FILE COPY

MAY 7 1976

Volume I

Coal Mining

national safety congress transactions

1975

CHICAGO, ILL. 60611

PLAINTIFF'S EXHIBIT

NSC-282

NATIONAL SAFETY COUNCIL
425 North Michigan Avenue
Chicago, Illinois 60611

63rd NATIONAL SAFETY CONGRESS

Papers Delivered in the Coal Mining Sessions

Coal Mining Sessions

PREBOLTING

By W. O. MONTGOMERY
Supervisory Coal Mine Technical Specialist, Mining Enforcement and Safety Administration, Johnstown, PA

Prebolting mine roof is a method of supporting overroof before blasting the immediate roof. The intent is to control the height of an area at a predetermined elevation. Such areas are usually defined as boomholes or overcasts. Another application is along entries where additional height is required. The system is comprised of a combination of resin and mechanical bolts installed in tandem in the same bolthole.

Areas selected for prebolting are projected in advance of mining where additional height for any purpose is desired. Roof boltholes intended for the combined installation are drilled to a predetermined depth depending upon the amount of additional height required and the condition of the overroof to be permanently supported. The permanent support is resin bolts, and the roof to be removed is temporarily held in place by mechanical bolts.

After the combination bolts are installed, the blastholes are drilled, additional temporary supports are provided, the mechanical bolts are removed, the area is dangered off, and the top is shot.

For descriptive purposes, a coal seam height of 5 feet and an opening width of 18 feet will be used. The approved roof-bolting plan specifies 5-foot centers lengthwise and three rows of bolts spaced 4 feet, 5 feet, 5 feet, and 4 feet across the entry. To remove roof for a boomhole at an intersection, an increased height of 4 feet is sufficient. The roof area to be evacuated will be approximately 15 feet wide and 27 feet long.

Equipment required is a roof-bolting machine and drilling accessories. Material requirements consist of supplies of resin, rebars threaded 12 inches on one end, connecting sleeves, mechanical bolts, washers, slotted and standard flat roof plates, treated wooden cap blocks 2 inches x 8 inches by 16 inches predrilled, threaded stud bolts 6 inches long and nuts. Rebars and mechanical bolts are 4 feet long and all material is ¾-inch stock. Explosives and blasting supplies complete the material list.

The approved bolt spacing pattern is followed:

1. Drill a 1⅜-inch-diameter hole 4 feet deep.
2. In the same hole, overdrill an additional depth of 4 feet with a 1-inch-diameter bit.
3. Insert resin cartridges in the hole and follow with a 4-foot ¾-inch-diameter rebar with a connecting sleeve spotwelded to the outby end.
4. Thread a ¾-inch-diameter mechanical bolt assembly plate and washer in the connecting sleeve.
5. Lift the tandem assembly in the hole by raising the drill head of the bolter until the unit is in contact with the top of the hole. At the same time, the bolt is rotated a high speed for 15 seconds.
6. Apply a full upward thrust and hold in place for 20 seconds.
7. Loosen the conventional bolt enough to insert a slotted flat plate between the roof and the standard plate and retighten. This completes the installation by placing the mechanical bolt in tension.

Blastholes are drilled to a depth of 4 feet from the original roof elevation. Hole centers and amount of explosives charge are dictated by roof composition. It is beneficial to slant drill the holes to provide two exposed surfaces for blast relief. In sandy shale, roof blastholes were on about 48-inch centers. One-half to 1 pound of explosives per cubic yeard of material gave good fragmentation. Before the blastholes are charged, temporary supports are set at all four openings to the intersection.

Additional temporary supports are set for the removal of the mechanical bolt. Danger boards are posted at all approaches and the roof is shot. Good blasting results will expose the threaded ends of the rebar with the coupling. The couplings if exposed are removed with a pipe wrench and rod exposure is adjusted with plates and cap blocks. If the couplings are not exposed, stud bolts are threaded into the couplings, the plate is applied and tightened with a nut.

Additional sketches describing the complete sequence of application and variations of prebolting may be obtained by writing to U.S. Department of the Interior, Mining Enforcement and Safety Administration, Sunray and Goucher, Johnstown, PA 15905.

76 1308

TEMPORARY ROOF SUPPORT

By A. C. WAGERS
Chief Inspector, United States Steel Corporation, Lynch, KY
(Delivered by Larry King)

The United States Steel Corporation conceived and adopted the slogan, "Safety—*The First Consideration.*" This slogan forms the base for all operating decisions at all corporate levels.

The Coal Division of United States Steel encompasses five operating districts: Frick, in Pennsylvania; Gary, in West Virginia; Lynch, in Kentucky; Southern, in Alabama; and Western, in Utah and Colorado. Although operational differences may exist between districts, the basic concept of safety first still guides the action of each manager in each district. Any new facility, and new equipment, or any new method is closely inspected to insure maximum safety for our people and for compliance with applicable federal and state laws before the unit or method becomes operational.

Generally speaking, the Lynch District lies in a horseshoe-shaped valley in the eastern portion of Harlan County and is surrounded on three sides by Black Mountain and Looney Ridge. The district operates four mines—two in the Winifrede seam, one in the Harlan seam, and one mine in both the High Splint and Lower Splint seams. All raw coal is loaded into railroad cars at two loading points for transhipment to the Corbin Preparation Plant, located at Corbin, Kentucky. Washed coal is shipped in unitrain lots to various corporation locations.

Temporary roof support, the subject of this presentation, has probably received more managerial and engineering attention than any other single item. Our records indicate that the greatest percentage of injuries occur to roof bolters while installing temporary or permanent supports.

In an effort to provide maximum protection to roof bolters, we devised a temporary roof support plan commonly referred to as "Seven Jack-Nine or Twelve Set" plan. Three jacks are set no farther than five feet inby permanently supported roof. Two jacks are set on four-foot centers in line with the two outside jacks in the first row. After the first row of roof bolts has been installed, the two corner jacks are moved to fill the void behind the center jack in the first row. If required, the final row is installed by moving the jacks from the second row to the last position. This plan is minimum and must be followed even if the top is "self supporting." If abnormal conditions exist, such as kettle bottoms or slips and cannot be adequately supported by seven jacks, then additional temporary support must be installed or the fractured roof strata is taken down.

The first three jacks are set about five feet inby supported roof, with the other rows on four-foot centers. The extra foot in the first row is necessary to clear the

rotary drill heads when rotary drills are used. Regardless of the distance, either four or five feet, the fact still remains that our roof bolters must advance beyond permanently supported roof. This function cannot be eliminated. Someone must install safety jacks. Although necessary, advancing beyond permanently supported roof to install safety jacks is undesirable since an inherent hazard, a roof failure, could occur.

U. S. Steel Coal Operation's search for more sophisticated protection for roof bolters officially began in 1967. At that time, based on a seven-year injury analysis, manufacturers were solicited to develop protective systems which would be integral to the machine itself without destroying its mobility or flexibility. Tangible results were principally the development of hydraulic jacks integral to the drill masts. This improved protection while drilling and bolting, but did not obviate need for temporary supports. Until recently, technology fell far short of meeting our objectives.

We were stalemated in arriving at a satisfactory solution to our problems until we saw two roof bolting units at the Cleveland, Ohio Coal Show. One unit, manufactured by Acme Machinery Company, was a platform drill for thick seams with individually front-mounted safety jacks. The other unit was manufactured by Fletcher Machinery Company and was a thin seam drill with a single unit TRS system. Both roof drills certainly offered the potential for keeping people under supported roof.

The following presentation will give you some idea of the operational capabilities of these two roof bolting units as they are now operating in two of our mines with very dissimilar conditions.

Acme

Our No. 37 Mine is located on Cloverlick Creek, about one mile from Cumberland, Kentucky. The face equipment on each section consists of one 10CM Joy Continuous Miner, three twelve-ton capacity National Mine Service Torkars, one Stamler breaker feeder with a three-way dump, and one Acme platform drill.

The mine is being operated in the Harlan seam with an average mining height of approximately 12 feet. The roof is extremely competent shale, and rotary drilling is practicable with some bit usage problem.

We realized during the planning stage for this mine that a platform drill was a necessity, not a luxury, and Acme Machinery Company had a unit on the market that appeared to have all the features we considered necessary for full seam mining.

The drill we purchased is Model PDT-2, equipped with 75hp a.c. motors, and is rubber-tire mounted and tractor steered. It has four platform jacks, one mounted on each corner of the platform to raise the entire drill to the desired working height. There are four 20-ton safety jacks for temporary roof support. Each safety jack has a cap with about 430 square inches bearing surface. There are two drill masts mounted on a hydra-slide immediately outby the row of four safety jacks.

