G H Carly

# PROCEEDINGS OF THE ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892

1936

# PROCEEDINGS

*of the*

# ILLINOIS MINING INSTITUTE

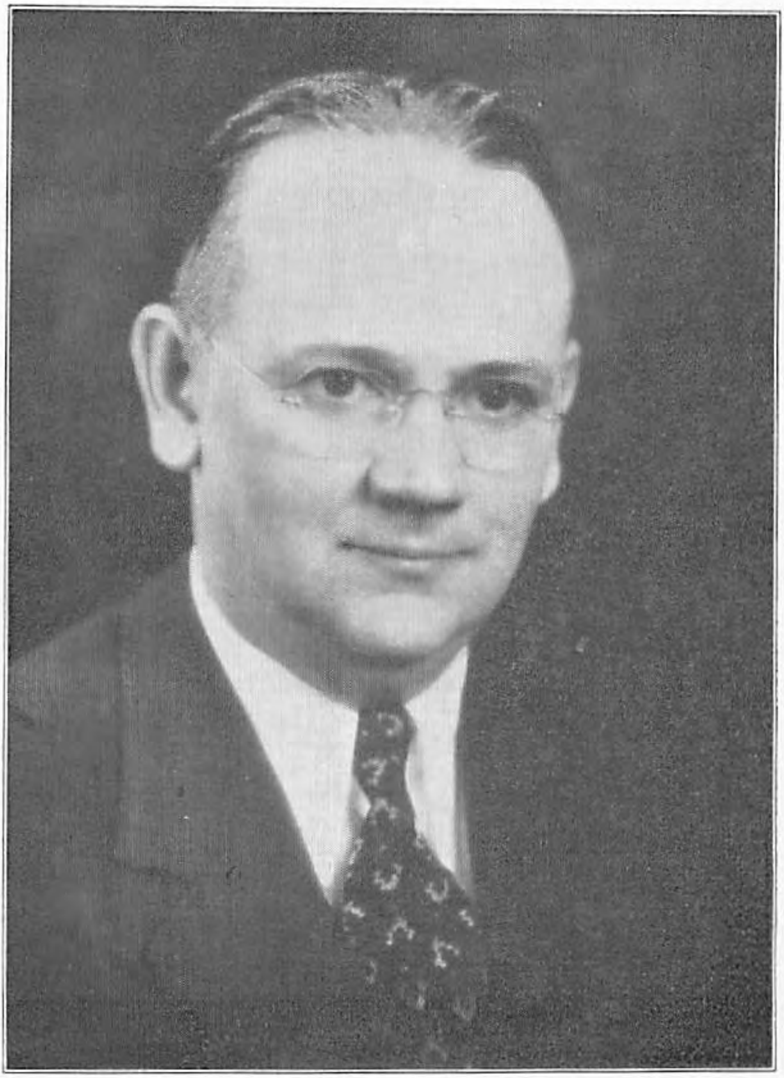
FOUNDED FEBRUARY, 1892

1936

Summer Meeting
on Board S. S. Golden Eagle
June 5-6-7

and

Annual Meeting
SPRINGFIELD, ILLINOIS
October 23



T. J. Thomas

President, 1936

# OFFICERS 1936

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T. J. Thomas

Chicago, Ill.

VICE-PRESIDENT

W. J. Jenkins

St. Louis, Mo.

SECRETARY-TREASURER

B. E. Schonthal

28 East Jackson Boulevard

Chicago, Ill.

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W. J. Austin

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M. M. Leighton

James McSherry

F. S. Pfahler

C. J. Sandoe

H. A. Treadwell

H. H. Taylor, Jr.

Paul Weir

# OFFICERS 1937

PRESIDENT

W. J. Jenkins

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VICE-PRESIDENT

H. H. Taylor, Jr.

Chicago, Ill.

SECRETARY-TREASURER

B. E. Schonthal

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H. A. Treadwell

T. J. Thomas

W. P. Young

# 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 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. |

We drifted down the river, on the good boat I. M. I.,
Without a thing to worry us, our spirits running high.
We joined, with others on the deck, soon after leaving shore,
To give a welcome to the ones who'd never sailed before.

And, then I started out in search of friends I hoped to see
And found them gathered o'er the boat, in groups of two or three;
Renewing friendships once again, and talking in a way
That sounded like a County Fair on some Old Settlers Day.

But some good friends of other days I couldn't find at all,
And learned that some had moved away and some had heard His call.
Those dear old friends of bygone days, whose evening sun has set,
Have left kind memories with us all, we never can forget.

In memory of those absent friends, who shared our work and play,
And helped to build our Institute to what it is today,
Let's bow our heads in sincere thanks, acknowledging our gain
In having had such loyal friends, whose work was not in vain.

---

When we are called to step aside, for younger men to show
More modern ways of mining coal, I hope that they will know
The members of our Institute worked with a single view:
To blaze a trail for those to come, so they might carry through.

J. A. ("JEFF.") JEFFERIS

## A WORD TO THE MEMBERS FROM THE SECRETARY

I doubt whether our members realize the tremendous amount of work connected with getting together the year-book which is presented herewith. Probably none of the members have ever stopped to consider what is necessary to make this book possible.

First of all, we are dependent upon the suppliers for advertisements in order to defray the expenses of the year-book. This is our eighth issue. Many of the advertisers have contributed to each issue, and we feel that the users of equipment would assist the Institute very materially if they would give due consideration to the suppliers whose advertisements appear in the advertising section in the back of this book, whenever in need of equipment and supplies.

It will be of great assistance for future issues if you will patronize our supporters—the advertisers—whenever possible. The success or failure of this publication and the issuance of future editions will depend greatly on this assistance.

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# ILLINOIS MINING INSTITUTE BOAT TRIP

June 5-6-7, 1936

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Eighteenth Annual Summer Meeting and Boat Trip of the Illinois Mining Institute held on S. S. Golden Eagle, leaving St. Louis Friday, June 5, 1936 at 10:30 P. M., and returning to St. Louis Sunday, June 7, 1936 at 7:00 A. M.

## MORNING SESSION

Meeting called to order at 10:00 A. M., by W. J. Jenkins, Vice-President.

Chairman Jenkins: Gentlemen, we will come to order. The first item to bring to the attention of this group is that there will be no service at the bar during the period of the morning session and the same rule will apply in the afternoon session; so we expect you all to be here and listen to what is going on and participate and take part in the conference.

I know you are disappointed in not having your President with you. Your President had an opportunity to go across the "big pond" and see how things were going on and being done "over there"; and he wouldn't go, he said he wouldn't go, unless the other officers would be present. So, while he is not with you in person, he is with you in spirit. Later on we will hear from him; he has sent us a message.

The first item of business will be the Roll Call. Each individual, as his name is called, will please rise; some of us may not be acquainted with you, and the Secretary will also have an opportunity to look you over. And while we are here at this time I might say this, to those of you who are not members, and those of you who are members of the Illinois Mining Institute and have not paid the annual dues for the current year: you want to take this opportunity of either becoming members or, if you are a member and haven't paid up, pay your dues before the afternoon session. It will give the secretary something to do and he says he will not be particularly busy in the interval between the morning and the afternoon session. We will now have the Roll Call by our Secretary, Mr. Schonthal.

# ATTENDANCE

ILLINOIS MINING INSTITUTE EIGHTEENTH ANNUAL BOAT TRIP

St. Louis, Down the Mississippi River, and Return

June 5-6-7, 1936

ADAMS, W. G. .......... Koppers-Rheolaveur Co., Pittsburgh, Pa.
AITKEN, W. I. .......... Dooley Brothers, Peoria, Ill.
AUSTIN, W. J. .......... Hercules Powder Co., Chicago, Ill.
BEAN, F. M. .......... Egyptian Iron Works, Murphysboro, Ill.
BELTZ, JOHN S. .......... Jeffrey Mfg. Co., Columbus, Ohio

| | |
|---|---|
| BURNETT, FRED | Peabody No. 18, West Frankfort, Ill. |
| CADY, DR. G. H. | State Geological Survey, Urbana, Ill. |
| CAPE, SAM | Sahara Coal Co., Harrisburg, Ill. |
| CARTWRIGHT, HARVEY | Indiana Coal Mining Institute, Terre Haute, Ind. |
| CHRISTENSEN, NICHOLAS | Safety Mining Co., Chicago, Ill. |
| COLEMAN, JOHN | Peabody No. 19, West Frankfort, Ill. |
| CRAWFORD, J. G. | Valier Coal Co., Chicago, Ill. |
| CURL, JOHN | Franklin County Coal Co., Royalton, Ill. |
| DAWSON, HUGH | Bethlehem Steel Co., Herrin, Ill. |
| EADIE, GEORGE | Sahara Coal Co., Harrisburg, Ill. |
| EDGAR, R. L. | Watt Car & Wheel Co., Barnesville, Ohio |
| ELDERS, WM. | Peabody Coal Co., No. 43, Harrisburg, Ill. |
| FARIS, J. B. | Dept. Mines & Minerals, Springfield, Ill. |
| FELDMAN, J. | Court Reporter, St. Louis, Missouri |
| FLEMING, J. B. | Mine Safety Appliances Co., Urbana, Ill. |
| FORESTER, LEONARD | State Mine Inspector, Percy, Illinois |
| FULTZ, E. W. | Franklin County Coal Co., Herrin, Ill. |
| GIVEN, IVAN A. | "Coal Age," New York, N. Y. |
| HAFFTER, CHARLES | Consolidated Coal Co., Staunton, Ill. |
| HALL, L. W. | Goodman Mfg. Co., Benton, Ill. |
| HARDSOCG, L. C. | Hardsocg Mfg. Co., Ottumwa, Iowa |
| HARVEY, HADLEY | Ohio Brass Co., Evansville, Indiana |
| HASENJAGER, E. W. | Consolidated Coal Co., Herrin, Ill. |
| HILL, L. A. | C. W. & F. Coal Co., W. Frankfort, Ill. |
| HUGHES, J. J. | Elect. Storage Battery Co., St. Louis, Mo. |
| JARVIS, W. R. | Sullivan Machinery Co., Pittsburgh, Pa. |
| JEFFERIS, J. A. | Ill. Term. R. R. System, St. Louis, Mo. |
| JENKINS, G. S. | Consolidated Coal Co., St. Louis, Mo. |
| JENKINS, W. J. | Consolidated Coal Co., St. Louis, Mo. |
| JOHNSON, E. H. | Jeffrey Mfg. Co., Columbus, Ohio |
| JONES, A. M. | John A. Roebling's Sons Co., St. Louis, Mo. |
| JONES, D. W. | Valier Coal Co., Valier, Ill. |
| JONES, JOHN E. | Old Ben Coal Corp., W. Frankfort, Ill. |
| JOY, DEWEY E. | Sullivan Machinery Co., St. Louis, Mo. |
| JOY, J. F. | Sullivan Machinery Co., Claremont, N. H. |
| KELLY, R. H. | Ahlberg Bearing Co., St. Louis, Mo. |
| KENTFIELD, R. H. | Superior Coal Co., Gillespie, Ill. |
| KLEIN, GEORGE | Klein Armature Works, Centralia, Ill. |
| KNOIZEN, A. S. | Joy Mfg. Co., Franklin, Pa. |
| LAMBERT, M. S. | Robins Conveying Belt Co., Chicago, Ill. |
| LEMING, ED | Union Colliery Co., Dowell, Ill. |
| LENZINI, JOSEPH | Bell & Zoller, Zeigler, Ill. |
| LEWIS, HOWARD | Old Ben Coal Corp., W. Frankfort, Ill. |
| LINDSAY, W. L. | Socony-Vacuum Oil Co., Benton, Ill. |
| LINDSAY, GEORGE | Rex Coal Co., Eldorado, Ill. |
| LONG, JOS. A. | Jeffrey Mfg. Co., Terre Haute, Ind. |
| LYONS, JOHN | Bell & Zoller, Zeigler, Ill. |
| MALSBERGER, A. H. | DuPont Powder Co., Springfield, Ill. |
| MANCHA, RAYMOND | Jeffrey Mfg. Co., Columbus, Ohio |
| MARSH, I. D. | Alcoa Ore Company, Belleville, Ill. |

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|---|---|
| MARTIN, ENOCH | Dept. Mines & Minerals, Springfield, Ill. |
| MEAGHER, GEO. M | C. W. & F. Coal Co., W. Frankfort, Ill. |
| MILLER, A. U | Bureau of Mines, Vincennes, Indiana |
| MILLER, FRED | Franklin County Coal Co., Herrin, Ill. |
| MILLER, J. B | Mines Equipment Co., St. Louis, Mo. |
| MILLHOUSE, JOHN G | Litchfield, Ill. |
| MOFFATT, H. A | Dooley Brothers, Peoria, Illinois |
| NASH, R. O | Westinghouse Elec. Co., St. Louis, Mo. |
| NIEDRINGHAUS, R. C | A. Leschen & Sons Rope Co., St. Louis, Mo. |
| O'BRIEN, FRANK | American Cable Co., Harrisburg, Ill. |
| PHILLIPS, E. R | Tyson Roller Bearing Co., Pittsburgh, Pa. |
| PICKARD, A. E | Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill. |
| POWERS, F. A | Hulburt Oil & Grease Co., Peoria, Ill. |
| PRITCHARD, W | Goodman Mfg. Co., St. Louis, Mo. |
| RHINE, F. E | Duncan Fdry. & Mach. Wks., Alton Ill. |
| ST. CLAIR, GUY N | Safety Mining Co., Benton, Ill. |
| SANDOE, C. J | W. Va. Coal Co., St. Louis, Mo. |
| SCHONTHAL, B. E | B. E. Schonthal & Co., Chicago, Ill. |
| SCHOOLER, D. R | Centralia Coal Co., Centralia, Ill. |
| SCOTT, G. W | Timken Roller Brg. Co., St. Louis, Mo. |
| SCHULL, FRANK | Binkley Coal Co., Clinton, Ind. |
| SHAMBLIN, JOHN | Consolidated Coal Co., Staunton, Ill. |
| SHERMAN, HUGH S | General Electric Co., St. Louis, Mo. |
| SIMPSON, J. H | Mines Equipment Co., St. Louis, Mo. |
| SMITH, PROF. C. M | University of Illinois, Urbana, Illinois |
| STARKS, WM | Peabody Coal Co. No. 9, Taylorville, Ill. |
| STEDELIN, JOHN W | Marion County Coal Co., Centralia, Ill. |
| THIES, JOHN | Portable Lamp & Equipt. Co., Pittsburgh, Pa. |
| THOMPSON, R. A | Hercules Powder Co., Collinsville, Ill. |
| TIRRE, FRANK | St. Louis, Mo. |
| TOMLINSON, W. H | Bureau of Mines, Vincennes, Ind. |
| TREADWELL, H. A | C. W. & F. Coal Co., Benton, Ill. |
| VLASAK, JOSEPH | St. Louis & O'Fallon Coal Co., East St. Louis, Ill. |
| VON PERBANDT, LOUIS | Allen & Garcia Co., Chicago, Ill. |
| WENTWORTH, B. K | C. W. & F. Coal Co., W. Frankfort, Ill. |
| WEISSENBORN, F. E | Illinois Coal Operators Assn., St. Louis, Mo. |
| WHITE, JOHN | Franklin County Coal Co., Royalton, Ill. |
| WHYERS, EDWARD | Wyoming Tie & Timber Co., Metropolis, Ill. |
| WIEDERANDERS, E. O | Jeffrey Mfg. Co., Springfield, Ill. |
| WILKEY, FRED | Illinois Coal Operators Assn., Chicago, Ill. |
| WILSON, J. C | Ohio Brass Company, Mansfield, Ohio |
| WOOSLEY, CLYDE | Pyramid Coal Co., Pinckneyville, Ill. |
| WRIGHT, D. D | C. I. P. S. Co., Marion, Ill. |
| YOUNG, A. M | C. I. P. S. Co., Springfield, Ill. |

Chairman Jenkins: Have you any communications, Mr. Secretary?

Secretary Schonthal: I have two or three here. I have a postal card from our old friend Gordon Marble, from Bryce Canyon, Utah. He says: "It's cold up here at 8,000 feet and one needs red flannels. Best wishes for a good meeting."

I have a telegram from New York, from James S. Anderson, past president:

"To the best from the biggest merry time for both.

James S. Anderson."

Mr. Anderson sailed on the Queen Mary.

I have a telegram from Mr. B. B. Brown, Secretary to Mr. T. J. Thomas; the telegram is addressed to Mr. Jenkins and myself:

"Have following cable from Mr. Thomas in Paris:

" 'I extend to you and all members of the Illinois Mining Institute my best wishes for an enjoyable and instructive conference. I shall be with you in spirit and follow with interest your trip and program. Shall have many interesting things to tell you about mining operations in the British Isles and Germany upon my return.' "

Those are all the communications, Mr. Chairman.

Chairman Jenkins: I might add I had the pleasure of meeting Doctor Young, who was for many years with Illinois, and is now with the Pittsburgh Coal Company, and he asked me to extend his regards to all his Illinois friends. He still thought he had many of them here.

I also had the opportunity and pleasure of meeting Harry Moses. Harry wanted to be remembered to you and he said if there was anything he would like to do better than he was, it would be being out here with you, but business just had to take precedence over pleasure.

Now, the balance of the morning session will be presided over by Mr. John W. Stedelin, whom you all know and for whom no introduction is necessary. Come up and take charge, Mr. Stedelin.

Chairman Stedelin: Thank you gentlemen. I hope you will not leave after the announcement that Stedelin is to be chairman.

Gentlemen, the business part of the meeting is over. We now come to the papers, which are the most important things we have at these meetings. The principal reason these boat meetings are being held is that you can't get away. If we had them in the city some of you would be leaving. But everybody is here; and everybody ought to listen. The papers which are coming, I think, are of most unusual interest; the first paper being: "Effect of Good Safety Practice on Operating Efficiency," by Eugene W. Fultz, Safety Engineer for the Franklin County Coal Corporation. Mr. Fultz.

# EFFECT OF GOOD SAFETY PRACTICES ON MINE OPERATION

By E. W. FULTZ
Safety Inspector, Franklin County Coal Corporation

Good safety practice may be defined broadly as the art of performing any work safely.

To speak in general of Safety Practices and their effect on mine operation, is to repeat what most of you have heard many times before. I shall therefore limit my paper to the discussion of some of the problems that our company has encountered during the past two years; our methods of combating them and the resultant effect on operation.

In planning any job, Safety should receive, and in many cases today does receive, as much consideration as any other item. Safety and improved efficiency are the direct results of hard thinking and far-sighted management. If, at the end of a day's operation, or upon the completion of any particular job, some individual has been injured, then something, somewhere, in our plan did not receive proper attention.

In order to carry a safety campaign to a successful conclusion, it is essential that the entire organization, from the highest to lowest ranking official, be whole-heartedly in support of the movement.

Many are still of the opinion that injuries and accidents move in cycles, regardless of efforts made to prevent them and I believe it is more difficult to prove, on paper, a direct savings realized from Accident Prevention activities than any other work in the industry. However, I also believe that with the management determined to have a safe operation and having made it plain to all concerned that safety planning must hold the same place in their thoughts as production, our curve of frequency and severity rates will show a trend in the proper direction. Operating Efficiency wi l likewise show an improvement.

Some of the requisites necessary for a successful supervisor along Accident Prevention work, are:

(a) He must be able to recognize a hazard.

(b) He should be able to and must eliminate or guard against the hazard.

(c) Or, he should reduce exposure to the hazard by education and example to the employe.

The whole scheme resolves itself into one of changing unsafe practices to safe ones, and in this connection supervision and discipline go hand in hand. Without this combination, little progress will be made.

In October, 1934, arrangements were made for the supervisors at both properties to take the Course in Accident Prevention, as prescribed and conducted by the U. S. Bureau of Mines. This Course, completed only last month, is one of the many outstanding achievements of the Bureau and we hold in high regard the benefits derived therefrom. It consists of ten major subjects which cover practically every phase of mining. We held regular weekly meetings. We discussed each question in detail, after which the Bureau's version was submitted by Mr. A. U. Miller, associate engineer, who conducted all meetings.

