PROCEEDINGS

of the

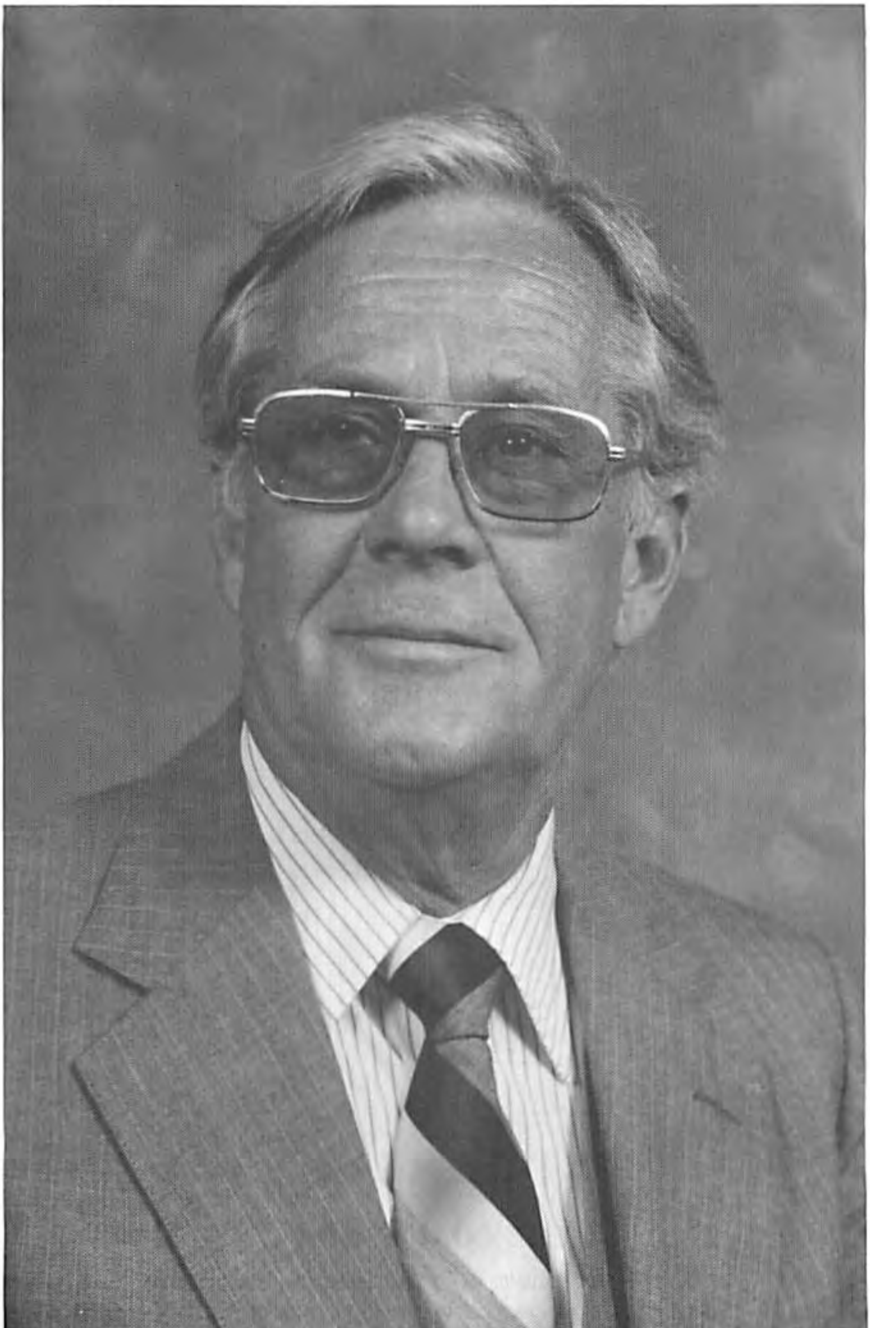
ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892

Eighty-eighth Year

1980

Annual Meeting
SPRINGFIELD, ILLINOIS
October 16-17, 1980



CHARLES E. BOND

PRESIDENT, 1979-80

THE COAL MINER

True — he plays no grandstand role in life
But his importance is vital, great and just:
For without his toil in earth's caverns deep,
Civilization would soon crumble into the dust.

AD 1964 — From his poem — Vachel Davis

(Dedicated on State Capitol Lawn, Springfield, Illinois, October 16, 1964)

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of

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1961-62	ROBERT J. HEPBURN, United Electric Coal Companies, Chicago, IL.
1962-63	JOHN P. WEIR, Weir Co., Chicago, IL.
1963-64	E. T. MORONI, Old Ben Coal Corp., Benton, IL.
1964-65	JOHN W. BROADWAY, Bell & Zoller Coal Co., Chicago, IL.
1965-66	B. R. GEBHART, Freeman Coal Mining Corp., Chicago, IL.
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1968-69	CLAYTON F. SLACK, Sahara Coal Co., Inc., Chicago, IL.
1969-70	JOSEPH Q. BERTA, Truax-Traer Coal Co., Pinckneyville, IL.
1970-71	R. F. DONALDSON, United Electric Coal Cos., Chicago, IL.
1971-72	CECIL C. BAILIE, Old Ben Coal Corp., Benton, IL.
1972-73	E. MINOR PACE, Inland Steel Co., Sesser, IL.
1973-74	ARTHUR L. TOWLES, Zeigler Coal Co., Johnston City, IL.
1974-75	DALE E. WALKER, Southwestern Illinois Coal Corp., Percy, IL.
1975-76	M. V. HARRELL, Freeman United Coal Mining Co., Chicago, IL.
1976-77	JOHN J. SENSE, Tosco Mining Corp., Pittsburgh, PA.
1977-78	BILL F. EADS, Monterey Coal Co., Carlinville, IL.
1978-79	WILLIAM E. WILL, Peabody Coal Co., Evansville, IN.
1979-80	CHARLES E. BOND, Consolidation Coal Co., Springfield, IL.

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LUNCHEON MEETING
FRIDAY AFTERNOON

PROCEEDINGS OF THE ILLINOIS MINING INSTITUTE

Eighty-Eighth Annual Meeting

Springfield, Illinois

Thursday and Friday, October 16-17, 1980

OPENING SESSION

The opening session of the 88th Annual Meeting of the Illinois Mining Institute convened at 2:20 p.m., Thursday, October 16, 1980 in the Lincoln Room of the Holiday Inn East, Charles E. Bond, President of the Institute, presided.

President Bond: Good afternoon ladies and gentlemen. As President of the eighty-eighth Illinois Mining Institute, I am very pleased to extend to each of you a most cordial invitation. As most of you know, the Illinois Mining Institute was founded eighty-eight years ago in 1892. In the first year of our founding the State of Illinois had produced a modest amount of coal, about 17.9 million tons. During these eighty-eight years the maximum amount of coal that was produced in our state was some 91 million tons, and this was produced in 1918 by 91,000 coal miners. This compares with an estimated tonnage in 1980 of 61 or 62 million tons that were produced with a total of some 17,500 employees or coal miners.

It is indeed a pleasant experience each year to meet with old friends here and share our common goals, or common problems, and our concerns regarding our business. It is also important and very pleasant to note that we sometimes share solutions to problems that we have had. The fellowship that we have had together during all these meetings I think perhaps is one of the most important things. This session is meeting at the beginning of a new decade. In spite of all the barriers which have been placed upon our industry, I feel that it can be one of our most successful ones. For those of us who thrive on challenge, I am sure it will be. I trust that each of you will be well rewarded for your endeavors throughout the year.

At this time before we get into the technical session I have several announcements to make. As you know our luncheon speaker will be Carl Bagge, President of the National Coal Association. I would remind you that this evening there will be a fellowship hour from 5:30 to 7:30. Tomorrow morning at 9:00 the start of our days business will be our technical session. I ask that if any of you know of one of our members passing away during this year, would you please give that information to our secretary, Betty Conerty. I would appreciate it very much.

Our technical session this afternoon is chaired by Mr. William (Bill) Murray. He is Director of underground operations of the Kerr-McGee Coal Corporation. Bill is a graduate of Strat-Clyde University of Glasglow, Scotland. He is a Fellow of the Institute of Mining Engineers. He spent about 30 years in the mining industry. In 1969 he came to Alberta, Canada as General Manager of the McIntyre Mines. In 1973 he joined the Federal Coal Company in Pennsylvania as Vice-president and General Manager. In 1979 he joined Kerr-McGee as Director of the underground operations. It is my pleasure at this time to present to you Bill Murray.

Bill Murray: Thank you Mr. President. Ladies and Gentlemen and colleagues, I feel very honored this afternoon as a mining engineer and also as a very new American that I had been asked to share this technical conference on this eighty-eighth annual meeting of the Illinois Mining Institute. My great grandfather, my grandfather, and my father were coal miners, and if it had been possible for them to be alive today, they would have been equally thrilled.

The expertise, productivity, and skills of the American mining industry have always been a source of admiration and a bit of envy to the British mining engineer. Sometimes when I reflect back on the years I have spent in mining in Scotland, and heard about tonnages in America, I thought some of the people that were speaking to us must have come from Texas. What has been an inspiration to me is to have been accepted by you as one of you. In this first meeting of the 80's what a wonderful opportunity lies in store for our industry. The industry to which so many of you have given so much, and to the young people present willing to offer so much more.

The present position of the coal industry is comparable to a top knotch professional football team. If you close your eyes for just a moment and attempt to visualize what that team, it could be perhaps the Steelers or the mining industry, have to offer. Superbowl champions, master of the knowledge of every offensive and defensive play, and coached by Chuck Knoll, eager and anxious to get the game started just for the winning of it. Fans are crammed into the stadium yelling their heads off. Howard Kosell is at the microphone telling it as it is. Then, anticlimax, the locker room doors are locked, and it is impossible to get onto the playing field. Despite our efforts we can't get out to play the ball game and the superbowl to end all superbowls.

Yet apart from a world side recession, it is my feeling that someday very soon that locker room door is going to open to allow the industry and you young mining engineers the opportunity you all so earnestly seek to go out and get a chance to play that game. The day is almost here, not because of but in spite of government regulations, studies, missions, research, crystal ball gazing, call it what you will, that has burdened the industry these last ten years. An example of that type of study, and perhaps a somewhat critical comparison, can be found in two articles in Tuesday's issue of the St. Louis Globe Democrat. In South Africa, a country with no reserves of oil and totally dependent on the whims and vagaries of Ali Baba and the forty thieves, is now preparing to launch their third synthetic fuel plant. This will provide almost half of the daily consumption if imported oil. These Sasol plants also provide jet fuel, diesel fuel, and a wide range of products. The South Africans are ten years ahead of anyone in the synthetic fuel field.

Meanwhile, in distant Baltimore the Department of Energy has now triumphantly broken through the energy barrier. They announced that in Baltimore's zoo, two elephants with their waist not marked BS but ES are now being used in the process known as anaerobic digestion to produce natural gas to power a generator, boil water, or run a gas water heater. Mr. Carter's peanuts have at last found a home. The organisms exude a high grade of natural gas, enough the spokesman said to produce about 75 cubic feet daily, or enough to power a gas operated clothes dryer. Little wonder that the vast reservoir of energy stored in Illinois coalfields lie dormant and as yet unleashed. However, do not despair, when that kickoff whistle sounds, as it will. The team of coal miners as always, will rise to the occasion and provide our industries, our people, and our country, with the energy required to keep us as ever, number one in the world.

As an example of this readiness, we are privileged to hear today a group of technical coal mining papers of the highest calibar. The first of these speakers and the first of these papers is "Alternatives for Coal Mine Financing," and it is being given by Stanley Suboleski, who is Vice President of The Continental Bank. Mr. Suboleski has a BS in mining engineering from Penn. State and a MS in mining engineering from Virginia Tech. He has been with the bank since 1977. Before that he was an instructor at Penn. State, and before that served as Vice-President of the Amac Division of Massey Coal. He has also held various positions from a general consultant to a general superintendent with Consolidation Coal Company and is extremely well versed to address us this afternoon.

Ladies and Gentlemen, Mr. Suboleski.

Mr. Suboleski was unable to submit a paper for the Proceedings because of other time commitments.

Bill Murray: The next paper is by Mr. Bob Danko, the General Superintendent of Mine No. 19, Peabody Coal Company. He is going to talk on the Mine No. 19, 19 South fire recovery. Mr. Danko holds an Associate Degree in electrical technology from Southern Illinois University at Carbondale, and has participated in various mining related advancement programs. Mr. Danko's career with Peabody Coal Company spans approximately 20 years. During this time he has held various maintenance and production positions. Bob, we look forward to your paper with interest.

MINE NO. 10 — 19TH SOUTH FIRE RECOVERY

BOB DANKO
General Superintendent, Mine No. 10, Peabody Coal Co.
Pawnee, Illinois 62558

INTRODUCTION

This paper deals with a mine fire that broke out in Peabody Mine No. 10 on January 12, 1980. The fire was sealed off, and later the area was reopened, explored, and finally sealed on October 7, 1980. With the time alloted, I can only briefly explain the steps taken during the fighting, sealing, and recovery of the fire and fire area.

Mine No. 10 is a belt haulage slope mine, located approximately 20 miles south and east of Springfield, near Pawnee. Mine No. 10 has been in existance since 1951 and has produced about 120,000,000 tons of coal. We have mined over 33 square miles and employ 1,000 people. The mine has three portals — Main, South, and North. The Main Portal, being the slope, is where the bulk of supplies are lowered, and where the coal comes out of the mine. The North and South Portals are air-man shafts with automatic elevators to lower the workmen into the mine.

FIGHTING THE FIRE

On January 12, 1980 at 4:00 a.m., smoke was detected in the 19th South area of the South Side of the mine. Immediate investigation led to the discovery of the fire in the belt and track entries (Belt No. 5-Track No. 6). The mine fire alarm was activated and all workmen, except those fighting the fire, were evacuated without injury. A direct attack of water, rock dust, and chemical fire extinguishers was applied to the fire. At first, it appeared that the workmen fighting the fire had it under control, but the fire would not be contained. The roof over the fire had fallen in both entries, and it could not be determined how far inby the fire had spread. It was noted that the fire was burning toward the No. 4 entry (return-entry) and 4th East seals. Attempts to enter the No. 4 entry by the mine rescue team failed due to the intense heat and heavy smoke. It was evident that continued efforts to fight the fire by direct attack would be futile. A decision was made to seal the fire area in order to create an oxygen deficient atmosphere. Construction of temporary seals was started at 5:00 p.m. on January 12, 1980, about 12 hours after the fire started, and completed at 3:20 a.m. on the 13th. At this time all persons were removed from the mine, and all power underground was shut off. The sealed area consisted of 10 entries, 10,000 feet in length, containing 2 active continuous mining sections and 1 idle section.

MONITORING OF THE ATMOSPHERE

The atmosphere of the 19th South return was monitored continuously by mine rescue team members underground during fire fighting and sealing operations. Readings were as follows: 18.5 to 21% oxygen, .1 to .5% methane, 1000 PPM to 4000 PPM carbon monoxide, and .5 to 2.5% carbon dioxide.

Due to the dense smoke and carbon monoxide gas, the return entry seals had to be built by our Mine No. 10 mine rescue team members, wearing oxygen breathing apparatus. Many hours were saved by having trained mine rescue teams ready.

At about 8:00 p.m. on January 12, 16 hours after the fire had started, boreholes were started over the fire area. Three vertical-drill crews that had already been notified by management to stand by, drilled a total of 12 bore holes. As the boreholes were completed, air samples were extracted. At 6:25 a.m. on the 13th, three hours after temporary seals were completed, the first of 17 truck loads, or 278.8 tons of liquid carbon dioxide, was pumped into the fire area.

On January 16, 3 days after temporary seals were completed, mobile laboratories from the Pittsburgh Technical Support Ventilation group, and the Department of Illinois Mines and Minerals arrived at the mine with all necessary support personnel. This specialized equipment provided a complete analysis of all gases as well as a shift by shift graph of the atmosphere in the sealed area. Plotted from bottle samples collected from boreholes, the range at this time was 4.5 to 9.18% oxygen, .4 to 1.5% methane, and 3480 PPM to 5050 PPM carbon monoxide.

INSPECTION OF MINE

When samples showed a downward trend in carbon monoxide and oxygen, and an explosive mixture of gases was not present behind the temporary seals, an inspection team entered the mine on January 17 at 1:50 p.m., 4 days after temporary seals were completed, to check the condition of the temporary seals and confirm the atmosphere behind the temporary seals.

It was determined by the results of their samples that permanent seals could now be built. These seals were started January 17 at 5:00 p.m., 4 days after the temporary seals were completed, and on January 19 at 4:12 p.m. they were completed. On Tuesday, January 22, after samples continued showing a downward trend, the order to close the mine was modified to permit normal operations to resume. Six and one-third production days were lost.

PLANS TO REOPEN FIRE AREA

On May 14, 1980, 4 months after the fire, a meeting between company, union, state, and Mine Safety and Health Administration officials was held to review and discuss the plans for reopening the 19th South area. Mine management also periodically met to discuss the procedure to be used when entering the 19th South fire area. A plan, telling of how the recovery work would be done was submitted for approval and a tentative date of May 24, 1980, was set for the 19 South fire seal entry and exploration. It was determined that 6 rescue teams were needed to properly enter and explore the 19th South fire area. Four Peabody Coal Co. teams from West Kentucky were asked to help.

On May 22, 4 months after the mine had resumed work, the Illinois Department of Mines and Minerals and Technical Support group again arrived and set up their portable laboratories. Instruments were installed to monitor the return air coming out of the South air-man shaft. As a precaution the fan house was equipped with a portable air supply pressurizing the fan house, and an A-frame was constructed over the explosion doors so air could be shorted should need arise.

Another meeting was held May 23, and after reviewing the gas samples it was determined that they were favorable enough to let teams enter the fire area.

Six properly trained mine rescue teams were assembled and were briefed by all phases of management. We assigned two teams to each shift. These teams were briefed as to what they would do and what kind of equipment would be used. They were also shown how to seal the stoppings and curtains with Rigid Pak foam.

ENTERING FIRE AREA

On the morning of May 24, two properly equipped mine rescue teams along with support personnel, both underground and surface, proceeded to their respective control center for a final briefing before entering the fire area. The teams, after checking all equipment, entered the No. 6 seal at approximately 12:00 noon on the 24th.

As teams were relieved, support personnel familiar with the Drager Apparatus cleaned, assembled, and tested the equipment before it was re-used.

Systematic exploration by the rescue teams, tying the areas across and behind continued until it was decided to erect an air lock at No. 21 crosscut. This consisted of building one stopping in No. 5 entry and two air-lock stoppings with doors in No. 6 entry. Curtains were hung between the No. 6 and No. 5 entries. No. 5 seal was made ready, and the area was ventilated with 30,000 CFM entering the No. 6 seal, traveling up No. 6 to the air lock and out No. 5 entry to the return air course. 5,600 CFM was measured at the air-lock. The exploration procedure continued, and another air lock was built at No. 31 crosscut. From the air lock at No. 31 crosscut, the fire area was reached at 8:20 p.m. on the 25th, approximately 20 hours after the teams entered the No. 6 seal.

The fire area showed no evidence of existing heat or smoke indicating the area was clear. Samples taken from the fire area at this point showed 13% methane, 1.5% oxygen, and 3 PPM carbon monoxide.

Knowing that the fire area was clear, the teams were brought out of the area, and No. 1 and No. 10 seals were removed. All persons were removed from the mine. Air entered the No. 10 seal, swept the 19th South as per the approved 19th South Recovery Plan, and returned out of the mine through No. 1 seal. The air traveled through it's normal path, ventilating the entire 19th South. This continued until samples taken at the No. 1 seal showed that there was not an explosive mixture returning from the 19th South.

At 1:30 a.m. on the 28th exploration resumed and continued until the face of the 19th South was reached at 1:45 p.m. on the 29th, 5 days after recovery operation began. The mine was then examined on the 4 to 12 shift, and work was resumed on the 12 to 8 shift May 30. By utilizing a holiday weekend, only two and two-thirds production days were lost.

To date all the equipment in the 19th South was recovered and the entry sealed on October 7 at 8 a.m. All work done in the 19th South fire area from start to finish was done without injury.

CONCLUSION

In conclusion, I would like to say that the sealing and recovery work could not have been done with this kind of efficiency without the many long hours of planning put in by everyone concerned. By working together, the company, the union, the Illinois Department of Mines and Minerals, and MSHA made the operation the success it was.

I would also like to say that having trained mine rescue teams available gave us an important edge toward the successful completion of an operation of this nature.

Bill Murray: Bob, we have no problem in classifying your paper as high caliber. There are a few moments for questions, and if there aren't any, I will pass on to the next speaker, who is Mr. Eric Powell.

Eric Powell is General Manager of Radmark Engineering, Inc., in Pittsburgh, Pennsylvania, and he is going to talk on "Pneumatic Stowing in Coal Mines." Mr. Powell graduated in mining engineer from the Glamorgan College of Technology in Wales. He is a qualified coal mine manager and a registered professional engineer. He has been a mining engineer with the National Coal Board in Great Britain and the manager of coal mines in India and Egypt. He immigrated to Canada in 1968 and was employed in consulting and mine machinery sales. He moved to Pittsburgh three years ago as General Manager of Radmark Engineering and has several patents and patent applications for pneumatic conveying techniques.

Ladies and Gentlemen, Mr. Powell.

PNEUMATIC STOWING IN COAL MINES

J. E. POWELL, P.E.
General Manager, Radmark Engineering, Inc.
Pittsburgh, Pennsylvania

INTRODUCTION

The disposal of tailings, development rock, and other unwanted refuse material underground in mines by using pneumatic conveying techniques has been undertaken in the coal industry in Europe for many years. Although the stowing of mine refuse in underground coal mines has not been an accepted practice in this country, the technique is currently being employed for backfilling over steel arches to stabilize the roof conditions in two mines in Pennsylvania. Similar equipment is in use in uranium mines near Grants, New Mexico, where sand is pneumatically conveyed underground to stow open stopes to prevent the emission of radon gases and to allow additional ore to be mined from the pillars. Diesel-powered, mobile stowing equipment has recently been used to seal off abandoned mine openings in Greene County, Pennsylvania.

There are two main reasons for backfilling coal mines: first to avoid bringing rock out of the mine from development work such as air crossings, enlarging entries, and other underground construction; secondly, to reduce the building of gob piles on the surface particularly in areas where this is expensive, for example on prime agricultural land or in mountainous areas where the haul can be a considerable distance to the gob pile from the coal cleaning plant. Additional reasons for considering backfill include: reducing the hazards of spontaneous combustion, improving ventilation, stabilizing roof conditions, and reducing surface subsidence.

Pneumatic backfill has the advantage that voids can be completely filled with a high degree of compaction, several corners can be negotiated within the one system, and a combination of infeed rock can be handled, for example, tailings from the washing plant mixed with development rock from underground and conveyed into the entry to be filled. One serious disadvantage of pneumatic conveying is the limited distance that rock can be conveyed. This paper describes a recent technique for overcoming this problem by pumping the refuse underground as a slurry, dewatering at a convenient location near the backfill area, and final placement with a pneumatic backfill system.

EQUIPMENT

Pneumatic conveying equipment used in the mining industry is of the dilute-phase type and consists essentially of a Roots-type blower to provide pressurized air, a rotating airlock feeder to introduce the material into the air stream, and the conveying pipeline with the necessary elbows and discharge unit.

Blowers to produce the pressurized air are of the Roots positive displacement type running at 1750 to 2000 rpm and are usually direct-coupled to electric motors for underground installations or if required, to diesel engines for surface installations. These machines are rugged, can be mounted with the prime mover on a skid-base for movement through the mine and are readily available commercially to produce air up to 18 psi, though in backfill systems, 8 to 12 psi is normally used. A disadvantage of the Roots-type blower is that it generates noise but with the use of silencers in the discharge line to reduce the pulsating effect, a filter silencer on the intake and enclosing the motor and blower within an acoustically-designed enclosure, the sound emitted can be reduced to a level acceptable in the mining industry.

A typical backfill blower package would consist of a 250 hp motor directly-coupled to a 5000 cfm blower. Blowers of up to 900 hp are utilized in pneumatic coal hoisting systems in mines and more recently, two 1000 hp blowers were coupled in series to hoist rock from a depth of 1240 feet at the rate of 220 tons per hour in a test conducted for the U. S. Department of Energy, to operate with a blind shaft boring machine.

The rotating airlock feeder is manufactured from abrasion-resistant steels with adjustable side jaws and replaceable wearing parts. It is powered with a hydraulic motor, which, when rock becomes jammed in the rotor pockets, will either shear the rock or will stop turning and so prevent damage to the feeder. This unit, similar to the blower package, is mounted on skids. Feeders are available in a range of sizes from 50 tons per hour to 400 tons per hour and can handle a rock size up to 4 inches.

Hydraulic power for the rotating airlock feeder is supplied from a 30 hp power pack with sufficient power to run the feeder and infeed belt conveyor or other ancillary equipment. Mounted on the power pack is a control panel with a simple forward/off/reverse lever, pressure gauges to indicate the hydraulic oil pressure and operating air pressure, and air pressure sensing switches which in the event of the system becoming overloaded will stop or reduce the infeed of material into the airlock feeder.

If the rock to be conveyed is of a highly abrasive nature, the pipelines are manufactured from abrasion-resistant steels with a hardness of up to 700 Bn. Elbows to change direction in the pipeline are manufactured from the same material and have replaceable liners. It is not always required to use pipelines of such high quality steel only where the rock consists of abrasive sandstones or where the pipes are for a permanent installation as for example in a rock hoisting system. In the entries themselves, mild steel pipelines can be utilized and when worn can be patched and finally rejected. There is a saving in labor cost in handling the lighter mild steel pipes. If tailings only are being conveyed and these do not contain development rock, material conducting rubber hose can be used as elbows and for the final discharge length which is particularly useful when having to fill over steel arches in an unstable area.

A typical example of a backfill system in a coal mine is that installed at the McDade Park Mine near Scranton, Pennsylvania, where refuse from an old gob pile is being conveyed pneumatically from the surface down a slope 1200 feet long through a 90° elbow into an abandoned area of the mine which is being stabilized with the backfill material to protect the slope and main entry into this exhibition mine. A further example of backfilling is that employed at a mine near Ebensburg, Pennsylvania, where granulated slag is being conveyed pneumatically, vertically downwards through an 8" I.D. cased borehole 600 feet deep, around a 90° elbow at the bottom of the borehole and for a horizontal distance of 400 to 600 feet where the material is discharged over steel arches. This mine is being recovered following a serious fire which resulted in falls of roof to heights of 40 to 60 feet. The falls are being cleared, the steel arches set with liners, and the granulated slag filled at the sides and over the top of the steel arches to a depth of five feet to stabilize these and protect them further from falls of roof.

BACKFILLING ROCK FROM UNDERGROUND EXCAVATIONS

It is now common practice to excavate the floor in the main entry of an underground section with rock cutting machines in order to increase the height suitable for trolley wire locomotives, and to fulfill ventilation requirements. The rock cut by these machines is most often taken out of the mine either in mine cars for dumping on the surface or loaded out on the belt line with the coal and sorted in the coal cleaning plant. Rock is also produced in building air crossings and other underground construction work or from raise boring or tunnel projects. If space is available underground, it is advantageous to stow the rock in a pillaring section or behind the supports on a longwall face. The same basic equipment is used as described above except that for working with a rock cutting machine, the blower and infeed equipment together with a crusher (Figure 1), are mounted on a single skid-base which is inched forward immediately behind the rock cutting machine with hydraulic winches. Such a unit has been built and is now undergoing tests prior to being taken underground at a mine in West Virginia. This machine can handle 100 tons per hour of rock up to 10 inches which is reduced to minus 3 inches by the double-roll crusher, then conveyed through an 8" pipeline a distance of 1000 feet including several elbows, for disposal in the rib entry. A telescopic pipe section allows the unit to move with the rock cutting machine, and the pipelines are shortened periodically as the machine progresses through the section.

When space is not available in the mine or it is undesirable to backfill, the rock can be taken to the surface through a borehole, again using basically the same equipment. There are two recent applications of this technique being employed in coal mines. The first at a mine in Kentucky where the cuttings from a raise boring machine were hoisted through an 8" borehole to the surface (Figures 2 and 3), the air being supplied by a diesel-powered blower at the surface and the air taken underground through a parallel hole leaving only the infeed equipment underground fed by a slusher from the shaft being raised. The second application is associated with a tunnel boring machine at a mine in Pennsylvania where the cuttings are hoisted through a borehole to the surface and in this instance, the blower for the system is electrically powered and located underground near the infeed equipment. Side dumping mine cars transport the rock cuttings from the tunnel boring machine to a discharge bin from where they are conveyed on a chain conveyor to the infeed equipment.

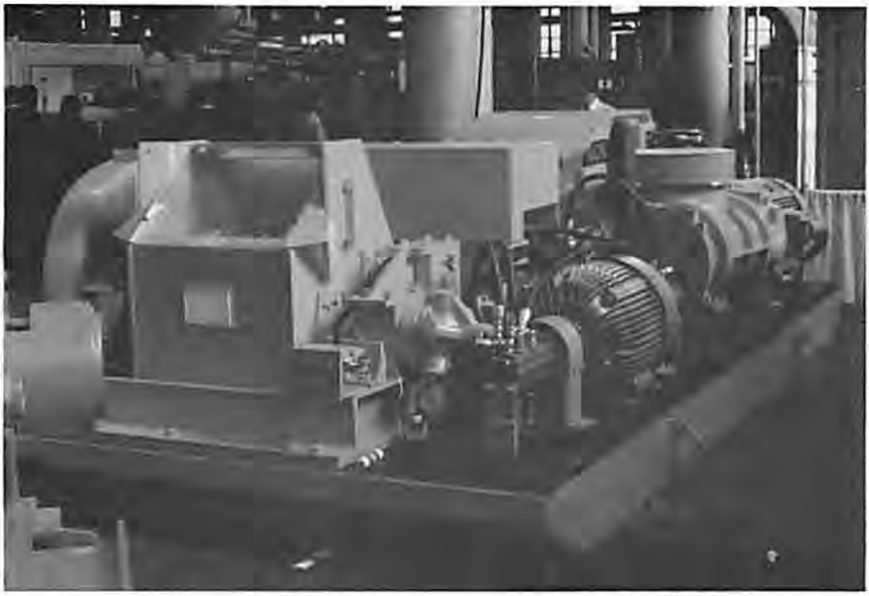

Fig. 1 — Radmark mobile crusher-stower to operate with rock cutting continuous miner.