All machine functions, excluding those directly associated with drilling, can only be performed from the operator's cab located near the center of the platform.

The drill has a tramming height of seven feet, is ten feet wide and 17 feet ten inches long. These dimensions indicate that the unit fairly well fills the entry. During place change, the second roof bolter trails behind the drill to assist in maneuvering and handling cable.

After the drill has reached the place to be bolted, the operator stops the drill before the TRS jacks are beyond supported top. The second roof bolter mounts onto the platform and assists the operator to spot the drill parallel to the center line and with the TRS jacks about five feet from the last row of bolts. The TRS jacks are then rotated from a tramming to a vertical position, but the TRS foot and head jacks are in the closed position.

The platform jacks are now lowered by the operator, which raises the platform to the desired position. These jacks can also be used as leveling jacks if the bottom pitches in any direction. No weight is on the tires during drilling.

After the platform has been raised and leveled, the TRS head and foot jacks are extended until pressure is applied to both top and bottom. The first row of bolts can now be installed.

The two drill masts can be moved along

the hydra-slide independently of each other or can be locked a fixed distance apart and moved as a unit. Two well-trained roof bolters can lock these masts eight feet apart and dispense with measuring for the location of each bolt hole.

The roof bolters normally drill simultaneously the hole on one side and the inside hole on the other side. This system keeps about eight feet between roof bolters during the bolting operation and minimizes unusual contact between the two roof bolters.

After the first row of bolts has been installed, the roof bolters start the move sequence in reverse to enable them to install the second row of bolts. The TRS foot and head jacks are retracted and the TRS unit rotated to the tram position. The platform is lowered until it rests on the tires and the roof bolting unit is trammed forward four feet. Again, the operator is assisted by the second roof bolter to position the TRS correctly. This move is, in effect, a four-foot place change and must be made four times during a normal cut, but the moves can be made with such ease and speed that we can normally bolt one cut with five foot bolts in about the same time required to set seven safety posts in this seam height.

The unit was purchased with a water deluge type fire suppression system, and we added a 50-foot, 1½-inch stub fire hose to enable quick coupling to the master fire hose stored in the feeder station.

Each mast on the drill has been provided with an emergency shut-off bar to stop drill rotation. When the bar is pushed, hydraulic oil is dumped and drill rotation stops within one-third of one turn.

The canopy covering the operator was a stock item and certainly provides adequate protection.

Fletcher Drill

The South Winifrede Mine service facility is approximately two miles from the center of Lynch. The mine equipment complement consists of continuous miners, three Goodman shuttle cars per section, one Fletcher roof drill, and one Stamler feeder. Continuous belt haulage is utilized from section to railroad car.

The mine is being operated in the Winifrede Seam, which has an average height of 54 inches with a medium hard shale to sandstone roof. Four- and five-foot bolts have been determined as adequate for roof support in this type roof.

The South Winifrede Mine operated approximately four years, utilizing pneumatically powered stopers for roof drilling. When stopers were used, the same temporary roof support system was used as previously described—"Seven Jack-Nine or Twelve Set" plan.

Here again, the same injury pattern prevailed. A positive method for installing temporary supports had to be developed. Also, a roof bolting unit which could replace the stopers to comply with federal noise standards had to be found. Accordingly, based on rotary drill data developed from another mine operating in the Winifrede seam, we placed an order with Fletcher Machinery Company for six low seam roof drills. Specifications required each drill to be built to accept a TRS system, but only the first unit delivered would actually be so equipped until operational experience verified the system's usability and reliability. Only a few operating shifts were required for us to recognize the TRS system's potential, and the remaining five units were so equipped.

The TRS system consists of eight-foot long beams formed into a horizontal H by a four-foot crossbeam, with each beam mounted on the crossbeam with a swivel connection. The center of the H is supported by a double-acting hydraulic jack by means of a swivel connection. The entire system is connected to a horizontal hydraulic ram which operates from the center of the machine to extend and retract the TRS system. The tilting or partial rotation of the TRS system is accomplished by a ten-inch long hydraulic jack attached to the ram and the double acting jack.

The roof drill is Fletcher Model DDSM-13, C-10, and is equipped with the following safety devices: a machine mounted temporary roof support; a hydraulically adjustable canopy over the operator's deck; a water deluge-type fire suppression system with a 50-foot, 1½-inch stub fire hose; an electrically operated shutdown system at each operator's position; a 15-ton capacity hydraulic safety-jack mounted near the drill mast on each boom; and centrifugal drill steel locks.

The drill mast has double flip-type steel guide, and the turn table has three centrifugal cams which lock onto and hold the drill steel in place once rotation starts. This is an inexpensive and efficient method for holding the drill steel in the turn table.

The drill is 25½ feet long with the TRS in the collapsed position, and is eight feet wide. There are two tramming heights for the drill, one of 49 inches with the TRS collapsed and folded over the drill frame; the other is 45 inches with the TRS collapsed and retracted but not folded over the drill frame.

During place change, the second roof bolter trails the roof bolting machine to assist the operator in low places, on turns, and to handle cable.

As the drill is trammed into the place to be bolted, the second roof bolter assists the operator in maneuvering the machine until the center of the machine is directly under the place center line. This maneuvering is expedited by two short pieces of rubber hose mounted in a vertical position on the top center of the machine, one near the front and one near the rear, the principle being the same as sights on a rifle. After the drill has been centered, the second roof bolter moves to the operator's side of the machine and makes sure that a marked position on the canopy is directly under the fifth row of bolts from the face.

After the machine is in position, the second roof bolter advances toward the front of the unit, remaining under permanently supported roof but near the rib to remain in position to be seen by the operator, and assists the operator to advance and set the TRS system.

The TRS is initially set with the outby beam positioned five feet inby permanent supports, which placed the inby beam nine feet inby permanent support, which permits two rows of roof bolts to be installed before advancing the TRS. Bolting sequence for this system calls for the two rib bolts to be installed first, and the roof bolters have the option of using either set of controls. The boom safety jack must be used for this bolt. The two inside holes are installed next, and the roof bolters must use the controls on the side opposite the TRS.

After the second row of bolts has been installed, the TRS is collapsed, retracted, and the unit moved forward nine feet.

It is permissible for the roof bolters to install the last row of bolts inby the TRS if the inby TRS beam is within five feet of the face. Otherwise, no one is allowed beyond the TRS.

At this point, I would like to thank the employees of South Winifrede Mine and the representatives of the Mine Enforcement and Safety Administration for their active role in making the machine-mounted temporary roof support system a truly viable system.

These two TRS systems we are now using are a great step forward; however, we will continue to improve them. They are assuredly today's answer for minimizing exposure to unsupported roof.

SERPENTIX MINING AT PEABODY COAL CO.

By JOE CRAGGS
Vice President, Peabody Coal Company, Taylorville, IL
(Delivered by David McDonald)

Approximately three years ago installation of a new and innovative process of mining began in the shop at Mine No. 10 near Pawnee, Illinois. Parts of the mining apparatus were being, in some cases, produced, gathered, and assembled in part. Later these parts were sent underground to be wholly put together and form a snake-like shape, complete with vertebrae. This massive piece of mining machinery became what is referred to around Mine No. 10 as the Serpentix.

The Serpentix is a flexible, movable, independent beltline which is suspended from the roof by a five-inch monorail. It is equipped with individual 32-inch wide rubber corrugations bolted together to form a corrugated rubber beltline, making it possible to go around corners and still convey coal to the main beltline in the entries—while on the move. The vertebrae are assembled in eight-foot long sections and are bolted to a rectangular support which in turn hangs from the monorail by an inverted dolly.

To complete the mining unit, additional equipment is used in conjunction with the Serpentix: one 12cm remote controlled Joy miner; one surge car on cat tracks; a bridge conveyor; a long Airdox twin boom arm roof bolter; a Kersey scoop and tractor. A 36-inch stationary belt runs into the entry along side the Serpentix and is fed by a cross conveyor which has been added since the initial installation of the unit. The length of this combination—bridge conveyor, surge car, and miner—is approximately 80 feet. This length determines the distance the unit can mine before the monorail must be extended.

Roof bolting is carried out as usual, and roof bolts are used to fasten the railing to the roof as well. Rail switches are strategically located so that the Serpentix can be switched (according to the mining plan, approximately 70-foot centers) to a different room.

To start the sequence of coal transfer, the 12cm miner, remotely controlled, allows the coal to be removed from the face with the operator controlling it from a safe distance. The miner is followed by a 10-ton surge car which acts to store the coal as it accumulates and in turn distributes the coal to the Serpentix via the bridge conveyor without overloading it.

