Abstract

The dissertation work of Shontayev Askar Dzhamanbayevich on the topic "Improving the Anti-Outburst Measures During Mine Workings at the Mines of the Karaganda Coal Basin" was performed at the Department of Development of Mineral Deposits of the Karaganda Technical University.

The relevance of the work. The coal seams currently being developed at the mines of the Karaganda basin are characterized by high gas content and, as a result, have a tendency to dangerous gas-dynamic phenomena (sudden emissions of coal and gas, rock impacts, souffle gas emissions, etc.). Sudden emissions of coal and gas belong to the category of the most dangerous in their catastrophic consequences, accompanied by the destruction of mine workings, machinery and mechanisms, injury to people, often with a fatal outcome and the release of large masses of crushed coal and gas.

Currently, although a variety of technical and technological measures have been developed to prevent the occurrence of sudden emissions of coal and gas, but still, for the most part, they have a number of disadvantages and are generally characterized by insufficient efficiency. The reasons for these shortcomings are primarily related to the lack of information about the conditions of occurrence of coal seams and the little-studied nature of the sudden emissions themselves, then with the high complexity of execution and the high costs of the measures carried out, as well as their low technology and multi-operability.

In order to ensure the safe conduct of mining operations in coal mines, it is important to establish potential sources of sudden emissions in formations (hazardous zones) by the factor of the manifestation of sudden emissions of coal and gas. Sudden emissions of coal and gas, as a rule, occur in areas of geological disturbances. Of the 60 cases of coal and gas emissions in the Karaganda coal basin, 23 were associated with discontinuous disturbances of the type - upsurges, 19 - to zones of minor tectonic disturbances, 10 emissions occurred in the zone of reservoir thickness change (thinning or inflating) and 1 - in the zone of a sharp change in the hypsometry of the formation. The gas content of explosive formations at the depth of coal and gas emissions ranges from 10.7 to 22.1 m^3/t.

When mining through a coal seam, an area of reference rock pressure is formed in front of the face, where compressive forces occur, reaching values significantly greater than in an intact massif. A correct assessment of the stress-strain state of the massif during the movement of the preparatory faces allows us to establish the nature of deformations of the coal seam, dangerous for sudden emissions in the plane of stratifications, which are actively manifested in an area equal to 1.5-2 times the height from the bottom of the mine, which corresponds to the size of the emission cavity and is an indirect confirmation of the focal nature of the manifestation of sudden emissions of coal and gas.

Various methods of preventing sudden emissions of coal and gas, which are divided into regional and local, are currently used in the development of hazardous formations. When carrying out mining operations, local methods play an essential role. Of the local ways to prevent sudden emissions, the main one is the hydraulic

compression of the coal massif and the drilling of advanced wells, with the use of which up to 30% of the annual volume of workings is carried out, but the method of combating sudden emissions of coal and gas by drilling advanced wells is considered the most effective and technologically acceptable.

Advanced wells according to existing passports are drilled according to the most crumpled (explosive) bundle (bundles) of the formation. The diameter of the leading wells is 130-250 mm, the length is 10-20 m. In particularly explosive mine layers or areas, the diameter of the leading wells is 200-250 mm.

In order to prevent sudden emissions of coal and gas, it is proposed to form technological schemes for mining in hazardous formations based on the use of geotechnological methods of active impact on the coal-bearing massif by effectively unloading stressed zones ahead of the workings. To ensure the safety of mining operations during underground workings, it is necessary to use the principle based on a comprehensive method of controlling geomechanical and geotechnological processes in coal-bearing massifs at mines based on the assessment of the technogenic stress-strain state of the array of contiguous rocks.

In this regard, extensive theoretical and experimental studies are required to study the dynamics of changes in the processes of gas release from mountain massifs, to establish patterns of influence of various factors on the nature of the discharge of mountain pressure ahead of the front of the advance of the preparatory face and, on this basis, to improve anti-blowout measures during mining.

Improving methods for predicting emissions, ways to prevent emissions, as well as effective anti-blowout measures aimed at preventing them during mining operations in areas dangerous for the manifestations of sudden emissions of coal and gas, taking into account the geomechanical state of the host rock mass and establishing optimal parameters of control actions depending on mining operating conditions and the degree of influence of complicating factors are an urgent task in underground mining of coal seams.

The objects of research are the emission-hazardous and emission-threatened coal seams of the mines of the Karaganda coal basin.

The purpose of the work is to improve anti-blowout measures during preparatory workings based on determining the patterns of manifestation of rock pressure along the front of the workings and their contour areas, depending on mining and geological factors and mining technical operating conditions based on computer modeling of geomechanical processes in the mountain range.