DISPOSAL OF MINE REFUSE UNDERGROUND

Due to several reasons, the cost of building gob piles on the surface has increased in many instances at a more accelerated pace than other mine operations. Although shunned in previous years in North America, it is again worthwhile examining the possibility of transporting cleaning plant refuse underground and stowing in pillaring sections or behind the powered supports on a longwall face — providing this can be done conveniently and economically. The major disadvantage of pneumatic conveying is the limitation in distance that material can be conveyed. For example, 400 tons per hour over a distance of 2000 feet in one system is the economic limitation for handling up to 4'' rock. Above this capacity and distance, the pipe size increases beyond that which can be conveniently handled underground in a mine, for example 16, 18, and 20'' I.D. pipes, and it is necessary to use two or more blowers in parallel which in themselves would be fairly large units.

It is common practice in hard rock mines to transport the fill material hydraulically from the surface to the stopes. There are several coal mines also applying this technique. Although hydraulic fill has an advantage over

Fig. 2 — Radmark pneumatic conveying equipment.

Fig. 3 — Radmark pneumatic conveying equipment for hoisting rock from raise boring operation.

pneumatics in the moving of material over a longer distance, it has the severe disadvantage of water percolating through the mine workings after the fill has been deposited which, if not carefully handled, will create a further problem with acid mine water in time. There is also a lack of control over the fill material with regards to dewatering and the potential hazard of bulkheads collapsing under pressure from fill material containing a high quantity of water which has not decanted.

It would, therefore, be of advantage if hydraulic transportation could be used to convey the material to an area conveniently near the fill and pneumatically transport it from there into the rooms to be filled. This technique has partially been tested at a uranium mine in New Mexico where sand tailings were pumped underground and passed through two cyclones in series with the underflow consisting of 14% moisture being run through a 3'' hose into the stopes to be filled. The overflow was directed through a pipeline to a sump for further settling and the clarified water pumped out of the mine without this having run through the mine workings. Cyclones can be used in this particular application because sand is readily separated from water. At this same mine, a pneumatic conveying system is being used for backfilling, and the operator now plans to "marry" the two systems. The dewatered tailings will be mixed with development rock and transferred to the infeed equipment of the pneumatic placement system. Cement will be added when concrete is required.

This technique is also to be applied in a coal mine in Colorado where refuse from the coal cleaning plant is to be taken underground to avoid a 23-mile haul to the approved dumping site (Figure 4). The rejects from the coal cleaning plant will be pumped underground in two pipelines; one for the fines, and the other for the larger refuse which will be crushed to a maximum size of 2''. For this particular application, two slurry lines are necessary because of the dewatering techniques to be employed underground. The larger refuse will be dewatered on a vibrating screen and the fines passed through a centrifuge. The resultant mix of materials will then be transferred to the Radmark feeder for stowing in a pillaring section (Figure 5).

The conveying of refuse underground at this mine had been under study for some time, the first idea being to pneumatically convey the material from the coal cleaning plant to the mine portal and down the main slope and finally into the pillaring section. However, as this distance is approximately 8,000 feet and will gradually increase and as the mine is located 6,500 feet above sea level, the size of blowers required would be very large and also the power consumption and pipeline costs made the economics questionable when compared with the present arrangement of surface dumping. A further study was made by the mine operator to transport the material into the mine with belt conveyors to a suitable location underground from where it could be stowed pneumatically. Although five conveyor belt sections would be required, this was more attractive both economically and aesthetically than dumping the material on the surface using a large fleet of trucks particularly through the winter months during the ski tourist season and all the other problems of environment and public relations which this current system creates. Finally, it was decided to examine the possibility of pumping the refuse underground, dewatering, and placing with a pneumatic conveying system.

The concept is now under a study review by the three partners in this venture which includes the mine operator, Western Slope Carbon; Foster-Miller, a Mining Consulting Group from Waltham, Massachusetts, who are designing the slurry pipelines and dewatering system and; Radmark Engineering who are designing and supplying the pneumatic conveying equipment (Figure 6). Part-funding for the installation is being provided by the Bureau of Mines and Office of Surface Mining, the main aim being not only to prove that this is a viable technique but to ensure that the economics are an attractive alternative to surface dumping.

The economics may prove that this technique is only justifiable in those areas of the country where present arrangements for building gob piles are expensive, for example in the Rocky Mountains which is the location of this first test or where an older mine has run out of surface dumping facilities or to solve the problems we understand you are facing in Illinois with the strict regulations for surface dumping on prime agricultural land. However, it may prove that using such a technique as the hydraulic-dewatering-pneumatic system is a viable alternative under any mining conditions to surface dumping and can be used under most circumstances found in underground mines in North America. There are additional benefits to be obtained from taking refuse into a coal mine including: stabilizing of the roof in bad areas which was the prime purpose of backfilling or stowing in Europe; reducing surface subsidence either immediately as would happen if a pillaring section was stowed solid or in future years as the mine deteriorates of which we have good examples in southern Illinois and the difficulty of stabilizing these areas now by surface boring, using flyash of flushing in material with a hydraulic system; improved ventilation by completing the sealing of the crosscuts between intake and return entries and; finally if the longwall advancing is ever permitted, the building of pack walls at the sides of the entries to protect these behind the face line.

Although not used now as extensively as in the past in Europe, pneumatic stowing was used to great advantage prior to the advent of powered supports and enabled coal mines to produce from seams with very poor roof conditions which made the cost of stowing worthwhile. There is a resurgence of interest in pneumatic stowing especially in Germany for refuse disposal and in Britain for building pack walls along side the steel arch roadways on the advancing longwall faces. In the past, pneumatic stowing was considered expensive due mainly to the number of men required to handle the pipelines in the longwall faces as each section of pipeline had to be uncoupled and maneuvered through the roof supports as the backfill proceeded along the face; also by using the main supply of compressed air in the mine which is generated at 100 psi and has to be reduced to 20 psi for the stowing system. Today it is possible to suspend the pipelines from the powered supports or attach these to the shields where stowing is to take place on

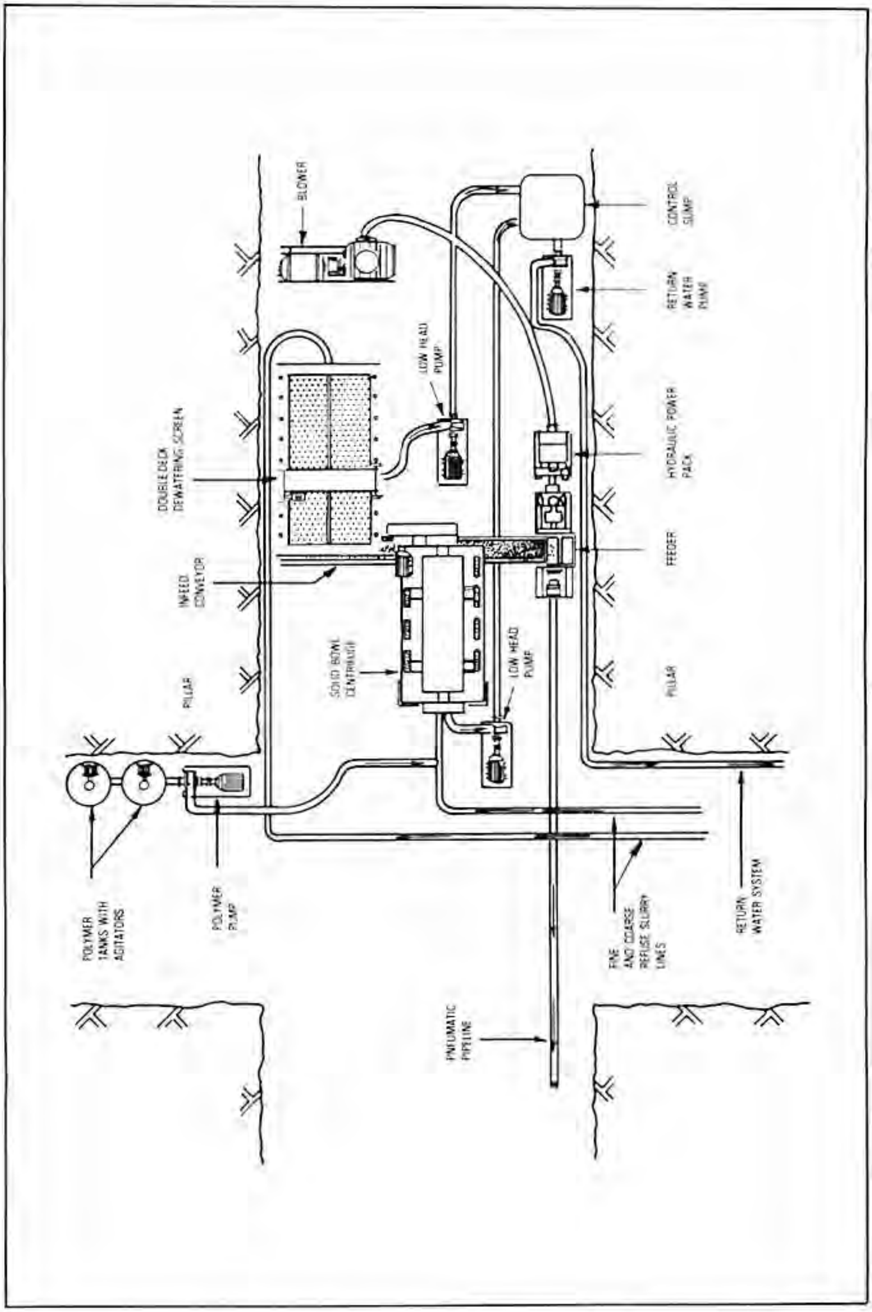

Fig. 4 — In-mine dewatering/pneumatic feeding system.

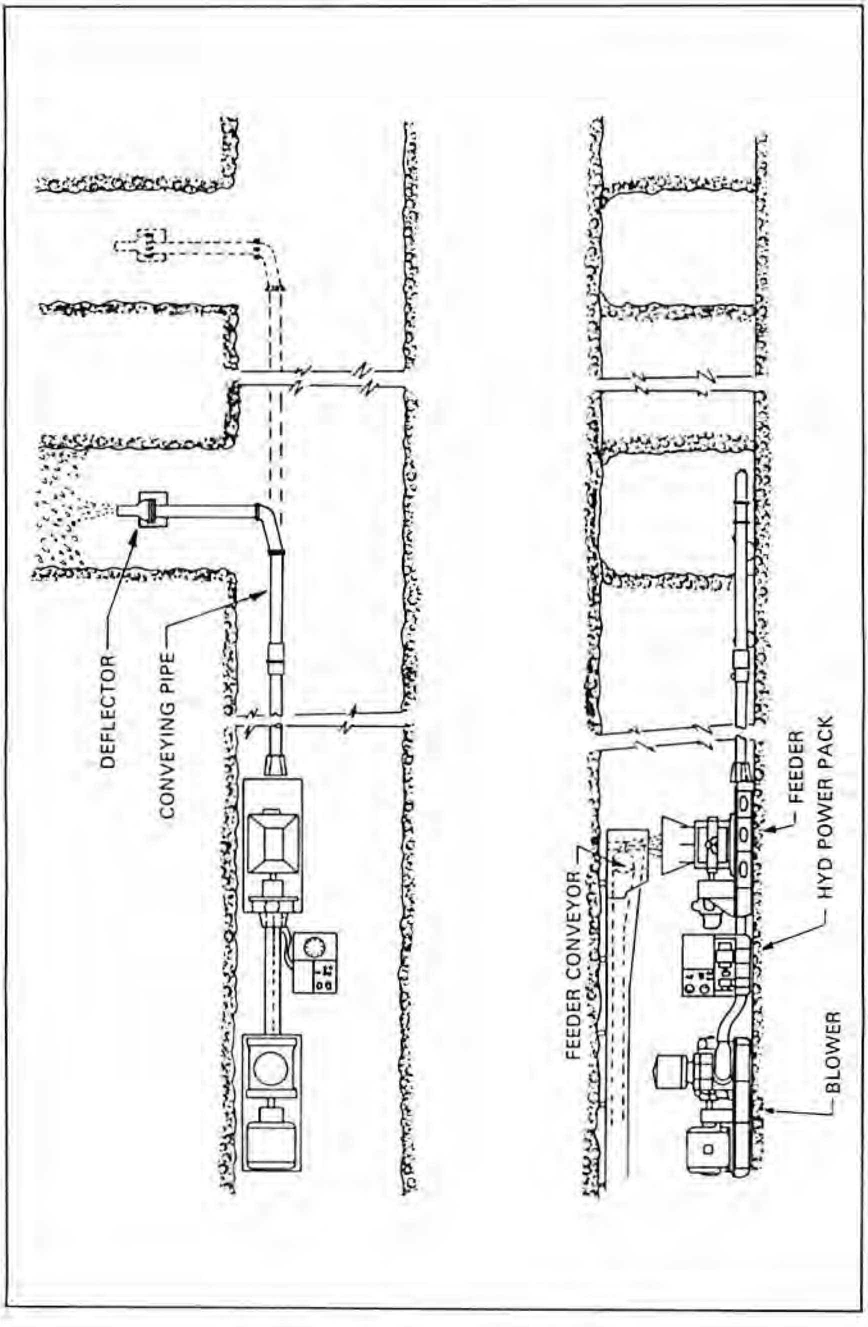

Fig. 5 — Radmark pneumatic backfill system.

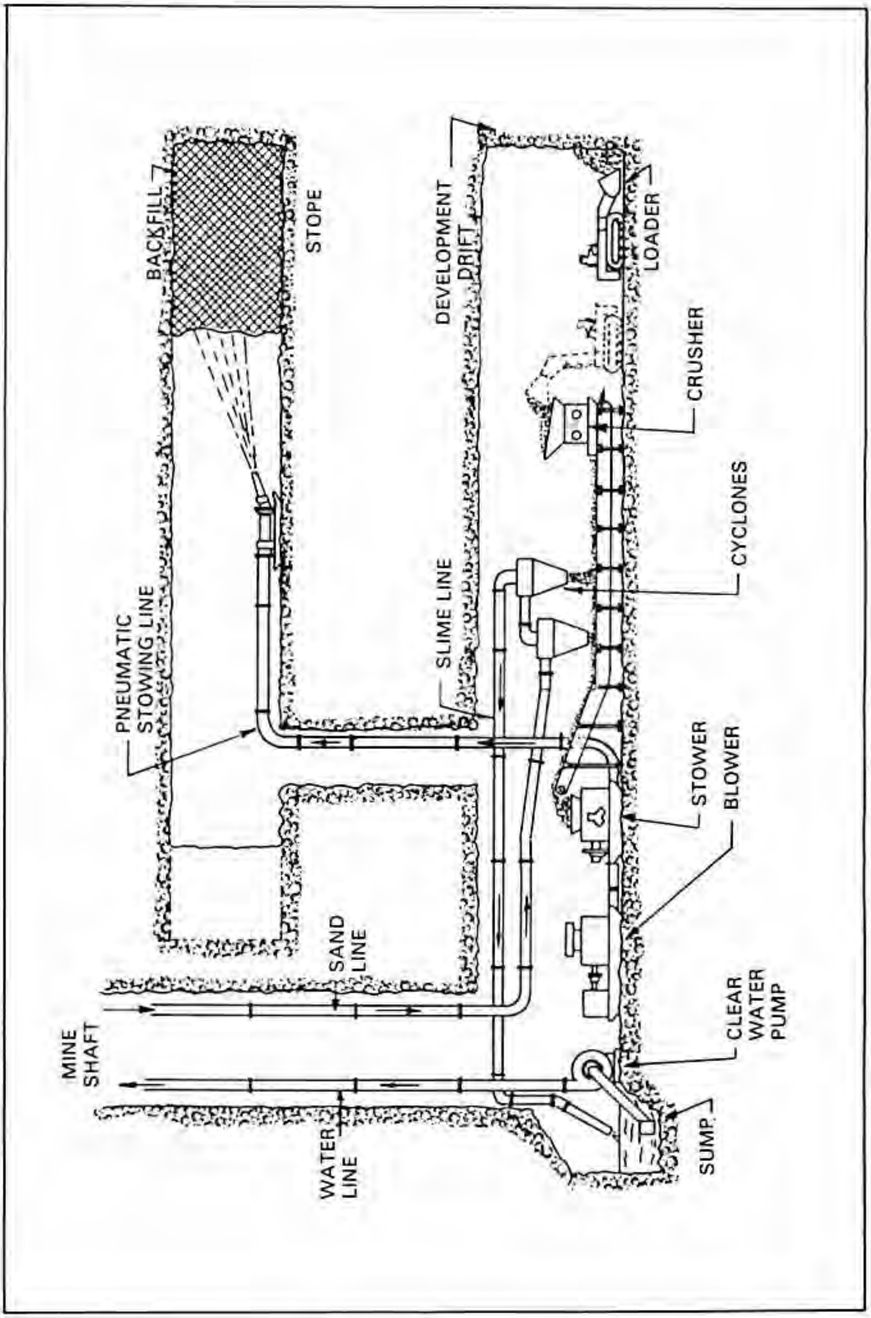

Fig. 6 — Hydra-pneumatic backfill system.

a longwall face. Of course, this is not now required as a means of roof support but is a convenient area to dispose of refuse providing the roof will hang up for a sufficient time to get the stowing material in place. By using Roots-type blowers and generating the air pressure at that required in the system, for example 10 to 12 pounds per square inch, the power demand is a lot less than European practice in using compressors which are normally employed for other machinery in the mine. Control techniques have also been improved in that the hydraulic power pack which powers the Staffa motor of the rotary airlock feeder is designed so that it senses the air pressure changes in the system and controls the infeed of material into the airlock feeder. As the pressure increases beyond normal working pressure which indicates that too much material has been fed into the system, it will slow down the infeed and bring the pressure of the system back to normal operating pressure. Similar techniques are employed on the vertical shaft coal hoisting systems of the National Coal Board in Great Britain where four pneumatic hoists are now in operation hoisting up to 80 long tons of coal per hour through a vertical lift of 1200 to 1600 feet. Recently, two pneumatic hoist systems were commissioned in Hungary working in parallel, each one hoisting 100 metric tons per hour of raw coal through parallel pipelines to the coal cleaning facilities on the surface.

CONCLUSION

It is not the object of this paper to prove that underground disposal of refuse is necessary for all underground mines in North America, but we wish to bring to your notice that equipment is available to undertake this task if it proves economically justifiable. Additional development is being undertaken at this time in the application of pneumatic conveying in the coal mining industry, for example, the rock hoisting system mentioned above which has been designed and tested to hoist 220 tons per hour of 4" rock through a vertical lift of 1240 feet and which is to be used with a blind shaft boring machine. Also in hand is a Bureau of Mines study to investigate: (1) coal hoisting with pneumatic systems in U.S.A. mines and how this will differ from European practice; (2) the conveying of cuttings from a tunnel boring machine operating in a coal mine which is paralleled by work previously carried out in civil engineering tunnel projects and finally; (3) the conveying of coal away from a continuous miner and the practical and safety limitations. This latter application of pneumatic conveying could result in increased production from continuous miners and the reduction in hazards associated with moving vehicles, such as shuttle cars, diesel tractors, etc., with the coal being totally enclosed within the pipeline and not subject to exposure to the mine atmosphere as it is on belt or chain conveyors.

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Bill Murray: Thank you Eric for a very interesting and a very thought provoking paper.

Ladies and Gentlemen the last paper of this technical session is on "Formcoke, a Potential New Market for Illinois Coal." This is being given by Jerome Knoerzer, who is a supervising research engineer with Inland Steel Company. Mr. Knoerzer has been employed for 25 years with Inland Steel Research Department and during that time he has worked as a technician and engineer on various projects related to coal preparation and utilization. He has been involved in all of the formcoke research projects at Inland. In addition, he holds a BS in mechanical engineering from the Illinois Institute of Technology.

Ladies and Gentlemen, Mr. Knoerzer.

FORMCOKE — A POTENTIAL NEW MARKET FOR ILLINOIS COAL

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INTRODUCTION

In the late 1950's, Inland Steel Company began investigating the possibility of producing blast furnace quality coke in a continuous formcoke process utilizing 100% Illinois coal as the feedstock. The reason Illinois coal was chosen was that the company had considerable reserves of low sulfur Illinois coal that would be more economical to use compared to the eastern high volatile coking coals normally used in the conventional coking process. For the past 24 years, Inland has used Illinois coal in conventional coke batteries; first, at a low level of 25% addition to the blend and later at over 60% for coal preheated prior to coking.

It became increasingly clear that the use of marginal coking coal in a cokemaking process was not the only reason for developing a formcoke process. In the late 1950's and through the 1960's, much work had been done to prepare the iron-bearing materials going to the blast furnace. The use of direct shipping ore had given way to the use of taconite pellets. These pellets had a high iron content, uniform size, and closely controlled physical properties, which resulted in a sharp increase in blast furnace productivity. Sinter quality was also improved. Blast furnace operating practices were changed in an effort to make the process more efficient. Thus, the only material which had not been improved significantly was coke. Some improvement has been made in coke strength through careful blending of strongly coking coals with the normally used high volatile coals. However, size, shape, and uniformity of coke was and still is left to vary according to the coal blend used, coal preparation practice, and operating characteristics of a particular coke plant.

Beside the desires to extend the coal base to include non-coking coal and to improve coke quality, a third factor in the consideration of a new coking process is the pressing need for better environmental control. The conventional coking process has presented a formidable challenge for controlling emissions during charging and pushing, as well as those emanating from the many doors and lids during the coking process. A continuous process with a limited number of processing steps offers an opportunity for acceptable environmental control.

Thus, the development of formcoke processes has been based on the following needs:

1. Extension of the metallurgical coal base to include poorly coking or non-coking coals,

2. Improvement of blast furnace performance through the use of coke with uniform size and shape characteristics, and
3. Better environmental control.

Toward these ends, numerous processes have been conceived and have progressed to the bench scale, but only a few have been developed to the point where sufficient quantities of formcoke were produced for limited blast furnace trials; mostly on smaller size furnaces. The results of these trials have been reported in the literature[1-7] and will not be reported in this paper, however, the basic steps encompassing most formcoke processes will be described which will show the applicability of coal type to the process.

BASIC FORMCOKE CONCEPTS

The term "formcoke" refers to a product of a forming operation, such as, briquetting, extruding, pelletizing, or balling, in which a blast furnace fuel is produced having specific size and shape characteristics. Specific properties, such as, crushing strength, abrasion resistance, and reactivity to carbon dioxide may also be controlled. In the broad definition of formcoking, there may be one or several thermal processing steps, which can take place either before or after the forming operation.

Those processes that utilize a heating step before forming rely either on (1) the inherent plastic properties of the coal when heated to the softening temperature for binding of the coal particles, or (2) complete devolatization of the coal with recovery of the tar to be used as a binder in the forming step. Another approach to formcoke production is to produce briquettes in a double-roll briquetting machine at ambient temperature using fresh coal with either asphalt or pitch as a binder.

Figure 1 refers to two processes (Ancit and BFL) that utilize an initial thermal treatment which combines the complete devolatization of a non-coking coal heated to a high temperature with a coking coal which has been heated to a lower temperature. The temperature of the resulting mixture is sufficiently high to effect the softening of the coking coal, which then acts as a binder in either the briquetting or balling operation. In general, about 75% non-coking coal can be combined with 25% strongly coking coal to produce a good quality formcoke. Figure 2 shows the basic step practiced by the Inland and Sapozhnikov processes. Here a single, weakly coking coal is heated to near its softening temperature and then briquetted, followed by coking in a shaft coker. Another type of hot forming process is that developed by Consolidation Coal Company. As shown in Figure 3, coking coal is heated and formed into pellets or balls in a hot balling drum using a tar binder. Also, the fines screened from the drum product are charred and recycled to the drum. One process that employs a complete devolatilization of the feed coal prior to forming is the FMC coke process shown in Figure 4. This process will be discussed later in more detail, however, basically coal is devolatilized and briquetted with a pitch binder derived from the carbonization step. The briquettes are then coked in a shaft coker.

Two processes that use cold briquetting of fresh coal are the HBN pro-

Table 1 — Pertinent features of various formcoke processes.

Process	Coal Required	Pretreatment	Forming	Post Treatment
ANCIT	25% Coking 75% Non-Coking	Heating to 300 °C Heating to 600 °C	Hot briquetting of mix at 450 °C	Controlled cooling
BFL	35% Coking 65% Non-coking	Dried Devolatilized at 750 °C	Hot briquetting of mix at 450 °C	Calcining
DKS	80% Non-coking 20% Coking	None	Cold briquetting with a binder	Carbonization in a slot oven
FMC	100% Non-coking	Devolatilized at 815 °C	Cold briquetting with a binder	Calcining
HBNPC	85% Non-coking 15% Coking	None	Cold briquetting	Carbonization
Zapozhnikov	100% Weakly coking coal	Heating to 500 °C	Hot briquetting	Carbonization in vertical ovens
Inland	100% Weakly coking coal	Heating to 450 °C	Hot briquetting	Carbonization in vertical ovens

cess (Figure 5) from France and the DKS process (Figure 6) from Japan. Both processes use non-coking coal, coking coal, and a binder which is blended, briquetted, and coked in either a shaft coker (HBN) or a vertical slot oven (DKS). Most of the processes employ a final heat treating or coking step as a means of assuring a completely devolatilized product. The pertinent features of the more successful formcoke processes are shown in Table 1.

INLAND STEEL FORMCOKE PROCESS

The early research effort at Inland was directed toward the development of a formcoke process with Illinois No. 6 Coal. Since this coal is a weakly coking coal with only moderate swelling properties, it was decided to concentrate on a process using cold briquetting with a binder for forming, followed by heat treatment in a countercurrent coker using an inert gas. The initial batch tests indicated that a very low rate of heating was required in order to prevent sticking and agglomeration of the briquettes as the temperature was raised through the plastic range. However, the disadvantage of the very slow heating rate was the necessity for a long coking time.

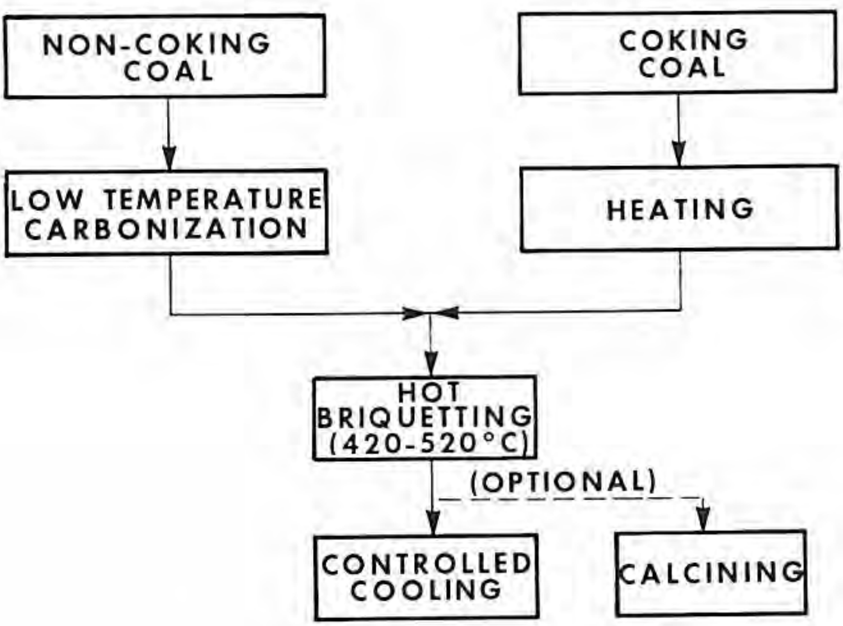

Fig. 1 — Basic flowsheet for the Aneit and BFL processes.

Further work showed that by heating the ground coal to near its incipient fusion temperature, briquetting immediately, and then subjecting the briquettes to a mild surface oxidation, the sticking and agglomeration between briquettes was eliminated. The batch tests led to the design of a 20 kg/h continuous coking unit, consisting of three zones for heating, coking, and cooling of the briquetted coal using an inert gas for heat transfer. A schematic flowsheet is shown in Figure 7. A patent application was filed in 1963 and granted in 1967.[8]

It became clear that the amount of developmental work and expense would be too great for Inland to carry out alone. Therefore, subsequent work with formcoke was carried out in cooperation with developers of other processes. The European processes, which were of interest to Inland, utilized hot briquetting and coking in sand-type heat exchange vessels. Briquette heating rate could not be controlled in the sand bed cokers, resulting in swelling and fusion of the coal, thus producing a weak product of irregular size and shape. Therefore, Inland's efforts were redirected toward the FMC formcoke process. This process offered promise since it was designed to operate with a single coal of either the subbituminous or bituminous variety, which included Illinois coal.