The bridge conveyor is attached to the outby end of the surge car by means of a ball joint hitch and links to the feed end of the Serpentix by ball joint. The bridge conveyor, because of the hitch, makes it possible to turn angles up to 85 degrees from the monorail.

From the bridge conveyor, the coal is dumped onto the feed end of the Serptentix and is carried to the extreme opposite end or tail. Here it is dumped onto a short cross conveyor where the coal is delivered to the stationary belt line to be taken to the main belt and out to the surface.

The Serpentix, as previously noted, has a corrugated shaped belt so that it may expand and contract as it bends around curves. These corrugations are bolted together and attached to a chain which acts as a drive chain. Every three feet four inches the belt is bolted to a roller carrier with four intermediate brackets linking the chain and rubber belt corrugations or links. In other words, each piece of belt is individually bolted to the chain by means of a bracket. After every fourth bracket (or chain attachment), the belt is bolted to a roller carrier.

The roller carrier runs on a race provided by each individual vertebra. A torsion bar extends through the center of the vertebra to control the curvature around curves. This torsion bar extends the length of each section of vertebrae.

The chain onto which each component is bolted is endless and moves around two sprocket wheels, one at each end of the Serptentix. One of these sprockets is driven by a hydraulic motor, coupled to a planetary gear box, to furnish the drive for the entire chain.

The Serpentix is driven by hydraulic power; the power pack is linked to the Serpentix and moves with the Serpentix as it moves. The hydraulic motors which power the chain drive and cross conveyor get their oil from the oil supply of the power pack. This power pack has a 100-gallon reservoir built around a d.c. motor, with pumps in tandem.

The present mine plan calls for three, four, and six-foot long roof bolts on four- to five-foot centers. For added support if and when needed, rail crossbars and side props are used. Kersey scoop and tractors are also used in this section for cleaning it up.

In the past two years, production runs well above that of conventional mining, approximately 300 to 400 tons more per shift. This was accomplished by using a 200-foot long Serpentix.

SAFETY ASPECTS OF SHORTWALL MINING

By WARNIE FLINT, Jr.
Division Inspector, Beth-Elkhorn Corp., Jenkins, KY

The safe production of coal is one of the greatest problems that confronts the coal industry and this nation at the present time. In addition to the energy problems relating to fuel oil and natural gas which face the United States, we also possess an abundant supply of coal which must be mined safely and economically if it is to benefit our nation.

One of the newest mining systems to be introduced to the United States is the shortwall mining system. The origin of shortwall mining can be traced to Australia, where it was first tried in 1959. Because of wooden roof supports, which lacked sufficient strength, this attempt met with limited success. In 1968 hydraulic roof supports were installed in lieu of wooden supports, and the results were outstanding. The first successful shortwall unit was put in operation in the United States by Eastern Associated Coal Corporation, Federal No. 1 Mine, near Grant Town, West Virginia in 1973.

Shortwall mining is a method of mining in which a continuous miner cuts and loads coal from the short end of a rectangular pillar of coal, while self-advancing roof supports provide protective cover. The ultimate goal is continuous haulage from the miner to the conveyor belt, which can be accomplished by belting or a chain conveyor. We are presently using shuttle car haulage and have been well pleased with the results.

A study was conducted at our Mine No. 22 to determine if the shortwall system would be compatible with our coal seam. This study included analyses of the roof structure, floor strength, seam height, ventilation, dust control, and many other variables. At the conclusion of this study an agreement was entered into by the Bureau of Mines, Beth-Elkhorn Corporation, and the University of Kentucky to implement and study this mining method.

Mine No. 22 recently completed the third production panel on the shortwall. During this time 180,000 tons of coal were recovered without a disabling injury. The success of this system can, in large part, be attributed to the cooperation of the party participants who entered into this agreement and the enthusiasm of our employees in learning to operate a new method of mining. As a result, we feel that we have one of the safest and most productive shortwall units in the industry.

The main safety features of the shortwall mining system are:

1. All face workmen are under the protection of steel canopies.
2. Excellent respirable dust control is attainable since no one works inby the cutting and loading process.
3. If methane gas is present, it is quickly diluted and coursed directly to the return and never passes over any energized equipment.
4. The necessity of final "push-outs," encountered in normal pillaring, is eliminated.
5. Exposure of roof bolters while setting safety jacks for the purpose of installing roof bolts is eliminated.
6. Trickle dusters can add rock dust to the coal dust that is generated and coursed to the returns.
7. Very few place changes reduces damage to cables and overexertion of employees because of handling cables.
8. Less need for material handling reduces accidents.
9. A minimum of loose coal and other combustible materials is left under the fall.
10. Possibility of "bumps" is reduced, because of a high percentage of recovery.
11. Very little special training of employees is needed to put this system in operation.

As with any mining system, there are certain potential safety hazards. Among the more prominent are:

1. Reduced vertical and horizontal clearance restricts freedom of movement.
2. Chock movement creates caught-between hazards and pinch points.
3. A large number of high pressure hoses, close to the employee, could be potentially hazardous.
4. Small rocks can fall between chocks and cause minor struck-by accidents.

Most of these disadvantages can be overcome by proper training of the crews, proper equipment maintenance, and a positive safety attitude by everyone on the section.

Beth-Elkhorn has had an excellent performance from the shortwall system to this date. We have experienced no lost-time accidents, and production has increased as costs have decreased. The average respirable dust concentration has been 0.26 mg/m^3, and we feel that the shortwall system is a leader in the industry in controlling respirable dust.

Some problems we have encountered have been running caves in the tailgate entry, roof breaking between the chock tips and solid coal, and bottom hoving in the headgate entry. A readily available inventory of supply parts is a must.

The success of a shortwall mining system depends upon many variables:

1. The seam height, depth of cover, immediate roof structure, floor strength, and undulations can all determine the feasibility of using the shortwall system in a particular seam of coal.
2. The equipment must be compatible with the system in capacity and size.
3. Management must be dedicated to the success of the system, as it requires more planning, follow-up, and involvement than normal room and pillar mining.
4. There must be cooperation between all parties involved in the system.

In summary, the shortwall system has been very successful in the Elkhorn Division. The cooperation between the Bureau of Mines, MESA, United Mine Workers, state agencies, and Beth-Elkhorn has been excellent. The future of the shortwall system of mining looks very promising.

CASE STUDY OF MINE SEALANTS

By DONALD W. MITCHELL
Mining Engineer, Technical Support, Mining Enforcement and Safety Administration, Bruceton, PA

Sealants that retard mechanical and chemical destruction of mine strata have been used in mines at least since the early 1920's. Among these have been paints, tars, water-proofing compounds, latexes, gunite, shotcrete, and even the "cocoon" used to mothball naval ships following World War II. With the exception of rigid urethane foam, seldom did any of these materials prove successful—that is, remain on the mine strata and retard its destruction for a sufficiently long enough time to justify costs for application and maintenance. Unfortunately, fire and health hazards severely limit the use of urethane foam in mines.

The prevalent use of sealants has been to reduce air leakage through ventilation controls. Repairing cracks in the sealant, and even reapplication, often could be justified by the realization that the alternative was construction of a new air shaft or the installation of a larger fan. The adquacy, or more properly, the inadequacy, of the sealants used on stoppings, therefore, did not receive too much attention.

The problem is different, however, for sealants applied onto mine strata. A man with a bucket and trowel cannot readily patrol and repair cracks when the coating extends for miles, and seldom is the entry available or accessible for use of a machine to spray on repeated repair coatings. As a general rule, sealants for coating mine strata should have a life expectancy of no fewer than five years, during which they do not develop cracks and fractures through which oxygen and moisture from the mine ventilating air can attack the mine strata.

Numerous materials have been used in attempts by miners to find effective, yet economical, sealants. Most of those attempts can best be described as "hit or miss." In 1971, however, a coal mine operator, the United Mine Workers of America, the Bureau of Mines, and MESA began a cooperative in-mine evaluation supplemented by large and small-scale laboratory studies of sealants then available. A detailed report of that might be published in the future. In summary, the findings to date are:

1. Urethane Foam. This has shown the best performance by far of all materials tried. Applications made as long ago as 12 years have withstood the everyday stress and movement in coal-mine environments with minimum damage. The foam has sufficient porosity to permit ground water to flow from the rock through the foam; yet, it has sufficient resistance to water and moisture ingress from the mine air to the rock that no obvious deterioration of the coated rock has occurred.

