

Research on Mechanized Mining Technology Based on Gently Inclined Medium Thick Ore Body

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ABSTRACT. *With the rapid development of social economy, it is necessary for mining enterprises to apply modern mechanical mining technology to mine mineral resources, so as to meet the needs of social production development. During the mining of mineral resources in China, there are many mining problems caused by poor geological and geomorphic conditions, especially in the operation of gently inclined medium thick ore body. According to the basic situation of this kind of ore body, this paper studies the theory and technology of mechanized mining, and analyzes the application points of this technology, so as to provide reference experience for the effective mining of more gently inclined medium thick ore bodies.*

KEYWORDS: *Gently inclined, Medium thick ore body, Mechanization, Mining, Theory, Technology*

1. Introduction

Gently inclined medium thick orebodies are distributed in many places in China. The thickness of this kind of ore body is 5 m ~ 20 m, and the inclination angle is 5 ° - 30 °. Under the limitation of these two factors, the actual mining difficulty is relatively large, and the mining amount of resources is far lower than that of ordinary ore bodies. Through the analysis of the mining operation of this kind of ore body, we can know that there is no effective method with high quality and high efficiency for mining gently inclined medium thick ore body. Therefore, mining enterprises are required to pay more attention to the content of mechanized mining theory and mining technology, so as to form an effective mining scheme for gently inclined medium thick ore body and improve the efficiency and quality of resource mining.

2. Characteristics of Gently Inclined Medium Thick Orebody

The definition of gently inclined medium thick ore body is that in the mining process, it must keep the mining production standard range and make it meet the standard requirements with all angles. It is a special ore body structure. This type of

ore body structure is characterized by great difficulty in mining, which belongs to the orebody structure circle with extremely difficult mining production in the whole mining industry. China's mineral mining industry is still in its infancy, and many modern new technologies have not been well used in the mining of gently inclined medium thick ore bodies^[1]. The immature construction technology reduces the quality of gently inclined medium thick ore body, causes the waste of mineral resources, brings negative impact on the surrounding ecological environment, and inhibits the further development of mining technology for gently inclined medium thick ore body.

3. Difficulties in Resource Mining of Gently Inclined Medium Thick Orebody

At present, in the mining process of gently inclined medium thick ore body, trackless mining equipment is often used for mechanized production, and the ideal application effect has been achieved: this method enriches the related theories involved in ore body operation, and expands the application scope of segmented open stope mining method, room pillar method and other operation methods used in conventional mining operation of ore body, and improves its application efficiency. However, due to the limitation of inclined angle and thick thickness of ore body, there are many application problems during the application of trackless mining equipment, which leads to low operation efficiency^[2]. The specific problems are as follows: during the mining period, due to the inclination angle of some places is slightly small, it is difficult for the ore body rock with small self weight to fall to the ground directly, which requires mining enterprises to spend higher cost and more time to transport these rock blocks. In addition, the lower level of mechanization also hinders the effective application of trackless large-scale automatic equipment in the operation of gently inclined medium thick ore body. Therefore, it is necessary to study the mining theory and operation technology of this kind of ore body, so that the level of mechanized operation can be significantly improved.

4. Problems in Mining Technology of Gently Inclined Medium Thick Orebody

The main problems in mining technology of gently inclined medium thick orebody are roof protection and low ore handling efficiency. In the mining operation of gently inclined medium thick orebody, with the deepening of mining operation, the exposed area of goaf roof will increase day by day. The increase of exposed area and the irregular change of its shape will affect the stability of rock. However, the current mining technology can not solve this problem safely and reliably under the condition of low cost. The technical problem of roof protection is still the main technical problem that restricts the large trackless equipment to enter the goaf. With the mining operation going on, the ore in the stope can not be transported by gravity due to the low dip angle of the ore body, so it can only be carried out with the help of violence and machinery with low efficiency^[3]. In the mining operation of gently inclined medium thick orebody in the new period, how to use modern mechanical technology to improve ore handling efficiency is the second major problem in

mining technology. In order to effectively solve the above two problems, improve the mining efficiency and quality of gently inclined medium thick ore body, and improve the safety of the working environment, mechanized mining technology must be used in the operation process.

