# PROCEEDINGS

*of the*

# ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892

1940

Summer Meeting
on Board S. S. Golden Eagle
June 7-8-9

and

Annual Meeting
SPRINGFIELD, ILLINOIS
October 25

Roy L. Adams
President, 1940

# OFFICERS 1940

PRESIDENT

Roy L. Adams

West Frankfort, Illinois

VICE-PRESIDENT

Dr. M. M. Leighton

Urbana, Illinois

SECRETARY-TREASURER

B. E. Schonthal

28 East Jackson Boulevard

Chicago, Illinois

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| James McSherry | D. D. Wilcox |
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# OFFICERS 1941

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# PAST PRESIDENTS OF ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892

| | |
|---|---|
| 1892-3 | JAMES C. SIMPSON, Gen. Mgr., Consolidated Coal Co., St. Louis, Mo. |
| 1893-4 | JAMES C. SIMPSON, Gen. Mgr., Consolidated Coal Co., St. Louis, Mo. |
| 1894-5 | WALTON RUTLEDGE, State Mine Inspector, Alton, Ill. |
| 1895<br>1911 | Institute inactive. |
| 1912-3 | JOHN P. REESE, Gen. Supt., Superior Coal Co., Gillespie, Ill. |
| 1913-4 | THOMAS MOSES, Supt., Bunsen Coal Co., Georgetown, Ill. |
| 1914-5 | J. W. STARKS, State Mine Inspector, Georgetown, Ill. |
| 1915-6 | WILLIAM BURTON, V. P., Illinois Miners, Springfield, Ill. |
| 1916-7 | FRED PFAHLER, Gen. Supt., Superior Coal Co., Gillespie, Ill. |
| 1917-8 | PATRICK HOGAN, State Mine Inspector, Carbon, Ill. |
| 1918-9 | WILLIAM HALL, Miners Examining Board, Springfield, Ill. |
| 1919-20 | WILLIAM HALL, Miners Examining Board, Springfield, Ill. |
| 1920-21 | FRANK F. TIRRE, Supt., North Breese Coal & Mining Co., Breese, Ill. |
| 1921-22 | PROF. H. H. STOEK, Mining Dept., University of Illinois. |
| 1922-23 | JOHN G. MILLHOUSE, State Mine Inspector, Litchfield, Ill. |
| 1923-24 | D. D. WILCOX, C. E., Superior Coal Co., Gillespie, Ill. |
| 1924-25 | H. E. SMITH, Gen. Supt., Union Fuel Co., Springfield, Ill. |
| 1925-26 | E. G. LEWIS, Supt., Chicago-Sandoval Coal Co., Sandoval, Ill. |
| 1926-27 | WM. E. KIDD, State Mine Inspector, Peoria, Ill. |
| 1927-28 | JAMES S. ANDERSON, Supt., Madison Coal Corp., Glen Carbon, Ill. |
| 1928-29 | JOHN E. JONES, Safety Engineer, Old Ben Coal Corp., West Frankfort, Ill. |
| 1929-30 | PROF. A. C. CALLEN, University of Illinois, Urbana, Ill. |
| 1930-31 | JOSEPH D. ZOOK, Pres., Illinois Coal Operators' Assn., Chicago, Ill. |
| 1931-32 | GEO. C. MCFADDEN, Asst. Vice-Pres., Peabody Coal Co., Chicago, Ill. |
| 1932-33 | CHAS. F. HAMILTON, Vice-Pres., Pyramid Coal Co., Chicago, Ill. |
| 1933-34 | HARRY A. TREADWELL, Gen. Supt., C. W. & F. Coal Co., Benton, Ill. |
| 1934-35 | C. J. SANDOE, Vice-Pres., West Virginia Coal Co., St. Louis, Mo. |
| 1935-36 | T. J. THOMAS, Pres., Valier Coal Co., Chicago, Ill. |
| 1936-37 | W. J. JENKINS, Pres., Consolidated Coal Co., St. Louis, Mo. |
| 1937-38 | H. H. TAYLOR, JR., Franklin County Coal Corp., Chicago, Ill. |
| 1938-39 | PAUL WEIR, Consulting Mining Engineer, Chicago, Ill. |
| 1939-40 | ROY L. ADAMS, Old Ben Coal Corp., West Frankfort, Ill. |

*We are proud to illustrate below the medals offered by this Institute to all authorized district first aid contests:*


On September 2, 1940, the Tri-County Labor Day Association held a first aid contest at Christopher, Illinois. First place medals (made of gold) were awarded to each member of Valier Coal Company team; second place medals (silver) were awarded to Bell & Zoller Mine No. 1 team; third place medals (bronze) to Bell & Zoller Mine No. 2 team.

You've read of young Tom Sawyer and of Huckleberry Finn,
Of their many great adventures and the troubles they got in
By hiding in a dark grave-yard, or some such escapade
As fleeing down the river on a raft that they had made.

You've thrilled at their adventures and you can thrill once more
By sailing with the I. M. I. along that same old shore
Where Huck and Tom met Indian Joe, with Becky and the rest,
And where they searched the pirate's cave and found the treasure chest.

Or, if some different place you'd see, we'll sail the other way,
Past Army Posts and quaint old towns, all famous in their day.
And still there is another trip, the one we most enjoy,
It's sailing past the locks and dams on the lovely Illinois.

To those who've sailed with us before, there's little to be said,
As they know the routine of the day and time to go to bed.
There's always five or six, of course, who stay up thru the night
To help the Captain steer the boat and see that all is right.

To those good men we owe our thanks — now truly we can say
There's always something doing, be it night or be it day.
So, when we sail away next June, we hope that you will be
Aboard the GOLDEN EAGLE, with others such as we.

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It's good to have an Institute where mining men may share
The knowledge they have gained each year with others who are there.
It's good to make a river trip with friends whom we might choose
To join us on a packet boat for a lovely three day cruise.

J. A. ("JEFF") JEFFERIS

***Members ! !***

**Plan to Attend the**

## Twenty-Third Annual

# Boat Trip

*and*

# Summer Meeting

*on the*

## S. S. Golden Eagle

●

**June 6-7-8, 1941**

# A WORD TO THE MEMBERS FROM THE SECRETARY

This is the twelfth issue of our Yearbook. There is, of course, a tremendous amount of work connected with getting together and issuing these Proceedings.

Probably few of the members have ever stopped to consider what makes this book possible. We are greatly indebted to the suppliers for advertisements in order to defray the expenses of the Yearbook.

Many of our advertisers have contributed regularly to each issue since our Yearbook was first published, and they have expressed satisfaction in the results obtained from such space carried in the book.

We are eager to have this feeling continue to prevail with our supporters—the advertisers. You, as a purchaser, can greatly assist if you will give the advertisers the support and cooperation to which they are entitled, by patronizing these companies and using their products.

*Refer to the Advertising Section and Index in the back of the book.* It will prove helpful to you.

The success of our publication depends greatly on this sort of cooperation. The Advertising Committee has done a fine job in its untiring efforts. The consistent cooperation of the members of the Advertising Committee with the suppliers makes this publication possible.

# CONTENTS

# ILLINOIS MINING INSTITUTE BOAT TRIP

June 7-8-9, 1940

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Twenty-second Annual Summer Meeting and Boat Trip of the Illinois Mining Institute held on S. S. Golden Eagle, leaving St. Louis Friday, June 7, 1940, at 10:30 o'clock P. M., and returning to St. Louis Sunday, June 9, 1940 at 7:30 o'clock A. M.

## MORNING SESSION

Meeting called to order at 10:00 A. M., by Mr. Roy L. Adams, President.

President Adams: Gentlemen, will you please come to order?

It is my great pleasure to welcome you at this time on the Twenty-second Annual Boat Trip. It is our desire to make the program interesting and snappy, and if at any time we find you are getting tired, a motion to adjourn the Meeting will be in order.

We expect to go directly into the program, most of which is on the leaflet which you have in your hand. The first thing we always do at this Meeting is to call the roll, and the Secretary will do that now.

(Roll call by Secretary.)

# ATTENDANCE

ILLINOIS MINING INSTITUTE TWENTY-SECOND ANNUAL BOAT TRIP AND SUMMER MEETING

St. Louis, Up the Mississippi River, and Return

June 7-8-9, 1940

| *Name* | *Affiliation and Address* |
|---|---|
| ADAMS, ROY L. | Old Ben Coal Corp., W. Frankfort, Ill. |
| ANGLIN, D. Z. | Truax-Traer Coal Co., Elkville, Ill. |
| BARGMAN, WALTER | Sahara Coal Co., Harrisburg, Ill. |
| BEAN, FRANK M. | B. E. Schonthal & Co., Murphysboro, Ill. |
| BECKER, L. O. | Utility Mine Equipt. Co., St. Louis, Mo. |

| *Name* | *Affiliation and Address* |
|---|---|
| BLAKE, ARTHUR | Peabody Coal Co., Taylorville, Ill. |
| BLANKINSHIP, G. F. | Egyptian Sales Agency, Murphysboro, Ill. |
| BROWN, WILLIAM | Crescent Mining Co., Peoria, Ill. |
| BUCHANAN, J. H. | Atlas Powder Co., Chicago, Ill. |
| CAINE, K. E. | Goodman Mfg. Co., Chicago, Ill. |
| CAMMACK, KIRK V. | Indiana State Teachers College, Terre Haute, Ind. |
| CHILDS, J. K. | The Tamping Bag Co., Mt. Vernon, Ill. |
| CLAYTON, R. R. | Hercules Powder Co., Benton, Ill. |
| COOK, WALTER | Central Mine Equipt. Co., St. Louis, Mo. |
| CUNNINGHAM, MORRIS | Goodman Mfg. Co., Terre Haute, Ind. |
| DANKS, G. H. | E. I. duPont deNemours & Co., Carbondale, Ill. |
| DAWSON, HUGH | Bethlehem Steel Co., Herrin, Ill. |
| DE WITT, C. S. | C. W. & F. Coal Co., Chicago, Ill. |
| DISCHINGER, H. F. | Robins Conveying Belt Co., Chicago, Ill. |
| DOOLEY, J. E. | Dooley Brothers, Peoria, Ill. |
| EDGAR, R. L. | Watt Car & Wheel Co., Barnesville, Ohio |
| ELLIS, HOWARD R. | Cardox Corporation, Chicago, Ill. |
| EUBANKS, FRANK | Old Ben Coal Corp., W. Frankfort, Ill. |
| FLEMING, J. B. | Mine Safety Appliances Co., Urbana, Ill. |
| FLETCHER, JAMES H. | Consulting Engineer, Chicago, Ill. |
| FULFORD, J. H. | The Jeffrey Mfg. Co., Columbus, Ohio |
| GIVEN, IVAN A. | Coal Age, New York, N. Y. |
| GLIDDEN, G. M. | E. D. Bullard & Co., Chicago, Ill. |
| GRIFFEN, JOHN | Koppers-Rheolaveur Co., Pittsburgh, Pa. |
| GUINEY, JAMES | Princeton Mining Co., Princeton, Ind. |
| HALL, G. F. | Goodman Mfg. Co., Chicago, Ill. |
| HANSON, V. D. | Pittsburgh Coal Co., Pittsburgh, Pa. |
| HARMON, R. G. | Timken Roller Bearing Co., St. Louis, Mo. |
| HARTWELL, LEN | Pyramid Coal Corp., Pinckneyville, Ill. |
| HARVEY, HADLEY | Ohio Brass Co., Evansville, Ind. |
| HARWOOD, R. H. | Mines Equipment Co., St. Louis, Mo. |
| HASENJAEGER, E. W. | Consolidated Coal Co., St. Louis, Mo. |
| HASKELL, J. B. | W. Virginia Rail Co., Huntington, W. Va. |
| HASKINS, LEE | Bell & Zoller Coal Co., Zeigler, Ill. |
| HERRINGTON, M. K. | Dept. Mines & Minerals, Springfield, Ill. |
| HERT, A. K. | Snow Hill Coal Corp., Terre Haute, Ind. |
| HITT, J. E. | Walter Bledsoe & Co., St. Louis, Mo. |
| HOLMES, A. W. | Link-Belt Co., Chicago, Ill. |
| HOPGOOD, TED | Atlas Powder Co., Belleville, Ill. |
| HURLBURT, J. R. | Mechanization, Inc., Washington, D. C. |
| JEFFERIS, J. A. | Illinois Terminal Ry. Co., St. Louis, Mo. |
| JENKINS, G. S. | Consolidated Coal Co., St. Louis, Mo. |
| JOHNSON, E. H. | Jeffrey Mfg. Co., Columbus, Ohio |
| JOHNSON, WM. J. | Dept. Mines & Minerals, Christopher, Ill. |
| JONES, ARCH M. | John A. Roebling's Sons Co., St. Louis, Mo. |
| JONES, D. W. | Princeton Mining Co., Princeton, Ind. |
| JONES, JOHN E. | Old Ben Coal Corp., W. Frankfort, Ill. |
| JONES, WALTER | Joy Mfg. Co., Franklin, Pa. |
| JOY, DEWEY E. | Cutter Bit Service Co., Christopher, Ill. |
| KAY, W. W. | E. I. duPont deNemours & Co., Carbondale, Ill. |

| *Name* | *Affiliation and Address* |
|---|---|
| KOLB, FRED L. | Jeffrey Mfg. Co., Terre Haute, Ind. |
| LEIGHTON, M. M. | State Geological Survey, Urbana, Ill. |
| LEWIS, HOWARD | Old Ben Coal Corp., W. Frankfort, Ill. |
| LINDSAY, W. L. | Socony-Vacuum Oil Co., St. Louis, Mo. |
| LIVINGSTONE, A. R. | Reporter, Springfield, Ill. |
| LUND, RICHARD J. | American Mining Congress, Washington, D. C. |
| LYONS, F. A. | Pyramid Coal Corp., Pinckneyville, Ill. |
| MANCHA, RAYMOND | Jeffrey Mfg. Co., Columbus, Ohio |
| McCABE, L. | State Geological Survey, Urbana, Ill. |
| McCOLLUM, H. C. | Allen & Garcia Co., Springfield, Ill. |
| MEAGHER, GEORGE | C. W. & F. Coal Co., W. Frankfort, Ill. |
| MILLER, A. U. | U. S. Bureau of Mines, Vincennes, Ind. |
| MILLER, F. A. | Franklin County Coal Corp., Herrin, Ill. |
| MILLER, J. E. | Mines Equipment Co., St. Louis, Mo. |
| MONICO, J. A. | Illinois Powder Mfg. Co., St. Louis, Mo. |
| MORAN, PAUL | Pyramid Coal Corp., Pinckneyville, Ill. |
| MOSER, C. E. | Socony-Vacuum Oil Co., St. Louis, Mo. |
| OEHLER, HARLAN E. | Franklin County Coal Corp., Herrin, Ill. |
| OLDHAM, R. J. | Centralia Coal Co., Centralia, Ill. |
| O'ROURKE, DAN | Sanford-Day Iron Works, Evansville, Ind. |
| O'ROURKE, JOHN | C. W. & F. Coal Co., W. Frankfort, Ill. |
| PFAHLER, F. S. | Superior Coal Co., Chicago, Ill. |
| PICKARD, A. E. | The Tamping Bag Co., Mt. Vernon, Ill. |
| POWELL, JAMES | Superior Coal Co., Gillespie, Ill. |
| POWERS, F. A. | Hulburt Oil & Grease Co., Peoria, Ill. |
| PRUDENT, N. C. | Crescent Mining Co., Peoria, Ill. |
| RICHMOND, JOHN | Truax-Traer Coal Co., Elkville, Ill. |
| ROLLO, JOHN C. | Crescent Mining Co., Peoria, Illinois |
| ROOS, J. A. | General Electric Co., St. Louis, Mo. |
| RUSSELL, JOHN | Joy Mfg. Co., Franklin, Pa. |
| SCHONTHAL, B. E. | Chicago, Ill. |
| SOLIDAY, H. | Westinghouse Elect. & Mfg. Co., St. Louis, Mo. |
| STEELE, T. A. | Sahara Coal Co., Harrisburg, Ill. |
| STOTLAR, J. C. | Mechanization, Inc., Washington, D. C. |
| SUTHERLAND, HARRY T. | Standard Oil Co., Marion, Ill. |
| THOMAS, T. J. | Valier Coal Co., Chicago, Ill. |
| THOMPSON, R. A. | Hercules Powder Co., Collinsville, Ill. |
| VAN DOREN, HAROLD | Standard Oil Co., Evansville, Ind. |
| VLASAK, JOSEPH | St. Louis & O'Fallon Coal Co., E. St. Louis, Ill. |
| VON PERBANDT, L. | Allen & Garcia Co., Chicago, Ill. |
| WEART, EVERETT T. | John A. Roebling's Sons Co., Chicago, Ill. |
| WEIMER, W. H. | Crescent Mining Co., Peoria, Ill. |
| WEISSENBORN, FRED | Ill. Coal Operators Assn., St. Louis, Mo. |
| WENTE, IVAN H. | Mobile & Ohio Railroad, St. Louis, Mo. |
| WENTWORTH, B. K. | C. W. & F. Coal Co., W. Frankfort, Ill. |
| WILKEY, FRED S. | Ill. Coal Operators Ass'n., Chicago, Ill. |
| WILLS, GERALD | Peabody Coal Co., Springfield, Ill. |
| WILLS, S. J. | Peabody Coal Co., Springfield, Ill. |
| WOOSLEY, C. W. | Pyramid Coal Corp., Pinckneyville, Ill. |
| YOUNG, W. P. | Crescent Mining Co., Pekin, Ill. |

Secretary Schonthal: You might be interested in knowing we have one hundred and five on the boat, of whom forty-eight are suppliers. I thought you might be inerested in that figure.

President Adams: The Secretary has some communications to read.

Secretary Schonthal: I have three wires here. One is from Mr. Thomas Moses, who says:

"I have delayed until today to answer your letter of May 21 with the hope that I would be able to attend your Meeting, but find it impossible to attend. I hope you have a successful Meeting and a pleasant time. Convey my regards to all my friends."

I also have a wire from Paul Weir:

"Best wishes for a pleasant trip. Kind regards to the voyagers."

I had a wire that made me feel bad. Our old regular buddy, Jack Wilson, of Ohio Brass Company, isn't very well. He wires me:

"Account illness regret unable to join you on boat trip. Wish you all a grand time."

That is all, Mr. Chairman.

President Adams: At this time I am going to turn this Meeting over to Mr. Fred Pfahler, President of the Superior Coal Company. Mr. Pfahler.

Chairman Pfahler: Gentlemen, out of courtesy to the speakers who follow, I hope you will be as quiet as possible, and I think we can make speed by doing so.

Before proceeding with the program, I have a pleasant task to perform. But while we are waiting for Mr. Weissenborn, there is a report we desire to have made before we proceed with the program.

Sometime ago a committee was appoined to analyze and report on Mines, Roofs, Face and Rib Falls. John E. Jones was Chairman. That committee has made quite an extensive study and report. I have a copy of the report, and have had the pleasure of going through it, and would like to take a half hour to discuss it. I am not going to do so, so don't worry. It is a very interesting report, with a lot of things brought out clearly. If John E. Jones is present, I would like to have him make a brief report on the progress of the committee.

Chairman John E. Jones (Rock and Coal Falls Safety Committee): Before going on with the report, I had a very pleasant visit with two of our honorary members, and this is the message they sent to you. This was in Equality, Illinois, on June 6, 1940, and is signed by Hugh Murray and Thomas Moses. It says:

"We, two of the honorary members of our Institute, are together today talking of the old times, in Hughie's home in Equality. Among them is the origin of the Illinois Mining Institute in 1892, and the mining men who were our cronies many years ago.

"We both would like to be with you on this trip. This cannot be. However, we are with you in spirit and wish you bon voyage."

You will recall that at our last Meeting in Springfield a motion was tabled with respect to the establishment of a professorship or part-time professorship in the scientific study of measuring loose rock. At that time it was decided I should gō and see the Director of the United States Bureau of Mines, and see what the Bureau of Mines had done or intended to do with this problem. This is the report of the Chairman of the Rock and Coal Falls Safety Committee on the investigation, and recommendation for future work on this problem.

# INVESTIGATION TRIP TO BUREAU OF MINES AT PITTSBURGH AND WASHINGTON. RECOMMENDATION ON FURTHER WORK ON THE PROBLEM

By JOHN E. JONES

Chairman, Committee on Scientific Studies of Physical Conditions and Improved Practical Analysis of the Hazards of Coal Bed and Adjacent Strata which Affects Safety in the Coal Mines of Illinois

On May 28, 1940 I conferred with Mr. H. P. Greenwald, Supt. of the Pittsburgh Experiment Station at the Bureau of Mines Station in Pittsburgh. I was shown two unpublished reports. These are 1219-K:41 of September 8, 1932 and 1249-K:44 of December 15, 1932 on —Investigation of Roof Testing Devices by S. Avins.

Preface to the September, 1932 Progress report is as follows. This is by H. P. Greenwald:

In March, 1932, G. S. Rice, Chief Mining Engineer, called a conference at Pittsburgh, Pennsylvania, to consider the question of standardizing methods of testing mine roof for soundness. Others in attendance were Messrs. J. W. Paul, J. J. Forbes and H. P. Greenwald. It was agreed that a collection of typical roof testing rods should be made and certain others designed. Messrs. Paul, Forbes and Greenwald were constituted a committee to investigate the general subject of the best form of roof testing rod for underground officials.

A meeting of the committee was held in April at which Mr. Paul presented a schdeule for determining the relative efficiency of roof testing rods for use of underground officials. As amended and adopted by the committee at that meeting this schedule read as follows:

1. There must be a minimum and a maximum weight of the rod or tool.
2. The tool must be convenient to carry.
3. The tool must not have sharp points which are liable to do injury to the person who carries the tool.
4. The tool shall not be designed as a substitute for a bar used for prying down loose roof material.
5. The tool shall be of such length as is convenient for use in coal mines having a roof of varying heights, 3 to 8 feet.
6. The rod shall be a non-conductor of electric current.
7. The rod may be of metal if

properly insulated.

8. The efficiency of the rod shall be determined by its capacity to impart vibrations to the roof material as may be suitable for a record of vibrations.
9. Iron bars of different lengths and weights shall be used as standards for comparing rods of similar weight.
10. A record shall be made of the factors which will determine the energy imparted by the tool under test.
11. The amplitude and frequency of the vibrations set up in the material which is struck shall be determined, if possible.

NOTE: The Bureau of Mines has repeatedly advised against using a miner's pick for pulling down loose roof material; consequently, a pick on the head of a testing rod only invites injury. There are records of mine officials being injured when using a testing tool having a chisel point, when using for removing loose roof material. To encourage the use of a testing tool, it should be attractive in appearance and the company should sell the device to the underground officials.

It was agreed that the actual test work could be carried out best at the Experimental Mine. It was also agreed that some standard body was needed to represent a piece of loose roof; this body should not change its characteristics with time as an actual piece of loose roof would do. It was considered that a concrete slab properly supported with an overhanging end would fulfill the requirements and one was placed in May. Test work was then started by S. Avins, junior physicist, and was continued until the latter part of July. The following report was then prepared to give an account of the work done. The work may be classed as theoretical, primarily, as it deals with the characteristics of the slab and the effect of change in the material striking the blow, change of mass and of velocity with which the blow is struck.

Contents of the report are as follows:

- Introduction
- Apparatus
  - Concrete slab
  - Electromagnetic pickup
  - Optical vibration pickup
  - Vibration characteristics of slab
- Test Results
  - Factors involved in energy transfer on impact
  - Volume of sound at impact
  - Characteristics of the initial cycle
  - Determination of absolute amplitude of vibration
  - Energy of vibration of slab
  - Energy transfer
- Discussion
- Conclusions
  - Work with roof-testing rods
  - Tactual perception of vibration
  - Development of a vibration instrument for testing roof

Text of "Development of a vibration instrument for testing roof," the last paragraph under Discussion, follows:

In continuance of the work an investigation of the factors of frequency and amplitude and damping under different conditions of the roof would be desirable. The varying roof conditions are available in the Experimental Mine. The object would be to establish conclusively the basis of differentiation along the lines indicated in this discussion. When the knowledge of the vibrational characteristics differentiating roof structure has been obtained the possibility presents itself of devising a vibration instrument which will make the differentiation between good and bad roof structure more independent of the personal equation. Such an instrument would include a device for automatically applying a blow to the roof structure and a mechanical or electrical system for recording or indicating the desired vibrational characteristics. A detailed consideration, here, of the mechanical or electrical systems which might be employed in such an instrument is not warranted until a knowledge of quantities to be indicated is ascertained; however, a number of indicating systems which might be employed are being considered.

Signed: Samuel Avins

The Second Progress Report of Dec. 15, 1932 is a brief 10 page report of further work done to which is attached many interesting graphs of vibrations and photos of rods tested.

These two reports constitute the work done by the Bureau of Mines in the technique of sounding and towards development of a more certain means to ascertain the loose or solid condition of a rock. Unquestionably, it was a start in the right direction; but only a start, almost entirely involving sounding rods. This work was stopped because appropriations for Bureau of Mines were cut approximately 25% on July 1, 1933. Over the years they have come back to approximately the original annual appropriation of $656,000.00 for the safety work of the Bureau in all types of mining. Unless some other work were dropped this problem could not be resumed without additional appropriation. This $656,000.00 includes—

1. All health and safety work in and about mines, including approval of gas masks and respirators.

2. All testing of electrical equipment.

3. All testing of explosives.

4. The Experimental Coal Mine.

On May 29, 1940 I conferred with Dr. R. R. Sayers, Acting Director of the U. S. Bureau of Mines, at his office in Washington. The Doctor verbally reviewed the work done in the reports that I read yesterday in detail. He remembered all about this work for he was instrumental in having it started. He was very enthusiastic about the problem and regretted that it was stopped.

Our discussion revealed that there was no chance for increased appropriation this year, the first opportunity for increase being at the next Congress. The Director agreed there was omission of this important mining chapter in mine safety work and texts. He stated, "We will go into it now and see what can be done." His parting statement was, "We will do all we can."

Many coal mining men, both operators and labor officials, were in Washington on other mining problems. I spent a day with them and others interested in mine safety in discussion of our problem. Upon my return I have done likewise with my committee and with Institute officials and many members. The consensus of opinion is that National and International problems are of such great concern at this time the best that can be done is for your committee to continue with its work. There is probability that data and knowledge can be gathered to be of value when opportune time arrives to go ahead in the best method then at hand.

I have prepared a primer upon the subject for the workers and management of our companies, the Old Ben Coal Corporation and Raleigh-Wyoming Mining Company, this primer now in mimeograph. I have copies here. The primer is too lengthy to read. It is in five parts as follows:

PART I—The Problem Unsolved.

PART II—Technique of Sounding.

PART III—The Human Factor.

PART IV—Types of Falls Exposures and Hazards.

PART V—Formation of the Coal seam and the Overlying Strata.

The primer has been prepared in the hopes it will be a beginning in better technique of the means now at hand in solution of better sounding and that interest may be awakened among the workers and bosses towards development of improved means in the measurement of a loose rock.

In conclusion, Mr. Chairman, I feel that this committee should continue with its work and seek the cooperation of all who can help. The primer has been mailed to some one man or two of several coal companies and mining organizations. I'll appreciate brief discussion as to whether or not your committee is working in the right direction.

* * *

Chairman Pfahler: Does anyone have any comment to make in connection with Mr. Jones' report?

Mr. T. J. Thomas (Valier Coal Company, Chicago): I want to ask if you know anything about the work done at Columbia University in connection with the stratafication of roofs.

Chairman Jones: I have been in correspondence with the doctor there on that work. They report they are chiefly interested in relation to taking out all of the coal, and the action upon the roof because of the amount extracted.

Mr. E. H. Johnson (Jeffrey Mfg. Co., Columbus, Ohio): When this committee was first organized, it is my recollection we looked upon this as sort of a project to which the Illinois Mining Institute might well lend its support. Roof falls are recognized as causing fifty per cent or more of all fatal accidents in coal mining.

This primer that is built up approaches the problem from an angle somewhat different from that approached by the United States Bureau of Mines and Columbia University and other industries in that it is a practical approach, designed to help the mine face boss and the mine superintendent to improve the safety on roof and falls in the mine.

I would like to suggest some means to be devised or at least directed by the Institute here whereby that information can be disseminated generally throughout at least our own State of Illinois to most of the miners and bosses. I do not know how that can be done, but I think we ought to consider the continuance of this as a project, and that that ought to be a part of our goal.

Vice-President M. M. Leighton: I do not believe any of us here expect this committee to pull a rabbit out of the hat. I think we all feel the work of this committee should be continued.

I simply want to add this, that our organization will be very glad to cooperate in any way that it can in this work. There may be something in the way of instruments that the committee will need in their study. We will be very glad to cooperate in any way we can.

Chairman Pfahler: Thank you, Dr. Leighton. Any other comments?

Mr. Raymond Mancha (Jeffrey Mfg. Co., Columbus, Ohio): Mr. Chairman, it might be in order to mention I have read over this primer Mr. Jones referred to, and it might be of interest to some here to know that he differentiates between the perfection of more accurate equipment in the future in doing this work and the schooling or training of men in a more intelligent use of what we already have in the way of devices and knowledge along that line.

In other words, from what I was able to get from reading this primer of his, there is a lot that is already known that was certainly news to me, and I think it would be news and construtive news to many men intimately faced with the problem to a greater extent than I am. I for one think that this outfit would do well to give serious thought to what Mr. Jones is talking about.

Chairman Pfahler: Any other comments at this time?

Mr. Fred Weissenborn (Illinois Coal Operators Association, St. Louis, Mo.): Gentlemen, I, too, have read this primer. I am deeply interested, principally in the sounding of the roof.

When I first went to work in the mines, I learned to sound the roof with a pick, and the sides with a pick, and later on I learned if I held my hand on it and sounded it with my hand on the roof and got a vibration, that was all that was necessary. We still do it the same way. I do not know of anyone else doing it any other way, and I haven't advised anyone to sound the roof any different, listening to the sound and saying "Well, that is all right. Sounds a little loose, but it is safe," and pretty soon the thing will fall and kill our men.

Mr. Jones elaborates upon that sounding a great deal. He refers to a "thud," a difference in the sound of loose roof and a "thud." Really, I am kind of in the wind myself about that. I do not know exactly what a "thud" would really mean.

I talked to Mr. Jones about this matter, and he called my attention to something I never thought about. A rock can be right on the front or rear, and you sound that, and it sounds solid. Take a sledge and try to break a rock lying on the floor, and unless there is a hollow space there you cannot do it, you will will have a dickens of a time breaking the rock.

Mr. Jones refers to the sounding of the roof very much. I think if we went into that as part of our examination papers, we would have less fatalities or injuries from fall of roof or side or face.

I would suggest to this Institute that you take some action relative to having this primer distributed throughout the State. If we cannot do it here, let's see if we cannot have the State do it in the Mine Bureau, the Department of Mines and Minerals. I think it should be taken up, and I think this Institute could, Mr. Chairman, push that thing along in that it can be distributed and put in the hands of most of our miners, our workmen. I believe it would help. I think that should be done.

I have learned a lot from it. I have been sounding roofs a long time, boys, and I do it the same old way your grandfathers did, and my grandfather never sounded a roof for he wasn't a miner. But his grandfather and great-grandfather and great - great - grandfather sounded roofs just as we do. We haven't progressed a great deal. We still have about fifty-four per cent of all fatalities in mines from this, more than all the other work put together, including every other injury or fatality that comes in. We have fifty-four per cent, four per cent more than half, from falling roof, side and face.

Men are killed who believe them safe and solid. I heard of a man just a few months ago killed in the eastern part of the State. He had sounded the face, and it was all right, safe and sound, and would not fall, but it killed him just a short time later.

That is the thing. We sound the roof and think it is all right, and perhaps the boys think it is all right and take chances. We have gotten past taking chances. I did it many times, and we all do it. Every miner takes a chance every day. But I think something ought to be done in making improvement in the sounding of loose roof and loose face and loose side.

I thank you, gentlemen.

* * *

Mr. T. J. Thomas (Valier Coal Co., Chicago): Mr. Chairman, I haven't had an opportunity of reading Mr. Jones' report, or primer, to which you refer but I was interested in the statement Mr. Weissenborn made about the man that sounded the roof and it sounded all right, and the man being killed a short time afterwards. I remember a statement made to me by an old coal miner one time the sounding of roof that seemed all right, and he said "There is no substitute for a prop." I would like to ask Mr. Jones if in his report he has given consideration to and dealt with the matter of systematic timbering.

Chairman Jones: The report is written primarily with respect to the science of sounding. The report acknowledges that the correct thing to do is to timber properly. Preceding that timbering, there is need of proper sounding.

Practically all we have gone into throughout the years has been the difference between loose rock and solid rock, a loose sound and a solid sound. Very few are hurt because the rock is loose and they know it, except when they take the risk and know they are taking the risk. The majority of accidents in my opinion occur because of ignorance of that roof.

I have suggested another sound, and that is the "thud" sound Mr. Weissenborn spoke about, believing that if we could know more about the science our miners would be safer in the sounding of roofs.

Yes, Mr. Thomas, we have considered systematic timbering in the report, but the report is not on systematic timbering.

Chairman Pfahler: Gentlemen, I feel we will have to close this discussion. I realize it is one of the most important and interesting discussions, and we could take up considerable time, but I hope we may have some time this afternoon at the Meeting. I doubt if we will this morning. For the time being, we will close the discussion.

# PRESENTATION OF HONORARY LIFE MEMBERSHIP TO MR. FRED E. WEISSENBORN

I have one other matter to present before we go on with the regular program. We have in our midst today a man who is one of the older members of the Illinois Mining Institute. The Institute was formed on February 27, 1892, with twenty-seven charter members. This man I have in mind joined that year. Out of the one hundred and twenty-four, I think today he is the only active member attending the Illinois Mining Institutes.

He started in the mines when he was ten years old, in the Belleville district. He later went to Iowa — yes, it is you, Mr. Weissenborn. He came back to Illinois, working through different jobs until he became general superintendent of one of the large coal companies in the State, and later on, the Operators insisted he become a commissioner of the first, fifth and ninth, and later of the Illinois Coal Operators Association.

He has been a loyal friend, fair to both sides, and we all love him. I have known him perhaps as long as any man on this boat, and perhaps longer. Right here I might say I could tell a lot of interesting stories about this gentleman. Some might be personal, but due to the fact they might be slightly embarrassing I am not going to tell them.

To look at him you would think he was around forty years of age. I am not going to tell his age, by the way.

I think the Coal Industry is indebted to him. He has done a lot of wonderful work. I think I am safe when I say he has handled more labor disputes than any man in Illinois, and perhaps in the United States. He has handled them well. He is here present today. And to help pay off that debt, Mr. Weissenborn, the Institute, something which it rarely does, wishes to present to you with pleasure an honorary life membership.

Mr. Fred Weissenborn (Illinois Coal Operators Association, St. Louis, Mo.): Mr. Chairman, I really cannot find words to thank you for this. Thank you. . . .

Gentlemen, I was so surprised and pleased awhile ago that I just broke down. I want to thank you for this honor.

Your Chairman said that I started to work as a trapper in the mines when I was ten years old. I did. Before I was twelve I was told "Fritzie, you go home," because I told the owner and the boss of the mine to kiss something. Later on, when I was thirteen, I went to work at the face. I got fired there too. I was working with a fellow named Bill Jacques who had a friend who came from England and I got into a quarrel with him. Bill told me to go home, so I went home. I was working at the coal face with Bill at a quarter-turn for my share of our earnings. I, of course, had to stand one quarter of the expenses. The price of one keg of blasting powder (25 pounds) was $7.50; it was put up in wooden kegs; the inside of the keg was coated with pitch; the opening in the head of the keg for removing the powder was made with a thread in it, and the plug was screwed into this opening to secure the contents. At the price of $7.50 you may be sure we did not use the quantity of powder in one shot as is the practice now. Six inches of powder in a cartridge made on a one and one-quarter inch stick was considered a heavy charge.

In 1878 we had a little strike. I was kind of smart — Billy Roberts and I. When the strike was lost and we reported for work — at that time we usually lost the strike — Jim Wyle said "Fritzie, there is nothing for you, get your check."

Of course, I could not get a job anywhere as I was blacklisted as we called it at that time. Billy and I went out to Iowa, Lucas County, I believe, and got a job in a little mine about three miles out of Chariton. I believe there was fifteen inches of coal. Imagine me going out of six to nine feet of coal in Belleville into fifteen inches.

Later I came back to Belleville. The punching machine was installed in the Belleville District at that time. The Abbie Coal Company at Collinsville had one, and one was put in at Troy. Yock Brothers put them in. I learned to run the machine, and at that time we called it the iron man. We had an idea if that darned iron man kept going we would all lose our jobs. I concluded if I quit running that machine they would have to take it out. I quit, but some other fellow took it and it stayed there just the same.

In 1886 the Consolidated Coal Company was organized, and they sent me to Nashville to take charge of that mine. That was my first experience as pit boss as they called it at that time. Now it is mine manager.

In 1889, my good friend John Rolla — and by the way a charter member of this Institute — was at old No. 8 mine at Mount Olive and was transferred to Gillespie as Division Superintendent of the mines on the Big Four. I went to No. 8 as Mine Manager, one of the biggest mines in the State at that time. No. 6 at Staunton was the banner mine, however, producing one thousand tons of screened coal in ten hours.

The Big Muddy Coal & Iron Company's mine No. 5 at Murphysboro kept close up to No. 6, but No. 6 beat them every year in the average tonnage. No. 6's record output was twelve hundred tons in ten hours. That was a record run at that time.

I tried to break that record at No. 8 and got eleven hundred, ninety-nine and one-half tons. We had thirteen hundred dumps and I thought that would be equal to more than twelve hundred tons. If I only had known I needed another ton I would have held the whistle and run a little bit longer.

John Rolla was transferred over to the B & O, and I went to Gillespie in charge of the mines as Division Superintendent.

In regard to washers, the Consolidated Coal Company built a washer at No. 14 mine, Staunton, in 1903. It had the Stewart jiggs, as Mr. Lyons described. They went up and down and the coal went out with the water, and the heavier gravity stuff went down and out with the sludge. In 1905 they built another washer at No. 15. In 1906 they built a washer at No. 17 at Collinsville. Perhaps at that time there was also a washer down at Murphysboro.

We also had at Gillespie the first shaker screens and picking tables in Illinois. A replica of that plant was in the World's Fair at Chicago in 1893. We also had the first dump cage at No. 10 at Mount Olive,—the Cherry cage. It was some mechanism. A replica of this cage was on exhibition at Chicago along with the shaker screens. There were four forty pound rails spiked on the timbers, one near each corner in the shaft, and there were four flanged wheels on the cage. The wheels ran on the rails, and as the cage was hoisted or lowered the pressure against the rails kept the dump part of the cage from dumping. About every two or three weeks we had to change the wheels on the cages, and sometimes oftener, as they would wear out. That is about the history of the introduction of the automatic dump cage.

When the Consolidated Coal Company was organized back in 1886 they operated the first coal shipping strip pit in Illinois. This pit was known as Mission Field in Vermilion County near Danville.

In 1909 when I was Division Superintendent of the Company's mines on the Wabash R R, Mr. Raymond Mancha, Sr. came to Staunton to see me about trying the electric storage battery locomotive for gathering coal in our mines. After he explained the mechanism and construction of the machine I told him I was satisfied it would be a success. I said to Mr. Mancha "That locomotive can go into any working place that a mule can go." Mr. Mancha's face brightened and he said "That is a good suggestion, it is an electric mine mule." A short time later storage battery locomotives were installed in the No. 14 mine at Staunton.

In 1919, through the good efforts of our Chairman, Mr. Pfahler, and others, I was appointed commissioner for the Fifth & Ninth Coal Operators Association of Illinois. Then in 1928, when the Fifth & Ninth merged with the Illinois Coal Operators Association, I went with that organization. I am still going good and I feel like I will be with you for a long time to come.

These, gentlemen, are some of the highlights on the changes that have taken place in the coal industry since I started with it as a boy.

* * *

Chairman Pfahler: Thank you, Mr. Weissenborn. If time would only permit, I could tell a lot of stories about your activities other than coal mining. I think I could get a laugh out of every man in this crowd.

Chairman Pfahler: Now, gentlemen, we will proceed with the program. The first paper is "Relations of the Development in Illinois Oil Fields to the Hazards of Coal Mine Operations," by Mr. William J. Johnson, State Mine Inspector, Tenth Inspection District, Christopher, Illinois.

Mr. William J. Johnson (State

Mine Inspector of Christopher, Illinois) : Mr. Chairman and members of the Illinois Mining Institute, you have me now where you had Mr. Weissenborn. I do not know whether I can read or not.

# RELATION OF THE DEVELOPMENT IN ILLINOIS OIL FIELDS TO THE HAZARDS OF COAL MINE OPERATIONS

By WILLIAM J. JOHNSON
State Mine Inspector, Christopher, Illinois

This subject has recently become of great importance in southern Illinois because of the sudden and rapid development of the oil fields in that section of the State. It is the same section in which valuable coal seams exist, and which unquestionably will be worked in the future.

The potential hazards from uncharted oil wells and improperly plugged wells to present and future coal mining is in probable unknown lateral tapping of such wells as passages are driven in the coal seam. Such tapping may permit sudden explosive mixtures of gas in large quantities to enter the mine, endangering the lives of all who are in them.

Hazards also exist in the sudden liberation of water. This hazard usually is limited to the loss of property rather than life. A recent example of this was at the Clarkson Mine at Nashville, Illinois, during 1937 where an uncharted oil well, abandoned some forty years ago, was accidentally tapped and salt water flowed into the mine at 160 gallons per minute with an estimated pressure of 220 pounds per square inch. This experience was a deciding factor in the abandonment of this mine.

Another instance is that of the Marion County Coal Company's mine near Centralia, Illinois, where headings were driven into two drill holes which had been drilled many years ago, unknown to the coal company. The first of these flowed a lot of water but was easily controlled. The second drill hole was cut into by a cutting machine and flowed much more water than the first. Efforts to stop this flow of water failed until the cut of coal was shot down and loaded out. A wooden plug the size of the hole with a two-inch pipe through the center was then driven into the drill hole. This two-inch pipe was connected to a pump and the water pumped down below the wooden plug. A cement slurry was then poured on top of the plug and around the pipe. The pump kept the water level down below the wooden plug until the cement set. The pipe was disconnected and plugged. This last effort proved successful for the time being. At best it is only temporary.

A fire is sealed off in this same mine, due either to the coal seam being near shallow oil formations or from an unknown oil well. There is a lot of seepage of crude oil into the mine, this oil having caught fire and requiring a section of the mine to be sealed off.

From the United States Bureau of Mines Bulletin No. 65 the following fire and explosion accidents are copied:

A machine runner and a helper were under-cutting the coal with chain mining machine in a room. The machine cut into an uncased well and a large volume of gas immediately entered the mine. The gas was lighted by the open lights of the miners and they were forced to run from the working place. As they ran out of the room a flaming gas followed just beneath the roof. Several unsuccessful attempts were made by the foremen and others to reach the face. Seals built of brick were quickly installed and later by digging on the surface the top of the well was found. It was cleaned out to a depth of 715 feet which was 500 feet below the coal seam and where there seemed to be no obstruction. The hole was then cased with an eight-inch pipe and proper methods of packing were used. This arrangement allowed a free vent from below the coal to the surface. After an investigation with helmets inside the sealed area had indicated that the fire was extinguished the territory was reopened and ventilated.

Probably the most serious accident that has yet occurred from natural gas entering a mine resulted from an improperly capped well that had been drilled through a coal seam in West Virginia. The well in question was so small a producer that it had been closed since its commercial value was questionable. The well passed through the mine at one end of a coal pillar 125 feet wide and 380 feet long. In some manner not definitely known the gas from the tubing leaked into the casing which was closed at the surface. The high pressure, said to be possibly 1,000 pounds to the square inch, forced the gas through the rock strata underlying the coal and the gas entered two mines at a number of places. These two mines were nongaseous and open lights were used. Fortunately, the coal dust in both mines was damp so that the explosions were not so widespread or violent as they might otherwise have been. An explosion occurred at 6:50 in the morning while the men were going to work. Three men lost their lives owing to inhalation of flames. The others succeeded in getting out without being burned or caught in the afterdamp.

In the other mine gas blowers were lit by a pumpman who was the only person in the mine. He succeeded in putting the fire out with his coat. The next morning he lit the gas again and an explosion occurred. Fortuntaely, the explosion ruptured an overcast near where the pumper was thrown and the short-circuiting of the air prevented his suffocation by afterdamp.

The explosion caused considerable damage in the mine. Samples of gas were taken in both mines. Analysis indicated that natural gas was present. Considerable percentage of ethane was found. When the well was opened at the surface the gas blowers in the mine began to diminish and eventually disappeared.

In another mine in southwestern Pennsylvania there was an abandoned well located in a pillar near the fork of two entries. Air samples taken two years prior in an air current from this section showed 0.87 percent of natural gas a minute.

The instances cited show that greater precautions should be taken to properly seal all wells through the coal seams.

There is always a possibility of danger from wells that pass through the workings of an operating mine if not properly safeguarded. I have heard of no case where serious accidents have resulted in the mines in Illinois from such a condition; however, many such wells are a constant menace to the safety of a mine on account of the fact that the exposed condition of the casings renders them more likely to be injured than if they were inclosed by a protecting concrete wall or coal pillar.

Many coal measures have, as shown by the records, been drilled in southern Illinois since and including 1936. I wish to emphasize that I think proper precautions have been neglected with respect to future coal mine safe operation. The first of these is the lack of systematic allocation of the drill holes in production areas. The efficient production of the oil or gas product seems to be of little if any consideration. Far more wells are drilled than is necessary. The multitude of holes through the coal seam presents a picture the layman can well understand with respect to future hazards of coal being mined.

The second is the high percentage of non-plugged holes. Only one such well in a mine property can be of inestimable hazard. To consider many such wells is a deplorable picture in the mining of coal safely.

The third is the probable non-efficient plugging of all the holes. Too many are presumably well plugged. There is too much guesswork with respect to the plugging to permit the future miner in that vicinity to drive his mine passages with certainty that the charted wells shown as plugged are certainly well plugged.

The fourth is the lack of teeth in our well plugging law demanding log recording accuracy. In my experience at wells I find drilling by the most improved methods is of such a character and speed that it is difficult for the driller to accurately determine and locate coal seams. Many of the logs of oil wells drilled in Illinois through known coal seam localities do now show any coal. One is sometimes inclined to believe that many of the logs are made up from memory in so far as coal is concerned and show only a true picture of the gas and oil situation. It is certain that a driller cannot properly protect a coal seam that he does not know exists. It is of temporary advantage to the driller not to know of the existence of coal seams since, if it isn't there, then according to our records he has no need to protect it. Any regulation that provides that the hole shall be plugged a certain number of feet below a coal seam and for a certain distance above a coal seam is not of much value if the seam is not accurately located. Drillers for oil or gas are only as interested in locating coal measures as they are required to be. It entails more effort to drillers to keep an accurate log of each hole to establish the location of the coal seams. This is possible and essential and it should be made compulsory.

A peculiar circumstance is the frequent arrival of the oil company's geologist after the well has been drilled below the coal meassures. The law does not compel interest in the first few hundred feet, that depth involving the coal measures.

It must be conceded by coal men that the owner of the gas or oil has a right to its production. This, however, should not be at the expense of the coal industry. Any inconvenience ought to be paid for, let alone permitting them to create hazards. The reason all the precautions that should be used in drilling through coal measures is to protect the lives of the miners and the mining properties as well as the coal itself.

The laws should be flexible enough so that unnecessary hardships will not be imposed on reputable drillers. But they should also permit the Director of the Department of Mines and Minerals to keep his regulations as modern as those of the drillers. The Department should be empowered to require a bond from drillers for the faithful performance of their legal duties, the bond is to be returned when the well is abandoned and properly plugged. If a driller cannot produce a correct log of the hole, either because of secrecy or some other reason, then the Department of Mines and Minerals should have the power to require that the hole be filled from bottom to the surface with a concrete mixture of a cement slurry.

It has only been recently that Illinois has had legislation requiring the filing of a statement giving the exact location of a drill hole and on plugging. There is an absence of law with respect to ascertaining and recording of logs, the oil company being absolved of responsibility if no coal seams are found. To authorize those drilling on what the coal seams are as to existence or thickness is too haphazard when considering that a major industry's safety and even its existence in certain localities is at stake. The opinion of State coal geologists is needed.

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Chairman Pfahler: The paper is now open for discussion. I think at this time, with all the oil flowing, it should be a very interesting discussion. Who is going to lead it?

Vice-President M. M. Leighton: I want to apologize for rising to my feet so soon.

Chairman Pfahler: We do not accept it.

Vice-President M. M. Leighton: This is, as has been pointed out by Mr. Johnson, a very important matter that we all appreciate. There are some very practical questions involved which he has also mentioned.

In the course of the new oil and gas development, over six thousand, three hundred wells have been drilled. Most of you have been in the Illinois coal basin. In the course of the drilling of these wells, the driller presumably keeps a log. We are finding that in the case of many of these wells there is no record of the hole. We have called the attention of the oil operators to this fact and requested they give us their cooperation by obtaining better drillers' logs.