One of the first steps in our campaign was to recondition the motor haulage. Gob sloped from rib to rail. Haulage equipment dragged on both sides and in some places, in the center of the track. Rotten lagging over cross-bars—loose overhanging ribs were prominent—trolley wire originally 4/0 worn to less than 2/0 was constantly a source of trouble. Over 350 railroad cars of gob were loaded out and 100 mine trucks of old timber and lagging were removed. Haulage grades were reduced. Eighty percent of all main line haulage is now laid with 60-pound steel, on treated wood ties properly bonded. Seventy-five percent of all main line trolley wire is now of the 6/0 type.

At one mine we use mules for gathering purposes, also handling man-trips. A fatal accident, traced directly to a stumbling mule necessitated removal from service of several animals in order to prevent a possible recurrence.

Standard trap doors have been adopted at both properties which provide ample man clearance on both sides of the track.

The practice of coupling on the fly, back poling and getting off and on moving trips have been decreased almost to the point of elimination.

Since then an improvement in haulage efficiency has been noted and haulage accidents have been materially reduced.

Carrying our activities to the face, the following practices have been established: Some were the follow-up of anticipated accidents, others were the result of near or actual accidents and still others were as a result of information gathered from accidents in neighboring mines. Systematic spragging and blocking of the undercut face is in effect on all mechanical territories at both properties. We hope eventually to have this practice in effect on our few remaining hand loading sections. The use of the split prop has been abandoned. Standard round props of the various lengths are found to be much more economical due to the noticeable decrease in replacements necessary. Seventy-five percent wedge shape cap pieces are used and we hope to entirely eliminate the use of the axe by inside timbermen and hand loaders by furnishing props of proper lengths and one hundred percent wedge shape caps.

Systematic timbering has been established insofar as distance from the track is concerned. Previous to this step, numerous injuries resulted from men being caught between car and prop or hand between sprag and prop. This type of injury has practically disappeared from our injury records. Systematic sounding of the roof by all mechanical crews at both properties has recently been established. The practice of any member of a mechanical crew working along the face directly behind a loading machine has been abolished, as has also the practice of any cutting machine runner or helper riding any part of his machine while moving from one place to another. Instead, the helper walks in front and the runner behind to line and reline switches and guard against collisions. Not more than one mechanical operation is allowed in one working place at the same time, *i. e.*, cutting machine and drill operations are not allowed at the same face at the same time, or loading machine, cutting machine, or drillers are not allowed at two faces off the same working place at the same time. As a protection against trips or runaway cars for the cutting, or drilling crews, the switch to the place in which they are working must be lined against them in addition to a barricade of ties, or props across the road behind them. As a result of the above practices and by the application of common sense safety rules, our face accidents have been materially reduced.

Along with the above, we also attacked our ventilation. Low air readings and numerous gas mark-outs resulted in a minimum of 5500 cubic feet of air being established for the last cross-cut in any pair of working panels. Extensive air course work and plastering of face stoppings at both properties and the building of 89 concrete block stoppings at one property has greatly improved the ventilation. The building of concrete block stoppings and air course work continues.

A case of blood poisoning last year resulted from the merest scratch on the elbow of an employe and proved extremely costly. Now each supervisor carries with him a pad of stickers on which an order for medical treatment is printed. On his several rounds during the day if he notices or has his attention called to any legitimate injury he fills out one of these tickets and hands it to the man injured. That night, this man's lamp is "red checked." It takes the company doctor's release to free this man's lamp at the lamp house. This practice has materially increased the number of reported injuries. However, after one treatment the patient is usually discharged and we have had no blood poisoning cases since the one mentioned.

A number of serious injuries resulted when one of our mines was partially mechanized last summer. These were due mainly to the radical changes in occupation. Realizing the possibilities of injuries resulting from these necessary changes, careful consideration was given in the selection of individuals. As usual, mistakes were made and in some instances further changes were necessary. As the men became accustomed to their new occupations, these injuries decreased.

We have urged the sale of hard shell caps and hard toed shoes. About 70 percent of all underground employes wear this equipment. A marked reduction in head and toe injuries is the result. Three specific instances where fractured skulls have been averted by the use of the hard shell caps are known to have occurred in the last 18 months.

We furnish goggles to main line motormen, trip riders, timbermen and tracklayers. An appreciable reduction of eye injuries in those classes has been the result.

A campaign of orderliness and cleanliness was conducted in and around the surface buildings at both properties. The increased amount and quality of work turned out since that time has been pleasing to everyone.

Guarding dangerous moving machinery has been given considerable attention and while much work along this line remains to be done, we know that much has been accomplished and that a number of hazards have been definitely removed. A new machine and blacksmith shop completed this year embodies these practices throughout.

An accident in which a brake rider received a broken wrist and heel bone resulted in the design of a safety belt. This belt is being made of a light webbing material with a sling of such length as to limit a fall to not more than two feet in the event of a slip of any kind. We do not know as yet how successful this experiment will be.

We derive benefits from the monthly fatality bulletin issued by the State Department of Mines and

Minerals, and consider this a very worthy publication.

We have not as yet adopted a complete set of Safety Standards. However, a code of Standards is being drawn up designed specifically for each classification of labor and will be adopted when completed.

We realize fully that all our operations are far from being perfect. In many cases our efforts to combine safety and more efficient operation have fallen short of anticipated results. However, we do believe that with the foundation which we have laid that we have something solid to build upon. To accomplish our aim requires constant effort, but we firmly believe it can be done.

Notwithstanding the fact that we have made the improvements and adopted better safety practices in our mines as mentioned in the foregoing paragraphs, as well as many improvements that could be mentioned but time would not permit, our cost of production has not been materially increased and we know that our two mines are in better condition today than they were when we started our safety work. We are of the opinion that good safety practices has its effect on Mine Operation and the better the safety practices the more efficient will be the operation.

That we are not alone in this view, I wish to quote, in effect, a statement made by superintendents and a safety engineer of two large producing companies in Southern Illinois. "Necessarily a mine is operated to produce coal at a reasonable cost. However, we have found that the method of haphazard speed and hurry is not profitable either from a tonnage or safety standpoint, but to the contrary, we have found that a system based on Safety Practices will always prove most efficient and economical."

Chairman Stedelin: Gentlemen, that's a very excellent paper, and we have lots of time for discussion. There will be only one more paper this morning. You can't do anything but eat lunch and lunch won't be here for an hour and a half; so, we ought to have a good deal of discussion. Is there anyone who wishes to add to, suggest, or discuss this paper? We have got to hear from Alec Miller; he might just as well get up and tell us what he thinks about it; I don't think there is anybody here who is better qualified and who can make a better talk than Alec Miller.

Mr. Alex U. Miller (Vincennes, Ind.): Mr. Chairman and members of the Institute, I would rather hear somebody else talk, myself. However, I believe in the principles that are stated in Mr. Fultz's paper, that any time we have an accident, whether it causes an injury or whether it does not, I think, if we will analyze that accident and determine all of the results of the accident, there can only be one thing, one result therefrom, and that is a higher cost of production. I think we should readily see, in analyzing these accidents, or failures, as we may determine them, that the better we make our operation the more efficient it's going to become and the fewer accidents we are going to have.

Chairman Stedelin: Anybody else?

Mr. John Lyons (Zeigler, Ill.): Mr. Chairman, I know Mr. Fultz pretty well, and he and I talked together quite a little over the accident situation. And I think the Safety Engineers and the Operating Department, while they may be two separate units, it is absolutely necessary that they think and work together. In regard to Mr. Fultz's statement about learning things from accidents, and Mr. Miller also repeated the same thing, I think if you don't learn them you are not getting anywhere. I have in mind some particular accidents along the line that Mr. Fultz was talking about, in my experience with the Bell & Zoller Company; we had a case where an unclean road caused a pretty bad accident. There was a gang of men running a breast machine; they brought this machine out on the entry and one of the men saw a switch ahead of him that was lined in the wrong direction, so he was riding the machine and seeing this switch, he threw his haddock on top of the machine and jumped off and ran ahead to throw this switch. Well, it happened that the side of the roadway was gobbed up; the result was that he slipped on the gob and landed under the machine and truck, and he had a pretty bad foot. In bucking the operating department on that particular thing, —it was in my early days at that particular mine—the operating department didn't think they had anything to do with the particular accident; "the man was just a damn fool; he shouldn't have run past the machine." Well, that's one way to look at it. But there is another way which I think is, and must be, the better way. If the gob had not been piled up on the side of the roadway and sloped down to the track, even though the man did run past the machine, he wouldn't have fallen on the rail, and there would have been an accident eliminated. We played on that, and I think that finally got over. But there is a tendency on the part of the operating department sometimes to "cuss" the Safety man because he takes that particular angle. They like to think that the man himself made the mistake, that he shouldn't have done that particular thing, that "our side" was all right.

The talk about systematic spragging. We had several years ago several breast machines and we had a fatal accident from face coal falling out and hitting the helper. We tried to introduce spragging, and it was suggested in the report that we put in a spragging law and a spragging rule. That is, we should have sprags every six feet across the face of the room in breast machine cutting. It didn't go over very well the first time. Some fellows thought, well, that's all right, it's a pretty good idea, but maybe these fellows haven't got time to do that spragging, maybe you will have to pay them; and a lot of arguments came up. It wasn't long before we had another one exactly the same way; face coal fell over and hit the shoveler and killed him. Well, we brought up the spragging rule again and we finally got it over.

While we have the breast machine practically eliminated now and there is probably not the same demand for a spragging rule, yet, I think a six foot spragging rule or maybe fifteen feet, or whatever the conditions would demand, is a very good thing.

Then, coming back to the wedge cap boards; another standard that we adopted several years ago. We had a fellow chopping the cap boards and he had his thumb, of course, across there, making a wedge and the first thing you know he chopped his thumb off. Well, he lost a thumb and we paid seven or eight hundred dollars for it, and then we adopted the wedge cap law, and we haven't had any thumbs lost for four or five years, and the efficiency is still maintained.

Then, talking about riding cutting bars. Several years ago we had an accident from that particular hazard. The helper would hop on the cutter bar and when he would see a switch ahead, instead of stopping the machine, he would jump off and fall under the cutter bar. So we put in a rule on that, not quite as broad as Mr. Fultz's, we only required that the helper not ride; that is, we allowed the runner, of course, to ride on the back end of the machine, but the runner must walk ahead and line the switches. And there is no question in my mind but what we have saved several accidents from that particular hazard since we put that rule in.

I think I could go on with several hazards and several standards in safety rules. I think one of the greatest things in safety work is the safety standards. Just as an illustration, and after that I am going to quit. If you have, say, on your main line — I think everybody knows every now and then you get a bridle bar that will break and the bolt will come out of the bridle bar and the lips will be neither open nor closed and your motor comes along and you have a wreck and not only smash up machinery, knock out timbers and injure somebody, but you cut down your operation and you lose tonnage that way; so we adopted — one of the standards I want to illustrate—we adopted two bridles on all our switches which were sixty-five pounds or over, which took in all main line switches.

I think that one of the greatest things in safety work is the adoption of safety standards and, of course, live up to them. I thank you.

Chairman Stedelin: Is there anybody else?

Mr. H. A. Treadwell (Benton, Ill.): I just want to make this statement. A couple of years ago—and this is one of the things mentioned in Mr. Fultz's paper, and we found it very beneficial—I found that a thing that helps any organization more than anything else is to get a comparison if any rule be made, with other mines, and find out what other people are doing. I think it is the hardest thing in this State to get a comparison of the accidents, in an intelligent form, so that you can know about what you are doing in comparison with the other men. Now, the Bureau of Mines established at our place a Severity and Frequency formula which gives the number of days for certain specific losses and accidents that should be charged, and I think some of the companies are using it, and with those companies that are using it we can compare our severity and frequency rate and know where we are standing. I believe if that was more universal in this State we would see a good deal of improvement because any organization, I think, that finds that they are below the other fellow in preventing accidents, would be interested in getting their record up. I think that is a thing that we need in this State, some uniform method of reporting accidents so that you can compare one organization with the other.

Mr. John S. Beltz (Columbus, Ohio): Along the line of Mr. Treadwell's remarks, it seems tragic that so often accidents happen, and fatal accidents, before we think of the freakish nature that brought about the accident. After it happens, then the thing is taken into account and means are taken to prevent its repetition.

I have in mind the very freakish accident which resulted in the death of a man in Pennsylvania. It happened to be a five hundred volt mine, and thank the Lord we don't have them in Illinois. A machine runner was going down, tramming the machine, not looking along, and he came to a downgrade, sort of a low place, and he left his starting box on and reached over and the hot hook kind of pressed against his throat and of course, the starting box being on, and the heavy compound wound motor, and going down the hill pretty fast, he was generating perhaps around 550 volts and when he leaned over that way, standing on the machine, the current hook laying on the machine, he was instantly electrocuted.

Another incident of the same kind, in a 250 volt mine, really had its comic side. This happened to be a colored machine runner, running a track cutter. He was coming down a long grade and the machine was way above speed, so I suppose he was generating around 300 volts, but he was a husky chap and he stopped his machine. We were out at the entry, and as he came walking out we said, "What's the matter, is the machine broken down?" If you ever saw a colored fellow white, I believe that fellow was, and he could hardly talk; he said, "I don't know what happened. I was coming down the hill and my back kind of itched and I took the stinger and scratched my back and I was knocked on the floor."

The result of that one fatal accident and the other near-accident was, that both of those companies put trolley poles on all cutting machines; they don't have a transverse switch or anything of that kind, they merely put a trolley pole up and then there is a hook on the harp, and the instructions are positive, when you take the hot hook off the trolley you hook it on this hook on the trolley harp and trolley that way.

That is a very freakish accident, but yet any electrical man will appreciate the position of a fellow leaving the box on, taking the hook down and maybe reaching or looking for something, with the regeneration downhill 250 volts are liable to come off.

Mr. Johnson: Mr. Chairman, I happened to have the same mine difficulty that Mr. Beltz spoke of, where a fatal accident occurred. A day or two after the accident occurred they attempted to reconstruct the situation under which that man was killed and they put a recording instrument on the machine and found under that condition, on that same grade, that machine was generating 450 volts, on a 550 volt circuit.

Mr. D. R. Schooler: Mr. Chairman, I think one of the main phases of any safety program is the education of the miners. We all know up until the last few years that the safety end of coal mining has been taken for granted by the miners, but now it has come to a point where, I think, they realize something can be accomplished, and I think the Mining Institute, being a cooperative body, could help quite a bit along that line. We all have some safety rules which are written up and posted in the mine and no attention is paid to them; that is, there is no strict regulation for those rules being enforced, and if those rules aren't enforced they don't amount to much. I think if a custom is established by each company so that when a set of rules is posted they would have to be followed, these miners would have more regard for them. If a man runs from one place to another, he would have regard for safety rules and a lot would be accomplished along that line.

Chairman Stedelin: Those are very fine suggestions. You know this is one of the hardest things to sell to the management of a company that carries insurance; they will say, "It doesn't cost you a damn thing anyhow." I notice a good many of the fellows who talked today carry their own insurance; that is what brings it closer to them. But those of us who do carry our own insurance, it is hard for us to sell our ideas to the managers and bosses and so forth that say, "It doesn't cost us a damn thing anyhow." But it does cost, whether we have to pay for the injury or not. And Harry Treadwell's suggestion that if we had some method so that each of us could see the experience of the other; none of us want to be lagging and none of us want to have a bad record against a good record of somebody else.

I am glad to hear from the Bell & Zoller people especially because they had a wonderful accident record. I am more familiar with that because we are neighbors. They have a wonderful accident record and they are making wonderful progress. "Doc" didn't tell you about their broadcasting, but they broadcast a safety program to the fellows on the bottom, and they are doing a devil of a lot of stuff and getting results.

Has anyone else anything further to say on this paper?

Mr. C. J. Sandoe (St. Louis): I have only a few words on something that hasn't been brought out. Our larger mines are not the ones that set the accident record in this State; it is the small mines that cause more accidents in this State, and I wonder if the Department in any way could tell us the percentage of accidents happening in small mines. Where we have safety activity and records in the larger mines I think the State will stand up in pretty good shape, but when you come to the small mines I don't think they carry safety rules for the prevention of accidents. I wonder if the Department has any figures or any recommendation whereby we can reduce accidents in the State by trying to assist the smaller mines.

Chairman Stedelin: We have with us Mr. Enoch Martin of the Illinois Department of Mines and Minerals. Mr. Martin, will you come up here, please?

Mr. Enoch Martin (Springfield, Ill.): Mr. Chairman and friends, it took me longer to walk up here than it will to make the talk I am going to make, for the reason that under the Illinois Mining Law the Department is not privileged to spend money except for certain specific purposes. There has been no budget prepared that sets aside a fund for compilation of accidents, mining accidents, in either the small or the large mines; the money that is appropriated is for the mine rescue service and the inspection service, and paying people that do other tasks in connection with the administration of the Mining Laws.

There is so much that could be said in connection with the matter of safety, if one was familiar with all of the circumstances pertaining to the physical condition of the property where the report was coming from, as to the dependability of the management and sub-bosses and what nature had done in confining the coal seam between a certain sort of top and bottom, and as to whether or not nature had further impregnated that seam with gas or water.

I think the subject matter that has been discussed is very properly the property of the Illinois Mining Institute.

A rule may be the best that would be possible for anyone to establish and try to enforce but when you get out to the fellow who is busy producing coal, he in turn entrusts every operation in the territory that has been assigned to him, to a fellow who possibly is not competent—through no fault of the face boss,—to a fellow who is not competent to take care of himself.

Naturally the paper, as suggested by the chairman, is from a company that carries its own compensation. It would have a more elaborate arrangement for securing information and adopting new rules of conduct to reduce the accidents, both fatal and non-fatal. My pet peeve in the reports that come into the office, whether they are fatal or non-fatal, is where the labor is permitted to run pell-mell over the property, either on top or on the bottom, and get themselves killed or injured. I am not saying this in the way of criticism. I am saying it with the hope of being helpful in the reduction of these accidents both minor and major. About all that a fellow has to do to get a job in a coal mine is to form some sort of contact so that he can approach the management and secure employment. It doesn't necessarily follow that the fellow who assigns him to labor knows his qualifications; if he knew his qualifications possibly he could assign him to some work where he would be a profitable servant, that the cost of the work that he does wouldn't counter-balance the benefit received. I know of no authority any place where a face boss can refuse to put a man to work at any job the General Superintendent sends him to do. We don't know the background of all of these miners' accidents, we don't know the reason why. I don't know whether or not a single, solitary company would show their manifest or their cost sheet from a given time to a given time. I don't know that it would be tactful for them to do that. I don't know that it would do the industry any good. I do know, though, that whether or not there is anything of a concrete nature in the way of action by this Institute, the result of reading and discussing this paper is that the mental reaction of each one who hears the discussion will be of benefit to the organization which the gentleman represents; and I know you are all sober and representing honestly and intelligently the people who have assigned you to be a member of the Institute.

Mr. John E. Jones: Mr. Chairman, further along the lines of the questions asked by Mr. Sandoe, I believe a study was made of the different amounts of accidents in small mines as compared to the large mines, by the Illinois Mining Investigation Commission. A period of years was taken, and it was found that mines employing ten men and less had double the fatality rate per thousand men employed, as compared with the shipping mines or mines employing more than ten men. That was for fatal accidents alone and did not consider the non-fatal accidents.

Chairman Stedelin: Mr. Sandoe, that answers your question, but it doesn't suggest what has been done to fix it, so that that condition might be changed.

Mr. C. J. Sandoe: I am satisfied.

Chairman Stedelin: That's the thought. Has anyone else anything to say on this discussion?

I think this paper, to begin with, is one of the best safety papers that I ever heard read at this Institute, and I think the discussions have been the best that were ever had on any paper at this Institute. And it's a question that can carry a lot of discussion; it's a question on which we all need more education. If there is any more discussion we would like to hear from you.

Gentlemen, we will pass on to the next paper. The next paper covers one of the principal factors, if not the most important factor, in an increased production behind mechanical loading. You know, most of us have made time studies and we find that if our loading machines were operating fifty per cent of the time or more than fifty per cent of the time we would be getting a pretty fair tonnage, and, since the car change enters in the biggest part of the delay, it is a very important subject. We will now hear a paper on "Improving the Car Change Cycle Behind Loading Machines," by Howard Lewis, Assistant General Superintendent of the Old Ben Coal Corporation. Mr. Lewis.