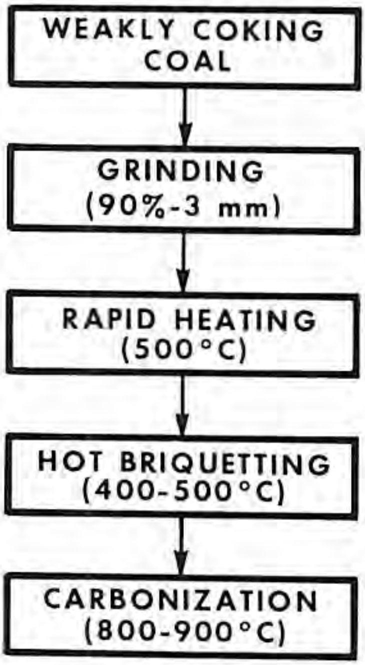

Fig. 2 — Basic flowsheet for the Inland Steel and Sapozhnikov formcoke processes.

DESCRIPTION OF THE FMC PROCESS

The FMC formcoke process was designed to produce coke for use in the production of elemental phosphorus at Pocatello, Idaho. The coal for the production of formcoke was the Elkol subbituminous coal from the Adaville seam near Kemmerer, Wyoming. Research work was carried out which led to the design and construction of a 227 Mg/d demonstration plant at the Wyoming site. This plant, which was a joint venture between FMC and United States Steel Corporation, had the two-fold purpose of producing formcoke for the phosphorus furnaces and sufficient formcoke for testing in an experimental blast furnace at Universal, Pennsylvania.

The FMC process, shown in Figure 4, is divided into two semi-independent processing sections. The front-end of the plant is the pyrolysis section in which the coal is processed through a series of three fluid bed vessels to carbonize the pulverized coal and recover the by-products. Coal is

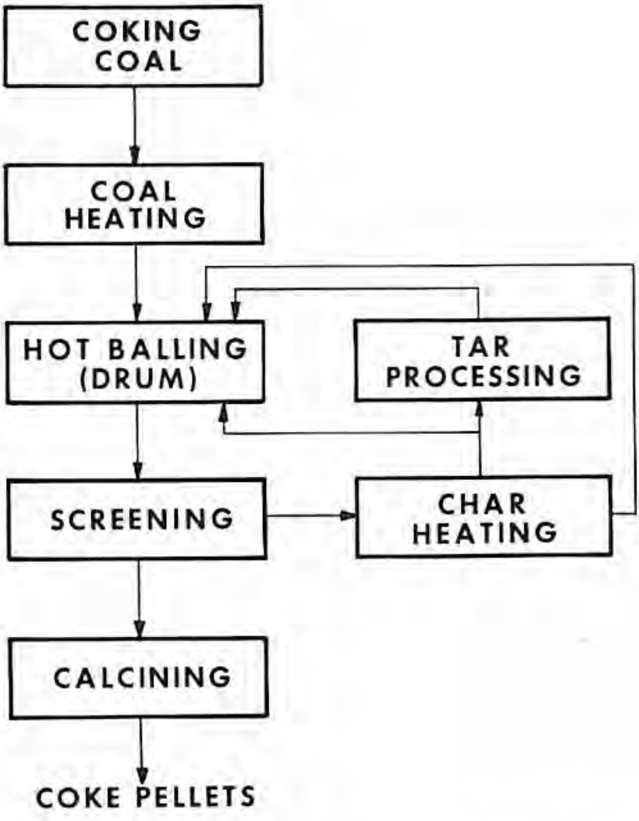

Fig. 3 — Basic flowsheet for the coke pellet process (Consol-BNR process).

received, pulverized, and screened at 4 mm. The undersize is dried and heated to 150 °C in the catalyzing fluid bed vessel, which is fluidized with steam and a controlled amount of air to prevent agglomeration of the coal. This oxidiation step is necessary for bituminous coals that swell and soften, however, for western subbituminous coals, drying and heating is usually sufficient. After heating to 150 °C, the coal is conveyed to the second fluid bed vessel, which is the carbonizer. Here the coal is heated to about 480 °C with a fluidizing medium of steam and a controlled amount of air. The air is required to provide the oxygen for combustion to heat the bed. All of the tar and a portion of the by-product gas is removed from the coal in the carbonizer. The char from the carbonizer is conveyed to the third fluid bed vessel for final calcination at 815 °C. The calciner is fluidized with an inert gas and air which produces an off-gas with a low heating value. The final processing reduces the calcinate to less than 3% volatile matter. The calcinate is cooled to about 120 °C and stored for subsequent briquetting.

The back-end of the process includes the forming and coking steps. The tar that was produced in the carbonizer is dried and polymerized with air to produce pitch, which is used as a binder in briquetting. Pitch is blended with calcinate and briquetted in a double-roll briquetting machine. The screened briquettes are then cured on a travelling grate in a curing oven at 230 °C. This curing generates sufficient strength in the briquettes to minimize degradation in the coker. The cured briquettes are coked in a vertical shaft kiln heated to about 815 °C, and cooled in the lower section of the shaft by recirculated inert gas prior to their discharge. The off-gas from the coker is stripped of the tar that is derived from the binder. A portion of the gas is burned to generate heat for coking and provide an inert gas as a heat carrier in the coker. The excess gas is used in an incinerator to burn waste products and produce steam.

ILLINOIS COAL TEST WITH THE FMC PROCESS

In 1966, Inland joined with Armco and FMC to conduct a blast furnace test of formcoke at Armco's Hamilton, Ohio plant.[1] The formcoke produced for this test was larger than FMC had normally been producing which resulted in a product with a very grainy texture with poor adhesion between grains. This poor adhesion resulted in the generation of excessive amounts of granular fines along with a more troublesome airborne dust. In spite of the operating problems, the tests did show that a production size blast furnace could operate on formcoke. However, it was clear that much work was necessary in order to improve the abrasion resistance of formcoke before further testing could proceed.

In an effort to improve the product, Inland sponsored research at FMC's Philadelphia pilot plant using Illinois No. 6 Coal. As a result of the pilot plant work at FMC, it was determined that by modifying the briquetting practice a good abrasion resistant formcoke of high crushing strength could be produced. Since we were interested in the use of Illinois coal, the next step was an evaluation of Illinois coal at FMC's Kemmerer demonstration plant. Two trials were made in 1970 to produce formcoke to be evaluated for handling characteristics at Inland's blast furnace. The first trial was aimed at producing the highest quality product using Elkol subbitiminuous coal. The second trial was conducted using about 900 Mg of Illinois No. 6 coal. This trial was the first time any coal other than Elkol coal had been processed at Kemmerer. After adjusting plant operating temperatures and feed rate, a good quality formcoke was produced. Several railroad cars of the product from each trial were shipped to Inland where the briquettes were utilized in the blast furnace without difficulty.

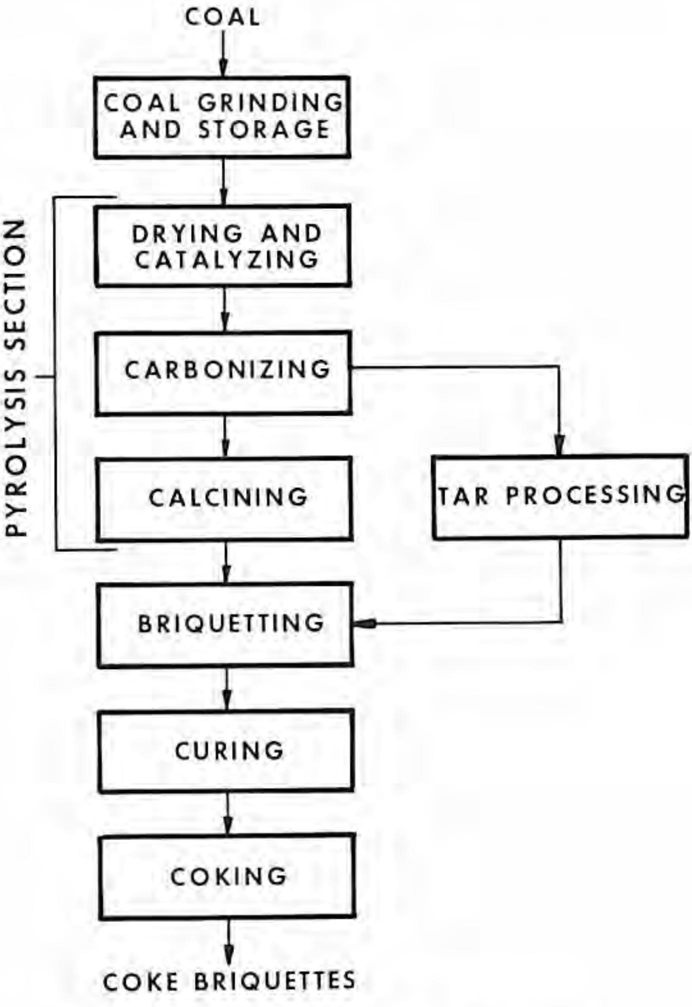

Fig. 4 — Basic flowsheet for the FMC coke process.

The objective of the trial with Illinois coal was to prepare for a sustained run using 100% formcoke in a large blast furnace operating at high production rates. In 1973, a consortium of six companies, which included Inland, FMC, Armco, Jones & Laughlin, McLouth, and United States Steel, carried out a test at Inland with 18,150 Mg of formcoke produced at Kemmerer from Elkol coal.[5] Elkol was chosen because of the cost and downtime required to modify the plant to process Illinois coal on a continuous basis, and the transportation cost for shipping Illinois coal to Wyoming. Formcoke was used up to 80%* replacement for regular coke, however, problems developed when the inwall temperatures increased and remained above normal, in conjunction with high top gas temperatures, indicating channeling of gases along the walls of the furnace. It was postulated that channeling resulted from an unusual distribution of formcoke in the furnace. At the 50% replacement level, the furnace operated

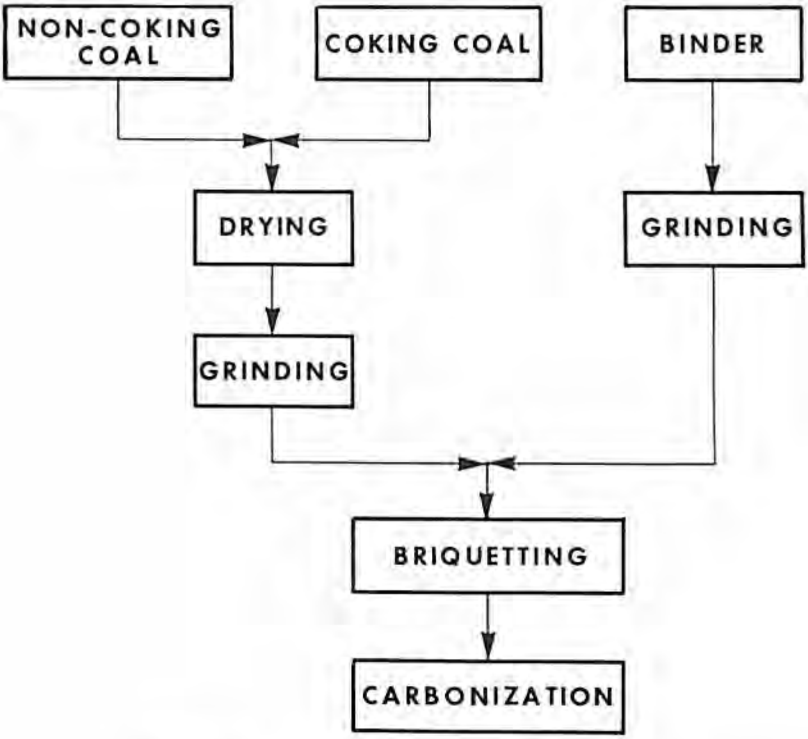

Fig. 5 — Basic flowsheet for the HBN formcoke process.

**100% replacement was used for 5 hours, however, the problem had developed previously at the 80% level after 105 hours of operation.*

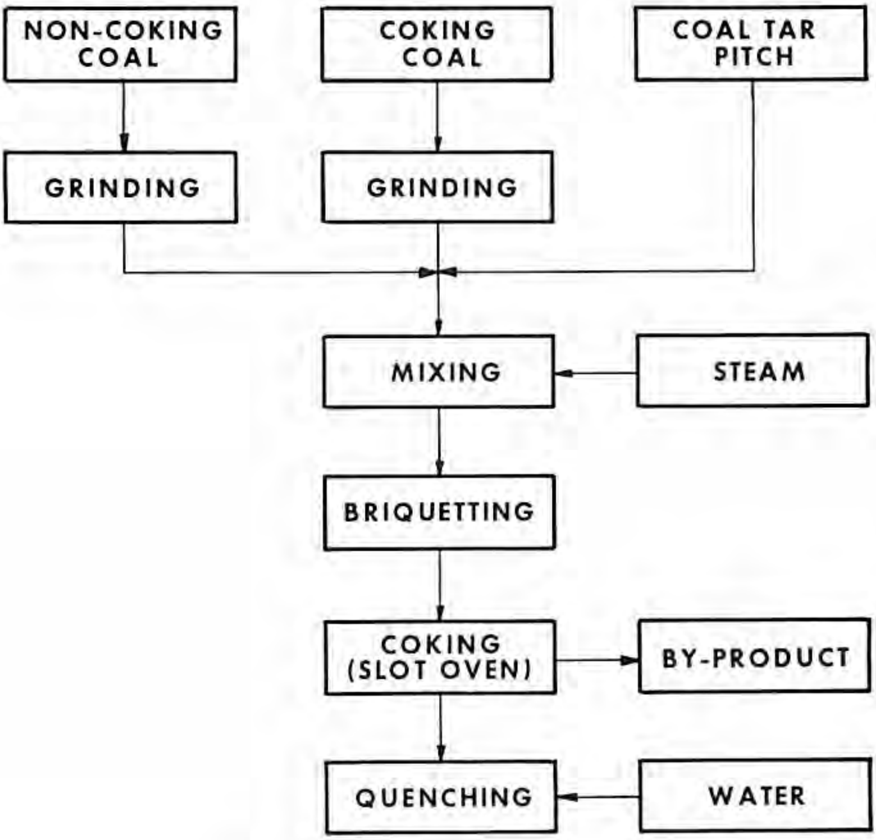

Fig. 6 — Basic flowsheet for the DKS formcoke process.

successfully at high wind rates. The conclusion from this trial was that formcoke can be used at 50% replacement levels with no significant operating problems. At higher replacement levels, charging patterns would have to be developed for better distribution of formcoke to prevent channeling of gases in the furnace.

FUTURE DEVELOPMENT PROGRAM FOR FORMCOKE

The developmental work that is still needed, as indicated by the 1973 trial, prompted Inland to develop a large scale demonstration program aimed at the use of formcoke as a total replacement for regular coke in several different size blast furnaces. In addition, process modifications are proposed to utilize oxygen and steam, instead of air and inert gas, in the carbonizer and calciner to produce a higher quality of gas for use in existing plants designed to use coke oven gas. Basically, the plan calls for building a formcoke plant large enough to supply a small furnace with formcoke for a sustained period so that proper charging practices can be developed. The second phase will be the operation with 100% formcoke in an intermediate size furnace, which would be the same one used in the 1973 tests. The final phase will be a trial on a fully instrumented large blast furnace. The plant, to be built at Inland, would use Illinois coal to produce 907 Mg/d of formcoke. The by-product gas, which would be either of low or medium heating value, depending on the use of air or oxygen, would be utilized within the steel plant. Due to the magnitude of this project and the overall cost, a proposal has been submitted to the Department of Energy requesting government participation. This proposal is currently being evaluated.

The demonstration of the sustained use of formcoke as a replacement for conventional coke in a blast furnace is an important step in the development of formcoke. The other objectives for developing formcoke processes, as stated earlier, namely use of marginal or non-coking coals and better environmental control, have been demonstrated to a limited degree.

COALS APPLICABLE TO FORMCOKING

The range of coals tested at various stages of the FMC formcoke process has been reported by Moran and Joseph.[10] Most of their tests were conducted in their pilot plant, which is a duplicate of the front-end of the demonstration plant. The raw coal feed to the pilot plant is about 0.9 Mg/d with an evaluation run lasting about five days at steady-state conditions. Coals ranking from low volatile bituminous to subbituminous-B have been evaluated in this pilot plant unit. Figure 8 shows that range of rank of coals used in formcoking processes. Only two coals, Elkol (subbituminous-B) and

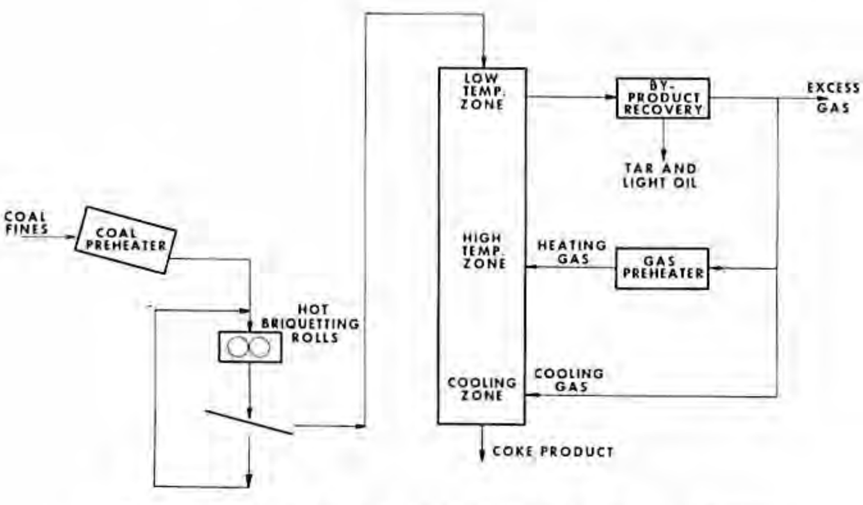

Fig. 7 — Schematic flowsheet of the Inland continuous coking process.

Illinois No. 6 (B-bituminous) have been run in the Kemmerer plant. FMC found a good correlation between the pilot plant results and actual production runs in the demonstration plant. The pilot plant results showed that all of the coals tested would produce a calcinate suitable for producing good formcoke under specific processing conditions. In those runs in which the calcinate was further processed into formcoke, the products were found to be similar in crushing strength and volatile matter content on a dry, ash-free basis. Ash and sulfur can be expected to vary as the coal feed varies. Generally, the high volatile bituminous and subbituminous coals can be expected to produce sufficient tar for binder to make an acceptable product. However, it may be necessary to use supplemental binder with some coals of lower volatile matter content.

The conventional coking process places restrictions on the candidate coals for use in the production of blast furnace coke. First, the coal must have the ability to form strong coke from the agglomerating properties of the blend's component coals. These coals are blended in a narrow range of proportions to achieve cokes of maximum strength. In the FMC formcoke process, a single coal can be used without regard to cokability. Oxidation in storage or weathering is not critical, except that highly oxidized coal may not produce sufficient tar for binder. The second requirement is that of desirable chemical composition for subsequent blast furnace use. Ash content should be low for all coking processes. Generally, sulfur must be maintained at as low a level for the production of formcoke as in the conventional coking process. However, the FMC formcoke process offers the opportunity to utilize sulfur removal processes which would tend to destroy the coking ability of coal in the conventional coking process. Also, desulfurization of the char or calcinate may be possible in the FMC process. Thus, the FMC formcoke process may be able to use higher sulfur coals in the production of blast furnace coke.

ENVIRONMENTAL CONTROL OF FMC FORMCOKE PROCESS

The continuous nature of the FMC formcoke process makes it amenable to better environmental pollution control. As an example, the efforts of FMC to control emissions from the Kemmerer formcoke plant were described by King, et al.[11] The plant was constructed in 1960 for the purpose of demonstrating the process. Therefore, the main emphasis was directed toward product quality with only a minimum effort to control emissions. In subsequent years, a number of modifications and improvements have been incorporated for better product quality and environmental control. All of the processing steps are contained in closed vessels equipped with off-gas recovery or scrubbers. Therefore, little is required to control emissions to the air, except for fugitive emissions mainly from the materials handling systems. For this purpose, dust collection systems with baghouse filters have been installed. Incinerators have been installed on those stacks which do not produce a by-product quality gas. Water from the wet coal and scrubber water from the dryer-catalyzer are discharged to containment

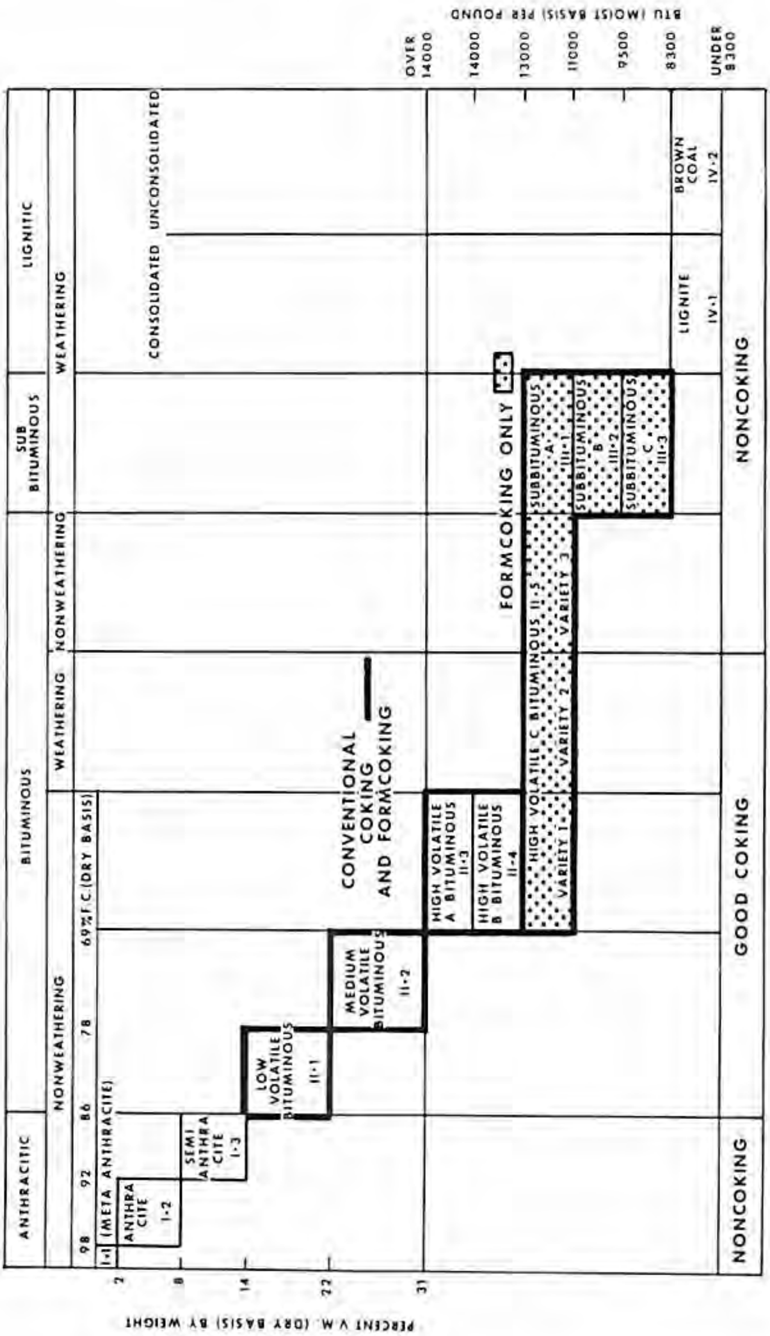

Fig. 8 — ASTM classification of coals by rank.

ponds for evaporation. Scrubber water from the by-product gas streams and tar decanters is disposed of in the front-end incinerator where organic waste is destroyed. Thus, with evaporation and combustion of process water, a "zero" discharge condition is attained. In less arid regions, suitable alternative water treatment systems, such as, biological or chemical oxidation would be required.

SUMMARY

The incentives for development of a formcoke process are an extended metallurgical coal base, potential for improved blast furnace performance, and better environmental control. The particular incentive for Inland is the use of greater percentages of the more economical Illinois coal. Research had shown that an acceptable quality product could be made from Illinois coal. Of the processes evaluated, the FMC formcoke process was the most advanced and has the greatest chance for commercialization because of the many years of successful operation at Kemmerer. Blast furnace trials indicated the potential success for full scale continuous use of formcoke on large furnaces operating at high driving rates.

The potential for producing formcoke from a variety of coals was shown by FMC to be quite feasible. However, some modification may be required to process coals of different rank. Illinois coal had been successfully processed in the Kemmerer demonstration plant to produce acceptable blast furnace quality formcoke.

Environmental control of a continuous formcoke process should be easier to achieve, due to the reduced number of emission sources, and the elimination of the charging, pushing, and quenching steps normally associated with pollution problems in the conventional coking process.

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Bill Murray: Thank you very much Jerome. Mr. President, ladies and gentlemen, on behalf of the speakers I would like to thank you for your courtesy for listening to the speakers this afternoon. In conclusion, I would like you to join with me in thanking the speakers for the many hours of time, their own valuable time, that it has taken them to prepare the papers and also for the gift of knowledge and experience in the presentation.

MORNING SESSION

The Friday morning Business and Technical Sessions convened in the Lincoln Room of the Holiday Inn East at 9:00 a.m., October 17, 1980. President Charles E. Bond presided.

BUSINESS SESSION

President Bond: The first order of business will be our Secretary's financial report by Heinz Damberger.

SECRETARY-TREASURER'S REPORT

Heinz Damberger: This is actually the Secretary's and Treasurer's Report. A count of the people who showed up today and yesterday indicates that we have here 920 regular members, 9 life members, and 50 students which add up to a total of 979. There are still people signing up so I think we are going to hit 1000. We were very close to 1000 last year; I think it was 993.

Our financial status during the past year has deteriorated somewhat. We have had more expenses than income. The Executive Board has discussed this, and you know that this year we have increased our dues. Next year we will be increasing the advertising fees to increase our income. There were some unusual expenditures this year, which will not occur again. We had a penalty of $1690 from IRS, which I think we are going to get back. This happened when I came in as Secretary and I really didn't know that we had to file our return by a certain date. Hal didn't brief me, and they put a penalty of ten dollars a day on us. But I understand that a change in officers is a valid reason for filing late, so we will get our money back, I think.

We also had a little over $2,000 in expenditures, which will be a one time expenditure for development of a computer program for addresses of all the membership and the advertisers. Now we can automate our mailing, which we have done this year. For the first time we can sort by zip code, and this makes it possible to use spot mailing. As a result of this, this year we have substantially reduced our mailing costs. For instance, we mailed the Proceedings for $340 less than the previous year, and as a result of this computer program we could give our addresses in a sorted order. On our regular mailings we saved $720 as a result of the use of bulk mailing. We needed some extra money to help Betty package the things. When you do bulk mailing there are certain requirements, so that takes a little extra work. We still saved about $600. The $2,000 will be paid back in about three and a half years, so I think that is a pretty good investment.

The cost for our fellowship hour went up last year by $2,350, mostly on a basis of upgrading. You may have noticed that you got beef sandwiches last year and this year again. I think they were received pretty well, but it does mean extra cost to us. Also we put out some more food than the previous years.

And thirdly, a major item of increase and expenditures was the Proceedings volume. They cost $2,500 more this year than in the previous year for two reasons — 1) We had fifty pages more; mostly there were some extra pages of advertising, but there was more text, and 2) we have more members so we increased the number of copies that we printed, and of course, there is inflation. So all of these increased our expenditures and much more so than our income. Income went up about a thousand dollars, and expenditures after we subtract the IRS penalty was up $9,000. It is about an $8,000 draw down. Now I think we are going to be fairly balanced this year and next year again. For those of you who are interested in the details I have copies of the financial report, and you are certainly welcome to look at them. The Auditing Committee has approved the financial report.

NOMINATING COMMITTEE REPORT

President Bond: The next item of business will be the Nominating Committee Report, and that will be given by Wally Lucas.

Walter Lucas: Thank you. The Nominating Committee consists of Chairman Mr. Bill Will, who sends his regrets he could not be here today, Mr. George May, and myself. We would like to submit to the Institute the following four people for three-year terms to the Executive Board. Three are re-nominees, and one is a new one. They are as follows — Mr. Robert Izard of Midland Coal, Mr. William J. Orlandi of Ziegler Coal, Mr. Brad Evilsizer, Director of Mines and Minerals of the State of Illinois, and the new one, Mr. Ron Siler of MAPCO. The other nominee that we would like to submit is for Second Vice-president, and his is Mr. Wayne E. Haynie of Old Ben Coal Company.

President Bond: You have heard the nominations as presented. Do I hear a motion to accept as submitted? So moved. Is there a second to that motion? All in favor say I. Opposed? Motion carried.

ADVERTISING COMMITTEE REPORT

The next item of business will be the report of our Advertising Committee that was chaired this year by Mr. Ray Taucher. He is unable to attend, so I believe Heinz is going to give that report.

Heinz Damberger: As you all know the Advertising Committee is really the heart of this whole organization, because they provide the money. Last year we had 239 pages of advertising which brought in $26,883, and that is the bulk of our income. Compare this to $7,000 from dues. So these gentlemen are doing a marvelous job. This year we already have 120 pages again for your Proceedings volume, and we are ahead of last year. I think these gentlemen are doing very well. I suggest to anybody here or to any of your friends, that if you can support this committee, they will be very appreciative and everyone else will be too. I think they deserve a hand for their work.

President Bond: As Heinz indicates this is the financial backbone of our association, and we do appreciate the participation and attention that has been given to this matter.