The foam has been outstanding as an effective sealant around the perimeter of stoppings. It, more than any other material tried to date, consolidates and binds loose rock and coal. Its adherence to most mine rock is outstanding.

Urethane foam, however, presents health and safety hazards that, to protect against, demands its application by specifically trained persons under knowledgable supervision. No application made according to the recommendations given in 1965* has presented a hazard. Many applications that did not follow those recommendations have led to fire or have adversely affected the health of men in the mines.

2. Lightweight Aggregate Cement. A number of products are available that contain cement, light-weight aggregate, and additives (generally calcium carbonate). Those are among the easiest materials to handle and apply; the bagged, dry ingredients are brought to the work area, dumped into a tank of water, mixed, and applied as a slurry onto the mine surfaces. The final coating should be at least ¾-inch thick; failure can be expected at lesser thicknesses.

Fire Hazard of Urethane Foam in Mines, by Donald W. Mitchell, Edwin M. Murphy, and John Nagy, U.S. Bureau of Mines, RI6837, 1966.

The most satisfactory formulations contained vermiculite as the aggregate and Portland as the cement. A product containing perlite aggregate and oxy-sulfate cement failed, sometimes shortly after application and often after a year, seemingly because excessive shrinking led to cracks and crazes. Efforts are now being made to add fibers, generally glass, into these coatings. This may or may not improve their performance. The likelihood is that for real success the length-to-diameter ratio of the fibers preferably should be from 90 to 100. However, to achieve that ratio might necessitate the use of such long fibers that the present advantage of easy mixing and application might be diminished.

3. Other Cement-Based Coatings. Chief among these are gunite, shotcrete, and steel-fiber reinforced concrete.

Gunite has been used for many years in coal mines. It generally failed within one or two years, because it is relatively easily cracked by small ground movements. Moisture and oxygen from the mine air enters the cracked areas and further and rapid deterioration of the coated strata and the gunite occurs.

Shotcrete has been used for many years in tunnels and metal mines. Coal miners are beginning to use it more frequently. Experiences have been too erratic to judge the causes for successes and failures and to predict the future potential of shotcrete in coal mining.

Steel-fiber reinforced concrete possesses promisingly good physical properties. However, deficiencies of available equipment have not only made its application difficult and costly, but result in coatings having few of the expected properties. Hopefully, a coal-mine-suitable application system will be developed in the near future.

4. Sodium-Silicate Based Coatings. A number of these have been used. One, a mixture of asbestos and sodium silicate, provided little protection as a mine sealant because of excessive shrinkage, cracking, and curling.

Another, a foam containing glass fibers in addition to other ingredients as well as sodium silicate, has proved inadequate, particularly when applied just before or after the wet season and onto strata containing sulfur-bearing minerals. This foam has effectively consolidated rib and roof free of sulfur where it was applied during dry periods.

Sodium silicates applied as a liquid have not been satisfactory. They failed for the same reasons as did the foamed silicate, and they neither bridge cracks nor withstand minor ground movements.

5. Asphaltic Coatings. A number of these have been used. The most effective is one that contains latex in addition to asphalt and fire retardants. It seems to be of little use where ground movements are more than very minor. It has provided good-to-excellent seals on dry wall stoppings and on some overcasts. Because of its relatively low cost and easy application, this sealant could be one of the first tried.

6. Other Coatings. Other materials, such as cellulose fiber, borates, and sulfur compounds, are available. None of these should be considered. Efforts to consolidate or stabilize mine strata by injection of plastics containing in excess of three per cent organic matter should not be permitted until it is proven that the injected strata is no more flammable than non-injected strata.

The properties of the optimum sealant are:

1. Noncombustible as determined by ASTM Method of Test E-136.
2. Incapable of autoignition at temperatures below 1500°F.
3. Free of asbestos; contain less than two per cent by weight of calcium chloride and calcium hydroxide; and produce no fumes or agents before, during, and after application that threaten the health and safety of miners.
4. Nonconductive and have a dielectric strength greater than Kv/mn.
5. Resist enlargement of microcracks. This can be estimated in part by not seeing cracks or crazes in a one-inch thick sample that was applied onto cardboard and cured in an air flow greater than 900 fpm at more than 50°F with relative humidity above 40 per cent.
6. Have a higher modulus of rupture as determined by ASTM C78, CSA A23.2.15 than other candidate sealants.
7. Have greater toughness than other candidate sealants. Toughness, the total energy absorbed prior to complete failure, can be predicted by measuring the

area under a stress-strain curve such as the load-deflection curve developed in 6 above; the larger the area, the greater the toughness.

8. Adhere to the mine surfaces. This important property cannot be predicted; it is proved by in-mine trials only.

Natural Destruction of Mine Strata

Destruction of mine strata takes place in three stages over a 10- to 15-year period unless preventive measures are taken. The first stage generally is evidenced by fractured coal ribs and by slabs of roof rock. In the second stage, small pieces of rock and coal fall from the ribs and the roof. Progressive sloughing can lead to the third stage.

Stage 1. The first stage is caused by redistribution of stresses surrounding a mine passageway. Stresses produce movement that, if sufficiently great, can cause coal and rock to fracture and break loose.

The first stage occurs in every mine. Its seriousness increases with increase in depth of mine, span of roof, height of coal, and tectonic residual stresses. It also becomes greater with decrease in the compressive strengths of the coal and bottom rock and in the shear and compressive strengths of the roof rock.

This problem is not curable by use of just any coating. In fact, one might argue against the use of a coating, because failed materials hidden behind it could break out disastrously.

Stage 1 sloughing effects might be minimized by driving narrower entries and leaving larger pillars, at least 90 to 110 feet in width and length. Banding or strapping pillars with steel wire has been effective. Road mesh and wood planks anchored against the ribs by bolts have been partially successful; their success depends solely on the ability of the rib bolts to maintain anchorage. Steel-fiber reinforced concrete applied to a thickness of at least two inches has a potential for providing the structural support needed in some mines. This has been inferred from limited applications onto highly stressed ribs in coal mines in Colorado and West Virginia.

Stage 2. The second stage develops over a one- to five-year period. It is most common in entries where there is a relatively extreme air-rock temperature differential and large changes in air-moisture content. This is the cause of sloughing in slopes, shaft and slope bottoms, main entries, and in shallow mines. It is in those areas that a coating that does the job well will have a most dramatic effect.

The mine engineer can often predetermine the likelihood of Stage 2 failure and thus the potential benefit of applying a sealant. For example, if the roof rock and bands in the coal seam contain montmorilonite, then there is little question that a protective coating should be applied as quickly as possible after the rock is exposed. The higher the montmorilonite content, the greater the chance for the rock to become plastic as it absorbs moisture. Rock containing considerable water as free liquid in the pores and on the surface of the rock particles is likely to deteriorate rapidly when exposed to the mine atmosphere. The loss and gain of free water results in shrinkage and expansion of the rock; drying sets up differential stresses which crack the rock. Rocks containing iron sulfide, siderite, calcium carbonate, organic material, and carbon dioxide will be deteriorated rapidly by the combined reaction of water and oxygen. Such rock will benefit greatly by a coating being applied as quickly as possible after exposure of the rock. Rock composed of silt-sized particles should be coated at least within a few months after exposure; the problem is not as serious if particles are sand-sized.

The coating material, to be effective, must adhere firmly to most of the coal or rock surface; it must not develop an extensive craze or crack pattern; it must be sufficiently flexible or strong enough to withstand the Stage 1 stress distribution; and it must be not so impervious that ground water can collect in large quantities in the rock behind the coating.

Stage 3. The third stage is the result of the first two. That is, progressive widening of the entry by rib deterioration and destruction of the rock against which roof bolts bear result in major falls of roof. In this stage, the only preventive measure known is resupport of the roof and ribs. This might involve rebolting the area if the damage is not too great; road mesh with an effective coating has been successful where ground stresses are not too high (which can be determined by trial and error only); and in severe conditions timbering, cribs, steel arches, and tunnel liners must be used.

Cost of Clean-Up

Costs are comparable for cleanup of accumulations from either Stage 1 or 2. Both involve the labor and logistics required to remove small quantities of coal and rock from long lengths of entry. An annual cost of $2 to $4 per foot of entry maintained can be expected for this. Stage 3 costs, however, may be formidable because of the quantities of material to be removed and because resupport of the roof requires bolts, timber, cribs and, for some conditions, steel arches and tunnel liners.

