National Institute for Occupational Safety and Health
NIOSH
Technology News
No. 481 Milestones in Mining Safety and Health Technology June 2000

UPDATE: Roof Monitoring Safety System for Underground Stone Mines

Objective

The Roof Monitoring Safety System (RMSS) introduced in late 1997 has been modified to improve durability and simplify the measurement of roof or rib movement. Greater knowledge about the stability of roof and rib rock is expected to result in safer conditions for the mine worker. Developing safety tools and methods is part of NIOSH's mission to prevent work-related injuries and deaths. A mining operation with a proactive approach to control ground conditions is in a better position to make essential decisions related to mine development and take remedial actions in the event of roof or rib falls.

Background

Falls of roof and rib rock are responsible for a high number of mining injuries and fatalities. Visual inspections and the sound of breaking or cracking rock are often relied upon to indicate unstable roof conditions. In some mines, roof bolt holes are checked for separations or gaps with a scratch tool; this provides further information about the stability of the roof. Monitors such as the RMSS can confirm roof movement that was surmised only by eye or ear, or potentially detect movement that was missed by these means. An added safety feature of the RMSS is the capability of locating the measurement station at a distance from where the monitor is placed in the roof.

Stone and other industrial minerals are the basic raw materials used in construction. Continuing economic growth and highway building in particular have resulted in record demand for stone. This high demand, coupled with increasing constraints on surface mining, have caused many new stone mines to be developed underground. These new mines in many cases will be employing new and inexperienced miners who may not have the ability to recognize unstable ground conditions using just sight and sound.

From the initial introduction of the RMSS, it was anticipated that improvements and modifications would occur. We correctly assumed that, once miners and operators were exposed to the monitor, suggestions would evolve. In one case, the RMSS was used to determine if an impact hammer used on a mechanical scaler was causing or increasing instability of roof rock. The test showed little or no movement resulted from this method of scaling under the particular conditions at this mine. In another instance, an operator needed to monitor the stability of a haulageway in a benched area that had very high ceilings. The RMSS requires a 2-in-diam hole for installation; however, only roof bolt holes of a smaller diameter were available, and it was impossible to drill new holes at that height. The operator attached a 2-in collar at the roof line and was able to install the RMSS.

These examples illustrate the potential for further enhancements of this tool. NIOSH continues to seek additional candidate sites for use of the RMSS. As usage increases, we anticipate further refinements and additional applications.

How It Works

The new RMSS, cable, and read-out box are shown in figure 1. The read-out box has a green light that stays lit until battery replacement is needed. The red light is set to come on to indicate movement. The red light can be adjusted for increments of movement as low as .010 inches. The RMSS red light should not be considered as a primary or only means of determining the stability of roof or rib. It is intended to serve as a supplement to existing methods or procedures for determining stability.

An overview of the RMSS components is shown in figure 2. Movement of rock layers within the mine roof is measured relative to a fixed-point calibration at the monitor housing. The housing contains a potentiometer, roller switch, plastic rack, and spur gear. Movements are detected by the transfer of electromotive forces

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through the rack of the spur gear, which is attached to a 5,000-ohm potentiometer. Movement is precisely measured by comparing the output of the potentiometer to an initial reading. The indicator light is controlled by an adjustable set screw. Cable is attached to stereo plugs and extended from the roof to ground level. If the RMSS is located at an active face, the cable can be unplugged during blasting and reconnected afterward to take readings with an ohmmeter. The monitor requires a 2-in-diam hole extending 12 to 18 ft into the roof.

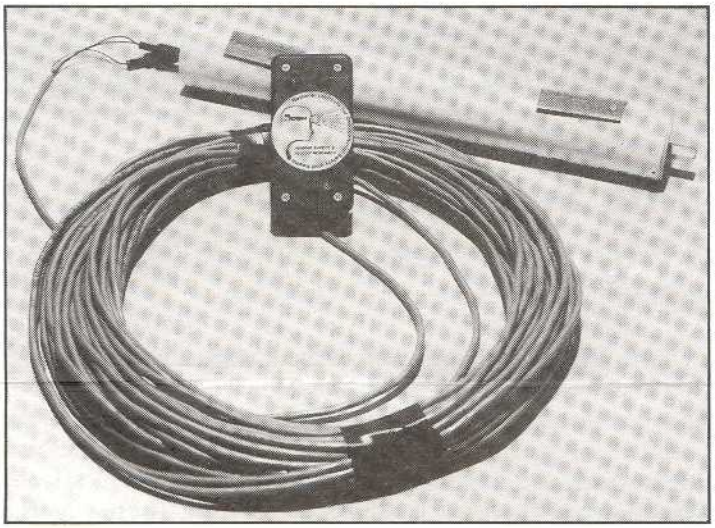

Figure 1.—RMSS cable and read-out box.

