Application of drilling technology in prevention and control of water in coal mine

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Abstract. As an important technical means of coal mining, drilling has been widely used in coal mine waterproofing and water control. The complexity of underground coal mines increases the difficulty of drilling. This paper expounds the types of water damage in coal mine and analyzes the technical requirements before, during and after drilling.

1. Introduction
In recent years, the proportion of water accidents in coal mine accidents is increasing. For example, five people died in a flood accident in Yibin Coal Mine. Six people died in a flooding accident in the underground mining and production system of the Wajipo aluminum mine during the clearance of the roadway. Therefore, it is extremely urgent to take effective detection methods to find out the harmful water sources near the mining face. Drilling technology is the key technology to ensure the smooth progress of water prevention and control in underground coal mine. In order to effectively improve the application efficiency of drilling technology in water prevention and control work in underground coal mine, this paper makes a detailed analysis on it.

2. The Type of Coal Mine Water Disasters.
(1) Roof water damage.
Once the mining activity and its influence range touch the rock stratum (especially the rock stratum with water filling), it will cause serious water damage. According to the specific situation between the ore body and the rock stratum, it can be divided into the following two parts: the roof water filling type and the roof indirect water filling type. If there is accidental contact or collision with the aquifer in the process of mining, it is easy to cause serious water damage underground. According to the relationship and function between ore body and water filled rock, it can be divided into direct and indirect water disasters. Therefore, in order to ensure the safety and stability of the mining process, it is necessary to confirm the connectivity and water yield of the aquifer, so as to ensure the smooth development of the mining process.

(2) Floor water damage
In the course of mineral development, the rock formation of the underground ore body is liable to be damaged and cause water damage. According to the actual situation between the ore body and the water filled strata, the water damage at the bottom of the ore deposit is judged to confirm whether it is direct or indirect. It can be concluded that the cause of water damage caused by the bottom of the deposit has a great impact on the connectivity between the aquifers. If the rich water layer is found to have obvious connectivity during the development of mineral deposits, the water damage will increase accordingly.
(3) Goaf water damage
Due to the mining process in the past, a large goaf will be formed. It is because of the existence of goafs that serious underground water is accumulated. If ignore or approach the goaf during the mining process, there will be a great chance of infiltration or flooding into a large amount of groundwater and causing serious mining difficulties. According to the results of incomplete statistics by the domestic authoritative organizations, the water damage caused by the mining process is mainly caused by the goaf.

(4) Fault and collapse column water damage
If during the construction of the coal seam, problems such as breakage or chipping of the roof wind board are found, the corresponding support work must be done in the shortest time. If the caving height is connected with the water diversion fracture and the aquifer, serious seepage problem and water damage will be caused. Because of the problem of limestone cave or internal damage, the supporting rock will break, break and so on, then a vertical channel will be formed. If this situation occurs in the tunnel, corresponding protective measures should be taken, so as to avoid the safety problems caused by a large amount of groundwater pouring into the mine.

3. Drilling requirements
(1) Before drilling.
Before designing a borehole, the designer must observe the drilling environment on the spot, measure the inclination of the coal rock layer, observe and judge the lithology of the coal rock layer, and then design the borehole according to the actual situation. Construction drilling personnel must be qualified and certified to work. Before drilling construction, the working surface must be safe, the top and bottom floors and the two groups of support are intact, there is no water and gas on the working surface, and communication equipment is installed near the construction site. Workers should wear labor protection articles and carefully check the drilling tools before drilling to ensure they are intact.

(2) Drilling construction.
Once drilling starts, the operator can only stand on one side of the rig. It is strictly prohibited to stand under the vertical shaft or stand on the rotating part of the machine. The rotating part must not accumulate other materials. Every time the drill pipe is extended, it must be operated according to regulations. It is strictly forbidden to operate with gloves. During the drilling process, the staff shall pay attention to the rotation speed and drilling depth of the drilling machine, and it is strictly prohibited to pull hard and twist when accidents occurred such as sticking. Every drilling record must be carefully and accurately recorded during the drilling process. When drilling, the geological surveyor should make original records. When the coal and rock formations change, the depth and nature of the changes must be recorded in time. The data must be true and reliable. When drilling for a certain distance or replacing drilling tools, the number of drill pipes must be measured and the hole depth must be verified, and rechecked again before finishing the hole. During drilling, if the coal seam suddenly softens, the side is sliced, the pressure comes, or the water pressure and water volume in the borehole suddenly increase, as well as the top drilling, the drilling must be stopped immediately, the hole depth shall be recorded and the drill pipe shall be fixed at the same time, but the drill pipe shall not be taken out, the report shall be made to the mine control room immediately, and measures shall be taken in time.

Slant hole drilling
If the self weight of the upper strata is ignored, the hole may collapse, which makes the drilling of the broken strata more difficult. In order to give full play to the role of drilling technology, it is necessary to strictly control the water pressure to maintain a proper distance between the drill bit and the hole wall and hole bottom. In the process of drilling, when the distance between the drill bit and the bottom of the hole is 15 m, it is necessary to bring an underwater drill pipe and effectively control the water pressure to ensure that it can be in a suitable position. When pressure holding occurs, it is necessary to raise the drill to deal with it to ensure the normal operation of drilling. When the drill bit reaches the bottom of the hole, it is necessary to use pressure water to make the hole return water normally before drilling.

Drilling with casing in soft layer
Soft rock, broken rock and soft coal constitute soft layer. If the soft layer is encountered after drilling to a certain depth, the problem of sticking or plugging may occur. When such a problem occurs, a large orifice pipe can be placed down first and drilling can be carried out with the help of a core that is twice the diameter of the drill bit. After drilling into the soft soil layer, it is necessary to pay attention to pulling and drilling with the help of pipe drilling technology. This treatment method can effectively protect the hole wall of the soft layer. It will increase the difficulty of opening when the soft layer is encountered during opening, because when the drain hole is explored, the orifice needs to be sealed to improve the pressure of the waterstop casing.

(3) After drilling.

After the completion of drilling construction, if there is water outflow and other phenomena in the drilling, special personnel shall be arranged to regularly observe the water inflow, gas and other conditions, and make records. If the drilling has reached the drilling purpose, the hole must be sealed in time when there is no other function.

4. Conclusion

To sum up, the coal industry is an important supporting industry in China. All the drilling technologies applied to prevent and control water in coal mines are the life support for the safety of the inspectors and provide an important aid for the prevention and control of coal mine water damage. In any case, we should increase the research of professional technology in this field. Only by continuously following up in technology and reducing the error in operation, and handling every detail well, can we ensure the life safety of investigators. So as to achieve the stable and sound development of the coal industry.

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