Stage 1-2 Clean-up Costs. Manual shoveling of loose materials into mine cars and shuttle cars was the method used in the 68 mines from which costs of clean-up were obtained. In those mines, clean-up was done by the same miners who also maintained track, stoppings, and ditches. The total efforts for all those activities approximated one man-year per mile of entry of which clean-up required an estimated one-third to one-half man-year. Cleanup involved removal of as much as eight tons of accumulations per man-shift. Logistic costs were not available, but two mine operators opined that $1000 per year per mile would not be unreasonable. Thus, for those two operators, clean-up of accumulations from either Stage 1 or 2 sloughing was 23 and 29 cents per annual ton of coal produced, and the length of entries maintained was 13 and 57 miles.

Stage 3 Clean-up Costs. In the Pittsburgh, Freeport, and Kittaning seams, 30 to 40 per cent of the entries that are 10 or more years old require constant maintenance to repair Stage 3 sloughing damage. Repair generally involves rebolting, installation of road mesh, cribbing, or combinations of those three things. Typical costs for these, detailed below, range from $17 to $100 per foot of entry maintained. For three mines where Stage 3 sloughing was relatively severe, costs ranged from 25 to 35 cents per ton of coal produced; and that added to Stage 1 and 2 costs results in clean-up costing more than 50 cents per ton. A large portion of these costs results from the repairs being made thousands of feet, if not miles, from present working areas where the needed drills, loaders, and shuttle cars are operating and electrical power is available. Further, repairs are often made on off-shifts at premium rates. Costs for elements common to Stage 3 repair are:

Cost Item	*$/ft.*
Equipment transport, 10 man-shifts	8.00
Clean-up labor	3.00
Rebolting	6.34
Boards, 26/100 feet	(.78)
Bolts, 78/100	(1.56)
Labor—5 man-shifts/100 feet for clean-up, bolting, and logistics	(4.00)
Wire Mesh	12.20
#9 gage, 4x4, @37¢/ft²	(7.40)
Labor, 700-1000 ft²/shift/3 men	(4.80)
Cribs	39.60
Wood blocks, 20-5"x6"x40"/crib	(11.76)
Construction labor, 11 man-shift/crib	(26.64)
Maintenance labor, 1.5 man-shift/100 feet	(1.20)
Above-haulage road cribbing	91.00
Posts along rib, 40-lb. rail, 6 ft. long on 4 ft. centers @16¢/lb.	(19.00)
Rib stringers, 60-lb. rail 15¢/lb.	(18.00)
Cross beams, ⅜" x 8" x 14' @75/each	(19.00)
Wood blocks, 36/crib	(15.00)
Construction labor, ¼ man-shifts/ft	(20.00)

Cost For Sealants

The cost of a sealant depends mainly on the cost for the material used. Generally, one that uses water from the mine water pipeline will be less expensive than one that requires a special liquid or is premixed. The cost distribution for most sealant materials that use mine water is: material—54-70 per cent; logistics—18 per cent; labor—10-26 per cent; equipment—two per cent. This totals 50-70 cents/sq. ft./ inch thick (1974 average).

Generally, the more expensive the material, the lower the labor costs. That may be changed in the near future if more efficient equipment for handling bulk rather than bagged materials becomes available, in which case total costs could be as low as 20 cents.

That is one way of looking at costs. Another way is to consider values. For example, a main haulage road, intake airway, and escapeway each five miles long are coated while they are driven, and the coating remains reasonably effective during the 25 years those passageways are used. The cost, assuming 12,000 tons of coal per day and the present value compounded at six per cent, will be less than 1½ cents per ton of coal produced.

A third cost analysis involves evaluating potential benefits. For example, a roof cavity if left alone will dribble rock. Every person having to pass beneath the cavity is endangered. The record shows one fatality caused by a two-ounce "bird" —the word used in that mine for a small rock falling from a roof cavity. A trip derailment was caused by fewer than 10 birds; because the wreck blocked the main haulage road no coal was produced for the three days it took to clean up and repair the damage. Obviously, hazards and costs increase with time as the cavity enlarges. An actual example of how costs increase is:

Year	*Cavity Size* Length	Height	*Action*	*Cost*
1960	1-10'	0-⅓'	Clean up	$ 70
1961-63	10-100'	⅓-6'	Clean up	230
1964	100'	6'	Rebolt, clean up	1700
1965-68	100-120'	6-8	Clean up	280
1969.	120-170'	8-9	Rebolt, install road mesh, clean up	6720

The $9000 spent would have paid for coating at least 800 feet of the entry while it was driven. Interestingly, in 1970 the mine operator applied a shotcrete-like material on five miles each of the main haulage road, the intake airway and the escapeway (this was the basis for the example given previously); and no costs for subsequent clean up and repair of roof in those passageways have been incurred. That application reportedly cost 18 cents per square foot and totaled less than $400,000, which for the past four years is equivalent to four cents per ton of coal produced in that mine.

Conclusion

Clean-up of accumulations and repairs to mine strata to reduce both the quantity and hazards of accumulations is costly. Many mine operators do not realize the cost benefits to be gained by using sealants that reduce sloughing. Such sealants can reduce costs of mining by as much as $300,000 per million tons of coal produced.

The important qualities of a sealant are that it is safe to use and has a long-term effectiveness. Unfortunately, many miners evaluate a sealant mainly by how easy it is to apply and by how much can be applied in a shift. As shown previously, those are not important primary decision-making factors.

76 1312

NEW METHODS OF UNDERGROUND MINE COMMUNICATIONS

By ROBERT BALGO
Director of Communications, Ohio Valley Div., Consolidation Coal Co.,
Moundsville, WV

In the past 20 years there have been great strides taken to improve communications. All over the land, sea, and space, in commercial and industrial uses, improvements can be seen everywhere. Through much work, this technology of the 20th century has now gone underground to include the mining industry.

The Ohio Valley Division of Consolidation Coal Company has taken the lead in underground communications by adding a complete communication center to its coal mining concern. The center includes an underground dial phone system, a Quindar electronic monitoring-control system, and a computer system consisting of a Texas Instruments 960-A Mini Computer.

Telephone System

Communications in an underground coal mine is, at best, poor. For this reason the Ohio Valley Division decided to upgrade its underground phone system.

After conferring with representatives of C & P Telephone Company, a PBX (private branch exchange) system was installed in all of our mines. The system provided by C & P Telephone Company on the surface proved to be extendable to the underground working area. The telephone system is linked to the surface by multipair telephone cable. Multipair telephone cable has been installed in all three of the Division mines. The cable installation and also the maintenance has been performed by OVD personnel using telephone company techniques and materials. This provides the underground worker with a private line dial system to the surface or to any other telephone underground. A miner at the face can now reach the surface in a matter of seconds. Each phone has been assigned an extension number and can call to or be called from any other extension as a private line.

The section telephones are equipped with both an audible signalling device and a visual lighting system that will alarm when a call is received. All phones are mounted in a protective case on a height adjustable steel post which can be moved with ease as the situation may arise.

Benefits of this system include ordering parts quickly and reliably. Also, key personnel can be located and dispatched to trouble areas when needed.

All repair work on the telephones is done by telephone company personnel after removal from the mine. The phones can be removed by a simple twist plug and a new spare phone is installed.

Extension 200 in the communication center has been assigned as an emergency extension. This extension is available at all times and used only when an emergency situation arises anywhere in the Division. It guarantees a link from anywhere underground to the surface.

The heart of the system is the PBX at the main office. It provides switching among the many off-premise extensions used underground. McElroy and Ireland mines are tied to the PBX with leased lines, due to their proximity to the main office. This provides an inexpensive method of servicing the required underground off-premise extensions. Shoemaker Mine is serviced by its own miniature PBX. This small PBX will provide all switching and will be tied directly to the underground phone cable. Special switching arrangements for emergency use will require some modification of this PBX. Once this PBX proves feasible, it could possibly be used at each portal. This would do away with the cost of the many leased lines, but it would have to be compared with the rental of the PBX and three or four leased lines tying the main office to the portals.

The use of phone lines to transmit voice and pulse frequencies has increased the capability of the trolley phone system.

ing, etc.)

The information is now being used by the communications center and has been incorporated into the systems program. In the future, the information will be supplied to the TI-960A computer which will monitor and provide a hard copy of all the information for future review.

In summary, the benefits derived from the monitoring and control system are:

1. Monitoring fans. When a fan goes down, the signal will be sent immediately to the communication center.
2. In the event of an emergency, power can be tripped at boreholes in a matter of seconds from the communications center.
3. Power can be restored to mines in a matter of seconds through Quindar system. Prevents having to have a man go to each individual borehole and restore power. Saves time and cuts production delays.
4. Any change in ventilation which causes the water gage to drop would result in a signal being received through Quindar system at the communications center.
5. It enables one mar to perform all these duties mentioned above at a moment's notice.
6. Multi-signals over one pair of leased telephone wire.
7. Capability of transmitting data through Quindar to computer, giving hard copy of all fan outages, power trips, etc.
8. Has the capability of activating devices such as pumps, valves, switches, etc.
9. This system has the capability of expanding to give control of all on-off status check functions such as gas (air) analysis, air velocity fire detection systems, environmental monitoring, car counting system, etc.

