

HOISTING ENGINE COMPOUND FACILITIES - SCIENCE AND RESEARCH APPLICATION IN CZECH REPUBLIC

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ABSTRACT. Hoisting engine type facilities (i.g. Koepe winder) ensure guaranteed output i.e. extraction of minerals (exploitation) and both personal and materials transportation services. Depth average of coal mines in extraction zone was formerly up to 1560 m (Uranium ore mines) .For the time being (at present) usually deep mines depth level is at average 1100 m approximately (ČMD, a.s. corporation. All components comprise latest both scientific development and technology latest know-how accordingly to praxis in work effectiveness requirements.

НАУЧНО-ИЗСЛЕДОВАТЕЛСКИ ИЗСЛЕДВАНИЯ В ЧЕШКАТА РЕПУБЛИКА ОТНОСНО КОМБИНИРАНИ ПОДЕМНИ УСТРОЙСТВА

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РЕЗЮМЕ. Този тип комбинирани подемни устройства осигуряват гарантирано количество производство, в т.ч както добити минерални суровини, така и транспорта на обслужващия персонал и необходимите материали. Средната дълбочина на въглищните мини в добивната зона до скоро беше около 1560 м (Уранови мини). В настоящия момент обикновено тези дълбочини – е приблизително около 1100. Всички компоненти обхващат последните научни разработки и технологии, най-новите познания от практиката, така че да отговарят на изискванията за ефективна работа.

1. Introduction

Development at deep-mines transportation technology , both vertical skip hoisting included personal transportation proved to be culminating during period between 1948 up to 1967 years.

The very first crisis noticed falls between 1968 – 1970 yeras. Than it came to a great step in development of minerals extraction. Simultaneously there was a new requirements on increased emphasis at vertical transportation improvements dealt with such a situation and consequently its solution.

2. Hoisting engines (TS)

So called engines of a first generation i.e. an asynchronous motor types of maximum output attainable at about 1 MW is at present time a thing of the past, (brought this point of view of up to date). The only existing exceptions are in circumstances of so called "blind holes" or holes aimed at helping underground works operation supporting.

So called engines of a second generation drive, direct-current equipped with a rotary convertor (dynamotor) of a Ward-Leo type, so these are in operation from 1960 year up to a present days.

It has to be noticed that above spoken engines were delivered via ŠKODA PLZEŇ CORPORATION up to 1965. And consequently accordingly to Czech government decision as a general general contractor (i.e. overall supplier) was dedicated ČKD Praha corporation. In 70-tieths of the previous 20-tieth century, there were introduced in operation multiple – ropes engines marked as 4k4016 . Declared engines' performance 2x1, 75MW, usable workload was 20 tons, an average hoisting speed 14ms^{-1} (16ms^{-1}).

So called engines of a third generation drive, delivered only via ČKD Praha (with exemption of transportation) than included types are as follows 2B6018/21, 2B6124 a 4K5016.

Useful workload-skip-hoisting is 35 tons, at average hoisting speed 18ms^{-1} (14ms^{-1}), transportation depth at 1000 m.

Operation process control (regulation) in former state was done with help of 12 pulse thyristor.

Main stress is laying on programmed speed control. A special precautions are taken into account as for end skip-buckets positions.

In this case there was computer technique method used and simultaneously backing up acquired data writing it into data medium (data-carrier).

For existing technologies as for both 2nd and 3th engines generation machines used, there were developed special friction (wheel-brakes disks), multiple ropes disks with help of computation techniques correspondingly relevant to those present "time-line" accessible.

In the period comprising years from 2002 year and later on, this computation technologies used when developing new construction methods were namely - finite element method (FEM).Accordingly to hoisting facilities actual state situation (TZ) than relevant steps were taken correspondingly to reconstruction requirements.

Also further on design computation and construction of the main engines compounds were realised in accord with both latest science and research know-how (knowledge) – main shafts (arbours), shafts bearings (recently friction bearings, but for the times being anti-friction bearings (or so called rolling bearings) 500 mm up to 740 mm diameter, shoe-type brake (or so called brake shoe) in recent times, now at present times it is disc modular system constructions.

9/2005 there are prepared for expedition to foreign countries hoisting engines of which parameters are as follows:

- a) 6 ropes, - hoist tower, Koepe, type 6K5012;
- b) 2-drums type 2B5024;
- c) useful workload (skip) 45 tons;
- d) speed of mining work operation 10,5 ms⁻¹;
- e) mining shafts depth 405 m;
- j) installed rated capacity 2x4 MW (Koepe)
2x2,5 MW(2B5024).

3. Vertical holes equipment

3.1. Drums type (TS)

Engines are situated in retractable holes and serve the purpose of both materials and persons transportations (at max. speed 12 m⁻¹). Equipped with 4-etage (4-floor) cages (72 person).Routing slide rails – wooden and clued guidance facility, span pieces and shaped cross-member- steel beams, U, I, shapes or angular (squared) pipes.

3.2 Friction TS (Koepe)

Operating engines a great deal are running within in ventilacion holes as two-ways operation skip facility. Guiding of buckets – steel angular (squared) pipes ((150/150 or 150/200). Spans and cross-mebers – recently U, I now angular (squared) pipes.

In the event of occurrences aggressive pit water (mine waters) containing both iodine water and bromine waters and NaCl, than in these cases a special materials are used designed for anticorrosive purposes.

For dynamics subsystem assessment dealt with transportation vessel (pot, container) – hole equipment facility, the mathematical model was created named „DYNAD“.

Simultaneously verification is also done accordingly to ČBÚ Praha Vyhláška č. 415/2003, Sb. regulations after every 2 years succeding and it takes place for all TZ with declared speed above 8 ms⁻¹.

For these cases there were developed on our department the digital recording system aimed at continuous recording immediate acceleration of the relevant subsystem.

Protocolarly this document is a part of audit-document, so called "Two years periodical complex audit (inspection) TZ".

4. Conclusion

For further needs of mining enterprises there are running research works within our department of which main goals are aimed at life-span prolongation namely hoisting equipment , especially main holes i.e. with diameter 7,5 m equipped with 2 operational TZ.

Science and research became a great deal a matter of computation (computing works), projects and construction of TZ and TS. It comprises cooperation of VSB – TU Ostrava, Department of Machine Parts and Mechanisms and contractors (i.e. providers, suppliers).

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