proposed within this paper 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 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. The experimental results of measurements. The interpretation of results.

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" are presented in table 1.

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. Within Annex the PP USON elaborated program is being found, by means of which the graphical representations of the functions $V= f(t)$ have been achieved.

The excavated coal volume, V is being calculated by means of the relation:

$$V = A \cdot e^{\pm B} = A \cdot 10^{\pm B} \qquad (1)$$

And the experimental results obtained are graphically represented as functions $V = f(t)$.

Table no. 1

Year	Month	Day	Hour	State of the belt	Volume of Excavated Coal
2006	2	14	13: 5:45	START	7.38515587133861E-0002
2006	2	14	13:12:54	START	0.00000000000000E+0000
2006	2	14	13:12:55	STOP	0.00000000000000E+0000
2006	2	14	13:14:18	START	0.00000000000000E+0000
2006	2	14	13:14:18	STOP	0.00000000000000E+0000
2006	2	14	13:14:57	START	0.00000000000000E+0000
2006	2	14	13:14:57	STOP	0.00000000000000E+0000
2006	2	14	13:15:39	START	0.00000000000000E+0000
2006	2	14	13:15:39	STOP	0.00000000000000E+0000
2006	2	14	13:16:18	START	0.00000000000000E+0000
2006	2	14	13:16:18	STOP	0.00000000000000E+0000
2006	2	14	13:29:41	START	0.00000000000000E+0000
2006	2	14	13:29:41	STOP	0.00000000000000E+0000
2006	2	14	13:52:48	OK	8.25616892870748E+0001
2006	2	14	13:53:45	OK	8.26881787845632E+0001
2006	2	14	13:54:32	OK	8.26104722666496E+0001
2006	2	14	13:56:37	OK	8.25977021615545E+0001
2006	2	14	13:57:32	OK	8.26111903019482E+0001
2006	2	14	13:58:17	OK	8.28634878400189E+0001
2006	2	14	13:59:14	OK	8.25090879945201E+0001
2006	2	14	14: 0: 8	OK	8.25016330956132E+0001
2006	2	14	14: 0:50	OK	8.25581633188121E+0001
2006	2	14	14: 1:34	OK	8.26992572042218E+0001
2006	2	14	14: 2:17	OK	8.26251801852486E+0001
2006	2	14	14: 3: 1	OK	8.25538811337028E+0001
2006	2	14	14: 3:46	OK	8.27079387773119E+0001
2006	2	14	14: 4:48	OK	8.25676931186463E+0001
2006	2	14	14: 5:23	OK	8.26182758455107E+0001
2006	2	14	14: 6: 4	OK	8.26895349037659E+0001
2006	2	14	14: 6:49	OK	8.25696873229172E+0001
2006	2	14	14: 7:48	OK	8.25200356887071E+0001
2006	2	14	14: 8:36	OK	8.25756733610469E+0001
2006	2	14	14: 9:19	OK	8.25878100554110E+0001
2006	2	14	14:10: 3	OK	8.26097017178254E+0001

The values of the material capacity (sterile/coal) has been represented in figure 4.19; 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 23.09.2006, 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.

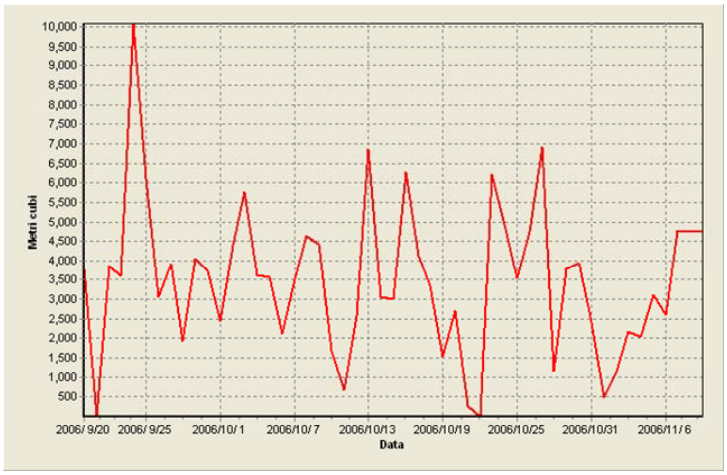

Fig. 1

The figure 4.20 shows in detail the functioning of the equipment during the interval 20 – 28.09.2006 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 24.09.2006.