For More Information

For more information on the RMSS, contact Thomas E. Marshall, phone: (412) 386-5077; Lou Prosser, phone: (412) 386-4423; or Anthony T. Iannacchione, phone: (412) 386-6851. They can also be contacted at the following address: NIOSH, Pittsburgh Research Laboratory, Cochrans Mill Road, P.O. Box 18070, Pittsburgh, PA 15236-0070. Inquiries may be sent by fax to (412) 386-6891.

To receive additional information about occupational safety and health problems, call **1-800-35-NIOSH (1-800-356-4674)**, or visit the NIOSH Web site at www.cdc.gov/niosh

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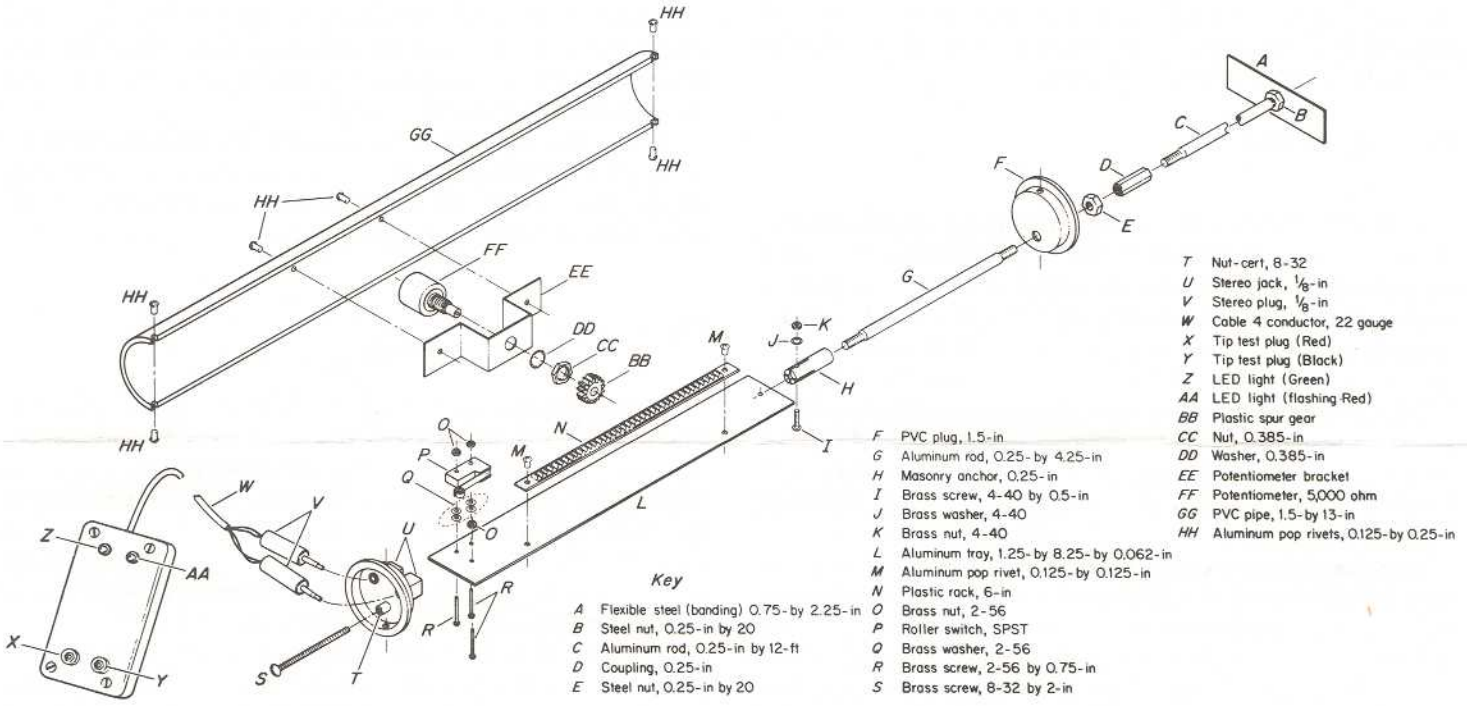

Figure 2.—Overview of RMSS components.