STUDY OF AN AUTOMATIC INSTALLATION FOR TAKING COAL SAMPLES IN CHARGING STATION WITH CAD SOFTWARE

COZMA BOGDAN-ZENO[1]

Abstract: When delivering the lignite to the beneficiaries, manual sampling is practiced from the means of transport which, although it is tributary to human error generating subjective controversies between the parties, excludes the investment and responsibility for the realization of an adequate installation. The installation for automatic sampling of lignite samples, which was proposed to be made at the Jilţ Sud loading point, is fully made and is working.

Key Words: Automatic installation, coal, CAD software

1. INTRODUCTION

When delivering the lignite to the beneficiaries, manual sampling is practiced from the means of transport which, although it is tributary to human error generating subjective controversies between the parties, excludes the investment and responsibility for the realization of an adequate installation. Manual sampling is only an accepted but not recommended method, being tributary for the following reasons:

- The subjectivity of the prover and the proofing assistant leads to disputes between the producer and the beneficiary.
- Full compliance with the sampling technology implies; a long sampling time and intense physical work in harsh conditions, especially in the cold season, lead to compromises that increase testing errors;
- The staff is oversized both at the producer who ensures the sampling and processing of the sample and at the beneficiary who ensures the supervision of the testing operation;
- The long duration of sampling operation, in compliance with the standard provisions generates additional expenses for the parking of the means of transport.

[1] *Assoc. Prof. Eng., Ph.D. University of Petroşani, bogdancozma@upet.ro*

Moreover, specialized literature recommends excluding manual testing in the case of large-capacity deliveries. The replacement of manual sampling, from the means of transport by rail or car, with the mechanical, automatic one, from the flow of material in motion, in the case of high loading rates achieved with the help of high-capacity conveyor belts, ran into a series of problems.

2. CONSTRUCTION AND OPERATION OF THE AUTOMATIC LIGNITE SAMPLING PLANT

The automatic sampling of elemental material samples involves obtaining in the first stage a quantitatively representative elemental sample, which through subsequent mechanical processing (crushing and division) leads to obtaining the sample for the laboratory.

The sampling device at the Jilţ Sud loading point, in order to ensure the sampling of a representative sample, must meet several requirements, namely:

- have a device that takes the dynamic energy of the material and directs the material to the sample sampling device;
- to take the elemental sample by going through the entire falling lignite flow;
- to eliminate any possibility of intentional or accidental contamination of the sample.