Those companies also desire better drillers' logs. In the initial drilling of a field, it is impossible under various conditions of construction for them to obtain even the number of logs that day. But we have singled out a class of wells to which they should pay special attention. They are as follows: First, all of these wildcat wells that are drilled in new territory. A careful drillers' log should be kept in such a well. The larger companies do a better job on that than some of the fly-by-nights that come in and do some of this wildcat drilling, and those are the persons who need attention.

The other group of wells is those wells drilled in the development of a pool. We have requested one log and a series of sample cuttings for each well in a section of land. If a good log were kept of one well in a section of land in a pool that is being developed, it would give adequate information as to the depth at which the important coal beds lay, and other valuable information with regard to the thickness of those coal beds that would have a bearing on the question of whether or not those coal beds would be worthy of future development and under what conditions. So that those wildcat wells and those wells within a pool, one to a section, should have carefully kept logs.

Now, it is impossible for a driller to keep an accurate log. We must recognize that he is not a geologist and cannot keep an accurate log. The major coal companies realize that. On these wells I have spoken of where careful records should be kept, it would be possible for them to have enough trained young geologists under supervision placed upon those wells or placed over groups of wells to make possible the securing of an accurate drilling log. That can be done in one or two ways. One would be that the State require that it be financed by the owner of the well, or that the State finance it on behalf of the future welfare of coal mining in the State, and also for the other valuable information that these well logs would give.

And so, in facing this problem, it seems to me we should recognize the conditions under which those logs now are made, and make provision for the improvement of conditions under which the logs are prepared. The only way I can see that it can be done is to have a man in charge of a number of such wells for that part of the section where they pass through the coal vein, and see that the important items of that log are kept and submitted for filing.

There is one other aspect. When it comes to the plugging of an abandoned well, that is a very important matter. It seems to me it would be a good idea if those in charge of the plugging of abandoned wells would secure any information there may be from the study of the cuttings that we have received from many of these wells, to find out the depth at which the important coal occurs, in order that the provision of law with regard to the extent of the cemented portions so-many feet below the coal bed and so-many feet above the coal bed can be intelligently adhered to. We will be very glad to cooperate in giving that information, to the best of our ability.

Chairman Pfahler: Thank you, Dr. Leighton. You feel free to rise to your feet at any time. We value your opinions and suggestions.

Anyone else?

Mr. John E. Jones (Old Ben Coal Corporation, West Frankfort): Mr. Johnson has very ably told us of the hazards of future coal mining and the necessity for the removal of those hazards. Dr. Leighton has very well told us of the possibility of their correction.

I am a member of the Illinois Mining Investigation Commission. Very early in the history of these sixty-three hundred wells we endeavored to rewrite the Oil Law of the State of Illinois. After we had rewritten that, for a beginning we called in the president of the Illinois-Indiana Petroleum Corporation, and Dr. Bell and Dr. Cady of Dr. Leighton's State Geological Department. We wrote the proposed bill. That bill went before the Legislature, and it was later changed.

The chief change in that bill that concerned us as coal men was that they removed the responsibility of the oil men to record the coal measurements. In that bill we had the responsibility in the hands of the Geologic Survey to a considerable extent, as it has been proposed by Dr. Leighton. That is the chief thing in my opinion that has resulted in the weakness in that bill to serve us in future coal mining.

Chairman Pfahler: Anyone else?

Mr. W. P. Young (Crescent Mining Company, Pekin): Mr. Chairman, I feel this is a question we are all more or less concerned with, because the development in this State, as we all know, has covered a great deal of the coal-producing area of the State already, and doubtless further developments will cover more of the State.

We have had an experience with one of our properties where unfortunately we had to mine coal under part of the pool. Some of the workings were forty or fifty years old, and no longer accessible, and a great many holes were put down.

The original development, which took place there twelve years ago, caused us a great deal of concern. We at that time had absolutely no law in the State. We had a few words in the State Mining Law regarding the plugging of holes, which might just as well not have been there, for there was no provision for enforcing them. The provision for the plugging in the laws was not worth much, if anything, to us. We were able to secure some relief by having some additional legislation which would help, but still I think we are a long way from having adequate laws.

The chief trouble today from a practical standpoint is to get the right kind of foremen. You have two types of oil operators. You have the responsible operator and the fly-by-night type, who are worse than fly-by-night coal operators. They have neither moral responsibility nor financial responsibility nor any other responsibility. They promise us something and do nothing. They work the mine when you are not there. You have to be there twenty-four hours a day to keep track of them.

I do not know how you will handle that proposition. We have worried with it, staying up at nights with it, and have watched them twenty-four hours a day, and still are not able to keep up with them.

It is a thing we may not all be in a position to take part in, for it depends on the future development of the State. It may be many years before we get into the development of coal where there has been this drilling. But when we do, these wells will be as big a hazard to that future development if not properly plugged as they are to our property today.

I think from a practical standpoint the thing we are primarily interested in is a good plugging law. That is the thing we really need. We should have a record of the coal fields and all that, but we will get that ourselves if the coal industry gets good enough to want to sink more mines. We know how to find out whether it is there or not, but there isn't a thing we can do about these improperly plugged wells. These wells were drilled years ago, and we do not know they are there, and run into them with oil and gas unexpectedly. They are really a hazard we are concerned with.

I think at the present time if we could get a plugging law with more teeth and a better law, we would be getting somewhere with something that would really be helpful to us.

Vice-President Leighton: Just one additional point of information I think the group here will be interested in, and that is with regard to the location of these oil wells.

Ever since the new oil development started we have maintained a monthly drill report on all oil wells drilled in the State, giving their location and other information. We follow that up by also preparing maps that show the location of these wells, location within the pool, and the location of the wildcat wells in the territory, and the result of that, I think, will be that there will be few if any unknown oil wells drilled in this campaign that will be encountered in the course of future mining. That we feel will be an important thing in future extension of mining, that we have this permanent record shown with regard to the listing and with regard to the capping of these wells that are being drilled.

Chairman Pfahler: I would like to make a short statement in connection with this.

The Superior Coal Company spent several thousand dollars fighting this. At that time there was what we call fly-by-night concerns drilling through our working face. We had a trial in the Federal Court before Judge Fitzhenry in 1917. I mention that, because in the Court's decision, while we thought we took a licking, we did make two points. This probably would not apply to any other coal company, I assume, although I am not a lawyer. But anyone who wants to drill a gas or oil well must first serve written notice on the Superior Coal Company as to the approximate location. We have five days to locate that. The second is, and this has prohibited or barred the fly-by-night drillers, the Judge ruled we were entitled to the market value of the coal it was necessary to leave surrounding the wells to properly protect the mine. That usually ran into several thousand dollars. When the fly-by-night outfits discovered that, they dropped it. That I think has driven those fly-by-night operators out of existence.

Mr. George Meagher (C. W. & F. Coal Company, West Frankfort): As a matter of fact, under the laws on the books today, a map showing the location must be filed with the State Mining Inspector, the County authorities and the Department of Mines and Minerals. I think we are being a little unkind as to new legislation. That is on the books if I am not mistaken. That must be filed within a certain time after the well is proposed, showing an accurate location for each well, each and every well.

Mr. R. R. Clayton (Hercules Powder Company, Benton): Has any method been laid down for determining the exact area surrounding these oil and gas wells? You mentioned that subject.

Chairman Pfahler: Not in our case, except this: when we are unable to agree, the Court went on also to say if we submit the facts to the Court he would determine both the amount of bond and the coal and the price. In several instances there have been disputes as to the price of coal, of course.

Mr. W. P. Young (Crescent Mining Company, Pekin): May I say a word on the question of location of wells? We have the report on well drilling. There must be a survey of location and a permit obtained to drill through the department. I think the State of West Virginia has a very good law which would do well for the coal companies to get. That is, when a well is located in an area where a coal company is interested, they file their permit or request for permit with the department, and the department notifies any mining company in that area which might be interested, and they have so many days, ten or something like that, to file objections to this location. If there is objection filed there is a hearing held, and if the objection is sustained the oil company must relocate their well.

I think that would be a very fine help. There are possibly locations which should not be made for one reason or another, on account of mine work. At the present time all you have as a prohibition against that is if it happens to be a responsible company they will drill the well and you will have no trouble, for they are liable, and they are very cautious about it. But the irresponsible fellow has no liability. He is drilling on somebody else's money. He does not have a dime invested himself and will leave you holding the sack. Those fellows will move in and drill, and the only way you can stop it is by getting an injunction. They will probably be down through your mine at the rate they drill today before you get that. They drill eighteen hundred-odd feet in less than a week. I think we would do very well in this State to have a law similar to that law on location.

Chairman Pfahler: The time is passing very rapidly, and I am afraid we will not be able to do justice to this paper any more than we could to the Jones report and Mr. Weissenborn. I think we had better proceed with the next paper, and if there is time left we can go back to the discussion of either of them.

The next paper is "Coal Cleaning and Preparation" by F. A. Lyons, of the Pyramid Coal Corporation, Pinckneyville.

# COAL CLEANING AND PREPARATION

By F. A. LYONS
Pyramid Coal Corporation, Pinckneyville, Ill.

The subject of Coal Cleaning and Preparation is almost as old as the Coal Industry itself. I believe that a brief review of some of the earlier methods and experience with Coal Cleaning would be of interest at this time, as well as some of the circumstances and conditions that have brought us to present-day methods.

About 25 years ago the coal industry in Illinois enjoyed a good business and was in a fairly satisfactory condition financially. Practically all coal was loaded by hand and on the solid; was cleaned as much as possible by the loaders below, picked as it passed through the preparation plant, and loaded as Mine Run, or sized coal. Screenings were loaded in cars without impurities being removed, or in the same manner as a part of the Mine Run, if Mine Run were being loaded. It was seldom that serious complaints were received; and when they were, they were more of a general nature than specific. There would be a report of boiler or plant failure, or of the coal clinkering. In considering fuel values, the B.T.U. was given the greatest consideration; and in many cases, grates and drafts of consumers were corrected to accommodate a fuel of good B.T.U. content at comparable prices with coals of a lower B.T.U. content.

It was about this time that the first coal washing plants were put in operation. They were very crude in comparison with preparation plants of today, being built to wash coal minus 3″. At that time the wash boxes consisted of open top boxes, with perforated plates in the bottom; straps or bars ran upward from about the corner positions to eccentries on a shaft immediately over the center of the boxes. These boxes operated in guides, similar to a cage, with the up-and-down motion of the eccentrics causing a pulsation in the bottom of the box and a separation of coal and foreign matters of heavier specific gravity. The refuse was discharged through a door at one end of the bottom of the box into a bin or hopper, which was an integral part of the hopper designed for receiving the washed coal, whence it was conveyed by bucket to a refuse bin, dumped into specially designed cars for handling refuse and hauled by mule or some other method adopted to a refuse dump. The coal would be discharged over the top edge of the other end of the wash box into the main tank or hopper, thence by conveyor to shaker screens working in conjunction in some instances with revolving screens. Bins were located under the screens and the coal would drop directly into the bins, for loading into cars. The only dewatering process was the drainage of the coal by perforated buckets while being elevated from main washing tank or hopper to the screens. An overflow was provided in the main washing tank to carry off the excess water, and it was either wasted, or dammed up for settling purposes if water was short, to be pumped back to the main water supply point after settling. Sludge was not removed from the coal, and dirty water was in continuous use, except as replenished by a small constant flow of fresh water added to that being used.

Shortly after this period there was a slump in the coal business, and the coal industry suffered. More washers were built to provide a market for their screenings; and by the time the war broke out in 1914, the industry in Illinois was very hard pressed financially and it was during this period that they were able to recoup their losses. Coal demand continued to be good, and millions of dollars went into new development and equipment, not only in Illinois, but in other fields. Modern at that time. Result was that when the war was over, the industry was over-developed, and the law of the "survival of the fittest" prevailed. Those who had not mechanized their mines were compelled to do so in order to stay in business and compete. By this time, some other fields were operating non-union, and having established their fuels in markets previously held by Illinois, were able to maintain their gains on account of having a very high grade coal, and being able to undersell Illinois. This threw the industry in Illinois in chaos for some years. And to overcome these obstacles, and continued reduction in demand for coal, further mechanization of mining was developed. The modern preparation plants of today resulted.

We find the public of today more exacting in their requirements than ever before. There must be

*Flexibility in sizing*
*Ash control*
*Better cleaning of large as well as small sizes*
*Provision for Oil or Dust Treatment*

and

*Treatment to prevent freezing*

During the summer and fall of 1939, we installed at Pinckneyville, Illinois, a McNally-Pittsburg Manufacturing Company Preparation Plant, with a rated capacity of 750 T. P. H. of washed coal. This plant was to prepare coal produced by two of our mines, as well as coal that might be purchased from other mines. Installation was made also with the thought of servicing coal for others, as occasion required. To this end, a 500 ton steel lined concrete hopper was built adjacent to the tipple. A Link-Belt Rotary Dump installed over one side of the hopper, and track laid for direct dumping of mine cars on other side. This was to insure a steady flow of coal through the plant at all times. In case of disability or slow haulage from the pit, the flow of coal to the preparation plant would continue uninterrupted by dumping Railroad cars. At the bottom of the hopper, a large adjustible double-roll breaker was installed, the adjustment ranging from 7″ to 18″. This permits breaking to a predetermined lump size, or to a 7″ egg and minus. Under this crusher there is a variable speed feeder delivering the coal onto a conveyor belt for travel to the preparation plant. This variable speed feeder has remote control, and remote indication, which affords the operator a positive control of the input rate to the preparation plant, instantly variable over a wide range of tonnages, enabling us to adjust our feed rate to meet situations that might be brought about by varying conditions of the raw product, or particularly exacting demands of the finished product. All units of the plant appear to be able to receive the sudden and wide variations in the feed rate, including considerable overload, without noticeable changes in preparation efficiency.

The conveyor belt delivers the coal onto a dry-coal double-deck shaker screen, which serves three purposes:

*First*: To divert all or any portion of the raw screenings directly to cars, to wash box, or to a conveyor where it may be delivered raw to the mixing conveyor for re-assembling with the larger grades which have been washed. This latter process would simulate Mine Run, except for the washing instead of hand picking of the larger component parts.

*Second*: To carry lump over the top deck for loading as lump when desired. It is discharged to shaking picking tables where it is hand picked, foreign matter being thrown into hoppers which discharge to chutes and make delivery to refuse belt traveling to a refuse bin. Laminated coal picked from this table is thrown into other hoppers with chutes leading to a Lump Middlings Crusher located immediately under the table, where these middlings are broken down in size and then returned to main belt conveyor from hopper to plant, and re-circulated. The cleaned lump is delivered from end of picking table, by a lowering conveyor onto boom, and into cars. When Lump is not desired, and with the hopper breaker set at 7″, any coal not going to the egg and passing over this table is diverted to the lump middlings crusher and broken down for re-circulation.

*Third*: The third purpose of this dry coal shaker is to divide or separate the coal for delivery into three wash boxes. These are Norton wash boxes, or washers, and are fully automatic. The first is for washing 1¼″ minus; the second for 4″ x 1¼″, and the third for 4″ x 7″ coal. Each washer may be set for washing to any ash content desired, and have reject and refuse elevators on both the primary and secondary ends. The primary end is to remove strictly foreign substances of heavier specific gravity than coal, and the secondary end takes out sufficient laminated pieces to give the desired ash content. Both primary and secondary ends of the 1¼″ washer deliver the rejects to a belt conveyor for delivery to the refuse bin. The coal passes out of the box into a laundry, where it is delivered with the overflow water to a fine coal classifier and screened to 1¼″ x ¾″, ¾″ x ⅜″, and ⅜″ x 0″ coal. The first two sizes mentioned may be delivered to mixing conveyor, or loaded on boom for direct loading into cars. The ⅜″ x 0″ coal passes completely through this fine coal classifier into another laundry which delivers it to de-watering screens where the water and ½ mm. minus is removed, and the coal passing over the screens feeds into a drag conveyor, which will either deliver all or any percentage of this coal to the mixing conveyor, and the balance to cars. The water and minus ½ mm. after passing through the de-watering screens passes by gravity to a steel sump located on the ground floor. This water is elevated by pump to a settling cone, slightly higher than the preparation plant. This cone is provided with a flume around the top edge. Sludge settles to the bottom of the cone, which is sufficiently high for gravity disposal by trough, without pumping. The partially clarified water passing over the flume is re-used, and returns by gravity to the fine coal washer, completing this water circuit. This settling provides the higher degree of clarification, which is necessary for the fine coal washing, than would be the case in straight re-circulation without allowing time for settling.

On the coal going to the nut and egg washers, the rejects are removed in the primary end and delivered to refuse belt, intersecting with refuse belt from the fine coal box, but the rejects from the secondary end of these two boxes are discharged onto a belt that conveys it to a middlings crusher, breaking this down to 1¼″ in size, from which point these middlings are conveyed to the main conveyor belt from hopper to preparation plant, and again re-circulated, as in the case with the pickings from the lump table. The coal after passing through these two wash boxes is delivered onto a coarse coal classifier for sizing, and may be discharged either to mixing conveyor or boom, as desired. There is a laundry under the coarse coal classifier and 1¼″ screen plates on the bottom deck of the shaker where any degradation minus 1¼″, or any improper screening from the dry coal screen, is carried to a drag type settling tank, through which travels a very slowly moving drag conveyor, and returns this product to the head of the fine coal classifier for final sizing and de-watering. The water from the coarse coal boxes and screen is returned directly from the drag type settling tank to the washers with hydraulic relief valves for regulation of operating pressure. In this manner, we have a split water circulating system. This arrangement greatly reduces the total volume of water passing over the de-watering screens and provides a much more favorable coal and water ratio than would exist if the wash water of the entire plant had to pass over the screens. If the entire volume of water were passing over the de-watering screens, it would require double the screens now in use. Further, the splitting of this water system makes it possible to locate the pump sump for the coarse coal washers above the track clearance, greatly reducing the head, and resulting in a saving in power consumption.

The top run of the mixing conveyor is used in the mixing and blending of the sizes as may be required. The bottom run is arranged so that any of the sizes over ¾″ may be turned into it, and delivered to a primary stoker coal crusher. This stoker coal crusher makes delivery onto a vibrating screen, and the coal passing over this vibrating screen goes through a secondary stoker crusher, after which it intersects with the coal having passed through the vibrator, and is conveyed by bucket elevator to another and larger vibrating screen at the top of the washer, and at the head of the fine coal classifier. This vibrator is a three-deck screen, and the grades from here may be turned directly to the respective loading booms, to the mixing conveyor, or to the fine coal classifier as desired.

At the discharge of each classifying chute, there are degradation screens, all discharging into a degradation conveyor delivering degradation to the secondary stoker crusher for re-sizing. There is also installed at the discharge chutes of classified coal, automatic coal spraying equipment for oil treating the coal. Over the mixing conveyor, vibrating calcium chloride feeder is used, which may be set to automatically feed any number of pounds per ton of coal that may be desired.

We have chemists constantly checking the ash content of the loading to detect and correct irregularities if and when they develope. Ash is one of the paramount considerations at this time, but it is developing that consist of individual sizes must also be given careful consideration, and that both of these items must be watched very closely. This also is handled by our Chemists.

We are now confronted with the proposition of a smokeless coal and extensive experimenting is in process. Something will be developed to meet this condition, but only experimental work and time can give us the best solution.

Will be glad to answer any question that I can, with reference to this reading. Any communications addressed to Pyramid Coal Corpn. at Pinckneyville, Illinois will receive prompt attention.

* * *

Chairman Pfahler: Who is going to start the discussion? Does anyone wish to ask some questions? Aren't there some washer people here? Is the paper so complete nobody has any question to ask?

Mr. V. D. Hanson (Pittsburgh Coal Company, Pittsburgh, Pa.): If you had the thing you speak of to make over again, would you make it the same size or larger?

Mr. Lyons: I think the present size would be sufficient to handle any conditions such as exist now.

Mr. Hanson: Do you find degradation in this bin that might be corrected if you had a larger bin to get away from it?

Mr. Lyons: We do not, for the reason that any time there is failure of the mine to dump, then you always have the alternative of dumping railroad cars and they are sufficient to insure a steady operation.

Mr. Hanson: In other words, the bin is never closed down, then?

Mr. Lyons: The bin is sufficiently large to take care of it, with the two options you have of dumping.

Mr. Hanson: You mentioned you would be watering the 3/8 x 0. Do you have to use any water to keep those screens open?

Mr. Lyons: Sprays are used on that. Otherwise you would have the appearance of fine clay and a rusty appearance of the coal after it dries.

Mr. Hanson: Between the feed and discharge vent of that screen, I do not understand at any time you did any heat drying.

Mr. Lyons: No heat drying.

Mr. Hanson: Are you able to get the moisture down in order to have no trouble with freezing, or does calcium chloride help that?

Mr. Lyons: You cannot remove water by any artificial means to prevent freezing. Calcium chloride is a good help, however.

Mr. Hanson: The refuse from your ½ mm. goes into your primary settling cone?

Mr. Lyons: Yes.

Mr. Hanson: The overflow goes back into — the minus 48 is in the overflow from the cone?

Mr. Lyons: Minus 48 settles in the cone and it is discharged as sludge.

Mr. Hanson: What would be the minimum size carried over into the cone?

Mr. Lyons: Nothing over ½ mm. The only possible chance would be by leakage in the stream.

Mr. Hanson: So you have no carriage into the sludge around the top of the cone?

Mr. Lyons: That is so.

Mr. Hanson: At the beginning of your paper you mentioned the exactness of the public demands in regard to this coal. In our company we have not very many kicks. We get one a car, or something like that, for every car loaded. The thing I was bringing out is when a customer complains on these products, have you found that — in any number of cases they will make claim that they get a certain ash not possible to get, not in your seam. Do you in that case try to argue with the customer about a thing like that, or make the reduction and say you will do better next time?

Mr. Lyons: In a case of that kind, where possible we send an engineer out to see that samples are properly taken. We have found in many instances high as his claimed where samples were improperly collected, and that can be corrected in a very nice manner.

Mr. Hanson: But if you haul five hundred or six hundred miles you cannot follow that procedure very well.

Mr. Lyons: That would be dependent upon the spirit or attitude he wanted to take.

Mr. Hanson: But you try to settle your complaints by having them checked up?

Mr. Lyons: We have them checked. If it is not properly collected, we try to show them how to properly collect their samples.

Mr. John Griffin (Koppers-Rheolaveur Company, Pittsburgh, Pa.): In connection with your five hundred ton bin, do you check it at all for degradation, to find out what effect it has on the breakage of coal?

Mr. Lyons: No, but we do make an endeavor never to dump in an empty bin. In the dumping of our coal we keep it at a high level to hold breakage to a minimum.

Mr. Griffin: You feel degradation has not been a serious problem?

Mr. Lyons: Not seriously affecting us, no sir.

Chairman Pfahler: Anybody else? I do not want to miss anybody. Our time is approaching for adjournment. Do you have any announcement, Mr. Secretary?

Secretary Schonthal: No, sir.

Chairman Pfahler: Do you, Mr. President?

President Adams: No, sir.

Chairman Pfahler: Does anyone want to carry on the discussion? I want to thank you for being so kind and so helpful in these discussions.

The Meeting will resume at 2:00 o'clock sharp.

(Whereupon, at 12:15 o'clock P.M., a recess was taken until 2:00 o'clock P.M. of the same day.)

## AFTERNOON SESSION

At 2:00 o'clock P.M. the afternoon session was opened by Mr. Roy L. Adams, President.

President Adams: Gentlemen, will you please come to order? We realize passing through the locks may divert your attention momentarily from the program. Nevertheless, we do want to proceed with the program, because at 4:00 o'clock we expect to tie up at Louisiana for an hour, at which time you will have an opportunity to get off and stretch your legs.

We have two papers to be presented this afternoon, and we expect plenty of discussion on both of them. Then we hope, if we have any time to spare, to have another subject presented by one of our number.

The first paper for the afternoon session is "Underground Trucking," by H. C. McCollum, of the Allen & Garcia Company, Springfield, Illinois.

I wondered who H. C. McCollum was. He was a rank stranger to me until somebody said "Squib." That explained it all, and I apologize to Squib for not recognizing that "H.C." Squib McCollum.

Mr. H. C. McCollum (Allen & Garcia Company, Springfield): Mr. President and members of the Institute, a lot of people do not know who "H.C." McCollum is. Mr. Adams isn't by himself. I do not want some of them to know.

This paper happens to be on Underground Trucking in the Springfield district. I confess I know more about it there than I do other places.

# UNDERGROUND TRUCKING IN THE SPRINGFIELD DISTRICT

By H. C. McCOLLUM
Allen & Garcia Company, Chicago, Ill.

It is not my desire in presenting this paper to be drawn into controversy on the theories of underground trucking versus all rail haulage. This is merely an explanation of one particular installation which I have seen and my honest deductions as to how it will "work out" in the future. The fact remains that shuttle cars are now being used for underground trucking of coal in some sections of the Springfield mines and that they are replacing mule gathering and room tracks. Before going into the performance of these shuttle cars perhaps it would be best to give you a brief outline of the physical conditions and handicaps found in this district plus some idea as to the seam of coal and mining system involved.

Most of the shipping mines in this district are about 40 years old, one having been opened in 1884 and still being operated. This means, of course, that any new system of speeding up production is automatically saddled with the handicaps of an old mining layout and the attendant difficulties such as an average three mile haul to the mine bottom, small capacity mine cars, old mining machinery, etc., etc. Another difficulty encountered in this district is the frequent occurence of "horsebacks" or clay veins. As you know, this district mines coal in the Illinois No. 5 seam at a depth of approximately 230 feet. The seam ranges from 5 feet to 5 feet 6 inches in thickness and is comparatively level and free from faults. The "horsebacks" mentioned have no regularity in occurrence or direction and it is sometimes necessary to change the direction of rooms normally driven on sights in order to dodge the "horsebacks." The roof is dark shale running from 2 inches to 4 feet in thickness and generally stable enough to permit the mining out of rooms. Above the shale is a band of limestone which is from 6 inches to 3 feet in thickness and which makes an excellent roof for long life entries when the shale is removed. The bottom is of fire clay and the mines are usually very dry.

The mining system is room and pillar, rooms being driven 24 feet wide leaving a 12 foot pillar and entries 12 feet wide with a 24 foot pillar. Normal extraction is 50%. The face is center sheared by a shearing machine mounted on caterpillar trucks. All places are drilled electrically by the post-mounted type drills and the coal is shot down on the step system by the use of pellet powder. With the exception of the "horsebacks" this is all the usual, approved method of getting out the coal. These mines have gone through the various stages of mechanization from pick work and hand loading to conveyors and from conveyors to the present day loading machines.

The first of the underground rubber tired shuttle cars were put in operation in the Springfield district in December, 1939, and have been in continuous operation since that time. They are the single buggy four-wheel type, powered by storage batteries and equipped with built-in bottom flight conveyors which move the coal forward in the shuttle car while it is being loaded and later discharge the coal from the shuttle car to the elevating conveyor, the latter discharging the coal to the mine cars. Each shuttle car carries an average of $4\frac{1}{2}$ tons of coal and two of them are used to serve one loading machine. They are loaded by a well known crawler mounted mobile loading machine and the shuttle car travels between the loading point and the elevating conveyor. They operate on a double shift basis and it is necessary to change batteries at the end of each shift. Batteries from the charging station are brought into the transfer point where it takes about 15 minutes for each of the two battery boxes to be changed. The batteries are transported to and from the charging room on a specially built battery car.

Each shuttle car makes its own roadbed rolling over the floor between the loading and discharge points. The fire clay bottom has some soft spots which make it necessary at times to do some grading. To date this has not been a serious difficulty.

The elevating conveyor usually located in an entry crosscut is the connecting link between the trackless rooms and the regular track haulage. The shuttle cars, by means of their bottom conveyors, discharge end of the elevating con- end of the elevating conveyor. This lower end is usually set in a shallow pit and is accessible to the shuttle car section being operated. The discharge end of the elevating conveyor is on the track side of the section and trips of from 10 to 15 cars hauled by a relay locomotive, are used to serve the elevating conveyor. The relay locomotive then takes the loads to the parting where it picks up another trip of empties for loading. The usual main line locomotives take care of the loads and empties between the parting and the shaft bottom.

The statement was made at the beginning of this paper that I could not enter into controversy as to the relative merits of underground trucking and all rail haulage. It is equally obvious that I cannot disclose actual costs and tonnages because of the confidential nature of such figures. However, I can mention that by the use of this system of loading and gathering the mines in this district can effect a savings in labor of 5 men per loading machine unit. The reduction in the number of men necessary in the loading machine supporting crew cannot help but have a lowering effect on costs. In addition to the labor savings the other advantages in this one installation are the increased tons per loading machine unit; the decrease in the amount of deadwork usually necessary on account of the "horsebacks"; the reduction in the room territory formerly required because of trackwork; the elimination of all room track materials; and finally less timbering. The decrease in the amount of deadwork usually necessary to avoid the "horsebacks" is very advantageous to the mine. The shuttle cars in many instances can go around the "horsebacks" thus saving time and labor.

The shuttle cars have not been in operation long enough to accurately determine a true maintenance and depreciation cost, but since the first five months of operation show a very low maintenance cost the operator believes the future costs will not be excessive.

In conclusion let me say that I have approached the study of this installation as an independent, critical engineer. I must admit that in this one instance and up to this time it is a complete success. It is obvious that the replacing of mule haulage was bound to cut down on the number of men in the supporting crew. However, I could not help being impressed with the very definite increase in the tonnage loaded per day per loading machine. It is that item which we all recognize as the first step in the lowering of the cost of digging coal.

* * *

President Adams: This paper is now open for discussion and consideration. Who will be the first to respond?

Mr. T. J. Thomas (Valier Coal Company, Chicago): I would like to ask if in the use of shuttle cars you can get along with fewer pit cars? In other words, a mine operates under the law of diminishing returns as you ride your entry main and cross entries farther in. There comes a time you have to add to your equipment. By the more expeditious loading of these cars, can you operate with fewer cars?

Mr. McCollum: I consider the shuttle car takes the place of a pit car in that sense.

Mr. Thomas: Only one pit car?

Mr. McCollum: More than one.

Mr. Thomas: You haven't made any study along that line, have you? Here is what I have reference to: Suppose you are operating a mine, and may have seven hundred pit cars in that mine, and you maintain seven hundred. But it is only going to be a matter of time as your mine is advanced that you may have to add to your rolling stock. Now, you come to the point you introduce the shuttle car. By the introduction of the shuttle car, do you lengthen out the time when you reach that saturation point of pit cars?

Mr. McCollum: I would say yes.

President Adams: John Russell, do you have anything to add to the discussion?

Mr. John Russell (Joy Mfg. Company, Franklin, Pa.): Well, I haven't seen that installation. Therefore I do not feel I am qualified to make any remarks about that particular installation there.

President Adams: I would like to ask a question. Mr. McCollum, I believe you stated that there was a saving in the number of pit cars necessary. Assuming that the shuttle car has a capacity of five tons and the mine car has a capacity of two and one-half tons, would the saving in the number of pit cars be in direct proportion to their relative capacities? That is to say if you have four shuttle cars in service, does that mean you need eight less mine cars? Or is there a greater saving than that?

Mr. McCollum: My opinion is that there would be a greater saving than that.

President Adams: Greater than that?

Mr. McCollum: Yes, greater.

President Adams: Anyone else?

Mr. James H. Fletcher (Consulting Engineer, Chicago): Perhaps I can get a little light on that, from Mr. Thomas' question. Putting these in a mine having five-ton cars, the same loading equipment, the number of cars would drop in service from seventy-eight to twenty-eight.

President Adams: I did not get that.

Mr. Fletcher: Putting trackless haulers in a mine having five-ton cars, producing the same tonnage, the number of cars in service is dropped from seventy-eight to twenty-eight, giving the same tonnage.

It isn't a question of the saving of the means of transporting coal from a loading machine, but a saving in the time the cars are held up at the loading point in proportion to the number of cars needed at the loading point.

Mr. T. J. Thomas (Valier Coal Company, Chicago): In other words, if I understand your statement, you eliminate the time of going here — the movement of the car from the parking on in to the point of loading?

Mr. Fletcher: Yes.

Mr. Thomas: Then do I understand from what you say you would get substantially the same load factor with twenty-eight cars as with seventy-eight cars?

Mr. Fletcher: The same tonnage. It is actually done.

Mr. John E. Jones (Old Ben Coal Corporation, West Frankfort): I am interested with regard to a possible hazard with shuttle cars. Those mines I have visited where shuttle cars were used have a tremendous coal dust thickness on the floor where the coal has been ground. I have made the suggestion that coal dust is a possible added hazard and should be corrected.

I suggested that a good way to correct that would be to use the shuttle car on an idle day of the mine as a rock dust distributing machine, filling the shuttle car full of rock dust and running it over the dirt, and have the fan working at the same time putting a carpet of rock dust in its path so that when operating during operating days it will rock dust that territory.

Mr. Walter Jones (Joy Mfg. Company, Franklin, Pa.): To verify his statement relative to rock dusting, where you have excessive coal dust due to operation of a shuttle installation, there is an installation carrying out your suggestion of putting rock dust in the car and distributing it over the roadway. One particular shuttle car installation was using a rock duster or blower with an attachment behind the rock dust for distributing over this particular roadway.

Mr. James H. Fletcher (Consulting Engineer, Chicago): Mr. Chairman, the question Mr. Jones brought up is one that is quite important in rubber tired hauling. It is a question of keeping a pressure in proportion to your floor so that it is not necessary to cut up your floor.

There is another problem in the type of tire you use. If you use tires that have a tendency of vacuum in rolling out and going over the same territory so many times, you pick up a little dust particle each time you go over. The smoother the tire you put on and the better distribution you get on your surface, the more you eliminate the hazard you speak of.

I made some very extensive tests a few years ago before I went into this on an open pit in which I had fresh coal just taken off. By running trucks with different weights in them, that will determine what it will take before it will start to grub or start to pick up. That is the question we will have to iron out with the equipment.

Mr. McCollum: My observation in the Springfield district has been that the rooms they are working by the shuttle cars are cleaner and less coal in them, less coal left in them, and most of your dust there is cleaned up, and we are running over that and it is partly dust. Those mines are dry. It isn't coal dust as much as dust from the fire clay surface.

President Adams: I would like to ask Mr. Fletcher a question regarding the tires. Do the smooth tread tires give as good service or any better service than the other treads?

Mr. Fletcher: The smooth treads we have in mind — it is a question of the amount of rubber you put in them. On a smooth-tread tire you would not increase the percentage of rubber just because you did not put holes in them. When you go to a smooth tread you get to a rotary action. If you balance your weight on your surface properly or in proportion to that particular mine floor, you will by a great deal cut down your dust question, which has come up particularly in the east.

Mr. J. B. Haskell (West Virginia Rail Company, Huntington, W. Va.): It has been known for a long time that it costs a great deal more to transport general commodities on rubber tires than on rails. As applied to coal mining, I am wondering if any study has been made to know how much more it costs to move a given tonnage on rubber tires over what it would cost to move the same tonnage on wheels or rails, just as to the point of figures?

President Adams: Can anyone answer Mr. Haskell's question?

Mr. McCollum: I will say that cost would depend upon the length of the haul. It would be hard to determine the cost off-hand, but a shuttle car is not good for a great length of haul where your rail car is. It would all depend upon the length of haulage, I would say, and the cost of laying your track in for a short haul.

President Adams: Anyone else? If there is no further discussion on this paper, we will pass to the next, the title of which is "Modern Underground Methods," by A. K. Hert, General Superintendent of the Snow Hill Coal Corporation, Terre Haute, Indiana.

Mr. A. K. Hert (Snow Hill Coal Corporation, Terre Haute, Ind.): Mr. Chairman, and gentlemen of the Illinois Mining Institute, I wish to express to you first at this time my appreciation of the invitation which you gave me to address this body of men. This is my first visit to the Illinois Mining Institute. I am enjoying myself a whole lot. If this paper is worth anything to anybody, then the visit will be well worth while.

The subject which the committee gave me was "Underground Methods." I think we could write volumes on that subject, and describe many mechanical methods that are generally known today. However, I have confined this paper strictly to my own operation, which is at Terre Haute, Indiana.

# MODERN UNDERGROUND METHODS

By A. K. HERT
Snow Hill Coal Corporation, Terre Haute, Ind.

In the transition from manual methods in coal mining to mechanical methods there have been developed various types of equipment designed to do the same job. Among operators and manufacturers alike certain equipment preferences have developed. It is natural that this situation should produce sharp differences of opinion. Opinions about subjects of this kind should be based on factual data rather than prejudice, but it is often difficult to obtain facts, and it is not always easy to analyze facts after they are obtained, so as to provide an unquestionably correct conclusion. Nothing can be gained by the emotional statement of ideas based on prejudice. Such argument merely serves to confuse the issue.

One of the most interesting and important problems that has arisen in mine mechanization is the relative merits of the more or less conventional mine track systems as compared to the various so-called trackless methods.

It was with some reluctance that I undertook the task of attempting to contribute something to the fund of information available relating to this problem, and in preparing this paper I have attempted to adhere to data pertinent to the subject, which is available from the operating records of our Talleydale Mine. At a recent meeting of mining men one man suggested that it would be helpful if someone could propound ten points which could enable an operator who was struggling with the problem of the type of equipment to use to come to a quick, accurate decision, and thus avoid having to go through the laborious process of studying his particular problem carefully in its details. The author of this paper does not believe that the problem could be solved by any such simple method. The paper which I have prepared makes no pretense of settling anything. If I am able to contribute some useful information that might be of assistance in some particular problems, I will have accomplished enough to justify the presentation of this paper.

The Talleydale Mine of the Snow Hill Coal Corporation has experienced some degree of success in the application of modern mechanical equipment to a rather difficult mining problem. This mine operates in the Indiana No. 3 seam. The percentage of impurities included in the seam make it necessary that efficient low cost methods be used throughout the operation. In designing the mine this fact was given first importance.

This No. 3 seam is one of the most extensive coals in the eastern interior basin, but due to its adverse mining conditions, it has been practically untouched in Indiana.

The development of the Talleydale Mine in the No. 3 seam has been a pioneer venture in seeking to solve one of Indiana's basic mining problems. The Snow Hill Coal Corporation recognized that to successfully mine No. 3 coal, the following problems would have to be solved. First, the coal contained from twenty to twenty-five per cent of high ash and high sulphur refuse, which would have to be removed by an efficient coal-cleaning plant. Second, in order to produce coal at costs that would be at all comparable to competitive operations, mechanization would have to be carried out to its most up-to-date expression. The mine as it stands today is the result of effort to meet these requirements.

It is not within the scope of this paper to give a detailed description of the cleaning plant, but touching upon the physical conditions of the seam will suggest what some of the mining problems are. The vein lies three hundred fifty feet below the surface. It is fairly level, and its average height is about six feet. The strata, immediately overlying the coal, is generally gray slate. The underlying strata is a firm fireclay ranging from thirty inches to five feet in thickness. Beneath this clay is a layer of unconsolidated material which acts more or less as a fluid. This condition, coupled with the weight of over-burden, tends to develop a squeeze or general subsidence immediately after the coal is removed. This has a very detrimental effect on the roof, inasmuch as the gray slate has very little elasticity or tensil strength.

The problem of roof control is, therefore, very much to the fore, both from a production and a safety standpoint. This is reflected in the fact that the cost of timbering represents about fifteen per cent of the total production cost.

The coal seam is characterized by two distinct rock or pyrite partings, located about twelve to eighteen inches apart, the lower one being about four to eight inches from the bottom. In addition to these two partings, the seam is shot through with lenses of pyrite and sulphur balls. It will be obvious that this condition presents major difficulties in undercutting, drilling, and blasting.

The mining system adopted is the more or less conventional room and pillar system, although at the present time we are experimenting with a modification of this system which we believe will be very helpful and decrease mining costs. Sufficient data is not available at this time to warrant further mention.

Underentting at this mine constitutes a major problem, due to the fact that the seam contains impurities in profusion. These impurities are in the nature of iron pyrites and they influence materially the cutting capacity of any machine used. The fact that only eight-tenths of a ton per bit is produced will give some indication of the severity of the cutting conditions. Awareness of this situation influenced the selection of the type of undercutter to be used. The undisputed superior capacity and ruggedness of the track mounted machine made its suitability for this job very clear. Notwithstanding the fact that we are convinced that we are using as efficient a machine as is built for this duty our labor costs for the cutting operation are twenty per cent higher than the labor cost for the loading operation. It will be obvious, therefore, that for a condition such as we have it would be a serious mistake to underestimate the importance of maximum efficiency in the cutting operation. The tramming ability of the track loader is therefore a very important factor.

High capacity and high efficiency in the loading operation at this mine are vitally necessary, due to the unusually high percentage of refuse passed through the transportation system, through the washery, and to the refuse pile. We recognize four major factors influencing loading machine performance. Stated in the order of their relative importance they are: First, Management; Second, Face Preparation; Third, Car Change; Fourth, Roof Control.

Regardless of the amount of money spent on equipment; regardless of the potentialities of the equipment purchased if the mining operations are not efficiently managed it is impossible to achieve any worthy success. It is a prevailing and dangerous misconception that the problem of successful and economical coal production can be turned over to the manufacturers, whose wonder-working ingenuity will enable them to design and sell machines which will solve all the problems of producing low cost coal. Mediocre equipment with good management has much better chance of success than good equipment and mediocre management.

If the other factors effecting production are properly organized the importance of face preparation is emphasized, as the speed with which the coal can be picked up by the machine will have a marked effect on performance. The drilling and blasting procedure is the key to proper face preparation. It happens that at the Talleydale Mine the coal is very difficult to prepare, due to the impurities contained and the structure of the seam. All types of explosives have been tried, as well as Airdox and Cardox. Shearing is impossible due to the pyrite bands. Our efforts at this mine have resulted in progress in obtaining good face preparation, but notwithstanding this fact, reference to our time-studies and observation of the loading machines in action shows that a great deal of time is consumed in digging down the coal.

The other factor mentioned, namely car change, may be subdivided into several contributing elements. First, there is the size of the mine car. It goes without saying that a large mine car simplifies the car change problem. The Talleydale car has a raw coal capacity of five and .8 tons. In 1935, when this car was designed, it was considered as being a big car. It is dwarfed, however, by cars that have been placed in service since then. A new mine developed in this seam today would probably resort to skip hoisting, which would permit the use of a car having a capacity between ten and fifteen tons. Regardless of the size of the mine car its performance will be dependent upon the track layout. Unfortunately most underground track systems are a compromise between what would be most efficient and what is available at the mine in the way of old rails, ties, switches, etc. It seems absurd to spend huge sums for intricate machinery and then fail to give due consideration to the importance of the track system. In the Talleydale Mine we use 40 lb. rail. We are convinced that any rail lighter than this is a serious mistake, where track cutters and track loaders and large mine cars are to be used. All our rails are uniform in length, namely, fifteen feet. All our switch and frog material is uniform. Our supply of frogs and switches is unlimited. We used steel mine ties. Our track layers work efficiently since they are supplied with the proper materials. We have worked out a room track system which facilitates car change and provides storage capacity for loaded and empty cars.

Good mine cars and good track require the proper haulage facilities. If battery locomotives are used they must be capable of the tasks imposed upon them. We use cable reel locomotives. The wire must be properly hung; the cables must be maintained in good condition; the locomotives must be maintained in a state of excellent repair. In the Talleydale Mine we use one 6 or 8 ton locomotive to serve each loading machine. One swing motor serves two units. Our haulage facilities are readily capable of changing 140 cars per 7 hour shift under the conditions prevailing.

Where timbering is necessary the performance of the machine may be influenced by improper posting. On the other hand, the timbering may be adversely effected by the design of the loading machine. In the Talleydale Mine it is necessary to timber close to the face. The track machine which we use is designed so as to maneuver successfully under these conditions. We consider this as being a very important matter.

In the Talleydale Mine we operate six complete units and one development unit. This development unit consists of a crew of five men. The standard crews average seventeen and one-half men. During the month of May the six fully manned units averaged 584.4 tons of raw coal per 7 hour shift. The average number of cars loaded by these units for this month was 103.8.

The following timestudies, which were recently taken, show the performance of our units quite clearly:

(Off Record)

2 —Loading
3 —Cutting
3 —Track
3 —Timbering
1½—Motor
1½—Trip
1 —Bugdust
1½—Drilling
1 —Foreman

May 27, 1940

TIMESTUDY — SNOW HILL COAL CORPORATION

Following you will find a resume of the timestudy made at the subject mine today on the Type 260 loader:

| | | |
|---|---|---|
| Total places loaded out | | 14 |
| Total cars loaded | | 95 |
| Total gross tons loaded | | 551 |
| Total actual loading time | | 244′ 02″ |
| Total actual car change time | | 78′ 18″ |
| Total actual tramming time | | 41′ 22″ |
| Total distance trammed | | 5625 ft. |
| Total delay time | | 56′ 18″ |
| Motor waiting on emptys | 15′ 47″ | |
| Loader not being served | 12′ 50″ | |
| Change motor delays | 5′ 00″ | |
| Loader breakdown delays | 15′ 47″ | |
| Bad truck delays | 6′ 17″ | |

| | *Total Elapse Time* | *Average Per Place* | *Average Per Car* | *Per Cent Total* |
|---|---|---|---|---|
| LOADING | 244′ 02″ | 17.42′ | 2.57′ | 58.1 |
| CAR CHANGE | 78′ 18″ | 5.59′ | 0.824′ | 18.6 |
| TRAMMING | 41′ 22″ | 2.95′ | — | 9.8 |
| DELAYS | 56′ 18″ | — | — | 13.5 |
| TOTAL | 420′ 00″ | | | 100.00 |

| | |
|---|---|
| Average tramming speed in feet per sec. | 2.27 |
| Average loading rate in tons per minute | 2.33 |

SUMMARY:

| | | |
|---|---|---|
| Total places loaded out | | 17 |
| Total number cars loaded | | 127 |
| Total gross tons loaded | | 736.6 |
| Total actual loading time | | 267′ 25″ |
| Total actual car changing time | | 80′ 20″ |
| Total actual tramming time | | 33′ 28″ |
| Total distance trammed | | 3732 feet |
| Delays: | Motor waiting on emptys | 3′ 19″ |
| | Loader not being served | 21′ 39″ |
| | Motor off track | 10′ 55″ |
| | Swing motor delays | 13′ 49″ |
| Total delay time | | 38′ 47″ |

| | Total Elapse Time | Average Per Place | Average Per Car | Per Cent Total |
|---|---|---|---|---|
| LOADING | 267′ 25″ | 15.77′ | 2.1′ | 63.6 |
| CAR CHANGE | 80′ 20″ | 4.74′ | 38 sec. | 19.1 |
| TRAMMING | 33′ 28″ | 1.97′ | — | 7.9 |
| DELAYS | 38′ 47″ | — | — | 9.2 |
| TOTAL | 420′ 00″ | — | — | 99.8 |

Average tramming speed in feet per second.......... 1.85
Average tramming speed in feet per minute........111.00
Average loading rate in tons per minute........... 2.85

It will be noted that the loading rate is quite low considering the high production of the units. This indicates what has been mentioned already about the amount of time the machines spend in digging down coal. The time spent in changing cars is relatively low, which reflects the advantages of properly designed haulage system.

* * *

President Adams: Is there any discussion of Mr. Hert's paper?

# DISCUSSION ON MODERN UNDERGROUND METHODS

By MORRIS CUNNINGHAM
District Manager, Goodman Mfg. Company, Terre Haute, Ind.

Mr. Chairman and gentlemen, I am sure we have all enjoyed Mr. Hert's paper, which has given us a general description of his Talleydale operation. There are a few notes which I have made on it and which I would like to comment upon.

It seems to me this installation offers an excellent illustration of what can be done with good management and with high capacity track loading and cutting machines. An average production per loader per shift of five hundred eighty-four tons of raw coal from a six foot vein of coal and operating under very adverse physical conditions can only be obtained by good management and high capacity track loaders and cutters.

Cutting conditions at Snow Hill are extremely difficult. Mr. Hert's paper states that he is able to secure only eight tenths of a ton per bit. This indicates that approximately fifty bits would have to be set for each room face cut. The difficulty of cutting is caused by impurities in the coal at the point of cutting. These impurities, as stated by Mr. Hert, consist of sulphur balls, rock and pyrite lenses.

Another difficulty confronting management and equipment in this mine is that of hard loading coal. This is illustrated by a loading rate varying from 2.3 to 2.8 tons per minute. Mr. Hert's loading machines are of the high capacity type which have a free loading rate of better than six tons per minute. Mr. Hert's paper explains very carefully and clearly the difficulties encountered in trying to secure proper face preparation.

Mr. Hert states that 15% of the total mining cost is chargeable to timbering. We can easily understand why that cost is as high as it is when we remember that it is necessary to set steel cross bars on not more than three foot centers in all development work and in a big percentage of his room work.

Again I think the performance is excellent at Snow Hill because the average tonnage per unit of 584 tons is being secured with a seventeen and one-half man crew. There are two men on the loading machine. Three men are required to cut the coal. Three timber men per crew are used. Another remarkable thing is he is able to lay all the necessary switches and track for the above tonnage with a total of only three track layers per crew. This is a remarkable achievement. Mr. Hert has been able to do this because he has standardized all track work. All switches are the same. The rails are cut to the same length and are of the same size, and steel ties are used throughout. Each track crew is efficiently equipped with proper tools with which to work and the proper track materials are always available at strategic points in the territory.

