The prospects of introduction of surface miners in technology of development of deposits of contiguous seams of the limestone

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A B S T R A C T

The main ways of use of the limestone extracted with help of open-cast mining are considered. The main mining-and-geological and mine technical peculiarities of limestone flat seam are established. Disadvantages of technique in operation of limestone open-cast mining are given. The most effective order of mining which reasonable at development of flat sheet grounds. Field development technology of the limestone contiguous seams with use of the surface miners, allowing to increase efficiency of development of deposits, to increase productivity of the overburden equipment and to save time of working off of overburden bench is offered.

INTRODUCTION

Calcareous rocks are the raw materials consumed by various industries and agriculture [1].

One of the most valuable types of carbonate raw materials are the limestone used as the main guimboil in ferrous and nonferrous metallurgy and by alumina production [2].

Limestone is used as one of the burden components, and also for desiliconization the aluminate liquor in alumina production from nepheline ores [3].

Raw mixes, consisting for 80–85% of low-magnesian carbonate breeds, for 15–17% from clays and a small amount of pozzolons (molding box, bergmeal, diatomite), are used for production of cement [4].

In a form of a bedding of mineral products all carbonate deposits, including deposits of flux limestone and raw materials for cement production, are presented by sheetlike or pod-like forms of deposits [5].

Open-cast mining of flat seams of limestone with slides of restricted power has the specifics, and technological schemes of conducting mining operations when developing such deposits have the features.

Limestone belongs to group of semi-rocky rocks, and development of breeds of given group demands preliminary preparation of the massif for digging-out by drilling-and-blasting, mechanical or in a different way.

The analytical review of project documentation of the mining companies which are carrying out development of deposits of limestone, allowed to establish that for preparation of mined rock for digging-out, they generally use drilling-and-blasting works which conduct to considerable costs of drilling and explosive materials. The cost of production of drilling works on open-cast mining makes from 16 to 36% of a total cost of digging out of a ton of mined rock [6].

Carrying out of huge blasts is connected with allocation of large volumes of dust and gas mixture and creation of serious earthquake exposure of territories which border on a strip-pit.

Shattering of the mined rock by explosion leads to uneven length frequency of the broken ground, and the shattered mineral consists of pieces of the different size – from flour particles to boulder, which settled by the sizes of implement of loading shovel and coarse-ore bins of crushing stations.

Due to the high yield of boulder in process of production it is necessary to make its crushing by mechanical means or with recovery of energy of explosion by mud caps.

In this regard, the prime cost of mining increases because of need of involvement of additional forces and means in process of development.
The mineral mined with use of a preliminary shattering by explosion, is exposed to additional qualitative fragmenting of all stages. Processes of fragmenting of rock are connected with allocation of large volumes of dust, considerable noise loads of surrounding territories, and also the increased industrial hazard to the attending personnel.

Production of huge blasts when developing semi bedrock leads to emissions of combustion products of explosives in the atmosphere that renders big harm on ecology of a pit and surrounding grounds, especially when huge blasts are carrying out.

The grounds, where reclamation for forest plantations and reservoirs is carried out, become soiled, ground waters get littered.

The blast has an effect on high-cube of surrounding rocks and breaks solidity of the solid, exercising influence thereby over stability of slopes in a pit.

Besides all above-mentioned, conducting drilling-and-blasting in a pit is connected with dangers for workers of a blasting site when explosives are delivered and located. The blown-up solid of mineral needs extra works on destruction of boulders.

By way of the solution of above-mentioned technique in operation’s shortages of open-cast mining of deposits of limestone, it is necessary to apply surface miners as the detting loading equipment which allow to develop effectively the solid of rocks with strength of 30-70 MPas without preliminary ripping of rocks by blast [7, 8].

Systems of development by longitudinal stope with transfer of waste rocks in the developed space are one of the most effective ways of mining operations at opening of sheet ground. In these systems of development the equality of speeds of movement of an overburden and mining stope has to be observed. For ensuring standard volume of the accessed reserves the overburden excavator has to advance mining excavator and return to the beginning of the following stope after working off of an overburden stope. And the mining excavator also comes back by the beginning of the stope.

During cooperative working off of three contiguous seams of limestone mining is operated by six benches at the same time: top overburden bench, top mining bench, a bench of the first rocky seam, a bench of the second mining bank, a bench of the second rocky seam, a bench of the third mining bank. [9].

The overburden excavator is arranged on a roof of the top bank of mineral and works off the top overburden bench, using receding course with the upward digging, and pours out overburden rocks on work platforms of the ground pay horizons. More powerful overburden excavator is on a roof of the third bank of mineral and works off the second overburden bench, bulk of reexcavations and a seam between the second and the third mining benches, using a coming course. Due to such location of the second drag line it works with the maximum radius and unloading height, arranging overburden breeds in the developed space.

Mining technology which using surface miners in pits there limestone is got out, are the perspective direction of development of an open-cast method, because of possibility of combination of several main operations of mining practice in the same process (developing rocks for mining extraction, directly mining extraction and degradation) [10].

Difficulty of using process flowsheet with application as the mining equipment, and drag-line excavator as the overburden equipment, consists in reexcavation of large volumes of overburden rock in the course of development of a deposit.

By way of optimum alternative of mining operations with use of surface miners in field development technology of the contiguous seams of limestone the geometrical model of a site of mining operations (Picture 1) was developed. Management of parameters of mining operations on benches of the site of deposit allowed to establish the best available technology of mining operations on all six benches, providing the minimum volumes of reexcavation of overburden rocks.

Picture 1: The diagram of mining operations with use of surface miners in a field development technology of contiguous seams of limestone.
By way of transition to blast-free technology and miniaturization of reexcavation of overburden rocks when developing fields of three, divided and blocked by comminuted overburden rocks, contiguous seams of limestone, it is necessary to make limestone dredging by inclined benches with use of surface miner.

The offered technology of development of deposits of the contiguous seams of limestone allows to increase efficiency of development of deposit, to increase productivity of the overburden equipment and to save time of working off of overburden benches.

REFERENCES