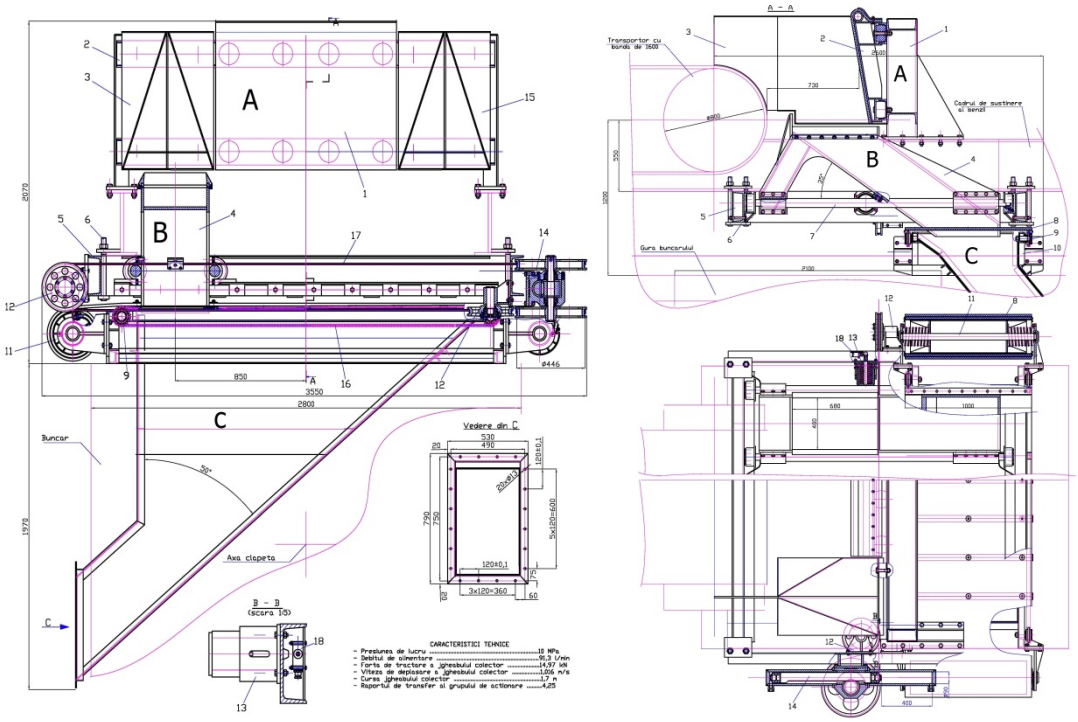

Figure 1. Automatic installation for taking elementary samples of lignite

To meet these requirements, the automatic sampling installation, shown in figure 1, is designed from three subassemblies:

- the deflector shield A is composed of the metal frame 1 stiffened on the support frame of the belt conveyor, the deflector screen 2 and the steering screens 3 and 15.

- the sample sampling device B is made up of the collecting chute 4 which takes the sample from the free-falling material flow by deflection, the support frame 5 with the running tracks, roller axles 7, the cable wheel 12 and its drive group 14.

The movement of the collecting chute through the jet of falling material in a rectilinear-alternative movement, with constant speed, is done with a tractor cable in a loop 17, which is wound and unwound from the two drums of the drive group 14 and passes over cable wheels 12.

The elemental sample collection system C, consists of: the sealing strip 8, the chain wheels 9, the collection chute 10 and the tape winding drums 11. The sealing strip 8 protects the opening of the collection chute 10 against accidental or intentional penetration of material quantities foreign to the elemental samples taken.

The sealing tape 8 is wound on two drums 11, which have two helical torsion springs inside that keep the rubber carpet in a stretched state, thus achieving a good sealing of the intake chute 10. The tape 8 is transversely stiffened with metal plates which rests on two roller chains 15 that run on the chain wheels 9. Both the sealing strip 8 and the roller chains 15 are driven together with the collecting chute 4 by the drive group 14. To reduce the shocks when stopping and starting the collecting chute, two damping pads with spring 13 were provided, which also actuate the travel head limiters.

The time interval between two successive samples can be adjusted according to needs with the help of a time relay, if the sampling is done at equal time intervals, or with an integrator relay that acts after loading equal quantities of product, both variants being allowed by STAS.

In the present case, according to what was presented, the variant of sampling at regular time intervals (t=2.5 minutes) was adopted, ensuring an appropriate number of elementary samples as well as a quantity of representative sample far above that imposed by STAS.

Depending on the results obtained, as a result of the tests for the approval of the installation, the minimum number of samples and the interval of taking two consecutive samples will be determined so that the sample for the laboratory falls within the degree of precision imposed by STAS.

3. THE CONSTRUCTION AND OPERATION OF THE LIGNITE SAMPLING DEVICE

Figure 2 shows the constructive solution of the device for taking the lignite sample from the discharge flow on the belt conveyor, which consists of: 1 – support frame; 2 – sampling trough; 3 – cable deflection wheel; 4 – shock absorber for end of

stroke; 5 – oscillating hydraulic actuation group; 6 – looped cable; 7 – fixing clamps on the belt conveyor support.