960 A Computer

The Texas Instruments Model 960A computer has been incorporated in the mining system at the Ohio Valley Division of Consolidation Coal Company. Data acquisition has been established as the computer's primary function with the possibility of expansion into various control applications.

The initial efforts to bring computer aid into coal mining were necessitated by the lack of an organized, reliable means of information communication. Also, the inherent inaccuracy of daily manual data acquisition invites the superiority of a computerized system. The 960A is a versatile and innately expandable machine which lends itself to the future of the coal mining industry. Process control as yet has not been programmed into the system; but during an emergency, limited computer control may very well come into existence. Future applications of the 960A are unlimited and will be acted upon as the need is justified.

The computer's monetary justification becomes exceedingly more apparent as its capabilities are more fully utilized. In addition to safety and maintenance considerations, coal production will be enhanced while mining costs are reduced. The critical needs in these four areas and the computer's ability to provide improvements leads to the aforementioned justification.

Ventilation Fans

The Quindar monitoring system will be interfaced with the computer to store all fan failures (times, dates, and causes) and provide hard copy information on demand.

Oil Circuit Breakers

Interfaced with tone signal, the system will monitor breaker status (close-trip), count breaker operations in each 24-hour period, and give hard copy information every 24 hours or on demand.

Belts

Due to the 1969 Mine Law, it is now required that all belts used in an underground mine be monitored for fire. Different schemes have been designed to perform this function. At present, Ohio Valley Division is using MSA's Thermotect system. This system provides a hard copy message for fire or trouble on the system. Each of the division's five portals has a printer for this purpose. To duplicate these printouts at the Division's Communications Center, we have interfaced the MSA system with the computer. Teletype printouts will duplicate any messages concerning belt fire or trouble.

Power Monitor

Presently each mine's power bill reflects not the actual power usage, but rather a 15 minute peak demand. Power is metered on a 15 minute time interval with each integrated peak being recorded. The highest peak demand recorded for that month is then used as the billing base for the entire month. Because of this procedure, it will be beneficial to monitor the integrated demands, and to keep them under pre-determined limits. The electric company transforms our kilowatt demand into a series of time-based pulses which then become their basis for billing. The division is acquiring access to these pulses thru cooperation with the power company. It will then be fed to the Texas Instruments 960A computer for evaluation. If within a 15 minute interval the integrated demand approaches a specified demand limit, a printout from the computer will indicate the demand is in jeopardy of exceeding normal predetermined values.

The power demand will be controlled thru heating and haulage load manipulation. With this degree of control, above-normal billing rates will be avoided.

Car Counter

A car counting function has been incorporated in the computer system. This function will provide an accurate report on the number of cars loaded per shift for each coal running section. With more accurate information a realistic study could be made concerning coal production down time, time studies, and related maintenance problems.

The counter will be located at each section spotter. An armstand assembly will be used to determine the number of cars loaded. These signals will be picked up by an electronic scanner which will in turn relay the information to a transmitter. The data will then be transmitted over telephone lines to the computer at the main office. In the future this information will not only be available to main office personnel, but thru a teletype system will be made available to each mine's dispatcher. This will enable the dispatcher to better utilize his available empties.

Miner Cutting Time

The maintenance of our machinery is a critical factor in determining the actual time and lost production time in our mines.

Mechanical malfunction may or may not represent the dominant factor in our lost time problems. In order to get more accurate information on this, equipment has been installed on the miner to record the machine's total coal-cutting time.

By monitoring the current used by the miner, the time the machine is under current load can be determined. Current transformers are used to monitor the current, while an over-current relay will trigger our scanning equipment. The TI-960A computer will be able to clock the cutting time.

The information received will hopefully answer in the production as well as the mechanical aspects of our coal mines.

Check In/Out System

This feature could also be operated from the existing system used for the monitoring features and the car spotter system. It would offer a reliable account of the names and check numbers of the men underground, as required by State Law 22-2-56. By the further application of a time clock, the actual time spent underground could be recorded. Each man will be issued an electronically coded card. This card will be handed to his respective foreman before entering the mine for the purpose of checking in. The cards can then be left in a small locked container (such as a locking metal mailbox as found in apartment buildings) located inside the portal building. Upon returning to the surface, the foreman will check in his crew, the cards may be re-issued to the men or retained by the foreman until they are re-assigned or re-classified. A master key will be kept by the lampman for checking in men not returning with the crew due to injuries or for other reasons.

In addition to providing a positive print-out of the men underground, the system could be used for payroll purposes. The cost savings cannot be calculated, but it is obvious that men have been paid whether or not they show up for work under our present system. It would also eliminate the time consuming job involved in our present Crew Status Report which has to be verbally reported over the phone to the Safety Control Center. With regard to this report, the section location of the crew would be provided on one sepa-

The ever-growing coal mines with increased transmitting distances has made it necessary to complement the trolley phone system with a reliable dial phone system. The main job of a mine dispatcher is to direct transportation. With the enlargement of a mine, the dispatcher has become increasingly busy with nontransportation duties such as production reports, maintenance problems, parts location, etc. All these take away from his original responsibilities as a transportation foreman. With the new dial system, mine management can check on parts, production, location of personnel, etc., without going through the dispatcher.

A. T. & T., the parent company of the C & P Telephone Company, is now including underground mine communications in its research and development program. An acceptable system to all federal, state, U. M. W., and management standards should result from this effort.

A unique feature of the underground telephone system is the emergency console which is located in the communication center. This console gives the operator on duty the complete ability to ring all underground section-telephones with the operation of only one switch on the console. The ringing of the underground phones is continuous and will continue until the telephones are answered. Once the phone has been answered a white indicator light will appear on the console indicating that a person is waiting to receive information. This light also indicates to the operator the extension number and location of the answering party. Conversations can be held either with individual sections on a section basis or with any group of sections. Upon the completion of relaying information to the individual section, a red indicator light appears on the console which indicates to the operator on duty that a particular section has received information. This lets the operator know when he has contacted all sections and eliminates the chance of ringing the same section more than once. This saves time for both the personnel within the mine as well as the operator and also eliminates the possibility of forgetting to notify a particular section.

This system also has the capability of overriding any conversation which may be occurring when an emergency exists. The override permits the operator on duty to break in on any conversation, thereby eliminating the chance of not notifying any particular section of the existing emergency.

Each of the three mines within the Division have an individual console assigned to each particular mine, all located within the communication center where an operator is on duty around the clock, 24 hours a day, seven days a week.

Category II telephones (haulage phones) have been placed along haulage ways, at portal bottoms, parts holes, and shaft bottoms. These telephones are party line extensions of the dial network system and are capable of reaching any extension in our network. They are primarily for outgoing calls and will not be equipped with a horn or light.

Category III telephones (emergency escapeway telephones) will be a direct line connection to the communication center and no dialing will be required. However, a palm button will be installed in case a telephone is accidently removed or knocked from its cradle, thus preventing the telephone lines from becoming tied up. These phones will be installed every 4000 feet in the return air escapeways.

The total system will be as fail-safe as practical by double looping the circuits above ground in order to provide a second path for the telephone signal in the event of damage to the underground cable due to fire, roof or rib fall, explosion, etc.

In brief, the benefits that have been derived from the new dial system are:

1. Enables a man underground to easily contact someone outside in case of an emergency. (Dispatcher — two lines, communication center—four lines)
2. Gives the underground man contact directly with the shop or warehouse without disturbing the dispatcher for parts.
3. Enables people on sections to contact each other such as face-to-spotter and section-to-section, thus cutting production delays.
4. In case of an emergency at home, the phone call can be placed directly to the man underground without having to relay a message through the dispatcher.
5. If a man is underground and has a problem at home, he can call from underground and check with someone at home without having to go outside to call. Thus, his mind is relieved, making him better able to work safely and efficiently.
6. Maintenance problems, can be called into the communication center from a section, and then the maintenance foreman calls the communication center periodically. This helps to keep the maintenance foreman aware of trouble areas and also eases some of the load from the dispatcher.
7. In case of a mine emergency, all pertinent information can be relayed directly to the sections and individuals as to the situation in their area.
8. The new system is more reliable, easier to maintain, and more direct than the older phone system.
9. The new system has private line conversation—no more party lines.
10. In emergency situations, the communication center and dispatcher have greater control of conversations, thus holding down panic and confusion.
11. Shortens the time required to get an injured person from the section to the hospital.
12. Enables us to have voice-to-voice advice from a doctor to the injured person underground.
13. Availability of Bell Laboratories for communication research in the event of functional problems, expansion, or new developments.
14. Underground supervisor can get immediate advice or assistance from top management without leaving problem area.