The question of the size of a mine car can be debated from now until dark and we would not arrive at any definite conclusion. I believe we will all agree that if we are considering a new mine we would want to put in a mine car of as large a capacity as was feasible, making due allowance as to clearance and other factors that might influence our selection. There is little room for argument on that point.

However, the operator who finds himself with a mine equipped with a small mine car and shaft which is too small to accommodate a large car, is faced with the problem of overcoming this difficulty by other means. There is a track system which can be applied to such a mine and which will give the cheapest possible cost of any equipment that can be applied to such a mine. This system is based upon the use of, shall we say for illustration, ten ton mine cars of the drop bottom type. These large capacity cars are used to transport the coal from the loading machine at the face to a central transfer station. This transfer station is located on the cross entry one-half way between panel entries. Four loading machines working in four separate panels deliver coal to this one transfer station. The transfer station consists first of two chain flight conveyors which lie on the entry floor and parallel to each other. A ramp is built over this chain conveyor. Necessary top clearance is obtained by shooting the roof. The large capacity drop bottom cars run over the ramp and dump their coal on the chain conveyors. At the end of these horizontal conveyors the coal is discharged on to two smaller chain flight conveyors which elevate the coal through the cross cut to a common discharge point. The regular small capacity mine cars are pulled past this discharge point by either a locomotive or hoist and are loaded in one continuous string. One man at the discharge point controls the operation of all conveyors.

Such an installation has recently been installed by the Princeton Mining Company at Princeton, Indiana. This installation has not been in operation long enough to give definite results as to cost, but enough has been learned to date to warrant rather high hopes.

An interesting feature connected with this system is the fact that approximately one half million tons of coal can be moved over this one station before it becomes necessary to move it to another location. This results in a very small charge per ton for moving the set-up.

The maximum distance coal can be hauled to this transfer station is not definitely known. However, I would like to recite a hypothetical case to you. First let us assume that we will have forty tons of coal per fall in any one room. Let us then assume that we are using cars of ten ton capacity. If we assume an average loading rate of 2½-3 tons per minute it would require fifteen minutes to load out that forty tons of coal. This is actual loading time. We can safely assume a total car change time of three minutes per place. This should be easily obtained with good switching. Time studies show that the track loading machine will not average more than two minutes for each move. This gives a total time per place for loading, car change time, and moving time to the next room of around twenty-one minutes.

If the installation is working at 100% efficiency it should be able to load out twenty places per seven hour shift for a total of 800 tons. We know that 100% efficiency can not be maintained. If the installation is operating at only 75% efficiency the production would be 600 tons per unit. During the twenty-one minutes required to load out, change cars, and move the loader, a swing motor can utilize the same twenty-one minutes for hauling the coal to the transfer station, dumping it, and returning to the next room. If we assume the average tramming speed of the swing motor to be three miles per hour it could travel a total distance during this twenty-one minutes of about 5500 feet. Due allowance of course should be made for dumping time at a transfer station. Roughly this would indicate that the total distance from the transfer station to the farthest point should not be over 2000′.

Please bear in mind that the use of the large car and transfer station system gives this high tonnage and corresponding low cost to the operator who is running an old mine equipped with small mine cars. In other words the system gives him, to a large extent, the same advantage as the operator who can utilize the large car from face to the tipple.

I believe this system will provide the cheapest production cost for old mines of any system known to the industry today.

* * *

President Adams: Is there anyone else who can contribute to this discussion? Or who has any question to ask?

Mr. Raymond Mancha (Jeffrey Mfg. Company, Columbus, Ohio): I was interested in seeing that the lower tonnage load was loaded fifty-eight per cent and the higher was loaded sixty-five per cent. I presume that is due to the fact that one machine had five thousand feet for the loading distance and the other had three thousand?

Mr. Hert: Part of that would be answered that way. The machine, of course, which had the longer distance and which I figured to get the accurate load on was in a number of narrow places, and the percentage of narrow places to the total as compared to the same total for the other machine.

Mr. Cunningham: I think another point on that would be one hundred and twenty-seven cars on the big day as against ninety-five on the smaller day. Much more time was consumed in changing cars even though you got higher tonnage for you had more cars to change.

President Adams: There is one thing I missed in Mr. Hert's paper, and that is the capacity of the mine cars.

Mr. Hert: 5.8 tons.

Mr. Howard Lewis (Old Ben Coal Corporation, West Frankfort): I happened to have had the pleasure of visiting that operation one day about two or three weeks ago. I was certainly impressed with the simplicity of the operation, and also the efficiency of it. I feel it incumbent upon me, with my experience with that particular type of machine, to just express my congratulations to Mr. Hert upon the very efficient manner in which they operate their handlings. Those four points of management he stated in his paper are certainly being outlined in a very efficient manner. The track work and also timbering is of a very high mechanized order, and all given factors are co-ordinated in a manner which it occurred to me was a pleasure for me to see.

Mr. T. J. Thomas (Valier Coal Company, Chicago): I would like to ask if you shoot on the shift over there.

Mr. Hert: We do not. The Indiana law does not permit us to shoot explosives on shift.

President Adams: Any other questions? I have one, Mr. Hert. The gathering locomotive which serves your loading machines runs six or eight tons. Are they what we call standard speed? That is to say, are they old ones which have been in service for twenty years, or are they slow speed three and one-half miles per hour or thereabouts?

Mr. Hert: They are the standard six or seven mile an hour locomotive which we found when we went there. They are all old locomotives.

President Adams: Have you ever had any experience in serving your loading machines with locomotives of half the standard speed?

Mr. Hert: We did have, Mr. President, but only for a short time. That was about four years ago, where at the Dresser Mine operated by the same company they provided a six-ton locomotive with a speed of three and one-half miles an hour. They not being hardly ready to use it and we being hungry for locomotives, we did use it about two months, as I remember. When you wish to introduce anything new into a bunch of coal miners, you find it just will not work. That was the first reaction from our motormen. We did not run any time studies on it, as I remember, but it was the general opinion and observation of the management it would have done the work very nicely.

President Adams: How long did you use that slow speed locomotive?

Mr. Hert: As I stated, about two months as I remember and we did not get a very good check on it.

President Adams: You did not use it long enough to really determine whether the maintenance on that locomotive was any different today from the others?

Mr. Hert: We would not have had the opportunity to have gotten any figures on that due to the fact our locomotives are old, and that being a brand new locomotive, and only having it such a short time. We have no figures. I could really offer nothing in support or against that particular locomotive.

President Adams: Anything else? We still have some time before the boat docks, in an hour.

I think we might well devote some of the time that we have left to discussion of a subject which probably concerns every one of us, one about which some of us know little and some of us know a great deal because of having been close to it. That is the subject of the St. Louis Smoke Ordinance.

Mr. J. E. Hitt has consented to open the discussion on the St. Louis Smoke Ordinance, and I take it that just a chance to talk about it is all that is needed. I will ask Mr. Hitt at this time to open the discussion.

## DISCUSSION ON ST. LOUIS SMOKE ORDINANCE

By J. E. HITT

Vice President, Walter Bledsoe & Company, St. Louis, Mo.

Mr. President and gentlemen, I have some hesitancy in talking about this subject, or would have except for the fact that it is one which is vital to everybody in this room, the Operators of Illinois and Indiana, and the forty-eight peddlers as well who serve us.

The City of St. Louis had an ordinance, a good ordinance that served every purpose which could have been served or will ever be served in the smoke abatement in St. Louis. I do not say "elimination," for it is silly to talk about elimination. We cannot eliminate smoke.

The question in St. Louis, because of the peculiar atmospheric condition which obtained last summer and made a large amount of pall, mostly smoke fog, started a commotion. They carried it to the extent that the Mayor appointed a committee composed of a college professor engineer, three politicians, two doctors and two industrialists, but no coal men, to settle this problem. They met more or less continuously for a period of about ninety days, and then were all coal experts. I say that without any reservation, because they say they are. And they then proceeded to enact an ordinance, nine pages of closely printed material. If the National Bituminous Coal Act in any of its aspects is asinine, then I have the right word for this.

I want to talk about what they proposed to do, what they have done, what they are doing to us today, and how they propose to carry out this ordinance against the use of Illinois coal, and then as a prediction how it will finally wind up. Before I do that, however, I am going to propose a resolution which will be the basis of our discussion, and I hope we can all discuss this.

This resolution has been passed by quite a number of Chambers of Commerce in towns of Illinois. It has been passed by the Progressive Miners of America. It has been passed by the Illinois Junior Chamber of Commerce, and is being presented today to the Illinois Manufacturers Association and I expect they will adopt it.

If you will bear with me, I want to read this. And before I read it I want to say if it meets with your approval after we have finished the discussion and this organization passes it, I have a number of copies of it. If you are as interested in this as I think you are, many of you can take it home and present it to your own civic bodies, whether Chamber of Commerce, Rotary Club or business men's association — the more of them interested the better it will be to help this cause.

Many of you fellows in St. Louis here know there has been what the St. Louis Chamber of Commerce calls a boycott against St. Louis, but what we call a reciprocal arrangement, that if you buy our coal we will buy your merchandise. No official action has been taken, but merely as individuals, for they sent G Men to southern Illinois to put us in jail for starting a boycott, which was never done.

I will read the resolution:

"Resolution of

..................................

of ..............., Illinois.

Whereas, pursuant to the solicitation of the City of St. Louis, through its Mayor, the Honorable Bernard F. Dickmann, the Sixty-first General Assembly of the State of Illinois appropriated the sum of One Hundred Eighty Thousand Dollars now being being used by the Illinois Geological Survey in study and investigation of possible methods for the processing of Illinois coal to meet the demands of the City of St. Louis in its program for smoke elimination; and

Whereas, Illinois coal producers have expended huge sums of money for the preparation of coal to meet previous St. Louis smoke ordinance requirements; and the State of Illinois and its coal producers have cooperated in good faith with the City of St. Louis for the attainment of smoke elimination through a fair and equitable program of smoke control through continued study, work, effort, and cooperation; and

Whereas, the officials of the City of St. Louis have declared publicly and officially to the State of Illinois that its smoke elimination program would be based upon an effort to continue the use of Illinois coal, and that said program would be sponsored, designed and conducted in such manner as to preserve the economic equilibrium of industry, labor, and commerce within the coal areas of Illinois and between the State of Illinois and the City of St. Louis; and

Whereas, the City of St. Louis has since enacted an ordinance which prohibits the use of Illinois coal except in stokers, thus reducing the use of Illinois coal in St. Louis to about 25% of its previous consumption; and

Whereas, such legislation and restrictions and new policies of the City of St. Louis are foreign to the agreed program upon which the City of St. Louis was to proceed; and

Whereas, such legislation and restrictions together with proposals to substitute other coals for Illinois coal, is such as to cause and increase unemployment within the State of Illinois, and, through the reduction of employment and payrolls, to affect seriously the trade and commerce between the State of Illinois and the City of St. Louis; and

Whereas, the use of methods and coals provided by the recently adopted legislation of the City of St. Louis will not procure results in smoke reduction for the City of St. Louis which cannot be attained by a continued use of Illinois coal; and

Whereas, the sale of stokers and the increased use of stoker coal has been jeopardized rather than accelerated in the City of St. Louis because of the erroneous belief of its citizens that "smokeless" coal for the hand-firing of furnaces can be delivered in St. Louis at a price less than has prevailed on hand-fired sizes of Illinois coal; and

Whereas, the seemingly increasing problem of smoke in St. Louis during the past year has been accentuated by atmospheric conditions rather than by the fuel used; and

Whereas, the Honorable Lloyd C. Stark, Governor of the State of Missouri has voiced disapproval of trade barriers between States, and the St. Louis ordinance is not in accord with the present movement to eliminate trade barriers and interstate discriminations;

Therefore, Be It Resolved, that the ..............................
(Name of Organization)
of ..............................,
(City)
Illinois recognizes the need of the people of St. Louis for total and permanent solution of the smoke problem which has confronted them for generations, and reaffirms its faith that smoke elimination can be attained only through a patient program of careful study, activity, education and enforcement; and

Be It Further Resolved, that this organization reaffirms its faith and belief that the St. Louis smoke problem ultimately can be solved with the continued use of Illinois coal; and

Be It Further Resolved, that it is the belief of this organization that the recently enacted ordinance of St. Louis is a hurried, untimely, and drastic prohibition against Illinois coal, which will postpone rather than hasten the ultimate processing of Illinois coal by seriously crippling the coal industry of Illinois which is trying to cooperate with the City of St. Louis; and

Be It Further Resolved, that this organization protest the recent procedure of the City of St. Louis as a break of faith with the State of Illinois, and that the Mayor and Board of Aldermen of the City of St. Louis be requested to repeal all St. Louis legislation with respect to restrictions or specifications on coal which have been enacted since the City of St. Louis, through its Mayor solicited and procured appropriation of funds, by Illinois

General Assembly for the study and investigation of processing Illinois coal; and

Be It Further Resolved, that this organization request the Mayor and Board of Aldermen of the City of St. Louis, after thus restoring the smoke control program to that program which was previously held out to the State of Illinois as the desire and purpose of the City of St. Louis, that the Mayor and Board of Aldermen again proceed, as previously agreed, in a cooperative plan of smoke abatement which will preserve the industrial, commercial, and employment equilibrium of the City of St. Louis and the State of Illinois; and

Be It Further Resolved, that the members of the House of Representatives and the members of the Senate of the General Assembly of the State of Illinois, now convened, be memorialized to adopt similar resolutions of protest as now before them; and

Be It Further Resolved, that the Chamber of Commerce of St. Louis be requested to join with this organization in procuring repeal of the undue restrictions and prohibitory provisions of the St. Louis ordinance which have been passed since the appropriation of sums for the study and investigation of processing Illinois coal; and

Be It Further Resolved, that the citizens of the City of St. Louis and of Illinois be memorialized to join with this organization in cooperative effort for a better understanding between each other, for the elimination of trade barriers and the attainment of free trade between themselves and each other; and

Be It Further Resolved, that the officers of this organization be instructed to cause copies of this resolution to be addressed to the Clerk of the House of Representatives and to the Clerk of the Senate of the General Assembly of the State of Illinois; to the Mayor and Board of Aldermen of the City of St. Louis; the Chamber of Commerce of the City of St. Louis; Mr. James L. Ford, Jr., Chairman, St. Louis Committee on Smoke Elimination; Mr. R. R. Tucker, Commissioner of Smoke Regulation, City of St. Louis and of the State of Illinois.

ADOPTED ............, 1940.
ATTEST:

............................
*President.*

............................
*Secretary.*"

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(In the course of reading the foregoing resolution, Mr. Hitt interposed the following remarks):

I would like to interpose that in all meetings of this committee, when anybody from our organization or the Illinois Operators went to the Smoke Committee, we got scant hearing, and were absolutely passed out the door when we said anything that had any reference to education, their statement being: "The time is past when we will educate anybody, but we will just eliminate the smoke."

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I might say in that connection that the resolution was introduced into the State Legislature by Representative Johnson, of St. Clair County, who is now running for Congress over there. It was a sort of a pacifying if-you-please sort of a resolution. They succeeded in getting him to withdraw that resolution, and sponsor another one which I have here, and which I will not read because of its length, but it has been passed by both Houses of the Illinois Legislature. They have really anticipated being asked to do that in this resolution I am reading.

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I might say in that connection, particularly to the Press, we got no consideration from the Press whatever. They will not listen to us, they will not talk to us, and they have misquoted us. They have started on a program which has now assumed a political phase.

They have no idea what they will do with the one hundred and twenty-three thousand stoves used in St. Louis east of Grand Avenue. Within the last week a friend of mine talked to Mr. Tucker about a stove, and convinced him that the stove could be fired smokelessly, and he said: "That is fine, that is all right, but we have an ordinance which says the Illinois coal cannot come in Missouri."

In the hotel where I live they burned Illinois coal for years, and put my coal in there for three years. It is a down-draft boiler, and the coal burned smokelessly and always has. We never had a complaint. But they are throwing our coal out and buying eastern coal, and the point is in trying to burn it smokelessly. It makes no difference what coal you use, you must learn how to burn it, whether the so-called smokeless or Illinois coal.

In one breath they go to St. Clair County and tell the fellows over there they want them to raise five million dollars for a processing plant. They have gotten through the Legislature a bill permitting revenue bonds to be used by all counties in Southern Illinois. I mean by a revenue bond one which is not guaranteed by the county. They sell the bonds and the revenues from the operation of the plant will pay interest and bonds if they make money, and if they do not the poor sucker buying the bonds is out.

At the same time they made the statement before the Press of Illinois, and reiterated it, that they would get the so-called Arkansas coal at $3.50, the so-called semi-anthracite. They will pay $2.00 for the coal, they say. They did not tell the people the average rated cost of coal in Arkansas, according to the Bituminous Coal Commission, is $3.22 per ton, but they say they will get it from the operators for $2.00 a ton, six-inch mine run, which by actual breaking down of size runs seven-eighths to one and one-quarter inch.

Now, they do not say that the Arkansas operators are all practically broke, and would go into bankruptcy if they had to sell coal at that price. They went to Washington to get the Bituminous Coal Commission to give them a $2.00 price, and were told to take it up with them in the usual way after the Act is in effect, and you all know what that means.

They propose a $2.00 train-load to St. Louis. That is another $2.00 on the $5.50. The coal must be shipped in loads of two thousand tons, in a train-load from one consignor to one consignee. All the mines in Arkansas and Oklahoma together last year did not produce but one hundred thousand tons more than the Pyramid Mine, probably one and one-half million tons of coal in Arkansas and Oklahoma. Arkansas and Oklahoma are winter consumers of coal. Kansas City and points north take their winter's coal. They possibly can put that six-inch mine run coal into St.

Louis in the summer time to these coal dealers and people in St. Louis who have always lived in a forty-eight hour market, where you can get coal even from southern Illinois within forty-eight hours.

These coal dealers haven't the yard facilities or finances and would not be so silly as to put six-inch coal in their yards in the summer time and expect the consumer using a fine grade of coal to put that dirty six-inch coal in there in the summer and burn it in the winter.

Then, the retail coal dealer is to handle it for $1.50 per ton. You fellows know what trouble they raise with us if they get a small per cent of slack in the coal. This will be seventy-eight per cent slack. The coal has always been porous, and the retailer has to sell it where he can, but he cannot put that on the people. They expect the retailer to sell it for $1.50, and for the consumer to buy it. Aside from those matters, the $5.50 price is just fine.

That illustrates one place they will get coal to substitute for the Illinois coal. They can get eastern coal, of course, I presume in the winter time. They can get it now for about $2.60 or $3.20 freight rate. And Mr. Tucker said to me the other day: "Why can't these retailers put this coal into the yards?" I said: "A lot of reasons. They will not pay that price until they can sell it. Another thing, you told them you would have $5.50 Arkansas coal. I get telephone calls two or three times a week asking 'Where do we get this $5.50 coal'"? He said: "They are laying down on us."

The point is the yards in St. Louis are empty. We are not permitted to bring our coal in. When the cold weather comes St. Louis will freeze unless something is done to win these theorists, who are all crusaders now.

My only statement to Mr. Tucker has been all the time: "Enforce this ordinance one hundred per cent," for I think that is the best way they can hang themselves. If he does enforce it one hundred per cent and make the people who have been buying this cheap Illinois coal —St. Louis is one of the greatest industrial centers in the country, built entirely on low-cost Illinois coal, and then to throw it out and say they will burn something else is good.

They talk about Chicago being a smokeless city — that is, compared to St. Louis, but they have plenty of black-outs at times, and they made the statement through the Press they will not allow the people to burn Illinois coal in Chicago, but I know, for I was there twenty-five years, that it is not true.

I do not think there is very much argument about this thing. I hesitated a little to say how silly the ordinance is, for if the newspapers are correct Dr. Leighton was brought down to St. Louis at their request as their adviser. I do not hesitate to say this now, for I think I could say without any hesitancy that Dr. Leighton had nothing to do with the drafting of any part of that ordinance. I think he probably was there to tell them of his efforts to preserve the coal market, which he is doing a fine job with as we know, but the newspapers construe that "They have that expert, that fine fellow, here for their adviser."

I talked to one of Ford's associates, the chairman of the committee, and he said: "You cannot tell Mr. Ford anything about Arkansas coal. He was down there two days." So he is an expert.

So that is what we are up against in St. Louis. Today we cannot ship one pound of coal in St. Louis over two inches, and not two inches and under unless burned in a stoker. It is serious beyond anything I can express, it seemed to me, and that is why I had the temerity to come and ask your President to talk to you, for I know some of you Illinois boys know as much about it as I do but some do not. A lot of you northern Illinois Operators are as much interested as we are in southern Illinois, for if thrown out of the St. Louis market we will go up there and be your competitors, and will have to place three million tons of coal that are going into St. Louis, coal that has satisfied the people there for a century.

We are not in any way taking the stand we are against smoke abatement. The very fact that we have spent millions of dollars for preparation plants—my company spent a half-million dollars for that as our contribution to St. Louis smoke abatement long before the politicians in St. Louis thought anything about eliminating smoke.

They say this proposition of educating the people to burn the coal is all out. In Chicago, look at your stacks. That is what we asked them to do down here. Here they do not care about the stacks, but go in the basement and say: "You have Illinois coal, take it out." They do not wait until it makes smoke, but say: "Take it out of the basement, we will not let you use it."

That is the situation. It is just another offspring of all this haywire stuff that has been coming out of Washington. They would not have thought about this four or five years ago, but they have ideas now. They say: "To h—— with the people. We will cater to the poor fellow," and he does not give a continental about smoke. That is how poorly they have analyzed it.

The people who want smoke abatement most already have oil burners or stokers or gas furnaces. But the poor fellow on whom they are depending for their votes is the one who is being crucified, and I am here to tell you if you let them enforce this one hundred per cent this winter, Bernard Dickmann will not be elected Mayor next April in St. Louis. That is as sure as shooting. Those are the fellows, the 175,000 negroes and poor whites down there that are still using stoves.

One fellow came to me the other day — three of them, in fact, working in the garage where I keep my car — and said: "What are we going to do?" They are people who bought it by the basket, some of them. They say: "How will we pay $7.50 for coal when we only get $15.00 a week?" I said: "It is your own fault." I made a political speech. I said: "You niggers jumped over the traces and went with this gang, you fellows that ought to be indebted more than anybody to the Republican party went to this gang and all voted for it."

I would like to hear a lot of discussion about this before you pass the resolution, but I am so deadly in earnest about it that I feel you ought to be. I just can't say enough. I could talk until long after we get to Louisiana if I did not consume too much time. But something has got to be done.

There is one phase I did not touch upon, and that is the legal phase. We do not know whether we can knock this out legally. We do not know what the Courts will do. If we take it far enough from the St. Louis Courts, maybe we can do something with it.

We do not know yet what can be done. We are making a careful analysis of it, but we will not do what they did, study the proposition a week or so and take snap judgment. When we take it into the courts we will take it through, but we want to know we are right first. If we can get public sentiment with us, especially over in Illinois — personally I do not care if they call it a boycott. It is being spread in Illinois lately. I know a salesman for Hibbard-Spencer, who sells hardware down there in competition with Norvell Shapleigh, who tells me his business increased three hundred per cent since they cut us off.

But I do think if you fellows have enough interest in it, every one of you should take it back to your respective towns. I have plenty of these here. Get your local Chamber of Commerce to send this thing in, and just flood them with it.

I resigned from the Chamber of Commerce — maybe I am talking too long. Anyhow, the Chamber of Commerce of St. Louis, the Board of Directors, has sixty-six members. Twenty-eight members were present at the meeting. Bernard Dickmann opened the meeting, and this banker Ford made a speech and told them how fine it was. The Chamber of Commerce put it to a vote, these twenty-eight members, and they said yes and nobody said no, and the papers came out that the Chamber of Commerce unanimously adopted the ordinance. What will we do when the papers perform like that? It is hopeless.

The only thing we can do in Illinois — all we got in so far is what we got in the Illinois papers which we shipped into St. Louis. We cannot get it published in St. Louis at all.

I would like to hear some discussion about this thing. Maybe somebody has some idea I haven't got, but we are fighting a battle for our lives down there.

* * *

Mr. T. J. Thomas (Valier Coal Company, Chicago): I would like to ask a question about that. If what you say is correct, insofar as it relates to price of Illinois coal and Arkansas coal, and this winter the people of St. Louis will find they have to pay \$2.00 or \$3.00 a ton more for this coal they have been told they can get for somewhere around \$5.00, won't this ordinance fall of its own weight then?

Mr. Hitt: I think that is what the St. Louis papers would like to have to stick on against Dickmann, for they are after him. They would like to beat him.

Mr. Thomas: What do you think about it?

Mr. Hitt: I think Tucker is a crusader now, and will fight to the finish. I think he is terrifically worried and this fellow Jim Ford is too. We do not pay much attention to him. He is a coal expert, probably as good as he is a banker, but he is a coal expert.

Mr. Thomas: On the other hand, wouldn't they like to publicize the fact the Illinois Coal Operators are to blame for their price?

Mr. Hitt: We cannot do that, for all we have to say is: "Here is the price of our coal. Here is what you can have it for if you let us bring it in."

Now, the City of St. Louis within the last two days has asked the Council for $300,000.00 as a revolving fund. If these dealers won't put it in, they say the City of St. Louis will buy this Arkansas coal, bring it into St. Louis and sell it to coal users, take their money and then buy coal again. They will go into the coal business, in other words.

Mr. Thomas: That is exactly what I was going to ask. Is the City itself going into the coal business?

Mr. Hitt: That is what they propose to do as an emergency effort when they cannot get the coal. I wish when they come to us this fall and beg us for coal we could say: "We have our coal sold somewhere else." Of course, we can't do that, but I would like to.

Mr. J. A. Jefferis (Illinois Terminal Railway Company, St. Louis, Mo.): Mayor Dickmann declared this an emergency measure, and they are apt to call it another emergency measure this fall when they want this coal.

Mr. Hitt: They called this an emergency measure for one sole reason. Under the St. Louis statute, I guess you call it, the City Laws, you cannot present any ordinance passed by the Council in St. Louis to a referendum if it is an emergency. That was done for the sole and only purpose that instead of getting the three thousand names on the petition we have to get a certain percentage of the last registration, which would be twenty-five thousand, and which we can do if necessary. If it went to a referendum today with all this fanaticism they might lick us. If we let them suffer awhile we can lick the tar out of them.

Mr. Jefferis: You did not explain how the coal men were given a chance to answer. Tell how long you were given after their month of going into it with the special experts.

Mr. Hitt: They asked us to present our case. We said we would be glad to. They said: "We want you to present it in writing." We presented it in writing. Mr. Ford said to us: "Now, don't give this to the Press. We will give this to the Press."

We waited forty-eight hours and the Press did not get it, and we gave it to them, and we got nothing in the Post-Dispatch, and a couple of inches in the Star-Times, and a little in the Globe-Democrat. Then the next day the ordinance was passed, and we never got an answer to our argument. We never had it brought back to us with the statement: "You are all wet," or anything, but they just passed it. That is all the consideration we got.

Mr. A. E. Pickard (The Tamping Bag Company, Mt. Vernon): What can they do with the public if they use the Illinois coal as it is?

Mr. Hitt: They cannot do anything to us. We can sell it to the dealers at the mine, but the dealer cannot receive it.

Mr. Pickard: How will they control interstate shipment? Have they privilege and right to build up a wall around the State and say you cannot ship it in?

Mr. Hitt: That is the trade barrier thing we are talking about. We know it is all hay-wire, but that is what they are doing. He had served notice on all carriers of St. Louis —they had it at the end of the Free Bridge, and I have seen sixty cars pass me going across the river — trucks of coal. They cannot weigh any trucks that come across the bridge that have coal in them over two inches.

Mr. T. J. Thomas (Valier Coal Company, Chicago): I understood they are predicating this on public health.

Mr. Hitt: Yes, We presented statistics in our argument to show that from throat diseases which they said were affecting all of them, St. Louis has a better death rate than either Washington or Philadelphia, both of which burn entirely smokeless fuel. That is how much there was to that.

Mr. Thomas: Of course, on throat and lung diseases the doctors officially prescribe creosote.

Mr. Hitt: Take the automobile exhaust, that causes more physical ailments than smoke.

Now, if some one will second that motion, I would like to see the resolution adopted.

A Voice: I move the adoption of the resolution.

President Adams: Before we proceed with this resolution, let me say this, that the Illinois Mining Institute is composed of more than seven hundred members. We today represent only about one-seventh of that seven hundred.

Further, this boat trip is simply an outing at which time we have never taken up consideration of questions of this kind and put the Institute on record. I would hesitate to submit this resolution to so small a representation of the Institute, because we immediately throw ourselves open to criticism from the other six hundred who are not here.

Mr. Hitt: I do not think this is a time to be technical. You say this is a pleasure trip. I thought this was a business meeting today. That is what I came for, to listen to a business meeting.

I do not think this is any time to be technical about the thing.

President Adams: I am not being technical, Mr. Hitt, and am in sympathy with what you have said. But as President of the Institute I feel it would be highly improper on my part to permit a resolution on a controversial matter to be voted upon at a meeting of this kind, and this is not a business meeting. We have conducted no business here today in either session.

I am sincere in saying that I think it would not be proper for us to pass this resolution at this time and at this meeting. With all due respect to you and to those who sympathize with this resolution and are ready to vote on it and vote for it, I do not think it can properly or should properly come before so small a representation of the Institute.

Mr. Hitt: With your permission, I would like to have some more discussion on it.

Mr. T. J. Thomas (Valier Coal Company, Chicago): Would it be possible through the Secretary—how long would it take to arrange for a mail vote?

Secretary Schonthal: If the membership would act promptly, we ought to be able to get it within a week.

Mr. T. J. Thomas (Valier Coal Company, Chicago): If they did not answer, they would not vote.

Secretary Schonthal: I could get out a copy of the resolution and a letter on Tuesday, and it would take a week to get it back if they act promptly.

Mr. Hitt: The unfortunate feature of it is if my argument here may not have meant anything to any of you, the other five hundred and ninety-five members have not heard it.

President Adams: They would have an opportunity to read and study the resolution.

Mr. Hitt: But it takes a good deal of explanation to go along with it and make them see how very vital it is.

Mr. J. A. Jefferis (Illinois Terminal Railway Company, St. Louis, Mo.): What member could or would object to it?

President Adams: That is not for me to say, Mr. Jefferis. I don't know. If it was submitted to the entire membership, I think probably we would not have a dissenting vote. On the other hand, I do not propose to be left holding the bag if we should have a load of objections to a resolution that a few of us passed here on this boat trip.

Mr. Hitt: I resigned from the Chamber of Commerce because they took that action.

Mr. Howard Lewis (Old Ben Coal Corporation, West Frankfort): If we did vote on that now, would we not be in the same position as the Chamber of Commerce, when twenty-eight members voted on that with a membership of sixty-six? Would we not be in the same position as this gentleman referred to in the St. Louis Chamber of Commerce?

President Adams: It seems to me we would.

Mr. Hitt: Definitely we would not. Those twenty-eight members were of the Board of Directors. This is not the Board of Directors. This is all the enthusiastic members who make this thing a success. This is not the Board, but the membership. The membership never got it in the Chamber of Commerce. It was this hand-picked Board of Directors. There were only twenty-eight of the Board voting.

President Adams: I have tried to explain that the business meetings of this Institute are always conducted in the Fall of the year, and for the more recent years in the meeting in Springfield. I have no objection to an expression of sentiment on this resolution by those of you who are here. But I do object and will not present the resolution and have it go out to the Press as an action of the Illinois Mining Institute in regular business session, because that would not be the truth.

Secretary Schonthal: It will not take long to put this to our membership. I think it will be a lot better if we can say in a letter attached to the resolution that today the majority of the members of the Illinois Mining Institute, composed of approximately seven hundred members, are in favor of this resolution, than it would be if some one asked how many attended the meeting and the answer was one hundred and five. I do not think the thing has to be handled today. I believe it could be handled in a week or ten days just as effectively as now.

Mr. Hitt: Let's do it this way, then, that we adopt this resolution subject to communicating with the membership, and then when you present this to those fellows, say a meeting composed of one hundred and five members unanimously adopted it and took it to the membership, and a majority of them adopted it, but not present what we do here until we get the word.

Secretary Schonthal: Don't you think it would be better not to adopt it today, but in the letter to the members say to those not on the boat this resolution was presented, and in order to give the entire membership an opportunity to study it —

Mr. Hitt: Let me withdraw my resolution, with the consent of the second, and make this resolution, with your permission:

"Resolved, That it is the sense of this Meeting that this resolution should be passed, and that it should be presented in writing to the entire membership for their vote."

Secretary Schonthal: I will second that motion.

President Adams: The motion has been made and seconded. Will the Reporter please read the resolution?

(Resolution read by the Reporter.)

President Adams: Is there any discussion on this resolution as presented?

Mr. Hitt: I presume there can be a motion presented after this is voted on, but before we leave I think it would be fine to have Dr. Leighton tell us briefly, if he wants to, about what he has done to get the spending of that $180,000.00 toward briquetting Illinois coal.

President Adams: Let's dispose of the resolution. We will hear from Dr. Leighton, if he cares to speak on this resolution. Do you care to speak on the resolution?

Vice-President Leighton: Not on the resolution, but I will be glad to speak on the subject suggested.

President Adams: If we are going to convert this into a business meeting, let's make it business-like. Let's dispose of the resolution. Are you ready for the question?

Voices: Question Question!

(Whereupon the pending motion was unanimously adopted.)

President Adams: The motion has been adopted unanimously. Dr. Leighton.

Dr. Leighton: I might say it seems to me this resolution is a very reasonable one. It is very well set up. I think it states the case very well.

I attended a large number of these meetings. That committee was a hard working committee. That committee was working under a very definite impression that the people of St. Louis wanted the smoke eliminated in the City of St. Louis.

When that committee was appointed, Mayor Dickmann asked me to be a member. I told him it was not possible for me to accept membership on the committee, that I thought it was evident it wasn't possible for me to be a member of that committee. He said: "Well, that isn't what we want. We want from you research advice." I said: "All right, I will be glad to serve as research adviser," which was what he wanted.

Dr. Buehler, the State Geologist of Missouri, likewise was asked to serve as research adviser.

Throughout it all, my stand on the matter was this: "Let's take this thing in stride."

In the case of stoker coal, there can be no complaint of the smoke nuisance. Stokers now burn Illinois coal very efficiently. As a matter of fact, we regard Illinois stoker coal as a superior stoker coal, and we have good reasons for it, good scientific technical reasons which some of you have already heard.

In the case of those industries of St. Louis that are burning coal with equipment which is antiquated and is creating or helping to create the smoke nuisance of St. Louis, there is where the ordinance should first be applied. All industries can afford to install stokers. Everyone knows that it is more economical to burn Illinois coal completely and not let part of that coal go out of the chimney.

The same is true of the apartments and the larger residences. Insist, I told them, upon them installing stoker equipment, and that will solve the smoke nuisance from those premises.

But when it comes to the poor people, I said: "Be careful, and take that in stride." I said: "You have asked the State of Illinois to appropriate money. The first amount was \$300,000.00, and the Governor reduced that to \$180,000.00." I said: "You have requested the State of Illinois to carry on research work in order that Illinois coal can be burned smokelessly and we have in mind the poor people. We are going ahead with the proposition. We are keeping faith with you. We are making progress on this matter. Let this be taken in stride." That is my stand on this.

Another aspect of that was this. Back in 1931 we began our study of the making of briquettes from Illinois fines. You will recall at that time there was a great deal of waste fine coal because of the market conditions. Our thought at that time was that if briquettes could be made of those fines it would be an economy for the industry and would help promote its marketing. Our first studies showed that it was possible to briquette Illinois fines without using a binder, by using a substance within the coal itself under certain temperatures and pressures.

When we found that was possible, then we took the next step, namely the making of smokeless briquettes, because if a binder such as tar is used in the making of briquettes, the smokey characteristic of the fuel is simply enhanced.

So we proceeded to make a study of the making of smokeless briquettes, and we found this. We found if Illinois coal is heated to a temperature of 470° Centigrade about ten minutes, and the volatile matter is driven off which makes the smoke, and then subjected to a pressure of thirty thousand pounds per square inch, excellent, sound smokeless briquettes having a smoke index less than the so-called smokeless coal of the east could be made. We have a great deal of laboratory data on that, but we progressed still further.

We discovered that in the case of de-duster dust such as is produced in some of the Illinois mines, it was not necessary to drive off any of the volatile matter, that that de-duster dust contained enough of what we sometimes call natural charcoal — you have heard me call it fusane, which has a composite which approaches anthracite — we found that that could be heated only to a temperature of 400° Centigrade and briquetted, and would make smokeless briquettes. There was an opportunity for commercial briquetting, we felt.

Since this time another step had been taken, another discovery had been made, and that is this, that the finer sizes of carbon coal, particularly in the Belleville district, does not need to be heated before briquetting, but can be briquetted at room temperature under a pressure of thirty thousand pounds per square inch, and produce briquettes not quite so firm as the other, but firmer than most of the briquettes put on the market, and firmer than the natural coal, and having a smoke index less than that of Pocahontas coal.

In other words, we have carried this thing up to the point it looks as if it will be commercial.

With the approach that has been made, we now have a briquetting machine built. This process is an entirely new process. The machine is one of an entirely new design. It is a rotary process of briquetting. It is being built by the J. T. Devine Manufacturing Company of Mount Vernon, Illinois, where they have a very fine staff of engineers. I was just talking yesterday to the Chief Engineer, and he told me they now have almost all of the component parts of the machine, and in about two or three weeks they will be ready to fabricate the machine. We expect that machine will be ready to try out, ready to turn over early in July, and by the time our new Research Laboratory is built in September we will have had time to iron out any bugs that may develop in it.

We are counting upon there being bugs in it that will have to be ironed out, and I think you will agree with me that is the thing to do now, count on such things, for in the case of new equipment the human mind cannot immediately vision all the intricate relationships of such a machine. We will have it done by September, when this laboratory will be completed, and at that time the machine will be transferred to Urbana to this laboratory, and this Fall, as we have always stated all along, we expect to schedule these demonstrations.

In other words, we are proceeding in good faith with the City of St. Louis in this matter. I remarked to someone today noon that these things cannot be developed all of a sudden. It takes time for them to develop. It takes time for them to become commercialized. That is the way things develop substantially.

The briquetting will start in a relatively small way, and as money is made and others see money is being made, it will grow. In other words, we must take these things in stride. We are working upon the principle that time will enable Illinois coal to be burned smokelessly, not only in the industries, not only in the apartment houses and larger homes, but can be burned in the small stoves of the poor people.

Further, we also have in mind this matter of a device, a stove device of a kind that will burn coal smokelessly. These briquettes, mind you, that we are working on are those that have a smoke index equal to or less than the smoke index of Pocahontas coal.

We feel there will be a very much wider approach eventually than just the St. Louis market. In the case of Chicago, the Illinois coal industry has lost more than five million tons of market to the eastern more volatile coal. Why? Because they are insisting upon reducing the smoke there. We feel we are definitely moving toward an objective of increasing the market for Illinois coal by putting it on a basis that will compete with the coal of the east.

* * *

Mr. Hitt: Just one word. I want to say Dr. Leighton's statement to the Smoke Elimination Committee was exactly our statement to them. We are exactly together on it. We asked for time for him to finish his job, but they did not give us the time.

President Adams: We are now pulling in to Louisiana. The boat will leave promptly at 5:00 o'clock. Bear that in mind, and be back at 5:00 o'clock sharp.

The Meeting is adjourned.

(Whereupon, at 4:15 o'clock P.M., President Adams declared the Meeting to stand adjourned sine die.)

# PROCEEDINGS OF ILLINOIS MINING INSTITUTE FORTY-EIGHTH ANNUAL MEETING

Held in Springfield, Illinois

FRIDAY, OCTOBER 25, 1940

## MORNING SESSION

10:00 O'clock A. M.

President Adams: Will you please come to order?

We are delighted with the wonderful turnout this morning and your evident interest in the program of the day. We want to move along with as much dispatch as we can, because we want to take time out this afternoon for the funeral of Mr. Sam Wills, and for that reason we may carry the morning session a little longer than we would otherwise.

Those of you who have not already obtained your tickets for the banquet tonight, please do not delay the matter beyond the conclusion of the morning session. The management of the hotel, of course, is anxious to know how many people will attend the banquet at the earliest possible moment.

In reference to the session this evening, it is possible if it is the will of the Institute that we will arrange for a broadcast of Mr. John L. Lewis. Of that we are not sure just yet, but we think it would be possible for us to do that and still not carry the evening session to a late hour. Certainly no later than usual.

Now, we want to go directly into the business part of our session, so as to get that out of the way for the papers and discussions which follow. The first item of business will be the report of the Secretary-Treasurer.

Secretary-Treasurer Schonthal: Mr. Chairman and members, the Secretary has but little to report, for fear that he might bore those in attendance. I might say that while it may appear to our membership that there has not been a great deal of activity, this is in error — because, as a matter of fact, the Institute has been quite active in endeavoring to lay plans that will work out in the near future.

In addition to many matters that have been decided by the Executive Board, the Secretary's Office has been quite busy throughout the year, sending out various important notices. It may be of interest to you to know that approximately 7,000 pieces of mailing matter were sent out of the Secretary's office during the year. This means circularizing matter only, and does not include the general correspondence, of course.

We furnished, in September, prizes for first, second, and third place to First Aid Teams for the *only* First Aid Contest held in the State of Illinois this year. And I might add these prizes are available to any organized district First Aid meeting held throughout the State from now on.

We contributed to the cost of an illuminated relief map of the minerals in the State of Illinois, prepared by and on exhibit at the Museum of Science and Industry at Chicago. We also participated in the Red Cross Drive.

Our membership has held up quite well, despite conditions. We have approximately 700 members, all in good standing. This includes 75 new members. We are looking for considerable activity in that particular quarter during the coming year.

All committees have functioned well and are laying the foundation for greater activities during the coming year.

During the past year we have had the misfortune to lose four of our regular members:

Samuel Hantman died
September 13, 1940

Simon A. Boedeker died
October 12, 1940

John H. Davis died
October 21, 1940

S. J. Wills died
October 22, 1940

Letters of condolence were dispatched to the families, as is our custom.

I wish to take this opportunity to thank the officers and members of the Executive Board for their help, interest, and cooperation throughout the year.

Now, the report of the Treasurer, the financial statement, is as follows:

| | |
|---|---|
| Cash on Hand | $2,381.29 |
| Receipts for year | 7,074.22 |
| Total | 9,455.61 |
| Disbursements | 6,725.72 |
| Balance | $2,729.89 |

In addition to this, we have on hand the following:

| | |
|---|---|
| U. S. Government Bonds | $8,000.00 |
| C. B. & Q. Bond | 1,000.00 |
| Missouri Pacific Bond | 1,000.00 |
| | $10,000.00 |

This report is signed by the Auditing Committee, consisting of H. A. Treadwell, Chairman, J. A. Jefferis and W. J. Austin.

Mr. G. M. Glidden (E. D. Bullard Co., Chicago): I move the report be seconded.

(Which said motion was duly seconded.)

President Adams: Motion made and seconded that the Secretary-Treasurer's report be approved.

(Which said motion was unanimously adopted.)

President Adams: We will now have the report of the Nominating Committee.

## REPORT OF THE NOMINATING COMMITTEE

Secretary-Treasurer Schonthal: (reading)

"The undersigned, appointed by you to membership on the Nominating Committee, have unanimously agreed to recommend to the membership the nomination of the following members for the offices shown:

For President: Dr. M. M. Leighton, Illinois State Geological Survey,

For Vice-President: Mr. J. A. Jefferis, Illinois Terminal Railroad System,

For Secretary-Treasurer: Mr. B. E. Schonthal, B. E. Schonthal & Company.

There are four to be elected for a three-year term to membership on the Executive Board. The Nominating Committee recommends the nomination of:

Mr. J. G. Crawford of the Valier Coal Co.

Mr. Byron Somers of the Truax-Traer Coal Co.
Mr. Clyde Woosley of the Pyramid Coal Corp., and
Mr. Howard Lewis of the Old Ben Coal Corp.

Respectfully Submitted,
Paul Weir, Chairman
John R. Foster
J. M. Johnston

Mr. F. S. Pfahler (Superior Coal Co., Chicago): I move you that the report of the nominating Committee be accepted, and that the Secretary be instructed to cast the ballot of the membership.

(Which said motion was duly seconded.)

President Adams: The motion has been made and seconded that the report of the Nominating Committee be accepted, and the Secretary instructed to cast the unanimous ballot. Are you ready for the question?

(Which said motion was unanimously adopted.)

President Adams: The motion is unanimously adopted.

Secretary-Treasurer Schonthal: And the ballot is cast.

President Adams: And the ballot is cast.

We have some communications that we will hear at this time.

Secretary-Treasurer Schonthal: I have a telegram from Julian D. Conover, Secretary of the American Mining Congress, Pittsburgh, Pennsylvania, as follows:

"Roy L. Adams, President
Illinois Mining Institute,
Hotel Abraham Lincoln

"The members, officers and staff of the American Mining Congress extend hearty congratulations and good wishes to the Illinois Mining Institute upon this, the occasion of your Forty-Eighth Meeting. The excellent work done by your organization is a real aid to the cause of mining and we greatly appreciate your cooperation in national affairs. Long live the Illinois Mining Institute.

Julian D. Conover, Secretary
American Mining Congress"

I have a letter here from George F. Campbell, Vice-Preident of the Old Ben Coal Corporation, as follows:

"October 23, 1940

"Mr. R. L. Adams
West Frankfort, Illinois
Dear Roy:

"I had hoped to be able to attend the 48th annual meeting of the Illinois Mining Institute on Friday, October 25. However, I have some things going on that will keep me in Chicago and I regret having to give up this meeting.

"With every good wish for a successful program, I am

Sincerely,
Geo. F. Campbell"

I also have a letter here from Marc G. Bluth, of the Chicago office of the National Coal Association, calling attention to two or three things I would like to present. It isn't very long. It is addressed to me, and is as follows:

"Dear Mr. Schonthal:

"At your meeting at Springfield this week I hope that your Resolutions Committee will give some serious attention to three major problems facing the coal industry, not only in this state but the industry on a national basis as well.

These three problems are:

"First, the construction of proposed natural gas pipe lines from Kansas and Texas into Wisconsin and from Texas into New Jersey, Pennsyvania and New York. Both of these markets are vast and important coal consuming markets and the Wisconsin market is an especially important market for Illinois.

"Second, the Federal Mine Inspection Bill. As you know, our Association has led the fight against the passage of this legislation. You are familiar with all of its features and the basis on which the coal industry and others have opposed this measure. I hope that a strong resolution by your Institute will be adopted at your meeting.

"Third, the proposed St. Lawrence power project and waterway. I am enclosing a copy of a press release which our Washington office issued on October 21st and which outlines the dangers existing in this proposal from the standpoint of the coal industry. As you have perhaps noticed in the newspapers, the President is seeking to proceed with this project without Senate ratification. This means, if it eventually is placed into operation, displacement of many millions of tons of coal for electric generation purposes and we are utterly opposed to this action.

"I am writing you because I will be unable to attend the meeting in Springfield on Friday. I shall be in Madison, Wisconsin, attending the hearing before the Federal Power Commission of the applicants who propose to build a natural gas pipeline into that territory.

"All of these three suggestions involve the very bread and butter of thousands of Illinois miners, as well as people in other capacities in our industry, and I hope that you will pass these suggestions on to your Resolutions Committee for their careful and earnest consideration.

Yours very truly
*(Signed)* Marc G. Bluth
*Manager Chicago Office*"

President Adams: This communication will be presented to the Resolutions Committee for their consideration.

We are now ready for the report of some committees which have been working throughout the past year. The first is the Roof Hazard Committee, which has been very active, and Mr. J. E. Jones, the Chairman of that committee, will give the report now.

Mr. J. E. Jones (Chairman, Committee on Roof Hazards): Mr. Chairman, since my report to you at our semi-annual meeting on the boat, I have again contacted the Director of the United States Bureau of Mines upon the problem of a scientific study of the knowledge of the looseness or tightness of rock. He informs me that the Bureau is very keenly interested in this work, but that owing to the great problems now facing them, active work on this problem has not yet begun.

The Committee, by correspondence, has given some study to this problem, has collected data, has collected advertisements with regard to sound apparatus for various causes. The Committee is not yet ready to report on its findings.

Since our last meeting, the Primer has been printed. This Primer, you will recall, was distributed at our last semi-annual meeting. This

Primer was printed in pocket size pamphlets, and was available to those who wanted it for distribution. Some six thousand copies were printed, and I understand they are nearly all gone.

This, I think, is all I have to say on behalf of this Committee, Mr. Chairman.

President Adams: I am sure you will understand that this is merely a progress report of this Committee. They have by no means completed their work, as Mr. Jones implied. In all probability this work will go on over a period of years.

Another committee which has been active during the past year is the Committee on Vocational Education. Dr. M. M. Leighton will give you the progress report of that committee.

Dr. M. M. Leighton (State Geological Survey): Mr. President and gentemen, the Committee on Vocational Education consists of your President, Mr. Adams, Mr. F. A. Miller, and myself.