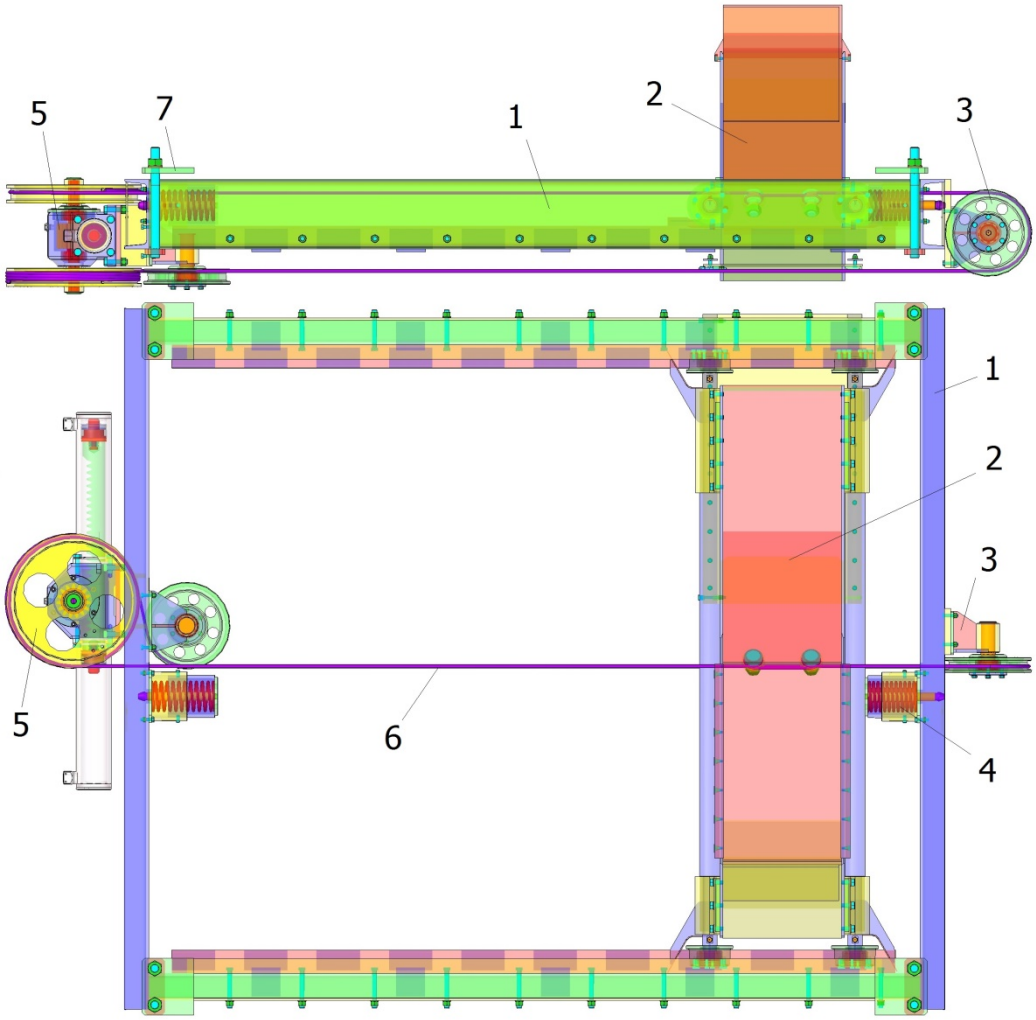

Figure 2. Device for taking the lignite sample from the discharge stream from the belt conveyor

Position the sampling chute at the end of the stroke, as in the figure above. The end of the towing cable is fixed on the upper wheel of the hydraulic drive group with the help of the clamp and a wrap is made on the wheel. The other end of the cable is passed through the holes in the support frame, over the two deflection wheels and wrapped in four turns on the lower wheel of the hydraulic drive group. Before stretching the cable on the deflection wheels, it is attached to the sampling chute. Fastening is done by making two loops on the two threaded bolts of the gutter and tightening the clamps with one M30 nut each.

The constructive solution of the chute for taking lignite samples is presented in figure 3, which consists of: 1 – the metal construction; 2 – large clamp with rubber damping bushing; 3 – axle of the wheel train; 4 – small clamp with rubber damping bush; 5 – squeegee for cleaning the running path; 6 – wheel with oscillating radial bearing with barrel rollers in two rows 22308; 7 – ball lubricator UB3; 8 – clamping clamp of the tractor cable; 9 – knife; 10 – clamping system of the end of the tape that covers the receiving chute.