HONORARY LIFE MEMBERSHIP

President Bond: The next item of business is the Honorary Life Membership. As you well know, it is customary that each year we select someone to present this honor to, and I would have to admit this year it seemed a little difficult to find that particular person. After a long search, as a matter of fact probably as late as three weeks ago, a name was mentioned, and we have selected that person. I will tell you a little about him. The recipient is a very worthy coal miner, but he has been somewhat inactive in attendance in the last few years, and in just a minute you will understand why. This year he is celebrating his century birthday. His mining career started at the age of 15 in 1895 in the central part of Illinois along the Illinois River, and he later migrated to southern Illinois around Eldorado. After having spent some 45 years with Peabody, he retired in 1940. So he has been out of circulation all these years, but he has been somewhat active. We felt he would be a good prospect, we pursued it, and he accepted it. His name is George Lindsay. Some of you probably know him; I know some of you do. Some of you may know him by his nickname when he was mining coal. He was called Stub Lindsay. He has a son George who lives in Chicago. He has another son, a doctor, who lives in Springfield. Unfortunately Mr. Lindsay had made prior arrangements, and he won't be here to accept the award today at the luncheon. But we do have a very distinguished person to accept for him, and you will find out who that is at the luncheon.

SCHOLARSHIP REPORT

President Bond: The next item of business is the Scholarship Report, and this will be given by Jack Simon.

Jack Simon: As I think all of you know, one of the jewels in the crown of the Illinois Mining Institute is the rather outstanding scholarship program that a relatively small organization, such as we are, has been able to sustain, and there are some members of the Executive Board who are hoping that we can do even better. But this year we have five full scholarships. There are two at the University of Missouri-Rolla, two at Southern Illinois University, Carbondale, one at the University of Wisconsin at Platteville, and three awards to three junior colleges — Rend Lake College at Ina, Illinois, Wabash Valley College at Mt. Carmel, and Southeastern Illinois College at Harrisburg. I think we have representatives from most of them here to make a brief report on the scholarships at their institutions. First is the University of Missouri-Rolla, and Ernie Spokes will be making that report.

Ernie Spokes: Thank you Jack. Mr. President I am happy to be able to represent the University of Missouri-Rolla and report that this year we have Craig Beck, who is on a scholarship. Craig would you stand up please? We also have Steve Reel, who has an examination this morning and can't be present. Steve will be graduating in December, and when he vacates the scholarship Todd Grounds will go on it. All three are from Illinois, and they are all very enthusiastic about the mining industry, particularly coal mining. I hope that some of them, if not all, will end up in the coal mines of Illinois.

Usually I am asked to say something about what is going on at Rolla. Our enrollment is just a little lower than last year because we graduated about 50 or 55 mining engineers last year. When anybody looks at the enrollment by class they ask me how that can be because we always have a lot more seniors than anything else. One reason is that the community colleges both in Illinois and Missouri and a few scattered elsewhere send us some very fine juniors, so we do get a much larger enrollment in the upper classes than the lower classes. I think we are expecting 30 to graduate near Christmas. I just got the list on my desk yesterday morning before I left, and I didn't have time to read it over and see just where we stood. But we look for another bumper crop this year.

I am sure not all of you know that Dean Plans died in the middle of July, and his duties have been transferred to me. One of the serious problems that we have is keeping up the level of faculty. There is always the problem, of course, of having the money to hire people, but you just can't throw money into a situation like that. The ads can run for years on end, but we never find suitable people or even people who are interested. So we constantly worry about using up all the seed corn when all the graduating class goes directly into industry. We are hoping that we're going to persuade a few of our students to go to graduate school. It has always been my theory that graduates should go out and work a year or two, then they know exactly what they are interested in before they come back and do their graduate study. But we are getting almost to a point of desperation. We just have to turn out more masters and doctors or pretty soon there won't be any mining schools. The buildings will be there, the money will be there, but there won't be any faculty to teach the students. If any people are thinking of retiring and think they have talents that we might utilize, please keep us informed. I can usually manage this in the field of mineral dressing, which doesn't include coal preparation on campus, because we teach that in the mining department. But in that field we already have a mill superintendent as a lecturer. We may see a considerable change in the pattern of education in mill industries because of the shortage of people that qualify to meet the standards of creditation. We don't make all of the decisions on our own campus. Some of the decisions are made for us, and we have to meet certain standards so we are doing our best to do that. We are going forward with a lot of research related to coal, and I am sure you have seen that in the journals. I would like my students to stand up so you can get a glimpse at them. Maybe you can meet them later on. Please stand. Thank you very much.

Jack Simon: Ken Tempelmeyer from Southern Illinois University at Carbondale is here to make the report for Southern.

Ken Tempelmeyer: Thanks very much Jack, Mr. President. I am also pleased to be here and have the opportunity to thank the Institute for the scholarship support that they have continued to give to Southern Illinois University. I am sure as many of you must know, that we reinitiated last fall, undergraduate education in mining engineering in the State of Illinois with the establishment of a Mining Engineering Department at SIU, Carbondale. During the first year of this program we had nine majors. These primarily transferred into the program from other departments within the college. This fall we have about 60 undergraduate majors in mining engineering. I expect that next year we will have over 100, and my anticipation is that the program will reach the equalibrium number of 200 students or so. Our undergraduate mining program is also complemented by a graduate program in mining engineering, which has been in existance for several years. It has about 20 students in it, and in addition we have a baccalaureate program in mining technology which has also been in existance for several years. It provides a means to give students, who come from the community colleges throughout the state, their third and fourth years of education in mining technology.

Dr. Paul Chugh was bringing a group of our students, a dozen or so. I do believe they'll be here to attend the sessions later this morning. I believe that all of our mining educational programs are really proceeding impressively, and our problem too, is very similar to what you heard previously. We have no problem in recruiting students, but we do have a very serious problem in recruiting good, adequate faculty members in all aspects of mining engineering. And those of you who may be interested in looking at the opportunities at Rolla, I hope you will also give me a call and explore some of the opportunities that exist at Carbondale.

On behalf of the University and more specifically on behalf of the students, because they're really the ones who benefit from your aid, I would like to thank the Illinois Mining Institute for the scholarships received last year. We receive two $750 scholarships as Jack Simon mentioned. We actually divide these into three awards of $500 each. We award the scholarships on the basis of academic achievement, financial need, and a demonstrated interest in mining. We ask all of the students to submit a statement telling why they are interested in mining and what their lifes intention is. Then the Assistant Dean and I interview all of the top candidates. We think this procedure has allowed us to identify some outstanding candidates for the IMI scholarships that have been awarded. This past year the three scholarships were awarded to Stephen Kopenitz, Del McCabe, and Robert Schirato. All three were outstanding senior students; two are from mining families, and we know that all three will be a credit to the University and a credit to IMI. Normally, we like to bring our students and introduce them to you. I was unable to arrange that because these three lads graduated last May, and all three have been employed by the same company, Texas Utility in

Dallas, Texas. I don't know whether they were employed as a trio or not, but we surely would have had a hard time choosing the best among the three. I guess Texas Utility had that same difficulty and decided to take them all. Again we appreciate the scholarship support that you have given. We received the support for this coming year, and we are in the process now of identifying the 1980-81 recipients. We should do that within a month or so. Thank you.

Jack Simon: We have one full scholarship at the University of Wisconsin at Platteville, and I think Dale Dixon is here to report for them.

Dale Dixon: Thank you Jack. I wish to thank the Illinois Mining Institute for their continued scholarship program. It is interesting to note that out of the 29 we have had in the past year, 15 of them, which is a little better than 50%, have entered into the coal mining industry. A lot of our other students, of course, have gone into the coal mining industry. Most of these 15 are paying taxes in the State of Illinois which is nice to know. I now wish to introduce our IMI Scholarship winners — Mr. Russell Meyer and Mr. Scott Conotzen. Russell is a senior, and Scott is a junior. We are going to be graduating 17 good mining engineers this year, and its an exceptionally good class. We have an enrollment of 95 students in our program. We too are experiencing the problem of maintaining faculty, so if any of you are interested, contact us first. Thank you very much.

Jack Simon: I neglected to mention that the board has authorized one full scholarship at the University of Illinois. That award has not been implemented for several years, but it does remain on the books. We have three junior colleges, and I am not sure who the representatives are. Is there someone here from Rend Lake College? There is one $500-award for a student scholarship support for Rend Lake College. Is there anyone representing Wabash College? And the third one is Southeastern College at Harrisburg. Is anyone representing Southeastern? That concludes my report Mr. President.

President Bond: Thank you Jack for the fine report. As Jack indicated at the beginning of his presentation, our scholarship function is without any exception one of the most important functions of the Institute, and we have come up with dollars to support the scholarships for years. As a matter of fact, and I am very pleased to announce to you that just last evening we received a $1,000 anonomous gift to this scholarship fund, and we're not sure just how this will be administered. I am sure it will give us a start on increasing the scholarships and more than that, perhaps it will allow us to start a revolving fund that we can increase by both dollars and numbers. I thought we would be remiss if we didn't make mention of that fact. That concludes the business portion of our session today. Is there any other business or old business that anyone would like to bring before the membership? Is there any new business? If not, do I hear a motion for adjournment? Second. All in favor say I. Opposed? Motion carried.

TECHNICAL SESSION

President Bond: I open the Friday technical session of our 88th Anniversary, and at this time I would like to introduce the Chairman of the session. He is a good friend of mine, Mr. Robert (Bob) Holloway. Bob has a degree from the University of Illinois in agronomy and political science. He spent seventeen years of his career with the USDA and the Illinois Department of Agriculture. He has been with Arch Minerals for the last five years. He is director of land resources, and he will be the chairman for our morning session.

Robert Holloway: Thank you very much my very warm and personable friend, Mr. Charlie Bond. Charlie you certainly honor me in giving me this opportunity to be your Chairman of the technical session for the balance of the morning.

The first speaker in the technical session this morning comes to us all the way from Victoria, Texas. He is a very delightful and personable young engineer whom I had the pleasure of meeting just a few moments ago. Some of my ancestors come from Victoria, Texas. His name is William A. Hadden. He is a chief processing engineer for Allen & Garcia Company in Chicago, Illinois. Bill has about nine years experience with industry, and he has his engineering degree from the Pennsylvania State University, graduating in 1971. The title of his paper is "Today's Development in Coal Preparation Equipment and Processing." Would you please welcome William L. Hadden.

TODAY'S DEVELOPMENTS IN COAL PREPARATION EQUIPMENT AND PROCESSES

WILLIAM L. HADDEN
Chief Processing Engineer, Allen and Garcia Company
Chicago, Illinois

INTRODUCTION

The subject of this presentation is "Today's Developments In Coal Preparation Equipment and Processes". While researching the information for the presentation and trying to determine what were "today's developments", several curious conditions were found to exist.

The word "new" when related to new equipment and processes had different meanings among the suppliers polled. One group thought "new" meant anything developed in the period from the late 1960's through today, while another group thought new developments applied to prototype equipment and concepts under current development.

An attempt to discuss all the equipment and processes encompassed by either definition would at least be too time consuming. It was decided that only equipment and processes of "today's state of the art" would be considered. This too allowed for many pieces of equipment and many new concepts to be considered.

For the purpose of this presentation, preparation processes will be those processes that change any physical property of coal. This includes processes such as extraction and transportation. To narrow the field further, it was decided that the newer developments, especially those with which I have been recently involved, would be discussed.

Extraction and transportation have historically been part of the mining process rather than a part of the preparation process; but any process which alters any of the physical properties of coal must be considered as part of the preparation process.

NEW EXTRACTION TECHNIQUES

For example, in some of today's modern strip pits, overburden is removed and the exposed upper surface of the coal seam is cleaned of nearly all extraneous material by rubber-tired front-end loaders and motor driven sweepers. The loaders then scoop out a virtually pure seam of coal, whereas the older techniques permitted cleated dozers with rippers on the seam surface which caused much degradation and contamination from near seam rock.

Such advancements as found in the long-wall systems, their shorter counterparts, and respacing of continuous miner cutter-head bits, have been reducing the amount of fine and ultra-fine raw coals delivered to preparation plants. This reduction, in turn, can effect the final product moisture and Btu values, and could effect the amount of equipment and energy used to lower the moisture content.

NEW TRANSPORTATION AND HANDLING TECHNIQUES

Face to plant rapid conveyor systems, unit and dedicated train haulage, and silo and quick recovery bulk storage systems are some of the newer techniques being applied to today's transportation and handling systems that have reduced the time interval between extraction and delivery. This faster delivery has allowed for a fresher, less handled coal feed, which has not been permitted to weather, degrade or heat.

As can be seen, some detrimental effects that could be attributed to extraction and transportation techniques can be minimized by using some of the newer equipment and processes.

NEW PREPARATION TECHNIQUES

The majority of the physical and chemical processes used to beneficiate coal occur at the preparation facility. Not only have new equipment and processes been effecting preparation plant design and function, but advancements in older techniques have been making their mark.

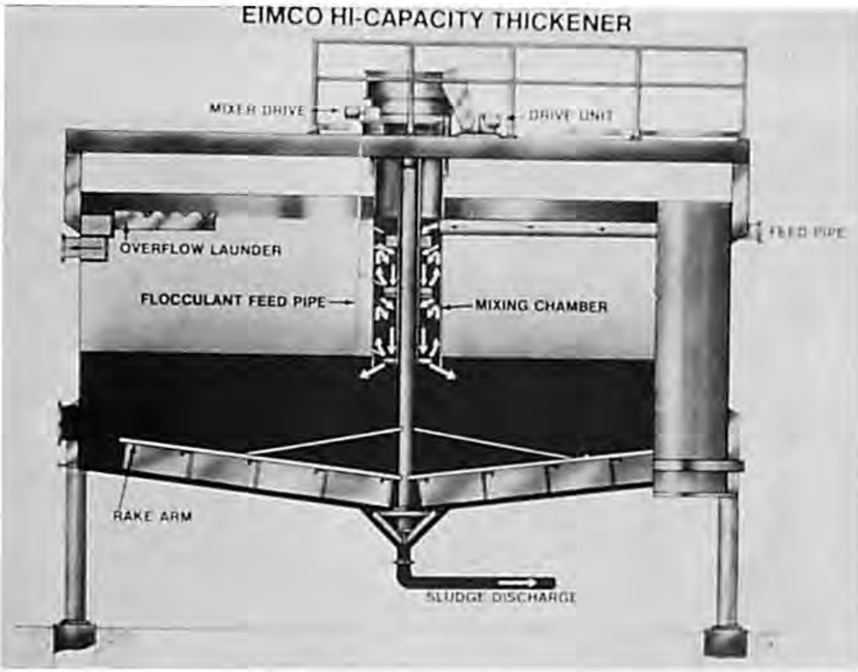

Fig. 1 — Schematic diagram of high capacity thickener.

Coal washing by jigging can be traced to approximately 1850, but today's improved jigs handle more capacity and make a better separation than those of their ancestry. The Batac jig is probably the most advanced jig operating today; it was designed for greater capacities and improved performance and to go beyond the capabilities of its predecessors.

SCREENING

Screening has been a function of coal preparation from the beginning, but only in today's state of the art do we have higher capacity, more compact, lighter units.

Development of screening has come a long way — from open, heavy, awkward wooden and steel units suspended by cables or wooden slats to rubber mounted, isolated and enclosed efficient units of today.

One such screen used for 20 mesh to 400 mesh separation is the Derrick Multifeed wet sizing screen. The manufacturer claims the unit is the ultimate in capacity, compactness, efficiency and economy for 20 mesh through 400 mesh separations.

The screen's unique multifeed concept provides three independent screening units within a single machine. The Sandwich Screen surfaces, which have high-speed, low amplitude screening action provide for fast and accurate grading of coal fines.

The advertised primary economic advantage of this unit is its high ratio of production to the space consumed. Further supplied information states that the overall screening efficiency of the unit is very high.

Fig. 2 — Typical external installation of high capacity thickener.

This unit is light weight and compact, with rubber float mounts to isolate vibration and requires no massive supportive structure. Evaluation of factors such as these directly effect the economics of design and construction trends in today's preparation facilities.

PUMPS

Pumps have historically been used about preparation plants, but it has only been in recent years that lower maintenance and longer wear life have been brought about by new alloys of various metals used in volutes, impellers, shafts, and liners. Pump improvement has not been limited to metal; complete pumps and some parts are being fabricated of ceramics, various cementatous and resin stone mixes, polyurethanes and ethylenes, tefelon, live rubber compounds, polyvinyl chloride, and numerous other compounds.

The use of these new compounds of metal, plastic, rubbers and other natural and synthetic materials is appearing widely throughout the industry as various parts — nuts and bolts, pipes, screen cloths, liners for launders, feed boxes for concentrating tables, drive chains, instruments, abrasion plates, cyclone liners, sleeve bearings, conveyor and v-belts, gears, belt scrapers, pinch valves, filter sectors and pump packing, just to name a few.

WATER SLURRIES AND THICKENER

The handling of water and water slurries of ultra fine coals and refuse has been problematic to the industry. Operating preparation facilities of 15-20 years ago disposed of unwanted contaminated plant waters by dumping them into ponds, lagoons or streams, but with today's environmental laws most facility circuity has become closed, or at least designed to remove the pollutants from the water. Several new pieces of equipment have been developed to facilitate economic water and/or slurry treatment. One of those pieces is the high-capacity thickener (fig. 1 and 2).

The high-capacity thickener looks very similar to a conventional thickener and has many similar features such as a tank body, rotating rakes, overflow launder and underflow line. The first unique feature that is noticed is the compactness of the unit — compact enough that they are being placed inside the plant proper. Other features unique to the high-capacity thickener are a mechanical flocculant mixer built into the feed well, a feed well design that injects the feed below the surface of the settling sludge, radially mounted inclined settling plates, and shorter residence time.

During operation, the feed to the unit is introduced through the feed well where flocculants are added and mechanically mixed in several chambers in series. The well mixed material leaves the mixing chambers and enters the sludge bed where settling occurs. Entrance to the sludge bed occurs below the sludge water surface which in turn aids in contact flocculation and settling.

The settled thickened sludge is mechanically raked to the middle of the thickener bottom where it is pumped out of the thickener. The resulting clarified water exits over the weir at the water surface and leaves the thickener by the overflow launder (fig. 3).

FLOCCULANT

Studies completed by one manufacturer indicate that multi-stage mechanical flocculant mixing improves flocculation. During the studies, tests showed that as the number of mixing chambers decreased, the capacity decreased due to improper flocculant mixing. Other studies indicated that thickening due to flocculation improves with mixer speed, which furthermore indicates that mechanical mixing improves thickening.

As previously mentioned, the mixed flocculated feed enters the sludge blanket below the surface of settling sludge. This allows for minimal disturbance of the flocculated particles once they have exited the mixing chambers. The possibility of short circuiting to the overflow weir is also minimized as the sludge blanket holds the feed down. The in bed feed allows for increased solids-contact flocculation and increases agglomeration and thickening. This system also minimizes floc shearing due to aggitated turbulance from water currents.

Some high capacity thickener systems incorporate sonic level detectors to maintain a stable sludge blanket. The level controls actuate discharge pumping and warn the operator if sludge levels rise too much.

Results of some test programs at various coal preparation plants

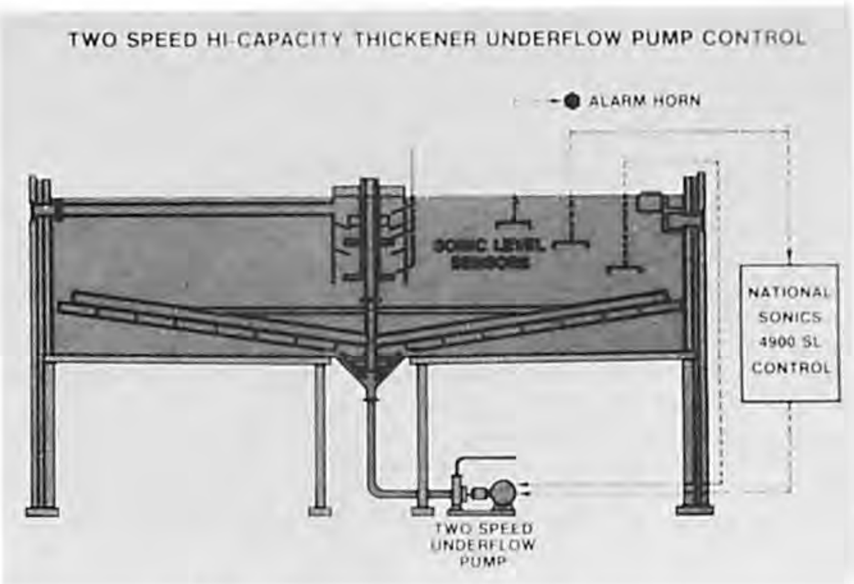

Fig. 3 — On-off underflow pumping control of thickener.

showed that the high capacity thickener could produce concentrations of underflow solids equal to or greater than conventional thickeners at load rates up to 10 times the rates typical of conventional thickeners.

Magnum Belt Press

Another piece of equipment developed for dewatering fine coal refuse is the belt press. One such press — the Magnum press — is designed to dewater flocculated slurry in three separate stages (fig. 4).

The flocculated slurry is fed into the feed distributor and onto a continuous belt of a polyester dewatering screen (fig. 5). During transportation to the second stage most of the free water is drained from the slurry through the screen. At the entry point to the low pressure second stage, the screen and sludge come in contact with a second continuous dewatering screen and pass about a series of perforated rollers of decreasing diameter. As the diameter decreases, the slurry is subjected to more pressure and this pressure combined with the serpentine movement of the belt allows for more sludge surface exposure creating more free water.

In the high pressure third stage of the press, external belts squeeze the screen and sludge against other perforated rollers and liberate more free water. As the dewatered sludge leaves the third stage, doctor blades remove the material from the screen. The dewatering screens are continuously washed as they return to the head end of the press.

The claimed energy savings, simplification of operation, and reduced operating and maintenance costs could make the unit a highly cost-effective dewatering device.

Supplied test data run on full scale units indicate that this equipment

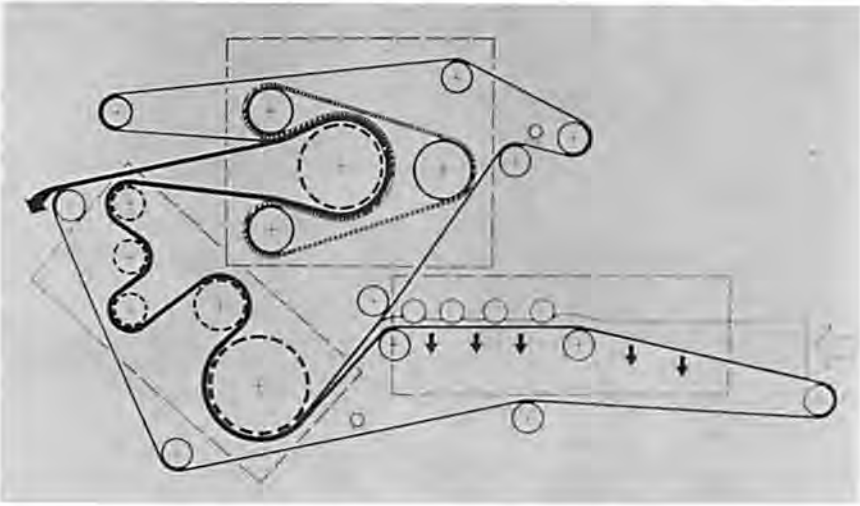

Fig. 4 — Schematic diagram of continuous belt filter.

could produce a cake having 82% solids by weight and recover as much as 97% of the slurry solids.

The product cake is dry to the touch and is capable of making a stable landfill mix material. Cake discharge of good chemical analysis is directly recoverable inasmuch as impurities such as ferric chloride or lime are not required to process the sludge.

Flotaire Hydraulic Flotation Cell

Yet another new process under development for recovering coal fines is the Flotaire hydraulic flotation cell. Although originally developed for the phosphate industry, this unit is now entering the coal fields. As of date, testing has been done in only one coal plant — the results are said to be substantially better than routinely received from mechanically agitated cells.

The cell operates solely on water power. Normal plant water is mixed with surfactants and aspirated air and fed to the bottom of the cell. Constriction plates distribute the air-water combination uniformly; as they rise to the surface they selectively attach themselves to mineral particles. The waste particles not picked up, pass downward and out the discharge.

Froth or concentrate is discharged at the top around the periphery of the tank. Projected feed to the cell is said to be as coarse as 14 mesh. Another claimed advantage is the capacity per unit floor space — the cell is

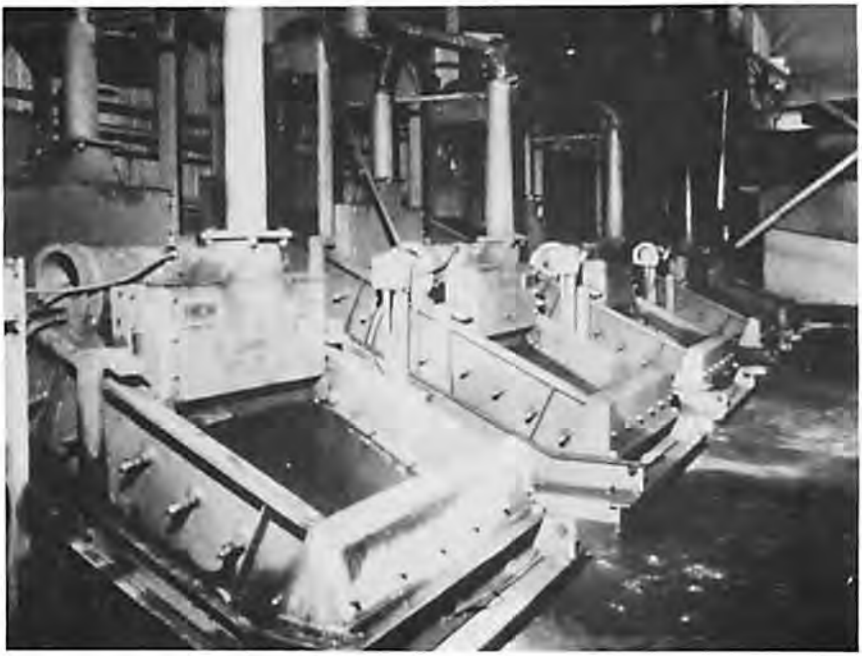

Fig. 5 — Typical installation of dewatering screen.

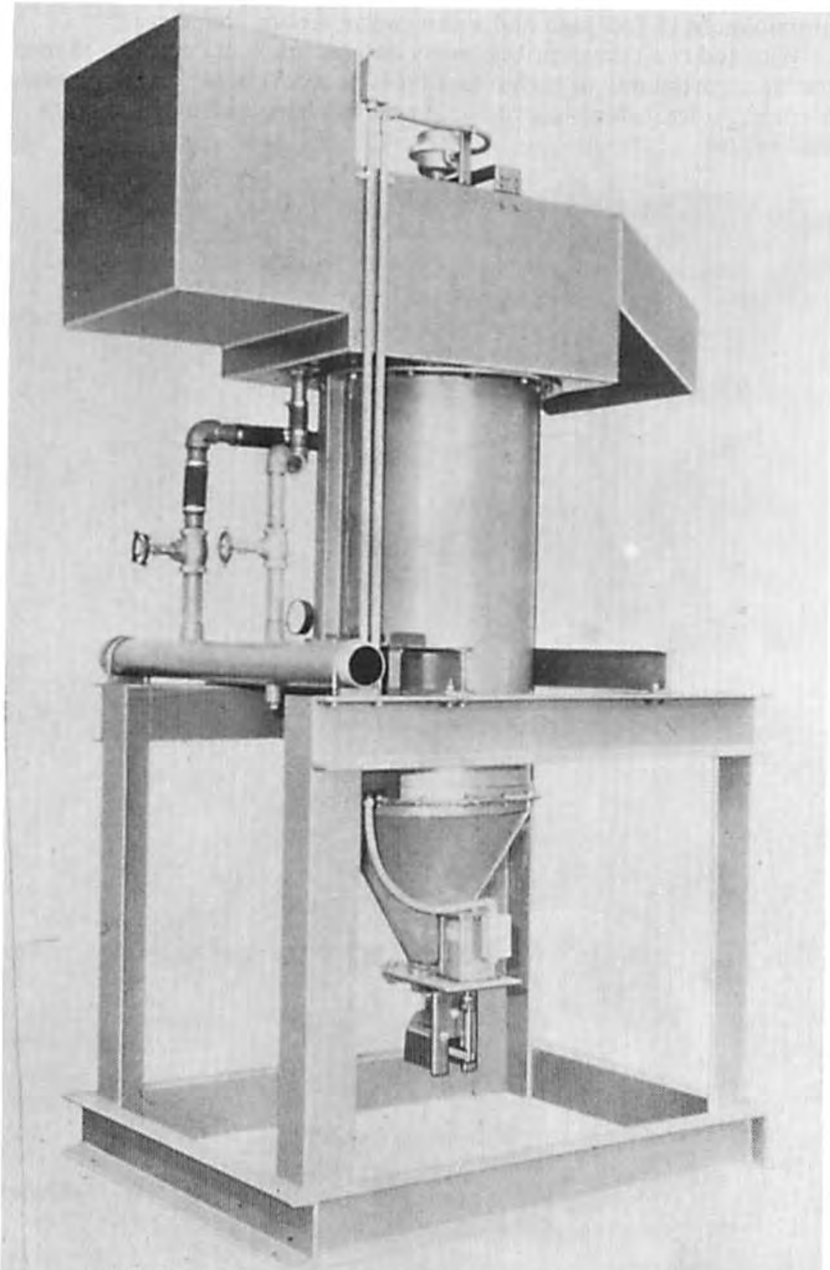

Fig. 6 — Super scalper that takes out excess refuse.

approximately 15 feet high and six to twelve feet in diameter.

With today's energy prices, many designs are being considered incorporating a partial mix of high refuse feeds or recovery of formerly rejected materials. At least one piece of equipment has been developed to scalp out excess refuse.

