ACCOMPLISHMENTS IN DESIGN OF ROOF-BOLT MATERIALS AND INSTALLATION EQUIPMENT

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(Part of a panel discussion, aided by slides.)

Since the conception of roof-bolting in the late 1940's by C. C. "Jim" Conway in the mines of southern Illinois, there has been a continuous history of mechanical advancement and safety.

Over the years rotary drilling machines have become more powerful, better able to install bolts rapidly and penetrate harder strata.

There have been advances in tools such as bits and steels.

The bolts themselves have been upgraded, and a new generation of anchoring materials is under test. However, two lines of development are receiving particular attention at this time: automation and operator safety.

To date, success has been achieved in automatic drilling of the hole. In practice, the operator positions the drillhead, places the drill steel between the chuck and roof while aligning with the drillguide, actuates the feed and rotation controls, and is then free to move from the drilling area.

The automatic controls, through change in hydraulic pressure, sense variations in roof structure, as from shale to sandstone. In shale the drill may rotate at 500 rpm with 3000 lbs. thrust. With internal dust collection, rate of penetration should approach six fpm. On encountering sandstone, rotation immediately drops to 250 rpm and thrust increases to as much as 10,000 lbs. If desired, impacting will commence. In sandstone, penetration is a function of hardness, and will probably average three fpm. Once the hard layer is drilled and the bit is again in shale, the rotation, thrust, and rate of penetration return automatically to the original setting.

Manual reaction is too slow to make instantaneous changes in rotation and thrust before damage to the bit. Automatic control increases bit life by as much as 25 per cent, as the bit is not dulled by high speed rotation and low thrust while in abrasive rock. A sharp bit drills more rapidly, demands less power from the machine, and reduces maintenance.

While the hole is being drilled, the operator can move from the drilling area, preferably toward the outby end of the machine under bolted roof. His free time may be used in making up bolts, changing bits, or in other work procedure.

In the last 12 months, protection of the bolting machine operator has been emphasized. Many safety devices have been added to the machine, not to mention supports for unbolted roof between the last row of bolts and the face.

A cab that will support 18,000 lbs. or 15 psi must be installed over the tramming control location to protect the operator from spalling roof and ribbing as he drives from place to place.

At the drilling location, de-energizing bars cover hydraulic controls so electrical circuits will drop out, should the man be squeezed between the controls and the rib; or to permit manual control if he is endangered by any of the drill movements. To overcome hydraulic lag due to inertia, a solenoid-operated dumping valve by-passes all hydraulic oil at the pump.

Another device is a latch to hold the drill steel or extension wrench.

A safety canopy at the drill location may be a hydraulic jack wedging between the floor and roof, or a pivoted arm between the machine and roof for protection from minor falls.

A study of roof-fall fatalities shows the majority occur under unbolted roofs. For many

years the roof bolt operator has been exposed beyond the last row of bolts with a minimum of roof support in the drilling area. Though many approved plans require temporary roof jacks or posts in the unbolted span, it is evident the setting of the temporary support has been without protection from possible falls. A corollary to the setting of a temporary support is that it must be taken down. Too often the post is inadequate or improperly placed, creating a false sense of security.

Recently a Temporary Roof Support system (TRS) has been developed for various style machines. The TRS is either carried on, or extended from the front of the roof drill. Tramming and TRS controls are in the cab of the machine, far enough outby so the operator is always under bolted roof.

Procedure is to drive the machine to the unbolted area and properly locate the TRS to protect the drilling position with the wedged arms. The TRS will support a 15 to 30-ton load. With the addition of a canopy support, the driller has protection while installing as many as three rows of bolts with an extending boom.

In the case of machines which position by moving the body of the drill, the TRS is carried astraddle the forward part of the unit. Once placed, it is cut off by means of hydraulic quick-disconnects, and either two or three rows of bolts may be installed before moving.

Drills capable of installing only one row of bolts per machine-setting use a single TRS bar.

The TRS has been approved as part of the bolting system in a number of mines. It replaces the temporary jacks. This increases bolting capacity, as setting and taking down the jacks can consume as much as 20 per cent of the working time.

Summarizing, experience has shown that automatic controls and TRS are well-accepted at the working face. Proof is the positive attitude of the operator, which is the most important factor in the effective use of any safety equipment.