Ventilation Fan Monitors and Power Control

Our monitoring and remote switching system was acquired from the Quindar Electronics Company, Springfield, New Jersey. It provides us with a tone system (FSK) for controlling and supervising from the communications center the status of 13 oil circuit breakers and 10 ventilating fans within the Ohio Valley Division.

The tone control system can be used to convey quantitative information over almost any distance depending on the transmission medium. This medium can be a carrier telephone circuit, a pair of wires, the information-bearing baseband of a microwave system, or a radio link. The signals can then control electronically actuated devices (pump on/off, valve open/close, etc.), report the status of such devices, and transmit processing data.

A tone channel for use in such applications consists of a tone transmitter and a tone receiver, both tuned to the same frequency, that can be accommodated by a single voice grade circuit. The number of channels actually used depends on the spacing of the tone frequencies, the selection of the tone receivers, the speed with which the tones are keyed, and the quality of the transmission medium.

For our application, frequency shift tone transmission was selected (Model QT-30). It is a silicon-transistorized frequency shift unit designed to convey information by shifting the transmitted frequency over a narrow range. The tone is transmitted at its base (or center) frequency at all times and is shifted in frequency by closure of a pair of contacts or application of a d.c. input voltage. It can be keyed to transmit one of three frequencies: Center, Mark, or Space for three state applications, such as open/no action/close control. Units can transmit any center frequency from 365 to 4375 Hz over telephone line pairs or other transmission media for subsequent detection and conversion into a functional output. They can be used in combination with other transmitters, each operating at a different center frequency, to perform many functions over the one transmission circuit (thus eliminating the need and cost of multiple wire sets).

All signals are received in the communication center via an audible and visual alarm and are checked and tested daily. The additional circuitry in no way inhibits the normal working procedure of the breakers or fans.

This system was chosen for its reliability and applicability to many varied functions of supervisory control. Ultimately, the system can be expanded to give control of all on, off, status check functions or information relaying within the Division (surface and underground) as necessary for safety and production or as required by the federal or state Laws. (This includes any monitoring function such as gas (air) analysis, air velocity, fire detection system, overall power demand monitoring, environmental monitorrate card to be inserted by the mine foreman before his own personal card.

Information provided for print-out would show name, check number, job classification, time in, time out, and work location obtained from the grouping with the respective mine foreman and Section ID card.

Future Aspects

Plans are being made to incorporate monitoring and control of inside section oil circuit breakers. This will provide a method of notifying a section in case of fire without knocking out all inside power. Environmental monitoring such as CO_2, CO, CH_4, or air velocities can be made part of the system.

The mine clerks are requested to make several independent reports by the general superintendent. Many of these reports involve several hours work and could be handled by the system in only a few minutes time. Examples of these are:

1. Crew Performance Report—showing tons/mach./shift, tons/man/day, with present figures and to-date figures.
2. Cost Sheets—$/ton by Section.
3. Totaling of supply costs, etc.

Fire and Escapeway Plans

The communications center has maps of all three of the Ohio Valley Division mines. These maps are divided into preplanned escape areas. Each area is accompanied with an escape route from the mines to the surface. These maps show all escapeways from each section to the surface, telephones, fire car locations, ventilation stoppings, mandoors, rectifiers, I.T.E. breakers, fans, and all working sections. These maps are kept up to date daily by our Engineering Department and are invaluable in any type of emergency.

Crew Status Reports

The crew status report is a complete up to date list that shows employees who are working underground on any given shift and their location. These men and their work locations are called in at the beginning of every shift and are adjusted as the men are moved from one area to another. In case of any emergency the communications center operator will have the locations of all employees working underground.

Safety Control Center

The establishing of a safety control center has many real benefits, one of which is the availability of a trained, responsible person during an emergency. When an emergency occurs to any one of our 1,800 employees, there is always on duty an operator who is ready to assist or help in any manner in which he can. The operator has many tools made available to assist him, telephone system, up-to-date maps, emergency procedures, emergency notification of key personnel, ambulance, doctors and emergency organizations.

Some of the duties of the safety control operator are to handle all fan failures, power failures, restore power, mine evacuations, transfer and monitor all telephone calls, operate computer, know all mine escapeways, location of emergency equipment, record keeping, and to render any assistance possible to any employee.

In the year of the ton Consolidation Coal Company (Ohio Valley Division) has continued to improve its safety record to one of the best in the coal mining industry. There have been many contributing factors to this record; one is the system that I have just described. The Ohio Valley Division has provided the coal miner with the most complete, reliable, technologically advanced, workable system in the mining industry. A tireless effort has been and will continue to be made to add to and improve upon this system. The future is indeed bright for the mining industry and for every individual who goes underground.

OFFICERS OF THE 76 1313

COAL MINING SECTION

NATIONAL SAFETY COUNCIL 1975-76

General Chairman—THOMAS E. KOBRICK, Manager, Safety and Workmen's Compensation, Bethlehem Steel Corporation, Bethlehem, PA

First Vice Chairman—PAUL M. BUDZAK, Safety Director, Freeman United Coal Mining Company, West Frankfort, IL

Second Vice Chairman—RALPH M. HATCH, Vice President-Safety, Consolidation Coal Company, Washington, PA

Secretary—EDWARD D. DONEY, Safety Coordinator, Monterey Coal Company, Carlinville, IL

Newsletter Editors—HERSCHEL H. POTTER, Chief (Co-Editor), Division of Safety, MESA—Coal Mine Health and Safety, Arlington, VA; MICHAEL ELLIOT (Co-Editor), Division of Safety, MESA-Coat Mine Health and Safety, Arlington, VA

Engineering Committee—DONALD MITCHELL (Chairman), Mining Engineer, MESA, Pittsburgh, PA; SAMUEL L. CORTIS, Chief Mine Inspector, U. S. Steel Corporation-Frick District, Uniontown, PA; NICHOLAS LEVO, JR., Mine Superintendent, Duquesne Light Company, Greensboro, PA; JOHN ASHCRAFT, Director, West Virginia Department of Mines, Charleston, WV; H. T. WILLIAMS, Chief, Safety and Inspection, State of Alabama, Birmingham, AL; RICHARD WEAVER, Assistant Safety Director, UMWA Safety Division, Bridgeport, WV; DONALD P. SCHLICK, Assistant Administrator, Technical Support, MESA, Arlington, VA; JAMES T. LEWIS, III, Safety Director, C and K coal Company, Clarion, PA

Research and Planning Committee—ALEX KELEMAN (Chairman), Superintendent, Safety Coal Resources, Armco Steel Corporation, Charleston, WV; EDWARD ONUSCHECK, Assistant to President and Safety Director, Rochester and Pittsburgh Coal Company, Indiana, PA; RALPH BANKS, Manager, Employee Services, Inland Steel Coal Company, Sesser, IL; C. WILLIAM PARISI, Director of Safety, Consolidation Coal Company, Washington, PA; JAMES B. GIROD, Chief Inspector-Coal, U. S. Steel Corporation, Pittsburgh, PA

Roof Control Committee—JOHN MCCORMICK (Chairman), MESA, Pittsburgh, PA; WILLIAM B. BEERBOWER, Product Specialist, P.I. Division, E. I. DuPont de Nemours and Company, Wilmington, DE; JAMES H. FLETCHER, Assistant to President, J. H. Fletcher and Co., Huntington, WV; JAY HILARY KELLEY, Dean, West Virginia University, College of Mineral & Energy Resources, Morgantown, WV; WILLIAM J. MCCULLOUGH, Superintendent, Consolidation Coal Company, Central Division, Rose Valley Mine, Cadiz, OH; WILLIAM O. MONTGOMERY, Supervisory Coal Mine Technical Specialist, MESA, Johnstown, PA; R. W. MATTERSHAW, Safety Coordinator, Monterey Coal Company, Carlinville, IL; NICK DEVINCE, Acting Safety Director, UMWA Safety Division, Bridgeport, WV; HARRY L. NICKLOW, International Grievance Committeeman, UMWA Safety Division, Bridgeport, WV