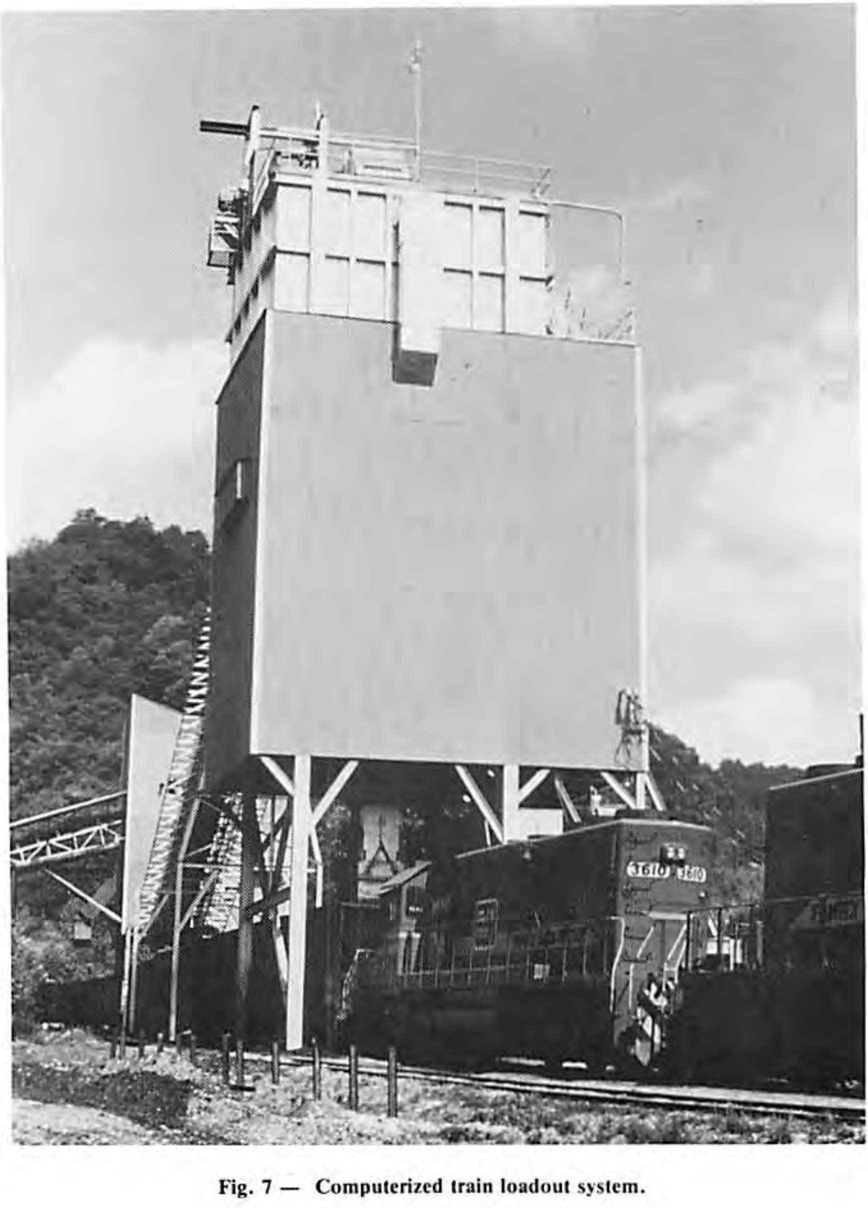

Fig. 7 — Computerized train loadout system.

THE SUPERSCALPER

The Superscalper (fig. 6) is advertised as an automated, yet simple and low cost means of scalping out excess refuse that can seriously reduce capacities of many fine coal cleaning devices. The manufacturer claims that the unit is best applied economically when the feed contains an excess of 40% reject material. Feed to the unit is suggested at -½, -⅜ ir -¼ inch.

The unit is an adjustable, hydraulic classifying device. The feed flows from the feed compartment across the roughing pocket and sorting column. There a rising current of water allows only the coarsest and heaviest particles of refuse to settle out to the bottom where they are automatically discharged by level controls. The coal and finer refuse are carried up and out the overflow to the final cleaning unit.

Installed prior to concentrating tables, the semi-classified feed is said to increase the efficiency of the tables. The overall cost of such a combination is advertised as being considerably less than for other fine coal circuits handling such a high reject feed.

AUTOMATION

Automation and the computers have reached all industries including coal. Today's plant designs include more and more automation. Automation to the point that some central control operators control the functions of the plant from an air-conditioned room. They monitor closed circuit TV, gauges and recording devices and communicate with their helpers over personalized walkie-talkie type radios.

Computerized systems are available that include data input systems which can supply constant print-out information on raw coal feed rate, clean coal production rate, percent recovery, specific gravity of separation, and bin and tank levels. Not only are computers helping us design and operate the plants, but they are helping us load the product. Systems are available which once initiated, record the railroad car number, weigh the empty car, load the car to within 0.1%, calculate the gross weight and print out all these data (fig. 7).

Loadout rate on at least one automated system has gone beyond 6,000 tons per hour and is limited only by the train engine pulling the cars. Even at these high rates, the system is said to meet National and Inspection Bureau standards.

Robert Hollaway: Thank you very much Bill for your interesting presentation. Our next speaker is Steve Bishoff, who is Assistant Environmental Engineer for Freeman Coal Company. He will talk to us about dam construction and safety regulations. Steve Bishoff.

REGULATION DUPLICATION: DAM CONSTRUCTION AND SAFETY

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INTRODUCTION

In today's mining industry, nearly every facet of operation is regulated and controlled to some degree by a number of Federal, State, and local government agencies. The industrial reality of this substantial government involvement is the increased manpower necessary to keep abreast of, and assure compliance with, the exorbitant volume of legal rhetoric that naturally ensues. This already complicated task becomes further compounded when more than one agency attempts to regulate a single area of operation. Such a situation presents unique problems in the form of regulatory duplication and inconsistency.

Duplication occurs when more than one agency controls a facet of operation using identical constraints, guidelines, and regulations. This does not directly threaten continued operations, however, it adds an element of confusion to the compliance process due to the unnecessarily increased volume of regulations. Even though all agencies can be satisfied by compliance with a single standard, the interagency duplication of effort must be verified to prevent the potential consequences arising from interagency inconsistency. Inconsistency occurs when more than one agency regulates a single detail of operation using completely different constraints, obviously presenting major difficulties because compliance with one agency does not assure compliance with *all* agencies.

These problems associated with multiple regulatory control exist in at least one area, that being the construction and operation of dams and embankments. In the following discussion, regulations and guidelines are presented as examples for comparison with those of other agencies in order to clarify the aforementioned relationships and difficulties. No argumentation is intended against the validity of any individual constraint nor is the basic premise of government involvement in this area intentionally questioned. The single objective is to indicate the futility of the present multiple regulatory authority system.

DAMS AND EMBANKMENTS

Dams and embankments contructed for use in the Illinois mining industry are presently regulated by three major Federal agencies: the Mine Safety and Health Administration (MSHA), the Office of Surface Mining (OSM), and the United States Army Corps of Engineers (Corps). In addition, OSM and the Corps have State of Illinois counterparts in the Department of Mines and Minerals and the Department of Transportation, respectively. The chronology of involvement by these agencies exemplifies the present alarm within the industry.

In 1972 the Corps of Engineers was the only one of these agencies involved in the regulation of dams and embankments. In 1975 MSHA became involved upon publication of regulations and guidelines concerning not only dams in general, but those specific to the mining industry. In 1977 OSM duplicated regulation of the same structures regulated by MSHA, and in 1979 the Illinois Department of Transportation developed their own set of regulations for dams in general. Thus, in the short span of eight years, five agencies have become involved in this regulatory process. At the present time, the industry may expect all of these agencies to scrutinize the construction and operation of dams and embankments to some degree, thus a basic familiarity with the requirements of each agency is essential for continued efficient operation. However, due to the similarities between the State and Federal regulations, only the three major Federal agencies will be discussed.

MSHA defines dams under their control as those that "impound water, sediment, or slurry to an elevation of five feet or more above the upstream toe of the structure and can have a storage volume of 20 acre-feet or more, or impound water, sediment, or slurry to an elevation of 20 feet or more above the upstream toe of the structure, or as determined by the District Manager, present a hazard to coal miners"[1]. The Corps defines 'dam' as "any artificial barrier, ..., which impounds or diverts water, and which (1) is twenty-five feet or more in height from the natural bed of the stream or water course measured at the downstream toe of the barrier, ..., or (2) has an impounding capacity at maximum water storage elevation of fifty acre-feet or more"[2]. In contrast, OSM classifies dams and embankments more by their intended use than their size, specific-use categories including: sedimentation ponds, dams constructed of or intended to impound coal processing wastes, and permanent impoundments. Additionally, specific-use structures are differentiated using the general MSHA size criteria previously noted. Beyond these general size definitions, MSHA and the Corps further classify structures as small, intermediate, or large as presented in Table 1. It should be recognized that the category labels, although common to both classification systems, do not describe the same size impoundment.

Table 1 — Classifications by the Corps of Engineers and MSHA of sizes of dams.

Corps of Engineers Size Classification System[3]

	Impoundment	
Category	**Storage (Ac-Ft)**	**Height (Ft)**
Small	$<1,000$ and $\geqslant 50$	<40 and $\geqslant 25$
Intermediate	$<50,000$ and $\geqslant 1,000$	<100 and $\geqslant 40$
Large	$\geqslant 50,000$	$\geqslant 100$

(Table 1 continued on next page)

Table 1 (continued)

MSHA Size Classification System[4]

Category	**Impoundment Storage (Ac-Ft)**	**Height (Ft)**
Small	<50	<20
Intermediate	$<1{,}000$ and $\geqslant 50$	<40 and $\geqslant 20$
Large	$\geqslant 1{,}000$	$\geqslant 40$

In addition to classification by size, the three major agencies classify dams by their hazard potential, or the expected damage to the surrounding area resulting from failure of the dam. The classification descriptions for each agency are presented in Table 2. Although the labels used between the agencies are not consistent, the descriptive criteria for the three hazard classifications are essentially the same. When these are combined with OSM's specific-use categories and the size classifications presented in Table 1, it becomes apparent that numerous possible classification combinations exist. Since each combination carries with it some unique design constraints, the mere predesign statement of intended use, size, and location, presupposes familiarity with three regulatory entities.

Table 2 — Classification by the three agencies of potential hazards of dams.

Corps of Engineers Hazard Potential Classification[5]

Category	**Loss of Life**	**Economic Loss**
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry, or structures)
High	More than a few	Excessive (Extensive community, industry, or agriculture)

(Table 2 continued on next page)

Table 2 (continued)

MSHA Hazard Potential Classification[6]

Category	Description
Low	Facilities located in rural or agricultural areas where failure would cause only slight damage, such as to farm buildings, forest or agricultural land, or minor roads.
Moderate	Facilities located in predominantly rural areas where failure may damage isolated homes, main highways or minor railroads disrupting services or relatively important facilities.
High	Facilities located where a failure could be reasonably expected to cause loss of life, serious damage to homes, industrial and commercial buildings, important utilities, highways and railroads.

OSM Hazard Potential Classification[7]

Category	Description
Class(a)	Dams located in rural or agricultural areas where failure may damage farm buildings, agricultural land, or township and country roads.
Class(b)	Dams located in predominantly rural or agricultural areas where failure may damage isolated homes, main highways or minor railroads or cause interruption of use or service of relatively important public utilities.
Class(c)	Dams located where failure may cause loss of life, serious damage to homes, industrial and commercial buildings, important public utilities, main highways or railroads.

DESIGN PARAMETERS

A number of design parameters essential to the effective operation of dams and embankments receive regulatory attention from more than one agency. Included among these parameters are site preparation, placing of the fill material, maximum slopes, crest widths, freeboard, spillway design, stability and safety factors, erosion control, inspection, maintenance, and abandonment procedures. A discussion of all these design parameters would be unnecessarily lengthy when conclusions can be drawn from a few predominant examples. It should be recognized that the examples cited are the most significant to the purposes of this discussion and to the safe operation of an impoundment.

Freeboard, commonly the vertical distance between the lowest point on the dam crest and the maximum water surface elevation, is a critical design consideration. The continued maintenance of freeboard is usually mandatory to prevent the uncontrolled release of water or sediments due to overtopping of the dam and possible subsequent failure. The Corps of

Engineers, however, state that "guidelines on specific minimum freeboard allowances are not considered appropriate because of the many factors involved in such determinations"[8]. In partial contrast, MSHA states that "the design freeboard distance between the low point on the crest of an impounding structure and the maximum water elevation for the anticipated design capacity should be at least three feet, however, where documentation is provided indicating that there is enough freeboard that there is no possibility of the embankment being overtopped, a lessor freeboard may be acceptable."[9]. The previous two guidelines allow for some flexibility in design considerations, the restricting condition being the assurance against overtopping. However, for dams constructed of or intended to impound coal processing wastes, OSM states that "the design freeboard distance between the lowest point on the embankment crest and the maximum water elevation shall be at least 3 feet"[10] and thus, for this specific-use structure, no real flexibility exists. In an alternate situation considering sedimentation ponds, OSM states that "the minimum elevation of the top of the settled embankment shall be 1.0 foot above the water surface in the reservoir with the emergency spillway flowing at design depth"[11] and thus, in this instance, some degree of flexibility is maintained as long as the OSM regulation is met.

These requirements are summarized in Table 3 and present a simple example of interagency inconsistency. Obviously, an impoundment cannot be constructed under the discretions of a single agency without risking violation of another agency standard. Knowledge of all three major agencies is required to ascertain the most stringent condition and in the case where some design flexibility exists, approval must be gained, on occasion, from more than one agency.

Table 3 — Freeboard requirements of the three agencies.

Agency	Dam Description	Requirement
Corps of Engineers	All	None
MSHA	All	3 feet unless proven that the dam cannot be overtopped
OSM	Sedimentation Ponds	1.0 foot
	Dams constructed of or intended to impound coal processing wastes	3.0 feet

A valid example of duplication exists within the regulations and guidelines concerned with dam and embankment stability, and more specifically, safety factors which are defined as the ratio of resisting forces to the forces tending to cause movement within the dam. Thus, a structure with a safety factor of 1.0 is on the verge of failure. The agencies designate two major loading conditions under which a dam should be analyzed to determine the appropriate factors of safety. The Corps of Engineers Case II and Case III loading condition correspond to the static condition designated by OSM and MSHA and refers to steady-state operational conditions with steady seepage through the dam. This is the most commonly determined safety factor for which all three major agencies require a general minimum standard of 1.5[12,13,15,16]. In addition, the OSM and MSHA references designate minimum static safety factors based on the hazard potential classifications, these being somewhat lower than the general requirements stated above[14,17]. This injects a confusing element into the design process because the general requirement does dominate. The additional material based on the hazard potential, especially in the case of MSHA, is useless.

The other loading condition, which the Corps designates as Case IV, considers the static loading condition under an earthquake situation, commonly labeled as the seismic safety factor. The Corps of Engineers has a general standard requiring all dams to have a minimum seismic safety factor of 1.0[12]. OSM requires a minimum seismic safety factor of 1.2, but this pertains only to dams constructed of or intended to impound coal processing wastes[16]. Beyond this category, the OSM references designate seismic safety factors as related to the hazard potential of the dam[14]. Similarly, the MSHA references specify seismic safety factors based on the hazard potential classifications[17], however, as in the case of static safety factors, MSHA has a dominate general requirement of 1.2[13].

As can be easily observed in Table 4, with the exception of the seismic safety factor specified by the Corps, the remaining safety factors fall into the domain of interagency duplication. For the purposes of an operational mine, the requirements are essentially the same for all agencies. It seems extremely unfortunate that the industry must become involved in the tiresome task of sifting through the regulations and cited references to arrive at this superfluous conclusion.

Table 4 — Minimum safety factors required.

			Safety Factor	
Loading Condition	**Dam Type**	**OSM**	**MSHA**	**Corps**
Static	General	1.5*+	1.5++	1.5
(Case II and III)	High Hazard	1.5**	1.5	
	Moderate Hazard	1.5**	1.4	
	Low Hazard	1.4**	1.3	
Seismic	General	1.2+	1.2++	1.0
(Case IV or	High Hazard	1.1**	1.2	
dynamic)	Moderate Hazard	1.1**	1.1	
	Low Hazard	1.0**	1.0	

*Sedimentation Ponds ⩾20 feet or ⩾20 acre-feet

**Permanent impoundments exceeding the general MSHA size criteria

+Dams constructed of or intended to impound coal processing wastes, regardless of size

++Dominates over hazard potential classifications

The final example area to be considered in this discussion is the regulations and recommendations regarding the minimum design storm, the runoff from which must be safely discharged from the spillway system (principal and/or emergency) of the proposed structure. Because of the large volume of regulatory material on this subject, discussion of specific minimum design storms for each impoundment size and hazard potential classification is prohibitive. Therefore, the summary of required or recommended design storms, as presented in Table 5, will be used to indicate the flagrant interagency inconsistencies that exist in this area.

Generally, OSM requires all small structures to be capable of passing the runoff resulting from a 25-year, 24-hour precipitation event,[18] and larger structures are referred to the Soil Conservation Service-Technical Release No. 60[16]. The Soil Conservation Service criteria cited in this reference makes up the bulk of the design storm data presented in Table 5 under OSM. As can be easily observed, these design storm formulas are not equitable to either MSHA or the Corps design storms, however, generally MSHA controls the moderate size structures and the Corps controls the large structures. One notable exception does exist. Other than for very small structures, OSM has the most stringent design storm criteria for only one class of structure, that being a low hazard impoundment with a volume-height product of greater than thirty thousand and less than forty thousand (volume-height product as utilized by SCS) which may include certain larger mine impoundments. This is not quite so readily distinguishable, though, when deriving the actual precipitation volumes from agency supplied procedures.

A minimum storm duration of 6 hours is required for use in the given OSM formulas, however, the 6-hour precipitation values must be increased by multiplying by constants supplied in the literature[20]. The MSHA design storms also require 6-hour duration precipitation values similarly increased by supplied constants[21], however, unfortunately the constants are not common to both agencies, and thus an identical design storm results in two separate precipitation values. This has no significant affect on the outcome of direct interagency comparison of values in Table 5, however, a significant portion of time is consumed in verifying the validity of this statement. This time involved in searching for and verifying the most stringent condition for any given design, is appropriately the basic motivation for this presentation.

Table 5 — Summary of required design storms.

Size	Hazard	OSM	MSHA	Corps
< 5 ft.	Low	$P_{25}(24)$		
	Moderate	$P_{25}(24)$		
	High	$P_{25}(24)$		
< 20 ft.* & ⩾5 ft.	Low	P_{100}	P_{100}	
<50 ac-ft. & ⩾20 ac-ft.	Moderate	$P_{100} + .12(PMP-P_{100})$	½PMP	
	High	$P_{100} + .26(PMP-P_{100})$	PMP	
<50 ac-ft. & ⩾20 ft.*	Low	P_{100}	P_{100}	P_{50}-P_{100}**
&<30,000 Product	Moderate	$P_{100} + .12(PMP-P_{100})$	½PMP	P_{100}-½PMP
	High	$P_{100} + .26(PMP-P_{100})$	PMP	½PMP-PMP
⩾30,000 Product	Low	$P_{100} + .06(PMP-P_{100})$	P_{100}	$P_{50}P$-$_{100}$**
<1,000 ac-ft. & ⩾50 ac-ft.	Moderate	$P_{100} + .12(PMP-P_{100})$	½PMP	P_{100}-½PMP
<40 ft. & ⩾20 ft.*	High	$P_{100} + .26(PMP-P_{100})$	PMP	½PMP-PMP
<50,000 ac-ft. & ⩾1,000 ac-ft.	Low	$P_{100} + .06(PMP-P_{100})$	½PMP	P_{100}-½PMP
<100 ft. & ⩾40 ft.	Moderate	$P_{100} + .12(PMP-P_{100})$	PMP	½PMP-PMP
	High	$P_{100} + .26(PMP-P_{100})$	PMP	PMP
⩾50,000 ac-ft.	Low	$P_{100} + .06(PMP-P_{100})$	½PMP	½PMP-PMP
⩾100 ft.	Moderate	$P_{100} + .12(PMP-P_{100})$	PMP	PMP
	High	$P_{100} + .26(PMP-P_{100})$	PMP	PMP

$P_{25}(24)$-25-year, 24-hour storm; P_{100}-100-year storm; PMP-Probably Maximum Precipitation
*Corps of Engineers 25 feet; **IDOT dominates requiring P_{100}

To this point, this abbreviated discussion has hopefully demonstrated the misfortunes of multiple regulatory controls. Beyond this, the basic underlying cause rests with the delegation of multiple regulatory authority. If Congress had not delegated authority to all of the aforementioned agencies, the industry would not now be faced with multiple Federal regulations and multiple permitting procedures. Thus, the actions and reasonings of Congress remain to be investigated.

THE ACTS

The Federal Coal Mine Health and Safety Act of 1969 as amended by the Federal Mine Safety and Health Act of 1977 led to the establishment of the present Mine Safety and Health Administration. In forging this Act, Congress declared that the first priority of the mining industry must be the health and safety of the miner. Further, Congress concluded that the existence of unsafe conditions in the Nation's mines seriously impedes the future growth of the industry, and that the loss of the production due to mine related accidents and diseases unduly burdens commerce. In keeping with these conclusions, the Congress declared the major purpose of the Act to be the promulgation of "improved health or safety standards to protect the health and safety of the Nation's coal or other miners"[22].

The Surface Mining Control and Reclamation Act of 1977 originated the present Office of Surface Mining. Like the Federal Mine Safety and Health Act of 1977, this Act was concerned with the establishment of legal protection from the adverse effects of the mining industry, however, the protection was afforded to society in general as well as the environment and only the effects of surface operations were considered. Among other things, Congress declared that it is essential to the National interest to insure an economically healthy mining industy, that mining contributes to the well-being of the Nation and, therefore, should be conducted in an environmentally sound manner, and that present expansion of the industry makes urgent the need to minimize environmental damage and to protect the health and safety of the public[23]. To institute these findings, Congress declared as two of the many purposes of the Act to "establish a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations" and "to assure that the coal supply essential to the Nation's energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and agricultural productivity and the Nation's need for coal as an essential source of energy"[24].

Appropriately, both of these mine-specific Acts foresaw the need to maintain an economically healthy mining industry. Recognizing this mutual concern, it seems illogical that any duplication of effort would occur, due to the burden that this places on industry. Instead, Congress included dams and embankments in both pieces of legislation contrary to their findings and included a confusing network of statements to theoretically reduce duplication. With regard to inspections, investigations, and recordkeeping, the Federal Mine Safety and Health Act of 1977 states that "any information obtained . . . . shall be obtained in such a manner as not to impose an unreasonable burden upon operators", and "unnecessary duplication of effort in obtaining information shall be reduced to the maximum extent feasible"[25]. This does not specifically require interagency communication, however, in promulgating mandatory safety and health standards, the Act states that "other considerations shall be the latest available scientific data in the field, ..., and experience gained under this and other health and safety laws"[26]. In addition, the Surface Mining Control and Reclamation Act of 1977 provides that the Secretary shall "consult with other agencies of the Federal Government having expertise in the control and reclamation of surface mining operations" and "cooperate with other Federal agencies and State regulatory authorities to minimize duplication of inspections, enforcement, and administration of this Act"[27]. Further, in establishing Federal and State enforcement programs the Act mandates the "establishment for the purposes of avoiding duplication, of a process for coordinating the review and issuance of permits . . . . with any other Federal or State permit process applicable to the proposed operations"[28].

In the Surface Mining Control and Reclamation Act of 1977, the above referenced statements would be extremely beneficial in eliminating interagency duplication if it were not for an additional provision effectively negating a large part of the non-duplication effort. Concerning dams constructed of or intended to impound coal processing wastes, the Act states specifically that "the Secretary, with the written concurrence of the Chief of Engineers, shall establish . . . . standards and criteria regulating the design, location, construction, operation, maintenance, enlargement, modification, removal, and abandonment of new and existing coal mine waste piles"[29]. Surprisingly, at the time of this enactment, MSHA had already published permitting requirements for the same structures (30 CFR 77.215 & 216) as well as the *Engineering and Design Manual-Coal Refuse Disposal Facilities* (1975). Thus, it would appear that an extreme miscalculation occurred within the Congress, directing OSM to the Office of the Chief of Engineers instead of MSHA. Unfortunately, as might be expected, the subsequent regulation development, although in some aspects identical to the MSHA criteria (Tables 3 and 4), is in part inconsistent with MSHA (Table 5). This seemingly intentional provision mandating interagency duplication of effort is undoubtably one of the instigating causes of the present multiple regulatory problem and appears to be in direct contradiction to duplication-eliminating provisions of the Act.

The National Dam Inspection Act of 1972 instructs the Corps of Engineers to undertake "a national program of inspection of dams for the purpose of protecting human life and property"[2]. This Act contains no provisions to prevent interagency duplication, however, the National Program for Inspection of Non-Federal Dams, 33 CFR Part 222, does contain an interesting recommended procedure. This states in part that no dam should be inspected until the hazard potential is verified, and significant and low hazard dams should be inspected only if requested by the State, based on evidence of deficiencies. Further, the inspection of dams constructed under the authority of some other Federal agency should be coordinated with that Federal agency, a representative of which should be contacted to obtain all available information existing on the dam. Specific examples of interagency coordination are cited in the regulations including high hazard coal mine waste dams under the jurisdiction of the Mine Safety and Health Administration.[30] Since all mine impoundments that come under the jurisdiction of the Corps of Engineers must be permitted by MSHA, this implies that the operators should not have to make submissions to the Corps except in very rare instances, indeed, the vast majority of mine impoundments should not even be inspected because of their low hazard potential classifications. Unfortunately, this has not been the case.

At the present time, the preceding three Acts account for inspection of dams and embankments by five agencies and require the lengthy process of obtaining three separate permits. Obviously, the Congressional concern with maintaining a healthy mining industry has not been retained in the Acts and even more so in the subsequent regulation development. For the low hazard impoundments most used in the mining industry, the large quantity of manpower presently consumed in maintaining regulatory compliance is simply not necessary to assure a relative degree of safety. When technical personnel must be removed from much more critical areas than these to deal with Government inefficiency, it not only creates an excessive burden on the industry but actually creates potential operational problems that would have otherwise been controlled. Thus, over-control in one area leads to minimum control in other areas, the problem becoming much broader than may have first appeared.

SUMMARY

In general, it appears that Congress began this dilemma by including dams and embankments in so many pieces of legislation, and it seems a small consolation that they did include enough provisions to, at least in theory, eliminate most interagency duplication of effort. The agencies, however, have not volunteered any great efforts to utilize the duplication elimination process and probably will not until industry demands an end to inefficient Government control. In Illinois, attempts have been made to correlate the actions of the various Federal and State agencies concerned with dam regulations and permitting and, although commendable, they have not yet produced a working solution. Full agency cooperation has not been obtained and without it no progress can be made towards a single regulatory and permitting procedure.

Interagency regulatory duplication, in all areas, has a monetary value taxing every group and individual however remotely involved due to the increased time and effort necessary for the industry to comply with the regulations and the agencies enlarged task of inspection, investigation, and evaluation. An equally important consideration is the ill-feeling produced in an industry seemingly overrun with controlling legislation. A balance between public and environmental safety and an economically healthy mining industry can be achieved with proper input and planning without incurring the costs of inefficiency due to multiple regulatory control. Increased coordinated involvement by industry and Government seems the only alternative for eliminating the problems existing now and preventing those unforeseen in the future.

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25. P.L. 95-164, Section 103(e).
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27. P.L. 95-193, Section 201(c).
28. P.L. 95-193, Section 503(a), also see Section 504(h).
29. P.L. 95-193, Section 515(f) as referenced by Section 515(b) (13).
30. Corps of Engineers, 30 CFR 222.8(j), 1979.

Robert Holloway: Thank you very much Steve. Do we have a quick question or two for Steve?

Question: Where do we get the records for a hundred years storm? Actually a bigger question would be where do we get the probable maximum precipitation, which is basically a thousand year norm?

Steve Bishoff: They are projections from the data taken from the Weather Bureau. I'm not really certain, but we get it from the atlas of precipitation events throughout the country. It is established by records of some rainfalls and the statistical analysis of those rainfalls to determine what value would be probable at, for example, a thousand years or hundred years if they don't have the actual data. There haven't been many one hundred-year storms recorded, and there has been only one pmp — probable maximum precipitation — that I know of in the country.

Robert Hollaway: Thank you Steve. President Charlie Bond very carefully and delicately balanced our program this morning. So far we have heard from Bill talking about advance technology and how industry is forging ahead. This is really the backbone of America's greatness. Steve just reported on some of the duplications and perhaps some of the inconsistencies in working with a variety of government agencies. The next two speakers have given their entire lives in the area of government service. Its really a pleasure for me to introduce Douglas Downing because I consider Doug a very professional person. If I were to describe a couple of his characteristics, I would immediately talk about his integrity and his fairness. Doug currently is Supervisor of the Land Reclamation Division of the Illinois Department of Mines and Minerals. He has a BA Degree from Luther College in biology, then he went on to SIU to receive a Master of Science Degree in zoology. The title of his paper today is "The Update on the Status of State and Federal Surface Mining Reclamation Laws." Prior to coming to the podium this morning, Doug did mention to me a suggestion that he had. He would really enjoy entertaining several questions, even though they might be rather technical in the minds of our audience this morning, pertaining to the Federal surface mining rules and regulations. Would you welcome please Mr. Douglas Downing.