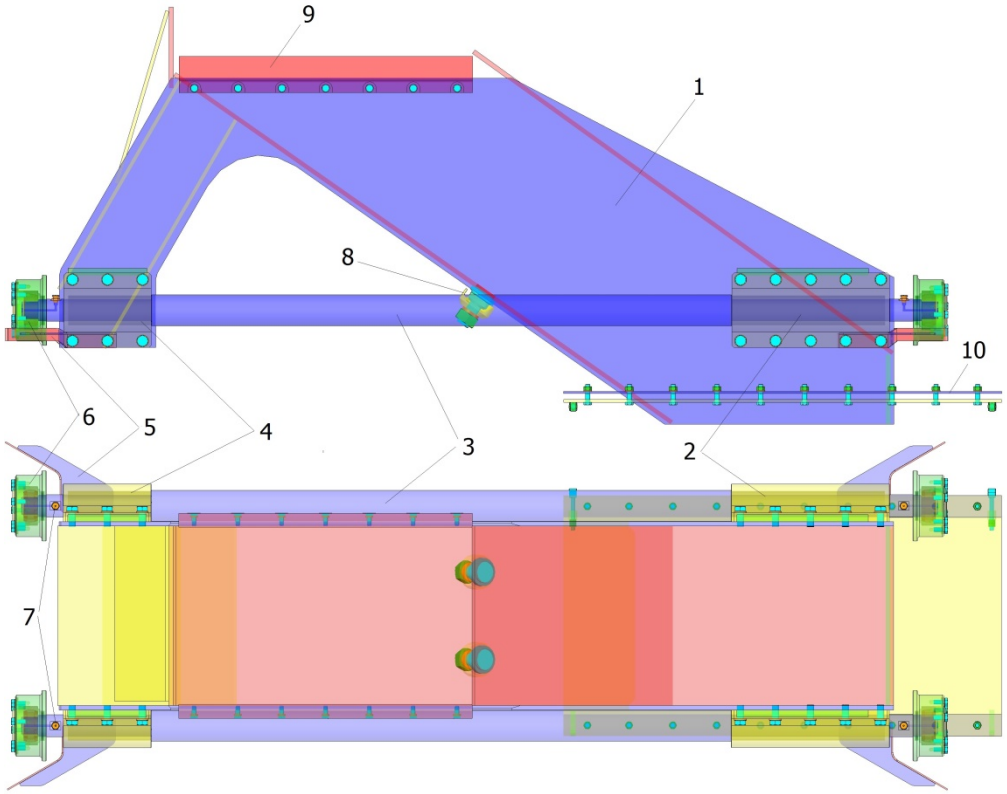

Figure 3. Chute for taking lignite samples

4. CONSTRUCTION AND OPERATION OF THE HYDRAULIC DRIVE GROUP OF THE AUTOMATIC LIGNITE SAMPLING PLANT

The hydraulic drive unit is designed on the principle of a double winch driven by an oscillating hydraulic motor with a rack.

The drive unit is shown in figure 4, being composed of a housing 1 inside which the toothed wheel 3 is mounted on the splined shaft 2. The splined shaft is supported by two radial barrel roller bearings in two rows, mounted in the housing and in the cover 4. On the grooved ends of the shaft, the two drums 5 for winding the cable

are mounted, which are equipped with clamps 6, for holding the ends of the cable in a loop. The positioning of gears, bearings and drums on the shaft is done with the help of spacer rings and retaining washers 7, and the sealing is done with the help of an O-ring and two rotation sleeves.