The Committee has secured extensive information from Pennsylvania, West Virginia and Ohio on vocational education for coal miners which has been carefully studied. It has taken the matter up with Honorable John J. Hallihan, Chairman of the State Board of Vocational Education; it has conferred in still greater detail with Mr. C. A. Bell, Director of Vocational Education and Mr. J. W. Thompson, Supervisor; and it has submitted a proposed budget for State appropriation to Director Bell for his further consideration in including it in the budget for State appropriation.

The Committee finds that last year Pennsylvania conducted about 100 classes in 75 centers, with about 2,000 men enrolled and with two full-time supervisors and about 100 part-time local instructors. West Virginia: 52 classes, 1,737 men enrolled, nine full-time instructors, and three part-time instructors. Ohio: About 10 classes, 350 to 375 men enrolled in the autumn quarter, two full-time instructors.

West Virginia has conducted these classes for twenty-five years and Ohio for more than fifteen years. We do not have definite information on this point from Pennsylvania, but the work has been well established there for many years.

In general the courses cover such subjects as mine gases, safety lamps, mine ventilation, mine fires and explosions, explosives, haulage, drainage and pumping, mining methods, coal geology, timbering, waste in coal mining, mining electricity, mining arithmetic, State mining laws and foremanship. The curriculum usually runs for three years of thirty-three to thirty-six weeks' instruction, the classes are conducted at night and in the afternoon to accomodate men working on both the day and night shifts, and each class meets once each week.

Text material has been developed by all three States and by the Federal Board for Vocational Education. However, it would be advisable to have qualified persons adapt such text material and other material to the needs in this State.

In Pennsylvania these classes operate under the Smith Hughes' plan, and the work is handled by or through the Mineral-Industries Division of Pennsylvania State College. In West Virginia it is handled by or through the Mining Extension Department of West Virginia University. In Ohio it is handled by or through the Department of Mine Engineering of Ohio State University. We gather that the teachers are selected and nominated by these Departments, certified by a State Department corresponding to our office of Superintendent of Public Instruction, and the funds dispensed by the State Board of Vocational Education, and that the courses are outlined and directed by the University Departments.

From the foregoing it is seen that the opportunity for vocational education has been extended to the miners in Pennsylvania, West Virginia and Ohio for many years; that in Pennsylvania and West Virginia the enrollment is very large — amounting to 1,700 to 2,000 men — and in Ohio, 350 to 375 men; that the work has apparently been in excellent hands and has succeeded in admirable fashion; and that the work on the whole has been well supported.

Illinois ranks second only to Pennsylvania and West Virginia in the number of men employed and the annual production of coal. Furthermore the mines of Illinois are the most completely mechanized of those in any coal producing State of the nation. We have more than 42,000 miners as compared with 134,000 in Pennsylvania, 114,000 in West Virginia and 30,000 in Ohio.

We expect to obtain the cooperation of the University of Illinois in providing a professor who will set up the text material and help coordinate the quality of work given in various places over the State, working in informal but close connection with the Supervisor in the office of the Superintendent of Public Instruction.

In order that the organization might be perfected and all details attended to prior to September 1, 1941, it is suggested that the supervisor and the cooperating professor of the University should start work early in the year so that text material, instructors and equipment will be arranged for in ample time to permit the work to begin promptly at the beginning of the school year.

President Adams: Another matter which has had the attention of your officers during the year is that of scholarship, sponsored by this Institute in the University of Illinois Mining School. Considerable study has been made of this matter. However, the officers are not ready to make a report to the Institute at this time, because of the presence of so many things that have been coming up not only with reference to the Institute but with reference to our individual jobs, which has made it impossible to bring this matter in in the form we wish to bring it before the Institute at this time. I do not want to say, however, that the matter is shelved at all, but will continue to have the consideration of the officers of the Institute until a very definite workable plan has been evolved and presented to this Institute.

Is there any unfinished business that should come before us at this time? Is there any new business? If not, we will proceed with the printed program. And because we want our newly elected President to begin getting his experience as early as possible, we have asked him to preside over this portion of the program. Dr. Leighton will take the Chair.

Vice-President Leighton: Mr. President and members of the Institute, permit me to take a moment to tell you how deeply gratified I am over election to the presidency of the Illinois Mining Institute for the coming year. I do not know when anything has made me happier than this election. I consider it a great honor to be made President of this splendid Miinng Institute.

We will proceed with the program with the same dispatch, because of the objective we have in mind of the funeral of our esteemed late member, Mr. Sam Wills. And may I suggest we want discussion of these papers? They are very pertinent papers. And may we be ready with our discussion, so that the time can be well utilized?

Our first paper is a very important one, and it comes from a member of our Institute whom we all know and whom we respect for his training and experience. The subject is "The Importance of Efficient Ventilation," by Mr. Charles Pullen of the Chicago, Wilmington & Franklin Coal Company, West Frankfort, Illinois. Mr. Pullen.

# THE IMPORTANCE OF EFFICIENT VENTILATION

By CHARLES PULLEN

Chicago, Wilmington and Franklin Coal Company, West Frankfort, Ill.

The importance of efficient ventilation is not a controversial subject although the method and the ways and means of establishing and maintaining that efficiency may be as widely diversant and debatable as there are conditions and characteristics throughout the length and breadth of the mining industry. We may argue methods of obtaining the highest efficiency but cannot deny its importance.

In the following comments I intend to deal only with the importance of efficient ventilation from three different viewpoints. We must have,

1. Safe mine operation.
2. A sufficient amount of fresh air for the workers to eliminate unnecessary fatigue and promote efficient performance of their duties.
3. A ventilating system easy to control, low cost operation and with which emergencies can be met as they occur.

Without going into methods or offering any solution to the much debated question of how to properly or efficiently ventilate a mine, or without reference to advantages or disadvantages of the use of multiple air courses, or the relative merits of exhaust or blower fans, it is needless to say that it is of prime importance to have a sufficient volume of air flowing at the necessary velocity to properly control dust and dilute and carry away all emissions of gas. The physical characteristics and local conditions of a mine will determine the amount of air, the pressure and velocity needed, to meet the above requirements. This means crosscuts should be driven at the right location, wide enough to handle the ventilating current, kept clean and free of refuse or other materials. If bad roof is encountered at the normal location of crosscuts then they should be driven outby instead of inby the normal location. When necessary to use a line curtain it should be stretched tight and extend from the roof to the floor making a smooth firm surface so that there will be the minimum of resistance and allow free flow of the air to where it is being conducted. Particuar attention should be given to the space between the line curtain and the rib. This space must not be choked with coal, gob or other material, which would retard the flow of air. Failure to observe these fundamental principles of efficient ventilation will create a dangerous condition.

Mining has always been considered a more or less hazardous occupation, and although persons are still killed by toxic and noxious air in mines, due to explosions, fires, dusts, and excessive heat, present conditions are much better than those prevailing during the early days of mining. Up to the present, ventilation has been supplied to underground workings mainly to dilute toxic gases and remove dust; and to prevent accumulations of explosive gas mixtures, with an occasional attempt to minimize the ill effects of high temperatures and humidities. In addition to temperature and humidity there are, however, other factors needing attention, such as general foulness of the air due to decaying organic matter and emanations from the lungs and bodies of workers and animals. Where men are employed under ordinary mining conditions, and where there is an absence of fresh air due to the presence of men and animals, it is of the utmost importance to provide efficient ventilation to remove the foul air. In addition to the above little considered source of air contamination there are naturally the more obvious and generally known hazardous conditions that result from the presence of gases and dusts, which conditions can and should be controlled by effective ventilation

One of the principal problems confronting mining men is the control of dust in the mines so that it will not be a menace to the workers or the property. The solution can be accomplished by giving real attention to efficient ventilation. The air in mines should have the approximate composition of outside air. No money expended brings better returns than the investment made in establishing and maintaining a first class system of ventilation.

In most states the quantity of air used in ventilating mines is regulated by law. In Illinois the requirement is 100 cubic feet per minute per person and 500 cubic feet per minute per animal measured at foot of the downcast and of the upcast, except that in gaseous mines there is to be not less than 150 cubic feet per minute for each person in the mine. However, in some states the requirement is indefinite and worded as follows, "Operator must furnish good ventilation," or "sufficient current of fresh air for health and safety of the miner."

Ventilation is the process of supplying or removing air to or from any space by natural or mechanical means. Ventilation of underground workings is that process plus the establishment of such control of air currents, that employes may work in safety, with maximum comfort and efficiency; that the air flow in mine openings may be subject to enough control to remove harmful gases and dusts from the workings at ordinary times; and that in an emergency, such as fire or explosion, as much or as little air flow may be maintained as desired in part of the mine or in the entire mine.

Much has been said and published about the efficiency of fans for the ventilation of mines, and too little stress has been placed on what is necessary to make efficient, flexible and economical mine ventilation possible. It is true that we must have efficient fans, but at the same time we must not lose sight of the importance of having efficient airways. All experienced operating men know what the mechanical efficiency of a fan means but few have given thought to the ventilating efficiency of a mine. Whether in gaseous or non-gaseous, in hand loading, in partly or completely mechanized mines, proper ventilation is the major duty of an operator. The high ranking position of ventilation can be fully appreciated by the fact that, according to a leading authority, methane emissions have initiated more than half of the explosions in coal mines in the United States. The loss of human lives and the resultant sufferings, and the destruction of property has been tremendous.

It is unfortunate that the power cost of fan operation has not occupied the spotlight more generally and more permanently in the industry. Because fans must run continuously in gaseous mines and frequent breakdowns cannot be tolerated the power costs are accepted as a necessary evil and is probably the reason for the widespread indifference concerning this item of cost.

The general practice to obtain increased air volume is to speed up the fan. Such practice is simple and inexpensive from a labor standpoint. We are all familiar with the ventilating formula that the power required varies as to the cube of the volume passing. This runs into a large amount of money. For example, an ordinary ten foot fan furnishing 140,000 CFM at 1½″ water gauge consumes 44 brake horsepower. Without changing the conditions in the mine it is found an additional 30,000 cubic feet of air is needed to properly ventilate it. This additional air is obtained by speeding up the fan. The water gauge goes up to 2¼″ and the horsepower to 83. There was very little labor expense involved. However, the power consumption per day has been increased about 100%. This increase prevails until we need more air. Then we repeat the process and we get another increase in power cost. This is not efficient ventilation. If we will always remember and realize in order to put a volume of air in the mine by speeding up the fan requires more pressure and more horsepower, I am sure we will look into the reason for needing additional air before shouldering the burden of increased power costs. Investigation will generally reveal that airways are insufficient and choked; that overcasts, regulators, stoppings and doors are poorly installed and maintained. Briefly, correction of these conditions spells the difference between efficient and non-efficient ventilation as well as the difference between low and high cost of power.

Another reason for the general laxity lies in the unfamiliarity of the majority of mine managers with the total investment in ventilating equipment and with the daily expenditure necessary to maintain the air flow in coal mines. This figure can reach a staggering height.

Then, from the economic angle, the importance of efficient ventilation cannot be over-emphasized, and to have this efficient ventilation extensive study should be given to maximum air volume requirement and resistance, roof conditions, timbering requirements, rate of gas emissions and the number and dimensions of airways.

* * *

Vice-President Leighton: You have heard this very valuable and suggestive paper. Let's now have the discussion on it.

I was in the office of Mr. T. J. Thomas, of the Valier Coal Company recently. He had on the wall of his office a map showing the ventilation system of his Valier mine, which was very interesting. I wonder if the representative of that company is here, and would like to discuss this matter? Or are there any questions you would like to ask Mr. Pullen? If not, I think we can take it for granted, Mr. Pullen, your paper is accepted as gospel truth.

Our next paper is on the subject of "Our Experience with Shuttle Car Operation," by Mr. B. F. Burnett, Peabody Coal Company, Harco, Illinois. Mr. Burnett.

Mr. B. F. Burnett (Peabody Coal Company, Harco, Ill.): Shuttle cars are something new, and we have not gone into a discussion of any operation and cost of it. All we have done is show our condition and what we have done . We have limited our paper, as we understand the Joy Manufacturing Company will show some matters in connection with this paper.

# OUR EXPERIENCE WITH SHUTTLE CAR OPERATION

By B. F. BURNETT

Superintendent Mine No. 47, Peabody Coal Company, Harco, Illinois

Our Mine is located in Saline County and we are mining coal in what is known as the Illinois Number 5 seam. In part of our mine the coal seam averages 52 inches in thickness.

Our Company decided to try the 14 BU Joy Loading machine with shuttle car haulage in this 52 inch height of coal. Our first move was, deciding on the plan we should use in working the shuttle cars, then follow up with the preparations for the shuttle car installation.

We decided to work a block of 16 rooms. The rooms were already turned off the entry, width of room necks were from 14 to 16 feet, the room centers were 50 feet, and the width of the rooms to be 28 to 30 feet. Our Division Mining Engineer made a project instruction map of the working plans to be used in working the rooms. Copies of this map were given to the Mine Manager and the Boss in charge of the shuttle car unit so the working plans could be strictly adhered to.

A Joy Heavy duty shuttle car loading elevator was placed in a crosscut, as near as possible in the center of the 16 rooms, this, so as to equalize the haulage from the working places to the loading elevator. On one side of this crosscut a shallow hole was made in the bottoms. The hopper of the loading elevator was placed in this hole, so the top of the hopper would be on the level with the bottoms, this allowed shuttle cars to easily unload on the loading elevator. On the opposite side of crosscut, the roof in front of crosscut was shot down making a high opening in roof, which allowed the other end of the loading elevator to be raised above the mine cars, which would permit us to get as much coal as possible on our mine cars. The rooms outby the loading elevator had the inby corners slabbed off and rooms inby the loading elevator had the outby corners slabbed off. This permitted the shuttle cars to have plenty of clearance to travel in and out of the rooms.

Our haulage road for the mine locomotives servicing the shuttle cars was on the opposite entry from the working room entry. This entry was widened, so two haulage tracks could be laid, one track to be used as a passing track. Two locomotives serviced the shuttle car unit, and by having a passing track, one locomotive could deliver the loaded mine cars to the parting, receive the empty cars, then by using passing track could be in readiness to service the loading elevator when the other locomotive left with his loaded cars, without any loss of time to the loading elevator.

As height of coal was 52 inches, mine cars were 40 inches in height, from the top of rail to top of cars, the haulage entry was brushed. All main haulage roads are brushed so the brushing had to be started at mouth of entry and extend to a distance by the loading elevator. This permitted us to load a much larger car of coal. Electric signal lights were installed, so the loading elevator operator could signal the motorman, servicing the loading elevator, when to move his cars, also when his string of cars were all loaded, so he could leave for parting with his loaded trip.

Two 500,000 c. m. feeder cables, one positive and one negative were installed, battery crane for charging batteries installed, tire pump, 250 volt, 100 lb. pressure, complete with motor and air tank installed, and a battery charging station was located, with all necessary equipment for charging batteries. Rubber tire drill trucks are used for the drillers. Transportation cars for hauling batteries to and from battery station are used.

For making the rubber-tired driller pull trucks, we used a front axle and wheels from an automobile. The trucks are narrowed, so as to fit a 24 inch bed. The trucks were placed under the bed a trifle off center, so as to make one end heavier than the other. A wooden leg was placed on truck bed, so same could be raised or lowered, purpose being so same could be lowered while standing so as to be level. A tongue was built on bed, starting under bed from axle, extending out, curving up, and then straightened out. The tongue was a piece of 1¼" pipe with a short piece of 1" shafting welded on the end of the tongue making a "T." This allowed drillers necessary leverage in handling pull truck. The battery transportation cars were built the size to hold two batteries. The sides and ends of cars were 4 inches high, this helps in taking batteries off or putting back on cars, as batteries would not have to be raised only this height above sides or ends of car. The inside of all cars were insulated.

An added help was made in installing 8 ½ foot cutter bars on our mine cutting machines. This allowed us to get a maximum tonnage from every cut of coal. One 14 BU Joy loading machine, two Joy standard T1 shortwall caterpillar mining trucks, 2 Joy shuttle cars, and 1 Joy heavy duty shuttle car elevator, complete with 2 push button stations made up the balance of the necessary equipment to start the shuttle car operation.

We completed our plans and preparations and started off with our first shuttle car operation. The first day we worked a single shift, starting the second day we started with double shifting. The last two days in working out this territory we worked single shift. Totaling up we had 3 single shifts and 47 double shift operations, in 50 days of mine operation, to work out a block of 16 rooms, each driven to a depth of 300 feet, having an average width of 28 feet with 52 inches average height of the coal.

Methods of charging and handling batteries. The batteries are charged at a central charging station located at bottom motor shop. Charging equipment consists of a balancer set made from two — 25 h. p. Allis Chalmers stationary motors, one reverse current relay, six — Exide M. P. charge control units mounted on panel with two Hartman magnetic switches, suitable resistance for 60 to 12 amp.rate. The above equipment suitable for charging batteries for 6 shuttle cars. The batteries are charged on the transportation trucks. There is a section of wooden track in front of charge panels and in additions to this, the transportation cars are lined with wood to further insulate the batteries from grounding. Battery changing is accomplished in from 20 to 30 minutes with two men, not counting switching or transporting batteries. Each battery change station has two swinging jack cranes with Coffing 1½ ton double chain hoist to lift the batteries from transportation car to platform to shuttle car or vice-versa.

Some of the comparative advantages of shuttle car operation are: There are practically no delays from broken caterpillar chains, from car derailments, from locomotives or from being blocked out by empty or loaded cars standing in way of cutting machine men or drillers. The Joy loader goes from one place to another more quickly because of no obstructions, going thru crosscuts close to working faces. Short cuts are more easily made when there is no track to consider. The loading elevator can in most places be located so the shuttle cars will have the hills in favor of the loaded cars, where there are such conditions. The increase in tonnage helps reduce maintenance costs, both as to haulage and loading equipment. No loss of materials such as rails or ties. Rock falls can be loaded on shuttle cars and unloaded in rooms that are not used for haulage purposes. Mine cars are not subjected to severe service. Rooms can be driven to greater distances by keeping loading elevator advanced which decreases the number of entries to be driven. Our shuttle car operations are producing good tonnage in low coal that heretofore seemed almost impractical to work unless the mine cars could be made much lower, which would reduce the tonnage of the mine, as the mine was hoisting all the mine cars, the hoisting engines could handle.

* * *

Vice-President Leighton: We thank you, Mr. Burnett, for this very interesting paper. I am sure there will be questions on this new operation, and those questions are now in order.

Mr. Norman Prudent: How many men do your work in your unit?

Mr. Burnett: That depends upon the condition you have. It runs from eleven or twelve to eighteen.

Vice-President Leighton: Any other questions? I am sure this paper involves an interesting subject. I am sure there are additional questions you would like to ask. Let's not hesitate, but take this chance now to get any information you would like to have.

A Voice: I am wondering whether the bottom conditions of wet and dry and so forth, what effect that would have on the operation.

Mr. Burnett: We have some things to contend with. We have to change batteries twice a day. We have some places where bottoms are wet, and you have some trouble with that.

A Voice: You work on a maximum of an 11% grade?

Mr. Burnett: Our maximum percentage of grade is around 11%, that we have for our shuttle cars.

A Voice: Do you have to plank whether the bottom is wet or not?

Mr. Burnett: Yes, but in those cases we take the pit car bottom and run something the same as corduroy track. In the low coal there are two different ways. In our coal we have one shuttle car unit there at 5-2 to 5-8. The other, in the low coal — there happened to be one place we could try the shuttle car on the higher coal. You can if you want to put backboards on your shuttle cars and increase the number of pit cars you get from the shuttle cars. In other words, you can add possibly one-half or three-quarters tons more on shuttle cars by adding sideboards.

A Voice: Do you have a pile of gob back in the room?

Mr. Burnett: We do.

A Voice: What is the minimum clearance to not interrupt the speed of loading?

Mr. Burnett: Twelve feet. We have a double row across, and use twelve feet between the trucks.

A Voice: That could not be narrowed?

Mr. Burnett: Not with any degree of safety, because the shuttle cars moving in and out, if there is any obstruction you will have the car sideways or hit a prop.

Mr. Chitty: What if any trouble do you have with traveling from the loading unit where the cars are loaded? Is there any particular difficulty in traveling on account of the width?

Mr. Burnett: That depends on your working plan, how you work your shuttle cars. Each individual must work out his own problem on that.

Mr. Chitty: I wondered if you had encountered any trouble on that one thing.

Mr. Burnett: We have not. In other words, we are all familiar with the way we have our track on our Joys, by having key rooms. To give you an idea, you can put your shuttle cars off of one room, making that one the key room. The other rooms are dead rooms. You can load on the shuttle car easy, and go back in the room and load the rock there.

Mr. Lewis Waldron (Peabody Coal Co., Springfield): What is the relation of upkeep or maintenance of shuttle cars and labor in transporting that, in comparison with the laying of track?

Mr. Burnett: I think it would be better for the Joy Company to give you an idea. We are not selling Joys but operating them. I think there will be some pictures and they can demonstrate that.

Mr. J. W. Starks (Peabody Coal Co., Marion): Speaking of handling rock, we have a shuttle car operating with a few more units, and are handling rock ten to fourteen inches in thickness. We are doing it with a mechanical device. We rig up a hoist on a caterpillar and handle this with a rack system. You cannot operate shuttle cars and have a lot of rock.

In answer to your question about the cost, we have been operating shuttle cars about a year, and of course cannot set up what the depreciation will be or what the life of the car will be. But where Mr. Burnett operates his mine, the track laying cost ran about seven cents per ton. You can figure you can do a lot of repairs on equipment for seven cents per ton. Where you have fifty inch coal and are working that out at the rate of some 4,800 tons every seven hours, you know what it would mean in the way of development in laying track, if you are going to lay track.

Vice-President Leighton: Thank you, Mr. Starks, and Mr. Burnett. It was a very interesting discussion.

We now pass on to the showing of a motion picture, following which we will take time for the first paper that is scheduled for the afternoon program. At this time we will have the motion picture, presented by Mr. A. S. Knoizen of the Joy Manufacturing Company, Franklin, Penna.

Mr. A. S. Knoizen (Joy Manufacturing Co., Franklin, Penna.): Before we show the picture I would like to give the Institute a few ideas of the reason why the Joy Manufacturing Company developed the shuttle car and so-called trackless mining.

Trackless mining takes in three distinct types of units: The rubber belt transportation unit, the conveyor chain and shaking conveyor type and the rubber tired trackless shuttle car units. The only and main reason for installation of rubber tired units or shuttle cars behind loading machines, and the only reason they can be justified is by the reduction in cost and the savings to the operator. I feel that Mr. Burnett and Mr. Starks brought this out clearly. Shuttle cars of the tractor type have been in the mines for several years. A self-contained conveyor bottom shuttle car has been in the mine to a large extent only within the last two years.

The Joy Manufacturing Company now have over 250 shuttle cars in operation. We have shuttle cars working in 36″ coal, 42″ coal, 48″ coal, 6′ coal and 14′ coal. Shuttle cars today are made in sizes as follows:

32″ high, either battery or cable reel
38″ high, either battery or cable reel
42″ high, either battery or cable reel
48″ high, either battery or cable reel
60″ high, either battery or cable reel

They range in tonnage capacity as follows: 2¾, 3½, 4½, 6 and 10 tons.

The shuttle car is not the answer to all the problems of cost savings in the coal mines of this country, but in our opinion where the shuttle car has application there is a decided saving possible. These savings run as high as 15c to 20c per ton over mechanical loaders working with the conventional mine car system. The main savings with shuttle cars are due to the elimination of track and the increased efficiency of the loading machine and the movement of equipment around the territory.

With the track eliminated there is never a congestion at the butt entry, which permits the free movement of loading machines, cutting machines or shuttle cars. We have installations where machines are loading from 250 to 350 tons per day on conventional mine cars holding 2½ to 3½ tons. After the installation of shuttle cars the same equipment averages from 500 to 700 tons per shift.

I feel that Mr. Starks and Mr. Burnett of Peabody are accomplishing some very outstanding results and if they were not this Company could not depend entirely upon shuttle cars for their production in some of the Southern Illinois Mines. The pictures we are going to show will cover trackless mining in 36″ coal into the conventional room conveyor, with Joy Juniors loading into room conveyors and in turn onto belt conveyors. We will also show our 8 BU Loader loading into shuttle cars in 42″ coal and shuttle cars being used in 6′ and 7′ coal in the Pittsburgh seam in conjunction with the large 11 BU machine. In this picture entire pillars are extracted on the block system, which is standard in the Pittsburgh area.

I will try to explain some of the operations as the pictures are run.

* * *

President Adams: Please come to order.

We will resume our program. We have two papers yet to be presented, and both of them bid fair to be of a great deal of interest to all of us, and surely will invite considerable discussion. One of them we want to have at this time, and the other, the final one, will be presented when we reconvene at 3:00 o'clock this afternoon.

"Track — A Liability or an Asset" will now be presented by Mr. J. B. Haskell, of the West Virginia Rail Company, Huntington, West Virginia.

Mr. J. B. Haskell (The West Virginia Rail Company, Huntington, W. Va.): Mr. Chairman and gentlemen of the Institute, the subject I have in a way asks a question. With over thirty years of experience with track work, in giving consideration to the problems involved, I myself have arrived at a certain answer to this question. I hope what I may say may cause you perhaps to arrive at a similar answer to that question.

# TRACK, A LIABILITY OR AN ASSET?

By J. B. HASKELL
West Virginia Rail Co., Huntington, West Virginia

It is no doubt true that it generally seems to those having to do with the production of coal that the items which could be classed as liabilities around a coal mine, would far outnumber those that might be listed as assets. I presume there are times when management wonders if there are any real assets at all. The coal itself is there ready to mine and ship, but the pathway to the tipple is beset with many problems. Generally speaking, the coal must be loosened from its bed, placed in a container and the container moved to the tipple, but in these three operations, much is involved. Unlimited thought and ingenuity has been expended upon *the container* in which the coal is to be placed for its initial movement, and a list of these containers would include, sacks, wicker baskets, tote boxes, sleds, carts, and various types of cars, from the simplest to the modern double truck car that is comparable in excellence of design to the best in railroad rolling stock.

It has always been essential that a pathway be provided over which this container or car could be moved, and in the beginning this pathway was literally what we commonly think of as a foot path. Nothing more was provided than a path over which man or beast could walk, carrying a pack of coal. Time moved on, the path was widened and leveled. As weights increased, this became insufficient and wooden rails were laid along the patch. The years rolled by and as the production of iron and steel rails progressed, it was found that greater weights could be moved with less effort on these rails than in any other known way. That condition exists to this day, and it is that fact, coupled with the proper design and placement of these rails that makes possible the low cost per ton mile of modern transportation.

Nevertheless, when we think of the investment needed to put a track system in a mine, and the expenditure required to keep that track in good operating condition, we often think of it as a decided liability, one that we wish we could avoid. We hear various figures, ranging all the way from three cents to twelve cents, rather loosely spoken of as the cost per ton of the mine tracks per ton of coal mined, and this cost is mentally set down as a liability.

We know that there is a certain cost of material, labor of installation and labor of maintenance, whether it be three, six or twelve cents per ton of coal, and it looms large in perspective. It is a cost, or perhaps as one at first might consider it, a liability, and one which common prudence would warrant in reducing as far as compatible with efficiency. But those items which are real liabilities in the sense here used are the units representing an investment that depreciates rapidly, that requires excessive maintenance and that does not give an adequate return of service. Conversely, we can readily see how units used in production, such as trackwork, although requiring a certain investment, could be classed as an asset if their use reverses the conditions just outlined.

Perhaps there is no part of purchased mine equipment more susceptible of rendering greater returns in proportion to the ultimate cost than the rail and track work used in the transportation system. Over these steel ribbons for the life of the mine will pass every pound of coal that is mined. Over them will pass the huge volume of supplies so necessary to modern mining. By their use it will be easy and economical to transport equipment to the shop for repairs and general maintenance. Their surfaces will become in many cases the very foundation on which rests the machinery that cuts and loads all of the coal mined. And the very fact that it is easy to move heavy loads over steel track makes it feasible to design the equipment that uses this track in a rugged, solidly built manner. Weight need not be sacrificed to mobility to the extent that is necessary in types of rolling stock that do not use rails as a pathway. The more the design of a carrier tends to complication, lightness and mechanical refinement, the more it is subject to breakdowns and rapid depreciation, while obviously the heavier and more rugged it is practical to build carriers, the less they are subject to trouble and the longer is their useful life. Proper planning and management can well make the investment necessary to secure good trackwork an extremely productive one.

The most economical results or the highest proportionate returns are not necessarily achieved with the least investment. The *best* in mine equipment hinges not primarily on lowest first cost, but on a combination of factors which include dependable service, adaptability, speed, safety, long life, and economical operative expense. The most satisfactory method of moving coal will be a method that will tie in with a means of cutting and loading that coal and with a rapid and economical means of transporting from place to place the machinery which cuts and loads it.

Track affords the means which best meet these conditions, as track mounted cutting and loading machinery can be moved more rapidly from place to place than can machinery otherwise mounted. The best known track mounted machinery has tramming speeds of 450 feet per minute in high gear. This is more than twice the high gear speeds of machinery that is not so built that it can use the mine tracks as a natural means of tramming. All time studies show that moving time of machinery is an important element of cost, so it is evident that if track helps to lower this moving time, it is responsible for some reduction of cost and consequently helps to classify itself as an asset.

Figures accepted as authoritative, show that track mounted cutting machinery has far greater capacity than any other type of cutting machinery. Shearing and cutting with track mounted machinery has reached a high degree of efficiency, a degree of efficiency that it might be impossible to reach with machinery otherwise mounted. With this fact in view, we have one more circumstance tending to set track up as an asset. Track sometimes gets a figurative black eye, not so much because it is track, but because of the kind of track it is. Track that is too light, poorly maintained and improperly planned, may be regarded as a liability, and may actually be such. But to compare a mining system having such track with a modern, well designed system using other means of conveying coal, may well be misleading No useful facts would be developed by comparing the functioning of an old, run down Packard with that of a new Cadillac, yet we frequently hear comparisons of the results obtained with a new, well planned trackless system of mining with those obtained by the use of an obsolete, poorly maintained system making use of tracks.

Some time ago, railroads found that the cost per ton mile of freight transportation was too high. One group said that the maximum of economy had been reached in the steam locomotive of that day and that the only answer to low freight movement costs was the electric locomotive. The other group maintained that although the electric locomotive installation would fit in with certain special cases, tremendous development of the steam locomotive would be possible if an amount of energy and talent were devoted to its development comparable with the amount of research and experimentation being devoted to the electric locomotive. Time has shown that the second group were right. There are specific cases where the electric locomotive is almost indispensable, but the modern steam locomotive has been so developed that under the conditions most generally prevailing, its power economies are unsurpassed. It has been made an outstanding asset to railway transportation. My point is that the same principles of design and improvement rather than change of method, apply to mine tracks, and that we study, improve and develop them both as tracks and as a component part of a haulage system rather than label them as a failure and proceed to spend the money and talent which would have made the track system a success, trying out other schemes.

We well realize that economy of movement of equipment, supplies and coal in a mine is dependent upon rugged and well aligned track. But economy of movement also hinges on the layout of the tracks and the plan of operation. This plan must take note of distances, car supply, loading time, haulage time, cost of tracks and turnouts and labor costs of laying and recovering them. It is not possible to set forth broad detailed plans specifying the most efficient track layout that will apply to all mines, as conditions vary so much, but some general priniciples apply to transportation, whether the system be in a mine, a steel mill or an automobile factory. It is, of course, fundamental that best results are always achieved by a planned program, rather than by trusting to an individual's spur of the moment ingenuity. This problem of design, installation and maintenance, so vital to the making of a productive asset of what might easily be a costly liability is worthy of the best thought of mine management. If we do away with tracks in our entries and rooms, we do away with the most difficult phase of our track problem. We do away with the part that has usually been most neglected but which at the same time is the part that offers the greatest opportunity for betterment and cost reduction. This elimination of track might avoid one more problem but the most successful business enterprises are monuments to managements who solved problems, rather than sidestepped them.

Figures gathered from widely scattered sources indicate that the cost per ton of coal that may be assigned to track material and labor charges, ranges from four cents per ton to twelve and one-half cents per ton. The average of the figures coming into my possession gives a cost of seven cents, made up of two and three-tenths cents for material and four and seven-tenths cents for labor. These figures are gathered from many mines and probably give us the total average cost of the steel haulage ways of mines. I think it may be assumed that these figures will cover the cost of good trackwork. We cannot but recognize the assistance to economical mining that good track can give, so the more we can reduce the cost of this assistance, the more of an asset our track becomes.

Another system might perhaps even do away with the room track cost per ton, but what costs would be introduced that you do not now have?

The question may well be asked, how can this cost be reduced? It may not be possible to greatly reduce the first material cost, except through economies that purchases of all standardized parts make possible. But ultimate material cost savings may be effected by buying material of such size and weights that depreciation may be reduced to a minimum. It is also possible to attack track costs from the installation labor cost angle. Shop fabricated track and turnouts reduce mine labor costs. A large part of the work having been done in the shop at the time of fabrication, it need not be repeated each time the track or turnouts are laid or moved. We have records showing that prefabricated or sectional turnouts have been laid in one-fourth of the time required by turnouts on wood ties, and in one-third the time required to lay turnouts on steel ties.

Good track may even reduce the number of turnouts required, because some turnouts are in the track system, such as breakthroughs, to speed up car supply to the loaders. Good straight tracks, over which gathering motors may move rapidly without delay, serve this same purpose. More money put into a track system does not mean higher costs per ton when it properly increases production. In fact, in many places, larger investments in modern track systems have decreased the track cost per ton. Cars need not be at the loader all of the time, because some maneuvering time is needed, but if the track system makes it possible to take away and supply cars to the loader the full percentage of time that it can actually load into them, and if it makes this possible at an economical cost, it is a very real asset. These tracks with their problems that are familiar to all, may loom as a liability, as opposed to new or somewhat untried methods, on the principle that distant pastures are always greener. Whatever failings or shortcomings old track installations may have are common knowledge; possible failings of new or little proven schemes are relativey unknown.

No matter how efficient the track layout may be, every car change makes a delay, even though that delay may be in seconds. When these delays exceed or do not correspond with the maneuvering time needed by the loader, efficiency is lost. Small capacity cars produce this result and present a difficult problem wherever mechanical loading is used. Shaft size or other limiting conditions may prevent changing the car to larger capacity. The minimum size car that will service the loader to capacity is subject to a wide variety of local conditions. Supply switches must be very close to make it possible to work small cars efficiently. This, of course, increases track costs. A moderate increase in car capacity will decrease loading costs and a larger increase, within reason, will reduce the cost still more. I have authoritative figures showing that a change from 2.25 ton mine cars to 5.5 ton cars has reduced the cost in the railroad cars 12c per ton.

As long as you are reminded that your coal is costing you four cents, or seven cents, or ten cents per ton of coal mined, you will be prone to think of that track as a burden or a liability. But when you think in terms of what that track is doing or making possible, and what it might cost you to do that work by other methods, it may occur to you that the track is actually an asset, a tool that pays big returns on the investment. Especially will this be the case if by one of several plans, you reduce the cost per ton to the low figures that have been achieved by some well planned operations.

Several plans to get the lowest transportation costs per ton have been tried and a brief mention of some of these plans may be of interest. One mine equipped with 2.25 ton cars, installed self unloading rail mounted transfer cars of ten ton capacity to transfer the coal from the loading machines to a conveniently located panel dumping point. This gave a saving of nine cents a ton of coal in the railroad car, as compared to the exclusive entire use of the 2.25 ton cars to the loader.

Another mine installed ten ton drop bottom track cars to haul from the loading machines to a dumping bin. I think this installation will be described to you in a later paper. An investment of $20,000 increased production 200 tons per day and lessened the labor cost. It was found economical to serve these ten ton cars from the room neck, no permanent switches being placed in breakthroughs. This, of course, was made possible by good room turnouts and track, which permitted fast running speeds. An interesting trial in this mine showed that the motors could handle a ten ton car out of the rooms at a faster average speed than they could handle their former three ton cars.

We have been furnished some interesting figures by a mine that found their costs high. This mine, by improvements in their track system and a change from 2.5 to 5.5 ton cars, reduced their costs twelve cents per ton on the railroad car. It seems that where conditions such as shaft size or other limitations permit, the ideal way of getting the most from the track is to greatly increase the capacity of the cars up to five, seven or ten tons, the capacity of course, having a definite relationship to the amount of coal realized per cut. Following this increase in car capacity should come a betterment of track conditions. Tracks, ties and turnouts of a design that offers all possible savings of labor costs should be used. As previously mentioned, pre-formed or pre-fabricated track parts show real economies in mine track labor. Included in these items are steel ties, curved rails, sectional track and sectional turnouts. And, as material is purchased in such form that installation labor may be reduced, so the labor itself should be trained and directed to handle, install and recover track material in the most efficient way. There is a right and a wrong way to do many things, and hard, sincere labor on the part of a track man does not mean economy, if through ignorance or lack of training his efforts be misdirected.

The Haulage Committee of the American Mining Congress is making a study of successful systems of service haulage tracks, with a view of setting up as suggested standards, the most efficient systems of service track work that have been devised and tried out in use. Every item of saving that can be made in track purchase, laying and recovery cost, every increase of efficiency that can be made by betterment of track layout and all possible decrease in lost loading time, means lowered costs per ton and a better return on track investment.

Is track an asset or a liability? I think the answer is that it can be either. Left to itself and handled in a loose way, it can easily become a liability. But if the same thought, engineering, investment and supervision be applied to track and its related problems as would be given to any other important phase of coal production, that track will become the efficient artery that will economically carry the very life blood of the mine.

It will be an asset that will be of vital assistance to the operator in his efforts to mine and deliver coal to the tipple in good condition and at a low cost.

* * *

President Adams: Are there any questions or any discussion on Mr. Haskell's paper? I think we are running well within our schedule. We can spend a few minutes in discussion on this subject of track.

If there is no discussion, I want to again call your attention to the hour for the funeral of Mr. Sam Wills, 2:00 o'clock this afternoon, at the First Methodist Church, just across the street.

I would also remind you that you should secure your tickets for the evening banquet before you leave the floor. They may be secured out near the elevator.

We want to convene promptly at 3:00 o'clock for the final paper of the day's program. I probably should not say we have saved the best for the last, but I am quite sure if you come back for the afternoon session you will be well repaid for doing so. I never knew of Ed Johnson saying anything that was not interesting. I am sure we will enjoy what he has to offer us this afternoon.

If there is nothing further, we will stand adjourned until 3:00 o'clock.

(Whereupon at 12:30 o'clock P. M., a recess was taken until 3:00 o'clock P. M. of the same day.)

## AFTERNOON SESSION
### 3:00 O'clock P. M.

President Adams: Gentlemen, will you please come to order?

We have ample time for the presentation of the last paper of our day's program, and for discussion afterwards. The paper to be presented now is "Man Tonnage and

Mechanical Routine," by Edwin H. Johnson, of The Jeffrey Manufacturing Company, Columbus, Ohio. Mr. Johnson.

Mr. Edwin H. Johnson (The Jeffrey Manufacturing Co., Columbus, Ohio): I hope you are not going to be too much disappointed by the wonderful introduction Roy gave me before the conclusion of the morning session. He just wanted to get you here this afternoon. I know by the past experience I have had with him that by the time I finish he will be sound asleep.

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# MAN TONNAGE AND MECHANICAL ROUTINE

By EDWIN H. JOHNSON
Jeffrey Manufacturing Company, Columbus, Ohio

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The first time I addressed this institute was on the boat trip meeting in 1925, when I talked of the future of machine loading in Illinois, showed movies of machines loading 400 tons per 9 hour day in West Virginia and talked of big mine cars holding five, six, and seven tons of coal. Fifteen years later we can hear of cars that carry ten tons away from the face, loaders that produce 700 to 800 tons in a 7 hour day, cutters that mine 1200 tons. Big figures have become commonplace. We are more likely now to look behind the big figures and ask whether such performances are uniform, if these things are done with due regard for our newer conception of mine safety, how many tons a man on the section is worth and how many dollars is invested per shift ton of production.

Once in a while a condition arises where with good mining conditions it becomes possible to provide equipment that will not only fit the mine, but will also dovetail with available mine equipment. Add this to good maintenance and supervision and the flow of low cost coal becomes almost automatic. When cutting, drilling, loading and gathering of coal can be accomplished with units that are flexible and of large capacity and when the capacities are well balanced, it has been found possible to obtain section labor cost as low as 20 cents.

Most mines do not fall in this class. The usual bottle-neck to smooth production is the size of the mine car which often is too small for efficient gathering from high capacity loading units. This has proved to be a most baffling problem, not only in Illinois, but in many parts of the country. The shaft size is one limitation and the large number of cars to be changed is another, because of the size of investment.

Briefly, I wish to outline the various methods of attacking this problem that have been tried. The first and most general method in this field has been to keep the switches close, using back switches and extra locomotives to reduce the car change time. Some of you by this method have been abe to cut average car change time to less than a half minute. By use of back switches and a 3½ ton car one of our track loaders has recorded averages above 100 tons per hour over long periods. Under these conditions the labor cost of laying and reclaiming section track has been moderate because of the high tonnage involved.

Another method combining the above plan with even smaller cars is the use of a conveyor long enough to load two cars at one setting, by reaching over the inby car to load the outby car first. A time study was made in July in this field in a mine of this type where the car capacity was 2.35 average. In a 7 hour period 310 cars were loaded. This may be a record for number of cars handled and loaded on a track behind a loader. The best hour showed 47 cars loaded and three moves completed. In all, 18 places were loaded averaging a little over 40 tons each.

The ideal solution, where possible, is to bring up the mine car standard to that of the other equipment, using cars of 6 to 10 tons capacity. I can think of about ten mines where the old cars have been discarded and replaced by big cars. Where the coal is hoisted through existing shafts this change has involved the additional investment of an inside dump and skip hoisting.

There are two other means of accomplishing the improvement. One is by use of shuttle cars with conveyor bottoms for self unloading, mounted either on rubber or on rails, and the other is by use of large capacity drop bottom mine cars, used for face gathering. Each of these types are used only in the working section and from them the coal is transferred to the regular mine cars for the main line haul.

The application of a few large capacity gathering units at the face has the effect of reducing the number of standard mine cars for the required output because the regular cars do not go beyond the main line or section parting.

The greatest development in this direction has thus far been shown in the trackless system as described earlier today. Also there have been some interesting results achieved with a few large mine cars. The best of the latter installations so far is the one at Kings Station Mine at Princeton Mining Company in Indiana. At this point two 10 ton drop bottom mine cars each with a 6 ton cable reel and trolley locomotive serves one loading machine. Some of the working faces are as far distant from the transfer station as 2000 feet. For these longer runs a third unit is added to prevent loss of time for the loader. Two of these cars will keep a loader busy within a quarter mile of the transfer point.

It will be recalled that in the earlier development of tractor trailer cars there was considerable objection to the installation expense of the dumping points. These had to be frequently moved because of the limited radius operation feasible with trackless units. A large item of this cost was the excavation of a deep pit. The self unloading shuttle car overcomes the pit expense, but suffers loss of time in the unloading operation, which has the effect of restricting further the effective operating radius.

At Princeton Mining Company we installed two parallel units of underground portable conveyors of standard construction and laid them, not in a pit, but directly on the mine floor and elevated the track just four feet. That is, the conveyor which is 42 feet long lies directly under the delivery track in the entry paralleling the regular haulage. This delivery track beyond the conveyor in each direction goes down at a convenient grade of about 10 per cent to the normal position on the entry floor. The sides of this double conveyor are built up to form a bin which holds twenty tons of coal. A similar double conveyor receives the discharge of the floor line conveyor unit and elevates the coal through a convenient cross out to discharge into the standard mine cars on the parallel entry. In this case the elevating conveyors are 47 feet long. At present, this unit, which is controlled and operated by one attendant, is handling about 1700 tons per 7 hour shift, operating two shifts per day. Four loading machines are tributary to this loading point. Coal is handled through this unit at an average rate of 9 tons per minute. The conveyors are running about 45 per cent of the day at present. The quantity of coal handled per shift will soon be increased by the addition of another loader unit. The material to be handled in this present location is about a half million tons. During the past week reports indicate a peak tonnage of over 1900 tons in a seven hour shift at this loading point. The percentage of the shift employed in loading time with standard mine cars was formerly 51½% of the shift, which with 3½ ton cars and high capacity loaders is recognized as unusually good. The larger cars have increased this effective loading time to 64% and more than doubled the ratio of loading time to changing time. Several similar set-ups are being located now in other mines, one of which, in West Virginia, is expected to be so nearly permanent that two-million tons will be loaded before it has to be moved. In this latter case the maximum haul to the loading point is 4500 feet. We are advised that nine collieries in Australia are now employing large drop bottom cars and transfer stations of this general type to improve face efficiency of loading equipment.

Other economies show up and result in higher man tonnage for the loading crews. Mounted cutting machines have the capacity to cut the extra coal. Back switches are not needed for high speed car changing, and the same track crew handles the increased tonnage. Actually, three-quarters of one man day is saved per crew while the output per crew has gone up 25 percent. It can readily be appreciated that many mines have much smaller mine cars and support an operating routine for their loaders far lower than 51½ percent. We expect to see unit tonnage doubled in some cases and man tonnages increased by at least 50 percent instead of 33 per cent as the figures show here.

Anytime that man tonnage on the section is less than thirty, in the Illinois number six mining conditions, there is room for substantial improvement. We feel that the development just described may make such improvements possible for shaft mines now handicapped by inadequate cars; without radical changes in mining methods or equipment and at a very modest capital outlay. The capital outlay for new equipment in the case described is below ten dollars per ton of production per shift.

Ever since the start of machine loading there have been advocates on both sides of the argument as to whether the face equipment should operate and travel on conventional mine track or on the floor. We manufacture equipment that lies on the floor or rolls on track wheels, rubber tires or caterpillar treads. Excepting conveyors, however, most of our portable equipment moves and operates on steel rails. Thus, our position as advocates of rail haulage within the working section is sufficiently well known to require no explanation. It would be fair to say that the line of equipment we build illustrates our conviction that the cost of a steel highway from face to sidetrack is justified by its value except when its use requires expensive brushing of roof or floor.

Recently, I sent out a number of questionnaires inquiring about cost of section trackage to some mines using loading machines. Some of you helped me to assemble this information. It is not complete, but it is representative. These were the cost items I asked to be itemized:

Cost of track material; rails, ties and switches

Labor cost of straight track

Labor cost, curves and switches

Labor cost, delivery of track material

Labor cost, recovery of track for re-use

Maintenance cost; repairing, straightening, etc.

Total cost per ton; above items.

My replies came from forty mines in eight states. The tons per fall varied from 11 to 64 and averaged 35.6. The highest cost per ton for material and for labor charges and the lowest cost for both items were reported by mines in the same state in the same coal bed under very similar conditions. The highest figure was \$ .125 per ton and the lowest \$ .0475 per ton. Some were worked out to the fifth decimal and some lumped it all together and called it ten cents. The average of these mines for material cost developed a figure per ton of \$.024 and the average total labor is \$ .0606. The average total is \$ .0846 per ton.

We may, therefore, fairly say that under a variety of conditions it costs 8½c per ton to buy, lay, maintain and recover the roadway that forms the secondary haulage in mines that run track to the face, where the work is done by day labor at prevailing rates. Since good track is cheaper in these items than poor track we now propose the question, "Is good track in the section worth 8½c per ton of production?"

The answer is to be found in the cost records by looking in three places. The first place is the investment cost per ton of daily production. The second place is the direct labor cost on the section where the item of man day tonnage becomes the critical figure. The third is maintenance and supply material cost. From consideration of all of these items the relative value of the secondary steel highway for coal and moving equipment can be properly measured. We readily agree that the answer is not always the same.

* * *

President Adams: Now, we have plenty of time for discussion on this paper, and plenty of time for questions. Are there any questions in the minds of any of you as to any part of the paper he has presented?

Mr. John Hanson (Peabody Coal Co., Taylorville): Did I understand him to say the cars can be loaded, the two cars at once?

Mr. Johnson: That is right. The cars are in tandem. So many of these mine cars are short, because the mine shaft was put in long before we had any idea extra length in the cars would mean a great deal. There are a lot of cars in service not more than seven and one-half feet long. Those cars can be increased in capacity somewhat by redesigning the cars to go down to a low loading bed a short distance above the wheels, and so forth. It is possible with most of the loading machines available to build a conveyor long enough to load a car fifteen feet long, which is what you have when you push two cars in back of the machine at one time.

There is one question that may occur to you which has occurred to me in connection with the figure I put on cost. As I said, these average figures show a little over two cents per ton. The report I received shows a variance of about one-half cent per ton to about five cents per ton. It is a matter of bookkeeping, I presume. There is one mine whose figures I include in that report that gave a figure of three and one-half cents per ton. Then they went on to explain to me it cost them in a particular section about $5,000.00 for all the track equipment that was added in that section, and they figured a depreciation in loss and wearing out and so forth of about twenty percent per year, which was a little over $1,000.00, perhaps $1,100.00, on that section. In that year they produced something like 120,000 tons from that section. So if you divide $1,100.00 by 120,000 tons, you do not get three and one-half cents. That is something we haven't any control of in our figures. These were as they sent them to us, and that accounts for some of the wide variation.