## IMPROVING THE CAR CHANGE CYCLE BEHIND LOADING MACHINES

By HOWARD LEWIS
General Underground Superintendent, Old Ben Coal Corporation

The need for proper coordination in mechanism is nowhere better illustrated than by consideration of the timer in combustion engines. There is none in this assembly but who has had experience with incorrect timing in his motor car, and who appreciates the drastic consequences when the motor timer has slipped a split second.

The problem of coordination existed prior to the mechanical age in coal mining as well as in all industry. There are many present who can recall the attention given to the mule driver from both the management and the miner with respect to proper delivery and distribution of empty cars. I recognize among you some of those mule drivers and fully appreciate your early training, and mine, to proper timing with respect to coal haulage. However, in those days, it was a question upon the fraction of an hour rather than upon the small fraction of a minute which now is of so acute concern.

In the time factors of mechanical loading there is considerable leeway, usually, in preparation of coal to be loaded and in car supply nearby at location usually termed the parting. Such leeway results from the factor of number. There is no limit, insofar as our problem is concerned, to the number of places that can be prepared to have abundance of loose coal, and the number of cars on the parting. Our problem of acute timing lies between these two locations.

The mechanical loader is a device applied to coal mining that is a delayed approach to the advanced mechanization of many years development in many avenues on the surface of the earth. This device, the result of mechanical engineering, is a drastic change from the relatively slow loading by hand labor. We receive it as a complete loading unit, its performance to approach constancy for a full shift, all other work in the cycle to be of service to the loading machine.

In each place, with properly prepared coal to load, approach to constant operation of a properly working loading machine is wholly dependent upon continuous supply of cars to be loaded with no stoppage of the machine while removing the loaded car from the coal delivery location and replacing there an empty one. One can appreciate approach to such procedure with a system whereby a trip of cars is loaded, one car at a time, the time required to pull the next car sufficiently well under the coal delivery point being so brief as not to require stoppage of pick-up by the loading machine. Such system requires some plan of long face work, success, of course, being dependent upon adequate natural mining conditions.

The time study problem given to me by your program committee is definite upon time requirement in relation to car change having track terminate at the loading machine. My problem, therefore, is limited to time studies of removal of the loaded car from the loading point of machine, replacing an empty car after the loaded car's removal and traveling along the same track, and car supply closer than the parting for the gathering locomotives' operation directly with the loading machine.

Consider an entry, 14 feet wide, from which a number of rooms at 35 feet centers are turned at right angles. The rooms average closely to 25 feet in width. Cross-cuts in the rooms are at 40° angles, 50 feet apart, the first being 50 feet from the entry. At time of each cross-cut's beginning, except the last one, a switch is laid permitting loading of cross-cut and room with minimum distance of loading machine tramming. The first cross-cut track is connected to the track in the adjoining room by a switch thus permitting locomotive delivery of empty car to the loading machine without backswitching. This results in the track frog in adjoining room being 95 feet from the center of the entry. Should other of the cross-cuts require such through track because of a roof fall or other reason, this is done.

Other factors of improvement as compared with a backswitching system are:

(1) Considerable lessening of derailments.

(2) Omission of switch throwing and its loss of time at this moment of haste.

(3) Hazard and loss of time in holding up and tramming under locomotive cables (in trolley wire mines) eliminated.

(4) Coupling of cars into small trips in vicinity of loading machine and its noise eliminated.

(5) The possible two or more haulage entrances to each room gives quick access to pick-up of rooms in event of roof falls along the room haulageway. In event of bad cave-in at room face the system automatically picks up the room with minimum delay.

Full appreciation of time differences between backswitching and straight switching can only be obtained by time studies. In Table No. 1, I have shown the loading and switching periods as taken by a stop watch where a section is laid for back switching. Similarly in Table No. 2, I have shown the data for straight switching. There is, of course, a greater tracklaying cost for straight switching. However, I know the one item in lessening derailment of empty cars during the haste in backswitching is alone sufficient to more than pay for this added track cost. An important economical factor is the possibility of greater pillar recovery by having track in all rooms from the entry to face.

# LOADING AND SWITCHING PERIODS IN MECHANICAL TRACK LOADING MACHINE UNIT

| | TABLE NO. 1. AVERAGE COAL IN CARS 3.14 TONS. | | | TABLE NO. 2. AVERAGE COAL IN CARS 3.64 TONS | | |
|---|---|---|---|---|---|---|
| | BACK SWITCHING | | | STRAIGHT SWITCHING | | |
| No. of Cars | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks |
| 1 | 1′ 30″ | 54″ | Sw. dist. 90 ft. | 2′ 30″ | 36″ | Sw. dist. 200 ft. |
| 2 | 1′ 6″ | 42″ | | 4′ 6″ | 36″ | Has straight switch |
| 3 | 1′ 0″ | 42″ | | 54″ | 30″ | |
| 4 | 1′ 12″ | 24″ | | 2′ 48″ | 36″ | Tight coal |
| 5 | 2′ 12″ | 1′ 18″ | | 2′ 18″ | 36″ | Tight coal |
| 6 | 1′ 18″ | 1′ 6″ | | 2′ 12″ | 54″ | 1200 ft. for 6 cars |
| 7 | 2′ 6″ | 36″ | Tight coal | 1′ 6″ | 18″ | Sw. dist. 150 ft. |
| 8 | 2′ 24″ | 1′ 6″ | Tight coal | 1′ 0″ | 18″ | Has straight switch |
| 9 | 2′ 36″ | 36″ | Tight coal | 54″ | 24″ | |
| 10 | 2′ 12″ | 1′ 0″ | 900 ft. for 10 cars | 1′ 12″ | 42″ | |
| 11 | 1′ 48″ | 1′ 0″ | 1′ 54″ Sw. dist. 80 ft. | 1′ 6″ | 42″ | 42″ |
| 12 | 1′ 24″ | 1′ 0″ | | 1′ 0″ | 12″ | |
| 13 | 1′ 12″ | 1′ 0″ | 4′ 0″ | 1′ 36″ | 24″ | 42″ |
| 14 | 1′ 42″ | 1′ 0″ | | 1′ 42″ | 24″ | |
| 15 | 1′ 24″ | 1′ 0″ | | 1′ 30″ | 24″ | |
| 16 | 1′ 54″ | 48″ | | 2′ 24″ | 24″ | 1500 ft. for 10 cars |
| 17 | 1′ 6″ | 42″ | | 1′ 0″ | 24″ | Sw. dist. 200 ft. |
| 18 | 2′ 18″ | 48″ | Slow power | 48″ | 24″ | 36″ |
| 19 | 1′ 18″ | 1′ 30″ | | 1′ 0″ | 18″ | |
| 20 | 1′ 18″ | 1′ 0″ | | 1′ 0″ | 36″ | |
| 21 | 2′ 54″ | 1′ 24″ | Tight coal | 1′ 0″ | 42″ | |
| 22 | 2′ 1″ | 54″ | 1′ 0″ | 1′ 18″ | 18″ | |
| 23 | 1′ 6″ | 48″ | 1′ 0″ | 2′ 24″ | 24″ | Slow power |
| 24 | 2′ 54″ | 1′ 42″ | 1120 ft. for 14 cars | 2′ 24″ | 30″ | and |
| 25 | 1′ 30″ | 48″ | Sw. dist. 140 ft. | 2′ 18″ | 24″ | Tight coal |
| 26 | 1′ 42″ | 24″ | 3′ 12″ | 2′ 42″ | 24″ | " " |
| 27 | 1′ 12″ | 24″ | | 2′ 0″ | 30″ | " " |
| 28 | 1′ 6″ | 1′ 0″ | 560 ft. for 4 cars | 3′ 54″ | 54″ | 5880 ft. for 12 cars |
| 29 | 1′ 6″ | 1′ 24″ | Sw. dist. 200 ft. | 54″ | 42″ | Sw. dist. 400 ft. |
| 30 | 1′ 0″ | 48″ | | 54″ | 36″ | Has straight switch |
| 31 | 1′ 12″ | 42″ | | 1′ 12″ | 36″ | |
| 32 | 1′ 30″ | 42″ | | 54″ | 36″ | |
| 33 | 2′ 30″ | 42″ | Slow power | 1′ 0″ | 36″ | |
| 34 | 1′ 6″ | 1′ 12″ | | 1′ 18″ | 42″ | |
| 35 | 3′ 6″ | 1′ 12″ | Cleaning track | 2′ 18″ | 30″ | |
| 36 | 1′ 24″ | 42″ | | 1′ 6″ | 1′ 0″ | |

| | BACK SWITCHING | | | STRAIGHT SWITCHING | | |
|---|---|---|---|---|---|---|
| No. of Cars | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks |
| 37 | 1′ 0″ | 1′ 18″ | | 54″ | 36″ | |
| 38 | 1′ 36″ | 1′ 18″ | | 2′ 12″ | 36″ | Tight coal |
| 39 | 2′ 18″ | 1′ 6″ | Tight coal | 3′ 24″ | 24″ | Tight coal |
| 40 | 2′ 42″ | 1′ 24″ | Tight coal | 2′ 48″ | 30″ | 4800 ft. for 12 cars |
| 41 | 2′ 24″ | 1′ 0″ | 2600 ft. for 13 cars | 1′ 0″ | 54″ | Sw. dist. 275 ft. |
| 41 | 2′ 12″ | 1′ 30″ | Sw. dist. 50 ft. | | | |
| 42 | 1′ 24″ | 42″ | | 1′ 6″ | 1′ 12″ | Has back switch |
| 43 | 1′ 24″ | 2′ 12″ | Entry for empties | 1′ 0″ | 42″ | |
| 44 | 1′ 30″ | 36″ | | 1′ 6″ | 48″ | |
| 45 | 2′ 48″ | 54″ | Slow power | 1′ 54″ | 48″ | |
| 46 | 1′ 18″ | 30″ | | 1′ 0″ | 48″ | |
| 47 | 1′ 36″ | 24″ | | 1′ 24″ | 48″ | |
| 48 | 2′ 6″ | 36″ | | 1′ 6″ | 48″ | 24″ |
| 49 | 1′ 54″ | 48″ | | 1′ 54″ | 48″ | |
| 50 | 1′ 18″ | 1′ 6″ | | 2′ 12″ | 48″ | Tight coal |
| 51 | 2′ 12″ | 30″ | 550 ft. for 11 cars | 2′ 0″ | 48″ | Tight coal |
| 52 | 1′ 12″ | 1′ 36″ | Sw. dist. 140 ft. | 2′ 36″ | 48″ | 3300 ft. for 12 cars |
| 53 | 1′ 30″ | 1′ 0″ | | 1′ 6″ | 18″ | Sw. dist. 80 ft. |
| 54 | 1′ 12″ | 42″ | 5′ 48″ | 1′ 30″ | 18″ | Has straight switch |
| 55 | 2′ 12″ | 42″ | | 1′ 6″ | 18″ | |
| 56 | 1′ 24″ | 42″ | | 1′ 42″ | 18″ | |
| 57 | 1′ 6″ | 42″ | | 1′ 42″ | 30″ | |
| 58 | 1′ 36″ | 36″ | | 1′ 18″ | 18″ | |
| 59 | 1′ 30″ | 1′ 0″ | | 1′ 12″ | 18″ | 3′ 0″ |
| 60 | 1′ 42″ | 36″ | | 1′ 42″ | 18″ | |
| 61 | 2′ 12″ | 1′ 1″ | | 2′ 0″ | 18″ | Tight coal |
| 62 | 1′ 30″ | 42″ | | 1′ 54″ | 18″ | |
| 63 | 2′ 54″ | 1′ 30″ | 48″ | 3′ 24″ | 12″ | 880 ft. for 11 cars |
| 64 | 2′ 0″ | 42″ | | 54″ | 42″ | Sw. dist. 400 ft. |
| 65 | 2′ 0″ | 42″ | 1′ 0″ | 54″ | 54″ | Has back switch |
| 66 | 2′ 0″ | 30″ | | 54″ | 54″ | |
| 67 | 2′ 12″ | 30″ | 2100 ft. for 15 cars | 1′ 6″ | 48″ | |
| 68 | 1′ 0″ | 30″ | Sw. dist. 125 ft. | 2′ 0″ | 48″ | Slow power |
| 69 | 1′ 0″ | 36″ | | 1′ 42″ | 48″ | Slow power |
| 70 | 1′ 6″ | 42″ | | 1′ 18″ | 54″ | |
| 71 | 1′ 18″ | 54″ | | 1′ 30″ | 54″ | |
| 72 | 2′ 6″ | 42″ | Slow power | 1′ 36″ | 54″ | |
| 73 | 1′ 30″ | 36″ | | 1′ 48″ | 54″ | Tight coal |
| 74 | 1′ 18″ | 36″ | | 2′ 0″ | 48″ | Tight coal |
| 75 | 2′ 12″ | 36″ | Slow power & | 3′ 6″ | 54″ | Tight coal |
| 76 | 3′ 12″ | 54″ | tight coal | 1′ 54″ | 48″ | Tight coal |

| | BACK SWITCHING | | | STRAIGHT SWITCHING | | |
|---|---|---|---|---|---|---|
| No. of Cars | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks |
| 77 | 2′ 12″ | 1′ 0″ | Tight coal | 2′ 6″ | 12″ | 5600 ft. for 14 cars |
| 78 | 2′ 18″ | 1′ 36″ | 1375 ft. for 11 cars | 1′ 42″ | 30″ | 1′ 0″ Sw. dist. 160 ft. |
| 79 | 1′ 12″ | 1′ 0″ | Sw. dist. 264 ft. | 1′ 6″ | 30″ | Has back switch |
| 80 | 2′ 6″ | 1′ 0″ | 1′ 0″ | 1′ 6″ | 42″ | |
| 81 | 1′ 6″ | 54″ | | 1′ 30″ | 36″ | |
| 82 | 1′ 12″ | 42″ | 2′ 0″ | 1′ 42″ | 30″ | |
| 83 | 1′ 12″ | 48″ | | 1′ 48″ | 1′ 6″ | 960 ft. for 6 cars |
| 84 | 1′ 6″ | 54″ | | 1′ 30″ | 42″ | Sw. dist. 325 ft. |
| 85 | 2′ 18″ | 1′ 24″ | | 1′ 30″ | 36″ | Has back switch |
| 86 | 1′ 0″ | 54″ | | 1′ 24″ | 36″ | |
| 87 | 1′ 48″ | 48″ | | 1′ 48″ | 36″ | |
| 88 | 1′ 42″ | 54″ | 3′ 54″ | 1′ 6″ | 36″ | |
| 89 | 2′ 54″ | 54″ | Tight coal | 1′ 18″ | 48″ | |
| 90 | 3′ 24″ | 54″ | Tight coal | 1′ 48″ | 42″ | |
| 91 | 1′ 48″ | 42″ | | 1′ 36″ | 42″ | |
| 92 | 2′ 24″ | 54″ | Tight coal | 2′ 36″ | 48″ | Tight coal |
| 93 | 3′ 0″ | 42″ | Tight coal | 1′ 54″ | 48″ | 48″ |
| 94 | 2′ 18″ | 1′ 18″ | 4224 ft. for 16 cars | 1′ 42″ | 48″ | |
| 95 | 1′ 24″ | 1′ 0″ | Sw. dist. 225 ft. | 2′ 48″ | 42″ | Tight coal |
| 96 | 1′ 6″ | 48″ | | 2′ 0″ | 48″ | Tight coal |
| 97 | 1′ 6″ | 1′ 6″ | | 2′ 54″ | 42″ | 24″ |
| 98 | 1′ 18″ | 36″ | | 2′ 30″ | 42″ | 4855 ft. for 15 cars |
| 99 | 1′ 24″ | 42″ | | 54″ | 42″ | Sw. dist. 400 ft. |
| 100 | 1′ 30″ | 1′ 6″ | 5′ 0″ | 1′ 24″ | 42″ | 2′ 6″ Has back |
| 101 | 1′ 42″ | 42″ | | 1′ 0″ | 42″ | switch and extra |
| 102 | 1′ 54″ | 54″ | | 1′ 12″ | 48″ | switch |
| 103 | 1′ 18″ | 36″ | | 1′ 0″ | 1′ 12″ | |
| 104 | 2′ 0″ | 48″ | Tight coal | 1′ 12″ | 48″ | |
| 105 | 1′ 30″ | 36″ | | 2′ 0″ | 1′ 12″ | Tight coal |
| 106 | 1′ 54″ | 36″ | | 2′ 0″ | 42″ | Tight coal |
| 107 | 1′ 54″ | 42″ | 1700 ft. for 12 cars | 1′ 12″ | 1′ 6″ | |
| 108 | 2′ 36″ | 48″ | Sw. dist. 100 ft. | 2′ 6″ | 48″ | Tight coal and |
| 109 | 1′ 36″ | 1′ 0″ | | 3′ 30″ | 1′ 18″ | Slow power |
| 110 | 1′ 18″ | 48″ | | 2′ 36″ | 42″ | " " |
| 111 | 1′ 0″ | 1′ 0″ | | 2′ 18″ | 1′ 18″ | 5200 ft. for 13 cars |
| 112 | 2′ 0″ | 30″ | Slow power | 1′ 0″ | 30″ | Sw. dist. 350 ft. |
| 113 | 2′ 36″ | 54″ | Slow power | 1′ 12″ | 54″ | |
| 114 | 3′ 18″ | 30″ | 700 ft. for 7 cars | 1′ 30″ | 36″ | |
| 115 | 2′ 0″ | 48″ | Sw. dist. 50 ft. | 2′ 12″ | 1′ 0″ | |
| 116 | 1′ 24″ | 36″ | | 2′ 54″ | 42″ | Tight coal |
| 117 | 1′ 18″ | 36″ | | 3′ 0″ | 1′ 6″ | |
| 118 | 1′ 36″ | 1′ 6″ | | 2′ 6″ | 42″ | 2450 for 8 cars |

| | BACK SWITCHING | | | STRAIGHT SWITCHING | | |
|---|---|---|---|---|---|---|
| No. of Cars | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks | Loading Time Min. & Sec. | Switching Time Min. & Sec. | TIME LOST: Motor & Cars off Track—Min. & Sec. Also Remarks |
| 119 | 2′ 0″ | 48″ | 1′ 30″ | 1′ 0″ | 42″ | Sw. dist. 420 ft. |
| 120 | 2′ 0″ | 42″ | 3′ 18″ | 1′ 6″ | 1′ 6″ | Has back switch |
| 121 | | | | 1′ 6″ | 42″ | |
| 122 | | | | 1′ 6″ | 1′ 6″ | 1′ 42″ |
| 123 | | | | 1′ 0″ | 36″ | |
| 124 | | | | 1′ 24″ | 1′ 0″ | |
| 125 | | | | 1′ 12″ | 36″ | |
| 126 | | | | 2′ 12″ | 1′ 6″ | Tight coal |
| 127 | | | | 1′ 18″ | 36″ | |
| 128 | | | | 2′ 24″ | 1′ 0″ | Tight coal |
| 129 | | | | 1′ 24″ | 48″ | |
| 130 | | | | 1′ 12″ | 1′ 0″ | |
| 131 | | | | 3′ 12″ | 42″ | 5460 ft. for 12 cars |
| 132 | | | | 1′ 24″ | 1′ 0″ | Sw. dist. 420 ft. |
| 133 | | | | 1′ 12″ | 1′ 30″ | Has straight switch |
| 134 | | | | 1′ 36″ | 48″ | 1260 ft. for 3 cars |
| 135 | | | | 54″ | 18″ | Sw. dist. 70 ft. |
| 136 | | | | 48″ | 18″ | Has straight switch |
| 137 | | | | 54″ | 18″ | |
| 138 | | | | 48″ | 12″ | |
| 139 | | | | 1′ 18″ | 12″ | 18″ |
| 140 | | | | 54″ | 24″ | |
| 141 | | | | 1′ 0″ | 18″ | 18″ |
| 142 | | | | 1′ 0″ | 24″ | 560 ft. for 8 cars |
| Total | 210′ 36″ | 107′ 48″ | 27′ 48″ | 234′ 48″ | 94′ 6″ | 12′ 30″ |

| *Not shown:* | Back Switching | Straight Switching |
|---|---|---|
| Tramming ........ | 21′ 12″ | 52′ 12″ |
| Other off track.. | 27′ 42″ | |
| Repairs and Oiling ............ | 24′ 54″ | 26′ 24″ |
| Total ................ | 420′ 0″=7 hrs. | 420′ 0″ |

| Back Switching | Straight Switching |
|---|---|
| Average time loading per car is 1′ 45″ | Average time loading per car is 1′ 36″ |
| Average time change per car is 53″ | Average time change per car is 35″ |
| Switching speed is 155 ft. per minute | Switching speed is 477 ft. per minute |

Summary from another time schedule in a territory of 14 rooms loaded out in one 7 hour shift in which 13 rooms had the straight system, 1 room had a back switch. 165—3.63 ton cars were loaded as follows:

| | |
|---|---|
| Loading time ........................ | 266′ 36″ |
| Car change ............................ | 73′ 12″ |
| Off track ................................ | 28′ 6″ |
| Repairs and oiling................ | 21′ 42″ |
| Tramming .............................. | 30′ 24″ |
| Total ...................................... | 420′=7 hrs. |

Average time loading per car is 1′ 37″
Average time change per car is 27″
Switching speed is 365 ft. per minute

From the foregoing tabulations it is evident that straight switching is an improvement over backswitching in the matter of time to make the car change. An important safety factor is also added in that less haste is natural, simply tramming the car without change in direction from the last switch to the loading machine. These time studies show that the average time for full backswitching is 53″ and for partial straight switching is 35″; the latter having an improvement of 18 seconds per car change. You will note that the minimum car change time in Table No. 2 is in the rooms where backswitching is done by the motor having empty car prior to departure of motor with loaded car from the loading machine, such procedure indicated in "Remarks" in notation "Has straight switch." In the third or "Summary" readings the average car change time is 27″ this being an improvement of 26″ per car change as compared with the 53″ car change time in a backswitching territory.