5. Theory and Technology of Mechanized Mining for Gently Inclined Medium Thick Orebody

5.1 Scheme of Trackless Mechanized Mining Ore Body

In the exploration of mechanized mining theory and technology, a metal ore body in Yunnan Province of China is selected as the research object: the ore body fully conforms to the characteristics of gently inclined medium thick ore body. Through the analysis of the ore body, the problems encountered in the mining process of the coal mine are as follows: a) there is a large area of exposed area in the roof plate of the goaf, and the difficulty of applying the roof protection technology in mining enterprises is significantly increased. Due to the difference of inclination angle during operation, the ore in the mining area needs to be blasted again to be small ore. the ore handling efficiency is very low, so the mining scheme of gently inclined medium thick ore body should be determined according to specific problems. The problem uses the special assignment method to deal with the way to perfect the plan. In view of the technical problems of roof protection, the shape of the roof in the mining area can be optimized during the operation, which requires the shape to be a long strip. Based on the concept of large panel and small section, the roof span is scientifically and reasonably controlled, so as to do the roof support work well under the less exposed roof area. To solve the problem of ore handling, gravity drawing should be applied in the process of operation, that is, first concentrate the ore, set up the ore collection device, and then use the scraper to transport all the ore out, so as to build a good working environment for the follow-up ore body using large trackless equipment, and significantly improve the working efficiency of mechanized operation^[4]. Therefore, it is necessary to effectively avoid the adverse effects of the above two aspects when working out the mining operation scheme of gently inclined medium thick orebody. The chambers are arranged in sections according to the inclined direction, so that the mechanized equipment in horizontal working state can be mined according to the operation requirements of room and pillar method. Therefore, the distribution of ore deposit direction is formulated according to the actual situation of the mine. After the mechanized room pillar mining followed by waste rock and tailings mixed filling mining method, the mining enterprises used this scheme to carry out mineral exploration work efficiency significantly improved.

5.2 Panel Layout

In the study of production operation of gently inclined medium thick ore body, it is required to lay out panel in a standardized way, so as to ensure the accuracy of the

research results. When judging whether the panel layout position is correct or not, the mining enterprise staff should conduct a detailed investigation on the strike length of the panel, and analyze the layout combining with the required standard parameters, pillar width and room span parameters. All parameters need to be input into the computer for calculation and processing, and the mine enterprise needs to rely on computer technology to arrange the panel. If abnormal parameters are found in the monitoring, the parameters should be adjusted in time to ensure that the layout of the panel is scientific and reasonable. When the computer system is working, it will build several structural models to express the specific inclination degree and pillar distribution of gently inclined medium thick ore body. At this time, the staff can compare different models and adjust the operation parameters of ore body by relying on standardized parameters, so as to make the pillar width and volume parameters consistent with the required parameters, so that the room has good stability. To promote the normal and orderly development of mining work. Through the research and analysis of panel layout, the unreasonable layout parameters can be reasonably optimized. The computer system plays a role in parameter verification^[5]. After all parameters are correct and filling operation is carried out, large trackless automatic equipment can be used for mechanized mining work, relying on reasonable layout of panel and highly standardized parameters. The improvement effect of mining efficiency will be very obvious.

5.3 Mechanized Mining Operation

According to the above mining scheme and panel layout method, the slope inclined panel, drift and other positions are cut. The cross-section size of the haulage roadway is determined by measuring. The section height is 4 m and the width is 4.3 m. There are two main types of rock drills, boomrl04 and 281. The scraper uses diesel oil as kinetic energy for ore transportation. The conventional operation scheme used in operation needs to be improved according to the data parameters obtained from the research, that is, the equipment required for construction shall be prepared in advance, and then drilling, measuring hole depth, pipe delivery and other operations shall be carried out in the operation area, and then the cutting groove shall be arranged. For the ore body with thicker distribution, the operation space shall be divided so as to facilitate the drilling equipment to drill in, cut and blast in the corresponding space. During the blasting mining operation, fan-shaped blast holes are arranged, with the cutting groove as the free surface, blasting is carried out from both sides to the middle^[6]. Generally, the first blasting collapse distance is slightly short, and the subsequent blasting needs to expand the distance to ensure good ore caving effect. The model of TOR0400E electric scraper can be selected to transport the mining minerals. During the operation of the equipment, the heat of the engine is controlled within a small range, so as to enhance the power, ensure the scientific rationality of the turning radius, and improve the operation flexibility of the ore drawing equipment.