President Adams: Gentlemen, this concludes the program for the afternoon. I would like to remind you again if you have not secured your ticket for the banquet tonight you should do so immediately at the adjournment of this meeting.

Also, I would like to remind you that the dinner will be served promptly at 6:30 o'clock. It is necessary this evening that we start promptly. We have for the evening what I presume you would call a double feature. Therefore, we want to start on time so that we may have sufficient time for the program of the evening and still adjourn at a reasonable hour. If you are late for the dinner tonight you will be served late. You might have to hurry through with it, because when we open the meeting following the dinner we will require that the waitresses retire from the room so that we will not be disturbed.

If you are not informed of the double feature, we have a guest speaker whose name appears on the program, and in addition to that, the radio address of John L. Lewis, President of the United Mine Workers, will be broadcast at 8:00 o'clock.

Now, if there is nothing further, we will stand adjourned until 6:30 o'clock this evening.

(Whereupon, at 4:00 o'clock P. M., a recess was taken until 6:30 o'clock P. M. of the same day.)

## EVENING SESSION
### 7:45 O'clock P. M.

President Adams: I wish at this time to introduce the members of the Executive Board as they will be for the ensuing year. I want to dispose of this matter in time that we may hear the broadcast, which starts promptly at 8:00 o'clock.

(Introduction of officers and guests)

President Adams: Now, I think I did pretty well. I did all that in five minutes, and we still have a few minutes left.

I am going to respectfully ask you to refrain from applauding during the broadcast, for the reason as I understood it there will be no studio audience, and therefore no applause will be coming in over the radio. If we applaud we probably will thereby miss a portion of what Mr. Lewis will have to say. I suggest that as soon as Mr. Lewis begins to speak you give your undivided attention, because I am sure everyone present is very anxious to hear what Mr. Lewis will have to say. Please let's not have too much confusion until the time that the broadcast begins.

In addition to the loud speaker for the radio, we expect to set this amplifier over so that we will get the benefit of the amplifiers on either side of the room. So you may be at liberty to talk for the next few minutes until the broadcast begins.

(Broadcast of remarks of John L. Lewis followed)

* * *

President Adams: Gentlemen, if you will please come to order, I want to present Mr. Paul Weir, past President of this Institute, who will introduce our guest speaker of the evening.

Mr. Paul Weir: Your toastmaster has asked that I assist with this program to the extent of presenting the speaker of the evening. I know that I am not in the same position as the gentleman from California who, when called upon at a funeral to say a few words about a departed brethren who it seems had lived a life such that there was little to be said, launched into an oration on the climate of California. I have a worthy subject, hence it will not be necessary for me to digress in any particular. The gentleman whom I have the honor to present to you is one of the younger executives in the coal industry who have come to the front during the age of mechanization, which age embraces the last 15 years. He has had operating experience in the anthracite industry with the Susquehanna Collieries Company in Pennsylvania and in the bituminous industry with the Hanna Coal Company in the State of Ohio. He is now President of the latter mentioned company. This gentleman is a personification of leadership, ability and energy. He is a Director of the National Coal Association, is Chairman of the Coal Division of the American Mining Congress and is President of the Ohio Coal Association.

Perhaps I have led you to believe that he lacks a human side. It has been my good fortune to have invested some of the wee small hours in his company, listening to his French-Canadian stories while, coal miner like, we were indulging in an occasional shot of drinking whiskey, washed down with branch water. I sincerely hope that in addition to the serious message which he has to deliver to you, he will repeat some of the stories for which he is famous. It is my pleasure to give you your speaker of the evening, Mr. R. L. Ireland of Cleveland, familiarly known as "Liv."

## ADDRESS BY MR. R. L. IRELAND, Jr.

President, Hanna Coal Company, Cleveland, Ohio

Mr. President and gentlemen — thank you, Paul Weir. I was a naval flyer during the last war, so I went from the sublime to the ridiculous. I went direct into the coal business. I reported to Hon. George Quinn, one of the grand old men of the anthracite industry. He looked me over and talked to me for awhile, and finally said: "I think you will like the coal business. I will promise you this, that in no other industry will you find so many damned fine, hard-working, hard-playing, optimistic good fellows as you will in the coal business. I am fifty-nine years old. I have been trying for fifty years to figure out why that was and finally came to the conclusion that nobody but that kind of a damned fool would stay in the business more than thirty days."

Gentlemen, as I look around the room I see a whole lot of coal men. It is a great pleasure to be here, I assure you. I thank you, Paul, for getting me here. As I look around the room I think of the days when I first started going to these meetings. I felt like a kid. I am now beginning to feel the ravages of age, as I call it, and that brings me to one of those French stories.

(*For text of story inquire of author direct.*)

Now, gentlemen, in this coal business of ours, we need the strong men, because we have a job. As you look at the coal industry by and large, and try to compare it with anything else in these United States, we find that we are just a bunch of farmers. We are disorganized, with small capital investment. We buy something, use it awhile and set it aside, and then pick it up and use it again later on.

But mechanical cleaning and mechanization of underground workings are going to make a business of this coal industry in spite of everything. The capital investment we now have to make is going to mean we have to learn how to use our equipment to its fullest extent. We take our hard earned dollars and we put them in the bank and expect them to draw interest 365 days of the year. We take those same dollars and put them in bonds and stocks and expect those dollars to work for us all the time. But we take those dollars and buy equipment, and why in the hell should that equipment sit idle half the time?

Back in 1933 when we had an emergency, the President of the United States said: "We need shorter hours to employ more men, but we want to get the maximum out of our equipment." General Johnson said to us: "The NRA is going to give more employment with shorter hours, but let's use our equipment." Billy Green said the same thing, and so did John L. Lewis. That was the opportunity, gentlemen, for every man in the coal business who could see into the future to wake up and take advantage of our opportunities. For those who failed to take advantage of that at that time, I think we have a new opportunity now.

We have an emergency. God knows how far it will go in the demand for industrial materials, but coal has always played a big part and coal will be a major factor even if it is not recognized as such as yet. But it will be if this goes on.

Gentlemen, now is the time to capitalize upon the pioneering work that has been done in the mechanization of the coal industry, to lift it out of the level of farming where the harrow and the plow sits idle a great part of the year. Equip your mines in such a way you can use them twenty-four hours a day and six days a week.

Going from a single shift to double shift introduced a lot of problems. It introduced the problem of coordinating two organizations working at the same job. It introduced the problem of overcoming the buck-passing going on between two organizations working with the same equipment. It introduced the problem of educating an organization to go back on the job and find their tools not where they left them but some distance ahead.

The second shift problem has been pretty largely licked, pretty generally. That is over the dam so far as I am concerned. It is the third shift that interests me as a coal operator. It is the third shift that is going to get the last return out of our investment.

Right here let me pause to say something about my friends the manufacturers. They have never fallen down. When you put up a problem to them, they mean business. If you want a piece of machinery that will stand up in continuous service, they will build it for you. But like smart fellows, they are not going to build it until there is a demand for it. When you go to the third shift you step into a brand new problem and one which has caused a lot of grief because it was not anticipated, and it caused me plenty, I can assure you of that. That problem is planning to take care of the work you used to do off-shift.

Let me give you two examples. One is to get your machinery so designed that it does not need off-shift maintenance or have enough spare equipment so that off shift repairs can still be made. The other is, cleaning rock falls on motor roads. Do your timbering when your entry is in the developmental stage. Spend your money when you can spend it to the best advantage, and do not worry about that entry after you put it into service.

With your equipment you have to have spares. You have to have spares in any game or any business. A football team without its reserve isn't worth a doggone, and you know it, nor is a baseball team, nor a business. Certainly you have got to have your spares.

But give your machinery a chance. We expect too much. We will not have that trouble when we put our problem up to the manufacturer, but until we do we must take what we have and it isn't built for continuous operation. Therefore, you have to give it the kind of care it needs and requires if it is going to stand up on shift, which means periodical inspection, changes of the weakest assemblies and things of that kind.

Your automobile today, when you buy it, carries with it a ticket or card which says the oil ought to be changed every so-many miles, the oil filter ought to be changed after so many miles of service, and so on and so forth. They are just one stage ahead of us. All we have to do is pattern after them and we can get the same results.

Gentlemen, if I have anything at all that I can say that can be of help to you, based upon personal experience, it is that if you are going to thrive in this business you have to make your dollars work as many hours in the day and as many days in the week as you can. Don't build on a car shortage, for the car shortage is gone. Build your production capacity to meet your sales ability, and then run the thing and make the sales department sell the coal. Don't give them more than they can do, or they will fall down and wreck you anyway.

That, gentlemen, is what I believe in very, very sincerely, and it is my pleasure to come here and tell you that. But before I get through, there are a couple of more remarks I cannot help making when I get a chance. One of them is the old St. Lawrence waterway and power project to which the President recently allocated, under the guise of National defense, $1,000,000 from his $300,000,000 defense fund for an engineering study of the power PHASE of the project. It wants to make every bit of lake shore front, be it Chicago or Cleveland or Duluth a seaport where we can take our children down and see the foreign sailors, the pretty uniforms the foreign sailors wear, and incidentally get infected by their foreign diseases. We think of all the merchandise we can ship out on those boats, and forget about all the material that will come in to compete in our market and close us down.

In this great lakes basin area we have a natural protective tariff. It is the Appalachian Mountains on the east and the Rocky Mountains on the west. It has been a God-send and the making of this great industrial world of ours out here. The St. Lawrence ditch wants to destroy that natural protective tariff so that we will have to substitute either a political protective tariff or free trade, and God help our industry then.

Now, the tenor at Washington has switched to the power project side of it. Build grand, enormous dams with WPA and get inefficient costly power while we sit on our fannies and watch our tipples rust. Any time any of you gentlemen can take a crack at that St. Lawrence waterway, I hope to God you do it, for it deserves it.

One more thing, and I say this with a certain feeling of fear and trepidation, for I know in every audience I approach feeling is divided. I refer to the Guffy Act I have always been opposed to its principles. I have been one of the few in Ohio who have been a consistent opponent of it. I have a great many friends in Ohio, and they are all proponents. They all told me they were looking after my best interests, that I was young and inexperienced and did not know the ways of the world yet, and if I would sit back and leave them alone they would fix things up so that I could run my mines and make a lot of money.

Well, the unexpected happened, and on October 1 we got the thing. It is my pleasure to tell my friends in Ohio I appreciate their interest in my behalf, for I am running my mines and am making money, but I still do not believe in the damned thing, and I want you gentlemen to know it.

At this time, I think it is time for me to quit. But in doing so I want to express my position to you a little more clearly by telling you another story.

*(Here again it is necessary to contact the author direct)*

* * *

President Adams: As the retiring President of your organization, I want to express my appreciation to those who have worked on the committees of our Institute, the Executive Board, our very efficient Secretary, and to all of you who in any way contributed to the on-going of the Institute during the past year.

It is now my very great privilege to pass on the responsibilities of this office to one who is known, I think, to every one of you, one who has been going up and down the State of Illinois for a long while, taking a great interest in the industry which most of us serve. And as I said it is really a pleasure and a privilege to pass on to Dr. Leighton the prerogatives and privileges and duties of President of the Illinois Mining Institute. Dr. Leighton.

President-Elect M. M. Leighton: My honored predecessor, fellow officers and members of the Illinois Mining Institute, you will note I have already taken off my coat, which I trust is a symbol of the beginning of the service I shall have the privilege of rendering this Institute.

About a year ago, just a little over, one of the daddies of this organization now seated over there in the corner got busy on the long-distance telephone from Chicago to Urbana. Not being able to find me in Urbana, he traced me up and down the highways and by-ways of the State and finally located me in Chicago.

He got me on the telephone and said: "Dr. Leighton, I want your resignation from the Board of Directors of the Illinois Mining Institute."

I said: "You can have it."

He said: "That is good."

He said: "Now that I have your word, I will tell you why I asked for it."

He said: "I want to make it possible that you can be proposed for the Vice-President of the Illinois Mining Institute."

That made me feel very humble, but having given him my word I would resign from the Board of Directors, and having been cornered so cleverly, there was nothing else for me to do. And here I find myself in a position of which I am very proud, as the next President of this Institute.

Now, I cannot claim the intellect that my predecessor has and has used for the welfare of this organization, but I think I can claim the privilege of good, hard work. Furthermore, I feel I do have an advantage over my predecessor in one important way. There has been for him the necessity of a certain amount of lost motion, and my thought about that is this. When I tell you I would like to have the Secretary standing by my side — would you, Bale, stand up here? In other words, it isn't necessary for you or me to waste any motion combing our hair.

In taking this office, I am very comfortable in having the help, the most valuable help, of our Secretary and of our Vice-President, Mr. Jefferis, and the members of the Board of Directors. And also to be able to feel that I can lean upon the shoulders of such a man as Mr. Jenkins and the other members of the Institute.

I am not given to radicalism. I think I am given to conservatism. It seems to me that the policies of this organization have been always along the line of good conservatism in the way of progress. And so I hope that I may have the cooperation of every member and every officer in the coming year, to continue this fine, steady program that my immediate predecessor and the predecessors before him have been able to accomplish for this organization.

In closing, may I extend my very warmest welcome to those of you who are able to come to Urbana tomorrow? Come early enough, if you can, before 12:00 o'clock, and stop at your Natural Resources Building. Give us the privilege of showing you those specially designed laboratories that you have helped to make possible.

I thank you.

I think we are ready to stand adjourned.

(Whereupon the Meeting was declared to stand adjourned)

The following advertisers in the 1939 Yearbook displayed merchandise of their manufacture in the Exhibit Hall at the Forty-eighth Annual Meeting. The exhibits were very well attended and created a great deal of interest.

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# MINE ROOF FACE AND RIBS

During the year John E. Jones, chairman of the Roof Hazards Committee, prepared a primer on this subject. The Institute had it printed and copies were sent to our membership. It is, therefore, not necessary to republish the 139 pages in these proceedings.

Six thousand copies of the primer were printed and these have been supplied at cost for distribution among mine key men.

From the primer's contents:



The following brief address was prepared from Parts I to IV and given before the National Safety Council in Chicago on October 7th, 1940:

# WHAT DO WE ACTUALLY KNOW ABOUT ROOF TESTING

Address given at Mining Section, National Safety Council, Chicago, Illinois, October 7th, 1940.

By JOHN E. JONES

Safety Engineer, Old Ben Coal Corporation, West Frankfort, Ill.

Prior to historical records mankind unquestionably understood the difference between a solid and a hollow sound. Senses were probably more keen then than now from necessity because of individual competition for existence. The ability to listen, to hear, and to comprehend the sources and reasons for various sounds was of greater range per individual than required in a more modern civilization.

### Early Roof Testing

Our first illustration is that of a cave man being impressed by the rock fall from the roof in his cave and his instinctive inspection of the roof condition. What we now actually know and practice about roof testing in the mines was probably fairly well known and practiced in that early period.

Quarrying and mining was done for centuries wholly by man power. Loosening of rock and ore was by pick, sledge and wedge, and by leverage. Sounding was important in efficient workmanship as well as safety. The sense of sounding would be better developed then per individual workman since explosives and mechanization have since largely eliminated the need of sounding in winning the product.

### Other Problems Important

Necessity has been the mother of invention in mining as in other industries. Invention has been compulsory for without certain inventions mining would not have continued.

Early in the history of coal mining was the water problem. Carrying of water from low points had been the only means, possibly for generations, until scientific study developed pumping. Ability to continue work was the prime motive in solution of the water problem. Knowledge of water has developed to remarkable degree including measurements of its quantity and pressure and its rapid removal.

Safety predominated in solution of the gas problem. Explosive gas was more quickly removed than water. This, in the early days, was by ignition changing it from a fire damp to gases that were not explosive. This was not a solution; simply a lesser evil requiring scientific study and invention to efficiently and safely remove the gas and replace it with air. Knowledge of gases has developed to remarkable degree their properties, hazards, removal and measurements. The development of ventilation was the most important factor against gas hazards.

In other phases of mining progress is pronounced in knowledge with respects to efficiency and safety including the loosening and loading of coal and ores, timbering, transportation, power, hoisting, machinery and preparation of the product.

### Roof Hazard Determination Inadequate

There is, however, an omission in mining progress that is difficult to understand. We still guess about the looseness or solidness of the roof and sides. Our guessing has been bad. In the fifty-seven years period of anthracite and bituminous coal mining in the United States, 1880-1936, 87,052 fatalities occurred in underground coal mining. 53.4% of these (46,476) were from falls of roof and sides. In the same period 15.2% or 13,189 lives were lost from mine explosives. This and other data in the nation and for Illinois coal mines are shown in the following tables. The total number of fatalities from the causes of accidents underground are given for a period of fifty-seven years for the United States and for Illinois.

UNITED STATES—*Bituminous and Anthracite Mines*

| | Falls of roof sides or gob | Explo-sions | Haul-age | Elec-tricity | Explo-sives | Other Causes | Total Under-ground | In Shafts | On Surface including stripping | Grand Total including 114 strip-ping fatalities since 1930 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1880-1936 | 46,476 | 13,189 | 14,324 | 2,485 | 5,956 | 4,622 | 87,052 | 2,596 | 6,633 | 96,395 |
| Avg. per Year | 815 | 231 | 251 | 43 | 104 | 81 | 1,527 | | | |
| Percentage of Under-ground Fatalities | 53.4 | 15.2 | 16.5 | 2.8 | 6.8 | 5.0 | 100.0 | | | |

ILLINOIS

| | Falls of roof and sides | Explo-sions | Haul-age | Elec-tricity | Explo-sives | Other Causes | Total Under-ground | In Shafts | On Surface | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1882 to 1938, inc. | 3,383 | 586 | 1,203 | 154 | 645 | 602 | 6,573 | 347 | 253 | 7,173 |
| Avg. per Year | 59 | 10 | 21 | 3 | 11 | 11 | 115 | 6 | 4 | 126 |
| Percentage of Under-ground Fatalities | 51.4 | 8.9 | 18.3 | 2.3 | 10 | 8.1 | 100.0 | | | |

Recognition has been and is that falls cause the majority of injuries. It is puzzling why there is such absence in mining texts, mining instruction courses and mining apprenticeship of the recognition and correction of this outstanding type of hazard. From time immemorial the criticism has been "He should have set a prop." Proper timbering is unquestionably the correct answer. It is fair to estimate, however, that the majority of the 46,476 fatalities from falls in the coal mines of this nation during the 57-year period resulted from incorrect judgment as to the solidness of the rock or coal. They sounded and guessed it was safe. Many simply looked and guessed it was safe. Occassionaly there have been some who did not even look.

There has not been aroused an interest in the study of roof and side inspection comparable with gas, electrical, mechanical and other departments of underground safety procedure. For correction of this neglect there is need: —

*First*, of a more thorough understanding by all underground workers of the inspection means at hand, that it is more than a simple tapping procedure, that more frequent inspections must be made, and that a fundamental knowledge of the science of sounding should be understood.

*Second*, there is need of scientific study to find, if possible, a more definite means of measuring the looseness and the solidness of roof and sides. The scientific progress of the last half century has frequently approached possible solution of this probem. Much has been done in the finding of flaws in metals, in alarms from vault burglary, and various accomplishments in the measurement and analysis of sound waves. There is possibility of accomplishment from scientific research of a more certain means of roof and side inspection.

That which is most prevalently known about roof testing is that if the roof sounds drummy it is loose and might fall, and if it sounds solid it is safe. Injuries from working under the known loose roof occur from the acknowledged risks that are taken. Occasionally injuries occur while in the act of correcting known loose roof and sides.

Facts which are not widely understood are: —

(1) The many variations of sounds other than those that sound drummy.

(2) It is difficult to recognize a sound that is not quite solid without comparison with a solid sound.

(3) The reasons for the various sounds.

(4) That an angled roof break does not reflect sound as does a break at right angle to the direction of sounding.

(5) A vertical break will not reflect sound showing there is a cavity.

(6) A rough or staggered break will not reflect sound as does a smooth break.

(7) A break even sufficient for the rock to fall will not sound drummy if there is no space at the break.

(8) That a thud sound is frequently indication of greater hazard than a drummy sound.

(9) The importance of thud sounds and their recognition in relation to solid sounds.

(10) The loose rock, if not cracked, would sound solid if slung in midair.

(11) It is not loose rock that gives the loose sound; it is the relationship of the loose rock to the parent rock.

(12) The relationship or position of a loose rock can be of such nature as to not indicate hazard upon sounding.

(13) The most perfect drum sound is from cavity condition having a complete enclosure. Where enclosure is not complete because of broken rock the drum sound is lessened.

(14) Damping of sound is frequently caused by fracture which may result in a deceptive sound approaching that of a secure rock.

(15) A fallen uncracked rock on the floor can sound solid.

(16) Fallen rocks on the floor can be sounded and found to give varying solid to loose sounds similar to those on the roof. Certainly all those on the floor are loose.

(17) Improvement in sense of hearing is necessary and can be developed in practice of sounding fallen rocks and coal.

(18) The importance of material that is used for sounding.

(19) That two sound vibrations are started, one in the rock and the other in the tool.

(20) The sound from the tool, such as the ringing of a pick, often predominates and a thud roof sound is not recognized.

(21) Sounding with a shovel is practically of no value. The rock must be thin and very drummy to sound louder than the ring of the shovel.

(22) Sounding with the knuckles is of no value.

(23) An iron bar or miners sledge are the best sounding tools.

ILLUSTRATIONS

*Solid Sound*

The forward motion of a sound wave in solid rock is shown in Fig. 1. The semi-circles in the rock and air represent the distance the wave has travelled in the same time. The graph shows only the velocity of sound. The sound waves travel into the rock there being no drum sound or other interference to the sound waves to create other than the solid tone from the vibrating surface close to the listener.

*Drum Sound*

In Fig. 2 a break and air (or gas) cavity are shown in the rock

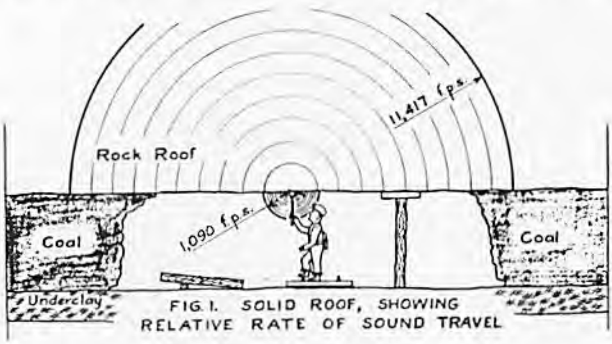


FIG. I. SOLID ROOF, SHOWING RELATIVE RATE OF SOUND TRAVEL

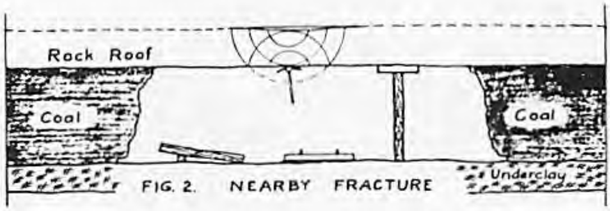


FIG. 2. NEARBY FRACTURE

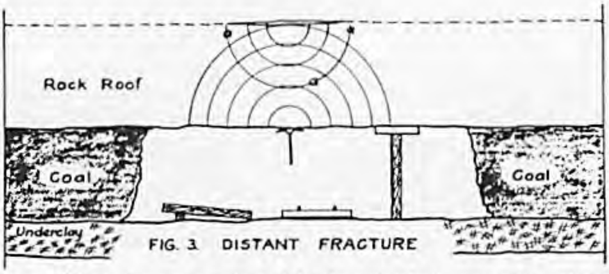


FIG. 3. DISTANT FRACTURE

not far from the location of the pick blow. Here the forward motion of sound and reflection are shown giving a drum sound.

The break shown in Fig. 2 is that frequenty occurring in laminated roof. Good examples are loose drawslate and top coal. The air cavity, even though it be thin, vibrating with the smooth shale which corresponds to a back drum head and the surface sounded gives a definite drum sound if the cavity is not far up in the rock for the reflected sound to return to the vicinity of the listener. There must be a cavity to produce a drum sound. The expression "draw slate" is well named because it tends to draw away from the parent rock and forms the drum-like condition.

The drum layer of shale (or coal roof) corresponds to the drum head which is struck. The cavity corresponds to the air cavity in the drum. The solid backing rock corresponds to the opposing or back drum end.

A flat rock on the floor can be arranged to give a drum sound when sounding its top surface, providing a smooth floor is cleaned so that the air space between the rock and floor is sandwiched between reasonably flat surfaces. A more resonant drum sound can be had if the outer edge of the air space (the circumference of the edge resting on the floor) is sealed as with putty. This establishes a similar condition to a loose rock at the roof that has an enclosed air or gas space between it and the parent roof.

*The Thick Rock*

In Fig. 3 is shown too great a thickness of rock between location of sounding and the cavity to permit the reflected sound to reach the listener. The forward waves reach the cavity but the audible reflection waves apparently cease at "a," those reaching the listener being too weak to be heard. The original sound waves at the roof surface that is tapped will, therefore, predominate approaching a solid ring sound. Close attention reveals more or less thud sound from the damping effect of the overlying conditions.

*The Angled And Vertical Cavities*

At A in Fig. 4 is shown a vertical cavity. This air cavity does not receive the vibration from the surface tap at A due to the cavity not being in direction of the vibration. Sounding anywhere in the vicinity of cavity A will not disclose by sound the presenese of this vertical cavity or crack. It is similar to sounding a drum parchment edgewise instead of flatwise.

At BD in Fig. 4 is shown an angled slip.

Slips often approach a 45 degree angle. They are occasionaly flatter than 30 degrees but are usually found between that angle and the vertical. At such angles there is no drummy sound when sounding between A and B. There cannot be a resonant condition from vibrations striking at such angles. We can readily understand why this is so by attempting to sound a rock surface at an angle. There is a scraping motion and scraping sound between sounding tool and surface. The sound waves are likewise affected. No tap vibration is possible until a much closer to horizontal position is approached. There can be no drum sound without vibrations set up to be reflected.

Assume A and B to meet at D and the large mass of rock ready to fall. There is no method of rod sounding that the ear can detect to show the true conditions. Sounding from A to within a few inches from B will give solid tones. Likewise at C such slip in the coal seam can not reflect a drum sound when sounding the coal rib.

*Angled Breaks*

In Fig. 5 is shown a frequent type of hazard that is difficult to ascertain by sounding. The room roof has fallen and one prop has been reset where the rock sounds drummy. Sound at A is a thud and not considered loose since sounds at B, C and D approach solid tones because of the angled back surface and the thickness. At E the sound is a definite thud sound. The approach to solid tone sounds at B, C and D is misleading and cleaning of the fall is often begun without temporary props since more permanent timbering will at once be set upon removal of the fall.

Insufficient attention to thud sounds, incomplete inspection of surroundings and too much risk for even a few seconds have resuted in serious and fatal accidents in many conditions similar to this one.

It is evident that a rock having a definite degree of looseness, even almost ready to fall, can sound through different drum sounds, through different thud sounds and even reach a solid sound to the ear. These are all dependent upon the cavity's distance from the roof

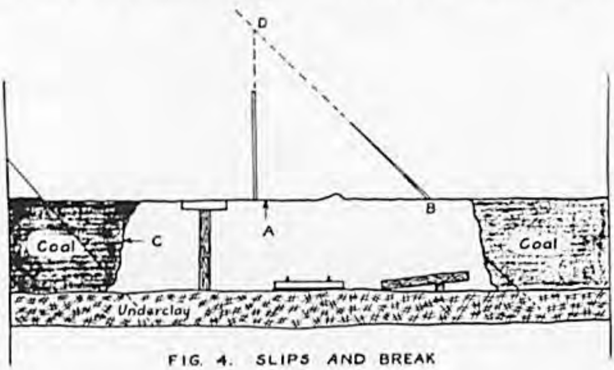



FIG. 4. SLIPS AND BREAK

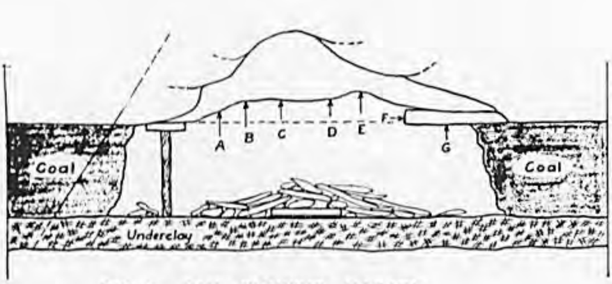



FIG. 5. FALL CLEANING HAZARD

surface sounded, its angle with the roof surface, whether or not the break is a cavity and if so, the degree of roughness or smoothness of its surfaces that are somewhat parallel to the roof surface.

The technique in this Fig. 5 example is to recognize the probable hazard; that the thud sounds at A and E resulting from continuation of the break from the drum sound at the prop. The almost solid sounds at B, C and D are probably so because of too great a thickness of rock between the roof surface and the break.

*The Loose Brow*

In Fig. 5 is shown the brow F-G. Sounding at F is similar to sounding at A in Fig. 4; parallel with the cavity. Sounding at G is damped by the loose rock above the loose one being sounded resulting in the usual thud sound mistaken for a solid tone.

Clod roof is shown in Fig. 6. This is especially hazardous since it is very difficult to analyze the true condition from sounding and because of its varying thickness. As the name suggests, one does not expect to get a solid tone upon sounding clod. The sound to be expected is a thud. Some estimate of clod thickness is occasionally made from sounding. A frequent hazard is shown in the figure where the clod adjacent to the pillars is thin and that over the passageway is thick. The beam support value at A and B is too weak for the weight between these two points, that location where thud sounds approach solid sounds.

*Boulders*

Fig. 7 is given to show the maximum of conditions where sound-

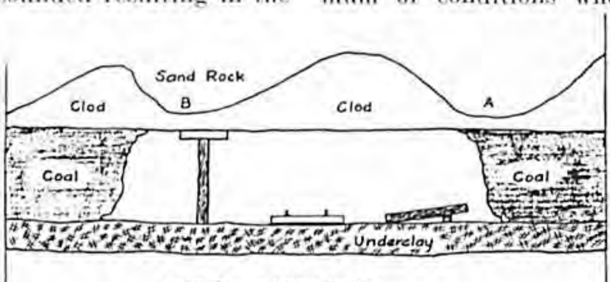



FIG. 6. CLOD ROOF

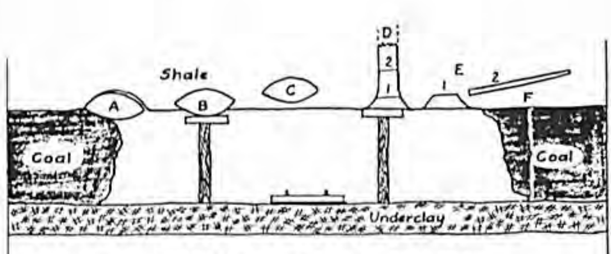



FIG. 7. KETTLEBOTTOM OR BOULDERS

ings are of no value. Boulder A will fall as soon as a small quantity more of coal is removed. The cavity and back rock above will not give a drummy sound. Horizontal conditions do not exist for unison of vibrations and for reflection. Likewise B and C will sound solid even though they are loose. In the kettle-bottoms D and E a horizontal cavity at "1" may reflect a drummy sound depending upon sufficient smoothness of the cavity surfaces and its closeness to the listener.

The rough coal break at F in Fig. 7 shows a large quantity of coal ready to fall. Sounding the coal rib will not give a drum sound, even though there is a cavity, because of the roughness of the inner surface. Examination of undercut and feeling for vibration will give better knowledge of the hazard.

The travel of sound in rock and coal is well understood by miners. In the approach of passages before connecting there is often a tapping on the solid coal face from each working face by the workers to estimate by sound the distance yet to be driven when the distance is short. When such sounding is done a solid place on the coal face is chosen to do the tapping. Usually the sound cannot be heard a long distance. As a boy listens on the rail or the Indian listened on the ground sound can be heard farther by listening on the coal. Blasting can be heard at much greater distances than hammer blows on the coal.

*Geophone*

A sufficiently sensitive device can detect sound waves at much greater distances than the human ear. Such a device, the geophone, has been made for detecting the tapping of miners in event of their impossibility to escape and tapping is done by them in effort towards communication with rescuers. Miners so imprisioned can organize a tapping system in the hope that listening is being done by means of the geophone on the surface, the coal rib or rail in another part of the mine or the coal rib of an adjacent coal mine. With geophonic success not only is it possible to hear the tapping but it is possible to locate the direction of the source of the sound. Unfortunately, practical development is not completed. Sufficient development has been made to prove the theory is true and possibility of practical success.

*Lamination Factors*

Soundings with the geophone are across the laminations when listening is on the surface and along the laminations when listening is on the coal seam. Sounding of coal in line with the partings is entirely different in tones and velocity than sounding at right angles; such as sounding roof coal. The differences may be shown upon sounding a prop or bar crosswise and lengthwise. Velocity of sound waves along the grain of elm wood is 13,517 and across the grain is 4,658 ft. per second.

There is added difficulty in ascertaining breaks (other than those a few inches from the sounded surface) in the coal seam and in sounding rock roof edgewise as compared with flatwise. The action is somewhat similar to tapping a steel rail endwise to find a flaw instead of crosswise.

*Comparison of Sounds*

It is largely by comparison that we measure. A runner is going fast at 100 yards in ten seconds. This 20 miles per hour is not fast in comparison with cars on our highways. When a car at fifty miles per hour passes a fast runner the comparison is more vivid than to see them separately at these speeds.

It is even more difficult to subconsciously remember slight change in sounds. The thud in sounding roof is difficult for many to recognize without direct comparison with a solid tone. Were it possible to always have a solid parent roof structure within reach to get the solid tone for comparison when sounding the draw slate, the clod or the rock above the fall that is to be cleaned, a better analysis from sounding would result. Were it possible to somehow artifically in some simple manner, such as with a toy cricket, to always produce that solid tone before sounding, a better comparison would be made than from memory of the solid tone. The chief failure in accurate sound analysis is faulty analysis that a thud sound is a solid tone sound. This often is because the drummy sound is absent and the ring of the pick predominates in the hearing. Accidents in working without timbering under or adjacent to that which sounds drummy are always because of self-acknowledged risk that was taken. Accidents in working under that which had the thud sound are often due to sincere faulty conclusion that it was solid and safe. It is amazing how large a number of miners of many years of experience who have not mastered this sounding technique of difference between the solid tone and the thud sounds, yet how plain it is to nearly all of them and how surprised they are when making a direct comparison within a few moments of a solid tone with the thud sound. Sometimes one is found who claims he cannot detect a difference. Reversing the pick and forcefully sounding with the handle end, thus eliminating the ring of the metal pick, usually convinces him there is a definite difference in sounds. A greater difference can be demonstrated by hard blows with a sledge hammer. At rare occassions one is found who still claims he cannot detect a difference in the sound, that the solid tone and thud sounds I hear sound the same to him. The distinct difference in sounds to me creates possibility that inability to clearly differentiate between sounds exists akin to color blindness.

*The Desire Factor*

Here also enters one or both of the psychological factors of "hurry up" and "want it to Sound safe." The desire that it is safe can predominate overcoming need of careful comparison. Safety may be important yet secondary to either of these two desire factors, accidents resulting from wanton risk through varying degrees of conscious risk and apparent safety.

*Wrong Analyses Factor*

It is my firm opinion that falls accidents usually occur from a wrong analysis of the true conditions, the majority of these wrong analyses resulting from improper, inadequate and non-understanding of sounding.

In apparently solid sounding drawslate, for instance, the sound is nearly always a thud sound approaching a solid tone. Even though no cavity exists there is sufficient absorption of the sound waves in the drawslate parting to dampen tone resulting in a thud sound. Insufficient comparison with truly solid sounding is done to develop correct knowledge of the thud sound, the most treacherous rock and coal sound in coal mining.

*Sounding Tools*

The sound from impact of two bodies may be from the vibration of both. In striking an anvil with a steel hammer the sound waves from both the anvil and hammer will be heard. In using a lead hammer only the sound waves from the anvil can probably be heard without very close attention.

In sounding of rock and coal the minimum of vibration from the sounding tool is desired. A baseball bat, a billiard cue and a copper rod are good in this respect. They would, however, be special equipment for the miner. He usually has a steel bar, a shovel, a pick and a 3 to 4 lb. hammer. The choice of these is the bar or the hammer. General use of a hammer for sounding throughout the length and breadth of coal mining plus proper vocational instruction upon the principles of structures, sound and testing would materially lessen falls accidents. Instruction at the mines and in study courses by laboratory means of sound variations and their causes would be of additional value.

There is possibility of improved sounding tool or sounding instrument development of sufficient simplicity and greater accuracy than our present means in the measurement of a loose rock. Its greatest value would be its possible use by all who sound the rock and coal. If not sufficiently practical for general use it would be of value in better development of sound sense.

*Other Than Sounding Inspection*

In effort towards determination of the condition of roof the miner in his analysis uses other means in addition to sounding. When sufficiently loose and not too big a physical vibration may be felt with the other hand when sounding. When a vibration is felt there is no question as to the very loose condition of the roof rock. Rock or coal, especially coal, on the rib or face can with considerable certainty be tested in this manner. In such vertical position it can be very loose yet remaining in position even though the holding support be very slight.

Excessive roof weight is usually shown by the crushing of pillars and timbers. Prior and during such crushing is the usual chipping noise and breaking off of face and pillar particles. A soft bottom will heave. Evidence is first shown in the weakest structure.

The presence of vertical roof breaks may upon close search be found. Sounding will not give evidence of these vertical breaks. Search for slips is also important. The fresh chipped surface edge from weight of a very big rock is evidence of a bad hazard that can not because of the rock's bigness be found by sounding. Occasionally such chipped edge can be followed from fresh shale chips that have fallen to the floor. In occasional locations the conditions are peculiar in that a moisture line appears along the line that soon will break.

Instruction with respect to safety and efficiency in mines has improved in all mining efforts except sounding. These include gas, ventilation, haulage, drainage, timbering and many others. Sounding is accepted as so simple in procedure and understanding as to require no study or instruction; simply advice and instruction that the roof be sounded.

*Need of Improved Technique*

Proper technique is understood by very few and much good can be accomplished from proper standardized instruction given as in gas, ventilation, electricity and first aid.

The usual falls fatalities are one by one and do not arouse public condemnation as explosions from which hazard fatalities per accident occasionally approach 100 and even go beyond that figure. In the bituminous mines of the United States during the 33 years of mine operation ending January 1, 1939, there were 27,080 fatalities from falls of roof and face and 8,048 from local and major explosions; 77 percent from falls and 23 percent from explosions. My contention is not that too much interest is given the explosion hazard but it certainly is that the falls hazard problem has not been given its proportionate attention and study.

*Safety Culture*

There has not been bred into us in the three centuries of coal mining a safety culture to balance the falls hazard. The American Indian was adept at looking and listening to see and hear with amazing sensitivity the possibility of food or enemies. His ability to sense foot prints in the leaves, hear the rustle of a branch and to walk silently impressed us in our school histories. Unquestionably there was training from babyhood through the play of boyhood and an important part in the discussion at family and community gatherings. All individuals lived in their industry from birth to the end, success of each largely depending upon development of his senses and correct interpretation.

It is difficult to conceive of an industry in which the family life is so divorced from the industrial physical activity as coal mining. There are no toys or play in copy of the father's work. There are toy soldiers, guns, wheel barrows, wagons, tractors, building blocks, tool chests, airplanes, chemistry sets and what-not, but certainly no roof sounding. The boy approaching maturity upon getting his first job in the mine enters into a new environment. The type of industry compels absence of this sense development in those most important impressionable years.

To listen or to look and not understand that which is heard or seen is similar to attendance at a baseball game without knowledge of the game. Sufficient interest in attention and questioning will soon result in knowledge of the game. The technique of baseball is well established in the majority of those who attend. A similar efficiency of technique with respect to the hazards of falls in mining is essential for safer workmanship and safer management.

*The Experience Factor*

The trend of thought is that our practical knowledge is in direct proportion to our number of years of work in the mines. This is equally as applicable to mine workers as to any other class of folks. Many of us absorb the maximum of all we know on safe workmanship within the first year's experience on a job. Those of us approaching half a century of work in the mines without a serious injury naturally think it is due to our knowledge from the many years of practical experience. From my study of this particular experience factor I am convinced that this years-of-experience factor per individual is of lesser importance than his ability factor. It is true there are many of us who have experienced many years in the mines without serious injury. The reason is possibly our safety ability and perhaps the good breaks that have been ours. Statistics tend to show that the number of years of experience is of little, if any, value regarding injuries from rock and coal falls at the working faces.

*Falls-Age; Fatality Data*

The most recent Illinois mine data available upon ages is from the annual coal reports from 1924 to 1928 inclusive. Fortunately for statistical data that five years is a fair representation of normal employment conditions. Sons of miners were normally employed and labor turnover as to ages similar to previous years; somewhat different to present abnormal conditions with respect to age per individual. We now hang on to our jobs more tenaciously irrespective of how old we are. Youth at present has not been employed in our mines as in the past and split time is a factor that upsets statistical data. A better study could be made if we knew the age of each employee during that five year period. The data given, however, is such that conclusions of unquestionable character can be deduced.

From those five annual coal reports the following table is made. It is a tabulation of all the fatalities from rock and coal falls occurring in the coal mines of the state in those five years showing the number of rock fall and the number of coal fall accidents per age of injured at time at accident.

In the first 18 year column, from 17 to 35 years of age, there were 90 fatalities. Some of these were haulage men, the cause of accident being runaway or derailment.

In the second 18 year column, from 35 to 53 years of age, there were 162 fatalities.

In the third column, from 53 to 74 years of age, there were 79 fatalities for the same number of years.

These columns speak for themselves in that years of experience apparently is not a factor in the reduction of falls accidents. The average age of 330 men who lost their lives by falls during those five years is 42.7 years. Unquestionably they had an average of over 20 years of experience in the mines.

The table follows. From it the student can make any comparisons. At age 50, for instance, is the maximum number of roof falls and total falls fatalities. An interesting study is had in grouping by fives as is done by eighteens.

## AGE AT TIME OF ACCIDENT AND NUMBER OF FATALITIES IN ILLINOIS COAL MINES FROM FALLS OF ROCK AND FALLS OF COAL

**Fiscal Year 1924 and Calendar Years 1925, 1926, 1927 and 1928**

ANNUAL COAL REPORTS—ILLINOIS

| AGE | ROCK | COAL | AGE | ROCK | COAL | AGE | ROCK | COAL |
|---|---|---|---|---|---|---|---|---|
| 17 | 2 | 2 | 35 | 4 | 3 | 35 | 2 | 1 |
| 18 | 1 | 1 | 36 | 3 | 4 | 54 | 7 | 2 |
| 19 | 2 | 1 | 37 | 3 | 4 | 55 | 6 | 4 |
| 20 | 4 | 4 | 38 | 4 | 1 | 56 | 8 | 2 |
| 21 | 1 | 1 | 39 | 11 | 2 | 57 | 6 | 2 |
| 22 | 3 | 2 | 40 | 9 | 4 | 58 | 3 | 4 |
| 23 | 2 | 5 | 41 | 2 | 1 | 59 | | 2 |
| 24 | 3 | | 42 | 5 | 3 | 60 | 5 | 3 |
| 25 | 1 | 3 | 43 | 8 | 6 | 61 | 3 | |
| 26 | 4 | 2 | 44 | 8 | 2 | 62 | 3 | 1 |
| 27 | 4 | 2 | 45 | 5 | 6 | 63 | 1 | |
| 28 | 4 | 3 | 46 | 9 | 2 | 64 | | 2 |
| 29 | 4 | | 47 | 2 | 2 | 65 | 2 | 1 |
| 30 | 2 | 4 | 48 | 1 | 5 | 66 | | 1 |
| 31 | 2 | 1 | 49 | 4 | 3 | 67 | 1 | 1 |
| 32 | 5 | 3 | 50 | 14 | 4 | 68 | 1 | 2 |
| 33 | 2 | 1 | 51 | 7 | | 69 | 2 | |
| 34 | 4 | 5 | 52 | 9 | 1 | 74 | 1 | |
| FATAL-ITIES: | 50 | 40 | | 108 | 53 | | 51 | 28 |

Fatalities from Rock Falls fcr 5 years........................ 209
Fatalities from Coal Falls for 5 years........................ 121
Age not given............................................ 1

TOTAL ........................................ 331

Average age of 209 men killed by rock falls was...........43.55 years.
Average age of 121 men killed by coal falls was...........41.22 years.
Average age of 330 men killed by falls was...............42.69 years.
Rock falls are roof and brow falls.
Coal falls are face, rib and roof falls.

From the foregoing it is evident that we as individual mine workers do not, irrespective of how many years we have worked in the mines, learn dangerous rock sufficiently well to affect the records or else we develop indifference to the danger at about the same rate that we grow in knowledge of the hazard.

*Failure of Progress*

The failure over centuries of coal mining to make definite encouraging progress against the falls fatality rate is indeed appalling. In the last third of a century effort far beyond all preceding effort has been made throughout the nation for safer coal mining. These efforts are included in creation of national and state governmental departments, national and state associations and institutes, compensation acts, safety instruction and literature, mine rescue and first aid, prizes and awards and many other costly efforts that did not exist before. In addition there are added mining laws, improved equipment, certified competency, added inspection and so on and on many times more than we had a third of a century ago. Encouraging results have been obtained in the reduction of other types of accidents but falls accidents in the main go on at the same high rate as before these special safety efforts were begun.

*Systematic Timbering*

There are occasional mines that have made remarkable progress in the lessening of all accidents, including falls accidents. The basis of their success is they don't trust the roof to be good, assume it is all bad and timber it, good or bad. Systematic timbering is adopted designed to safeguard the worst conditions. Safety posts are set in proximity to the working face usually ahead of the car and certain prescribed maximum distances only are permitted to exist between timber, rib or face supports. This is the most efficient and safest plan so far tried. Its success has been proven and demonstrated by many companies.

With this system there is a definite and interlocking supervision to ascertain first that material is at hand; if not, the working place is not worked. Second, that timbering is completed as per the system adopted and third, that the worker has his safety post or posts properly set or cleaning to set them. In addition is the assumption the worker and superivsor knows the technique of sounding roof, ribs and face. This is an essential part in the safety program of systematic timbering.

*Need of Scientific Study*

Irrespective, however, of how well timbering is done the need to correctly test roof and sides remains. We have not approached our best endeavor with the safety means we have at hand. We have not given proportionate scientific attention this fatality rate suggests when compared with the explosion hazard. We certainly have not attempted application of recent sound and vibratory applications to our problem that have been scientifically successful in other industries in improved efficiency and safety. There is unquestionably room for much improvement in our present technique and probably scientific application of roof inspection that can substantially improve over our present method of estimating the looseness or solidness of a rock.

# STATE STATISTICS — MECHANIZATION OF COAL MINE PRODUCTION

(Reprinted from MECHANNUAL, 1940)

Altho mechanization of coal mine production embraces all phases of mining, mechanical loading is the only phase of mechanization which can be expressed statistically for a large portion of the national production. It is reasonable to assume, however, that mechanical loading information serves as a useful index for observing changes and interpreting trends in mine mechanization, since the same motives which have brought about the mechanization of face loading have even to a larger extent impelled the increased mechanization of all mining processes.

This section presents details of mechanicallly loaded production by seams, seam thicknesses and mine size groups in many of the 23 producing districts into which the coal fields of the nation are subdivided by the Bituminous Coal Act of 1937. In general, the data upon which this information is based were obtained from state reports. In cases where 1939 reports were not yet available, the state departments have cooperated generously in furnishing material for publication. In many of the states where reports are lacking or do not show sufficient data, the operators associations have assisted in obtaining the necessary information from the individual companies.