AN UPDATE ON THE STATUS OF STATE AND FEDERAL SURFACE MINING RECLAMATION LAWS

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INTRODUCTION

Good morning, ladies and gentlemen. My topic today is an update on the status of state and federal surface mining reclamation laws. The federal regulations are still in a state of fluctuation. Even some provisions of the Federal Act (Surface Mining Control and Reclamation Act of 1977, Public Law 95-87) itself are being reviewed by the U.S. Supreme Court. Enabling state statutes have been enacted and regulations promulgated.

FEDERAL APPROVAL OF STATE SURFACE MINING PROGRAMS

As there is acute interest by the coal industry in the permanent program, I will begin by noting implementation of the permanent program phase of the Federal Act is now in the stage of state program approval or denial. Initial decisions have been made by the Secretary of the Interior on all state program submittals. Illinois' program was approved in part and disapproved in part. However, we are still awaiting official notice in the *Federal Register*. We understand notice will be published next week. We will also receive a "deficiency letter" apparently next week. This letter will set out in greater detail the concerns the Secretary has with the state's submittal. We will have 60 days after publication in the *Federal Register* of this initial decision in which to resubmit the amended versions of the disapproved portions of the program submittal for the Secretary's approval. The Secretary's decision on the resubmittal could come as late as mid-February depending upon the Secretary's perception of the mandatory nature of the January 3, 1981, deadline and his statutory review period of 60 days maximum.

COURT APPEALS

The Federal Act first came under attack by the Virginia Surface Mining and Reclamation Association which challenged the requirement to achieve approximate original contour provisions, and the provisions for summary issuance of cessation orders and civil penalties. The State of Indiana also challenged several provisions of the Act, most notably the prime farmland provisions. These cases are now pending before the U.S. Supreme Court. The National League of Cities, State of Illinois, and several other states, including Arizona, have filed amicus briefs. The bottom line of the issue before the court is not an environmental issue but centers on where land use decisions will be made. The states, of course, strongly believe those decisions should remain with the states. If any provisions of the Act are held to be unconstitutional, all of the regulations implementing those parts will have to be repealed.

The regulations are in an extreme state of uncertainty at the present time. Due to litigation by the Commonwealth of Virginia, the State of Illinois, and industry groups, approximately 60 regulations have either been suspended or remanded by the Court. The vast majority of these regulations have not been revised. In fact, most of those regulations which were the subject of the litigation are being appealed to the Federal Court of Appeals, and may be appealed to the Supreme Court. All of this means the states will have to repromulgate approximately 60 regulations when the Office of Surface Mining repromulgates them, or when the courts finally decide what regulations are valid.

One set of regulations which was challenged by Peabody Coal Company was appealed separately. These include all of the permit application regulations which require information not specifically required in the Act. A three-judge panel of the Appeals Court held such regulations invalid, but the Office of Surface Mining succeeded in getting the entire court to rehear the issues. This rehearing process is currently in the briefing stage.

SUSPENDED PROVISIONS OF FEDERAL ACT

It would take longer than we have today to go through each of the suspended regulations. It would better serve most of us to highlight the suspended provisions of particular importance in Illinois, and then use the remainder of my time to answer questions you may have concerning the Act and regulations.

Several of the Part 823 (Special Permanent Program Performance Standards — for Operations on Prime Farmland) standards were either remanded or suspended. Judge Flannery, U.S. District Court for the District of Columbia, ruled these standards could not be applied across-the-board to underground mines and their associated surface facilities; a high level of management could not be required in the demonstration of restoration of equivalent yield; and mine operators could not be required to actually farm reclaimed areas in order to demonstrate equivalent yield. As a result of the rules litigation, the Office of Surface Mining voluntarily suspended the moist bulk density standard for determining soil compaction of reclaimed soils and the "grandfather" rule as it was more restrictive than the Act.

Judge Flannery also remanded the Office of Surface Mining's regulations which required state programs to incorporate a point system for assessing civil penalties in order to be consistent with the federal scheme; regulations which required runoff from reclaimed lands to meet the same effluent limitations as those established for lands being actively mined; and regulations which delayed triggering an operator's five-year period of responsibility for revegetation until the operator meets the Secretary's standard for vegetative cover density.

Those are some of the most important suspended or remanded regulations which have or would have had a substantial impact on the Illinois coal industry.

As indicated previously, I will be more than happy to address any questions you may have concerning the law, regulations, of our program submittal.

When I think of the energy policy in the State of Illinois I think immediately of a very professional dedicated public servant, and his name is Frank Beal. He is our concluding speaker in this mornings technical session. Currently Frank is Director of the Illinois Institute of Natural Resources. He has given all of his adult life to the area of government service. He has a Masters Degree in urban planning from the University of Illinois, and the title of his paper is "The Place of Coal in an Illinois Energy Policy." Would you welcome please Director Frank Beal.

Frank Beal: I am very pleased to be with you today. Last week I was at the 75th anniversary birthday party of the Illinois Geological Survey, and while waiting for a dinner that night I was relating to a representative from an Illinois coal company what I had planned to say today. I outlined the general theme of my talk which was that the decline in coal production in Illinois after World War II had probably bottomed out and that we were on the verge of a new or second coal era in Illinois. There was a sense of optimism and the Illinois State government had an obligation to support and continue that turn around and to do even more than it has done in the past to support the coal industry in Illinois. This person questioned the wisdom in giving that talk to the audience and suggested that this audience has heard that same line for about seven years, at least since 1973, and that you were getting a bit tired of hearing bureaucrats stand before you talking about the bright rosey future. You wanted a little more action than that, and this is a tired old theme that you have heard before. Well I have some bad news for you, I didn't rewrite the speech, mostly because I didn't have time to rewrite it. Also, I believe that things are going to be brighter in the future. There will be oscillations, downturns, and readjustments, but if you take a slightly longer view of the coal industry in Illinois, I think it will be a more optimistic future than in the last couple of decades. Nonetheless, I understand your frustration. You have been given many promises, but many of them are unfullfilled. Perhaps as I give you these few remarks, you should keep in mind the concluding comments of the commencement address that Woody Allen recently gave to a high school graduating class. He concluded by saying that "More than any other time in history mankind faces a crossroad. One path leads to despair and utter hopelessness, the other to total extinction. And let us pray we have the wisdom to choose correctly." You may think things are bad, but they could be worse.

THE PLACE OF COAL IN AN ILLINOIS ENERGY POLICY

FRANK BEAL
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INTRODUCTION

Illinois' economy is strong, in large part because it is diversified. Agriculture, industry and energy production are woven together into the economic fabric of this state. It is among the highest priorities of state government to maintain this economic health, and this concern influences the development of state policies.

Some of you may be skeptical that the federal government has an energy policy in general and a coal policy in particular. There has been much turmoil and indecisiveness in the face of complex and shifting circumstances in recent years. But Illinois has an energy policy . . . . and a coal policy, and both are closely intertwined with economic and social policies. I'd like to speak to these policies for a moment.

Coal has been an important factor in Illinois for more than 140 years. It fostered the development of the railroads, permitted the rise of metropolitan living and stimulated the growth of industry. Though coal is inanimate . . . . has no voice or vote . . . . it has wielded enormous influence on the deliberative processes of government in Illinois.

But, following World War II, the character of coal's importance changed. The decline in demand for coal as an energy source and the unemployment that resulted became major concerns. The former policy of expansion, of seeking new opportunities, was replaced. Preservation of the coal economy became the dominant aspect of Illinois coal policy.

This is the environment to which today's coal policy can be traced. The policy of hanging on to existing markets and fighting off imports, however, has been a losing battle. It's not because Illinois didn't try. But the displacement of coal with petroleum and natural gas was a worldwide phenomenon, a shift with global impact that shocked coal-producing areas like Illinois in spite of state efforts.

Now after decades of decline in coal use, OPEC's grip on the world's petroleum supply balance has sparked a renewed interest in coal; its virtues are being rediscovered, and its shortcomings are under renewed study for potential solutions.

Coal does have a place . . . . a central place . . . . in Illinois energy policies. But coal's relationships to other resources is subtly different from the past; and coal policies are woven through economic and social policies in ways different from the past.

It would be impossible here to explore all the nuances of coal policy in Illinois. Instead, we will focus on one ket set of facts that are basic to making effective coal policy; and we will look at the path Illinois coal policy is on today. This will lead to a true glimpse of where coal policy will go tomorrow.

THE SECOND COAL ERA

It may sometimes be difficult to discern for the coal industry, and for scientists and technicians who long have been focusing on coal, but something is happening on the coal front. Despite the thoroughly plodding pace, national efforts are being made to expand coal's share of the energy mix. Despite a thoroughly inauspicious beginning, a second coal era is dawning.

There is a growing recognition on the part of the federal government that many desirable applications for coal — fixed facility energy needs, including electrical generation and conversion to synthetic petroleum fuels and chemical feedstocks — were forsaken as petroleum ascended to dominance after World War II. This is a key fact.

But what the federal government apparently has not yet realized fully is another key fact — that coal is not one homogenous, uniform commodity. And the distinctions are not just between eastern and western coals, bituminous, subbituminous, anthracite and so on. Coal is a generic term for a vast variety of materials of greatly differing qualities: caking and non-caking; high and low-sulfur; hard and soft. Literally thousands of compounds may be present in coals from varying regions and even neighboring seams. Different coals lend themselves to different applications.

Federal coal policies and initiatives to date show little sign of such differentiation; all coal seems to be treated the same under uniform, nationwide, undiscriminating perceptions. But we here in Illinois . . . . and especially the coal specialists assembled here . . . . ought to be capitalizing on the diversity of coals that exist, not ignoring this key fact.

And just as coal is not homogenous in the sense of physical properties, neither is it homogenous in another important way: in the places in which it is found. In Illinois, for example, coal underlies about two-thirds of the land area of the state: sometimes beneath productive agriculture soils; sometimes beneath cities, towns, and villages; sometimes near water resources. Some Illinois coal is near the surface, while some is found at great depths; some is in thick seams, some thin; some deposits are nearly contiguous; some nearly isolated. The physical location in which coal is found, like its physical characteristics, is important and influences its potential uses.

The State of Illinois has come to recognize these key facts; the federal government appears not to have achieved such a recognition. To cite one example: the federal government is supporting the construction of a coal gasification plant, which is a water-intensive activity, in North Dakota, where water is by no means abundant; yet no such support has been shown for coal conversion ventures in Illinois where more plentiful water supplies are available.

The importance of these considerations cannot be overstated: if coal ever is to meet its optimum potential for narrowing the nation's energy gap, the prevailing perception of coal as a homogenous resource needs to be replaced. While we understand the complexities inherent in coal use, there is much more we need to know, much we have yet to learn.

Following the Second World War too little of Illinois' resources were directed to the exploration, research and development of ways to use coal. A generation gap occurred as the scientists and technicians turned instead to developing the products that can be refined from petroleum, while similar investments in coal technology were ignored. It is these substantial gaps in our coal knowledge that must now be filled if we are to get the most out of Illinois coal.

THE ILLINOIS COAL PROGRAM TODAY

Several steps already have been taken to put Illinois in a position for dealing with coal matters realistically and effectively and some useful initiatives are underway. As you will see, the state has chosen its areas of involvement carefully; in general, state policy is to undertake efforts that complement, not compete or interfere with, the ongoing efforts of private sector.

In 1975, Illinois' executive and legislative branches worked together to create a bond fund that is to be used to help finance development activities which offer promise of yielding new or better ways of tapping the energy potential of Illinois coal. The $65 million set aside for coal efforts under the Coal and Energy Development Bond Act provides a way for the public to help assume the risks of creating or testing new technologies. If a coal technology were absolutely certain to work, were fully developed and tested, then there would be no risk; the private sector could be expected to make its own investments on its own criteria.

But many technologies that may have a real potential for benefiting all energy consumers, for benefiting the economy of the entire state as a result of increased coal consumption, involve some degree of risk to investment; in these situations it is incumbent on the state at large to match its potential benefit with some potential risk by the investment of public funds. This is the justification for the bond fund, and it is realistic and reasonable.

It is well known that most of the bond funds remain available. There have been several disappointments as project after project was cancelled, almost always because the federal government abandoned its stated intention of being a partner in the investment.

However, there are projects underway or in late stages of planning to which bond fund support has been committed. At the Great Lakes Naval Training Station in North Chicago, for example, a coal-fired boiler using a fluidized-bed at atmospheric pressure is nearing completion. The state committed $750,000 to this project in cooperation with the U.S. Department of the Navy, the U.S. Department of Energy, and Combustion Engineering, the firm which developed the boiler, because we believe that fluidized-bed technology offers a significant promise of allowing fixed-facility coal users a way of burning coal directly in an economically and environmentally acceptable manner.

The state also has pledged bond fund support for the Kilngas project, in which Illinois coal would be converted to low-Btu gas which would be burned at an electrical generating station near East St. Louis. In this case, the state joined in funding partnership with a consortium of electric utilities because we believe we should share the risk of testing a means for using Illinois coal in a technology that promises a clean way to general electricity with our high-sulfur coal.

This "front-end" fund is complemented in Illinois by a "back-end" fund: the Environmental Facilities Financing Authority, which Illinois has been using to help bear the cost of scrubbers and other energy-related pollution control technology. From 1972 through 1979 over $400 million in EFFA funds have been committed to pollution control construction in more than 100 locations across the state. The fund is not risk-oriented; instead, it recognizes that the state at large benefits directly from the use of pollution control devices which make it possible to burn Illinois coal while meeting environmental standards.

Through legislation enacted this year by the General Assembly the definition of pollution control technologies eligible for funds has been expanded to include fluidized-bed combustion boilers in the belief that this technology soon will be adequately proven and the risks will be appreciably reduced.

The state, through the Institute of Natural Resources, also has been pursuing federal funding for another initiative: conducting statewide cataloguing of the coal, water and other resources that be available for potential synfuels production. Jointly with Standard Oil of Indiana, the Institute has applied for $4 million under PL 96-126 and PL 96-304, two federal acts which provide funds for synfuels development activities.

The application proposes a feasibility study for the siting and design of a plant that would convert 5,000 tons of coal per day into methanol using Texaco coal gasification technology. Standard Oil has had an active interest in coal conversion and other alternative fuels development. Its technical and marketing expertise will complement and augment state experience in coal development.

THE ILLINOIS COAL PROGRAM TOMORROW

If coal . . . . if Illinois coal . . . is to fill a larger share of the state's, the nation's, the world's energy needs as the petroleum era wanes, there will be complex decisions to be made regarding other natural resources. Illinois will need to weigh costs and benefits with the utmost care; potential negative impacts will have to be mitigated effectively.

To illustrate the range of concerns involved, we can use the example of a synfuels plant:

- A commercial-scale synthetic fuels plant might process 25,000 tons of coal per day, or about 10 million tons per year.
- The production capacity of two mines might be required, involving thousands of acres of land.

- From 20,000 to 50,000 gallons of water might be consumed each minute; perhaps 21 billion gallons of water per year.
- The cost of the plant could be 1.5 to 4 billion dollars.
- Two to five square miles of land might be needed for the synfuels plant site.

It is not inconceivable that as many as 10 or more synfuels plants eventually could exist in Illinois alone. The economic benefits — in terms of jobs, taxes and the like — could be enormous. And the costs — lost agricultural production, heavy pressure on water supplies, boom-town social impacts and more — would have to be balanced against these benefits.

Illinois must not lightly approach the second coal era. Obviously a wide range of social, economic and energy policies are involved in complex interplay here. But let us focus on two critical areas directly involved in preparing Illinois for the future:

1. We need to characterize our coal — both by physical properties and physical locations — so that we have an inventory to use in decision-making; and,
2. We need to design better technologies for using Illinois coal, spending state dollars on projects that will foster the use of our kind of coal.

These characterization and technological programs involve scientific and technical research and development challenges that will require real effort to surmount.

Illinois is extremely fortunate in having the three state scientific surveys — geological, water, and natural history — and university-based coal research centers, such as the Coal Extraction and Utilization Research Center at SIU-Carbondale, all of which have long and distinguished records in answering many tough coal-related questions.

And the private sector in Illinois is actively engaged in research and development — better mining techniques, reclamation and coal use technologies are but a few pertinent areas — and this range of activities from the state and private sectors complement each other well. It is a solid foundation on which to build.

But build we must, if we are to meet the challenge. It would seem to be the right time to coordinate and expand coal research activities and to coordinate the investment of state and federal funds. A coal research board might be a step in the right direction. Other states, notably Kentucky, our neighbor to the south, has established such mechanisms. The resulting progress achieved indicates the effort is worthwhile and probably should be undertaken here.

CONCLUSION

Coal necessarily occupies a central position in Illinois energy policies. Coal offers a good chance of buffering the state against the effects of rising prices or diminishing supplies of petroleum. It represents a realistic way of keeping factories running, transportation moving, farming viable, and the economy sound during the waning decline of the petroleum era.

It does not appear that there is any energy resource other than coal that offers the flexibility needed to significantly bridge the developing energy gap. Of course other energy sources will play a part and must be cultivated diligently, but coal's versatility and abundance are not yet matched by any energy sources except petroleum and natural gas.

It therefore is essential that Illinois be prepared to enter a second coal era; to make wise investment choices; to rise to challenges and identify opportunities. But we cannot fall prey to undifferentiating boosterism, neglecting or stubbornly refusing to address the broad range of concerns that will attend significant growth in the use of coal.

Illinois has its own interests to protect; its own benefits to reap. Our own policies should be designed to complement national priorites where appropriate; and to mitigate the effects of national policies when there are conflicts, as there inevitably will be. Any success achieved will be based on advancing our knowledge of coal, and in this area we all can expect to share the challenge.

Robert Holloway: Thank you very much Director Frank Beal. We have time for a question or two.

Question: Would you want to comment on your concluding remarks about expanded research in Illinois?

Frank Beal: I think I was addressing the issue from a government point of view. Throughout my remarks I was indicating that we had to look at coal in a new way. I think a lot of the private industry is exploring this from their own research and development facilities, but I think government has a responsibility to aid where it can and stay out of the way where it simply is interferring.

Robert Holloway: Thanks very much. Are there any further questions?

Question: Frank Beal, do you feel your organization in the executive branch could eliminate some of the government duplication and regulations in the State of Illinois?

Frank Beal: The short technical answer is "No" because our office doesn't administer directly any of these regulatory programs. I personally am not responsible for them, but that's the short bureaucratic answer. The longer answer is that in some cases we have contributed to the resolution of those kinds of conflicts. For example, we have been working with a blasting noise program for several months with slow plodding success, I think, in dealing with a very complex problem. I think that some of our research capabilities would allow our office to work with the regulatory agencies and support a more uniform and more rational system of regulations. I know that there are numerous horror stories in the field today about the insanity of some of the regulatory programs. I am sympathetic, but you see the heirarchy often from federal laws not just administrators are setting the standards, and then the regulations are promulgated down to the state laws and state regulations. The layering that must be gone through in order to reverse back and amend is emense. But it is still important to keep trying. The cost of duplication is high to bear for too long.

Robert Holloway: Thank you very much Frank. On behalf of Charlie Bond, I want to thank members of the Institute who were here this morning and for your questions, for your courtesies, and for your attentiveness. Also, I would like to thank our speakers who presented papers today. We appreciate the efforts you put forward here. All of us will look forward to reviewing these papers when they come out in printed form later in the year. We are going to adjourn in just a moment, but prior to adjourning I would like to call your attention to the 12:15 luncheon, and the outstanding keynote address to be given by Carl Bagge, president of the National Coal Association. I think you will enjoy his remarks and address. The title of his address is "Coal: It's Here, It's Ours, Let's use it!"

We are adjourned.

LUNCHEON MEETING

The annual Luncheon Meeting convened at 12:15 p.m. in the Ford Room of the Holiday Inn East. Approximately 240 members and guests were in attendance. President Charles Bond presided. Proceedings of most of the luncheon meeting are not given here because of the inaudible quality of the tape.

President Bond introduced individuals seated at the head table. Representatives of the universities and colleges that are receiving IMI scholarships introduced their students, who were attending the meeting. President Bond also read the names of members of the Institute who passed away during the year. These were Robert F. Bozarth, John Kopuster, and Edgar A. Steker.

CERTIFICATE OF HONORARY LIFE MEMBERSHIP

President Bond: Unfortunately George Lindsay, who was to receive the Certificate of Honorary Life Membership, was unable to attend the meeting this year. On George's behalf, it is my pleasure to present this plaque to my good friend, Doc Harrell (figure 1). Between Doc and myself, we will bestow the honor upon George as soon as he gets back into town.

Fig. 1 — President Bond (right) presents the Certificate of Honorary Life Membership to Doc Harrell in behalf of George Lindsay.

LUNCHEON ADDRESS

President Bond presented Carl C. Bagge, President of the National Coal Association, Washington, D.C. (figure 2).

Fig. 2 — Carl C. Bagge, luncheon speaker.

THE COMING DEBATE ON THE CLEAN AIR ACT

CARL E. BAGGE
President, National Coal Association
Washington, D.C.

INTRODUCTION

I'm grateful to the Illinois Mining Institute for its invitation to return to my home state to once again discuss coal with this distinguished group.

I want you to know that I became familiar with coal early in my life here in Illinois. My home on Chicago's south side was at the junction of most of the city's great trunkline railroads, a neighborhood called the Grand Crossing. Even then I regarded coal as a renewable resource — long before that energy terminology became fashionable — for it was renewable to us kids every time the trains went through the neighborhood. Everyone in Grand Crossing knew that coal was a remarkable substance which a benevolent providence manifesting itself in the Thirties placed in ever-renewing supply as it fell from cars along the railroad tracks. That source of coal supplied heat for many homes in South Chicago and, for the more ambitious such as my father and me, it also provided a small source of income.

So when I talk about the importance and prospects of coal, I speak as much from my heart and memory of my youth here in Illinois, as from my subsequently acquired knowledge of the country's most abundant energy source and the problems facing the industry.

I saw that President Carter was downstate earlier this week, pledging his best "to see on the world energy markets, Arab oil replaced by Illinois coal." I'm for that. Do not be misled, however. The fact is that neither the actions of the Carter administration, nor the Ford and Nixon administrations, have been much real help in fostering greater demand for coal, no matter which state provides it.

In simple truth, you and I know that other forces have been responsible for increases in the demand for coal which we experienced only during the past 18 months. Specifically, the "credit" must go to the psychological impacts of the developments in Iran in late 1978 and early 1979, the sharp increases in oil prices charged by OPEC countries in 1979, and serious delays and setbacks in the nuclear power industry. These developments have underscored the price and security of supply advantages of coal, with the result that production and consumption have risen since 1979.

Let's look at the facts. In July 1979, President Carter announced that he would propose legislation designed to cut in half by 1990 the rate of electric utilities' oil consumption of 1.5 million barrels per day. This would mean a reduction target of 750,000 barrels per day by 1990. However, even by mid-1979, utilities had begun to feel the impact of oil price increases, and were reducing their use of oil. In fact, by June 30, 1980 — 11 months after President Carter's announcement, and without enactment of any of the proposed legislation — the utilities on their own had reduced consumption of oil by 400,000 barrels per day. Thus, real world market forces — not legislation — achieved more than one-half of the President's 10-year goal in less than one year. During this time, nearly everyone's attention was focused on the so-called "oil backout" legislative proposal and were diverted from the important impediments that still remain to increased coal use, which if changed could have made the 400,000 barrels per day figure even higher. And that is the real point.

The recent increases in coal use in the utility sector are encouraging, but the important point is that the rate of increase is and will continue to be far less than it could be if the government would focus its attention on the real problems, on the government policies and requirements that are unnecessarily holding coal demand and production below its potential.

Today I want to talk with you about one area that is doing precisely that and, because of that, deserves serious attention: The Clean Air Act. It will be debated strenuously over the next nine months. Specifically, I want to talk about:

- The setting for the upcoming Clean Air Act dabate,
- the issues that must be debated, and
- the changes in public opinion that seem to be occurring which will influence its outcome.

THE SETTING FOR THE UPCOMING CLEAN AIR ACT DEBATE

As you know, Congress must review the Clean Air Act beginning early in 1981. The authorization for the appropriations needed by EPA to carry out Clean Air Act requirements is currently scheduled to expire at the end of the current fiscal year, on September 30, 1981. This forces the Congress to review and consider amendments to the Act.

PROPOSALS FROM ENVIRONMENTALISTS

It is already clear from statements made by officials of EPA and the environmental organizations that they will attempt to get new restrictions included in amendments to the Act. The full content of the environmentalists' agenda is not yet known, but it does seem clear that EPA will seek to add new restrictions, particularly on existing coal-fired facilities, to reduce emissions. For example, we are already seeing aggressive public relations campaigns by EPA and environmentalists on the evils of "acid rain," about which very little is actually now known. Proposals probably will be justified on grounds that they are necessary to reduce "acid rain." There is sharp disagreement as to the justification for EPA's position and I will return to this subject later.

PROPOSALS FROM INDUSTRY AND OTHERS

Industry and others who believe that some existing air quality requirements are unnecessary and not justified by scientific facts or national policy also will make proposals for changes. Congressman Tom Corcoran of the 15th District of Illinois and two of his colleagues (Richard Shelby (D-Ala.) and Henson Moore (R-La.)) have already introduced a bill which deserves attention.

The debate will be joined in a few months. The focus of the debate will be in Congress, but the basic issues have nationwide implications and should be discussed nationwide! In fact, the impacts of the Clean Air Act are among the most far reaching of all the statutes ever added to the law books. The Act affects not only air quality but jobs, consumer prices, our economy, and our national security as the result of over-dependence on imported oil.

Quality of the Debate

We hear a lot about the "quality of life" these days. I think we should also be concerned about the "quality of debate" on important national issues such as the Clean Air Act.

For I am sorely disappointed in the approach to the debate being taken by some environmentalists. For example, Doug Costle, the Administrator of the Environmental Protection Agency, has already charged publicly that industry will attempt to "gut" the Clean Air Act. Such statements heighten emotions and contribute to confusion rather than constructive dialogue. But this is the "quality of the debate" being pursued by the "quality of life" people. I know that Costle's "gut the Act" statement is not true for the coal industry and I sincerely doubt that it is true for others.

The fact is that the basic goals and objectives of the Clean Air Act have long been accepted by industry as they have by most of the citizens of America. The fact also is that many in American industry and the public honestly believe that some requirements of the Clean Air Act are unnecessarily stringent and not in the total national interest. It is these points that deserve serious and constructive debate. And I pray that Doug Costle and our government will approach this in the future as seriously as the coal industry intends to do.

UNDERLYING ISSUES THAT DESERVE ATTENTION IN THE UPCOMING DEBATE

During the next three months, the NCA will decide on the specific proposals that it will seek to have introduced in the next Congress. The proposals we make will not be an attempt to "gut" well-accepted Clean Air Act objectives. They will be focused instead on adjustments to deal with requirements that are *unnecessary*, not justified by scientific data, or not justified when considered in light of the overall national and public interest after rationally balancing competing goals.

It is of course too early to provide specifics, but I would like to review with you some of the underlying issues that deserve serious attention during the upcoming debate.

I want to emphasize two points so that they do not get lost in the comments that follow. First, the objective of protecting public health cannot be questioned. Second, other non-health related, environmental objectives must not be shortchanged as the nation seeks the best balance among our competing environmental, economic, energy, and national security objectives.

However, accepting the goals and objectives of the Clean Air Act does not mean that there are not problems with any of its provisions or with the manner in which it is being implemented. The changes which we believe are needed would not take us further in the direction of the amendments of 1977, which added unnecessary or duplicative requirements and injected the federal government still further into implementation of the Act. This has frustrated the original goal of state implementation. The result has been a regulatory morass. The nation will have before it in 1981 the opportunity to make changes that will preserve its environmental goals without continuing to jeopardize economic growth or energy and national security, while reducing pervasive federal involvement at all levels.

There are four basic themes that run through the detailed adjustments which the coal industry probably will be seeking next year. These are themes which I believe will be shared by many others — and not only within the industrial sector. They are:

- First, the federal government must establish more credible, defensible standards to protect public health — so-called "primary standards."
- Second, each individual state would have the principal responsibility for making the important judgments involved in standards relating to the public welfare, the so-called "secondary standards." This includes implementing the laws and regulations which will assure the attainment and maintenance of ambient air quality standards, and such other limitations as the states may individually choose to adopt.
- Third, more realistic and reasonable deadlines and schedules must be established for EPA as well as industry, to avoid the charade of schedules which are more honored in the breach than in the observance, and which have led to de facto implementation of the Act by the federal courts, not by EPA or the states.
- Fourth, the harsh reality that there are unavoidable conflicts between environmental goals and economic and energy objectives must be recognized and carefully designed trade-offs must be forged. This, in spite of what President Carter told the coal industry this week, is the harsh reality which this administration has refused to face up to and which it continues to ignore.

The Federal Government Must Establish Credible Standards to Protect Public Health

No one can seriously question the concept of a National Primary Ambient Air Quality Standard to protect public health. In general, the health effects of any particular substance are the same in Maine and in California. Standards set separately by the states would be duplicative and confusing and would interfere with the objective of equal protection. Setting the federal primary standard is of course a matter of great importance. But, based on our experience to date and recent medical data, changes are needed in both the level of the primary standards set by EPA in 1971 and in the procedures for setting them.

Primary standards, which are intended to protect public health, need to be sharply distinguished from secondary standards, the so-called "welfare standards" which are intended to protect various non-health related objectives, including aesthetic values. These non-health matters figure importantly among the goals and objectives of the Clean Air Act, but

- they are *secondary,*
- they necessarily compete with other equally legitimate goals, not incorporated in the Clean Air Act, and
- their relative importance is likely to differ from one region to another.

Consequently, it seems reasonable to view the *secondary* national standards as more exemplary than obligatory (like the primary standards) to be pursued by the various states as they individually place higher or lower values on various non-health related environmental amenities.