Environmental Health Committee—RODNEY ALLEN (Chairman), Manager, Industrial Hygiene, Peabody Coal Company, St. Louis, MO; RALPH BANKS, Manager, Employee Services, Inland Steel Coal Company, Sesser, IL; JEREMIAH R. LYNCH, Assistant Associate Director, NIOSH, Cincinnati, OH; ROBERT G. PELUSO, Mining Engineer, MESA, Arlington, VA

Off-The-Job Safety Committee—DONALD F. METHENY (Chairman), Safety Engineer and Chief Inspector-Coal, Safety and Workmen's Compensation, Bethlehem Steel Corporation, Bethlehem, PA; GERALD A. BAYLESS, Chief Inspector-Corporate

Safety, Consolidation Coal Company, Pinckneyville, IL; WARNER L. DUGAN, Safety Engineer, Duquesne Light Company, Greensboro, PA; BENJAMIN F. POWELL, Safety Director, Eastern Associated Coal Corporation, Beckley, WV; JAMES F. KENTNER, Senior Safety Engineer, Utah International, Navajo Mine, Fruitland, NM

Training Committee—WILLIAM HOOVER (Chairman), MESA, Pittsburgh, PA; SAMUEL SAPPO, MESA, Pittsburgh, PA; MYLES E. ALTIMUS, JR., Director-Manpower Development, Peabody Coal Company, St. Louis, MO; WALTER FLEMING, Chief Inspector, U. S. Steel Corporation, Southern District Mines, Fairfield, AL; RUSSELL T. DAWE, Director, State Deparment of Mines and Minerals, Springfield, IL

Visual Aids Committee—E. J. SANDY (Chairman), Associate Professor, College of Mineral and Energy Resources, West Virginia University, Morgantown, WV; MAURICE E. FOWLER, Safety Engineer, Duquesne Light Company, Greensboro, PA; BEN T. SPEARS, Assistant Safety Director, Amax Coal Company, Evansville, IN; JOHN T. CRAWFORD, Assistant Administrator, Coal Mine Health and Safety, MESA, Arlington, VA

Membership Committee—CLARENCE JESSE (Chairman), Chief Safety Supervisor-Mines, Allied Chemical Corporation, Welch, WV; LEMOYNE A. JONES, Energy Development Company, Hanna, WY; EDWIN K. WILES, President, West Virginia Coal Association, Charleston, WV

Program Committee—EDWARD D. DONEY (Chairman), Safety Coordinator, Monterey Coal Company, Carlinville, IL; ROBERT L. VINES, Vice President-Health and Safety, Bituminous Coal Operators' Association, Washington, DC; JAMES CLEM, Director, Safety and Industrial Hygiene, Peabody Coal Company, St. Louis, MO; RONALD A. JARVIS, Employee Relation Manager, Illinois Division, Monterey Coal Company, Carlinville, IL; JOHN F. DICKINSON, Chief Mine Inspector, Gary Coal District-U. S. Steel Corporation, Gary, WV; C. WILLIAM PARISI, Director of Safety, Consolidation Coal Company, Washington, PA; RAY LIGHT, Manager-National Accounts, Mine Safety Appliances Company, Pittsburgh, PA; WALTER J. VICINELLY, Commissioner, Deep Mine Safety, Pennsylvania Department of Environmental Resources, Harrisburg, PA; ROBERT E. BARRETT, Administrator, MESA, Arlirgton, VA; EDWARD ONUSCHECK, Rochester & Pittsburgh Coal Company, Indiana, PA

Publicity Committee—HARRISON GILMER, Consultant (Chairman), Takoma Park, MD; MR. QUINN MORTON, III, Kanawha Coal Operators Association, Charleston, WV; MR. HARRELD KIRKPATRICK, Kentucky Department of Mines and Minerals, Lexington, KY; WILLIAM E. BYERS, Chief, State Grants Office, MESA, Arlington, VA

NOTES

NOTES

plan now to attend the 1976 NATIONAL SAFETY CONGRESS & EXPOSITION

OCT. 18 - OCT. 21, 1976 / CONRAD HILTON HOTEL, CHICAGO

The Congress is always a big week, a worthwhile week, for the 16,000 safety people who attend.

At the '76 Congress you can meet other safety people with the same problems and responsibilities as yourself. You can exchange views and ideas on accident prevention, health, hygiene and fire prevention . . . on safety in industry, traffic, school, at home and on the farm.

You can see the largest of all safety equipment exhibits at the Congress . . . an opportunity for you to make well-informed buying decisions for your company.

This four-day educational program, planned and presented by the National Safety Council, can be your most thought-provoking, most worthwhile safety experience in 1976.

Make plans early to attend the 1976 Congress and bring the other people in your organization who have safety responsibilities.

NATIONAL SAFETY COUNCIL
425 North Michigan Avenue • Chicago, Illinois 60611

ORDER FORM 1975 CONGRESS TRANSACTIONS

Quantity Ordered	Stock Number	Vol. No.	Title	1-9 Copies	10 or More
	022.16	1-28	COMPLETE SET OF 28 VOLUMES:		$18.50
	022.27-1	1	General Sessions	$1.20	$.95
	022.27-2	2	Aerospace; Air Transport	1.20	.95
	022.27-3	3	Automotive, Tooling, Metalworking and Associated Industries; Power Press & Forging	1.20	.95
	022.27-4	4	Cement, Quarry & Mineral Aggregates	.70	.64
	022.27-5	5	Chemical; Fertilizer; Research & Development	1.20	.95
	022.27-6	6	Civic Leadership; Church, Women, Youth, Farm	1.20	.95
	022.27-7	7	Coal Mining	1.20	.95
	022.27-8	8	Construction; Public Employee	1.58	1.39
	022.27-9	9	Electronic & Electrical Equipment	.70	.64
	022.27-10	10	Food & Beverage; Meat & Leather Industries; Trades & Services	1.20	.95
	022.27-11	11	Glass & Ceramics; Rubber & Plastics	1.20	.95
	022.27-12	12	Industrial Subject Sessions; Associations	1.58	1.39
	022.27-13	13	Labor	1.20	.95
	022.27-14	14	Marine	1.20	.95
	022.27-15	15	Metals	.70	.64
	022.27-16	16	Mining	1.20	.95
	022.27-17	17	Motor Transportation	1.20	.95
	022.27-18	18	Occupational Health Nursing; Hospitals	.70	.64
	022.27-19	19	Petroleum	1.20	.95
	022.27-20	20	Public Utilities	1.20	.95
	022.27-21	21	Pulp & Paper; Printing & Publishing	1.20	.95
	022.27-22	22	Railroad	.70	.64
	022.27-23	23	School & College	1.58	1.39
	022.27-24	24	Traffic; Driver Improvement	1.20	.95
	022.27-25	25	Wood Products; Textiles	1.20	.95
	022.27-26	26	Early Morning Sessions	.70	.64
	022.27-27	27	Public Safety	1.20	.95
	022.27-28	28	Home Safety	1.20	.95

Automatic 20% discount to NSC members, or 8% to U.S. federal government agencies, if paid within 30 days. Government please attach purchase order. Payment must accompany orders of $5.00 net or less. Shipped F.O.B. Chicago.

SHIP TO:

organization__________

address__________

city__________ state__________ zip__________

attention__________

NSC member #__________ SIC #__________

BILL TO:

organization__________

address__________

city__________ state__________ zip__________

attention__________

telephone #__________

MAIL TO: NATIONAL SAFETY COUNCIL
425 N. Michigan Ave. / Chicago, Illinois 60611

1M476-61 Printed in U.S.A. 022.27-7

National Safety Council

A Membership Organization Dedicated to Protecting Life and Promoting Health

March 21, 2001

Baron & Budd, P.C.
The Centrum
3102 Oak Lawn Avenue, Ste. 1100
Dallas, TX 75219-4281

To Whom It May Concern:

The attached records are kept and maintained in the regular course of business of the National Safety Council, and it is the regular course of business of the National Safety Council to keep and maintain the attached records.

The attached photocopied material is an authentic reproduction of an original file copy of :

NATIONAL SAFETY COUNCIL CONGRESS TRANSACTIONS 1975, VOLUMES 1-5, 7-13, 15, 16, 18-22.
National Safety Council, Chicago, IL.

Respectfully,

Robert J. Marecek

Robert J. Marecek
Manager, Library

Marilyn P. Pettersen

"OFFICIAL SEAL"
MARILYN P. PETTERSEN
Notary Public, State of Illinois
My Commission Expires 10/26/03

1121 Spring Lake Drive • Itasca, IL 60143-3201 • (630) 285-1121 • FAX (630) 285-1315 http://www.nsc.org