Success in mine adaptation to serve modern loading machines is not yet on a par with modern loading machines. This is largely due to the need of time to readjust from hand mining systems to systems designed and suited for mechanization. However, it is not wholly due to this cause. It also takes time for us to change, both consciously and subconsciously, completely adapting and timing ourselves to this relatively new procedure.

* * *

Mr. Raymond Mancha (Columbus, Ohio): In Mr. Lewis' experience, I noted one item there, a car change average of 27 seconds per change. Now, there are things you can do, but in view of the fact that so often a car gets back before the machine is ready—

Chairman Stedelin: We can hardly hear you, Mr. Mancha, will you please talk a little louder?

Mr. Raymond Mancha: I say in view of the fact so often when you get to the car change such a short period of time elapses that when a car gets back, the loading machine isn't ready for it, it is bucking around trying to get a more advantageous position of attack, and quite often the car is there but you are not ready for it; now, I wonder just about where does that saturation point come in?

Mr. Howard Lewis: I should say that is just about the time; if you could change your power on the type of loading machine you have, in 26 seconds or 27 seconds, your machine will not stop. There is very little lost motion there. I would say the point lies between 27 seconds and thirty-two or thirty-one.

Mr. Raymond Mancha: Is that two motors?

Mr. Howard Lewis: Yes, two motors and two trip riders and a turbine motor.

Mr. I. D. Marsh (Belleville, Ill.): How large are the cars?

Mr. Howard Lewis: The cars on Number one and two average 3.23; and on the other time study they average 3.65 and a little more.

Chairman Stedelin: I wonder, Mr. Lewis, if you would come back up here and answer any questions anybody might ask?

Mr. H. A. Treadwell: I would like to ask Mr. Lewis how many empties do you carry on those motors as a normal run?

Mr. Howard Lewis: We keep about twenty empties on the service motor. Do you mean on the motors that make the change?

Mr. H. A. Treadwell: Yes, on the motors that make the change.

Mr. Howard Lewis: Sometimes four, but very seldom; mostly three.

Mr. H. A. Treadwell: Start out with three and work down?

Mr. Howard Lewis: They start out with three and work down.

Mr. H. A. Treadwell: Thank you.

Mr. Howard Lewis: That's due, of course, to conditions. Sometimes, in very rolly places it isn't well to do that; but in the ordinary place we will take three and four cars.

Chairman Stedelin: Any other questions, or any further discussion? This, of course, is a change of locomotives. Have you something to say, Johnny?

Mr. John Jones: In further answer to Ray, and regarding when this time period stops or begins; when the car lands back at the loading machine, that's when his time stops for tramming, irrespective of whether the loading machine is ready for him or not; it's the loading machine's fault from that time on; it ought to be ready; and there is a certain split second there that the tramming time ceases.

Mr. Raymond Mancha: Mr. Chairman, that isn't exactly what I meant. What I meant was, if you were doing that with two motors, and two trip riders—is that correct?

Mr. Howard Lewis: Yes.

Mr. Raymond Mancha: Supposing he did that with one motor and one trip rider and that car change was thirty-five seconds? Since you are dealing with such a small percentage of the whole, what would the difference be? You say your only difference is that you have got two men on the crew. Although you have a difference in time, that wouldn't always slow you up because sometimes that loading machine can't do anything; not always, but quite often it is not ready. And other times it is ready on time. Now there is a saturation point in there; though you could get a little higher tonnage with a faster car change, I wonder whether you are getting enough tonnage with those two men? —You must feel that you are, or you wouldn't do it.

Mr. Howard Lewis: Because of slight delays that you have with one motor, you have the other motor available there for service, and if you had just the one motor naturally it would have a tendency to cut your tonnage down because you couldn't supply your cars fast enough. In order to make that car change you must have two motors to make a rapid car change of that sort. If you take one motor, and the distance to travel is 230 feet, to switch his car and come back, it would naturally increase the car change at least half—more than half.

Mr. E. H. Johnson (Columbus, Ohio): Mr. Lewis, what is the weight of the motor used for shifting cars? What do you think is the most efficient size of motor for that type of car, and what weight rail?

Mr. Howard Lewis: In my opinion, with the equipment we have available, the six-ton Jeffrey motor is the best.

Mr. E. H. Johnson: Thank you for the "Jeffrey."

Mr. Howard Lewis: Well, we also switch cars with Goodman humpies, as we call them, and make good time. I have switched cars with a Goodman humpy in 4 seconds with a loading machine.

Chairman Stedelin: How about a Manchon?

Mr. Howard Lewis: Never used a Manchon.

Chairman Stedelin: Now, you heard the discussion on changing cars in motorized mines. Is there anybody here who can tell us anything about how they change cars in mule mines, mule driven mines? How about it Joe?

Mr. Joe Vlasak: We haven't any mules.

Chairman Stedelin: You haven't any at all?

Mr. Joe Vlasak: No.

Chairman Stedelin: And you were going to tell me when you were going to sell them so I could buy some.

Mr. H. A. Treadwell: You can tell us, John.

Chairman Stedelin: Yes, I can tell you about it. Of course, we have a small car and our crews perhaps are a little larger than some of the rest of you, but we couple through each cross-cut and we have two mules to each loading machine and, of course, the mule with the empty car comes through the cross-cut, and the mule to pull the loaded car is up at the machine and as soon as the car is loaded of course he gets out of there. It's not practical to pull that car under the machine with a mule, as a rule, so we have devised a little car-puller or a hoist or whatever you want to call it, that we put into the bumper or in place of the bumper on the loading machine. That car puller—the drum is on a clutch and we have a car pusher, what we call a car pusher on the crew; immediately that that loaded car leaves there he takes this three-eighths rope, couples it on the car left in the cross-cut and the Joy operator—well, leave the Joy out—but the operator—I didn't mean it that way, Mr. Knoizen—I meant I didn't want to advertise the machinery; we are having very good success with the machines we are using; —but that Joy—that operator, handles that car puller in the same position; he always stands by, having a foot-clutch and so forth, and he pulls that car up. I often thought this same idea might be used successfully instead of a second motor at a loading machine. We tried it out down at Buckskin Mine in Indiana, but it didn't go over. It didn't go over because they didn't want it to go over; the motorman came in and jammed his car up against the bumper and bumped the plate up against the drum and in a short time it wouldn't operate; there was no cooperation with the management. I believe that outfit is very light; it only needs a horse and a half motor, a high speed motor geared down where the rope travels only about 300 feet a minute, maybe; but it has horse-power enough so that when you do couple onto the string of cars you can pull five or six cars up and uncouple one car so you have one car close. That is the way we handle car changes with mules, and we have had a record of somewhere around 35 or 40 seconds on a car change. Mr. Mancha asked whether a few seconds might make a difference, or might not pay for the extra men required to operate the second motor. A good many of us are so poor we can only operate a limited number of machines, and a few more cars on each machine, you know the cost is diluted through the whole outfit, provided you are not producing below as much coal as you can hoist. In a general mechanization proposition or formerly, when we had the men in the mine who loaded coal by the ton and when they loafed they loafed on their own time and not on our time, we always had enough coal on the bottom so that the top was covered up. But today the problem is to keep your outfit balanced so that if there is any delay, it will be on top where the least number of men are employed. If you had more loading facilities below than you could hoist, it would cost more money, until you had the facilities to hoist the loading on the bottom. But it does make a difference on the proposition if one, two, three, four, five or six extra cars are loaded by each crew.

I do know the chairman, as a rule, gets very unpopular when he talks the most. I want the rest of you to do the talking. I told you how we did it. If anybody has anything to say, speak up. Let us have your ideas.

Mr. L. W. Hall (Benton, Ill.): Mr. Chairman, this doesn't refer to Illinois; I know of a North Dakota operation where a unit in one seven hour shift, using four mules, one of those mules being a relief mule, in other words three being active, two serving motors and one serving a swing motor, loaded 321 cars in seven hours with an average car change of 23 seconds. This was a lignite mine in North Dakota where they had about 15 feet of coal and the room's depth to the shear, so the car was turned loose on the entry and it jumped to the loader and a mule simply pulled it away. But that is a lot of cars, with a 23 second car change.

Mr. Frank Schull (Terre Haute): Mr. Chairman, might I ask Mr. Lewis about what he averaged, the number of cars per seven hour shift?

Mr. Howard Lewis: Well, sir, I should say about 165 or 170 cars at Number 8, and about 160 at Number 14. Of course, the cars are heavier at one place and some are not as heavy. We have switched 211 cars in seven hours.

Mr. Frank Schull: And, Mr. Chairman, what did you get with mules in seven hours, the way you handled it?

Chairman Stedelin: We only get about 135 to 140 cars. Well, our cars only average about two ton, or a little over two ton to the car.

Mr. Frank Schull: One mine of ours averaged about thirty hundred, and I wondered if we could learn something to speed up car changes in cars.

Chairman Stedelin: You can't learn much from us; we started out early, and others have started out since and are ahead of us.

Mr. A. S. Knoizen (Franklin, Pa.): Mr. Chairman, are you using your portable switches to expedite car changes, or have you eliminated that?

Chairman Stedelin: We eliminated that entirely; we got enthusiastic about portable switches, but we find we can couple the cars through cross-cut easier than to use the portable switch.

Mr. H. A. Treadwell: I wonder if it is a fair question to ask about what percentage of increase the track laying is on these different methods of car changes, where cars couple through the cross-cuts and where cars couple so there is no back-switching, in relation to the ordinary panel where you are just using one motor and not going through the process?

Mr. Howard Lewis: Well, sir, I figured it up roughly the other day, and it will run maybe two-tenths of a cent.

Mr. H. A. Treadwell: About two-tenths of a cent?

Mr. Howard Lewis: It won't run that, because that wasn't a fair estimate; it won't run that. I don't think—it might do it, too—I will not state that definitely.

Chairman Stedelin: Anybody else? How about Davey Jones? You fellows do a good job down there in tonnage per man—you must do it by car changes.

Mr. D. W. Jones (Valier, Ill.): Well, it all depends on the work in the place how you are going to regulate your haulage; if you have got good conditions, you put two locomotives in starting your car change, and we have a car that will average around nearly four and a quarter tons and you don't get up around the hundreds, over a hundred in those cars very often, but two motors should pull a hundred cars or better than four hundred tons with conditions in mine work such as are working. Mr. Mancha brought out a good point there. It isn't a good idea to try to force the machine with two motors. If the coal is there and they can loan it and you can get car changes to that machine as fast as it can load it, that is the deciding point or saturation point, if you give the machine all it can load. You must take into consideration the conditions that you have. If you just make an arbitrary rule that you are going to put two locomotives on this machine and one on the other, it wouldn't be fair, the results wouldn't be what you expect. As far as laying switches in a room is concerned, that's another point that must be governed by the conditions. If you have grades and it would be expensive to lay switches, then it couldn't be considered. If it is fairly level and conditions are right and you can head off the room for a cross-cut, and if conditions are right, you can eliminate a lot of travel. As I say, again, you don't find any two sections in a mine with the same conditions. Usually it is the grade, and top and height of coal that regulates what can be done. And when we have two locomotives I don't think it is necessary to have two trip riders, because the motor is only handling one car and he is next to the car and he can handle that, and the trip rider can stay at the engine and do switches for him.

Chairman Stedelin: Boys, it's a long time until lunch. This is a very important subject and a very interesting subject.

Mr. I. D. Marsh (Belleville, Ill.): Mr. Chairman, answering Mr. Mancha's question about the minimum time it is practical to go in car changes and utilizing it and not have the car change waiting on the loading machine, there is a great deal of difference in different mine conditions. We have had car changes with two mules which, under certain conditions, would run as low as six and seven seconds per change; one mule would swing out with the load and the next mule would swing in with the empty. Where the switch was within thirty or forty feet and where your room is full of coal and your loading machine is in good condition, there is no waste; the loading machine is ready to go when the empty is there. Now, if you have got a lot of tight coal and the room is not down properly, or you are finishing up a room, you are probably back sooner than you need to be with your empty.

I didn't get up primarily to say that—I did want to ask Mr. Lewis to describe briefly exactly their procedure on locomotives. I am not sure that I have just the picture of how two locomotives handle it. As I understand, you have a switch through the last cross-cut right behind your face all the time?

Mr. Howard Lewis: The first switches are laid fifty feet from the entry, and they are on a thirty-five degree angle; it brings them about ninety feet in the other room; there is one locomotive waiting at the point, at the ninety foot point all the time, for the other one to come out. Suppose, or assuming we are loading out of Number 2 room, the one locomotive would go in Number 1 and wait at the point of intersection, at Number 1 switch, at Number 2, and he would put his load back in Number 1; the other motor, when he had placed his load, would wait at that point, ninety feet inside the entry. That gives him a little start, and he starts his trip in motion.

Mr. I. D. Marsh: And both locomotives pick up three empties at a time and cut off one empty until they are free and go get the second empties, and you have a third locomotive at the relay?

Mr. Howard Lewis: Yes, and generally that locomotive takes care of two or three relay loaders along the track, he gathers the coal off of them, which helps out considerably.

Chairman Stedelin: There are some operations in the State, I think, where they don't change cars in that way, pulling them by, and I think I heard they do that at St. Ellen. I wonder if Mr. Sandoe would tell us about that.

Mr. C. J. Sandoe: I don't know a lot about that. We have tried a circular track, and we had cars going around like an electric button, but I think it is up to the management of the mine to decide where you want to make the saving, on labor, man-hours or the machine; it is a question of where you will take the delay.

Chairman Stedelin: Has anybody else anything to offer?

(A motion was made to adjourn.)

Chairman Stedelin: Oh, no, you have to stay until the bell rings. I don't expect to be chairman any more and I am going to show my authority right now. Well, I believe you win; we can't sit here and look at each other and not hear somebody talk.

Gentlemen, I think you will agree that we have had two excellent papers and we had more discussion than we usually have. I think we all learned something. We have an excellent program for this afternoon. The meeting will stand adjourned until two o'clock this afternoon.

## AFTERNOON SESSION

At 2:00 P. M., the afternoon session was opened by Mr. John E. Jones (Old Ben Coal Corp., West Frankfort, Ill.), who acted as Chairman.

Chairman Jones: The meeting will please come to order. On these boat trips we have had many very interesting problems to discuss. At various times we have had outstanding problems. Some few years ago the outstanding problem was that in relation to explosions. Later we had as the outstanding problem that of mechanical loading. At various times these problems of special interest have been discussed on these boat trips. Today, in coal mining, the outstanding thing is in regard to the subject we are going to discuss this afternoon, "Factors Affecting Sizes of Coal Produced." It seems to be the thing attracting the most attention now with respect to coal mining. We have quite a lengthy program this afternoon and the discussions will have to be prompt and as little time lost as possible.

The first speaker will be Professor C. M. Smith, of the University of Illinois. Professor Smith.

# FACTORS AFFECTING SIZES OF COAL PRODUCED—METHODS OF CONTROL:

## (a) TESTING COAL FOR BREAKAGE

By PROFESSOR C. M. SMITH
University of Illinois

This program has been arranged in recognition of the commercial importance of the breakage of coal, and it is my wish to try to bring out some points concerning the tendency of coal to break down, *i. e.*, its inherent friability, and means of testing therefor.

We are all aware of the wide range in friability of different coals, with anthracite at one end of the scale and Pocahontas at the other. Tests made in our laboratory a few years ago showed Pocahontas coal to be more than three times as friable as Pennsylvania anthracite, while Illinois coal is, roughly, twice as friable as anthracite.

How are we to account for this great difference in the friability of different coals? It cannot be the composition for Illinois coal is, on the average, higher in moisture, volatile matter, ash, and sulphur than either Pennsylvania anthracite or Pocahontas coal, yet it stands between them in friability. The answer evidently lies in the nature of the earth processes to which the coal has been subjected.

Our Illinois coal has simply been consolidated by comparatively moderate pressure into its present form, out of enormous accumulations of vegetal matter. Pocahontas coal has likewise been consolidated, but it has also been greatly fractured by more intensive pressure. This pressure not only fractured it, giving it great friability but it also squeezed much of the moisture and volatile matter out of the coal, as well. Anthracite coal probably went through this stage too, but the process did not stop there as the composition and structure of anthracite indicate quite clearly that it has been reconsolidated through subjection to both heat and intensive pressure.* The heat removed nearly all of the volatile matter while the pressure so compacted the material that it can be broken only with comparative difficulty.

As to means of testing coal for its friability, we have developed in the laboratory of the University of Illinois Engineering Experiment Station a drop-test applicable to medium-sized pieces which gives quantitative data on the extent to which a sample breaks down when dropped ten feet onto concrete. 3 x 2½-inch sample pieces are recommended for the test. Sixty of these are spread out in a single layer on trapdoors which are suddenly withdrawn, allowing the coal to drop to the concrete below. The test material is then screened over a succession of round-hole screens, ranging by ½-inch intervals from 2½-inch to ½-inch in hole diameter. The material remaining on each screen is weighed and this weight is converted into percent of sample. Each of these items is then multiplied by

* For an interesting discussion of these processes see "The Metamorphism of Coal" by John Roberts, Colliery Engineering, May 1934, pp. 170-5.

the mean diameter of its particles and from the sum of these products the mean size of the tested sample material is calculated. For example, if the pieces of dropped coal, average three-fourths as large as the test material, the sample has lost one-fourth of its mean piece-size, and the size degradation is said to be 25 per cent.

As the results of duplicate tests may not agree as closely as could be desired, it is usually necessary to make a half dozen or more parallel tests on samples from a given lot of coal, to get a dependable average per cent degradation, which is regarded as being the best measure we have of the inherent friability of coal tested in medium-sized pieces.

The procedure may be refined somewhat by deriving the average loss in piece weight, rather than in screen size, and this is known as the weight degradation. This is usually about twice as great as the mean size degradation, but the latter has come to be more widely used than the weight degradation. To illustrate the sort of numerical values of size degradation which are obtained, we may return to the comparison of Illinois coal with Pennsylvania anthracite and Pocahontas coal. The samples tested gave the following mean size degradations:

| | |
|---|---|
| Pennsylvania Anthracite | 12 per cent |
| Illinois coal | 25 per cent |
| Pocahontas coal | 39 per cent |

Following the development of the test method, a limited field survey was made in which drop tests were made on freshly-mined samples of Illinois coal.