As the debate proceeds, serious consideration should be given to whether the federal government should have some expanded but still limited authority to override state-imposed standards more stringent than necessary to protect public health when the more stringent standards interfere with important national problems such as the continued dependence on imported oil.

STATES SHOULD HAVE ADEQUATE AUTHORITY AND RESPONSIBILITY

The second thrust of change should be toward reinstating the concept of "state implementation." The Clean Air Act calls for state implementation plans, or SIPs, which are supposed to be the mechanism by which states regulate sources of pollution in order to attain or maintain the national ambient air quality standards. State governments are closer than the federal government to emission sources and, in general, are better able to make choices in deciding how stringently to regulate particular sources so as to attain or maintain national standards. States are also best qualified to make the many necessary trade-offs among conflicting goals and objectives needed to meet any additional limitations.

The federal government must maintain oversight, since it bears ultimate responsibility for seeing that primary standards are met. But, oversight should not require elaborate federal review of every change in state implementation plans or every permit issued by the state. At present, the federal EPA is involved in detail, in each such effort through the non-attainment and prevention of significant deterioration (PSD) regulations, and in the review of construction and operation permits for all new or modified stationary sources.

The additional detailed federal regulations and federal involvement in the review of all new and modified sources, as a result of the 1977 Amendments, has subjected industry to duplicative requirements and diffused the responsibility for attainment and maintenance of primary standards. Industry often faces passing of the buck from state to EPA regional offices and then to Washington and back, second-guessing of states by EPA, and delayed or blocked industrial or energy developments. And the result is that the system is breaking down.

REASONABLE DEADLINES AND SCHEDULES SHOULD BE ESTABLISHED

A third direction of change should be the establishment of reasonable dates for compliance with primary standards and for taking other action. All too often, industry is faced with unrealistic deadlines from government, which must then be laced with exemptions because they are known to be impractical. The net effect is not prompt achievement of goals, but instead they force industry to seek every possible exemption and bear the bureaucratic burdens that come with each required dispensation.

Evidence of the unrealistic nature of Clean Air Act deadlines can be found in the many exemptions granted, and the wholesale extension of deadlines at each reauthorization of the Clean Air Act. Next year will prove no exception. Industry will be charged with "footdragging", but the real causes, I submit, are:

- The unrealistic deadlines for meeting the multiple complex compliance requirements of the 1977 Amendments, and
- the cumbersome procedure for revising state implementation plans and EPA's review and approval of those revisions.

The 1977 Amendments required that states revise their implementation plans to meet requirements of the revised Act and EPA's implementing regulations, and to submit the revised SIPs to EPA by January 1, 1979. EPA was to complete its review and approval by July 1979. Lacking such approval, states were to be subjected to cut-off of federal highway and public works funds and other penalties.

Today, 15½ months past the EPA deadline, EPA has received from from the states 40 completed plans and 11 partial plans. EPA has approved 18 of the completed plans, has disapproved one and has approved 20 partial plans. In some cases, EPA's approvals have been conditional, leaving in jeopardy anyone who proceeds with an investment or other energy development activity under a "conditional" approval.

Attempts to proceed with projects that create jobs and which would increase reliance on domestic energy resources are plagued by such uncertainties. However, let me hasten to add that uncertainty is only one part of the problem. No one should be misled by the common bureaucratic rhetoric that certainty of requirements is more important than the relative stringency. As we know from experience, unnecessarily stringent requirements in some cases prevent coal use and in others push up costs to a point that some other fuel such as imported oil is used instead of coal. The price of certainty where we have it has simply been too high!

Unavoidable Conflicts Among Environmental, Economic, and Energy Objectives Must Be Recognized

The fourth general change that must be addressed is the need to recognize the significant adverse effects involved in meeting the many non-health related environmental objectives prescribed in the Clean Air Act and the implementing regulations. Coal has been a particular victim of the disingenuous position taken by many in the environmental movement, and frequently repeated by officials of the Carter administration, that there is no need for trade-offs between environmental quality and energy objectives. The current day equivalent of the guns *and* butter philosophy is that we can use as much coal as is desirable without adjustment of environmental requirements.

In the past year, we have heard many calls for increased coal use — accompanied by a stone-walling on environmental requirements. Thanks to the doubling of oil prices in the past two years, coal has become cost effective in many situations even with the pollution control measures desired by the environmental advocates. However, we must recognize as unwise the position that OPEC-established prices of oil somehow should provide a guideline for determining the amount of pollution control equipment that should be installed. The contention that coal is still cost effective even with very expensive pollution control measures sounds like a free lunch. But, this approach merely hides the fact that the costs of using coal are much higher than necessary with few, if any, compensating benefits.

The same fundamental problem is carried to its extreme when pursuing "zero emissions" rather than realistic ambient standards set to protect public health and the environment. We must recognize that few individuals or nations can afford costs that are not balanced by benefits.

There are at least three areas where a comparison of benefits and costs of air quality requirements should be undertaken. The first concerns the secondary, non-health related standards. We have a rich and bountiful land, but even the United States cannot afford to ignore the costs to individuals in jobs and prices and to the nation in economic growth and energy security that would be required to protect every amenity within the scope of secondary standards. In fact, when damage to public health is not involved, the government should have an absolute obligation to consider every implication of the proposed requirements, to compare the benefits and costs, and to make the trade-offs openly and objectively.

A second example of disregard for costs is found in the prevention-of-significant-deterioration or PSD requirements of the 1977 Amendments and EPA regulations. These requirements apply to all areas of the country which are already cleaner than required by the primary national standards — that is, areas where by definition, pollutants do not jeopardize public health. The essential feature of these regulations is to limit increases in pollution in these areas to certain specified increments above the level prevailing in 1975. These increments are set without regard to the costs or other adverse impacts (such as economic development and jobs) of the requirement and without the need to show benefits.

The basic concept is an extension of the idea that in certain areas, pristine air must be valued for its own sake without regard for effects on public health. Many will support this much of the concept, but there is strong objection to the extension of the concept, even with provision for increments, to the whole country. The effects of PSD requirements include an impossible regulatory burden, as EPA attempts to determine the contribution of each new or modified source to the remaining increment, and, eventually, an absolute limit on economic growth without regard to public health.

A third area where an objective analysis of benefits and costs should be required is in connection with the "visibility" regulations that EPA recently proposed to implement another provision of the 1977 Amendments to the Clean Air Act. There are many problems with those proposed regulations but I will give only one illustration. EPA now proposes to protect not only the so-called pristine areas (Class I areas in PSD terms) but also "integral vistas" of such areas. In layman's terms, this would extend the boundaries of such areas as national parks to include any area that is visible from the protected area. It would prevent construction of any source whose visible emissions would intrude into such "*viewshed*." Needless to say, this proposal if finally adopted would place severe new limits on the ability to locate new industrial facilities or other economic development activities. Again, public health is *not* involved and, again, the proposed restrictions totally ignore the need for realistic balancing of the benefits and adverse effects.

RECENT CONCERN ABOUT "ACID RAIN" ILLUSTRATES FUNDAMENTAL PROBLEMS WITH THE FEDERAL GOVERNMENT'S APPROACH

The recent escalation of environmentalist and media concern about "acid rain" illustrates several of the fundamental problems that I have outlined. The nation has been treated to a full-scale publicity campaign about the dangers of "acid rain." The casual reader or listener could be forgiven for imagining that we are faced with a grave threat to human health. Fortunately, a closer look shows that even the most strident alarmists have recognized that human health is *not* an issue. Nevertheless, we are faced with a campaign of misleading publicity which seems designed to gain public support for new legislative and regulatory measures to deal with an *alleged* problem.

The contention, as you may know, is that sulfur and nitrogen oxide emissions from the combustion of coal and other fossil fuels combine in the atmosphere with other substances and form sulfates or nitrates which are eventually deposited, perhaps at a long distance from the source, in a liquid or dry acidic form, such as rain that is more acidic than "normal." These deposits, so goes the contention, adversely affect fish, flora, fauna, and the likes, but not human health. The contention further is that precipitation is becoming more acidic in many parts of the country.

A careful review of the scientific basis for the contentions, conducted by objective observers, has shown that data are *not* available to justify most recent contentions about "acid rain." In fact, relatively little is known about the formation of acidic precipitation, the role of sulfur or nitrogen oxides emissions, the transport and transformation of the substances of concern, and their deposition on land, water, flora and fauna. Furthermore, relatively little is known about the sources and the relative importance of the contributions from various sources — natural and man-made — of acidity which eventually appears at the point where adverse effects are alleged to appear.

What has become clear from the review of the available data is that it does *not* justify a conclusion that precipitation is becoming more acidic over ever wider areas. Clearly, more research is needed and far better information should be available before attempts are made to establish new controls. This fundamental fact was recognized by Congress in the recently enacted Energy Security Act of 1980. But this hasn't deterred Doug Costle and EPA from charging ahead.

EPA efforts to regulate "acid rain" are important for another reason. They could represent a major new attempt to implement authority in the 1977 Clean Air Act Amendments dealing with "non-criteria" pollutants. Briefly, this is a major new loophole added in 1977. Previously, EPA was required to publish a "criteria" document setting forth details of the nature, causes and effects and behavior of pollutants *before* ambient air quality standards could be set and other regulatory measures taken. The "non-criteria" pollutant provisions of the 1977 Amendments opened the possibility that EPA could try to proceed with regulations *without* the scientific data necessary to promulgate criteria and standards under other provisions of the Act.

The real threat is that EPA will embark on a regulatory program imposing significant costs without adequate information to justify the program. It has happened in the past. They have acted without adequate information, imposed huge costs and then have been proven wrong.

CHANGING ATTITUDES IN THE CONGRESS AND THE PUBLIC

The final point I want to leave with you today is that the forthcoming debate on the Clean Air Act will be heavily influenced by the attitudes about jobs, energy, and the environment evolving in the public and the Congress.

Public Opinion

With respect to public opinion, several recognized polls have revealed important changes occurring in the public's understanding of energy and environmental issues and a willingness to accept trade-offs among energy, environmental and economic objectives when necessary.

Let me give you three examples from a nationwide poll conducted by Louis Harris in May 1980.

- 70 percent of the people surveyed favor building more coal-fired power plants.
- There has been an increase from 37 percent in 1977 to 58 percent in 1980 in the number of people who favor some reduction in environmental standards to improve the likelihood of meeting the nation's energy requirement goals. (The percentage increased 8 points from 1979 to 1980.)
- And, finally, one of the more surprising statistics to me is that 53 percent of the people surveyed indicated that they *agree* with the statement in the survey that "Even if there is some danger to people's health from coal-burning power plants, the present energy situation makes some risk worth taking since coal is so plentiful in this country." I find this statistic surprising since the coal industry has long accepted the Clean Air Act's basic objective of protecting public health.

Attitudes in Congress and the Executive Branch

We shall have to wait to see what the attitudes will be in the Congress when the Clean Air Act is debated in the years ahead. During the past year, there appears to have been a growing reluctance to add major new environmental requirements. In addition, we know already that several key members of the House and Senate Committees that handle the Clean Air Act will not be returning due to retirements or losses in primary elections.

The upcoming election should give us new signals or probable attitudes, since a number of strong advocates and opponents of tighter environmental requirements are facing tough contests. Perhaps, needless to add, the outcome of the presidential election will also have a major impact. As you are well aware, there are sharp differences between the platforms of the two major parties on the matter of whether there should be changes in environmental requirements when necessary to achieve a balance with other important national objectives.

CONCLUSION

I would like to close by urging each of you to participate fully and actively in the upcoming national debate on the Clean Air Act — and to work hard to assure that the voice of Illinois and the voice of coal is heard loud and clear. And, finally, I urge you to vote next month and, based on my political experience here in Illinois, I urge you to vote early and often!

President Bond thanked Mr. Bagge for his interesting address.

President Bond: We have now approached the point in the 88th session of the Illinois Mining Institute which will be my last official act as preciding officer — that of presenting the gavel — the instrument of authority — to your president-elect, Mr. Walter S. Lucas. Walter, will you please step forward so that we may make the act official?

Walter, will you please accept this gavel as the official instrument for conducting the Illinois Mining Institute Business during the upcoming year? In so doing, I wish you much success in your new official capacity as President of the Illinois Mining Institute during the upcoming year. I am certain that you will receive the help and cooperation needed to make your new job as easy as mine has been. Finally, I would extend my appreciation for the opportunity of presiding over the 88th annual meeting of the Illinois Mining Institute.

Thank you, Ladies and Gentlemen, for the cooperation and help extended to me over the past year. Now, Walter, I will turn the session over to you.

President-elect Walter Lucas presented a souvenir gavel to Charles Bond and thanked him for carrying out the duties of the President of the Institute during the past year (figure 3). Then President-elect Lucas adjourned the meeting.

Fig. 3 — President-elect Walter Lucas (left) presents souvenir gavel to President Charles Bond.

CONSTITUTION AND BY-LAWS

Adopted June 24, 1913

Amended November 12, 1926	**Amended October 23, 1964**
Amended November 8, 1929	**Amended October 23, 1970**
Amended November 8, 1935	**Amended October 22, 1971**
Amended October 21, 1938	**Amended October 3, 1975**

Amended October 16, 1980

ARTICLE I.

Name and Purpose

The Illinois Mining Institute has for its object the advancement of the mining industry by encouraging and promoting the study and investigation of mining problems, by encouraging education in practical and scientific mining, and by diffusing information in regard to mining that would be of benefit to its members.

ARTICLE II.

Membership

Section 1. Any person directly engaged or interested in any branch of mining, mining supplies, mining appliances, or mining machinery may become an active member of the Institute. Any person desiring to become a member of the Institute shall fill out a blank for that purpose giving his name, residence, age and occupation. This application shall be accompanied by the current year's dues as established by the Executive Board. Each application for membership shall be submitted to the Executive Board, who shall make an investigation as to the qualifications of the applicant, and shall be authorized to elect to membership and issue a certificate of membership to such applicant subject to the ratification of the next regular meeting of the Institute.

Section 2. Any person of distinction in mining may be elected an honorary member of the Institute by two-thirds vote of the members present at any regular meeting. Any member who has been an active member of the Institute and shall have retired from active business in mining may become an honorary member.

Section 3. The annual dues for active members shall be determined by action of the Executive Board, on any person in arrears on August 1, of the current year, after having been sent two notifications of dues, shall be dropped from membership. Members in arrears for dues will not receive the printed proceedings of the Institute.

Section 4. Any active member may become a life member by the payment of $100.00 and shall be exempt from further payment of dues during his lifetime.

ARTICLE III.

Officers

Section 1. The officers shall consist of a President, First Vice-President, Second Vice-President, Secretary-Treasurer and twelve Executive Board members. The services of all officers shall be without compensation.

Section 2. Nominations for officers and the Executive Board shall be made by nominating committee of three (3) appointed by the President at least thirty days before the annual meeting, provided that anyone can be nominated on the floor of the meeting for any office for which an election is being held.

Section 3. The President, First Vice-President, Second Vice-President, and Secretary-Treasurer shall be elected by ballot, annually, at the regular meeting and shall hold office for the ensuing year.

Four Executive Board members shall be elected by ballot, annually, at the regular meeting and shall hold office for the ensuing three years.

Section 4. In case of death, resignation, or expulsion of any officer, the Executive Board may fill the vacancy by appointment until the next regular meeting, when the vacancy shall be filled by regular election. In case of a vacancy in the office of President, the duties shall devolve upon the First Vice President.

Section 5. The Executive Board shall consist of the officers, the 12 elected Board members, and, as an ex-officio member, the current active Director of the State of Illinois, Department of Mines and Minerals.

ARTICLE IV.

Duties of Officers

Section 1. The President shall perform the duties commonly performed by the presiding officer and chairman. He shall, with the Executive Board, exercise a general supervision over the affairs of the Institute between sessions.

Section 2. The First Vice-President shall preside in the absence of the President and perform all the duties of the President in his absence. The Second Vice-President shall perform all duties of the First Vice-President in the absence of First Vice-President.

Section 3. The Secretary-Treasurer shall keep a record of each meeting, shall read and file all resolutions and papers that come before the Institute, sign all orders for money, and shall purchase necessary supplies.

He shall keep a true record of all money received by him and payments made on account of the Institute. He shall pay out no money except on an order signed by himself, and shall retain these orders as vouchers. He shall give bond in such sum as the Institute may provide, the premium on said bond being paid by the Institute.

He shall act as editor-in-chief for the Institute and may furnish the newspaper and other periodicals such accounts of our transactions and discussions as are proper to be published. His own judgment is to prevail in such matters unless objection is lodged at a regular meeting or by the Executive Board.

The retiring President shall act ex-officio in any capacity for the ensuing year.

Section 4. The President shall appoint an auditing committee annually to audit the accounts of the Secretary-Treasurer, and said audit shall be submitted to the annual meeting of the Institute.

Section 5. The Executive Board shall perform the duties specifically prescribed by this constitution; it shall supervise the expenditures and disbursements of all money of the Institute, and no expenditure other than current expenses shall be authorized without first having the approval of the Executive Committee, it shall act as program committee for each meeting to determine what is to be published in the proceedings and shall perform such other duties as may be referred to them by regular or special meeting of the Institute.

ARTICLE V.

Meetings

Section 1. The annual meeting shall be held in the fall of each year and on such days and in such places as may be determined by the Executive Board of the Institute. Notice of all meetings shall be given at least thirty days in advance of such meetings.

Section 2. Meetings of the executive board shall be held on the call of the president, or at the request of three members of the executive board, the president shall call a meeting of the board.

ARTICLE VI.

Amendments

Section 1. This Constitution may be altered or amended at any regularly called meeting by a majority vote of the members present, provided notice in writing has been given at a previous annual meeting of said proposed change of amendment.

ARTICLE VII.

Order of Business

At all meetings, the following shall be the order of business:

(1) Reading of minutes.
(2) Report of executive board.
(3) Report of officers.
(4) Report of committees.
(5) Election of new members.
(6) Unfinished business.
(7) New business.
(8) Election of officers.
(9) Program.
(10) Adjournent.

ARTICLE VIII.

Dissolution

In the event of complete dissolution of the Institute, the cash assets of the Institute will be distributed to the University of Illinois at Urbana and the University of Missouri School of Mines, Rolla, Missouri, in a ratio of four to one respectively, for support of scholarships in Mining Engineering. Equipment will be donated to any not-for-profit organization that the Executive Board may determine to be worthy recipients.

ILLINOIS MINING INSTITUTE

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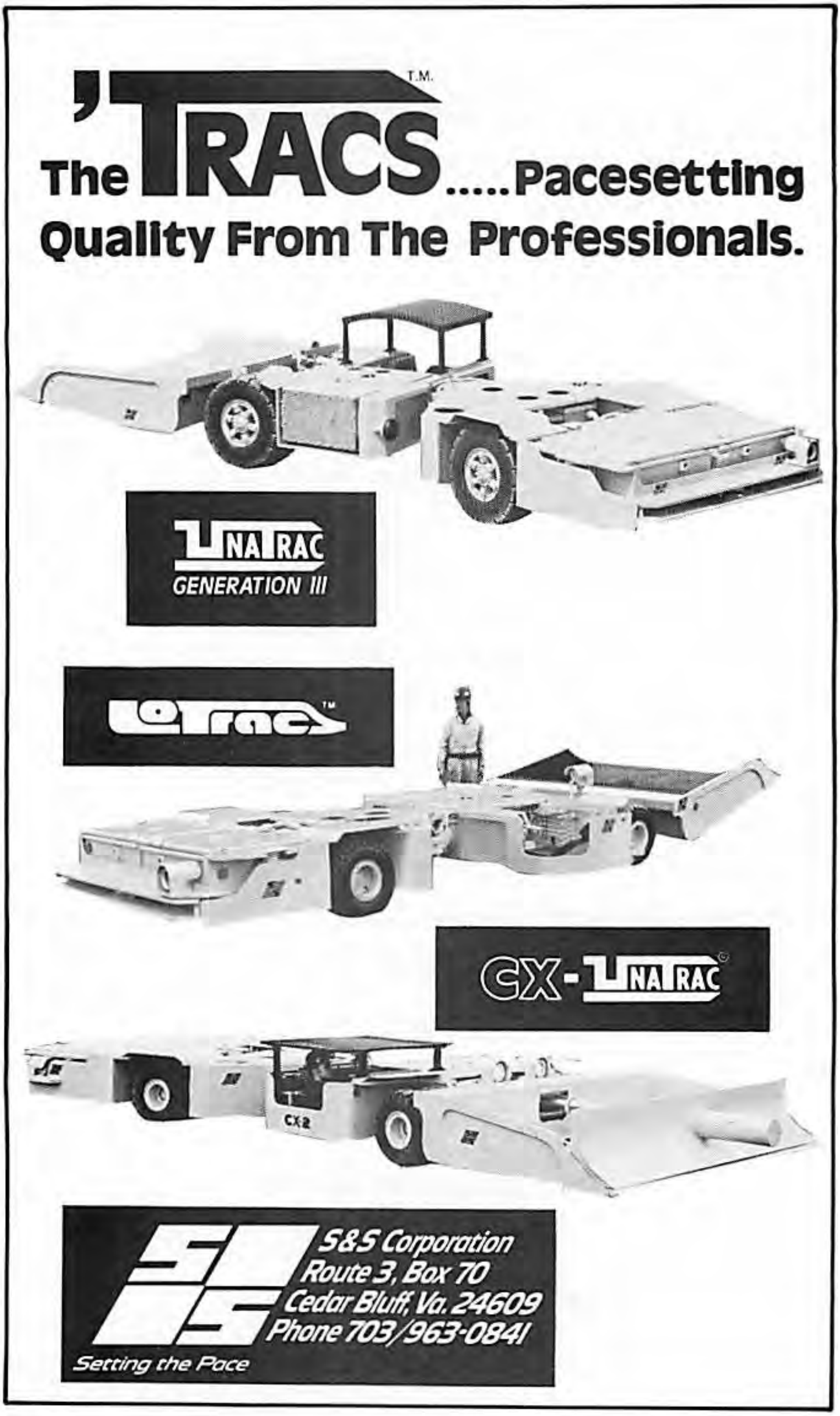
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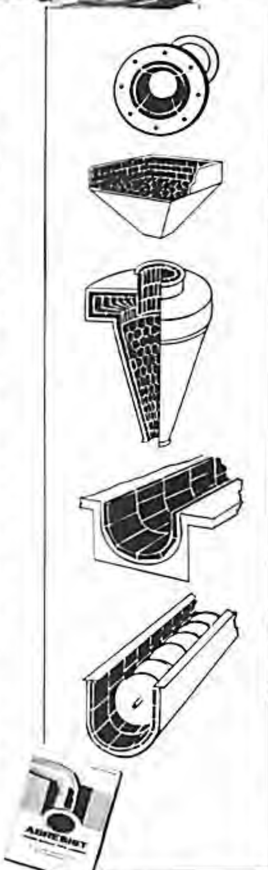

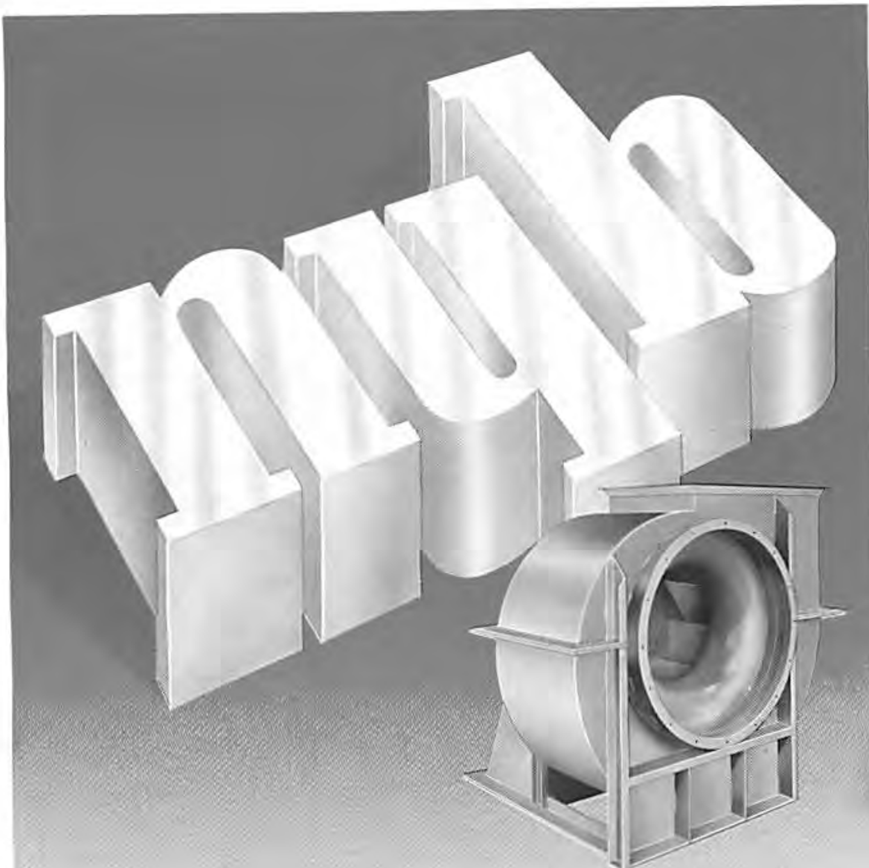

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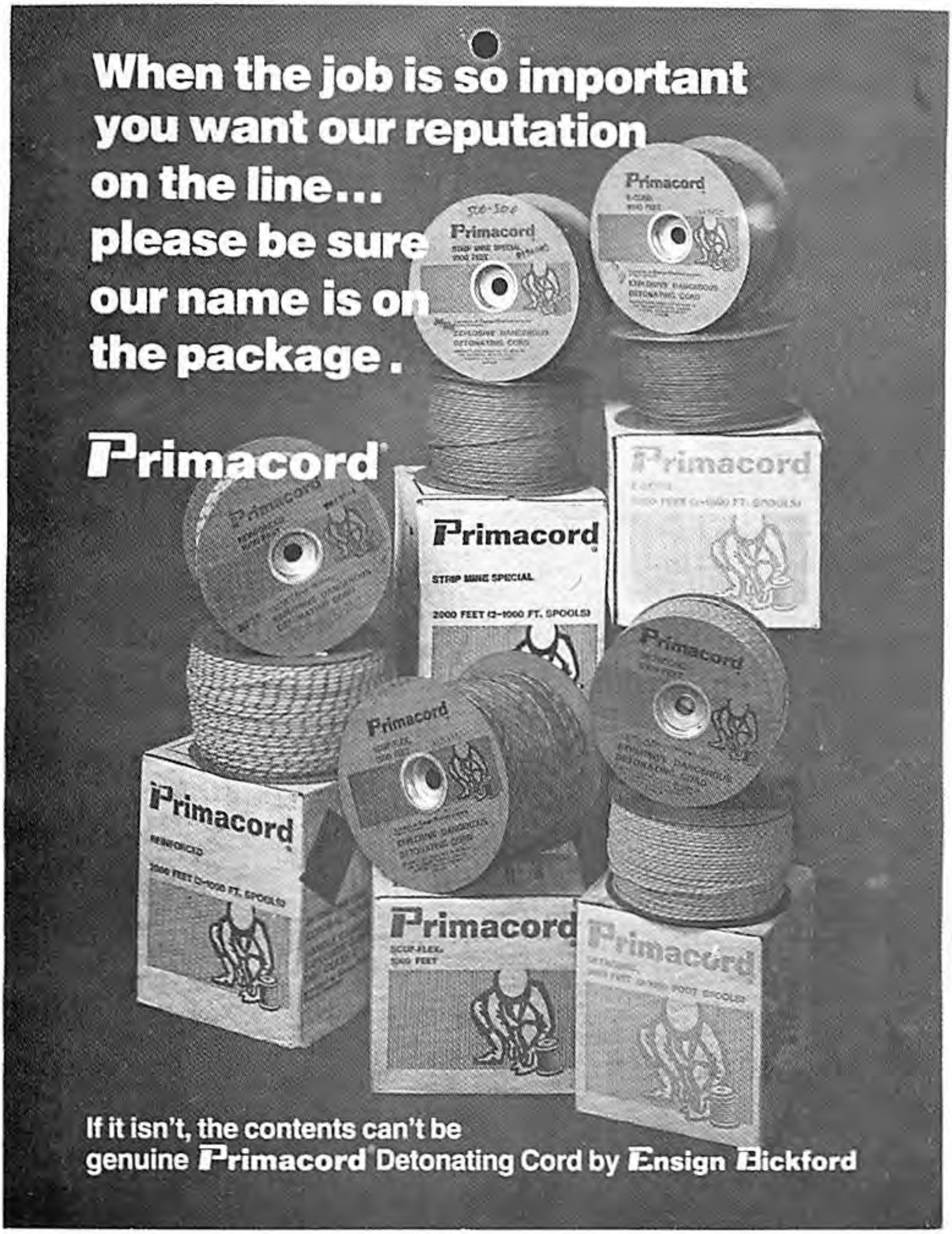
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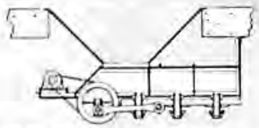

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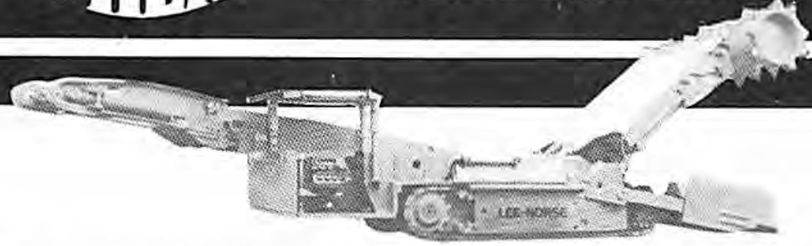

Our Phase II improvement program has greatly increased the reliability of our low and high seam miners. Model LN800 incorporates Phase II toughness into its design along with other outstanding features including electric tram and a comfort cab designed with the operator in mind. Take a close look at the features listed below, and you'll see why the LN800 is destined to become the leader in high seam miners.