The idea of the work is to create a geotechnological method for preventing sudden emissions based on the control of the stress-strain state of the carboniferous massif in front and in the zone of the contiguous rocks of the mine with a targeted impact on the stressed zones using mathematical modeling of geomechanical processes in the mountain massif.

Scientific provisions submitted for protection:

- tangential stresses have a tensile character at a distance of up to 5 m into the depth of the face in the center and the soil of the workings, and then turning into compressive ones, contribute to the emergence of unloaded areas ahead of the face of the workings being carried out, and the main normal stresses in the zones of the

stressed state of the massif ahead of the workings when drilling leading wells are stretching, leading to unloading of the mountain massif;

- the emerging area of the coal-rock massif ahead of the face of the preparatory work being carried out, in which, under the action of tangential stresses, the continuity of the massif is disrupted with a decrease in the main stresses with their approach to the pressure of the overlying rocks, softening outside this zone is achieved by drilling advanced (degassing) wells beyond its limits to increase gas output;

- the effectiveness of anti-blowout measures is ensured by softening the areas of the array in order to increase the gas output from the installation

To achieve the purpose of the dissertation, the following tasks are set: conducting theoretical and experimental studies to study the processes of gas release from the faces of workings, establishing the patterns of influence of various factors on the occurrence and nature of changes in unloading ahead of the front of the preparatory workings; mathematical modeling of the stress-strain state and stress distribution in the near-contour array of the preparatory workings to establish the parameters of desorption processes ahead of the workings; feasibility study of the effectiveness of technological schemes for carrying out workings on hazardous formations.

The scientific significance of the work consists in:

- investigation of the aerogasic situation during preparatory workings on coal seams d6 and k10 to determine the "critical" threshold of the gas content of hazardous zones;

- study of the gas content of coal seams, taking into account the deformed state of the rock mass and the nature of the impact of unloading on its magnitude in the conditions of mines.

The scientific novelty of the work is to establish the parameters of the processing zones of the coal massif by drilling leading wells beyond the area of destructive tangential stresses ahead of the face in the mountain massif, where high stress concentrations are formed to form systems of discharge cracks around these wells deep into the massif along the front of the development.

The practical significance of the work lies in:

- improvement of anti-blowout measures with the use of geotechnological methods of active impact on the mountain range to prevent gas-dynamic phenomena by increasing the zone of effective impact on hazardous areas.

- development of recommendations on anti-blowout measures in order to improve technological schemes for the preparation of explosive formations and during preparatory workings based on the determination of the patterns of manifestation of rock pressure depending on mining and geological factors and mining technical operating conditions based on computer modeling of geomechanical processes in the intersected mixed coal-rock massif.

Research methods. In solving the above tasks, a comprehensive research method was used, including the analysis of literature sources on sudden emissions; conducting theoretical research to develop technological proposals aimed at reducing the risk of sudden emissions; computer modeling of geomechanical

processes in the intersected mixed coal-rock massif; technical and economic assessment of the effectiveness of technological developments.

Technical and economic efficiency of work. The developed anti-blowout measures during mining, based on the targeted impact on the stressed zones of the massif ahead of the workings, make it possible to effectively manage sudden emissions of coal and gas with control of the intensity of the formation of zones of discontinuity with excessive stress-strain state of the mountain massif. The estimated technical and economic effect of the recommended technological developments during the preparatory mining operations on hazardous formations is 331,000 tenge for every 20 m of the work carried out (drilling cycle).

The validity and reliability of scientific provisions, conclusions and recommendations are confirmed by the technical capabilities of the proposed anti-blowout measures during mining operations on hazardous coal seams and its use in technological schemes of mining operations.

The structure of the work. The dissertation consists of an introduction, five sections, a conclusion and contains 150 pages of text, 72 figures, 30 tables, a list of references from 90 titles.

Implementation and approbation of the dissertation. The research results have been published in 3 scientific articles in publications included in the Scopus database; in 1 article in the publication recommended by the authorized body (Committee for quality Assurance in the field of education and Science of the Ministry of Education and Science of the Republic of Kazakhstan), 7 abstracts of international scientific conferences. The main provisions of the work were reported and approved at scientific seminars of the Department of Development of Mineral Deposits, the Scientific and Technical Council of the Karaganda Technical University. The doctoral student thanks national and foreign scientific consultants for their recommendations and assistance in conducting experiments and performing certain stages of the dissertation work.