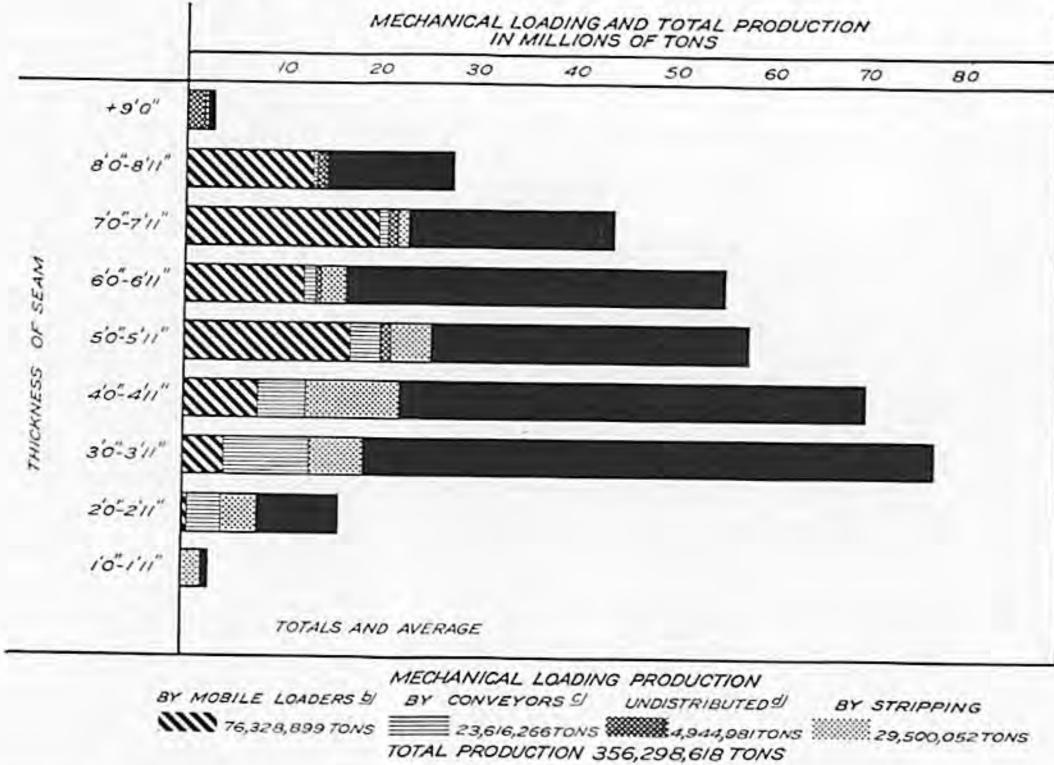
On the following page is presented a chart which summarizes graphically the amount and proportion of mechanically loaded, stripping and total production in 12-inch increments of seam thickness for the districts presented in detail in the remainder of this section. The information on this chart represents 91 percent of the total national production, 94 percent of the underground mechanically loaded production and 84 percent of the strip mined production. In general, the production represented on this chart is restricted to shipping mines. In a few of the western states, however, where separate tabulations of shipping mines can not be made, all mines producing over 1000 tons during the year have been included.

The highest concentrations of mechanical loading, expressed by the proportion of mechanically loaded production to total production, are in the thick seams in excess of 7′0″. With decreasing thickness the concentration of mechanical loading also decreases, altho total production rises in each successively thinner 12-inch increment thru the seam thickness of 3′0″ to 3′11″. The concentration of mechanical loading again rises in seam thicknesses of 2′0″ to 2′11″.

### DISTRICT 10 — ILLINOIS

District 10 includes all of the coal-producing counties in Illinois. Statistics on 1939 coal production were obtained thru the generous cooperation of the Department of Mines and Minerals, State of Illinois. In order to show in detail the relationships that exist in Illinois coal production, the statistics con-

## BITUMINOUS COAL PRODUCTION 1939[a]
## METHODS OF MINING BY THICKNESS OF SEAM




| Thickness of seam | Percent of total production | No. of mines: Total | No. of mines: Using mechanical loading underground | Percent of production: By mobile loaders | Percent of production: By conveyors | Percent of production: By mechanical loading underground | Percent of production: By stripping |
|---|---|---|---|---|---|---|---|
| +9'0" | 0.8 | 40 | 11 | 10.0 | 13.2 | 69.3 | 5.0 |
| 8'0"-8'11" | 7.8 | 99 | 40 | 47.4 | 2.2 | 52.2 | 0.8 |
| 7'0"-7'11" | 12.4 | 158 | 73 | 45.3 | 2.4 | 50.8 | 2.5 |
| 6'0"-6'11" | 15.7 | 246 | 70 | 22.6 | 2.0 | 25.4 | 5.0 |
| 5'0"-5'11" | 16.3 | 311 | 100 | 29.9 | 5.6 | 37.5 | 6.8 |
| 4'0"-4'11" | 19.7 | 459 | 94 | 11.2 | 7.0 | 18.2 | 13.8 |
| 3'0"-3'11" | 21.8 | 608 | 141 | 5.6 | 11.3 | 16.9 | 7.3 |
| 2'0"-2'11" | 4.5 | 272 | 49 | 3.2 | 21.9 | 25.1 | 23.1 |
| 1'0"-1'11" | 1.0 | 67 | - | - | - | - | 73.2 |
| Totals and average | 100.0 | 2260 | 572 | 21.4 | 6.6 | 29.4 | 8.3 |

[a] Refer to preceding page for sources and extent of information.
[b] Includes production by scrapers and part of production by self-loading conveyors.
[c] Includes production by pit car loaders and part of production by self-loading conveyors.
[d] Underground mechanical loading in Wyoming for which types of loading are not available.

cerning total, mechanically loaded and strip-mined production are presented by two charts.

The first chart, on the following page, indicates the distribution of the total production of the state by seams, thickness of seams and size of mines. It also shows the relationship of strip-mined coal to total production in each of these various classifications. The second chart, on the next page, indicates the distribution of the total underground production of the state by seams, thickness of seams and size of mines. It also shows the relationship of mechanically loaded production to total underground production for each of these various classifications.

over 500,000 tons during the year, strip-mined production decreased from 35.1 percent in 1938 to 32.3 percent in 1939. It also decreased slightly in the 200,000 to 500,000-ton group but increased from 12.6 percent in 1938 in the group producing between 100,000 and 200,000 tons to 13.4 percent in 1939.

The proportion of underground production to total production in Illinois increased slightly from 73.4 percent in 1938 to 73.7 percent in 1939. The proportion of mechanically loaded production to the total underground production increased from 82.6 percent in 1938 to 84.5 percent in 1939. All of the increase in mechanically loaded production, amounting to approximately 4,500,000 tons, was accomplished with mobile loaders. The proportion of mobile loaded production to total underground production increased from 72.8 percent in 1938 to 79.3 percent in 1939. Conveyor production, principally by pit car loaders, fell off materially, dropping from 9.8 percent of total underground production in 1938 to 5.2 percent in 1939.

The largest relative growth in mechanical loading by seams occurred in seam number 5, where the proportion of mechanically loaded production to total underground production increased from 56.0

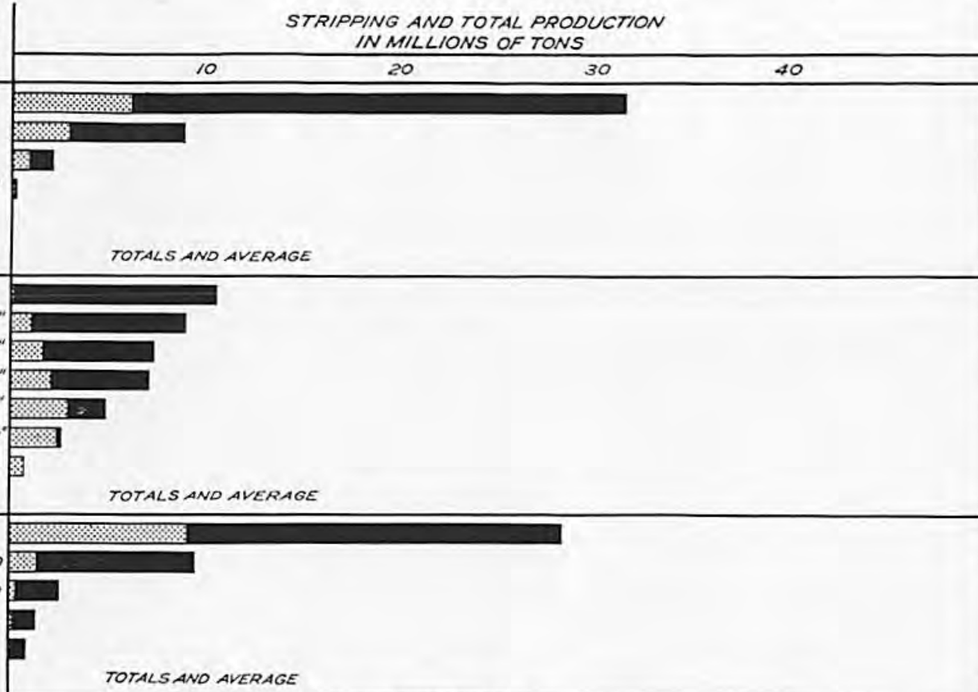
DISTRICT 10. ILLINOIS, SHIPPING MINES ONLY

Comparison of Production Statistics, 1938-1939

| | 1938 | 1939 |
|---|---|---|
| Total production, thousands of tons | 38,698 | 42,994 |
| Number of shipping mines | 153 | 147 |
| Number of mines, strip | 26 | 26 |
| Strip Mining: | | |
| Production, thousands of tons | 10,290 | 11,296 |
| Percent | 26.6 | 26.3 |

Altho approximately 55 percent of the total strip-mined production in 1939 was obtained from seam number 6, which supplies 73.7 percent of the total production of the state, the proportion of strip-mined production to total production in that seam was only 19.5 percent. The proportion of stripping production to total production in all other seams was materially higher. The proportion of strip-mined production to the total production of each increment of seam thickness decreases progressively with increasing thickness of seam. In the mine size group producing

# DISTRICT NO. 10 — 1939. ILLINOIS — TOTAL PRODUCTION

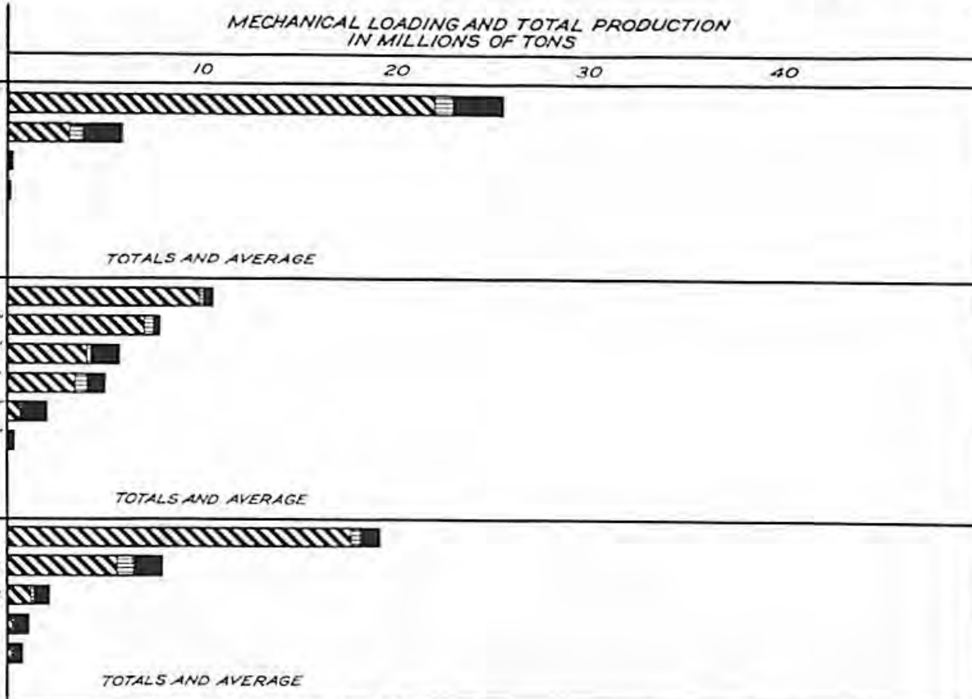



| PRODUCTION INCREMENTS | | PERCENT OF TOTAL PRODUCTION | NUMBER OF MINES: TOTAL | | | NUMBER OF MINES: STRIPPING | PERCENT OF EACH PRODUCTION INCREMENT STRIP-MINED |
|---|---|---|---|---|---|---|---|
| NAME OF SEAM | NUMBER 6 | 73.7 | 99 | | | 12 | 19.5 |
| | NUMBER 5 | 20.7 | 34 | | | 7 | 34.2 |
| | NUMBER 2 | 5.1 | 9 | | | 5 | 88.1 |
| | NUMBER 7[a] | 0.5 | 5 | | | 2 | 66.1 |
| | TOTALS AND AVERAGE | 100.0 | 147 | | | 26 | 26.3 |
| THICKNESS OF SEAM | +8'0" | 24.9 | 23 | | | 2 | 0.9 |
| | 7'0"-7'11" | 21.0 | 27 | | | 1 | 12.1 |
| | 6'0"-6'11" | 17.4 | 31 | | | 4 | 22.4 |
| | 5'0"-5'11" | 16.8 | 34 | | | 5 | 29.8 |
| | 4'0"-4'11" | 11.8 | 20 | | | 7 | 60.3 |
| | 3'0"-3'11" | 6.3 | 8 | | | 3 | 89.9 |
| | -2'11" | 1.8 | 4 | | | 4 | 100.0 |
| | TOTALS AND AVERAGE | 100.0 | 147 | | | 26 | 26.3 |
| SIZE OF MINES ANNUAL PRODUCTION IN THOUSANDS OF TONS | +500 | 66.3 | 38 | | | 12 | 32.3 |
| | 200-500 | 22.3 | 27 | | | 4 | 15.6 |
| | 100-200 | 6.1 | 18 | | | 3 | 13.4 |
| | 50-100 | 3.1 | 19 | | | 2 | 12.4 |
| | -50 | 2.2 | 45 | | | 5 | 9.7 |
| | TOTALS AND AVERAGE | 100.0 | 147 | | | 26 | 26.3 |

MECHANICAL LOADING PRODUCTION
BY STRIPPING 11,295,547 TONS
UNDERGROUND 31,698,560 TONS
TOTAL PRODUCTION OF DISTRICT 42,994,107 TONS

[a] Includes one underground mine operating in No. 1 seam.

## DISTRICT NO. 10 — 1939. ILLINOIS — UNDERGROUND ONLY




| PRODUCTION INCREMENTS | | PERCENT OF TOTAL PRODUCTION | NUMBER OF MINES: TOTAL | USING MOBILE LOADERS ONLY | USING CONVEYORS ONLY | USING BOTH MOBILE LOADERS AND CONVEYORS | PERCENT OF EACH PRODUCTION INCREMENT MECHANIZED |
|---|---|---|---|---|---|---|---|
| NAME OF SEAM | NUMBER 6 | 80.5 | 87 | 37 | 4 | 13 | 90.2 |
| | NUMBER 5 | 18.5 | 27 | 8 | 1 | 4 | 64.4 |
| | NUMBER 2 | 0.8 | 4 | - | - | - | - |
| | NUMBER 7[a] | 0.2 | 3 | - | - | - | - |
| | TOTALS AND AVERAGE | 100.0 | 121 | 45 | 5 | 17 | 84.5 |
| THICKNESS OF SEAM | +8'0" | 33.5 | 21 | 13 | 1 | 5 | 95.9 |
| | 7'0"-7'11" | 25.0 | 26 | 13 | 2 | 4 | 94.8 |
| | 6'0"-6'11" | 18.3 | 27 | 8 | 1 | 3 | 75.6 |
| | 5'0"-5'11" | 16.0 | 29 | 7 | - | 5 | 78.9 |
| | 4'0"-4'11" | 6.3 | 13 | 4 | 1 | - | 35.1 |
| | 3'0"-3'11" | 0.9 | 5 | - | - | - | - |
| | TOTALS AND AVERAGE | 100.0 | 121 | 45 | 5 | 17 | 84.5 |
| SIZE OF MINES ANNUAL PRODUCTION IN THOUSANDS OF TONS | +500 | 60.9 | 26 | 17 | - | 9 | 95.0 |
| | 200-500 | 25.5 | 23 | 14 | - | 5 | 80.5 |
| | 100-200 | 7.1 | 15 | 7 | 1 | 1 | 63.4 |
| | 50-100 | 3.7 | 17 | 2 | 2 | 1 | 26.5 |
| | -50 | 2.8 | 40 | 5 | 2 | 1 | 23.5 |
| | TOTALS AND AVERAGE | 100.0 | 121 | 45 | 5 | 17 | 84.5 |

MECHANICAL LOADING PRODUCTION
BY MOBILE LOADERS 25,138,546 TONS — BY CONVEYORS [b] 1,648,515 TONS — HAND LOADED 4,911,499 TONS
TOTAL UNDERGROUND PRODUCTION 31,698,560 TONS

[a] Includes one underground mine operating in No. 1 seam.
[b] Includes production by pit car loaders.

percent in 1938 to 64.4 percent in 1939. In seam number 6 this proportion remained essentially constant in the two years. The largest relative growth in mechanical loading according to thickness of seam took place in the 4′0″ to 4′11″ and 5′0″ to 5′11″ increments, where the proportions of mechanical loading to total underground production increased from 29.5 and 67.5 percent in 1938 to 35.1 and 78.9 percent in 1939. The proportions of mechanically loaded production underground were changed but little in 1939 in the seam thicknesses in excess of 6′0″. As in 1938, the highest concentrations of mechanical loading were in the 7′0″ to 7′11″ and plus 8′0″ thickness increments where 58.5 percent of the underground production was obtained.

DISTRICT 10. ILLINOIS, SHIPPING MINES ONLY
Comparison of Production Statistics, 1938-1939

| | 1938 | 1939 |
|---|---|---|
| Total production underground, thousands of tons | 28,408 | 31,699 |
| Number of underground mines | 127 | 121 |
| Number of mines employing loading underground | 65 | 67 |
| Mechanically loaded production: | | |
| By mobile loaders, thousands of tons | 20,673 | 25,139 |
| By mobile loaders, percent | 72.8 | 79.3 |
| By conveyors, thousands of tons (a) | 2,777 | 1,649 |
| By conveyors, percent | 9.8 | 5.2 |
| Number of mobile loader units | 511 | 523 |
| Number of conveyor units (a) | 646 | 332 |

(a) Includes pit car loaders.

*(Reprinted from MECHANIZATION — The Magazine of Modern Coal)*

# COMBINED TRUCK AND RAIL HAULAGE IN THE FIATT MINE OF THE TRUAX-TRAER COAL CO.

By H. P. NICHOLSON

Assistant Professor of Mining Engineering, University of Illinois, and an Associate Editor of MECHANIZATION

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The Truax-Traer Coal Company is one of the pioneers in the coal stripping industry of Illinois, but the statement that the company is a pioneer does not in any way imply that it has not kept abreast of technical and mechanical developments during the past several years. The Fiatt Mine may be used as an example to show that, tho a pioneer, the company is thoroly modern in its equipment and management.

This mine is at Fiatt, Fulton County, Illinois. The company acquired and completed the development of the acreage in 1935, the first coal being shipped in September of that year. The area yet to be mined is sufficient to assure a further life of at least 15 to 20 years at the present rate of production. Until April 1938, the coal was prepared in a five-track steel tipple equipped with picking tables, loading booms, mixing conveyor, coal crusher and vibrating screens for preparing crushed screenings. At that time a new washing plant was placed in service, and a new heat drying plant went into operation in October 1938. As now constructed the preparation plant has capacity for 500 tons of cleaned coal per hour.

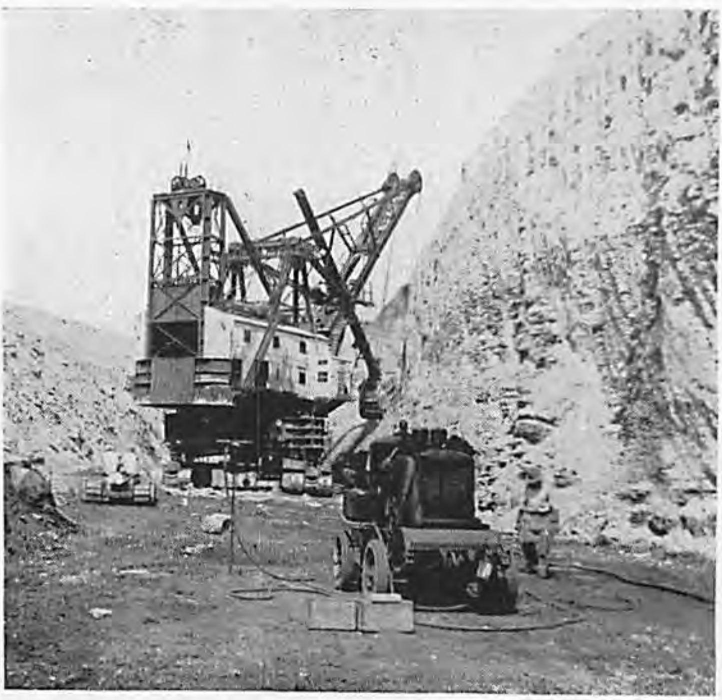
Illinois No. 5 Seam is being mined. It is approximately 4 feet 7 inches thick. Its principal impurities in this section are numerous wide, irregular and spreading fissures filled with clay, locally called "horsebacks," that cannot be separated from the coal with stripping equipment with any degree of satisfaction. Other impurities are sulfur lenses or balls, and calcite fillings in vertical cracks.

*Maximum Overburden, 75 Feet.* The coal is overlain with 2 to 4 feet of black slate, 4 inches to 2 feet of limestone, 45 to 50 feet of moderately hard, gray shale, 8 feet of sandstone and 8 to 10 feet of clay. As the topography is slightly rolling and erosion has cut more deeply in some places than in others, the sandstone is not present except where the overburden is thickest. The overburden averages 45 feet in thickness for the entire field but 75-ft overburden has been handled successfully in one operation by the stripping shovel, which is equipped with a 30-cu-yd dipper of high-tensile-strength steel, a 70-ft dipper handle, and a 108-ft boom. The dipper and handle are counterweighted at the rear of the shovel which is capable of spoiling the overburden on top of a bank 113 feet from its center. In shallow overburden, the pit is carried from 80 to 100 feet wide, but as the strata become thicker it is narrowed.

Operations were early planned so that the pit would be greatly curved in the area of thick overburden which covers approximately one quarter of the mile-long pit. In this zone, the width of cut removed by each passage of the shovel is narrowed to 30 feet because of the greater height and longer slope of the spoil bank. Summer operations have been concentrated in that end of the pit, as the lessened demand for coal gives the stripping shovel more time to remove the additional yardage.

The shovel has been able to handle the overburden without undue maintenance. Of course, dipper teeth need building up more frequently in hard than in soft overburden. For this purpose welding rods having 13 percent manganese, 1 percent carbon, and 0.83 percent nickel are used to bring the teeth to shape before a hard-facing substance is applied. This welding material has been found to adhere well, not peeling off when applied in several layers.

*Sidehole Drilling.* It has been possible for the stripping shovel to dig the overburden without blasting but, to assist it, drilling and blasting were recently initiated in areas of thicker overburden, Horizontal holes, 4 inches in diameter and 60 feet in depth, are bored with a power-driven auger. Each hole is sprung with three sticks of 2 x 8-in dynamite, allowed to cool, and charged with 40 per cent special gelatin dynamite. The amount of explosive loaded into a hole depends on the character and thickness of the overburden, up to 200 pounds of explosive being used per hole at the 75-ft thickness.

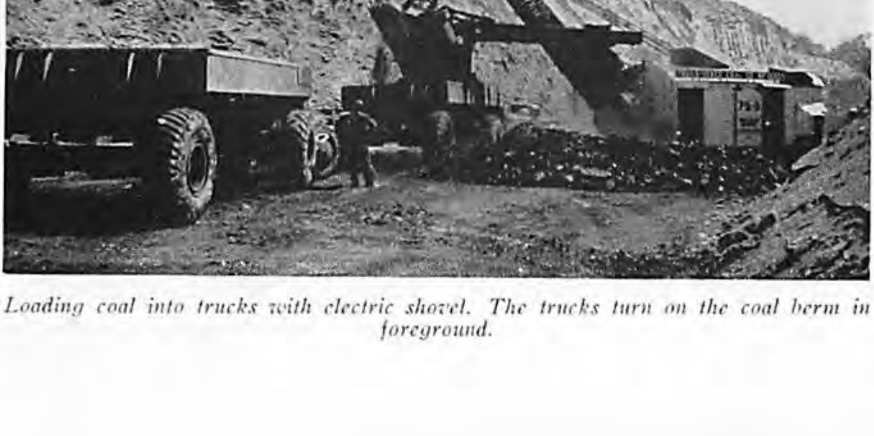


*Stripping shovel at work in 75-ft. overburden. The tractor is used for cleaning the coal and the air compressor, in foreground, for drilling.*

*Side holes for blasting overburden are loaded with 275 to 300 pounds of 40 percent dynamite in 3 x 8-in. sticks.*

Two crawler-mounted tractors are used in the pit for cleaning the top of the coal seam, constructing roads and general utility. Both are equipped with "bulldozers" for scraping and excavating.

The coal is drilled and shot before it is loaded. Compressed air drills, with hollow steel 5 feet 6 inches long and bits 2 inches in diameter, are used to drill vertical holes in the coal, air being furnished by a portable compressor. The coal loading shovel, which is electrically driven, is equipped with a 5-cu-yd dipper. In the areas of thick overburden the cut is necessarily limited to approximately 30 feet in width as previously indicated, but in thin overburden it is



*Loading coal into trucks with electric shovel. The trucks turn on the coal berm in foreground.*

TRUCK TIRES

| | Haulage Trucks | |
|---|---|---|
| | *15-ton* | *20-ton* |
| Front of tractor: | | |
| Number of tires | 2 | 2 |
| Size, inches | 9.00 x 22 | 11.25 x 24 |
| Plies | 10 | 14 |
| Rear of tractor and on trailer: | | |
| Number of tires | 4 | 4 |
| Size, inches | 18.00 x 24 | 18.00 x 24 |
| Plies | 16 | 20, 24 |
| | *Road Trucks* | |
| Tractor: | | |
| Number of tires | 6 | |
| Size, inches | 10.50 x 20 | |
| Plies | 12 | |
| Semi- and 4-wheel trailer: | | |
| Number of tires | 12 | |
| Size, inches | 9.75 x 20 | |
| Plies | 12 | |

possible for the loading shovel to remove more than one 50-ft cut for each passage of the stripping shovel.

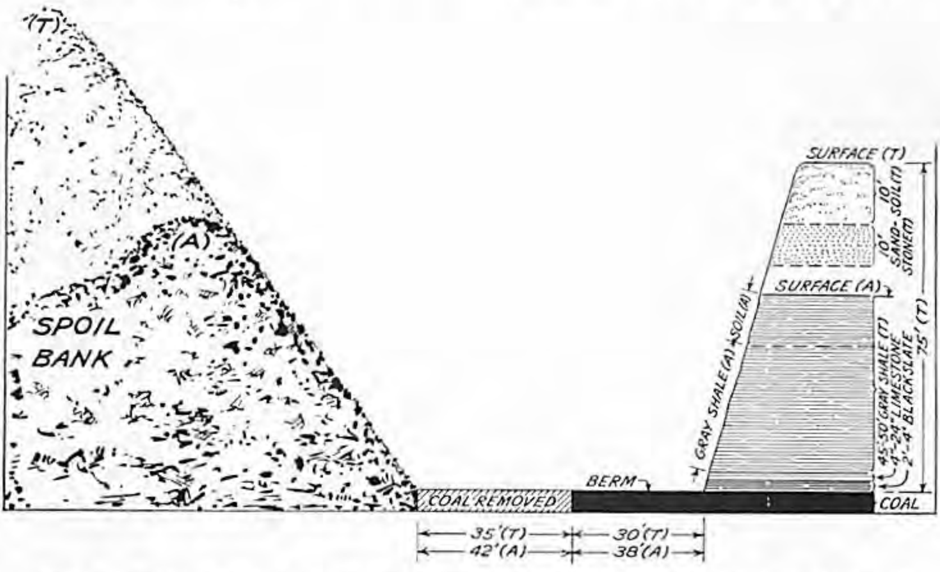
The coal shovel loads the coal into trucks in which it is hauled to a dump hopper near the pit. There it is sized or crushed, and reloaded into cars on narrow gage track to be hauled approximately 2 miles to the tipple by gasoline locomotives. Five 20-ton tractor-trailer trucks with 150-hp 6-cylinder diesel engines, two with 143-hp gasoline engines, and three 15-ton trucks with 105-hp gasoline engines are used for hauling coal from the pit. Their tire characteristics are shown in the accompanying table. Roads are built parallel to the pit on the unstripped area with laterals to the pit at suitable topographic locations, such as ravines, where the thickness of overburden is least and where an approach can be constructed and maintained at little cost with a utility dragline or a bulldozer. The roads are surfaced with refuse from the washer.

*Combined Truck and Rail Haulage.* The route of the trucks in the pit is not fixed, varying with the positions of the loading and stripping shovels, and pit conditions. The trucks may pass the loading shovel, turn on the coal and return to be loaded, or they may be driven overland, empty or loaded. The unloading point is about 2,000 feet from the end of the pit and, with the pit one mile long, the average truck haul is nearly a mile. The dump hopper for the trucks is so constructed that its dirt approaches may be removed with the dragline and the hopper moved to a new location, whenever the length of haul warrants the move. Operations have been planned so that the haulage railroad will be extended to the new hopper locations thru an approach which is now being left for natural drainage.

Coal is discharged from the truck hopper into a double-roll 36 x 72-in breaker or sizer, driven by a 75-hp motor. Mine-run coal may be broken to approximately 6 inches if desired. When that is done, virtually the entire output of the mine passes thru the washers in the preparation plant. The output of the crusher is elevated on a 72-in apron conveyor and discharged into drop bottom cars on track of 36-in gage. Rail haulage is now being conducted with three trains of six cars each, a fourth locomotive being used as a pusher on the heavy grade leaving the truck hopper. Locomotives are rated at 20 tons. They are powered by six-cylinder gasoline engines, with a 6¾-in bore, 7-in stroke, and a rating of 150 hp at 1000 rpm. The transmissions on the locomotives have four speeds in each direction.

The use of both truck and rail haulage combines the flexibility of trucks in and near the pit with the dependability of rail haulage in the fixed portion of the route to the preparation plant.

*Power Service.* Power for the pit is furnished by a substation at the end of a 33,000-volt transmission line, the voltage being reduced to 4000 thru delta-star connected transformers. A main truck line of three bare copper conductor wires and a ground wire is constructed on 20-ft poles approximately 1000 feet from and parallel to the edge of the pit, and laterals are run from the trunk line to the edge of the pit at intervals of 900 feet. They are built with 1/0 solid copper wire. Disconnecting switches are used at the end of the pole line, and power is taken by cable from the end of each lateral into the pit to a portable switch house which contains an oil circuit breaker and disconnecting switches for the cables leading to both the stripping and loading shovels. Electric cables used in the pit have a shield around each phase conductor and a ground wire thru which the shovels are grounded to the transformer. A complete ground system is maintained on all cir-




*This composite drawing shows typical cross-sections of the pit under conditions of average (A) and thick (T) overburden. (Not to scale.)*

*Six-car train of drop-bottom cars passing over track hopper at the preparation plant.*

cuits. Portable banks of transformers mounted on skids are used at the end of the laterals to reduce voltage to 440 for use on pumps, drills and the compressor.

*Mine-Run Screening.* At the preparation plant, coal is dumped into a hopper from which it is fed onto a main drag conveyor by two opposed reciprocating plate feeders. From the main conveyor the coal is discharged onto the main shaking screen which has 6-in round holes. The 6-in lump is hand picked on a combination apron-type picking table and loading boom which discharges into cars on track 5. The refuse is conveyed to a bin over the track hopper from which it is loaded into trucks, and the middlings are conveyed to a 24 x 36-in roll crusher from which they go to the main conveyor.

The minus 6-in coal is rescreened on a rapid shaker which is directly beneath the main shaker, and inclined in the opposite direction. It separates at 2 inches, into 6 x 2-in and 2-in x 0. The 6 x 2-in product is sent to a coarse-coal jig, while the 2-in x 0 coal is washed in a fine-coal jig. For the 6 x 2-in coal, the jig operates at the equivalent of 1.45 specific gravity and produces a primary refuse that goes to the main refuse conveyor. The middling from that jig is conveyed to a 24 x 36-in single-roll toothed crusher with a hinged breaker plate. Its product is discharged onto the main coal conveyor and rewashed in the fine-coal jig.

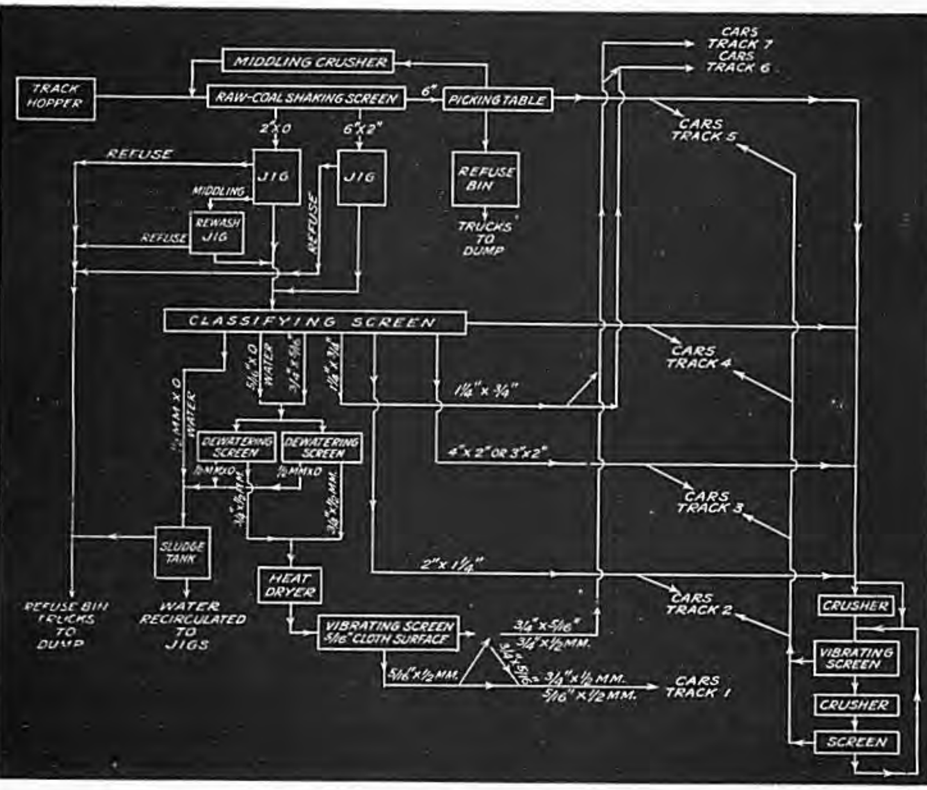
*Rewash Jig.* The fine-coal jig operates at the equivalent of 1.35 specific gravity and produces a primary refuse that is conveyed by chute to the main refuse belt and a secondary refuse or middling that is rewashed in a small Baum-type jig. The feed to this rewash jig approximates 60 tons per hour, 35 percent of it being recovered as coal when the jig is operating at the the equivalent of 1.41 specific gravity. However, not all of the present feed to the jig was discharged as refuse prior to its installation in July, 1939, since the middlings from the secondary compartment of the primary jig can now be drawn more heavily. Refuse from the rewash jig is elevated to the main refuse belt and the cleaned coal is elevated to join the other washed coal at the head of the dewatering screen. Rewashing is a feature of the Fiatt preparation plant that is new in midwestern coal preparation.

Approximately 15 percent of the feed to the preparation plant is removed by the jigs and discharged as refuse.

Coal from both coal jigs is carried in a common sluice to the head of a reciprocating classifying screen and separated into ¾-in x 0, 1¼ x ¾-in and 2 x 1¼-in sizes, while the last screen can be changed to make a 3 x 2- or 4 x 2-in stove coal and 6 x 3- or 6 x 4-in egg coal, at the management's option. The upper end of the lower deck of the dewatering screen has a section of ½-mm wedgewire screen which bypasses a large quantity of water and reduces the burden on the dewatering screens.

The 1¼ x ¾-in coal from the classifying screen is delivered to either of two long conveyors; one extending to track 7, the other to track 6. The track 7 conveyor has an auxiliary gate that may be used to discharge the coal on track 6. This size may be oil treated at the discharge from the cross conveyor.

The 2 x 1¼-in nut coal is conveyed by a chute from the classifying screen to the loading boom for




*Flow sheet of preparation plant.*

track 2. It may be oil treated at the chute. The 4 x 2- or the 3 x 2-in stove may be oil treated in a similar manner before it is discharged onto the loading boom for track 3. The 6 x 3- or 6 x 4-in egg coal is discharged from the end of the classifying screen where it may be oil treated, onto the loading boom for track 5.

*Heat drying.* The ¾-in x 0 coal, plus the water not removed by the section of wedge wire in the classifying screen is sluiced to, and divided equally between, two 6 x 30-ft high-speed reciprocating dewatering screens. The sludge from these screens, which are equipped with

*Refuse belt to refuse bin, upper left; coal conveyor to track 7, lower left; and coal conveyor to track 6, lower right. (Upper)*

*Discharge of dried coal from dryer onto elevator-conveyor. Vertical cooling chute in background returns hot coal to other side of elevator. (Middle)*

*A 5 x 8-ft. vibrating screen equipped with hood and stack to further remove moisture from hot coal by natural draft. (Lower)*

½-mm bronze wedgewire dewatering surfaces, is sluiced to a concrete-and-steel settling tank. The ¾-in x ½-mm coal is conveyed on the bottom run of a 24-in scraper conveyor to the top of two 15-ton dryer bins. The bins are equipped with electrical indicators which signal the dryer operator when they are either full or empty. Each bin is above and at one end of an independently reciprocated section of the dryer jig. Hot gases from two furnaces are drawn down thru the screens by an exhaust fan, its suction being pulsated by a revolving gate between the fan and the screen.

The furnaces are fired with dried or undried ¾-in x ½-mm coal, or a mixture of the two. They are equipped with two spreader-type stokers, which have 9 x 9-ft grate surfaces. A bridge wall separates the combustion chamber from the rear of the furnace, which is constructed with supported wall sections and arches. The front 15 feet on each side of the furnace are air cooled, the air being admitted at the base of the furnace wall. It passes into the upper part of the combustion chamber thru tuyeres.

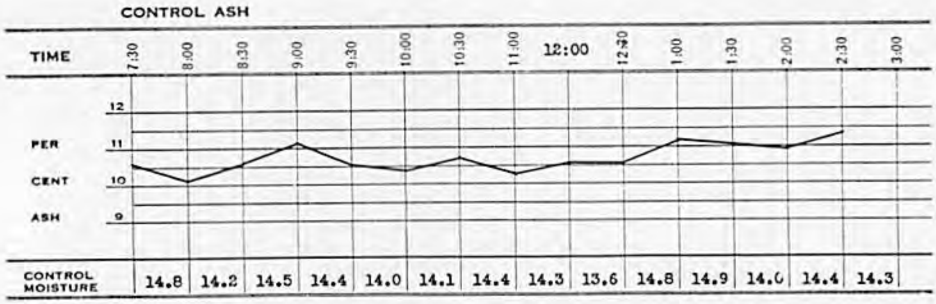
The two furnaces discharge their hot gases into a common duct which leads to hoods over the dryers. The hood over each drying screen is divided into two compartments, an upper and lower, corresponding to the two screen sections, each of which has an independent connection to the hot gas duct. Gates are provided for admitting cool air to the dryer to temper the hot gas.

Coal from the dryer is sent to a 5 x 8-ft mechanical vibrating screen equipped with a 5/16-wire-cloth screen surface. The resulting ¾-in x 5/16-in coal is discharged onto the top flight of a 24-in conveyor that leads to the top run of the incoming wet-coal conveyor and, in turn, to the long conveyor to track 6 or 7. The 5/16-in x ½-mm carbon can be loaded by chute to cars on track 1 or it can be taken with the ¾ x 5/16-in coal to track 6 or 7. Both sizes may be oil treated in the drying plant. If desired, they may be recombined at the screen and loaded as ¾-in x ½-mm on track 1. The temperature of the dried coal is 110 to 120 F, as it is discharged into the cars.

*Half-Hour Samples.* The ¾-in x ½-mm coal is sampled every half hour. Part of each sample is used for a moisture and ash determination, the remainder being saved to accumulate a composite sample for the day. Sulfur and Btu determinations are made on the composite sample in addition to ash and moisture. A sustained average of approximately 14¾ percent of moisture in the dried coal, for a 3-month period, compares favorably with the natural bed moisture of the coal which is approximately 14 percent.

The ends of the loading booms on tracks 2, 3, 4 and 5 may be raised to discharge the coal onto either the top or bottom run of a mixing conveyor. The top run carries the coal to a single-roll 36 x 36-in crusher from which it may be discharged onto the bottom run of the same conveyor, and returned to any of the above mentioned tracks, or it may be discharged onto a 30-in scraper conveyor that is over-and-under two screens and a coal crusher. The coal from the mixing conveyor may also be sent thru a vibrating screen with a 1¼-in wire-cloth surface. The thru product falls to the bottom run of the conveyor, the over product going to a 24 x 48-in double-roll cone-toothed crusher for stoker coal. The crushed coal is discharged onto a 5 x 12-ft vibrating screen with 1¼-in wire-cloth surface. Its thru product is discharged onto the bottom run of the conveyor, the over product being conveyed by a short belt and discharged onto the top run of the scraper conveyor to be recirculated. The bottom run of the 30-in scraper conveyor returns the coal to the bottom of the mixing conveyor and thence to cars.

*130-Ft Sludge Tank.* Sludge from the dewatering screens enters a sludge tank, 5 feet from the sloping end. The tank, 10 feet wide and 130 feet long, is equipped with a dewatering drag constructed of rivetless chains with channel flights between them. The sludge removed by the drag falls into the boot of a bucket elevator and is elevated to




*Control of ash and moisture, by ½-hr. samples.*

LABORATORY CONTROL REPORT

No. 212

Date ..............................

FIATT MINE

Proximate Analysis of Daily Aggregate Sample

| | As Received | Dry |
|---|---|---|
| Moisture | 14.48 | 0.00 |
| Ash | 9.00 | 10.52 |
| Volatile matter | 34.82 | 40.72 |
| Fixed carbon | 41.70 | 48.76 |
| Total | 100.00 | 100.00 |
| Btu | 10925 | 12782 |
| Sulfur | 2.71 | 3.17 |

Ash Fusion Temperature

Remarks:

Control size: ¾-in. x ½-mm at 7:30 thru 10:00 and at 12:30 thru 2:30
5/16-in. x ½-mm at 10:30, 11:00 and 12:00

Average ash 10.70% Average moisture 14.33%

(Signed) J. RALPH PRICKETT,
O.J. Chemist.

the main refuse belt. The clear water flows over a straight weir at the end opposite the sludge entrance and is recirculated by two 10 x 10-in pumps of 3500-gpm rating. They are driven by 75-hp motors. A 15-ft head is maintained on the wash box.

Refuse is hauled from the surface bin by four 10-ton gob trucks which are equipped with tandem rear axles with dual wheels. The trucks have insulated and heated beds to prevent freezing of gob on sides and bottom.

The oil treating system for dust proofing the coal consists of a 10,000-gal storage tank, dual circulating system, oil heater, and nozzles. An oil with viscosity from 1500 to 2000 at 100 C has been found to be successful.

The preparation plant uses 79 electric motors with a total rating of 1514¼ horespower. In size, the motors range from a ½ horespower for the pump which circulates the treating oil to 125 hp for each of the two exhauster drive motors in the dryer.

*Rail and River Shipment.* To supplement its rail loading facilities, the company has constructed a barge loading station on the Illinois River, 20 miles from the mine. Coal is trucked to the river terminal by two 150-hp diesel truck units each of which consists of a tractor and semi-trailer, and a four-wheeled trailer, with a gross weight of 72,000 pounds. The net coal load is 20 tons. Four round trips to the river are made in a 7-hr shift by each driver.

The trucks dump the coal on the ground at the river terminal, the rear trailer being dumped while standing, the front one while the truck is in motion. The coal is scraped from the ground piles to the foot of a belt conveyor that conveys and discharges it onto barges. A 3-cu-yd drag scraper, pulled by a 100-hp motor, is used for scraping the coal to the conveying belt,

*Loading trucks at preparation plant for haulage to barge-loading station.*

*Truck dumping coal at river station. Rear trailer is emptied while truck is standing, the front while it is in motion.*

the tail sheave being attached to a car which travels on a semicircular track. This makes it possible to have two or three sizes of coal stored on the ground and to load them without mixing. Coal may be cleaned up thru an arc of 135°.

*Reclamation of Spoil.* The Truax-Traer Coal Company has been greatly interested in the reclamation of the spoil banks in mined areas. To this end it has leased a few tracts of several hundred acres each to officials of the company for development, and 13,000 trees, principally black locust, walnut and cypress, have been planted at selected locations. Rather than to reforest the spoil banks, the plan has been to utilize the banks for grazing and to have shade for livestock at selected locations. The spoil banks have been planted with sweet clover, rye, lespedeza, blue grass and red top, while alfalfa has been planted on a few leveled acres. The general superintendent maintains several hundred cattle on his acreage.

*(Reprinted from MECHANIZATION — The Magazine of Modern Coal)*

# FACE PREPARATION FOR HIGH-CAPACITY LOADING AT MINE NO. 43 OF THE PEABODY COAL CO.

Work on the development of breaking coal with cardox cartridges was first begun in 1926, at Mine No. 43 of the Peabody Coal Company. The management is now using this method of breaking coal from the face and has satisfactorily incorporated proper cutting and drilling practices in face preparation procedure so that falls now yield and increased percentage of lump coal and are easily loaded.

The three basic steps in face preparation, cutting, drilling and breaking coal from the face, have been coordinated and improved at Mine No. 43 of the Peabody Coal Company, to the extent that its mobile loading machines are giving better results in loading from the Illinois No. 5 seam, which averages 5 feet in thickness, ranging from 4 to 7 feet. The coal is undercut with shortwall machines, drilled with post-mounted electric auger drills and broken from the face with cardox cartridges. It is loaded by crawler-mounted machines into rubber-tired shuttle cars for delivery to a central car-loading point in each working territory.

The mine is near Harrisburg, Saline County, Illinois. It is a room-and-pillar mine which is developed in panels of 52 rooms, 26 on each side of double panel entries. The rooms of each entry are worked in two blocks of 13 rooms each. An elevating conveyor is placed in the mouth of the middle room of the block for loading the mine cars in which the coal is hauled to the shaft bottom. Entries are driven from 15 to 18 feet wide on 32-ft centers, and rocms 26 feet wide on 50-ft centers. Rooms are turned at right angles to the entries. Room cross-cuts are driven from 14 to 15 feet wide on 60-ft centers except that the first crosscut may be started closer to the entry than this to give to remaining crosscuts a directional alinement from room to room. This facilitates movement of the shuttle cars toward the loading point, as illustrated in Figure 1. The No. 5 seam is under about 250 feet of cover at this mine. The coal is underlain by a hard fire clay and overlain in about three fourths of the working territory with draw slate that comes down with the coal. This slate ranges up to 11 inches in thickness, averaging about 8 inches. Where it is absent the roof is a hard slate that stands well. Plans are under way for supporting the draw slate in rooms with crossbars where it is a foot or more thick, but where it is thinner it is too fragile to support so that it comes down on the coal. In territories where this is the case, two men are sent in ahead of the loading machine to take the top rock off the fall of coal. They put it in the center of the working place and it is loaded by machine into a shuttle car which gobs it out of the way. Frequently as much as two shuttlecar loads of this material must be removed from a room. Any slate that the men cannot reach near the back of the fall is loaded with the coal. This can be done because the lump coal is hand picked on the surface in the tipple

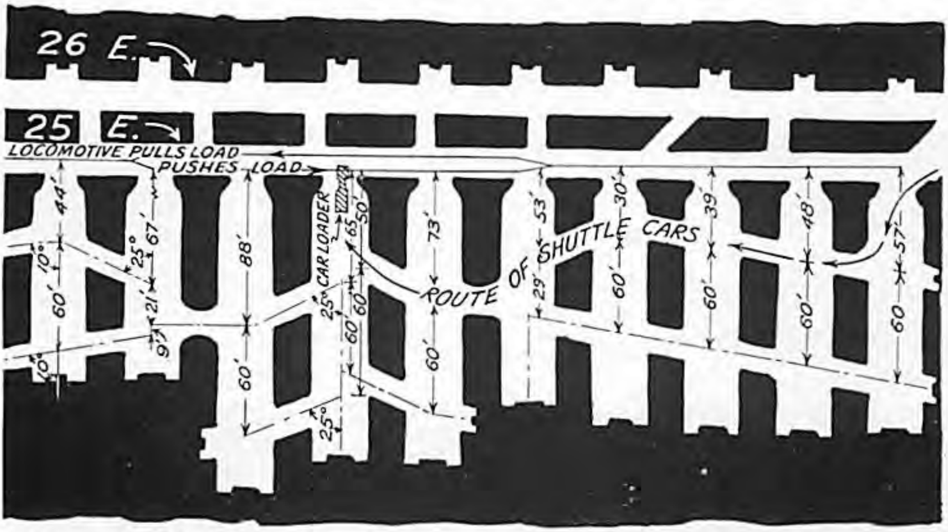
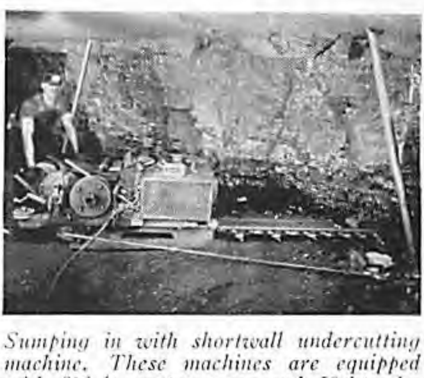



*Figure 1. This diagram shows how crosscuts are driven in rooms to facilitate the movement of shuttle cars toward loading point.*

and the smaller sizes are sent to a mechanical cleaning plant at the company's nearby No. 47 Mine for preparation.