The average size degradation by districts and seams were as follows for samples taken from underground mines:

| District | Seam | Average Size Degradation (%) |
|---|---|---|
| Northern Illinois | No. 2 | 22.5 |
| Fulton, Tazewell and Peoria Counties | No. 5 | 17.9 |
| Sangamon County | No. 5 | 25.3 |
| Macoupin, Madison and St. Clair Counties | No. 6 | 19.8 |
| Perry, Jackson, Franklin and Williamson Counties | No. 6 | 16.8 |
| Vermilion County | No. 6 | 21.7 |
| Saline and Gallatin Counties | | 19.5 |

The average size degradation of 38 samples from 22 underground mines in the state was 19.7 per cent. In comparing this rather low figure with the average size degradation previously cited for Illinois coal (25 per cent) it must be said that the latter figure is a mean for several samples which had been shipped to and stored for some time in dealers' yards. Such shipment and storage increases the friability of Illinois coal considerably. This was confirmed by testing some samples of freshly-mined coal at the mines and shipping duplicate samples to the laboratory where they were stored for several weeks. They were then drop-tested and, on the average, were found to be one-fifth more friable than the freshly-mined samples.

Only meager data are available for relating the results of drop tests on freshly-mined coal to the size of material produced by the mine, suitable data on mine production being available in only seven cases. Three of these were open-pit mines, the remaining four being underground mines in Southern Illinois.

In each case the production data for a month or more were used to determine the average piece-size of the mine-output. This was done by multiplying the relative proportion in each size by the mean of the diameters of the holes in its passing and retaining screens, just as was done in computing the size degradation for drop-tests. The upper size for lump coal was arbitrarily assumed to be 12-inch so the mean piece-size for 6-inch lump was taken to be 9-inch.

The following table compares the mean size of the mine output with the size degradation of its coal:

| Mine | Type | Size Degradation of Tested Sample (%) | Mean-Size of Mine Output (in.) |
|---|---|---|---|
| 1 | Open-pit ......... | 34.0 | 2.99 |
| 2 | Open-pit ......... | 23.0 | 3.55 |
| 3 | Open-pit ......... | 21.6 | 3.65 |
| 4 | Underground.. | 20.2 | 2.89 |
| 5 | Underground.. | 18.9 | 2.94 |
| 6 | Underground.. | 16.8 | 2.94 |
| 7 | Underground.. | 15.1 | 2.96 |

Here we see that, for each group of mines, decreasing degradation of the drop-tested coal is accompanied by increasing size of mine output, this relation being clearer for the open-pit than for the underground mines.

The following table gives us an interesting comparison between the output of open-pit and underground mines. As mine 1 is in Northern Illinois while the remaining mines are in the southern part of the state a fairer comparison can be made by omitting mine 1. If this is done we have:

| | 2 Open-pit Mines | 4 Underground Mines |
|---|---|---|
| Mean Size-Degradation of Drop-Tested Samples (%) ................................ | 22.3 | 17.8 |
| Mean Size of Mine Output (in.) ......................... | 3.60 | 2.93 |

As is to be expected, the drop-tests showed the strip-mine coal to be more friable than the underground coal because the former is ordinarily nearer the outcrop of the seam, but the extent to which strip-mining overcomes this handicap of more friable coal in producing coal of much larger mean piece-size (3.60 in. vs. 2.93 in.) is surprising. This is probably due to the fact that, in strip-mining there are ordinarily one or two more free faces of coal exposed, than in underground-mining, with the result that the more friable coal can be removed by stripping with less degradation than by underground work.

From the foregoing it appears that the potential breakage of a a given coal can be fairly well indicated by drop-testing a representative sample of it, provided that such drop-tests be made under carefully standardized conditions. In presenting this material to you, no claim is made for novelty as most of it has previously been published in bulletins* of our Engineering Experiment Station. It has simply been my wish to review for you the status of testing coal for breakage as the Experiment Station has developed it. Other speakers will point out to you the nature and extent of the breakage that coal undergoes between the time it is blasted from the seam until it is ready for the consumer.

* * *

Chairman Jones: You have heard what Professor Smith has had to say. We are now ready for the discussion, and we are ready for ques-

* See Bulletins 196 and 218 of the University of Illinois Engineering Experiment Station, entitled respectively, "An Investigation of the Friability of Different Coals" and "The Friability of Illinois Coals."

tioning the Professor. . . . Evidently, Professor, you have made it very plain. If there is no discussion, we will go on to the next paper. This is on the subject, "Cutting and Shearing," by L. A. Hill, of Chicago, Wilmington & Franklin Coal Company. Mr. Hill.

# FACTORS AFFECTING SIZES OF COAL PRODUCED—METHODS OF CONTROL:

## (*b*) CUTTING AND SHEARING

By L. A. HILL
Chicago, Wilmington & Franklin Coal Co.

There are many factors that affect the size of coal produced in mechanical mining, two of which are, the system of mining used and the preparation of the coal at the face.

We have always used the enclosed panel method at the Orient mines. This consists of two entries, twelve feet wide, on forty foot centers, and from each entry sixteen rooms are driven also on forty foot centers. Under normal conditions the rooms are driven 25 ft. wide and 250 ft. deep.

Under hand loading all the rooms were driven abreast. However, under mechanical loading we changed this method so that a complete loading unit worked the territory off each entry from No. 9 room to 16 inclusive. During the mining of this area No. 1 and 2 are driven 160 ft., 3 and 4 are driven 80 ft., and 5 and 6 are driven their full depth. Nos. 7 and 8 rooms are left blind, leaving an approximate 100 ft. pillar between Nos. 6 and 9 rooms. This pillar is used to localize the squeeze when the rooms between 9 and 16 are finished and the area caves. The outside half of the panel is worked with six short rooms driven off No. 6 into the 100 ft. pillar and two rooms driven off No. 5 towards No. 2, heading off Nos. 3 and 4. This development of the outside half provides a total of twelve short rooms off each entry between 1 and 6 and by this method we have been able to work a panel with two loading machine units from the time that it is developed until it is finished, without the necessity of removing one loading unit because of a shortage of working places. By the use of the blind pillar in the center of the panel, and the mining of the outside half with short rooms, we have reduced the roof weight and speeded up the recovery so that we have less crushing of the coal at the face, and therefore have improved the size of the coal loaded. This method of mining gives a sufficient number of working places for each loading machine, but as may be expected, causes congestion of traffic in the area worked.

The preparation of the coal at the working face for mechanical loading has always been a serious problem. If the coal was undercut and shot similar to hand loading methods, the tonnage loaded by the machines was not satisfactory. The coal was tight in the face, and badly broken up while digging it loose so that it could be loaded. The maintenance cost on the loaders was excessive for the low tonnage loaded.

If the coal was shot sufficiently hard to enable easier loading, the percentage of 2″ screenings was increased from 10 to 15 percent above that produced by hand loading. This increase in the amount of 2″ coal was not satisfactory. Therefore, it was necessary to make a decided change in face preparation. We experimented in methods of drilling and shooting, and while we showed improvement, we were not getting the results desired.

In the early days of mining when loaders were paid on a screened coal basis, they sheared their places with a pick to reduce the amount of fine coal produced. In our mines, the miners on hand loading fired their center buster shots, loaded them out, and then shot their rib holes. This method produced a higher percentage of lump. Because of past experience we started shearing coal.

We overhauled two old shearing machines and put them in operation. These machines shear in the center of the place a six inch kerf, 7 ft. deep. The actual shearing time is about 7 minutes. One machine will shear all of the straight places cut by two short wall machines if the traffic is not too congested. The use of these shearing machines reduced the minus 2″ coal 5 percent in places sheared, and increased the capacity of the loading machines from 10 to 15 percent. However, there resulted a further increase in congestion. As the machine requires 20 feet of straight track to shear a place, cross cuts and room necks cannot be sheared. A center shear in a 25 ft. place leaves practically 12 ft. of coal on each side. To shoot this type of place with rib holes was not satisfactory as it produced large blocks near the center, and powder burned coal on the ribs. Therefore, it was necessary to use a buster shot on each side of the sheared cut.

Our next attempt at shearing was with a track mounted undercutter with the universal head for shearing, known as the Arc Wall. This machine cuts and shears a 25 ft. room with a semi-circular face in about 21 minutes. The depth of the undercut in the center is 9 ft. The machine shears 21 inches off center. The arcwall machine eliminated the tight corners which are characteristic of the short wall cut. The place can be drilled from one setup instead of two, or three, as in shortwall cutting. The coal is shot with six holes. The yield per pound of powder is increased about 50 percent over shortwall coal not sheared. The arcwall increased the tons of coal per place about 30 percent. The average daily tonnage undercut is about 75 percent more than that of the short wall machine. With an increase in loader production due to the easier loading of the arcwall cut, it was found necessary to use a short wall in conjunction with two arcwalls for the purpose of cutting most of the room cross cuts. This eliminates the necessity of either laying a switch or stopping the room advancement while a cross cut is being driven. The number of cutting units for four loaders is, therefore, reduced by one-half where the shearing machines were used, the congestion is considerably lessened, and the quality and loadability of the coal is improved. The arcwall sheared coal contains 7 percent less 2″ screenings, and the loading machines will load about 25 percent more coal than is possible with shortwall non-sheared coal. However the arcwall machine requires 20 ft. of straight track on which to shear, therefore it is impossible to shear cross cuts and room necks. The inability of the shearing machine and the arcwall to shear on curved track is a serious drawback in the preparation of coal at the face. Finally we obtained an arc-shear machine that would shear on a curve.

Two years ago we tested a coal saw in our smokeless coal mines in West Virginia. The use of a double shear in that coal was so beneficial that we decided to test the saw in the New Orient mine. This test of the double sheared coal was very satisfactory. Since that time the machine has been redesigned, with greater weight, more power and cutting range to meet the requirements of a universal cutting machine. The remodeled machine has a nine foot bar cutting a 20 ft. radius. The cut can be made any place from one foot below the track to eight feet above. It can shear any place in the face between 22 ft. rib lines. It has a possible cutting speed of 25 ft. per minute. By the use of a hydraulic feed it will produce the maximum amount of cutting with a minimum amount of power consumption and without injury to the machine. It can shear on a curved track.

We have two of these machines in use. Each machine does all of the cutting and shearing for two loaders in their respective panels. They have increased the capacity of the loading machines 35 percent compared with those loading shortwall non-sheared coal. They have reduced the two inch screenings 12 percent below the shortwall non-sheared coal.

The machine undercuts a 24 ft. room, 9 ft. deep in approximately eight minutes, and requires about 5 minutes to make the two shear cuts, or an average of 13 minutes to a standard place. The kerf is four inches, or one third narrower than the old kerf. The reduction in bug-dust, even with the double shear, is 17 percent compared with the arc-well. While the volume available for expansion is also 17 percent less, the two shears reduce the amount of work required in blasting, thereby increasing the yield per pound of powder.

At present we are undercutting the places 24 ft. wide and double shearing. We shear the right hand rib 11 ft. from the center and grip the shear 1 ft. to the right. The left hand shear is placed 3 ft. to the left of center, gripping the shear to the left about 4 ft. We do this in preference to turning the bar over and shearing up on the left hand rib. Two holes are drilled at the left rib and shot first. Then four holes are shot in the block of coal between the two shears. This method of preparing the face coal affords excellent loading conditions and a very good quality of coal with a minimum of fines. The yield per pound of powder is about 50 percent greater than that of the arcwall coal, and about 100 percent greater than that of shortwall cutting. The congestion in the working area has been materially relieved.

At Orient No. 1 all development coal at the head end of the cross entries is cut by the older type of arcwall machine. The necessity for a rapid advancement of entries to maintain development for four loading units compelled their use. There are never less than seven entries, and at times eleven entries, that must be cut every day. The center shear made possible the shooting of as good a quality of coal as in wide work, and the ease of loading is reflected in the fact that the development loaders are among the highest producers in this mine.

It is noticeable that in working places where the coal is sheared, the top conditions are usually better. The smaller amount of powder used in blasting sheared coal is much easier on the roof. Pot holes and powder cut top coal so noticeable where coal is not sheared are practically absent in sheared coal places.

Shearing is the logical partner of undercutting, and gives the same desirable results today that it gave the miner when he sheared his coal by hand to reduce the production of the fine coal for which he received no pay.

* * *

Chairman Jones: You have heard a very concise statement upon the advantage relative to the plan in mechanical loading and a detailed expression upon the methods used. Have you any questions to ask Mr. Hill, or any discussion?

Mr. Edwin Johnson (Columbus, Ohio): Mr. Chairman, I would like to ask the average thickness in the curve in this new cutting Mr. Hill described.

Mr. L. A. Hill: The average is four inches—a four inch curve. . . .

Chairman Jones: Any other questions or discussion? If not, we will go on to the next paper.

"Drilling and Shooting," by Joseph Lenzini, of Bell & Zoller Coal & Mining Company. Mr. Lenzini.

# FACTORS AFFECTING SIZES OF COAL PRODUCED—METHODS OF CONTROL:

## (*c*) DRILLING AND SHOOTING

By JOSEPH LENZINI
Bell & Zoller Coal & Mining Co.

With the advent of mechanical loading in coal mines, the coal industry was confronted with the problem of producing as good or a better grade of coal than was being produced by hand loading methods and at the same time not retard the loading.

Our first experience was using permissible powder and cushioned shots. We found that we could not depend upon the driller to do this work properly and that we got better results by reducing the charge as low as possible and tamping all holes tight with a good stemming to the mouth of the drill hole.

Our next experience was to place snubbing pans in the under-cut and shooting the snubbers down on them, pulling the pans and snubbing at night and shooting the top shots in the morning before the day shift came on. This proved to be rather long drawn out and not always satisfactory. This coal was also shot with permissible and we did get some very good loading results.

Our next experience was converting breast machines into shearing machines and shearing the center of the place after it had been undercut. At this point we began using Cardox. We at first drilled two holes on each rib of a 26 ft. room. The coal was too big for loading and 2 to 4 powder holes had to be drilled next to the shear to break it up for good loading. We then decided to stop shearing and shoot six Cardox holes to a 26 ft. room. This made a good grade of coal and fair loading.

When any part of the preparation is neglected each succeeding step becomes more difficult. The quality of the coal is reduced, loading is retarded and the efficiency of the entire unit is affected.

There has always been a great temptation to overcome all obstacles and shortcomings by over-shooting —realization and quality thereby being sacrificed for loading results. This is not necessary as better results can be obtained by careful supervision to insure properly placed holes, shot in the correct order. This requires having men who are well suited for the work and who are interested in obtaining good results.

After loading out a place the first step in preparing for the next fall is to square up the face and clean up all loose coal, leaving the place clear for the cutting machine.

At Zeigler the cutting machines are all of the short wall type with 8′ 6″ cutter bars, cutting a 5½″ kerf. The adoption of this equipment is the result of experiments tending toward balanced units, one cutting machine for each Joy territory.

One of the greatest factors contributing towards coal preparation is that places be kept on sights, cut properly with straight ribs, square faces, level uniform bottoms cut to full depth of cutter bar and that machine helper keep the dust well shoveled back so that it will not be packed in the under-cut. In changing from hand loading to mechanical loading, one of our most difficult problems was to convince the machine men of the importance of cutting straight ribs and level bottoms. Nothing can be overlooked that would impair the quality or retard the loading.

We are now using low pressure Cardox. Drillers must become accustomed to the fact that they are drilling holes for a prepared and fixed charge. They must learn to know how much work they can reasonably expect a shell to do and that all holes must be spaced and balanced to avoid a tight or overloaded condition and drill holes accordingly. Drillers must avoid drilling holes too deep, too close to the rib, too high in the top or too low in the bottom.

Twenty-five to 28 ft. rooms are shot with 6 holes, 3 across the top and 3 across the bottom. The top rib drill holes are drilled about 3 ft. from the rib, parallel to the line of sights on the same level as the seam of the coal and about 1 ft. shorter than the undercut. The center top hole is drilled halfway between the two rib holes and on the same level and pitch. The center snubbing hole is drilled low enough to insure the coal being well broken up in the center, this being helped by driving a tight block about 12 inches long in the cut under the hole. The rib snubbers are drilled about 6 inches closer to the ribs than the top holes and as low as possible and not leave too much for the top holes. Where coal is seamy, the snubbing holes can be started higher and pitched downward to prevent the charge from following a parting seam and setting the coal down in a slab.

Narrow places are drilled with 5 holes. 2 snubbing holes are staggered—one higher and one lower. The fifth hole is drilled towards the center from a rib, set up about 2 ft. from the bottom or about 12 inches from the top, according to the character of the coal.

The contributing causes of tight coal are: places off sights, improper cutting and drilling, shooting more than one shell at a time, not shooting in proper order, leaving dust under the cut, not blocking up and letting the snubbing set down before shooting, tight or overloaded holes and impurities in the coal. The more of these causes that we can eliminate, the better the quality of coal, the easier the loading, the greater the general efficiency and morale maintained among the men. When a crew is trained to cooperate and work safely, sanely, efficiently and economically better results can be obtained for all concerned.

In low pressures, the most notable results are that we have been able to break up the coal with as low as 5,000 to 10,000 pounds pressure and that the high volumes heave the coal out away from the face and prevents it from setting down and interlocking, eliminating most of our tight coal and making a good grade of coal, easy to load.

* * *

Chairman Jones: You have heard the reading of the paper. Do you have any questions to ask Mr. Lenzini? Any discussion regarding drilling and shooting.

Mr. H. A. Treadwell: Mr. Chairman, I didn't get the clear picture of his snubbing shot, the center snubbing shot. He said he spragged the coal right under the hole. Is the hole in level, or a pitching hole?

Mr. Lenzini: The low hole or cut is more or less on level; we have to pitch it on account of the fact we are not always able to start it low enough. It really helps if it is pitched a little. But we try to break the coal all the way from the face out with our low snubbing hole in a wide room; that is, we try to break it up so that the coal is broken up so that the Joy can go all the way to the face; the loading machine can go all the way to the face without resetting; and we try to get the shot so it will go all the way or most of the way.

Mr. H. A. Treadwell: The use of your snubbing block is to throw the pressure of your shot across your strata?

Mr. Lenzini: Across your strata, so as to insure that coal being broken up and not set down in the slag.

Chairman Jones: Any other questions or discussion on the paper?

The next paper is upon "Loading," by J. W. Starks, of the Peabody Coal Company.

Mr. J. W. Starks: Gentlemen, you realize how difficult it is—you who have had experience in mechanical loading—to write a paper applicable to any particular mine or to any district or in some cases to all parts of the mine. Drilling that might be set in one place will not be so in another. Shearing has its advantages, also its disadvantages; if you happened to be mining a seam that contains a number of bands carrying impurities, the excess amount of screenings secured from such shearings is a detriment. So, in my paper I have only given one very brief table of percentages and that is taken from the actual experience in one particular mine in a district and in a modified form in another mine.

# FACTORS AFFECTING SIZES OF COAL PRODUCED—METHODS OF CONTROL:

## (*d*) LOADING

By J. W. STARKS
Peabody Coal Company

In approaching the subject of the effect of loading coal with loading machines as upon the sizes produced over the tipple, I wish to insert a few preliminary remarks.

During the past ten years we have witnessed a complete revolution in mining. In the last fifty years we have seen the production of coal increase from 1.9 tons to ten tons per man.

Before the introduction of the Mine Run Act the miner was paid only for such coal that passed over a bar screen. The screenings were considered to be of no value. After the passage of the Mine Run Act practically every mine was equipped with a washery, and cutting machines were introduced with the idea of maintaining a larger screened coal percentage.

While on the screened coal basis the miner did not use explosives, or if so very sparingly, depending upon his pick for lump sizes. With restrictions lifted those who were shooting coal off the solid began using enough powder to blast coal so that it could be loaded without the use of the pick.

During the time of the World War and boom years following, coal could be sold in raw state and the old obsolete cleaning plants were abandoned. Then followed a period of labor disputes in which the union miners of Illinois maintained a solid front and the miners of other districts (excepting a few isolated sections) went non-union. The resultant low wage scale in non-union territory permitted the operators of such districts to flood our markets with cheaper coal. Even though Illinois contained the finest group of mines and as a whole the best trained group of miners in the United States her annual production dropped from one hundred million (100,000,000) tons to thirty million (30,000,000) tons.

To stem the ruinous tide which was engulfing the mining industry in Illinois the introduction of mechanical loading was essential if the prevailing wage scale was to be maintained and the operator stay in business. During the year of 1927, twenty operators installed 129 loading machines in twenty-one mines. The machines were manufactured by fourteen different concerns and were mostly of the conveyor type.

Conveyor loading was a modified system of hand loading inasmuch as the miner shoveled the coal on an apron from which a system of chains and flights carried the coal to mine car. Other machines performed all the motions of transporting the loose coal from face to mine car.