- **3 Mining Ranges/3 Frame Heights**

Mining Range	Frame Height	Ground Clearance
10'2"	38"	10"
10'5"	41"	13"
12'0"	50"	13"

- **Narrow 7'10" chassis for narrow heading requirements**
- **90,000-pound machine weight on 19" wide, heavy-duty crawler chains with 22 PSI ground pressure**
- **Cutterhead:**
  - **Optimum bit lacing design by computer analysis**
  - **Face seal replacement without cuttershaft disassembly**
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  - **Chainless cutterhead for quieter operation and lower maintenance**
- **Electric tram:**
  - **Infinitely variable tram speed up to 70 FPM for cutting, tramming and loading**
  - **Full reversing speed for pillar work**
  - **Independent control of each crawler for positive traction**
- **Low pressure hydraulic system for greater reliability**
- **Arm or disc electrically driven gathering head**
- **Phase II features throughout for improved reliability**

Phase II Features Incorporated In LN800

LN800	HH386-II	HH106LP-II	HH106IP-II	HH497-II	HH546-II
Computer Analyzed Bit Lacing Design	•	•	•	•	•
Simplified Cutterhead for Underground Maintenance	•	•	•	•	•
Infinitely Variable Tram Speed 0-70 FPM Reversible	•	•	•	•	•
Independent Crawler Control	•	•	•	•	•
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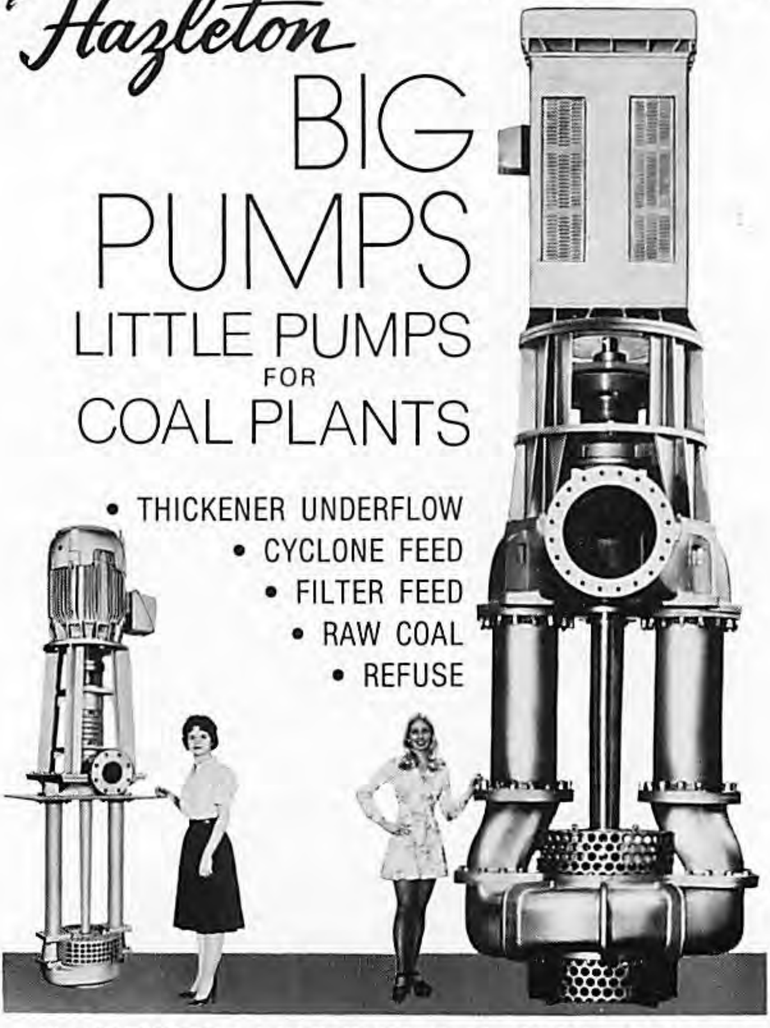

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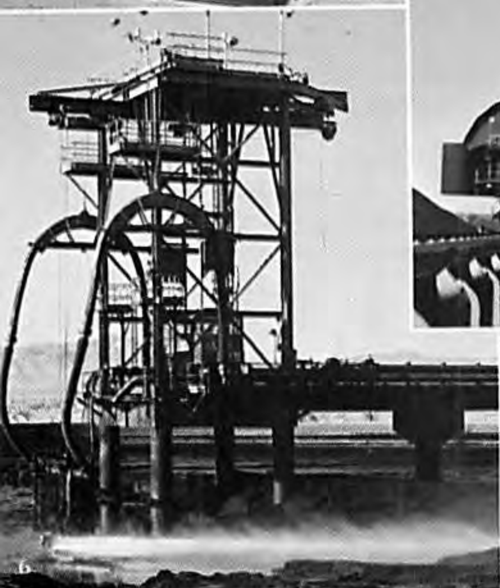

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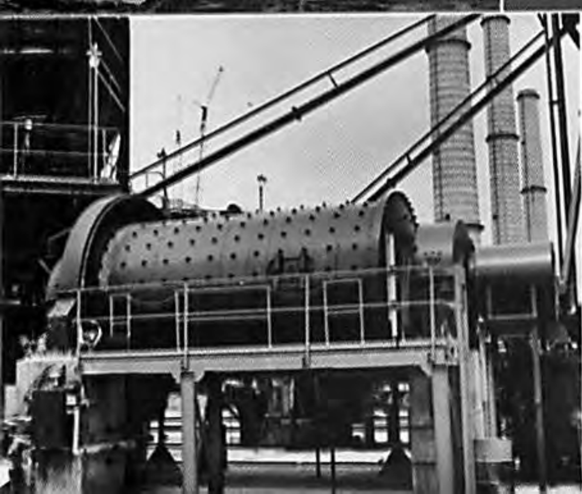

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Truly modular preparation plants with custom circuitry by McNally put the most sophisticated techniques within economic range of the independent operator whose markets are trending toward washed coal, while his mining operations are producing more difficult coals.

In the West, McNally Mountain States Steel provides structural steel both for McNally projects and for other major industrial and architectural construction.

For emission control.

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Photos at left: 1. modular cool preparation plant; 2. large heavy media preparation plant; 3. stacker/reclaimer; 4. unit train loading system; 5. limestone grinding system for stack scrubbers; 6. Marconaflo slurry system.

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Underground mining demands the toughest conveyor belting made. Cambridge Coal chose MineFlex!

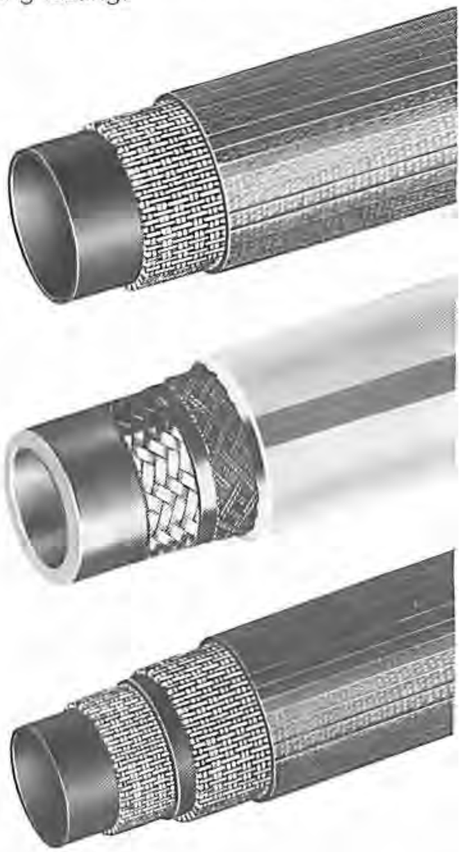
In underground mining, the entire operation comes to a halt if the conveyor breaks down. So the belting must meet tough specifications. It must be flexible enough to run over small pulleys and strong enough to resist ripping, tearing and impact damage. That's why the Cambridge Coal Company chose Uniroyal MineFlex belting. It has a balance of performance properties that results in a belt which delivers lower cost per ton carried, giving you the best value for your conveyor belt dollar.

MineFlex meets the fire resistance standards of the U.S. Department of Labor, Mine Safety and Health Administration (MSHA) and bears the acceptance designation: Fire-Resistant 28-5. Oil-resistant covers available.

your needs, look to Uniroyal

The full Uniroyal line gives you the best value for your hose dollar!

Uniroyal makes a full line of top quality hose for mining service, including air hose that is resistant to gouging and abrasion; and water suction and discharge hose that is flexible and long-lasting.



P-1174 RoyalFlex MSHA Mine Safety Hose

A fire-resistant, lightweight, flexible, softwall water discharge hose designed for underground mining service. Resists abrasion, gouging, chemical fumes, mildew, mine acids, alkalis and oils. Retains characteristics at temperatures of −20°F (−29°C) to +180°F (82°C). Meets requirements of MSHA Schedule 2-G.

P-1025 High Pressure MSHA Mine Hose

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P-1296 MSHA Rock Dusting Hose

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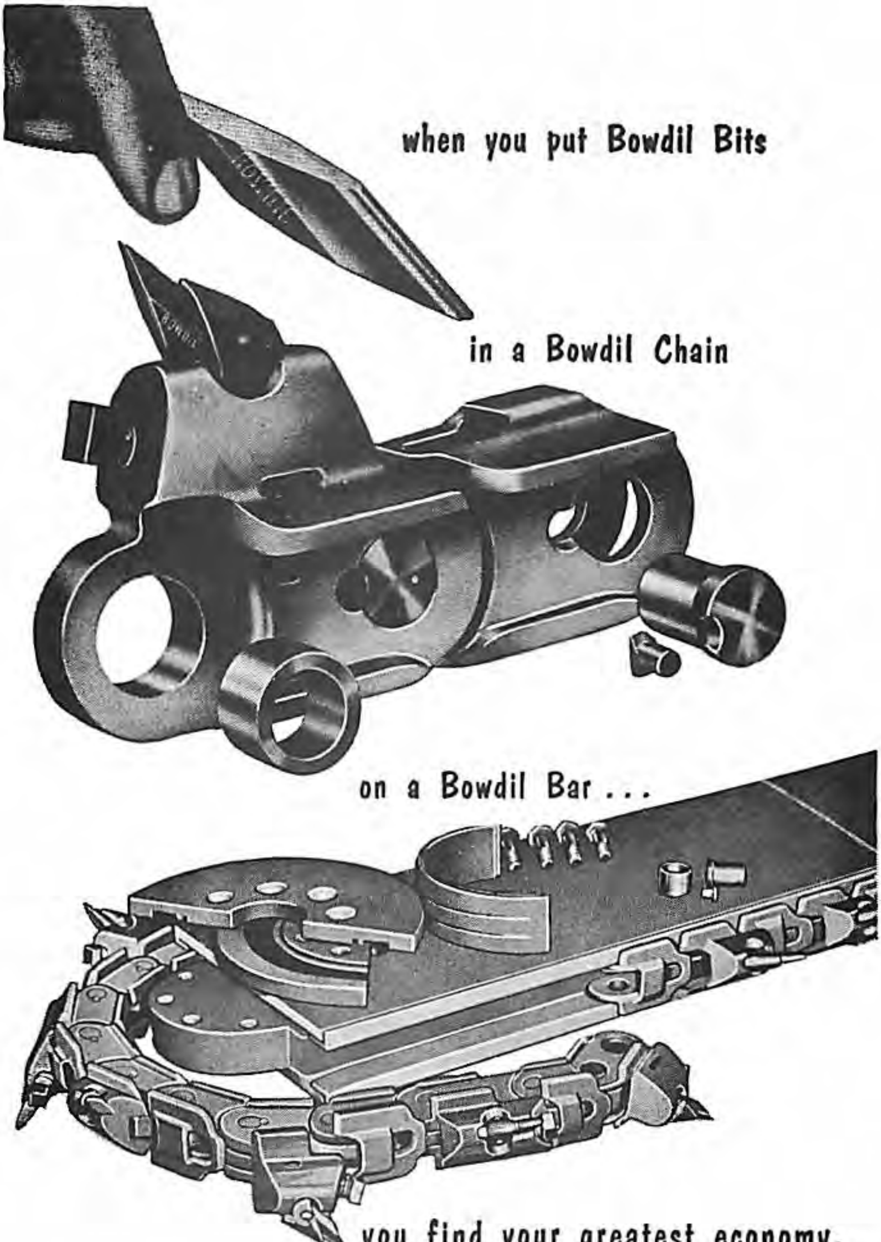

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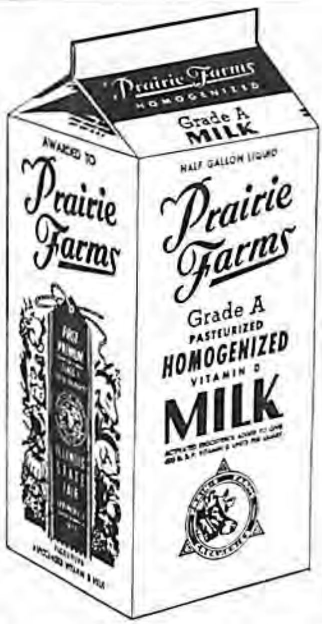

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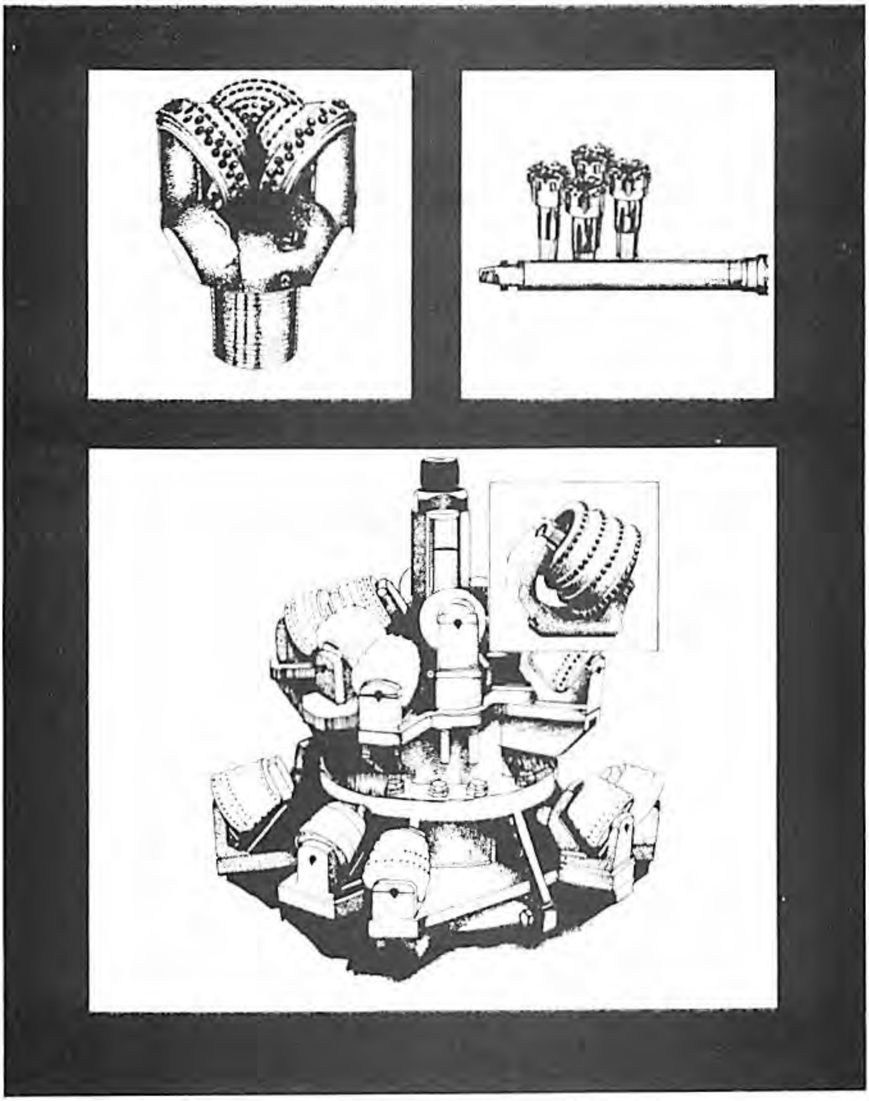

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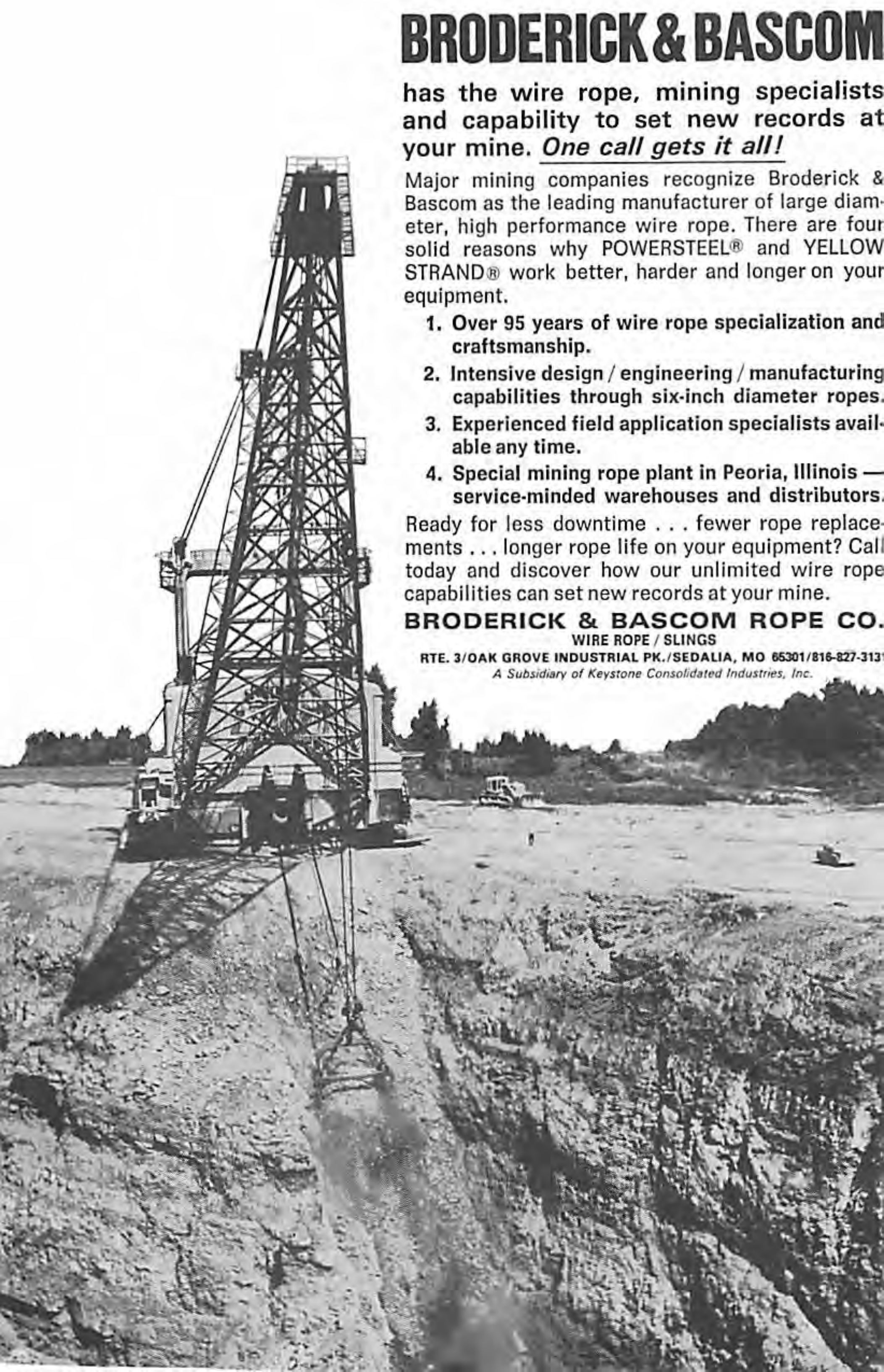
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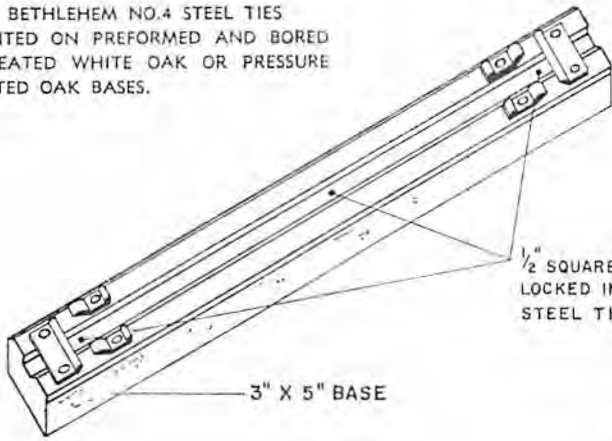

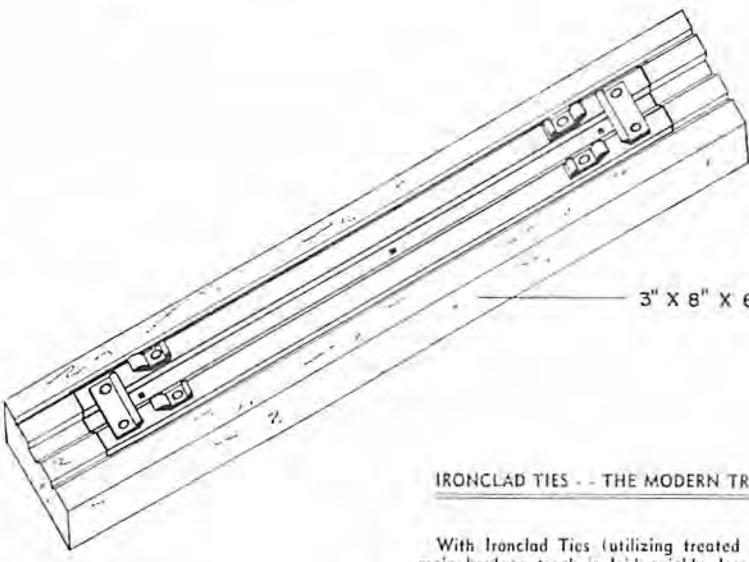

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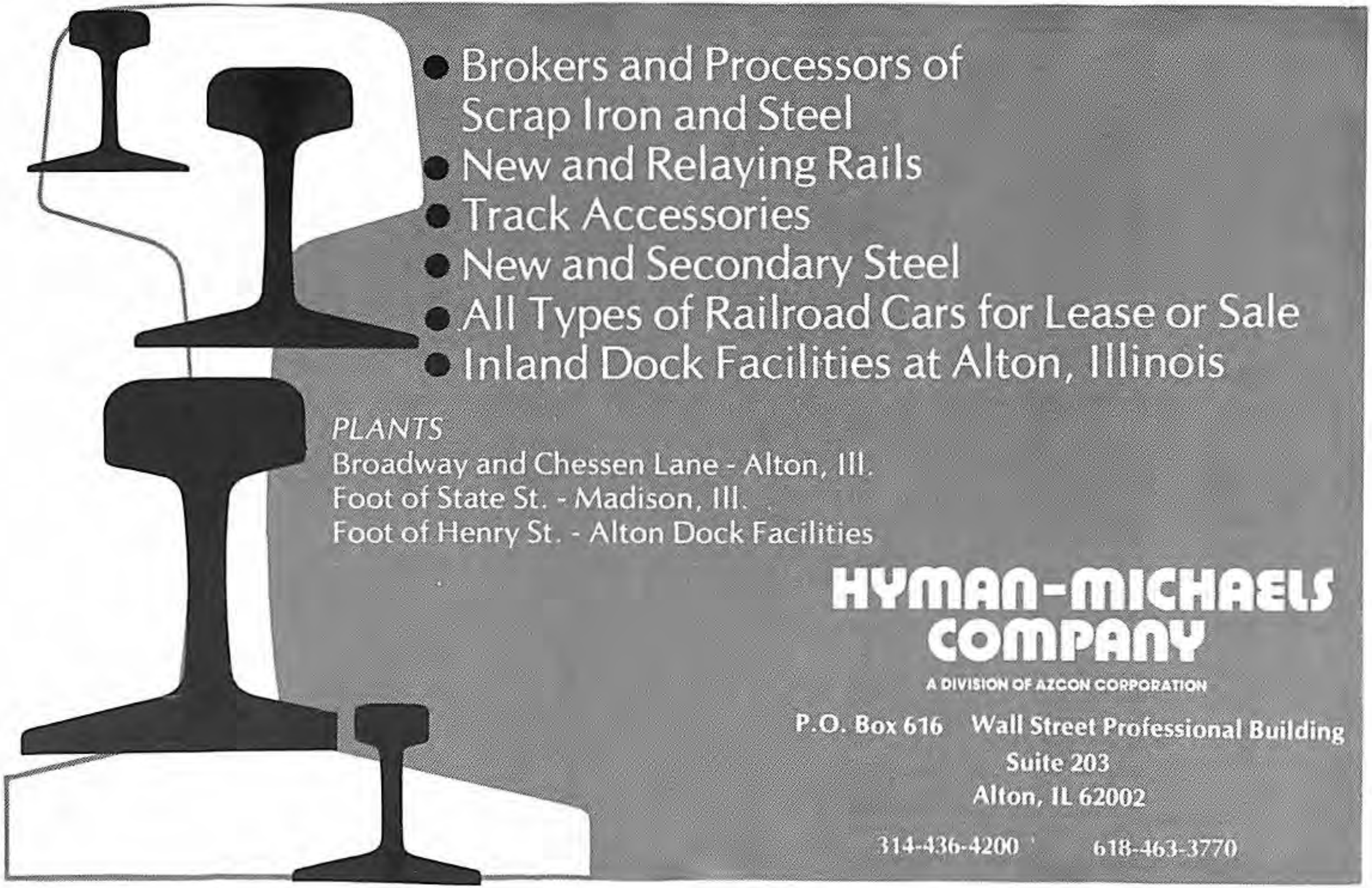
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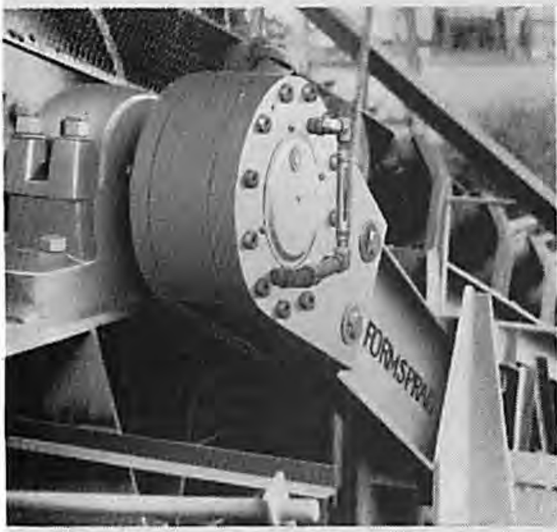

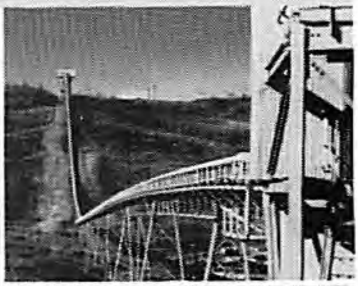

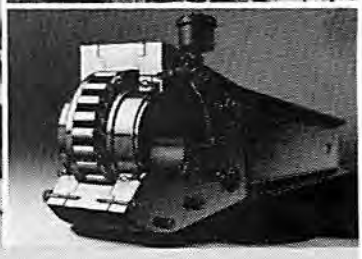

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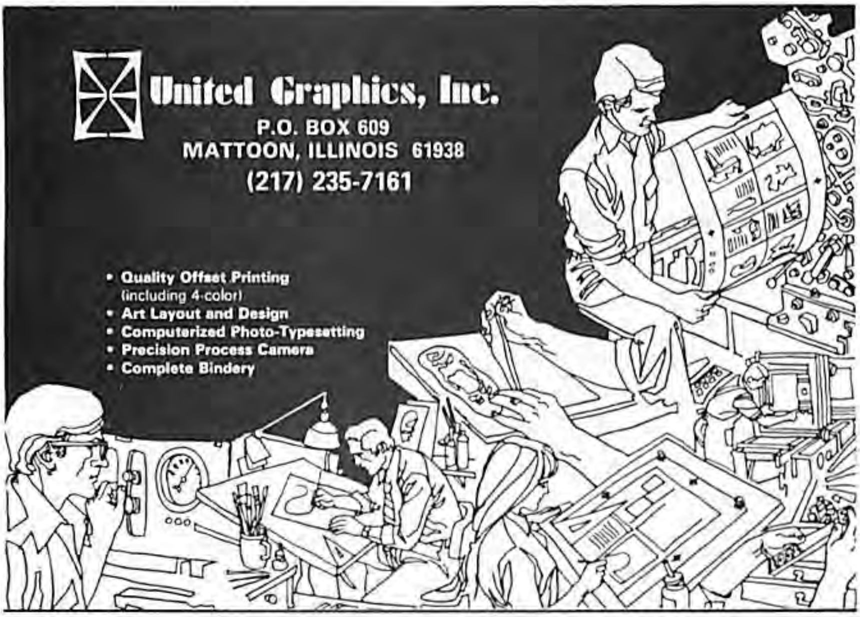

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