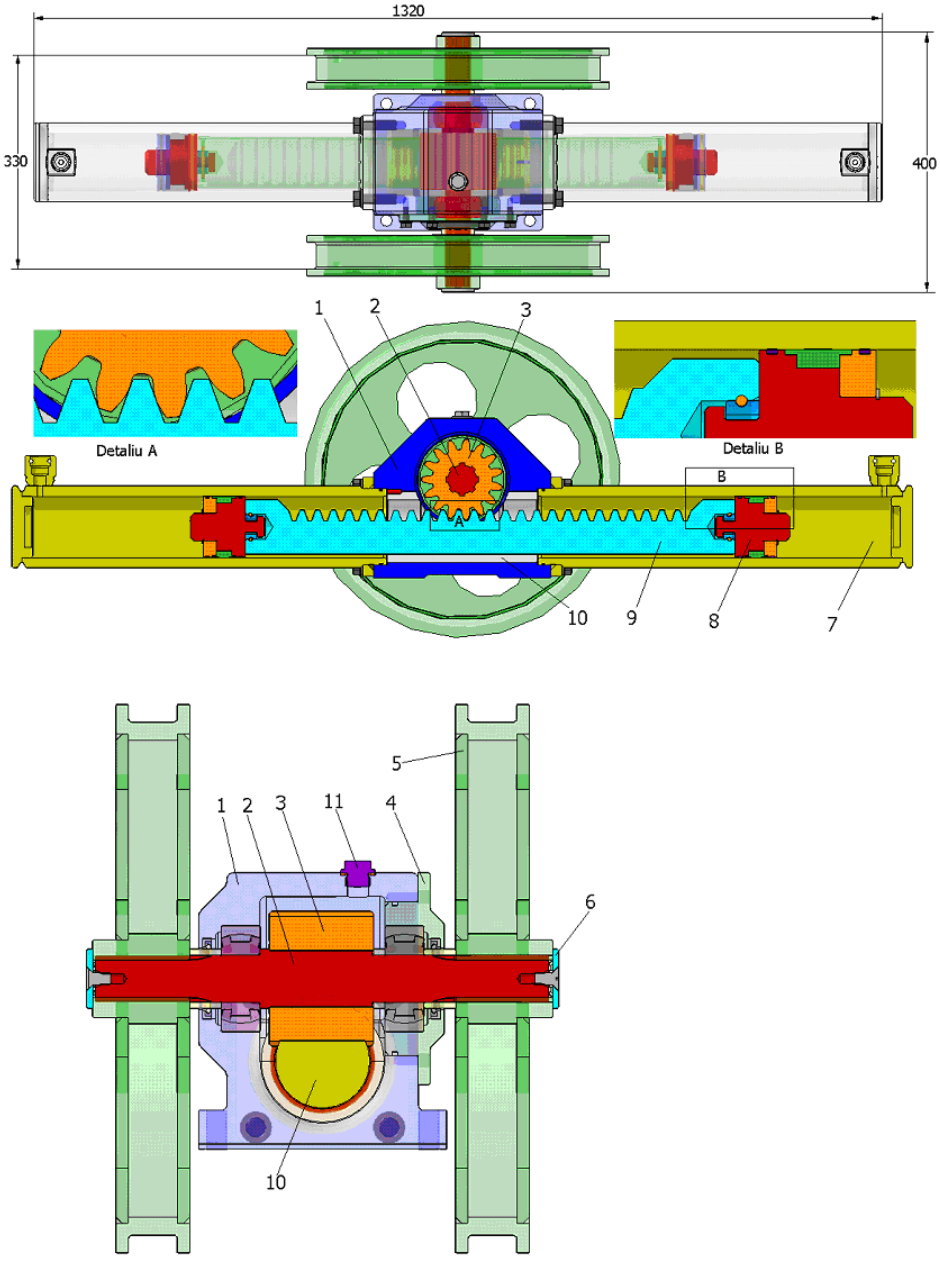

Figure 4. The 3D model of the drive group for the automatic plant to take samples of lignite from the stream to be loaded into wagons

On the housing 1 there are cylinder uprights 8, inside which the pistons 9 move, which realize the rectilinear-reciprocating movement of the rack 10. The assembly of the piston to the rack is done by a retaining system, with radial play, which allows the independence of the positioning of the piston against the rack. The sealing of the cylinders to the casing is done by O-rings.

The rack is guided by the bronze bushing 11, which has the role of taking over the radial forces from the pinion-rack gear. The positioning of the bush against the housing is done by a cylindrical pin.

The introduction of the oil for greasing the pinion-rack gear is done at the threaded plug 12.

The actuation group is fixed on the frame with the running tracks 5 by means of four M16 screws.

4. CONCLUSIONS

The installation for automatic sampling of lignite samples, which was proposed to be carried out at the Jilţ Sud loading point, is provided for:

- with an elastic screen type device that takes the dynamic energy of the lignite discharged from the belt and directs it towards the sample sampling device;
- the sampling of the elemental sample is done by completely traversing the falling lignite flow at a constant speed and at time intervals established according to the testing standards;
- elimination of any possibility of intentional or accidental contamination of the sample;
- with the possibility of automating the sampling and processing of the sample up to the delivery phase to the lignite chemical analysis laboratory.

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