In 1928 the number of machines had increased from the 129 in use in 1927 to 992 which loaded 12.4 percent of the out-put produced. Five years later 1,752 machines produced 50.2 percent of out-put loaded with strip mines producing 15.8 percent of out-put loaded.

In the meantime the market conditions had made a radical change. The large industrial consumer and railroads had abandoned the use of large sizes of coal, and large lump sizes were not in demand excepting from the householder during some three or four months during the cold season. The adoption of stokers and use of powdered fuel had lessened the demand for the larger sizes of coal. But, the consumer does insist upon a fuel practically free from impurities, thus a revival of interest and installation of cleaning plants as the product of mechanical loading reaches the tipple containing all the impurities which the seam carries in the natural state, plus some clod, draw slate or bottom clay.

Hand picking in the tipple in most cases provides the consumer with a better product than was furnished by the hand loader unless further preparation was made after coal passed the weigh hoppers.

Now as to percentages of different sizes of coal produced by mechanical loading against hand loading. Herewith are two tables which are fairly representative of Central Illinois miners. In each case the production represents a tonnage of over One Hundred Thousand (100,-000) tons during the month:

| | Undercut by machine and loaded by hand | Loaded by Mobile machine |
|---|---|---|
| 6″ Lump | 21.30 | 10.09 |
| 6x3″ Egg | 26.26 | 17.22 |
| 3x2″ Nut | 9.30 | 19.32 |
| 2″ Screenings | 43.14 | 53.37 |
| 1¼″ Scgs. | 32.52 | 43.75 |

A conveyor mine in which coal from Number Five seam is loaded shows the following comparison as to 1¼″ screenings:

| | |
|---|---|
| Hand Loading | 39.25% |
| Conveyor Loading | 44.28% |

Any mining man is aware of the fact that the increase or decrease of amount of screenings varies as to the amount of powder used in shooting and extent of snubbing. In hand loading the coal was usually snubbed to some extent and such snubbing reduced the need of heavy shots and more lump sizes were produced. In mechanical loading snubbing is not much in use. For free loading more powder is necessary with a resultant increase of finer sizes.

Whatever we would like to believe, the loading machine is not a mining machine and any person expecting to get full tonnage from a mechanical loader must expect increased screenings and a decreased amount of lump sizes.

It is absolute folly to force a loading machine to mine coal as decreased tonnage will increase the cost of production and abuse of machine will add to the cost of maintenance.

I thank you.

* * *

Chairman Jones: Have you any questions to ask Mr. Starks regarding his paper, or any discussion upon the subject? We will go on with our program. The next paper is upon "Screening and Tipple Handling," by Louis von Perbandt, of the Allen & Garcia Company, Chicago, Ill. Mr. von Perbandt.

# FACTORS AFFECTING SIZES OF COAL PRODUCED—METHODS OF CONTROL:

## (*e*) SCREENING AND TIPPLE HANDLING

By LOUIS VON PERBANDT
Allen & Garcia Company, Chicago, Illinois

This subject covers a very broad field and can only be handled in a general way in this paper, pointing out the more recent developments of equipment and their effectiveness for the particular purpose intended.

The problem of tipple handling begins after the coal has been placed in the mine cars and is ready to start on its way from the mine bottom. The first question that arises is the hoisting of the coal to the preparation plant in a manner that will make the least amount of breakage and reduce the amount of fines to be disposed of.

The present day trend toward total mechanization of mines has made it unnecessary to weigh the coal separately as in weigh pans, and by the substitution of a track scale one point of considerable degradation, namely, the weigh pan, could be eliminated.

Machine loading has naturally reduced the capacity of pit cars and this, together with the reduced number of working hours, has resulted in a greatly increased hoisting and dumping speed, if any attempt is made to make up the deficiency in tonnage. This increased speed of dumping has served to aggravate a serious degradation factor. Such a condition should lead to the consideration of some smoother method of hoisting the coal, such as a skip.

Many comparisons have been made between the actual percentage of breakage from cage hoisting as against skip hoisting, none of which have been satisfactory, owing to the varying condition of mines. In a properly designed skip, loading and unloading stations having easy lines and curved surfaces, coal may be handled in mass quite gently and with a minimum amount of degradation. Recent improvements have overcome most of the early objections.

In cases where the use of skips is not practical, much can be done to eliminate rough handling by the use of long radius dumping horns and with overturning cages when using closed end cars. This type of equipment, however, requires a reduced speed for the actual dumping period resulting in a sliding discharge rather than a violent throw of coal into the feed hopper.

An installation of 5 ton cars with knee action wheels, safety couplers and overturning cage, has been made recently for a mine having a capacity of 2,500 tons in 7 hours with a hoist of 400 feet having a smooth operation and gentle handling of the coal.

After hoisting, the coal is ready to be assorted into various sizes according to requirements, the factors governing what these sizes shall be, are chiefly the purpose for which the coal is to be used and the markets which are available to the mine. These may be generally classified as follows: 1st—Railroads; 2nd—Utilities; 3rd—Industries and 4th—Domestic.

When railroads are to be the largest users of the mine production, sizing may be limited in extent usually 2″ or 3″ lump and screenings, and crushing facilities provided for the reduction of all or part to screenings. It may be necessary to do some measure of cleaning and this would then call for a separation into one or more additional sizes with facilities for remixing after preparation.

Utility coal should normally call for the same general classification, with the main demand being for the smaller sizes with the addition of a possible break-down to facilitate the further reduction at the boiler plant, into powdered fuel. Plants of this type should be equipped with magnetic pulleys for the extraction of tramp iron to safeguard valuable equipment that might easily be damaged to such an extent as to cause serious shut downs and expensive repairs.

Industry has a varied assortment of boiler equipment and calls for a large number of the commercial sizes, so that it is necessary to be able to prepare a peculiar assortment of combinations and modifications.

The domestic trade so far, has called for the larger sizes, namely, egg and lump. However, the trend toward the installation of domestic stokers and furnaces, and the consequent reduction in large sizes when loading with machines, has decreased the demand or production of lump materially. It may be safe to say that this size demand is being slowly decreased to the extent that some preparation plants have provided facilities for reducing the size to a point where it can be picked with a minimum amount of labor or sent to a mechanical cleaning plant.

A mine catering to all of the various users must therefore, be prepared to cover a large range of assorted sizes and modifications, and will be limited only to the extent of the desire to meet all demands of the sales department or agency.

At present preparation may be classified into six or seven primary sizes, namely: 6″ lump—6 x 3 egg—3 x 1½ nut—1½ x ¾ nut—¾ x 5/16 nut—5/16 x 10 M. pea and 10 M. x 0 dust. Some mines have varied the above somewhat or have enlarged upon them, being governed by the characteristic of the coal. The scope can be increased by mixing and making various blends, through the addition of the necessary equipment, if such a thing is desired for any special purpose. Sometimes this has led into being able to provide from 40 to 50 various sizes and combinations in one tipple.

In order to obtain these assortments, various types of screens must be introduced into the flow of coal. For the larger sizes, shaker screens of the heavier type have given the most satisfaction. These may be supported on rollers, long hangers or short pendulum type hangers according to the views of the owner or engineer on this subject.

The successful operation of screens equipped with pendulum hangers is due to the relation between the length of hanger, the length of stroke and speed. Slower speeds can be used for driving because the rocking motion of pendulum hung screens tends to throw the coal upward and clear the perforations. This is due to the vertical component of the arc of swing.

Rotary grizzlies have been tried for this service but the general opinion seems to be that it has resulted in an increased amount of degradation, acting somewhat similar to a set of crushing rolls.

The heavier type of shaking screens are usually run at slower speeds and have been found satisfactory for the larger sizes down as small as 1¼″ diameter. However, careful attention must be paid to the design of the discharge chutes and transfer points, rounding of the corners and using deflecting plates with very shallow angles so that no direct blows will be given the coal; making the pitch or slope of the screen and dead plates so that the coal will not gain momentum and be difficult to control, keeping the drop from screen discharge chute to the picking table or loading boom as little as possible, with just a bare working clearance, and to the fitting of gates and to the placing of any obstruction in the flow of coal.

For sizes under 1¼″ there are various types of screens available, such as ashboard hanger screens, lightly constructed long hanger screens, or slow speed mechanically vibrated screens. When ashboard hanger screens are used having a reciprocating motion, less pitch than the heavier reciprocating screens with an increased speed and shorter stroke are required and give better results, and if the coal is relatively dry, an efficient sizing is obtained with the additional feature of providing an economical conveying medium if called upon to do so. These screens usually are limited to a bottom size of 5/16″ or ¼″.

New developments in the art of screening have made available a slower speed mechanically vibrated screen for the screening of coal from 2″ or 1½″ down to ⅜″ or 5/16″, and if the plant arrangement will permit they can be installed to advantage. There are on the market, a large number with an assortment of drives, that permit installations having a pitch ranging from horizontal to 20 degrees and the quality and durability holds consistent with the price.

These screens may be classified into various types, such as those which are mechanically vibrated by means of an unbalanced flywheel, or an eccentric and those having magnetic vibrators. The factors affecting the choice of these screens depends largely upon the moisture content of the coal to be screened. If very dry, almost any screen will produce a satisfactory product, but the intensity of vibration must increase materially if a screen is required to separate the undersize adhering to coarser pieces as it will do when damp. If the coal contains in excess of 6% surface moisture, the only way to provide a satisfactory screening job is to add water and wet screen it, washing the fine sizes down through the bed and to a place where they can find their way through the screen.

When using the vibrating type of screen, it has been found advantageous to make the slope rather steep, nearly as steep or steeper as would be necessary in an ordinary steel chute in order to keep the depth of the coal bed down to a minimum and give each piece a fighting chance to get to the bottom and try for a hole. Pitching in this manner has made it advantageous to elongate the mesh of the screen so as to obtain an equivalent screen mesh and yet avoid the clogging of the screen and its loss in efficiency. To predict definitely and accurately in advance what the slope is to be, and the capacity it will handle, so far has not been done very satisfactorily, so that arrangements must be made to provide sufficient leeway to make changes. It has been found generally, that screens which impart a uniform vibration over the entire surface usually give more satisfaction and efficiency over those in which the impulses tend to leave dead sections.

Something might be said at this time about the durability of screen cloth, a well designed screen providing for the stretching of the cloth and presenting a smooth surface with quick change facilities. The cloth section should handle about 100,000 tons of feed before requiring renewal. Naturally, the more wear the cloth experiences, the greater will be the variation in the percentages screened out and consequently, the loss in realization will more than offset the cost of new screen cloth.

In anthracite practice, definite standards have been set up regarding the mesh of screen, to be taken off when worn to a certain size, the wear allowed and the mesh of the testing screen. For example, egg coal must pass through 3⅜″ and over 2-7/16″ when new, and plates are to be taken off when worn to 3½″ and 2-9/16″; wear allowed ⅛″ and testing screens are 3-7/16″ and 2½″.

We have found that bituminous practice is subject to no such control and it is possible therefore, to obtain a large variation masquerading under the name of certain sizes. After the coal has been sized the question of preparation arises. Much has been said in the last few years on this subject regarding the finer points, and it is not my intention to discuss the whys and wherefores where in previous years R. O. M. was satisfactory. Picking is now generally done and in places where picking was essential, some method of mechanical, either wet or dry cleaning, has been or will be adopted. This again naturally affects the sizing. Cleaning methods have tried to adopt themselves to the most commonly known sizes and at present are pioneering in sizes above 3″, in other words, is it possible to wash coal above this size and if so, what is the limit. Some installations have been and are being made at this time in the Illinois field that include the washing of everything under 6″. In all cases, however, size ratio has been limited from between 2 to 1, and up to 4 to 1 on such coarse sizes. Here again the character of the coal dictates the possibility as to what the top size shall be.

When picking is resorted to as a method of cleaning, we again are limited by the size ratio for the most efficient results, and it will be found that any variation in excess of a 2 to 1 ratio increases the difficulty of picking proportionately.

In ore dressing accepted practice for years has been that presizing was very essential to obtain the best results in cleaning, but the economies of this method when applied to coal with the equipment available, made it advisable to increase the size ratio over that dictated by the then present commercial sizes and consequently, the urge to clean as large a range of sizes as possible became predominant and dictated to a large extent the policy of increasing the top size. Quite recently equipment has become available that is economical in first and operating costs that permits a return to presizing practice and its possible greater efficiency at a cost that compares favorably with the larger ratio units.

In general, the tipple handling of coal is governed by the markets it has to serve and the physical characteristics of the property. It is always advisable to avoid the making of degradation and the installation of units that will increase this tendency. Many mines are limited as to available track space and the inability to increase the number of tracks and have, therefore, resorted to bins, with their consequent breakage of coal, in place of providing a sufficient number of tracks to permit the loading of all sizes directly to cars by means of loading booms.

When dedusting, the appearance of the dedusted coal has dictated what the size shall be and one of the first installations was based upon removing the minus 48 mesh. However, when the coal was received by the customer, the complaint was that it had not been dedusted, this, in spite of the fact that there was only 2% undersize in the product. This was then stepped up until minus 10 mesh was removed and pronounced as satisfactory.

Summing up a careful survey must be made of all the conditions governing the production of coal at the mines and carefully weighed to determine the best possible type of equipment available to control the preparation. This may preferably be done by engineers having had a wide range of experience unlimited by their close association with manufactured specialties that may prejudice their selection of units required for the best possible economy and efficiency.

* * *

Chairman Jones: You have heard Mr. von Perbandt's paper. Do you have any questions to ask him, or any discussion?

You have been given a very general picture of our industry from the geological causes, as to why the coal is of a certain friability, on through its breaking down and the care of its loading and transportation into the tipple and its preparation. A very general picture. All that is left now is for someone to tell us how to sell it. Probably that will be taken up at some future Institute meeting.

While at the Mining Congress at Cincinnati, I listened to a very interesting paper by Jack Lyons upon "Broadcasting." This is a new thought and is relative to both safety and efficiency, and we want the paper printed in our proceedings. It was made primarily for the Mining Congress, and we have asked Jack to bring it and give it to us here. We will ask Jack to read the paper now.

Mr. John Lyons: Mr. Chairman, members, I feel that I ought to apologize for giving this paper again when I have already given it one time; but it may be most of you didn't hear the paper and you might be somewhat interested in it. The title of my paper is "Broadcasting Safety Messages Underground."

# BROADCASTING SAFETY MESSAGES UNDERGROUND

**(This paper was also presented at the American Mining Congress in Cincinnati in May. The article and the illustrations are reprinted through courtesy of the American Mining Congress.)**

By JOHN LYONS

Safety Engineer, Bell & Zoller Coal and Mining Company

Advertising merchandise over the radio has proved a successful means of selling.

If it "pays to advertise" tooth paste, automobiles, etc., surely it will pay to advertise safety.

The greatest asset in the prevention of accidents is the "safety


minded worker and foreman." This comes about only through constant training and education in the safe way of doing work. When this has been accomplished, he will not only endeavor to prevent accidents to himself, but also to his fellow worker.

To be "safety minded" simply means that the mind has been trained to avoid danger to the body.

To bring this about, everyone must be constantly reminded that whatever he does must be done in the safe way, and a constant safety education must be carried on.

Taking a page from radio broadcasting, our company, Bell & Zoller Coal & Mining Company, has installed at three of their mines, which are Zeigler Nos. 1 and 2 located at Zeigler, Ill., and mine No. 5 of the Centralia Coal Company at Centralia, Ill., a subsidiary of the Bell & Zoller Company, what we termed "safety broadcasting stations."

Our first installation was at mine No. 1, which we named station "S-A-F-E-T-Y," installed June 5, 1935. It consists of a 35-watt capacity public speaking amplifier or public address system to which is wired five 12-in. diameter dynamic speakers and one monitor speaker in the station making six in all.

Built into the amplifier is an electrically operated phonograph turntable, 12 in. in diameter and an electric pickup by means of which any phonograph record can be played. We also have a carbon microphone which feeds into the amplifier, and this is used whenever talks, vocal singing, or studio programs other than records are broadcast. The amplifier and microphone are housed in the mine manager's office underground and the five dynamic speakers are located along the entry where the mantrips load up, being spaced so that everyone sitting in the mantrips can hear whatever comes through the loud speakers. The set is powered by 110 volts a.c. obtained through a dry transformer from a 440-volt a.c. line used to operate our shaft bottom pumps, the distance from the set to the farthest speaker is 800 ft. and covers 550 ft. of entry without blasting or distortion. The mantrips are parked at a point where there are two parallel tracks.

At our No. 5 mine the amplifier and one microphone are located in the superintendent's office on the surface, another microphone and pre-amplifier are located near the shaft bottom and are used when the talks are to be made from underground. Three 12-in. dynamic loud speakers are used, two underground and one in the surface washhouse. A small monitor speaker is located at the amplifier. The name of the station is "T-H-I-N-K," and was installed on the 9th of December, 1935.

Our newest and most up-to-date is station A-B-C, meaning "Always Be Careful," located at Zeigler mine No. 2, installed March 30, 1936. It consists of a 60-watt amplifier, ten 12-in. dynamic loud speakers, one 8-in. monitor speaker and two microphones, a built-in phonograph turntable and electric pickup.

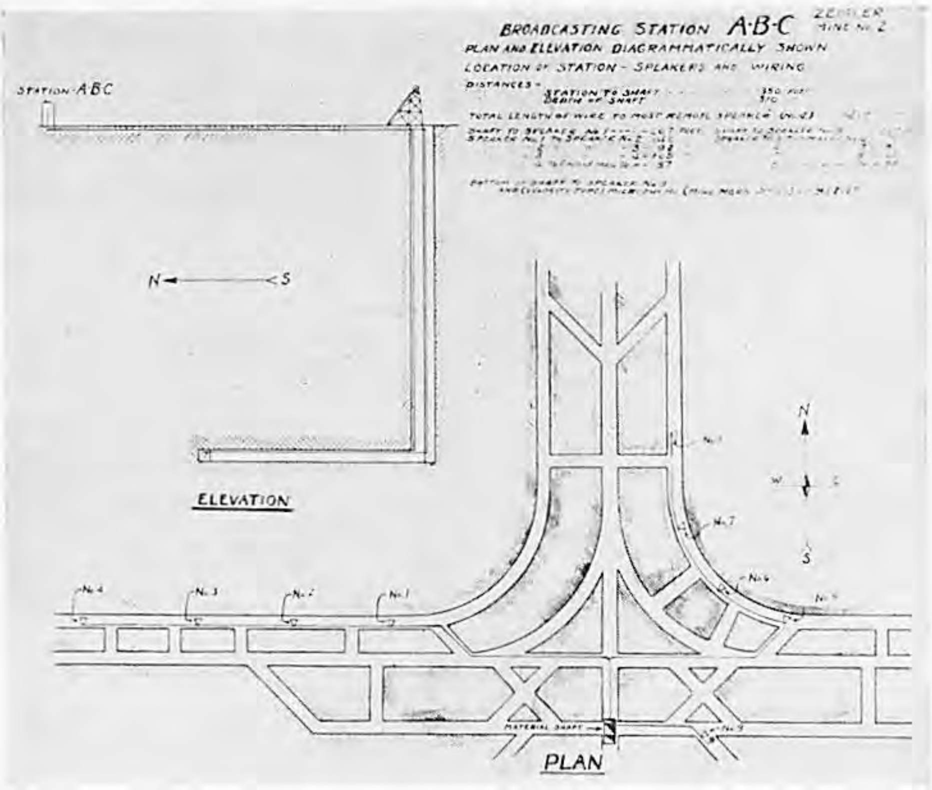
This station has several improvements over the other.

The speaker mechanism is all inclosed in aluminum shells and are of the bell mouth type which is a distinct advantage over the wood case type in that they are more dust tight. Speakers cannot be made dust tight because of air movements required by the diaphragm. The microphone used here is the crystal type, which is said to be more durable and does reproduce the voice more natural than the carbon type. The station is located in a building adjacent to the wash houses on the surface. This is particularly advantageous in that anyone speaking, singing or playing instruments in the programs does not have to descend into the mine and since we sometimes have ladies on the programs, it is more advantageous. Another advantage is that the amplifier is not subject to the dampness of the mine, also loud-speakers may be placed in the washhouse or any other designated place on the surface, thus serving a greater audience.