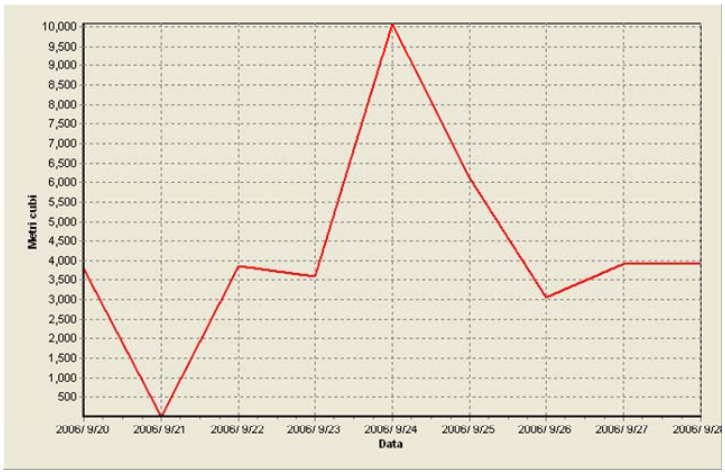

Fig.2

During the period 29.09.2006 – 22.10.2006, corresponding to figures 2, 3 and 4 the equipment is excavating sterile in very thick layers.

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.

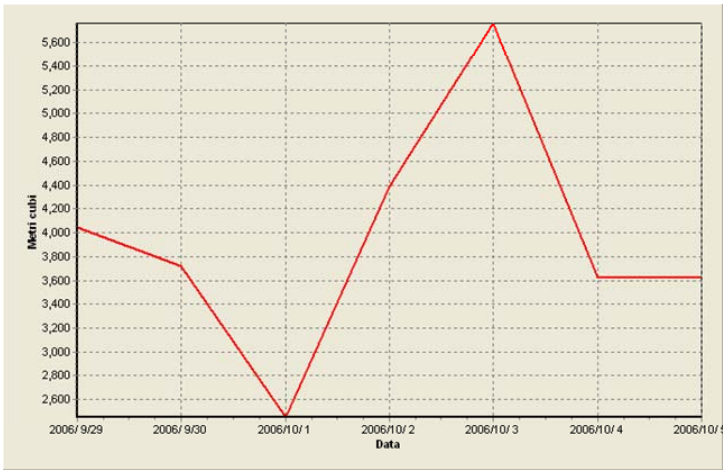

Fig. 3

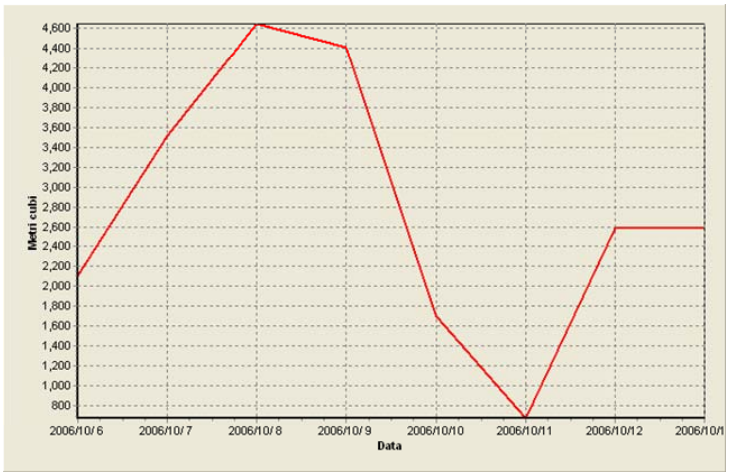

Fig. 4

3. Conclusions

The solution proposed in order to determine and control the volume (and implicitly the production) of sterile/coal conveyed on high capacity bands has a high degree of applicability in some other domains. Thus, future directions are foreseen and these are not necessarily related to mining industry. The method could be used successfully for determining the discharge of all materials that are belt conveyed: gravel, chalkstone, cement, etc.

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