6. Application Example of Mechanized Mining Technology for Gently Inclined

Medium Thick Orebody

6.1 Application Project Overview

The application project of mechanized mining technology for gently inclined medium thick orebody studied in this paper is a mine in Shanxi Province, which is a typical second stage project. The dip angle of the ore body reaches 53° and the average mining thickness is 18 M. the domestic slag discharging equipment, foreign rock cutting equipment, mining operation equipment and deep hole charging equipment are used. The deep hole charging equipment has powerful functions, wide application range, and can automatically absorb and display the charging speed. In each driving cycle, the driving footage reaches 3-3.5 m. The selected cutting groove is located in the middle of the room with thicker ore body.

6.2 Specific Application Process

The specific application scheme is as follows: 1) design and plan the circulation driving system, measure the cross-section size of the transportation roadway by using the air shaft and cutting drift, analyze the drilling equipment in the driving activities, introduce the full hydraulic rock drilling jumbo to ensure the scraper to support the operation of the slag discharging equipment; 2) according to the actual thickness of gently inclined medium thick ore body and the division of coal seam, the free surface can be segmented and continuous Blasting; 3) divide the ore body to be collapsed into three sections according to the length, and ensure the effective presentation of the positions on both sides of the goaf, and ensure the connection of subsequent mining procedures. According to the actual situation of the ore body, the design blasting parameters are as follows: the hole diameter is 80 mm, the hole spacing is 1.4 m, the hole depth is 27 mm, and the explosive unit consumption is 1.2 kg / T. In order to provide enough blasting space for the cutting groove, fan-shaped blast holes can be placed on both sides to form a rectangular space with a width of 7 m to ensure the smooth completion of blasting. In the process of blasting, the cutting groove is taken as the free surface, and the blasting is carried out from both sides to the middle; the whole ore body is divided into three sections according to the length of 30 m, 30 m and 23 m, and the first collapse is limited by the space of the cutting groove. The scope of the collapse on both sides of the cutting groove is 11 m and 12 m, while the scope of the collapse on both sides of the goaf is 15 m, and the scope of other collapses is 30 m. The density coefficient of blasting hole is 2, the explosive consumption of secondary crushing is 0.53 ~ 0.63 kg / T, and the ore collapse amount reaches 7.7 T / m. In the application process of mechanized mining technology for gently inclined medium thick ore body, the performance of ore drawing equipment is the most important. The staff should ensure that the performance of ore drawing equipment meets the production demand of panel area, so as to improve the work efficiency. In this application project, the ore drawing equipment produced abroad is selected. The equipment has excellent performance, can meet the demand of large-scale underground mining, and effectively improve

the mining efficiency. In the application process of mechanized mining technology for gently inclined medium thick orebody, ventilation should be paid attention to. In this application project, in order to solve the ventilation problem, three patios are excavated for return air to ensure that the fresh air can flow to the goaf during the mining process, and is discharged smoothly through the return air lane and return air patio, which is of great significance to the improvement of transportation level. After the mining process is completed, the previously excavated return air raise can be used as filling shaft to treat the mined out area in mining engineering through tailings filling and waste rock filling. This can not only improve the strength and permeability of filling materials, but also effectively reduce the surface storage of waste rock and tailings, and reduce the pollution of waste rock and tailings to the surface environment(Figure 1).

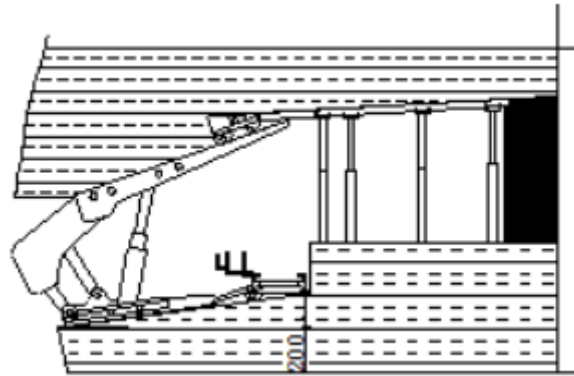


Fig.1 Mechanized Mining Technology for Gently Inclined Medium Thick Ore Body

7. Conclusion

When using mechanized mining technology to mine gently inclined medium thick ore body, it is necessary to master the characteristics of gently inclined medium thick ore body and the related application technology of mechanized technology. In addition, modern mechanical equipment should be applied to mineral mining technology in combination with the development achievements of the times, so as to improve the mining quality and mining level.

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