Nine of the loud speakers are located underground—four on the east side, four on the west side. The former covers over 325 ft. of mantrips, and the latter 450 ft. of mantrips. Speech can be heard perfectly at any point within this distance. It is not possible to specify a standard distance at which speakers can be located apart, because the distance sound travels varies in timbered entries, rock-top, coal top, around curves, and any opening such as a cross-cut will affect the distance materially. We located the distances for our speakers by having two men walk the entries in opposite directions as long as their voices could be heard clearly; we found these distances to be correct when the system was tried out. Sound from the bell mouth type of speakers does not travel backwards much and naturally the mouth of the speakers are placed in the direction that the air travels to better carry the sound and to keep dust from entering the speakers down to a minimum.

The ninth speaker underground is located at the mine manager's office to act as a monitor speaker when using a second microphone located there, and the talks are to originate from the said office. To carry the voice from this underground microphone back to the main amplifier on the surface, a separate two-conductor grounded metal shielded cable must be used, otherwise induction and static noises will be picked up from electric generators.

It should be understood that




sounds are carried to the speakers from the amplifiers by wires or cables. We use two 2-conductor Parkway cables of No. 12 B. & S. gauge solid copper, rubber insulated, lead covered and steel taped with an outside covering of jute. Two of the wires are used for the sound output and the other two carry 250 volts d.c. current to excite the fields of the electro dynamic speakers, two of which are placed in series, making 125 volts on each.

These Parkway cables are laid in the ground from the broadcasting station to the shaft and extend to the shaft bottom, a distance of 860 ft.

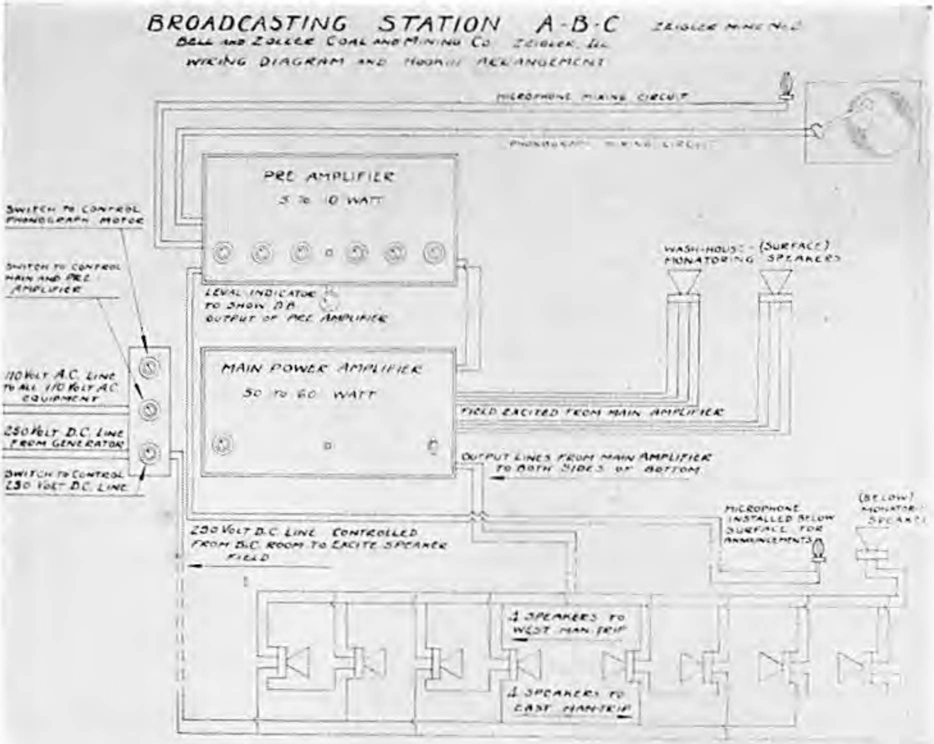
From this point a 4-conductor No. 12 B. & S. gauge solid copper rubber clad cable connects the Parkway cables and the loud speakers.

The most remote speaker from the amplifier is 1,217 ft.

On the surface we have two more 12-in. diameter loud speakers placed in the washhouses, one of these can be heard from the station so we do not need a monitor in the station.

All the power controls are in the broadcast station and are very simple—one switch for the 110-volt a.c. to power the set which has 13 tubes, and one for the 250 volts d.c. which excites the loud speaker fields.

To anyone interested in the cost of the installations described, the following figures may be of interest. The prices cover the cost of the amplifiers, phonograph turntable, pick-up microphones and loud speakers connected by the seller to




cables or wires installed by our company, all apparatus being guaranteed for 90 days by the seller.

Station T-H-I-N-K 30-watt amplifier, 2 microphones, phonograph, 3 dynamic loud speakers and one small monitor speaker less cables: $300.

Station S-A-F-E-T-Y 35-watt amplifier, 1 microphone, phonograph, 5 dynamic loud speakers, 1 monitor speaker less cables: $332.50.

Station A-B-C 60-watt amplifier, 2 microphones, phonograph, 10 dynamic loud speakers, and 1 monitor speaker less cables: $453.20.

The 2-conductor Parkway cables cost us $0.0972 per foot, and the 4-conductor rubber clad cable cost us $0.1785 per foot. Since the location of each broadcasting station and the distance to the loud speakers of same differ, I have not attempted to show the total cost of same, but from the cost of the cables one can readily figure the approximate cost of any installation.

We broadcast every day the mine operates. Beginning at 6 a. m. we play recordings or put on studio programs before our microphone until 10 minutes before the man-trips leave the bottom, when we give our safety talks which are never more than 5 minutes in length. Safety talks are made by our superintendents, general superintendents, and safety engineer. Each Friday, for the past six months, we have been favored with talks by Illinois State Highway engineers who discuss the various phases of highway accidents. This has gone over good. We discuss safety rules, accidents or near accidents which may have occurred at our mines as soon

as we get the facts, also fatal accidents occurring in the mines of our state as published by the Department of Mines and Minerals, and the different hazards of the various occupations in and around the mine.

A typical week's program is as follows:

Monday:

The Three Shadows, singing high school students with a guitar.

Talk by the safety engineer, "How much of your safety depends on the other fellow?"

12:30 p. m. Talk to shooters on their hazards and our safety rules as they apply to them.

Tuesday:

Phonograph recordings.

Talk by the safety engineer, "Am I a 'Safe Worker'?"

Wednesday:

Music by Hickory's "Old Timers," six of our own employes sing and play banjo, fiddle, guitar, and mandolin.

Talk by the safety engineer, "Drilling hazards describing known accidents in this occupation."

Thursday:

Phonograph recordings.

Talk by the safety engineer to cutting machine men on their hazards.

Friday:

Music by the Williams Sisters, 10 and 11 years old, daughters of one of our employes.

Talk by Illinois State Highway Department engineers on highway hazards.

We get numerous programs from vocal and instrumental quartettes that do not work for us, all of which is done free of charge.

As to its value in safety work, we are firmly convinced that it is worth while, and with us it has passed its experimental stage, and it will remain an important cog in our safety program.

I am submitting below a sample broadcast which will serve to give an idea of a typical safety talk:

"Have you ever thought how much of your safety depends on the other fellow and how much of the other fellow's safety depends on you? Take the skin-up man; it is his duty to take down all loose, or dummy ribs, face or top coal after the place has been loaded out by the loading machines. The cutting machine men and drillers are depending on you to do this. This does not, by any means, mean that every man should not test the place before commencing work in any place, but if the skin-up man does not do his part, it makes it mighty unsafe for the men who have to follow him into the place.

"Again, Mr. Motorman, when you are pulling your mantrips, handle them carefully, keep your trips under control, keep at least 200 ft. apart. The men in your trip are depending on you. We are getting numerous complaints about going too fast.

"Again, Mr. Timberman, the whole Joy crew is depending on you to take down all loose top coal before the Joy enters the place, and then it is you who must prepare the props that are to be used for safety props as the place is being loaded out.

"One more thing, which concerns machine men, drillers, trackmen, and air-hose men. In going my rounds I find that now and then you forget to reline and block your track switches after you enter a place. This has been the cause of some serious accidents in the past; cars break loose or are put in not knowing that you are in the room. You cannot hear them because of the noise of your machine. Make a habit of blocking your switch; drop a cap piece in the open latch whether the place is uphill or downhill. It pays to create the safety habit. Thank you, good morning.

"If you find a place which you are not able to make safe in your judgment, notify your boss."

* * *

Chairman Jones: Thank you, Jack. This paper was not upon our printed program but we want to especially thank Jack for bringing that at this time.

I will now turn the chair over to our vice-president, Mr. W. J. Jenkins.

Vice-President Jenkins: Members of the Institute, before bringing the spring session to a close I would like to comment. I think the papers prepared show a large amount of time has been taken and care has been given to the facts as presented; and on behalf of the Institute I would like to thank those who did prepare and present the papers. The program of itself, I think, was very well presented and I think the Program Committee, of which Mr. Herbert Taylor, Jr., was chairman, is to be congratulated on the work they have done. Personally, I don't know of any Convention that has 100 per cent attendance at all of its papers being read, except the Illinois Mining Institute at its spring meeting, and I think, for that reason, the spring session on the river is a particularly happy solution. Is there any other business before the Convention? If there is nothing before us, we will bring the spring session to a close. We will now stand adjourned.

The following papers by Eugene McAuliffe, Paul Weir, L. E. Young, Chas. F. Hamilton, D. D. Wilcox, James White, T. J. Thomas, Lee Haskins, Paul Halbersleben, G. Stuart Jenkins, C. J. Sandoe, Frank M. Schull, Thos. Garwood, Jack R. Verhoeff, James McSherry, Ernest Todd and I. N. Bayless—all members of our Institute—were presented at the 1936 meeting of the American Mining Congress at Cincinnati and were published in "Coal Mine Mechanization," yearbook for 1936. We are grateful to the American Mining Congress for their full permission to give these papers to you herewith.

# MODERN PRODUCTION METHODS AND THE FUTURE OF COAL

By EUGENE McAULIFFE
President, Union Pacific Coal Company

With respect to coal production methods, it is safe to say that changes approaching the revolutionary have taken place in the past quarter of a century. Among the most conspicuous of these changes might be mentioned:

The increased percentage of coal undercut by mining machines.

The rapid extension of power-driven coal loading machines replacing hand shoveling.

The substitution of electric cap lamps for oil and acetylene lamps.

The almost general use of permissible explosives.

Marked improvement in all mine equipment and coal preparation methods.

Sweeping reductions in the number of major mine accidents suffered, as well as individual fatal and non-fatal accidents.

Conspicuous improvement in labor relations and the very general elimination of unduly depressed rates of pay, creating a more uniform competitive condition between competing fields.

A better balanced relation between capital invested in mines and annual output.

The items mentioned represent returns received from the cooperative effort of the coal operators, the manufacturers of equipment, the United States Bureau of Mines, and mine labor. Two major opportunities for further improvement remain to be explored.

The experience gained through the attempt to control labor relations, price regulation, etc., through, first, the medium of the NRA Code, and later the Guffey Act, have not proven satisfactory. This premise is well established by the fact that at no time has the industry as a whole been able to agree either on the necessity for, or the workability of any Federal enactment, constitutional or otherwise, to regulate by mandate an industry so widespread and presenting so many diverse angles as does coal. I commend governmental fact-finding, complete and made public promptly, as the most promising aid to cooperative effort.

That the application of labor organization relations has been expanded to the advantage of industry is acknowledged by the majority of coal operators. However, there yet remains ample opportunity for a better recognition of the necessity for continuous cooperation along legislative lines, as well as in matters relating to the more economical and efficient operation of the properties. The further safety of mine employes also remains a fertile field for betterment. The labor organizations should try to compose their internal differences, discontinue their caustic, irritating type of publicity, and give more consideration to matters of mutual interest to employer and employe.

The coal industry is coming back slowly, but "quick money," obtained in the past by artificially created strikes, over-emphasized transportation shortages and "selling out," are things of the past. We need a wider conception of human relationships in dealing with our employes, our customers, and each other. We need rescuing from politically minded bureaus and individuals. In talking to one of my associates a few days ago, and after we had discussed present and anticipated problems, we both agreed that each of our own individual situations could be best met by our "doing our job so well" that even though something cataclysmatic should occur to the nation or the coal industry, we would be asked to stay to assist in the restoration process.

This gathering here today represents a distinct contribution to the better attitude of mind to which I have referred.

# COAL PRODUCTION METHODS—TODAY AND TOMORROW

By PAUL WEIR
Vice President, Bell and Zoller Coal and Mining Company

Improvements in coal production methods are being made at an ever accelerating rate. At times, it seems difficult to keep abreast of developments. What has seemed impossible of achievement only yesterday is being done today.

For many years and up until the past decade or two, the chief problem of mining men was considered to be proper mining methods. This involved a choice between room and pillar, and longwall or modification thereof. When mining men met, discussions centered largely on this question of mining methods. Text books on mining devoted many pages to it and only a meager amount to other problems of production. Today, while not detracting in any way from the importance of proper mining methods, we are concerned more and more with production methods, of which mining methods is but one division. Other important divisions of production methods which today receive just as much attention as mining methods are transportation, safety, face preparation, face loading and surface preparation. In a broad way, production methods have to do with the methods of performing all of those individual operations, surface and sub-surface, directly and indirectly connected with the extraction of coal from the earth's crust and its preparation for the market. Likewise, broadly speaking, the term "methods" includes not only practices but also the equipment employed in these practices. It is safe to say that when considered from this viewpoint, the problems of coal production closely resemble those of production in a factory. In fact, they are more complicated than those of a factory because of those additional problems which are peculiar to underground mining.

As previously stated, production methods may be broken down into divisions. Each division has at least two problems in common with every other division. These are organization and equipment. Some generalizations on these two things may be made.

The manufacturers of mining equipment after years of expenditure of money and effort have developed and are offering to coal operators today, mechanical and electrical devices which in the hands of a skilled operator can perform practically every task in the production of coal. The result of this is that comparatively few common laborers are required in and around mines. What is required are operators of machines. Practically all of the equipment being offered by manufacturers has passed the experimental stage, and is being used successfully at some mine or mines. This equipment may not be perfect but at the same time it is not experimental. Its application in any specific mine may be experimental. Sufficient data and experience are available so that even the application of equipment need not be entirely experimental.

Organization of the working forces at a completely modern mine must be patterned after the organization in mass production industries. Workmen must be trained to become expert on a single task if the maximum in safety and efficiency is to be had. He can not be expected to be a jack of all trades. Coal operators can study factory management with profit to themselves if they desire to get the most out of any investment in modern machinery.

Above all, production methods of today and tomorrow call for the intelligent assembly of facts by engineers, the analysis of those facts and then a decision based on those facts and not on tradition. We must know the "whys" and "wherefores." Mining engineering has become to a large extent industrial engineering. The machine age in coal production is here. The nation-wide stabilization of wage scales and hours of employment has removed the opportunity to cover up lack of efficiency and intelligent management by wage cuts. The manufacturers of equipment are on their toes and have given coal operators the necessary mechanical and electrical equipment. The operator's problem is the intelligent selection and application of that equipment. Within a very few years, less than five in my opinion, mechanically loaded and cleaned coal will dominate the market.

Scientific research is finding its place in production. Complete and detailed knowledge of the coal in our particular mine or mines is necessary not only in mining but also in surface preparation. A specific instance will illustrate this point. All coal seams are made up of the banded ingredients, vitrain, clarain, durain and fusain. The physical and chemical properties of these ingredients differ greatly one from the other. Some break down more easily than others. For that reason, the nut size may have percentages of these ingredients which are different from the buckwheat size or from minus 48 mesh dust. The amount of ash and its fusion temperature change with any variation in the percentages of these ingredients. Today our preparation plants are turning out a relatively clean product. Tomorrow this clean coal will be separated into its banded ingredients by crushing, sizing and further washing. The results of this will be to produce grades of coal having physical and chemical characteristics far different from clean mine run. Research is becoming a division of production.

The coal industry is going through revolutionary changes. It is no longer backward. On the contrary, it is now becoming one of the most modern and progressive. With or without political regulation, it will forge on. Those in the industry who are "learned out" and cannot assimilate the new things will pass out of the picture. Those in the industry who have vision will be rewarded. Recently Mr. Sargent, president of the Chicago and Northwestern Railroad, made an addition to the old adage "necessity is the mother of invention" by saying "competition is the father of progress." Because of, and in spite of competition, coal marches on.

# PROGRESS IN RELATED FIELDS OF INDUSTRY

By L. E. YOUNG
Vice President, Pittsburgh Coal Company

One of the business magazines which many of you read contains a section headed "No Business Can Escape Change." Annually some of the great machinery companies review the progress and achievements in their field and we thrill at the progress they are making. The coal mining industry and every other industry is undergoing technical change, and these changes indicate growth, improvement, and progress. Let us forget for a few days the economic problems that beset us in the coal industry and get as much encouragement as we can by observing the progress that is evident in the industrial world as a whole.

The pamphlets of the American Mining Congress announcing "A Few of the New Things to be Shown at the Exposition" lists nearly 100 items. It is interesting to note that a number of these new things are brought to us from other industries; that is as it should be. Here at Cincinnati it is possible in a few hours, to have the best new things paraded before us—like models in a "Fashion Show." Moreover we have the opportunity to go to the manufacturer of these new things, learn who is using them, and, by personal interviews with other operators whom we actually know, verify the results they have secured with these new devices.

In discussing with our own staff the fields in which substantial progress can be made, we have pointed out that we must not overlook research in other industries, and the developments that are being made outside of coal mining. It has been our endeavor to have our men visit plants in other industries, to keep in touch with the technical literature in related industries, and to profit by the experience of men working in all industrial fields. Our research should take advantage of research in every industry, and the innovations in other fields that can be adapted should find a place promptly in our routine.

Coal mining may be considered from a number of viewpoints; one is that it is a materials-handling job, similar in many respects to other materials-handling jobs. From that point of view coal mine operation is handling coal, rock, water, air, and supplies as cheaply as possible. Whether we use explosives, drills, hand shovels, power shovels, conveyors, rails, pipe, rope, cable, cars, wheels, axles, bearings, lubricants, locomotives, hoists, pumps, building materials, air compressors, dynamos, motors, transformers, batteries, electric lamps, boilers, engines, fans, tools, tool steel, we can learn something from men and corporations in other industries who are using such tools, equipment, and materials. We must take advantage of all the experience they have had and we should search the industrial fields over to find the best tools, materials, equipment, and methods.

The automotive industry will teach us much about bearings and lubrication, the machine tool industry can give some help in steels for coal cutting, and the aeroplane research engineers have told us the secrets of air movement in their wind tunnels. The steel industry can point the way in multiple-shifting of plants and equipment. The railroads are applying light alloys in transportation. The use of welding is being extended in many fields at a rapid rate. From the electric power industry we can learn much on control of operations generally. An enumeration of all the new things attributable to the mechanical, electrical, and chemical industries would not be possible in the brief time available, but a serious survey of the exhibits, and attendance at the various meetings will, I am sure, prove that the foregoing statements are not exaggerations.

Most of the advances and the technical progress referred to may be brought to the eye by tangible exhibits, but many changes and improvements are being made which cannot be shown in an exposition. I refer to progress in research, management, and human relations. Other industries are stressing these subjects and they will receive some attention in the programs that are being presented. Your participation in the discussion will be helpful to others, and I am sure the respective chairmen will appreciate any contribution you may make on papers relating to the subjects just mentioned.

In this gathering of Practical Operating Men I wish to take the liberty of repeating something I said on mining research in an address in Pittsburgh six years ago. I feel more strongly than ever that in these days when we are talking so much about "New" things, we need to secure all the help we can get from the men in our own organizations—the rank and file—the men at the face. I believe "there is great need for more research of the type referred to as 'field studies' and 'field experiments.' Such research should be conducted by the mining companies themselves, under their own auspices, with their own officials and men. Many of the problems worth investigating require observations covering a long period of time. To secure the most reliable results there must be available, cost data which represent not simply a set-up for a test, but they must cover a period of production on a practical operating basis. There are few tests made underground that exceed in value those made by the regular mine crew who are interested in the problem before them. The coal mining industry needs more research done with the aid of the practical operating men on the job who should be given an opportunity, because of their ability and loyalty, to apply their knowledge in the study of the more or less involved problems at the working face.