*Long Cutter Bars.* Coal in rooms and entries is undercut with shortwall cutting machines which have been equipped with 8½-ft cutter bars, replacing original 6-ft bars. Chains are laced in a nine-position wedge cut. Patented two-pointed bits are used and discarded after service. The bits are gaged to cut a 6-in kerf. In average practice it is necessary to change bit points completely after undercutting a 26-ft room. The cutting machines are powered by 50-hp d-c motors. To avoid cutting machine failures, the management follows a strict routine of maintenance of its cutting machines, replacing the frictions, drive sprockets, and intermediate shafts after 2 months of full service, with spare units which have been overhauled in the machine shop. A result is that a single machine can be counted on to cut all of the coal in a 13-room territory. As there is no track in the rooms the cutting machines are moved on crawler-mounted trucks.

*Cartridges.* The cardox cartridges which are used to break the coal are 2⅝ inches in diameter. Holes to accommodate them are drilled with post-mounted electrically driven auger drills which are equipped with 2⅝-in conveyor-type augers. These are sectionalized in 3-ft sections, the head section being



*Sumping in with shortwall undercutting machine. These machines are equipped with 8½-ft. cutter arms and 50-hp. d-c motors.*

provided with replaceable double-pointed bits. The kerfs are scraped clean by the driller, to prevent the undercut coal from settling down as a block. Two men with a drill are ordinarily able to keep up with the production in a section, altho in some parts of the mine where the coal snubs itself, that is 1 to 2 inches of coal immediately overlying the kerf come down into the kerf, an extra man is used to clean the kerfs.

and the hole is stopped directly above the back of the kerf. To assure a square, cleancut face, rib holes are drilled as nearly over the edge of the kerf as it is feasible to set the drill. This results in uniform rib lines, as the ribs normally break along the drill holes. Four holes are used in cross cuts, one inclined snubber hole and three parallel top holes. In routine practice, a crew drills nearly 60 holes in a 7-hr shift.

*Drilling coal for coal breaking cartridge with post mounted electric drill equipped with conveyor type augers 2⅝ inches in diameter. Helper is inserting cartridge in the rib hole. Note base on which drill post is mounted. The use of this base eliminates necessity of digging down to bottom for a post footing. Conveyor augers are sectionalized in 3-ft lengths, the first section being equipped with detachable mole-foot bits.*

Five or six holes are drilled in a room face according to local seam conditions. These include four top holes and and one or two snubbers, one of which is inclined with the direction of advance to give the hole a gripping effect. When a second snubber is used it is drilled in the direction of advance. All holes are drilled horizontally. The intermediate top holes are drilled about 6 inches below the top while the rib holes are dropped about $1\frac{1}{2}$ feet from the top to balance the corner discharges and to assure a clean rib. Before a hole is drilled the depth of the kerf immediately beneath it is measured

A cartridge is placed in each hole by the drillers after lead wires have been attached to the terminals and short circuited at the outer end. The cartridge is placed at the back of the hole, leaving the lead wires extending about 3 feet out of the hole and readily accessible to the shot firer, who discharges cartridges singly after the shift when other men are out of the mine. In each round the snubber cartridge is discharged first. It is followed by the intermediate top holes and then the rib holes in succession.

The cartridges are $2\frac{5}{8}$ inches in diameter and $47\frac{3}{4}$ inches long. They have shearing discs of 8-

gage metal which have a shearing diameter of 1-7/16 inches. Each cartridge is charged with 3 pounds of carbon dioxide. On release of a 200-gram heating element a pressure of about 23,000 pounds is built up before the disc shears, permitting the gas to work out the ports of the discharge cap and dislodge the coal. Productivity per cartridge varies with seam height. In a recent month it averaged 11.4 tons per cartridge in rooms in No. 2 territory, while it reached 12.5 tons per cartridge in No. 9 territory in higher coal. However, breaking

*(Top)*
*Closeup of cartridge in hole. It will be pushed to the back of the hole before being discharged.*

*Snubbing cartridge is shown lying as it fell, immediately after the discharge. Shot firer is connecting lead wires for a second snubber shot of this round.* ☞

*Shot firer is making connections for a second top hole. . . .* ☞

*(Bottom)*
*. . . which has been discharged in this photograph. Shot firer is connecting the left rib cartridge, the final one of the round.*

coal for development brings this average down to about 8 tons per cartridge for the mine as a whole, normal requirement for a 3500-ton shift being about 415 cartridges.

A careful record is kept of the location of cartridges thruout the mine and the shot firers make it a point to withdraw each one from the face and store it in the room where it will be picked up by the night crew. If a cartridge should become lost he makes a note of this fact so that the night crew can locate it. Spent cartridges are gathered on the night shift and brought to the loading point by a

*The charging plant. Cartridges from the mine are on the rack at the left. The operator at the left is removing the firing cap from a spent shell while the operator in the central foreground is putting a new heating element into a cartridge which is to be charged with $CO_2$. A cartridge is on the charging vice in the right background. Recharged cartridges are on the rack at the right ready for return to the mine. Each one has been checked for leakage at the firing and discharge ends. To Right—Recharged cartridges are placed in electrically insulated wood bodied cars and taken underground for distribution in the working territory.*

shuttle car where they are loaded into insulated wood-bodied cars and returned to a charging plant on the surface.

Altho there was pronounced skepticism in some quarters as to the ability of the management to undercut coal as thin as 4 feet to a depth of 8 or more feet with 8½-ft cutter bars, the plan has been entirely successful, and contrary to some predictions, the cutting machines have stood up well under the service. Along with adequate cutting facilities, proper drilling and breaking of coal play vital parts in the management's production program. The use of cardox for breaking coal is resulting in falls which are easily loaded and which yield an increased percentage of the larger sizes, whereas other methods of breaking coal failed to do either of these essential things. The management is following this plan of face preparation and production with equally satisfactory results at its nearby Mine No. 47 which is also in the No. 5 seam, under similar working conditions.

It is appropriate that Mine No. 43 should turn to this method of breaking coal, as the pioneer work on the development of the method was done at this mine. Experiments with carbon dioxide as a means of breaking coal were begun in 1926 by Dent Ferrel and A. M. Helmholtz who carried out their early tests with rudimentary equipment and methods on the surface at this mine. Since then the process has been greatly developed and refined, and established on a commercial basis. A further point of interest in connection with the face preparation practice at Mine No. 43 is that the conveyor type of auger which is now in use there and elsewhere was developed there.

*(Reprinted from MECHANIZATION — The Magazine of Modern Coal)*

# PYRAMID COAL CORPORATION BUILDS 900-TPH PLANT

## New Preparation Plant Replaces Two Tipples and Washery

A complete new 900-tph mechanical cleaning plant prepares the output of two strip mines, totaling up to 10,000 tons daily, and improves upon the sizing and classifying facilities of two tipples and a screenings washer, which it replaces. In the new plant, plus 7-in is hand picked; 7 x 4-in is washed in a 3-cell jig; 4 x 1¼-in, and 1¼-in screenings in separate 5-cell jigs. Flexible auxiliary equipment dewaters, crushes, classifies, dustproofs, loads the cleaned coal, as desired.

With a view to consolidating its facilities and unifying its preparation practice, the Pyramid Coal Corporation has built and placed in operation a completely modern plant for cleaning the combined output of its strip mines mechanically. Both of the mines, which are in Perry County, Illinois, are in the No. 6 Seam. The blue band, a persistent streak of hard shale a few inches above the bottom of the seam, constitutes the principal impurity which must be removed by the mechanical cleaning equipment.

In addition to supplanting a tipple at each mine, the new plant replaces a nearby washery which was built by the company in 1933 to treat screenings from its strip pits, and to do custom washing. With the construction of the plant,

*Moving 40-ft. cone from old washer to new plant with dragline excavator (left). The completed 900-tph plant is shown below. It treats the output of two strip mines.*

this washery was dismantled and its settling cone, larger wash box, and dewatering screens were incorporated in the present plant which has a rated capacity of 900 tons per hour.

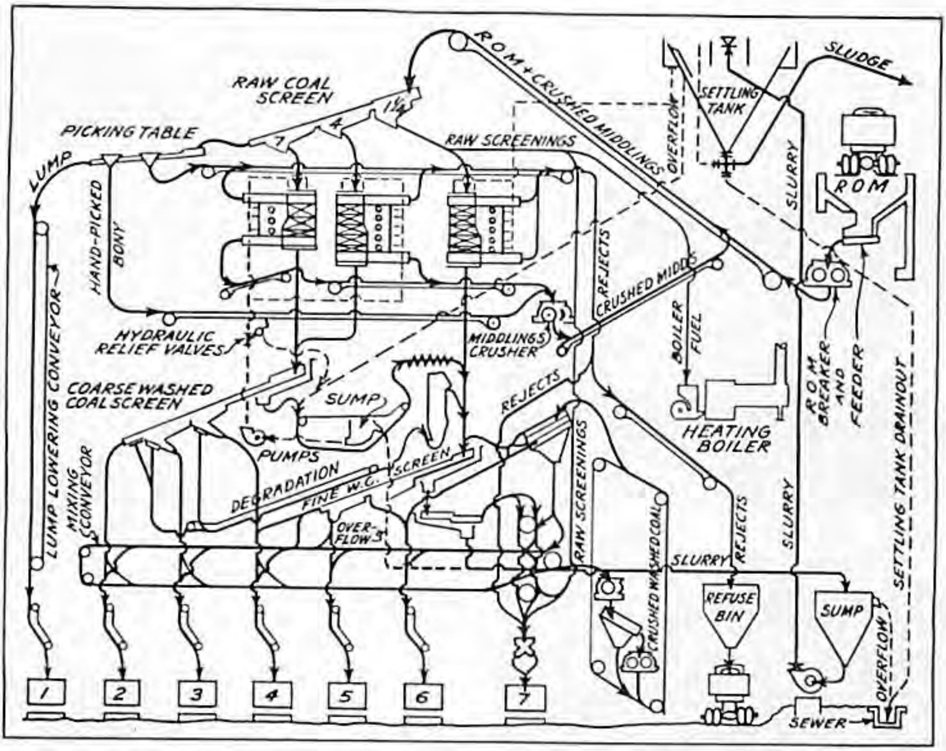
*Output of Two Mines.* The new washery receives mine-run coal from the No. 1 or Pyramid Mine which is adjacent to the plant, and from the No. 3 or Coalstrip Mine which adjoins Mine No. 1. The output of the Coalstrip Mine, about 4500 tons daily, is loaded into standard gage railroad cars at the mine and hauled to a rotary dump at the preparation plant. The No. 1 Mine production, which averages 5000 tons per day, is brought directly from the pit to the preparation plant in side-dumping cars on track. During the day, coal from the No. 1 Mine is given preference over the No. 3 coal which is held in reserve in railroad cars until the night shift, unless the supply from No. 1 Mine is interrupted.

*This rotary dump handles standard-gage railroad cars from Mine No. 3. Side dump cars from No. 1 Mine are emptied here also.*

The rotary dump is designed to handle the standard-gage railroad cars and to permit the side-dump cars to be emptied into a 450-ton reinforced concrete hopper beneath the dump. Coal is removed from the hopper by a reciprocating plate feeder which is driven by a 15-hp motor thru a variable speed transmission. A tachometer in the control booth over the loading booms indicates the speed of the feeder and helps the operator maintain a uniform flow of coal into the plant. The stroke of the feeder may be set at 8, 10 or 12 inches. It feeds the mine-run coal into a two-roll, 30 x 70-in breaker which is driven by a 75-hp motor. An interlocking device stops the feeder if the pins shear in the safety hub drive of the breaker. Stoppage of either the mine-run belt or the breaker automatically stops the feeder, and it cannot be restarted until both the breaker and the belt are going.

Coal goes from the breaker to a 48-in belt conveyor which delivers it to the head of the raw-coal shaking screen. This conveyor, which is rated at 1000 tph, is 334 feet long between terminal centers. It is driven at 350 feet per minute by a 100-hp motor. The drive mechanism is provided with a two-stage interlocking relay which brings the belt up to full speed over a period of several seconds. The drive is also equipped with a ratchet-and-pawl break with a solenoid holdup which releases and stops the belt from running back in case of current failure. The belt is endless, with a single vulcanized joint.

*Integral Shaker and Picking Table.* Raw coal is separated at 1¼, 4 and 7 inches on the mine-run shaking screen which is 8 feet wide and 45 feet long. It has a 6-in stroke and is driven at 120 rpm by a 25-hp motor. A picking table is integral with the shaker and its lower end, pickers removing impurities from the lump coal. The clean lump coal is lowered by a flight conveyor to the lump-loading




*The main lines of flow of coal and refuse, and water circuits, are shown in this diagram.*

boom, the lowering conveyor being controlled by a motor which retards the conveyor and its load by regenerative action. This motor is interlocked with the lump boom so that the lowering conveyor stops when the boom is stopped.

Pickers separate impurities into boney material, or middlings, and refuse which is dropped thru chutes onto a 24-in belt conveyor. It transfers the refuse to a 30-in belt on which it is joined by the primary reject of the washing jigs. This conveyor delivers the combined refuse to a 20-ton bin from which it is hauled to a nearby dump by trucks. Drive motors on both of the refuse belts are on the same relay so that they operate simultaneously. Hand-picked middlings go to a 24-in belt that transfers them to a single-roll crusher with a hinged breaker plate. This is a 30 x 36-in crusher, driven by a 30-hp motor. The crushed middlings are transferred by a 30-in belt conveyor to the mine-run conveyor which returns them to the main shaker.

*Three Baum-Type Jigs.* Two five-cell Baum-type wash boxes and a similar three-cell box have been installed in the jig section of the preparation plant. One of the larger boxes washes the 1¼-in screenings, and the other treats the 3 x 1¼-in nut coal. The 7 x 4-in egg size is cleaned in the three-cell box. Each jig, with capacity for 250 tons per hour, is supplied with compressed air for its pulsating mechanism by a centrifugal blower.

Primary refuse from all jigs and the secondary reject from the screenings box go to the refuse belt, while the secondary refuse from the egg and nut jigs is reclaimed through the middlings circuit, going to the middlings crusher along with the hand-picked boney material.

Belt conveyors that carry wet products are equipped with drip pans in which a stream of flushing water is kept flowing. The main belt conveyor is provided with a wiper at the head end, which keeps the belt clean.

*Screenings jig, with feed chute from main shaker in background (above).*

*Triple-deck vibrating screen sizes coal from coarse-coal crushing plant (left).*

*This single-roll crusher receives coarse coal from the lower strand of the mixing conveyor (below).*

Cleaned coal and water from the jigs are sent to two shaking classifying screens. One of them serves the screenings jig, while the other takes the combined output of the nut- and egg-coal jigs. The fine-coal screen separates at 3/8, 3/4 and 1 1/4 inches, and the coarse-coal classifying screen at 2, 4 and 7 inches. The 3/8-in x 0 coal and water from the fine-coal screen go to two 5 x 20-ft high-speed dewatering screens which are normally operated with a 3/4-in throw at 350 rpm. However, they may be operated at any speed up to 435 rpm. They have been equipped with 1/2-mm wedgewire screens but tests are being made with round-wire slot screens, stainless steel, and other forms of screening surfaces. The sludge is drained to the main sump, which is a 1000-gal steel cone on the ground floor of the plant.

Sludge is pumped from the sump to a 40-feet settling cone which is provided with a peripheral trough that adds the equivalent of 20 feet in diameter to its capacity. Water flows from the cone proper into the trough thru a weir which has a clarifying action. The 1 1/4-in screenings jig is supplied with water from the settling cone, and cone overflow goes to a sump in a drag-type settling tank which receives the degradation product from the nut-and-egg coal jigs. Sludge is drained from the settling cone by gravity and sluiced to the dump thru open launders.

*Degradation Settling Tank.* Water and $1\frac{1}{4}$-in x 0 degradation product from the coarse-coal classifier go to a steel settling tank which is 48 feet long and 9 feet deep. It is 12 feet wide at the top and 7 feet wide at the bottom. Settlings are removed by a drag conveyor which extends for 78 feet on horizontal centers, and has a vertical rise of 22 feet. Driven at 12 feet per minute, it delivers the solids to a screw conveyor, 16 inches in diameter and 24 feet long, which transfers the material to the head of the fine-coal classifying screen. Water from the settling tank is collected in a series of skimmer troughs which discharge into a sump within the tank. This sump also receives overflow water from the settling cone. Centrifugal pumps deliver water from this to the nut-and-egg-coal jigs. Overflow from the sump goes to the main sump that receives the fine-coal sludge, and is then pumped into the settling cone.

*Seven Loading Tracks.* Both the fine-washed-coal and the coarse-washed-coal classifying screens deliver their double-screened and over products to loading booms or to a mixing conveyor. This is a seven-track plant equipped with six loading booms and one chute. Two of the loading booms are 60 inches wide and four are 48-in booms; three are of the scraper type and three of apron type. All are driven by 10-hp motors. A conveyor and elevator are used to remove degradation products from the delivery points of loading booms and return them to the fine-coal classifying screen, the largest degradation size being $1\frac{1}{4}$ inches from the lump and egg booms. Oil spraying equipment is provided for all sizes shipped. A dual-line hot-oil system is used, the companion lines and the spraying oil being heated with steam. Sizes usually loaded follow:

*Track* *Size*

1.....plus 7″
2.....7 x 4″
3.....4 x 2″
4.....2 x $1\frac{1}{4}$″
5.....$1\frac{1}{4}$ x $\frac{3}{4}$″
6.....$\frac{3}{4}$ x $\frac{1}{2}$ mm
7.....$\frac{3}{4}$″ x $\frac{1}{2}$ mm, or raw screenings

The mixing conveyor, which is equipped with 48 x 12-in flights, is driven at 100 feet per minute by a 50-hp motor. It carries coal on both strands, the upper strand mixed sizes to the loading booms, while the lower strand takes coal to a coarse-coal crushing system which has been provided to crush larger sizes as required by market conditions.

*Coarse-Coal Crushing.* Coal from the lower strand of the mixing conveyor is crushed in a single-roll 30 x 54-in crusher which is driven by a 50-hp motor. Its product goes to a 4 x 6-ft vibrating screen, equipped with a $1\frac{1}{4}$-in square-mesh surface, the over product of which is sent to a two-roll cone-toothed crusher. Its output is combined with the thru product of the vibrator and elevated by a bucket conveyor to a 5 x 12-ft triple-deck vibrating screen which is equipped with $1\frac{1}{2}$, $\frac{3}{4}$ and $\frac{3}{8}$-in square-mesh screens. Excepting the $\frac{3}{8}$-in x 0, any of its products can go to the fine-washed-coal classifying screen, to the mixing conveyor, or directly to the conveyor which feeds the loading chute on track 6. In this way, the management can make specially sized stoker coal from any of the coarser sizes.

The main breaker under the dump can be set to crush the mine run to minus 7 inches, in which case the entire output of the plant is washed.

A laboratory has been established in a building adjoining the main plant. It is equipped to make proximate analyses, calorific measurements and other determinations. Every car of screenings is sampled for ash analysis. In sampling screenings, a series of five samples is taken by cutting the feed, and from these incremental samples a composite is made up daily. A similar composite sample is also taken for each size shipped every day. A 12 x 12-in ring-mill sample grinder, with riffles in the discharge, is used for sample reduction in the laboratory. Ash analyses are made by burning samples in oxygen combustion tubes. This enables the laboratory to report ash determinations within 10 minutes after the samples enter the laboratory. Sink-and-float tests of the wash box products are made from time to time to check plant performance.

*Modern Building Designs.* Provision is made for diverting raw screenings from the head of the screenings jig for boiler fuel in the heating plant, the washery being heated by steam thru fan-equipped unit heaters. The plant is housed in a flat-roofed building of modern design with rows of windows extending around the four sides. 22-gage steel was used for the roof and 26-gage for the sides. The roof steel is covered with an inch of porous building material upon which two layers of tar and paper were laid, with a final coating of tar to assure adequate heat insulation. This plant is so compactly arranged that one man controls all motors and car retarders.

# MECHANIZED COAL PRODUCTION IN SOUTHERN ILLINOIS

(Abstracted from the 20th Annual Model-Mining Number of Coal Age, October, 1940.)
(Printed through courtesy of Coal Age.)

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### Deep-Mining Methods

Long leaders in the use of mechanical equipment, southern Illinois shipping mines present a picture of almost complete mechanization of loading. This close approach to 100-per cent machine work is reflected in a high productivity per worker — 13.1 tons per man-shift underground for the 23 deep mines in Franklin, eastern Jackson, Jefferson, eastern Perry, Saline and Williamson counties surveyed for the 20th Annual Model-Mining Number of Coal Age.

These mines were Energy No. 5 and Royalton No. 7, Franklin County Coal Corporation; Kathleen, Union Colliery Co.; Old Ben Nos. 8, 11, 14 and 15, Old Ben Coal Corporation; Zeigler Nos. 1 and 2, Bell & Zoller Coal & Mining Co.; Bankston Creek Nos. 4 and 5; Bankston Creek Collieries Co., an affiliate of the Sahara Coal Co.; Orient No. 1 and New Orient, Chicago, Wilmington & Franklin Coal Co.; Blue Bird No. 6, Blue Bird Coal Co.; Majestic No. 14, Black Arrow No. 18, Harrisburg No. 43 and Harco No. 47, Peabody Coal Co.; Buckhorn, New Monarch and Jefferson No. 20, Consolidated Coal Co.; Freeman Spur, Seymour Coal Mining Co.; and Valier, Valier Coal Co.

Southern Illinois mechanical mining goes back to 1891, but serious work did not start until after 1920, when Illinois operators adopted it to compete with other fields paying lower wages. By 1933, when some 15 southern Illinois deep mines were handling two-thirds or more of their tonnage with either loading machines or pit-car loaders, output per manshift underground at these operations had risen to 10.1 tons.

Displacement of pit-car loaders with loading machines, further restriction of hand mining, improvements in methods and machinery, including higher-capacity loaders and, beginning in 1936, newer transportation mediums (rubber-tired haulage at Blue Bird No. 6 in 1936 and conveyors at Bankston Creek No. 5 and Buckhorn in 1938) steadily increased efficiency in succeeding years. Consequently, output at the 28 southern Illinois mines handling two-thirds or more of their tonnage mechanically, stood at 10.9 tons per man-shift underground in 1939. Two additional conveyor installations were made in 1938 and 1939, and shuttle cars were installed at Jefferson No. 20, Harrisburg No. 43 and Harco No. 47. Early in 1940, shuttle cars went into Buckhorn.

As a result of these and other advances, the 23 mines surveyed by Coal Age survey showed an average efficiency of 13.1 tons per 7-hour man-shift underground. Mechanical mining also has resulted in substantial safety gains. By 1939, as an example, the 28 mines producing two-thirds or more mechanically had a fatality rate of 1.92 per million tons, compared with the State deep-mine rate of 2.23. In 1933, the fatality rate at the 15

*Low-type track-mounted machine bailing up No. 6 coal in Old Ben 15 mine.*

southern Illinois mines producing more than two-thirds mechanically was 3.26 per million tons, compared with 2.12 for the State.

Shafts predominate in Southern Illinois. New operations, however, have installed slope openings with belts. These include Buckhorn, Bankston Creek Nos. 4 and 5 and Blue Bird No. 6, with average covers ranging from 75 to 185 ft. Minimum cover at shaft operations is 100 ft., while the average at most ranges from 300 to 500 ft., with 740 ft. at the hoisting shaft at Jefferson No. 20. General dip is 1 to 2 per cent northeast.

All mines studied in Franklin, Jefferson, eastern Jackson, eastern Perry and Williamson counties recover the Illinois No. 6 seam 5 to 12 ft. thick. Total thickness, however, normally varies from 8 to 10 ft. Thickness mined generally is 7 to 9 ft., the remainder (usually 1 to 2 ft.) being left to help hold the normal gray-shale roof. Faults, some with throws of 25 ft. and up, are fairly numerous, while slips and horsebacks are frequent in certain territories.

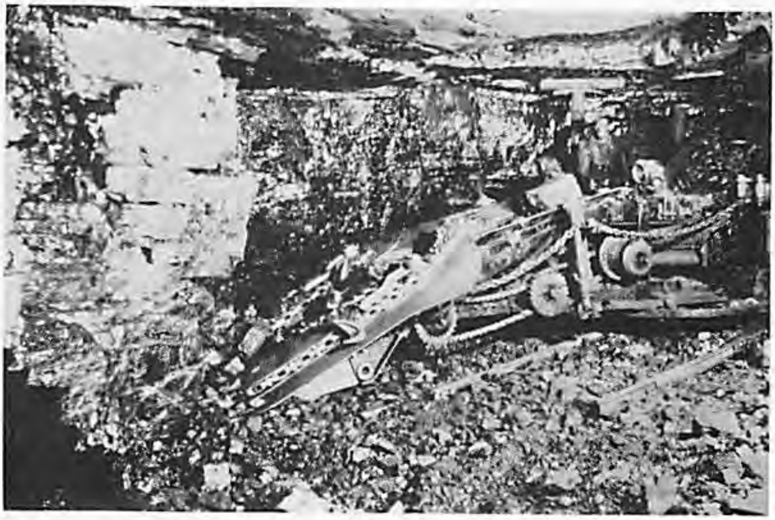
Faults, slips and horsebacks also are encountered in the No. 5 seam, worked by all Saline County mechanical mines studied. Thickness ranges from 4½ to 6½ ft., with the average somewhere around 5. The entire seam is recovered, necessitating, in most cases, handling up to 18 in. of drawrock, above which usually is a good, strong shale.

Mining in southern Illinois, with a few exceptions built around new transportation methods, is based on the panel system, under which the working territory is divided into individual sections, or panels, normally protected by solid pillars on all sides except where the headings are driven in. Rooms, as usual in panel mining, are turned both ways. Both sides of a panel normally are worked simultaneously in track-and-car mines. Ordinarily, rooms are turned at right angles, with New Monarch, (60-deg.) as one exception. Number of rooms on a panel entry varies on up from as low as ten a side at Kathleen. Generally, however, 16 to 24 are worked on a side, making the total per panel 32 to 48. Usually, two loading machines work in a panel, one on each side. Less frequently, one machine is assigned, normally working the inby half first. Room centers at the majority of the track-and-car mines are either 45 or 50 ft. Width generally is 24 to 28 ft., with infrequent increases to 40 ft. where good top prevails. Depth normally varies from 250 to 300 ft.

With the normal room centers, extraction within a panel seldom is less than 60 per cent. Mechanical mining, in fact, has increased extraction, as at Black Arrow No. 18, where 250-ft. rooms easily are worked out with machines whereas it frequently was necessary to leave a panel before completion with hand loading. Theoretically, the coal left is just sufficient to prevent squeezing and roof deterioration until the panel is worked out. Several mines, however, leave larger blocks of coal at strategic points by omitting room necks, as at Valier, or rooms, as at Royalton No. 7 and the Peabody mines.

Higher extraction by increasing room width or slabbing pillars is somewhat unreliable at best. As an alternative, the Orient mines turn stub entries off the regular panel entries, starting at the top of the panel. From these, short wide rooms are driven, 7 to 10 on a side constituting a territory. As the territories are worked out quickly, the machines are through before squeezing or caving occurs.

The 23 deep mines surveyed by Coal Age were operating some 250 loading machines, exclusive of spares. Reflecting early mechanization, some 100 were Joy 5BU units. Special machines include two McKinlay entry-drivers at New Orient. Six Goodman power shovels are used at Kathleen. Track-mounted loading machines totalled about 50, with 26 Goodman 260-A



*Loading No. 6 coal with a track-mounted machine in Orient No. 1 mine.*

and three 360-A track-mounted loaders at the Old Ben mines, along with 21 pit-car loaders. Royalton No. 7 was using three 260-A machines with one Joy 5BU, three 11BUs and six pit-car loaders. Clarkson loaders with 5 BUs were in service at Orient No. 1, with three Jeffrey 44-DD and three Jeffrey L-400 machines at Freeman Spur. Another mine using pit-car loaders was Majestic No. 14, working some 20 with eight 11BUs.

The seven deep mines using rubber-tired haulage or conveyors were operating 43 machines, viz: two 5BUs, 22 7BUs, 17 8BUs and two 14BUs. Average output per machine-shift, development and production, was 250 tons. Five operations are in the thinner No. 5 seam. Also, several still are developing and two still produce partly with track and cars. Notwithstanding, average output per man-shift underground was 15.5 tons.

Average output per man-shift underground at the sixteen mines serving 203 loading machines with track and cars was 12.7 tons. This lower figure results partly from the inherent limitations on mine-car changing. Also, these mines, all several years old, require relatively more men for auxiliary services. Mines using track-mounted machines for 50 per cent or more of their output averaged 350 tons per loading-machine-shift, both development and room work. Mines using caterpillar equipment averaged about 310 tons per machine-shift. Track-mounted equipment, mostly installed in the past five years, has a higher capacity than the large number of older caterpillar-mounted units. Excluding pit-car-loader and hand tonnage, however, there appears to be little difference between the two types of machines in production per man-shift underground.

*High-capacity track-mounted loading machine at work in No. 6 coal, Freeman Spur mine.*

Separate development machines are regularly used by the majority of the 16 mines employing track and cars. Crews may run as low as four men or as big or bigger than regular room crews, depending upon extra switch-laying and other work. Consequently, development machine production may run from 50 to 60 tons per shift on up, compared with 350 to 450 tons for the usual production machine. Majestic 14 uses pit-car loaders for development. At Kathleen, power shovels work solely in rooms, with all development and assistance in room production by 5 BUs. Skeleton crews handle development at the Old Ben and Franklin County mines.

Although departures are fairly numerous, the standard mechanical loading unit consists of a loader, cutting machine, drill and locomotive with, usually, one relay locomotive to two gathering locomotives. Approximately half the track-and-car mines, principally those with track-mounted loaders, use two gathering locomotives behind each loading machine. Certain operations employing two-locomotive changing commonly work a battery and a cable-reel unit together to prevent cable interference, as at Royalton No. 7 and Valier.

Crews at track-and-car operations using caterpillar loading machines normally vary fom 11 to 15 in number, excluding skeleton groups. Track-mounted-loading-machine crews, except for two operations running 11 to 13 men, normally number 18 to 22 men, due to common use of two locomotives and more switchlaying. In contrast to the usual practice of connecting all rooms through the crosscuts with two-locomotive changing, mines employing single locomotives change either on the entry or employ the "key-room" system, usually picking up a room on each side from the center place.

Shuttle-car users include Jefferson No. 20, reopened in 1938 with Joy 7BU loading machines, 6½-ton Joy shuttle cars (two per loading machine) powered with Exide-Ironclad 300-amp.-hr. batteries and Joy elevating conveyors. A room territory consists of seven places. A similar shuttle-car installation was in service at Buckhorn, which also serves loading equipment with Joy chain conveyors discharging into mother-belt conveyors. Eight rooms and three headings comprise a conveyor territory on the advance, with eight rooms on the retreat on the opposite side of the entry. Buckhorn production, at the time of the survey, was 350 to 450 tons per machine-shift.

Blue Bird No. 6 uses the tractor-trailer haulage units (Baker-Raulang tractors with Exide-Ironclad batteries pulling 3-ton Sanford-Day drop-bottom trail cars) developed by James H. Fletcher in connection with Barber-Greene dump hoppers, main-line conveyors and 8BU loaders. A new development plan eliminates room entries in favor of renecking at 300-ft. intervals. With 4½ ft. of coal overlaid by 2 to 3 in. of drawrock, crews averaging around 11 men per unit, and hauls up to 1,000 to 1,200 ft., production per machine-shift was around 250 tons.

With part of their production coming from shuttle-car sections, Harrisburg No. 43 and Harco No. 47 mines use a new working plan providing for developing panel entries as an integral part of the room-working cycle. Two 6-ton shuttle cars normally are used per 7BU or

*Here a shuttle car is receiving a 6-ton load of No. 5 seam coal in Harrisburg No. 43 mine.*

14BU loader. The coal varies from $4\frac{1}{2}$ to $6\frac{1}{2}$ ft. at 43 and 4 ft. 4 in. to 7 ft. at 47. With 16-man crews, shuttle-car production at 43 was running 500 tons, compared with around 220 tons from mine-car machines in room work. The shuttle-car output at 47 was averaging about 450 tons, compared with around 275 tons from mine-car machines.

### Face Preparation

Long cutters bars face preparation in southern Illinois, where measures to increase coarse-coal output or loadability, or both, include snubbing shots, shearing and the use of carbon-dioxide, air or hydraulic pressure plus, in one case, modified cushion blasting and in another a combination of carbon-dioxide and powder. Cardox coal-breaking was pioneered at an early Blue Bird operation in 1926. The "Energy Air Miner," predecessor of present air breaking equipment, was developed at Royalton No. 7 mine in 1930. And the du Pont hydraulic mining process was brought to a semi-commercial stage at New Monarch.

In addition to shortwalls, some 42 track-mounted machines are used in southern Illinois, as well as caterpillar and track-mounted shearing equipment at Kathleen. Users of track-mounted equipment include Valier (Goodman 324-AA units and shortwalls), Black Arrow No. 18 (one 324-AA), Majestic No. 14 (two Jeffrey 29-L), Orient No. 1 and New Orient (Jeffrey 29-LE and Sullivan CLU and 7-AU equipment, plus shortwalls), Freeman Spur (Jeffrey 29-U), Old Ben (Goodman 324-AA), Royalton No. 7 (Goodman 324-AA and shortwalls).

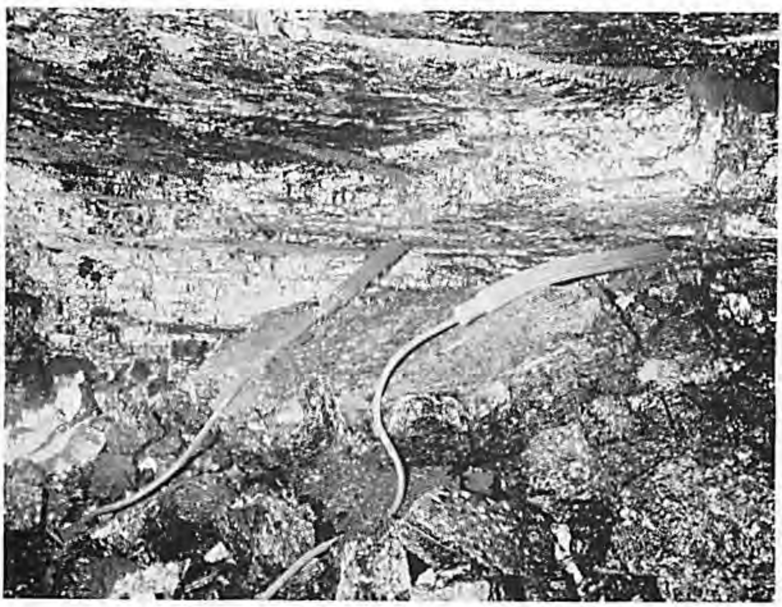
As cutting seldom is easy, practically all mines in the region use either throwaway bits or tipped standard bits. Throwaway bits include the Prox, Cincinnati, Goodman and Jeffrey "Star." Using Borod, Stellite, or Haystellite as the tipping medium, most mines get 2 to 5 regrinds before retipping.

Some mines obtain tipped bits from Cutter Bit Service or the Auto-Machine Co. However, retipping is done in mine shops by Consolidated, Valier, C. W. & F. (New Orient), Union Colliery, Bell & Zoller, Old Ben and Franklin County. Several also use throw-away bits or purchase from service companies.

Bit-tipping with borium was started by Franklin County in 1929, and bits now normally are reground 5 times before retipping. Old Ben, in addition to patronizing a service company, tips bits with Haystellite at No. 8. In 1937, when the four Old Ben mines produced 2,413,000 tons, total bit cost was $7,084. A bit plant installed by Union Colliery, using Haystellite, cut over-all cost to about one-fourth. Stellite and Sulite are used by Bell & Zoller, with a complete Sullivan bit-treating plant at Zeigler No. 2.

Drilling equipment is almost exclusively post-mounted (Chicago Pneumatic, Dooley or Jeffrey), with one Jeffrey track drill at Valier. Dooley, Hardsoeg or Coalmaster conveyor-type augers are widely used, generally with Hardsoeg or Coalmaster heads and bits. Permissible explosives, usually in 1¾ x 6-in. sticks, include Lump Coal C, Gelobel, Duobel, Monobel C, Herco No. 2, Alton "Big Red" No. 7-C and Burton A.

Since the No. 6 seam carries the characteristic "blue band" some 18 to 30 in. above the bottom, and because mining height seldom is less than 7 ft., snubbing shots are used to break the blue band and lower bench. At Majestic No. 14, snubbing coal is pulled out on the night shift before the top bench is shot. In the thinner No. 5 seam, snubbing holes may be omitted; some operations drill one or two to ease the loading machine in working in.



*Hydraulic tubes resting on top of a broken-down fall in New Monarch Mine.*

Shearing is practiced at Orient No. 1 and New Orient, Kathleen and Freeman Spur, to reduce explosives consumption, increase coarse-coal output and facilitate loading. New Orient supplements shearing with cushion blasting, drilling a large hole and leaving a 6-in. air space in front of the charge and thus breaking a center-sheared place making some 75 tons with 6 to 7 lb. of powder. A combination of powder and Cardox is employed at times at Royalton No. 7 (undercutting only). Powder is used in the snubbing holes to smash up the bottom bench and reduce digging, with Cardox in the top for a good roll and maximum coarse coal. At Energy No. 5, Cardox is used eight months of the year when lump demand is good.

Mines using Cardox exclusively include Zeigler 1 and 2, Old Ben 8, 11, 14 and 15, Jefferson No. 20, Harrisburg No. 43 and Harco No. 47. Old Ben adopted Cardox 100 per cent in 1931, reducing output of minus 2-in. coal some 10 percentage points. Rooms 28 ft. wide making 45 to 50 tons normally are broken with seven holes, with 6 lb. of carbon-dioxide per charge. Headings making about 20 tons are broken with four or five holes. At the Zeigler mines, the charge is 6½ lb. and the average yield per tube is 6.80 and 6.73 tons. Peeling of top coal at Jefferson No. 20 was eliminated by dropping the top rib holes to get an arch effect. In the thinner No. 5 coal, rooms at Harrisburg No. 43 making about 50 tons are broken with six holes, using D-100 tubes; headings, 20 to 25 tons, with three. In 4½-ft. coal at Harco 47, rooms 28 to 30 ft. wide are broken with five holes, one a half-length snubber (200-cu. in. tubes); headings, 12 to 14 ft., three holes. In 7-ft. coal, rooms making about 35 tons are broken with six holes, plus, occasionally, a short snubber. The heading standard is four holes.

With the du Pont hydraulic mining process, rooms 28 ft. wide and about 7½-ft. high are broken at New Monarch by ten holes. A unit is operated by two men and one regularly broke coal for two loading machines each averaging 300 to 320 tons per shift.

### Transportation

Shafts predominate in southern Illinois, although slopes serve new mines with 75 to 185 ft. of cover. The deepest operating shaft in the state is at Jefferson No. 20 mine (800-ft. hoist.) Zeigler No. 2, however, rates as the highest-capacity cage hoist in the district. A 10-ft. straight-drum steam hoist (345-ft. distance) raises 6,000 tons in seven hours in cars holding 3¾ to 4½ tons. Average output is 220 cars per hour; maximum, 1,600 cars in seven hours. Skips and electric hoists are used at Kathleen (11 tons, built up from 8), Valier (16 tons, straight-drum Ottumwa hoist and 1,350-hp. G. E. motor with Ilgner-Ward Leonard control; 70 hoists per hour); Zeigler No. 1 (9½ tons) and New Orient (14 tons). Present New Orient hoisting rate is 110 skips (around 220 cars) per hour for 10,000 tons per shift. The hoist (11- to 17-ft. stepped-drum Nordberg) is driven by two 2,000-hp. Westinghouse electric motors with Ilgner-Ward Leonard control.

Three Old Ben cage hoists also are electrified, and this company was the first to install an Ilgner-Ward Leonard set at a coal mine (No. 12) in 1912.

Main-line locomotives at mines studied by Coal Age range from 8

*Looking along a 30-in. main-line belt conveyor in Blue Bird No. 6 mine.*

to 20 tons. Hauls seldom are less than a mile and run up to 3¼ miles. Most mines normally divide haulage into main-line, relay and gathering, although Freeman Spur main-line locomotives run directly to the working sections. Signal system and dispatchers generally are employed. Main lines normally are graded to less than 2½ per cent, and the trend is toward steel up to 90 to 100 lb. in weight. Nearly all mines use or plan to apply treated ties, such as Zeigler No. 2, starting in 1920, zinc chloride; New Orient, creosote from 1922 to 1934 then zinc chloride; Energy No. 5 and Royalton No. 7, zinc chloride starting in 1925, etc. Few of these early tie installations have been replaced. Treatment is extended to room ties at Energy and Royalton, while Kathleen dips room as well as mainline ties in creosote. Osmose is sheduled for new mainline ties at Freeman Spur. Untreated main-line timber still is the general rule, but treatment is gaining ground. Bars at most operations are I-beams or rails, with Old Ben starting Bethlehem CB sections supported on pins and stringers put in by hitch-drills. New Orient does considerable guniting on main lines. Hitch-drill timbering also is done at Valier and Bankston Creek No. 5.

First welding of mine rails was done at New Monarch in 1933, using the arc process for a joint costing 68.2c., exclusive of power. The same practice is followed at Buckhorn and Jefferson No. 20. All main-line track at New Orient is being Thermit-welded, resulting in a substantial cost reduction over the joint life. Other Thermit users are Valier and Bankston Creek No. 5.

Six- and 8-ton cable reel locomotives are used for relay and gathering, with some larger relay units. Track in working sections usually is 30- to 40-lb. or heavier. Steel ties are coming into increasing use, not only in rooms but on panel entries, as at Harrisburg No. 43 (Bethlehem steel ties and 30-lb. rail). Wood on panel entries and up to the changing switches in rooms, with West Virginia steel ties thereafter, is the rule at the Zeigler mines, for example, with West Virginia steel ties throughout in rooms, except under switches, at Old Ben.

Mines being equipped with larger-capacity cars for greater efficiency include Freeman Spur (Watt 2.4-ton steel); Valier (5½-ton Mt. Vernon steel); Kathleen (4¾-ton A. C. F. steel), Zeigler Nos. 1 and 2 and others. Largest are the 11-ton Sanford-Day "1-2-3-4" drop-bottom cars installed at Buckhorn slope. Solid-end all-steel A. C. F. 171-cu. ft. cars were put in the new Bankston Creek No. 5 slope. Steel wheels have been installed at several mines, such as the Old Ben, New Orient and the Zeigler mines (cast steel), and Kathleen (Bethlehem rolled-steel). Cast-steel wheels first were adopted by Old Ben over ten years ago and 6,272 are in service, including the originals. Anti-friction bearings are widely used, with Timken leading. Others are Tyson and Hyatt, with several makes of ball bearings (Fafnir, New Departure, etc.).

Driving belt slopes with loading machines and conveyors was pioneered by the Consolidated Coal Co. in opening Buckhorn in 1937. In rock, five-man crews drove the 7 x 15-1/3-ft. slope an average of 22 ft. a day, three shifts. The Joy slope conveyor (900 ft. long, 17½-deg. inclination, 36-in. Goodyear belt) is operated by a Link-Belt dual drive (100- and 40-hp. motors). Capacity is 300 tons per hour at 375 f. p. m.

Using a 5BU loading machine and conveyors, the 7½ x 15-ft. 16½-deg. Bankston Creek No. 5 slope was driven 606 ft. in 120 7-hour shifts. The sinking rate (6-man crews) was 5¼ ft. per shift. A McNally-Pittsburg rotary-dumping installation, complete with coal and rock hoppers, feeds material onto a McNally-Pittsburgh slope conveyor 765 ft. long and equipped with a 54-in. wide 9-ply 48-oz. duck U. S. Rubber belt driven by a 300-hp. G. E. wound-rotor motor. Substantially the same system was employed in sinking the 313-ft. long 7 x 16-ft. 15-deg. Bankston Creek No. 4 slope in July, 1939. Average progress was 6 ft. per shift.

The 15-deg. 7 x 14-ft. slope 382 ft. long serving Blue Bird No. 6 was sunk in 1939 in 30 days (3 shifts per day; 5-man crews) using a loading machine and cars. Tandem Stephens-Adamson and Barber-Greene belt conveyors are installed. Underground transportation is handled by 600-ft. Barber-Greene conveyors in series.

### Ventilation and Pumping

Generally uniform conditions, including fairly level seams, thick coal in most cases and cover seldom breaking to the surface, have resulted in fairly uniform ventilation and drainage patterns in southern Illinois. Shafts predominate, with slopes for all other openings, and the panel system is used in the majority of the operations. This facilitates sealing individual working sections, done upon completion by Zeigler Nos. 1 and 2, Black Arrow No. 18, Harco 47 and Valier. Certain other mines seal only when squeezing or other trouble is encountered. Still others seal cross entries or other larger territories when worked out.

Outlying airshafts to reduce travel have been sunk at Old Ben No. 8, Kathleen and New Orient.

Fans have been placed at the bottom of the airshaft at Old Ben No. 11 and Kathleen, the Old Ben installation consisting of a 75-hp. 6-ft. Aerodyne. The original 300-hp. centrifugal on top is retained for emergency. Kathleen is being served with 39 per cent more air with 10 per cent less power. An old shaft-top centrifugal was replaced seven years ago by two Aerovanes on the bottom, these giving way to two Aerodynes providing 164,016 c.f.m. with a power input of 105.5 kw., against 117,700 c.f.m. and 116 kw. with the old centrifugal, still maintained as a spare. In 1932, Old Ben replaced the 1918 centrifugal at No. 8 with a 150-hp. 5 x 8-ft. backward-curved-blade Robinson centrifugal.

New shaft-top streamlined fan installations include a 9¼-ft. Aerodyne at the new airshaft at New Orient. This fan pulls 87 kw., compared with 275 kw. for the old fan before the airshaft was sunk. A 6-ft. Aerodyne has been installed at Majestic 14, with a 7-ft. Aerovane at Jefferson No. 20.

Most southern Illinois mines make relatively little water, so gathering units are most numerous. Borehole pumps are installed at Old Ben 15, New Orient, Orient No. 1, New Monarch, Kathleen and Zeigler No. 1, among others, with some shaft pumps in addition. At Jefferson No. 20 a new bronze 150-g. p. m. 800-ft. head Allis-Chalmers centrifugal forces water out the 740-ft. shaft. The water in some mines is acid and has resulted in some use of Universal cast-iron, cement lined, wood and other corrosion-resisting pipe. At Harrisburg 43, for example, where four pumps (1,000-g. p. m. Dayton-Dowd Dualoy, 800- g. p. m. Scranton bronze, 400-g. p. m. Weinman chrome-iron and Aldrich 6 x 9 cement triplex with porcelain plungers) deliver to the outside, pipe-lines include Universal cast-iron, lead-lined steel, concrete-incased steel (in bore-hole) U. S. S. "Duroline" and Wyckoff wood-stave.

### Power

The main power supply is purchased at 22 per cent of the mines covered in the Coal Age electrical survey. All these hoist by steam. Steam also is used for hoisting at the 34 per cent generating part of their power, usually d. c., and buying the rest. Three-fourths of the 44 per cent buying all their power use electricity for hoisting, with steam for the rest. Mines generating all their power include Zeigler Nos. 1 and 2, Jefferson No. 20, and Buckhorn and New Monarch (one plant). Companies generating part of their power include Franklin County, Peabody, and C. W. & F. Of the Peabody operations, Majestic 14 and Harco 47 use considerable minus 28-mesh carbon in boilers fired by Illinois spreader stokers. Illinois stokers also are used at Black Arrow 18 for hoisting steam and, with chain-grate stokers, for firing minus 48-mesh dust at Orient No. 1.

At electric-hoisting mines purchasing all their power, requirements average 6.47 kw.-hr. per ton. Underground consumption figures at three mines are 2.4, 2.52 and 4 kw.-hr.

Except for two of the six underground d. c. substations at Kathleen, synchronous m. g. sets, rather than converters, are used. Surface motors are mostly of the induction type. Consequently, several capacitors are installed to supplement the power-factor-corrective effect of the synchronous substa-

*In Black Arrow No. 18—looking through the steel doors, which will close automatically in case of a substation fire.*

tions, as at Valier, Black Arrow 18, Harco 47 and Kathleen (G. E. or Westinghouse capacitors), and the Zeigler mines (synchronous condenser). Demand-limiting is not practiced.

Except for Old Ben and Energy No. 5, operations surveyed take a. c. power underground, principally for operating d. c. substations but also in some cases face, transportation or dumping, or other equipment, as at Valier, Blue Bird No. 6, Bankston Creek No. 5, Buckhorn, etc. Valier employs 33 portable transformer sets. At all mines except New Orient (4,000) the a. c. power intake is 2,300 volts. Intake cables are hung in the shafts at, as examples, New Orient, Valier and Kathleen (lead sheath and wire armor) with non-metallic cables, including Simplex-Anhydrex at Kathleen, underground. Mines using boreholes include Buckhorn Peabody mines are "Okolite" wires) and Blue Bird No. 6 (G. E. No. 4 parkway-type cable). All late 2,300-volt borehole installations at Peabody mines are "Okolite" three-conductor rubber-and-braid cable.

Southern Illinois mines install all or at least part of their d. c. substations underground. Users of portable or semi-portable units include Consolidated (New Monarch and other mines), Majestic No. 14 and Kathleen. The latter has an automatic station ventilated by filtered air and also uses I. T. E. load-distributing equipment. Load distributors which insert resistance in the generator field are installed on part of the Valier sets.

Southern Illinois' long experience with mechanical mining is reflected in large d. c. circuits, whether in boreholes or underground. As examples, Old Ben mines are served by 2,000,000-circ. mil concentric cables suspended by the conductors in 500- to 600-ft. boreholes. Concentric borehole cables also are used at Energy No. 5, the latest being a G. E. 1,500,000 unit in a 370-ft. hole. Cables are suspended by grouting them in the tops of the casings.

Underground, the usual practice is 6/0 trolley wire and 250,000, 500,000- and 1,000,000-circ. mil cables. Practically all mines use 500,000- or 1,000,000-circ. mil bare returns in parallel with the track rails. Automatic sectionalizing or tie-feeder breakers are used in six mines, including 23 I. T. E. and old Columbus breakers in Valier. Each of four shuttle-car sections in Harrisburg 43 is served by a 600-amp. I. T. E. automatic reclosing unit. Installation of G. E. reclosing units was started in Kathleen about two years ago.

Battery power is used in New Monarch, Zeigler No. 1, Royalton No. 7, Majestic 14, Valier and Freeman Spur (Exide-Ironclad, Gould, Philco or KW battery or combination locomotives), Buckhorn, Jefferson No. 20, Harco 47, Harrisburg 43 and Blue Bird No. 6 (Exide-Ironclad, Gould and Philco powered rubber-tired haulage).

### Maintenance and Supplies

While there are exceptions, the usual maintenance set-up at southern Illinois mines provides for a chief electrician and a master mechanic on top and a chief electrician underground. Most mines find it economical to keep a maintenance man in each producing section.

Material and labor costs for maintaining loading machines run 3c. to 8c. per ton at the larger mines using the unit basis for loader maintenance. Part assemblies, such as rear conveyors, clutches, pumps and gathering heads, are overhauled on top, and work on the machines usually consists of replacing a worn or damaged unit with a rebuilt assembly. General overhauls have, in most cases, simmered down to chassis overhauls only, because other parts are kept in new condition by unit replacement. Time for an overhaul is determined by condition rather than tonnage or days worked. Exemplifying maintenance progress, time lost due to loader repairs at New Orient was 3.42 per cent in 1939, compared with 5.2 per cent in 1929.

At most larger mines, loading machines are lubricated by the maintenance crews at night. At about half, the lubricating crew also inspects and repairs the machines. A maintenance man on the shift handles lubricating at Old Ben mines, Special pressure trucks are used at Valier and New Orient, one crew at the latter lubricating 14 Joy machines a shift. Two crews with hand guns take care of the rest.

Mine-car greasing is continuous at some mines, as at New Orient, where the crew that maintains bottom tracks and replaces wheels also lubricates, and periodic at others. All cars at Zeigler No. 2 recently were greased in two days on the empty bottom at a cost per car of 46.7c., including grease. In single greasing in 1939, including inspection and adjustment of bearing and minor miscellaneous repairs, labor cost per car was 38.5c. Of the 1,860 bearings, 19 per cent needed adjustment.

A change from tires to steel wheels for locomotives was under way or completed at Valier, the four Peabody mines and the two Orient mines. Mines sending wheels or tires out to be welded included Kathleen, Energy No. 5, Royalton No. 7 and the Orients. An automatic tire- and wheel-welding shop at Harrisburg No. 43 mine is equipped with two Westinghouse heads and an automatic peening hammer. Preheating before welding is the practice and the filling material is "Stoody Positive" wire. Some 200 to 300 tires and wheels are welded per year and only three tires have broken after completion in three years. Wheels are preheated and rebuilt in a combination welding and turning lathe with two G. E. automatic heads at Valier. Hand-filling of tires and wheels is the practice at Old Ben and Consolidated mines. Using 1/4-in. "Fleetweld," Old Ben tires can be welded and turned for about half the cost of a new tire and give 9 to 10 months service, compared with 11 to 11 1/2 months for a new tire. Some tires have been welded five times and still are good for more.

Five companies are numbered among the experimental and regular users of glass insulation. Asbestos-covered wiring finds wide favor, while asbestos-insulated coils are standard for electrical equipment liable to severe overheating at Old Ben Mines. Old Ben also has vulcanized trailing cables for some time. Other companies doing vulcanizing include Peabody and C. W. & F.

In preparation-plant maintenance at both deep and strip mines, crews finds the acetylene cutting torch and arc-welder their most important tools. Plants which have installed oxygen and acetylene lines and low-voltage welding circuits include New Monarch, Bankston Creek and Pyramid strip. Piping systems at Jefferson No. 20 and Fidelity No. 11 strip handle acetylene only.

Central supply houses have practically passed out of the picture in southern Illinois. Separate houses, for example, recently were installed for the two Ziegler mines, less than two miles apart. Total inventory went down with fewer waits for parts as a result of closer relations between maintenance departments and storekeepers. Every large deep mine employs a warehouse clerk or storekeeper and keeps a perpetual inventory. Total inventories per ton of daily shipments average $11, with the range $6.65 to $19.

Several mines keep a number of supply items in underground repair shops and essential parts which the repairman can handle on the working sections. Examples are Kathleen and Valier. The latter has mechanized handling of heavy materials on the surface, equipment including a 6-ton crane mounted on a White truck supplied with a timber bucket, clamshell for sand and magnet for rails and other steel supplies.

### Stripping Methods

With overburden seldom averaging under 40 ft. and normally containing plenty of rock, southern Illinois strip mines use shovels alone or with draglines to uncover 4 to 7 ft. of coal. As most shovels are fairly new, dipper replacements to increase capacity are in the minority. Shooting overburden is universal, and conventional vertical and sidewall drills are supplemented by vertical augers or rotary drills. Liquid oxygen is widely used.

Strip mines covered in the Coal Age survey were: McLaren, McLaren Coal Co.; Bankston Creek No. 6, Bankston Creek Collieries Co.; and affiliate of the Sahara

Coal Co.; Pyramid Nos. 1 and 3, Pyramid Coal Corporation; Streamline, Southwestern Illinois Coal Corporation; Fidelity No. 11, United Electric Coal Cos.; Burning Star, Truax-Traer Coal Co.; and Delta, Delta Coal Mining Co.

Average cut width varies from 40 to 60 ft. Loading shovels range from 2 to 7 cu. yd. in capacity, the latter a Marion with aluminum-alloy dipper at Streamline. A Bucyrus-Erie 100-B shovel with 6½-cu. yd. Man-ten dipper is used at Bankston Creek No. 6. The Marion 490 shovels at Fidelity No. 11, originally 3-cu. yd., now have 4½-yd. dippers.

Operations using single shovels are: Bankston Creek No. 6, Bucyrus-Erie 950-B with 30-yd. Manten dipper; Pyramid 1, 950-B, 30-yd.; Pyramid No. 3, 750-B; and Streamline, Marion 5560 with 26-cu. yd. welded manganese-steel dipper. Upon moving into a new field, Delta becomes a tandem operation with a new Marion 5320 dragline with 10-yd. Page bucket helping out the 5321 shovel with 12½-yd. alloy-steel dipper with manganese lip (replacing a 10-yd. unit) in 20 to 50 ft. of overburden. McLaren works a 225-B steamer with 6-yd. dipper in tandem with a 6-W Monighan walking dragline (6½-yd. bucket). The two units together can handle 270,000 cu. yd. in a month in 32-ft. average burden.

Burning Star, with 60-ft. average cover, operates a 750-B machine (17-cu. yd. Man-ten dipper, manganese door, replacing a 12-yd.) in tandem with a Marion 360 dragline with 10-yd. Page bucket. Shovel yardage, due to better maintenance and pit supervision, has risen from 859 per hour in 1938 to over 1,100 in 1940. Burning Star auxiliary equipment includes two Caterpillar D-8 tractors pulling 9½-cu. yd. Bucyrus-Erie scrapers, used for ditching, road building, box-cutting, knocking off overburden peaks, etc. In opening a box cut, the scrapers were averaging 700 cu. yd. per machine-shift

*Shovel and dragline working in tandem in 70-ft. overburden, Burning Star mine.*

over an average one-way haul of 750 ft.

Stripping in one pit at Fidelity No. 11 is handled by a Marion 5600 shovel with 26-cu. yd. Man-ten dipper, which replaced a 15-yd. unit, and a 5480 machine with Amsco 15-yd. renewable-lip dipper, replacing original 12-yd. equipment. The second pit is a tandem operation, using a similar 5480 shovel and a 5480 dragline with 14-yd. bucket, increased from 12 yd. In overburden averaging 57 ft., stripper performance was: 5480 shovels, 650 cu. yd. per hour; 5600, 920 cu. yd.; 5480 dragline, 420 cu. yd.

Users of well-drill-type equipment and oxygen include: Bankston Creek No. 6, eight Bucyrus-Erie 29-T blast-hole machines and Airmite, 4½ to 5 cu.yd. of overburden per pound of oxygen; Streamline, four 29-Ts, supplemented occasionally by a sidewall machine, and Airmite; Fidelity No. 11, Armstrongs and one new 42-T and L. O. X., plus a Sullivan "Stripborer" and King "Detonite" for about 5 per cent of the shooting; and Burning Star, three 29-Ts (one-third) and two "Stripborers" (two-thirds the burden). Four of the 42-Ts are expected to replace six old Armstrongs at Fidelity. Burning Star shoots with du Pont No. 4 "Red Cross" and oxygen.

Delta employs both sidewall and vertical augers, with Alton black (gelatin core) for shooting. The goal is 5 cu. yd. per pound of explosive. The Delta vertical auger was putting down 16 to 17 holes in seven hours in 45-ft. burden containing 30 ft. of medium-hard shale. Sidewall drilling is done at McLaren, with Atlas "Blaxstrip" for shooting.

Drilling at Pyramid No. 1 is handled by two 29-T machines. At No. 3, two new Sullivan rotary rigs (Hughes oil-well-type bits) are employed. In April, 1940, in 35 ft. of overburden containing 15 ft. of shale and limestone, the drills averaged 6.14 holes per shift. Shooting is done with L. O. X.

The coal usually is shot, as follows: Delta, air drill and Alton pellet; McLaren, Hardsoeg vertical auger and Alton pellet or gelatin; Pyramid, Hardsoeg augers and Alton pellet or "Apcodyn"; Streamline, Hardsoeg auger and U. S. pellet with detonators installed at the factory; Burning Star, air drills and Monabel C; Fidelity, new rubber-tired Hardsoeg augers and du Pont pellet.

### Transportation

Automotive haulage, first installed in the district in 1934 at the Coal Strip mine, now Pyramid No. 3, is used at all but two southern Illinois stripping properties. Pyramid No. 1 employs steam. Steam also is used at Fidelity No. 11, but Pit No. 1 is being converted to combination haulage — Autocar tractors, Cummins diesel engines, and Garwood semi-trailers dumping sideways over a ramp into the present 40-ton A. C. F. standard-gage cars.

Bankston Creek No. 6 employs Autocar tractors each pulling a 20-ton semi- and 20-ton full Austin-Western trail car. Man-ten bodies are used on the last two-units, one with a Cummins diesel engine. Two more units (Cummins diesels) will supplement the ten Euclid tractors pulling 20-ton Euclid bottom-dumping semi-trailers at Burning Star. Eight White tractors with 25-ton A-W trail cars haul at Pyramid No. 3. At McLaren, one Interna-

*Loading 30-ton side-door-dump semi-trailer units at Streamline mine.*

tional and three White tractors pull 10-ton A-W trail cars. Delta hauls with seven Autocar tractors pulling 15-ton Sanford-Day drop-bottom semi-trailers, supplemented by a 20-ton Dart end-dump truck (refuse out and coal back). With a longer haul, sideboards raise capacity to 18 tons, while 125-hp. engines are being replaced with 175-hp. Waukesha gas units.

A longer haul resulted in Streamline removing side-dump bodies from the original Mack haulage units to make tractors pulling new 30-ton semi-trailers (Garwood "Hi-steel" bodies, Fruehauf running gear). All ten units are being equipped with 200-hp. supercharged Cummings diesels. The original unit, during trial, averaged 42 gal. of diesel fuel per day (100 to 110 miles) compared with 75 to 90 gal. of gasoline. The diesel unit was able to travel up grades in a 1 to 1½ higher gear ratio. Gasoline consumption at certain other properties was: Pyramid No. 3, 1.4 miles per gallon; McLaren, 3; Delta, 2½ to 3. Tire life varies from 10,000 to 30,000 miles, with the majority falling in the range of 20,000 to 30,000 miles.

### Power-Maintenance —Supplies

Complete electrification features all southern Illinois stripping properties covered by Coal Age but one. At completely electrified properties, all with full-scale mechanical preparation plants, requirements range from 6 to 9.9 kw.-hr. per ton shipped. Voltages of 4,000 to 4,500 are used on the strippers and most loaders, with 440 for auxiliary pit equipment. Pole lines serve all operations but Streamline, which uses a field-cable system fed from a pole line. Solid neutral conductors are carried over pole lines and through the cables in the high-voltage systems at all except Streamline and Delta. At Delta, however, trailing cables are fitted with ground wires, with a 10:1-ratio current transformer in the ground connection to the Y at the transformer station, plus a relay tripping the power company's oil circuit breaker at 2 amp. after 0.2 sec.

The local ground at Streamline is made where the field cable begins. The system consists of four 1,000-ft. lengths of Okonite 4/0 wire-armored cables containing three ground wires. Portable wooden juncton houses between sectons contain cutouts and taps for feeder circuits.

Pyramid No. 1, Bankston Creek No. 6 and Burning Star, three of the mines carrying solid ground wires, have current transformers and instantaneous relays to open the feeder breakers if grounds occur. Pyramid is one of the few connecting trailing cables directly to the lateral pole line, others using short intermediate cables between switch and/or connector sleds.

In maintenance, general overhauls of excavating equipment have given away to continuous maintenance of minor items, exchange of units and periodic overhauls of such major parts as booms or cats. Use of flanged or special high-tensile steels for structural parts and manganese steels for parts subject to severe wear and strain have materially lengthened service and reduced delays.

At Burning Star, non-digging time for the 17-yd. shovel averaged 2.7 hours per 8-hour shift in the first half of 1940, compared with 3.3 hours in 1938, including moving shovel and cable and repairs. Hard digging results in serious boom trouble every 2 to 3 years. Fidelity No. 11 operates equipment mostly over ten years old and moves burden averaging 57 ft. Great stress is laid on preventive inspection and early repairing. New or rebuilt parts that fail at regular intervals always are kept on hand, including dipper handles, crawler castings and treads, gears and pinions and a complete set of cables. Booms on large excavators are lowered and overhauled about every two years. Dipper handles get the same treatment annually, prolonging their life to five years. Fidelity and Delta, among others, go over and vulcanize trailing cables once a year. Special welding rods and hard-surfacing materials find many applications, especially in repairing dippers and buckets.

Total supply inventories at strip mines appear to nearly correspond with deep mines, averaging $11 per ton of daily production. Some operations, such as Burning Star, maintain perpetual inventories, while others, such as Delta, charge out supplies when received.

### Preparation and Sales

Preparation improvements in southern Illinois make it one of the foremost regions of the country in mechanical cleaning, as well as a leader in the processing of intermediate and smaller sizes, especially stoker, by crushing, rescreening, redusting and removal of tramp iron. Practically all operations are equipped to dustproof, with many trademarking by means of cardboard disks or squares and dye or lacquer.

Some 23 of the 31 deep and strip mines surveyed by Coal Age are served by mechanical-cleaning equipment. Six of these 23 can or do ship to a central preparation plant. A mechanical plant was being constructed at a 24th property while a 25th employs a full-scale pickings washer. Drying equipment includes both heat and centrifugal units.

Except that mechanical cleaning is not included, other southern Illinois plants adhere to the same standards and use substantially the same equipment. Product usage and opportunities for mechanical preparation elsewhere have materially simplified preparation at several operations. Thus, Valier, a railroad mine, operates a simple four track tipple. Harrisburg No. 43 customarily ships some 6-in. lump and 1½-in. screenings, sending other coal to Harco 47.

Energy No. 5 is another which can ship to a mechanical plant at Royalton No. 7. Like most southern Illinois properties, the Energy No. 5 plant includes a tipple and a rescreener for production of the smaller sizes over Gyrex vibrating screens. The rescreener is preceded by a Dings magnetic pulley. At Freeman Spur, rescreening is done on Jeffrey-Traylor and Selectro equipment. Finished sizes are loaded over a Stearns magnetic pulley. Jeffrey Type N and Flextooth crushers make stoker and other small coal. McLaren and New Monarch are equipped with Selectro and Symons horizontal equipment for dedusting screenings and making stoker, as well as auxiliary crushing equipment. At Buckhorn, using Link-Belt and Symons vibrators for rescreening and dedusting and an American ring mill for breaking down coarse coal, a Dings pulley removes tramp iron.

A new Robins installation at Jefferson No. 20, which includes crushing equipment, Gyrex and Tyler 400 electric screens, and special proportioning-type mixing equipment, permits, if desired, breaking all coal to less than 5/16 in. and dedusting it at 10 mesh. Dedusted screenings and stoker are made in a company-designed plant (shaker and Hum-mer vibrating screens and Koppers Birtley-type aspirators) at New Orient mine. Storage bins and proportioning feeders, supplemented by assembly equipment, permit making prescription mixtures, including 10-mesh and 48-mesh stoker. Pennsylvania "Granulator" and American ring mill breaking equipment is installed.

Pickings from main New Orient, after reduction to minus 1½ in. in an American ring mill, are washed in a New Jeffrey plant to recover merchantable coal. Washed coal (12 to 15 per cent surface moisture) is dewatered on two Selectro side-drive vibrators to 4 to 5 per cent. A similar dedusting plant is operated at Orient No. 1, now equipped with a new mechanical plant for washing 6 x 7/16-in. coal (Jeffrey Baum-type jig) and dry-cleaning minus 7/16 in. (Stump "Air-Flow" cleaners).

Chloride washers are used at all four Old Ben mines to clean 6 x 3 and 3 x 2- or 3 x 1½-in. sizes. Nos. 8, 11 and 15 include rescreeners with storage bins and reassembly conveyors for making small coal and stoker. At No. 14 is located the Old Ben "Processing Plant" for stoker coal, equipped to receive sizes up to 3 in. from the other mines. Plant facilities include a track hopper, American ring mill, shaker and Selectro screens, American "Twin-Dex" pneumatic separators for the 3/4 x 5/16-in. fraction, storage bins, etc.

Kathleen mine uses Stump "Air-Flow" cleaners and Gyrex screening equipment to prepare small sizes and stoker. Dedusting before washing may be done at Royalton

No. 7, with a track hopper to permit handling Energy No. 5 coal or rehandling surplus first-shift coal on the second shift. Equipment includes a Koppers-Menzies cone separator (3 x 0), Koppers-Battelle launder-type fine-coal cleaners (3/8 x 0) and Carpenter centrifugal dryers for dewatering minus 3/8-in. coal (14 to 22 per cent surface moisture down to 5 to 6 per cent). An American ring mill permits crushing all coal over 1 in.

A Koppers-Rheolaveur addition at Fidelity No. 11 includes Koppers-Rheolaveur coarse- and fine-coal washers for 4 x 0-in. coal, as well as screening and crushing equipment, loading and mixing equipment and Carpenter centrifugal dryers, which reduce "visible" moisture in the 5/16-in. x 48-mesh size to around 6 per cent.

Mechanical plants at Black Arrow No. 18, Harco No. 47 and Majestic No. 14 (McNally-Norton automatic and Link-Belt air-operated jigs) commonly wash from 6 in. down, usually after dedusting at 28 mesh. Magnets precede the washers, and rescreeners are operated for small washed coal, including storage bins fitted in most cases with proportioning feeders. All three plants split the tonnage and wash on two shifts, reasons being a reduction in the scope and cost of preparation equipment and greater flexibility. All include track hoppers and crushing equipment for pickings or refuse and for making small sizes and stoker out of large. Dedusting is done on vibrators plus an "Algar" aspirator at Harco 47.

Complete new mechanical plants in southern Illinois include Bankston Creek, rated at 825 tons per hour. One McNally-Norton automatic washer cleans 6 x 3-in. coal, with two additional units for 3 x 0. Equipment is provided for break-

*Trademarking stoker at Old Ben No. 14 "Processing Plant" by feeding into it a small percentage of coal coated with a green lacquer.*

ing down and rescreening washer sizes over 1 in. for household stoker. Three Christie heat dryers dewater minus 3/8-in. washed coal, reducing surface moisture (after preliminary dewatering) from 9 to 10 to 1 per cent.

Zeigler Nos. 1 and 2 coal is cleaned and prepared in a 1,000-tons-per-hour central plant. All sizing is done on Gyrex, Vibrex or grizzly equipment, with Tyler 400 units for dedusting minus 5/16-in. prior to cleaning in Stump "Air-Flow" equipment. Two Chance cones clean 6 x 5/16-in. coal. Complete mixing and crushing equipment is installed.

All screening also is done on vibrating equipment at the Blue Bird No. 6 plant, equipped with a Morrow "Multiflow" washer for 3-in. x 10-mesh coal. Dewatering is done on an Allis-Chalmers "Lo-Head" horizontal vibrator. A Robins distributing chute with degradation screens distributes picked lump and egg.

The air-operated jig in the Link-Belt plant at Delta cleans a 6 x 0 in. feed. A Link--Belt "Roto-Louvre" dryer is installed to reduce moisture in coal up to 1 in. to below the freezing point in winter or supply coal to definite moisture specifications. Delta also includes a Howe continuous centrifugal separator for minus 10-mesh fines. Initial operation showed a recovery of 75 per cent with an ash of 12 to 13 per cent, compared with 15 to 27 per cent (18 to 19 per cent average) in the feed.

Pyramid Nos. 1 and 3 mines are served by a new 1,000-ton-per-hour McNally-Pittsburg plant with automatic washers for 7 x 4-, 4 x 1¼- and minus 1¼-in. coal. Minus 3/8-in. washed coal is dewatered over high-speed shakers fitted with Bixby-Zimmer round-wire screens. About twice as much minus ½-mm. material is retained in the dewatered coal, while the moisture content is 3¼ per cent lower. Pyramid also includes a complete stoker-coal plant (crushers and vibrating screens). A settling tank in addition to the regular cones materially reduces head on most of the circulating-water.

All coal from 6 in. down is washed at Streamline. Provision is made for primary and secondary crushing, middlings crushing and recirculating, mixing, etc. One McNally-Norton automatic washer cleans 6 x 3, with two more for 3 x 0. Bixby-Zimmer round-wire screens have materially increased dewatering efficiency.

A small auxiliary washer is used to clean secondary refuse from the fine-coal unit at the Burning Star plant, equipped with McNally-Norton automatic units for all coal from 6 in. down. A stoker-coal crushing and screening plant employs McNally-Pittsburg crushers and Gyrex vibrators.

Hot oil (Viking system) is the predominant dustproofing medium in Southern Illinois. Exceptions are McLaren, "Dustlix"; Buckhorn, New Monarch and Jefferson No. 20, "Duosol"; and Bankston Creek, cold oil, 350 sec. in summer and 200 sec. in winter, using "Brownie" high-pressure spraying equipment. Hot-oil users fall roughly into two classes, those employing spray oils (Standard, Socony-Vacuum, Conoco, etc.) with a viscosity of around 300 or 350 sec. and those using 600-sec. or heavier material. Among the latter is Burning Star, employing 1,500 sec. "No-Kol-Dust," pioneered at

*This trademarking machine at Zeigler presents a gummed label to be placed on a lump.*

Truax-Traer's Fiatt property to prevent absorption and get the same or better treatment with a smaller quantity.

Old Ben coal is "Green-Marked" with a special green dye (large sizes) or by feeding into it a certain percentage of pieces coated with a green lacquer, known as "marlbes." Zeigler has installed "Dustlix" trademarking machines which feed gummed labels into the smaller sizes or into the hand for pasting on lumps. The Peabody product is trademarked by round cardboard disks, using an automatic feeding machine.

Although faced with strong competition from all sides, southern Illinois producers still enjoy a widespread geographical distribution, due primarily to (1) a high percentage of prepared sizes, (2) pioneering, consistent and effective merchandising promotion and (3), in recent years, special attention to the growing market for stoker coals.

The value of salesmanship in print — illustrations, color and copy that says something — has long been recognized. The importance of domestic coal is reflected in the fact that the bulk of the promotion material is devoted to household fuel. This material ranges from elaborate portfolios of direct-mail campaigns to simple, occasional mailing pieces or suggested newspaper advertisements. Most producers, in fact, emphasize newspapers ads for the use of dealers, and some are prepared to supply especially written copy to meet local conditions. Much educational material to supplements the efforts of the producers' salesmen is being put out, ranging from coal preparation facts to sales manuals to help the dealer in his own promotional activities.

Stoker coals, because of their growing importance, are receiving special consideration. Many producers are not content to let their advertising portfolios speak for themselves. Instead, they are actively merchandising them to dealers to insure maximum utilization. While most programs are made up on an annual basis, special campaigns to meet special conditions are offered. As an example, one producer has launched a special campaign to swing tonnage to the smaller sizes because of a growing scarcity of raw lump. Direct-mail campaigns to enlist the cooperation of both the retailer and his customers are being used successfully by another.

# CONSTITUTION AND BY-LAWS

Adopted June 24, 1913
Amended Nov. 12, 1926
Amended Nov. 8, 1929
Amended Nov. 8, 1935
Amended Oct. 21 1938

## 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 one year's dues of $3.00. 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 $3.00 and any person in arrears on August 1, of the current year, after having been sent two notifications of dues, to 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 $50.00. Funds received from life members are to be invested and only the income from these funds may be used in the regular operation of the Institute.

## ARTICLE III.

### Officers.

Section 1. The officers shall consist of a President, 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 November 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, Vice-President and Secretary-Treasurer shall be elected by ballot, annually, at the regular November meeting and shall hold office for the ensuing year.

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

To make effective this change, at the regular November meeting in 1938, in addition to the four Executive Board members who shall be elected for the three year term, there shall also be elected by ballot eight other Executive Board members, four for a two year term and four for a one year term.

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 vice-president.

Section 5. The executive board shall consist of the officers and twelve other board members.

## ARTICLE IV.

### Duties of Officers.

Section 1. The president shall perform the duties commonly performed by the presiding officer and chairman. He shall sign all orders for payment of money by the treasurer, and with the executive board shall exercise a general supervision over the affairs of the Institute between sessions.

Section 2. The vice-president shall preside in the absence of the president and perform all the duties of the president in his absence.

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, countersign all orders for money which have been signed by the president, and shall purchase necessary supplies under the direction of the executive board.

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 the president, and countersigned 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 newspapers 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 November 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. Regular meetings shall be held in June and November 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 semi-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) Adjournment.

# ILLINOIS MINING INSTITUTE

## LIFE MEMBERS

ANDERSON, JAMES S.............1300-28 E. Jackson Blvd., Chicago, Ill.
BARROW, W. E.............Joy Mfg. Co., Franklin, Penn.
BROOKS, C. W., Contr. Engr.............Room 601, 53 W. Jackson Blvd., Chicago, Ill.
BUCHANAN, D. W., Pres.............Old Ben Coal Corp., 230 S. Clark St., Chicago, Ill.
BUTCHER, FRED E.............First National Bank Bldg., Danville, Ill.
COWIN, G. D., Pres.............
Bell & Zoller Coal & Mining Co., 307 N. Michigan Ave., Chicago, Ill.
DUNCAN, W. M., Pres.............Duncan Foundry & Machinery Co., Alton, Ill.
GREEN, ARTHUR C.............Goodman Mfg. Co., 4834 S. Halsted St., Chicago, Ill.
HARRINGTON, GEO. B., Pres.............
Chicago, Wilmington & Franklin C. Co., 332 S. Michigan Ave., Chicago, Ill.
HARRIS, ALLYN, Pres.............Cardox Corp., 307 N. Michigan Ave., Chicago, Ill.
JENKINS, S. T.............Goodman Mfg. Co., 322 Clark Ave., St. Louis, Mo.
JENKINS, W. J., Pres.............
Consolidated Coal Co. of St. Louis, Railway Exchange Bldg., St. Louis, Mo.
JONES, JOHN E.............Old Ben Coal Corp., West Frankfort, Ill.
JOYCE, A. R.............The Wood Preserving Corp., Marietta, Ohio
KEELER, E. R., Pres.......Franklin County Coal Co., 135 S. La Salle St., Chicago, Ill.
KNOIZEN, A. S.............Joy Mfg. Co., Franklin, Pa.
LEACH, B. K., Pres...Egyptian Tie & Timber Co., 1803 Ry. Exch. Bldg., St. Louis, Mo.
McFADDEN, GEO. C., A. V.-P.....Peabody Coal Co., 231 S. LaSalle St., Chicago, Ill.
MORROW, J. D. A., Pres.............Joy Mfg. Co., Franklin, Penn.
MOSES, HARRY M., Pres.....H. C. Frick Coal Co., 1322 Frick Bldg., Pittsburgh, Pa.
PEABODY, STUYVESANT, Pres...Peabody Coal Co., 231 S. LaSalle St., Chicago, Ill.
PELTIER, M. F., V.-P.............Peabody Coal Co., 231 S. LaSalle St., Chicago, Ill.
PFAHLER, F. S., Pres.............Superior Coal Co., 400 W. Madison St., Chicago, Ill.
POWERS, F. A.............Hulburt Oil & Grease Co., Box 21, Peoria, Ill.
RYAN, JOHN T., Pres.............Mine Safety Appliances Co., Pittsburgh, Pa.
SANDOE, C. J.............648 Vassar St., St. Louis, Mo.
SCHONTHAL, B. E., Pres.............
B. E. Schonthal & Co., Inc., 28 East Jackson Blvd., Chicago, Ill.
SCHONTHAL, D. C.............West Virginia Rail Co., Huntington, W. Va.
TAYLOR, H. H., Jr.............Franklin County Coal Co., 135 S. LaSalle St., Chicago, Ill.
THOMAS, T. J., Pres.............Valier Coal Co., 547 W. Jackson Blvd., Chicago, Ill.
WANNER, E. W., V.-P.............Hulburt Oil & Grease Co., Philadelphia, Penn.
WARE, LOUIS, Pres.............
International Agricultural Corp., 61 Broadway, New York, N. Y.
WEIR, PAUL, Consulting Engineer.............307 N. Michigan Ave., Chicago, Ill.
ZELLER, HARRY, V.-P. and G. M.......West Virginia Rail Co., Huntington, W. Va.

## HONORARY MEMBERS

GOALBY, JOHN F. ........ 923 Kinsted St., Morris, Ill.
McAULIFFE, EUGENE, Pres. ........ Union Pacific Coal Co., 1416 Dodge St., Omaha, Nebr.
MOSES, THOMAS ........ 123 N. Franklin St., Danville, Ill.
MURRAY, HUGH ........ Equality, Ill.
STOCKETT, THOS. R. ........ Alta Club, Salt Lake City, Utah
TIRRE, FRANK F. ........ 4517 N. 20th St., St. Louis, Mo.
WEISSENBORN, F. E., Asst. Comm. ........ Illinois Coal Oper. Assn., 4266 Arsenal St., St. Louis, Mo.

## ACTIVE MEMBERS

ADAMS, R. L., Gen. Supt. ........ Old Ben Coal Corp., West Frankfort, Ill.
ADAMS, WILLARD C. ........ c/o Koppers Rheolaveur Co., Koppers Bldg., Pittsburgh, Pa.
ADAMS, W. G., Mgr. ........ Dooley Bros., 1201 S. Washington St., Peoria, Ill.
AHLEN, L. S. ........ Goodman Mfg. Co., 4834 S. Halsted St., Chicago, Ill.
AITKEN, W. I. ........ Dooley Bros., 1201 S. Washington St., Peoria, Ill.
ALFORD, NEWELL G. ........ c/o Eavenson, Alford & Auchmuty, 2050 Koppers Bldg., Pittsburgh, Pa.
ALLARD, A. F. ........ United States Fuel Co., Danville, Ill.
ALVERSON, RALPH, G. S. ........ Carney Coal Co., Harrisburg, Ill.
ANDERSON, G. G., Mine Mgr. ........ Old Ben Coal Corp., 106 S. Victor, Christopher, Ill.
ANDERSON, J. C. ........ 1633 N. Vermilion St., Danville, Ill.
*ANDERSON, JAMES S. ........ 1300-28 E. Jackson Blvd., Chicago, Ill.
ANDERSON, MAT ........ Bituminous Casualty Corp., 822 Sanders Pl., Webster Groves, Mo.
ANGLIN, D. Z., Supt. ........ Truax-Traer Coal Co., Elkville, Ill.
ARMS, GEORGE ........ Jeffrey Mfg. Co., Columbus, Ohio
ARMSTRONG, E. R. ........ Equitable Powder Co., Collinsville, Ill.
ARNOLD, MARK R. ........ 810 W. Washington Blvd., c/o A. Leschen & Sons Rope Co., Chicago, Ill.
AUSTIN, W. J. ........ 332 S. Michigan Ave., c/o Hercules Powder Co., Chicago, Ill.
BAECHLE, E. P., Div. Mgr. ........ Industrial Supplies, Inc., Marion, Ill.
BAGGOTT, JOHN R. ........ Wasson Coal Co., Harrisburg, Ill.
BALL, CLAYTON G. ........ c/o Paul Weir, 307 N. Michigan Ave., Chicago, Ill.
BARLOW, J. E. ........ Goodman Mfg. Co., 1052 Fayette St., Springfield, Ill.
BARR, ROY E., Frt. Traffic Mgr. ........ Illinois Central System, Park Row, Chicago, Ill.
*BARROW, W. E. ........ Joy Manufacturing Co., Franklin, Pa.
BARTLETT, A. G. ........ Austin Powder Co., West Frankfort, Ill.
BASKIN, E. D., Dist. Sls. Mgr. ........ The Upson-Walton Co., 737 W. Jackson Blvd., Chicago, Ill.
BASS, A. C. ........ I. B. Williams & Son, 164 N. Wacker Drive, Chicago, Ill.
BASTMAN, I. T., Pres. ........ Supplies, Inc., 25 S. Desplaines St., Chicago, Ill.
BAYLESS, I. N., Gen. Mgr. ........ Union Pacific Coal Co., Rock Springs, Wyo.
BEAM, D. M. ........ Mexico Refractories Co., c/o National Storage Co., 801 S. Washington, Peoria, Ill.

BEAN, F. M. .......... B. E. Schonthal & Co., 438 Murphy St., Murphysboro, Ill.
BEARD, E. W. .......... U. S. Rubber Co., 440 W. Washington St., Chicago, Ill.
BEAUMONT, G. L. .......... Mine Timber, Cowden, Ill.
BECKER, LESTER O., Sales Mgr. ..........
Utility Mine Equipment Co., 620 Tower Grove Ave., St. Louis, Mo.
BEDA, P. W., V. P. .......... Old Ben Coal Corp., 230 S. Clark St., Chicago, Ill.
BEDDOE, A. H., Pres. ..........
Illinois-Pocahontas Coal Co., 320 N. Fourth St., St. Louis, Mo.
BEGGS, D. W., Pres. .......... Macon County Coal Co., Decatur, Ill.
BELL, J. H. .......... Cardox Corporation, 307 N. Michigan Ave., Chicago, Ill.
BELLAMY, C. C., Ser. Engr. .......... Shell Oil Co., 231 S. Sycamore St., Centralia, Ill.
BELTZ, JOHN S. .......... c/o Jeffrey Mfg. Co., Columbus, Ohio.
BENDER, W. J. .......... Specialty Sales Div., DuPont Company, Wilmington, Del.
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BEVERS, P. T. .......... 2070 E. 61st St., Cleveland, Ohio
BIAS, H. O. .......... B. & O. Railroad, Temple Bar Bldg., Cincinnati, Ohio
BIENFANG, G. J. .......... Socony-Vacuum Oil Co., Decatur, Ill.
BLAKE, ARTHUR .......... c/o Peabody Coal Co., Taylorville, Ill.
BLAKELY, W. V. .......... Western Powder Mfg. Co., East Alton, Ill.
BLANKINSHIP, G. F., Sales Engr. .......... Egyptian Sales Agency, Murphysboro, Ill.
BLUTH, MARC G., Mgr., Chicago Office ..........
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BOLEY, CHARLES C. ..........
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Commonwealth Edison Co., Box 7, Taylorville, Ill.
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BRADBURY, WILLIAM .......... Peru Deep Vein Coal Co., Peru, Ill.
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Black Diamond Coal Co., 1242 Syndicate Trust Bldg., St. Louis, Mo.
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Illinois Coal Strippers Assn., Rm. 2300, 230 N. Michigan Ave., Chicago, Ill.
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MACWHYTE CO.........Kenosha, Wisc.
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Westinghouse Electric Co., 20 N. Wacker Drive, Chicago, Ill.
MALSBERGER, A. H.........DuPont Powder Co., 1837 S. College St., Springfield, Ill.
MANCHA, RAYMOND.........Jeffrey Manufacturing Co., Columbus, Ohio.
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MARTIN, ENOCH.........1217 Fayette St., Springfield, Ill.
MARTIN, WILLIAM A.........Tilton Mining Co., Tilton, Ill.
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MAYOR, ELMER S.........Binkley Mining Co., Macon, Mo.
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McCLOUD, DON B.........
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McCOLLUM, H. C.........Allen & Garcia Co., 1932 Lowell Av., Springfield, Ill.
McCULLOCH, LAWRENCE H.........McCulloch Lubrication Products, Vincennes, Ind.
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ROMIG, JOHN L.......Atlas Powder Co., Wilmington, Del.
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ROSING, BORGE, Gen. Sls. Mgr...The West Virginia Rail Co., Huntington, W. Va.
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SCHOEN, W. H., Jr., Pres.....
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SCHWARTZ, H. L.....W. M. Hales Co., Hillsboro, Ill.
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WITTEN, W. E..............Wasson Coal Co., Harrisburg, Ill.
WOLFE, F. J..............Coal Mine Equipt. Sales Co., Beasley Bldg., Terre Haute, Ind.
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WOOSLEY, CLYDE W., Gen Supt..............Pyramid Coal Corp., Pinckneyville, Ill.
WRIGHT, D. D..............c/o Central Ill. Public Service Co., Marion, Ill.
WRIGHT, H. D., Pres...Republic Coal & Coke Co., 8 So. Michigan Ave., Chicago, Ill.
WRIGHT, JOHN, Supt. Inspection & Del'y......Ayer & Lord Tie Co., Carbondale, Ill.
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YOUNG, ALEX..............Superior Coal Co., Gillespie, Ill.
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ZIMMER, WALTER..............
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Chicago Pneumatic Tool Co., 1931 Washington Ave., St. Louis, Mo.

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†Honorary Members.

# In Loving Remembrance

of our good friends and fellow members:

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| WILLIAM ORTMAN | February 22, 1931 |
| S. W. FARNHAM | March 12, 1931 |
| H. C. PERRY | April 13, 1931 |
| A. J. SAYERS | October 11, 1931 |
| C. E. KARSTROM | March 24, 1932 |
| JOSEPH D. ZOOK | May 28, 1932 |
| EDWARD CAHILL | August 4, 1932 |
| JOSEPH VIANO | December 12, 1932 |
| JOHN ROLLO | February 6, 1933 |
| DAVID I. ROCK | August 2, 1933 |
| WM. HUTTON | August 18, 1934 |
| FRED K. CLARK | October 24, 1934 |
| ERWIN CHINN | April 16, 1935 |
| ADAM CURRIE | June 12, 1935 |
| W. H. SLINGLUFF | September 10, 1935 |
| CHAS. B. SPICER | October 26, 1935 |
| NELSON P. MORRIS | September 3, 1936 |
| DON WILLS | December 9, 1936 |
| T. E. COULEHAN | January 11, 1937 |
| ALBERT WEBB | March 5, 1937 |
| H. B. COOLEY | March 23, 1937 |
| C. W. SWANSON | July, 1937 |
| JOSEPH McFADDEN | September 15, 1937 |
| E. G. LEWIS | September 21, 1937 |
| E. L. STEVENS | September 28, 1937 |
| W. C. ARGUST | December 17, 1937 |
| H. H. TAYLOR, SR. | December 28, 1937 |
| E. L. BERGER | May 27, 1938 |
| J. I. THOMPSON | June 24, 1938 |
| P. W. MacMURDO | July 11, 1938 |
| J. A. EDE | July 26, 1938 |
| M. C. MITCHELL | September 11, 1938 |
| C. F. HAMILTON | September 22, 1938 |
| H. C. LONGSTAFF | October 12, 1938 |
| JOHN JOHNSON | January 2, 1939 |
| C. A. BLOMQUIST | January 9, 1939 |
| JOHN WHITE | April 15, 1939 |
| CHARLES HAFFTER | May 21, 1939 |
| BRUNO F. MEYER | July 21, 1939 |
| JOHN A. GARCIA | August 11, 1939 |
| A. J. MOORSHEAD | October 16, 1939 |
| HARVEY E. SMITH | November 6, 1939 |
| C. W. McREAKEN | November 30, 1939 |
| C. C. HUBBART | March 4, 1940 |
| SAMUEL HANTMAN | Sept. 13. 1940 |
| SIMON A. BOEDEKER | October 12, 1940 |
| JOHN H. DAVIS | October 21, 1940 |
| S. J. WILLS | October 22, 1940 |
| HARRY HANTMAN | November 5, 1940 |
| J. C. WILSON | December 18, 1940 |
| NICHOLAS CHRISTENSEN | December 26, 1940 |

who left the world better for their

having lived in it

# Friends, Meet <u>Your</u> Friends

*A Message to Our Members:*

Please go over this section very carefully and take note of our good friends, who are helping us to issue this book.

They deserve your consideration on every possible occasion.

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*MECHANIZATION* is distributed monthly to key men in every important coal property. 12,500 readers hold responsible positions in this industry. The great majority of them receive *Mechanization* at home. They read it . . . study it . . . and keep it on hand. It's a veritable mint to those who desire to keep informed. It reports coal's progress . . . as it occurs . . . without bias or prejudice. It is owned . . . and edited by men thoroughly familiar with mining . . . for mining men. It is truly *"the Magazine of Modern Coal."*

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# *New* CINCINNATI COAL CUTTING CHAIN


Designed to handle the toughest possible cutting conditions in normal stride, with a comfortable reserve of strength, the new Cincinnati Cutter chain is distinctive and unique in the field. This is due to the outstanding, improved joint construction, illustrated here in both assembly and detail. In its simplicity, long life and over-all economy, it has no equal.

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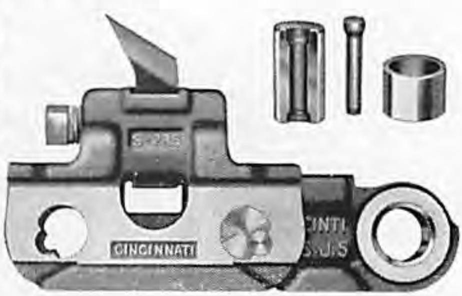


COAL CUTTING COSTS WITH CINCINNATI ARE DEFINITELY LOWER!

*Write for information on how the new Cincinnati Cutterchain can help you increase production and lower costs.*

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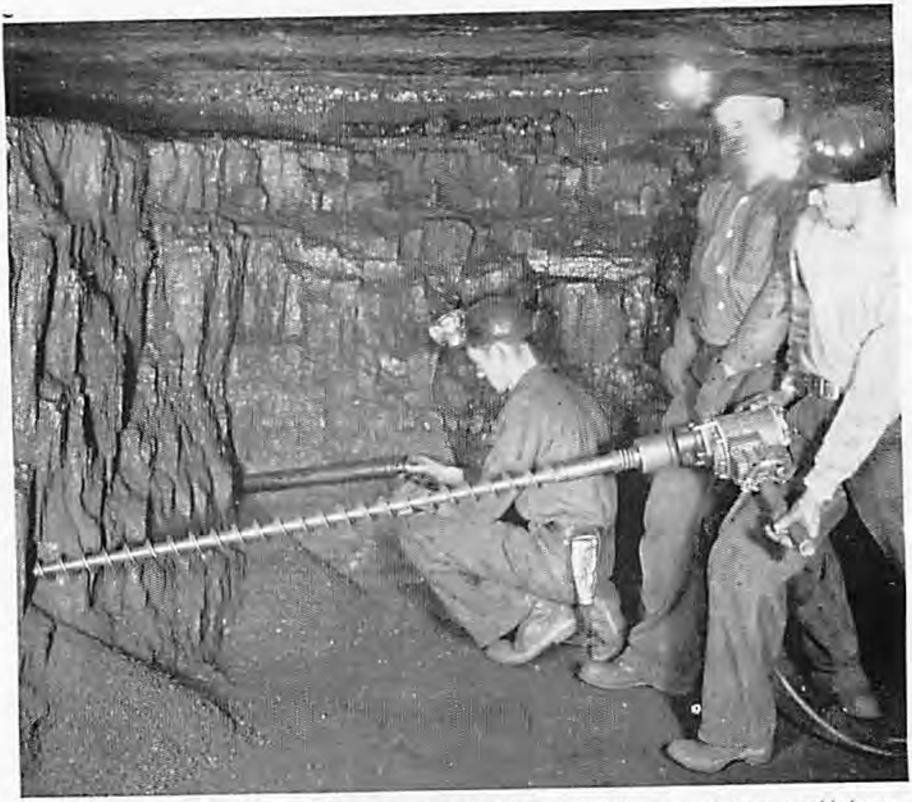
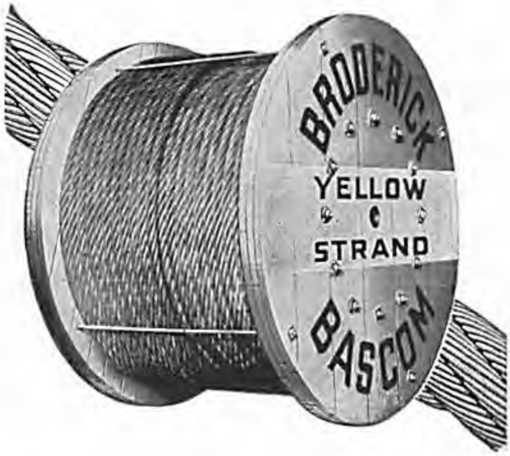


*Thread bars used in these coal drills are made from a cold drawn steel specially developed for this application by Ryerson engineers.*

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NOW, try "Flex-Set" *Preformed* Special Mining Machine Rope. The same high quality wire, but — the rope is limbered up by preforming. It handles more easily, is installed and broken in more quickly and safely. Less subject to fatigue, less apt to kink.

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You save an extra 40% when you exchange sound worn ball bearings for these Ahlberg Service-Proven bearings which carry a new bearing guarantee.

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Precision-manufactured by Ahlberg to even closer tolerances than S.A.E. Standards. Sizes and types to meet every need.

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Precision bearings in sturdy housings with generous lubricant reservoirs. Labyrinth type seals are effective and long-wearing.

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Here is a huge market for coal operators who can produce stoker sizes economically and efficiently.

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**June 6-7-8, 1941**

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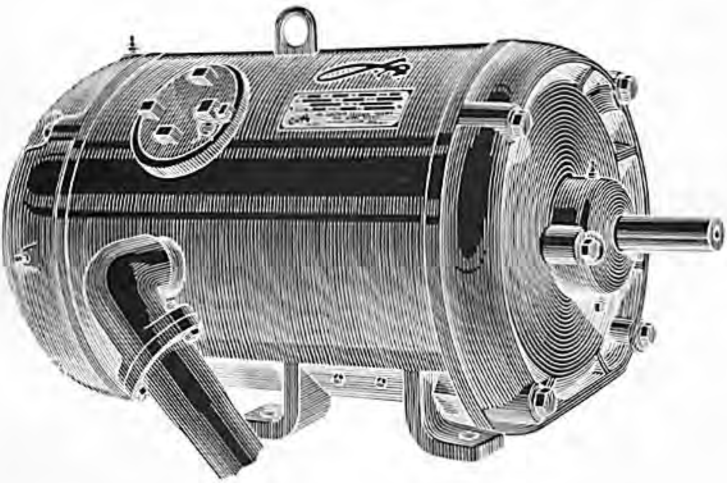

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There is a size and type Louis Allis motor especially designed for every coal mining and processing operation.

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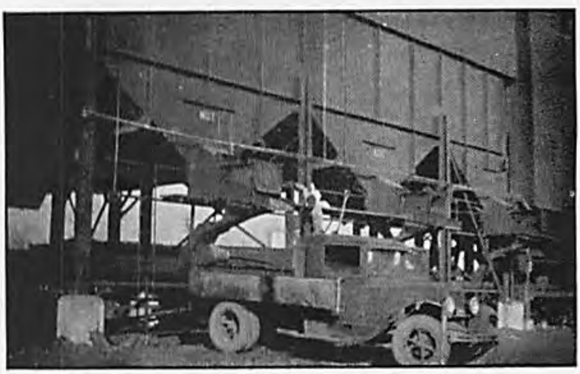

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of the Officers and Members of the Illinois Mining Institute goes to the Advertising Committee:

*H. E. Campbell, Chairman*

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