"One of the greatest needs in the mining research field is the development of 'research mindedness' in more of the operating officials of the mine. It is not unnatural that mine bosses should be more or less aloof when new methods and new equipment are tried without consideration for their experience and judgment. Suggestions coming from the veterans at the face will frequently solve many problems. If the skill and talents of these men can be enlisted their cooperation will be assured, and we will be able to secure more data that will be on a practical operating basis."

One of the world-famous British mining machinery companies has operated a Suggestion Department for many years. From all I can learn this program has been highly successful. It has resulted in a fine feeling among the employes because they have been rewarded for their suggestions, and they realize that expansion of the company's business means a better opportunity for them; for the company it has been worth while, because it has produced a more cordial relationship in the plant, and it has given the company the best that each and every employe could give. A number of industries in this country are striving to use the talents of the rank and file through Suggestion Departments and similar plans which offer incentives for improvements in methods, equipment, and products, and I am sure that your careful consideration will prove the importance of improving any plan you may now have to secure the cooperation of your staff and working force so that you may use effectively all the skill and brain power of loyal employes.

In closing, may I leave with you the suggestion that while we are building bigger and better plants and mines and improving our operating methods on the technical side, we do not overlook the human side; we must give more thought to the training of face bosses, mechanics, and the men at the face. Most of these men are eager to help, to have a part in our program, and to have some recognition for their increased efforts. With their fullest cooperation even greater progress is possible.

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## OUR MODERN COAL INDUSTRY

By CHAS. F. HAMILTON
Vice President, Binkley Coal Company

It is my thought that the Program Committee in the selection of the subject of my brief talk had in mind the pointing out of certain changes in the coal industry which would work for its betterment and advantage. Possibly because of the complexion of the committee they were hesitant in using the words "New Deal" in connection with the subject.

Many men in the industry, at gatherings of this kind, express ideas which would undoubtedly place our industry in a class by itself as to the desirability of being connected with it, but one of the great difficulties has been and is the ability to formulate a set of rules to which all operators will subscribe and then enthusiastically and wholeheartedly put into effect.

A year or so ago I attended a meeting of the coal operators of an adjoining state where one of the older operators made a very interesting half-hour talk as to the ills of the industry and what should be done to correct them, and after the meeting I narrated the purport of his talk to a legal friend of mine, with the final remark that the difficulty in carrying out the speaker's suggestions would be the adequate policing of them. He replied that he knew a way of doing this, and when I asked the method, he said, "arrest them all." Perhaps that is the germ from which has sprung the present plan of Federal assistance. May I, however, for a brief few minutes ask your attention to two points which seem to me would be of value to our industry.

The first is better sportsmanship. You may say at once that this is only another term for cooperation, but I sincerely believe that the willingness to play the game in accordance with a reasonable set of rules and regulations would go far toward producing the results which we all are so earnestly striving to accomplish. In any sport the individual is naturally the unit, but in baseball, football, hockey, and many other games it is the assistance which one individual gives to another which makes championship teams. In fact, there are many instances where teams composed of individual stars are soundly beaten by a team where the members are ready to make some personal sacrifice for another member in order that the team play may reach the highest point of efficiency.

It has been said of the coal industry that they are not good sports because of a willingness to cooperate only to the extent of lack of expense or effort to the individual. In other words, many operators do not view questions of policy from the point of what is best for the industry as a whole, but entirely from the effect that it may have upon their particular operation. It always takes real courage to be a good loser, but not a great deal of fortitude to smile when you are winning. Would it not be good sportsmanship if in the event one of your salesmen called on a prospective customer to find that you did not have the proper quality of coal for his use to advise a competitor of the situation in order to prevent the business from going to some other type of fuel.

Quite naturally you may say, what shall these rules be, and who shall be the umpire. These are, of course, necessary adjuncts to the idea, but time will not permit of their discussion.

My second thought is one of greater initiative. Our product is different than many other products used today in that it is almost impossible to create an additional market. We all look upon coal as being the source of energy for heat, and quite possibly are not giving the attention towards the investigation and discovery of new uses for it. Then, too, it seems as if the relationship between the producer and ultimate consumer of our product is not as close as it should be. There are too many middle men between the man who mines the coal and the man who really consumes it, and in reality these are the two parties who are most vitally interested in the complete transaction.

Of course, lower costs of production, high realization, lowering of freight rates and uniform rates of wage must all have their places in the problem, but it is my belief that some time should be found for improving the sportsmanship and increasing the initiative displayed in the industry.

# CUTTING BIT TREATMENT IN SOUTHERN ILLINOIS

By D. D. WILCOX
General Superintendent, Superior Coal Co.

With the expenditure of several thousand dollars for the purchase of a machine, weighing several thousand pounds, it follows that the business end of that machine is worthy of considerable time and attention, even though that business end consists of less than half a hundred bits of steel weighing about ½ lb. each. The committee of operators, selected by the American Mining Congress to make a study of this subject in the mines of south central Illinois, has found that at practically all Illinois mines, where the coal is mined by machines, experiments have been conducted to determine the efficiency of treated bits. In most cases the experiments have led to the adoption of some method of bit treatment.

A large part of the production of coal in Illinois comes from Seams 5 and 6. Seam No. 6, the Belleville vein, the most extensive seam of coal in Illinois, is fairly flat with only local dips or grades. It is sometimes called the blue-band seam because of a band of bluish shale mixed with pyrites which is ever present, being 1 to 2 in. thick and laying from 10 in. to 2 ft. from the bottom. The coal runs from 5 ft. to 10 ft. in thickness, although areas have been found as much as 15 ft. thick. Usually it is found in three benches, the top coal, about 2 ft. thick; then a thin layer of mother coal or charcoal; then the middle bench, which extends down to the blue band and which is lined with streaks of "steel band," then below the blue band is the bottom coal, which is the hardest part of the seam. Generally the bottom coal contains no steel bands, but in many cases there are "black jacks" which extend from the bottom up into the bottom coal. As most of the cutting is done about 3 in. from the bottom, these "black jacks" are a serious hindrance to efficient operation of the machine, especially in the consumption of machine bits, and they are one of the reasons that some operators are now cutting the coal up above the blue band.

Seam No. 5, which is below No. 6, does not contain the blue band of No. 6. It is not so definitely laminated, and the cleavages are not so distinct. It is a harder coal, having fewer steel bands but more sulphur, and is not as level as the No. 6 seam. The average thickness is between 5 and 6 ft. In the northern No. 5 seam it has never been the accepted practice to undercut the coal, due principally to the prevalence of "horse backs"; and the mining there is by shearing cuts. The southern No. 5 seam, however, is undercut.

Both seams 5 and 6 are underlain with a hard gray shale, commonly known as fire clay. In many cases the 3 in. of bottom coal, under the machine cut, is left, as it makes a splendid floor and prevents the "fire clay" being mixed with the product.

The part of the state from which the information, gathered by the committee, was received includes the central and southern counties. In 1934 these 14 counties produced 33,987,243 tons, out of a total state production of 41,724,078 tons. In the same period this territory produced 26,767,409 electric machine mined tons, compared to the state production of 29,733,013 tons. These figures are given to illustrate the importance of the lowly machine bit to operators in this field.

Although most of these operators are now using some method of bit treatment, it was early found that there was more to the subject than mere bit treatment, as the test of the efficiency of a bit is not wholly measured in the length of its life or the number of places that can be cut without changing bits. Neither can it be measured by the original cost of the bit steel, or cost of treatment, or distribution cost. It is recognized, of course, that the bits could be manufactured of a grade of steel that would serve the demands of mine work. However, that grade of steel would require a corresponding degree of care in forging which would be reflected in comparative labor cost for sharpening. The grade of steel used in machine bits varies, depending on the kind of coal to be cut, the skill of the blacksmith, and the judgment of the engineer. With the establishment of chain machines came the bit hammer; and later the bit roller was devised, but at many operations the hammer is again in use. After all of the above considerations comes the real tests—the size of coal produced by the cuttings, the power consumed, and the repair cost of the machine, all three of which are interrelated and each very definitely related to the efficiency of the mining operation. The size of the cuttings may not be of importance insofar as its commercial value is concerned, but it is of value in a study to determine the proper shape of the bit.

It would be understood that the shape of the bit may vary under different cutting conditions, but the bits should be given an opportunity to cut the coal and not merely to wear a hole in the face. If the shape of the bit is not proper, it is inevitable that the better steel used, or the more careful treatment of the bit, only tends to throw a further load on the machinery end of the mining machine, thus transferring the saving made on the bits, plus interest, to the upkeep of the machine. Even assuming there were 20 bits in the coal and a 50-hp. motor driving the cutting machine under full load, it is plain that there is an average of 2½ hp. behind each bit, much more on some; it then is not difficult to realize the relation between the bit and the power consumed. It can also be easily seen what a slight change in the shape of the bit may do to change this power consumption. The relation between the power consumed and the cost of repairs is so well known that it would be out of place to discuss that angle. Now that machine bits are shaped by machinery, it follows that the machine should shape the type of bit best suited for that particular operation, and not to expect the coal to be cut by a bit that happens to be made by the shaper. The dies of the bit hammer or roller can be changed to suit most any mining condition. These dies, too, need frequent inspection and renewing.

When by tests of the cuttings (it being assumed, of course, that the chain is in good order) and by measurements of the power consumption, the proper shape of the bit has been determined, one becomes interested in treating the bit for longer life. Due to the fact that the number of bits used in the average Illinois mining property is more than 1,000, and in some cases more than 2,000 each day, it is not possible to give very much attention to tempering; and the practice for years was to drop the bits into hot, soapy water after sharpening. Under this method an occasional bit is properly tempered to stand the strain of cutting coal.

One large Illinois operation has solved this difficulty by using an oil and salt treatment, both drawn at 580° F. By tempering the bits in the salt bath, the bits can be drawn at the temperature best suited for the cutting conditions, thereby eliminating excess breakage and wear that happened under the old method. They not only use fewer bits, but have done away with broken bits. The oil used is a special nonflashing kind.

The general practice is to plate the bits by means of an acetylene torch, or electric arc, with one of several brands of nonabrasive material. The tipping is put on the face of the bit from the point and back about ½ in., care being taken that the plating material is put on evenly so that the face or cutting edges are not left rounded. The cost of the material used is so small that it hardly enters into the calculation. With just an average job of tipping, a bit will last twice as long, and it takes about as much time of the blacksmith to plate a bit as it does to sharpen it, so the labor charge for preparing the bit will remain the same. The plating is done in the blacksmith shop at the top of the mine; and some companies, who operate a group of mines, have found it advantageous to sharpen and plate the bits at one of the mines and deliver them to the other properties by truck. Usually the grinding is done at stations set up in different sections of the mine, the bits being ground about four times for each time they are reforged. The delivery may be made on the hoisting shift by means of the regular motors, or it may be made on the night shift in special mine trucks. At some operations very careful records are kept of the number of bits used each shift by each machine, even having specially designed locked boxes for carrying the bits; while at other equally well-managed properties the bits are delivered in bulk and shoveled into receptacles where the machine men get them. After all, when the correct design of bit is agreed upon, the record of the number of bits purchased per ton of coal will pretty well tell the story of the bits' efficiency.

With the average plated bit the changing time will be cut in half, besides, of course, the saving in the original cost of the bits. The loss of bits is greatly reduced because the bits have an added value to the machine runner, and because most bits are lost when they are being changed. The life of the bits vary at each operation. Sometimes, due to different conditions in the same mine, the number used on each machine is widely varied. There are four types of machines used in these Illinois mines; the breast, shortwall, mounted cutter, and the shearing machine. The first three of these types, cutting parallel with the laminations of the seam, do not show any difference in the number of bits used per square foot of cutting, but the shearing machine sets up another problem, having to cut through the bands in the seam.

The kerf may be from 4 in. to 6 in., while the depth of cut varies from 6 ft. to 8 ft. 6 in. Depending on the chain, and the kind of coal cut, bits are used, before discarding, from 10 times at some properties to as many as 40 at others; and it is considered good service when 20 sq. ft. of kerf area is cut per bit used.

The practice is to purchase bit steel blank cut. This idea not only allows more bits to be forged from a given weight of steel but also takes less "smithing" time in forming the original bit. The size used is either ½ in. by 1 in. or ¾ in. by 1 in. Many different types of bits have been tried, large bits, small bits, nonresharpening bits, round bits, and double-ended bits, besides bits of different shapes. Manufacturers have been cooperative and helpful, not only with experimental bit sizes and shapes but also with different chain designs.

The practice of plating or tipping the bits in Illinois mines is not a mere hit-and-miss proposition, but is a process arrived at after many trials and experiments. The methods of treatment and the results obtained have been covered by many excellent papers given in past meetings of the American Mining Congress.

# MECHANIZED MINING IN INDIANA AND ILLINOIS

By JAMES WHITE
General Superintendent, Peabody Coal Co.

In discussing the progress made in mechanized mining in the States of Indiana and Illinois, it is well to be advised as to when the idea of mechanized mining was originated and the development of machinery for coal loading purposes.

The earliest record of the installation of such machinery in the United States was the year of 1888 when a Stanley header was brought to the United States from England and operated to some degree in the States of Colorado, Iowa, Illinois and Pennsylvania during the years 1888 to 1893, inclusive.

During the succeeding years different manufacturing companies experimented with various types of mechanical devices for loading coal.

The experimenting with mechanical loading devices was not confined to any particular mining state or seam of coal but extended into practically every coal-producing state.

Since the writer is limited to the progress made in mechanized mining in the States of Indiana and Illinois, with limited time, it will be necessary to confine ourselves to the experience of mechanized mining within these two states.

In the year 1903 a coal loader was designed by W. E. Hamilton and installed by the St. Louis and Big Muddy Coal Company, Dewmaine, Ill. Evidently this machine was operated successfully as the records show that ten of these machines were ordered and delivered to the Zeigler Mine but only one of the machines was actually operated because of the opposition of the employes to the use of such machines.

From the year 1903 but very little progress was made in the development and use of coal loading devices until the year 1920, so far as actual production was concerned in these states.

In the year 1920 the Pike County Coal Corporation, Petersburg, Ind., installed what was known as the McKinley entry driving machine. By agreement between the United Mine Workers of America and the Pike County Coal Corporation, the men engaged as operator and helper on this machine were paid $12 per day of 8 hours and $8.14 per day of 8 hours, respectively.

As late as this date old-time operators were skeptical as to the successful operation of machines for coal loading purposes as it will be noted that this coal company was required to make what is known as a local agreement covering wages for men employed on this machine and were not represented or advised by the Coal Operators Association, which had always negotiated wage agreements for the coal operators of this state.

In the year 1922 the Ingle Coal Company installed a Joy loading machine at one of its Ayrshire mines. At this time, by agreement between the Ingle Coal Company and the United Mine Workers of America, the wages of the operator and helper on loading machines were equalized by dividing the rate of $12 and $8.14, establishing a rate of $10.07 for each man per day of 8 hours.

This became the standard wage for the operators and helpers on loading machines and conveyor pit-car loaders for this state during all the period that the basic inside day wage of $7.50 was in effect.

This was the first underground mine in Indiana to be completely mechanized.

Since 1922 there has been a steady change from pick and hand loading to mechanized mining. While there is no complete available records for the years prior to 1930, the record for that year shows that the total number of tons produced with pick-up loading machines for Indiana was 2,014,533, while 875,830 tons were produced by the use of pit-car conveyor loaders and 7,470,800 tons were produced in mines using only hand loaders.

For the information of those interested, I am submitting a table of coal production for the State of Indiana during the years 1930 to 1935, inclusive.

The experience of progress made in Indiana is exactly similar to that in Illinois. Intense mechanization started in each of these states at about the same time and bears about the same proportionate change from hand loading to mechanized mining for the same period.

The seams of coal being somewhat similar in texture, physical conditions, etc. (except that the mines in Illinois are favored with much higher seams) permitted the exper-

INDIANA PRODUCTION BY FOLLOWING CLASSIFICATIONS FOR YEARS SHOWN

| Year | Strip | Hand loading | Pick-up loading machines | Pit car conveyor loaders | Total |
|---|---|---|---|---|---|
| 1930 | 5,591,045 | 7,470,800 | 2,014,533 | 875,630 | 15,952,008 |
| 1931 | 5,227,487 | 5,311,516 | 2,132,418 | 1,034,127 | 13,705,548 |
| 1932 | 5,633,897 | 3,841,589 | 2,237,464 | 844,079 | 12,557,029 |
| 1933 | 4,952,419 | 4,493,430 | 2,467,532 | 1,168,130 | 13,081,511 |
| 1934 | 5,863,973 | 3,121,201 | 4,346,510 | 798,381 | 14,130,065 |
| 1935 | 6,394,633 | 2,972,674 | 4,977,724 | 603,748 | 14,948,779 |

NOTE: This table also includes the production of strip-mined coal for the same period, showing the increase in this form of highly mechanized production.

STATEMENT SHOWING PROGRESS OF

| Year | Total State Production | Tonnage From Shipping Mines | Percent of State Production | Number of Shipping Mines | Tonnage From Local Mines | Percent of State Production | Number of Local Mines | Tonnage From Loading Machines |
|---|---|---|---|---|---|---|---|---|
| 1926........ | 69,813,256 | 67,836,441 | 97.17 | 244 | 1,976,814 | 2.83 | 677 | No record |
| 1927........ | 46,949,700 | 44,926,433 | 95.69 | 241 | 2,023,267 | 4.31 | 665 | 1,377,092 |
| 1928........ | 56,211,082 | 54,284,184 | 96.57 | 206 | 1,926,898 | 3.43 | 651 | 2,224,157 |
| 1929........ | 61,127,759 | 59,075,995 | 96.64 | 200 | 2,051,764 | 3.36 | 603 | 6,395,533 |
| 1930........ | 54,035,116 | 51,996,608 | 96.23 | 185 | 2,038,508 | 3.77 | 754 | 10,224,399 |
| 1931........ | 45,152,623 | 43,073,058 | 95.39 | 167 | 2,079,058 | 4.61 | 810 | 10,187,429 |
| 1932........ | 34,120,786 | 31,402,399 | 92.03 | 162 | 2,718,387 | 7.97 | 931 | 7,893,567 |
| 1933........ | 38,320,125 | 35,390,677 | 92.36 | 159 | 2,929,448 | 7.64 | 1,107 | 10,885,310 |
| 1934........ | 41,724,078 | 38,655,527 | 92.65 | 172 | 3,068,551 | 7.35 | 1,175 | 11,626,067 |

imenting with and the use of all types of mechanical devices for loading coal in these two states.

The record of production of coal for Illinois by the various types of mining is available for the years 1926 to 1934, inclusive, and is shown in above table.

One of the reasons for the slowness in the development of this system of mining was brought about by the lack of experience of the men employed to operate the machines and the necessity of their being taught by demonstrators furnished by the manufacturers of such machines.

Our experience has compelled us to conclude that even those representing the manufacturers of loading machines as expert engineers were unable to determine readily the lack of efficiency of the machines and loss of time because of unnecessary breakage of machinery and in many instances the inability of such experts to discover reasons for the failure of the machines to function properly when there was no breakdown at all.

But like all other changes in the method of operating industries, these faults are fast vanishing.

In addition to the above-mentioned handicap, mine managers and mine foremen, because of the lack of experience, took it for granted that coal could be shot and prepared in the same manner as the miner prepared it to be loaded by hand and that track, timber and transportation systems could be maintained in the same manner as they were in hand loading without disadvantage to the loading machines.

During the years that machines have been in use, mine managements have discovered that there must be a standard method of drilling, shooting, preparing coal and timbering working places and in their transportation systems to obtain the highest degree of efficiency from mechanized mining.

I may say in passing, that it is necessary to have different standards for the various mines and even in some instances in the same seam of coal.

The operators of Indiana and Illinois have gone through a period of costly pioneering in mechanized mining. During this period they have had the fullest cooperation

## MECHANICAL LOADING IN ILLINOIS

| METHODS OF MINING IN SHIPPING MINES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Percent of Production | Number of Machines in Use | Tonnage From Conveyors | Percent of Production | Number of Conveyors in Use | Tonnage From Strip Pits | Percent of Production | Number of Strip Pits | Tons Loaded by Hand | Percent of Production |
| ........ | ...... | No record | ........ | ........ | 3,582,611 | ...... | 16 | 64,253,839 | ........ |
| 3.06 | 83 | 280,766 | .63 | 46 | 2,757,408 | 6.14 | 15 | 40,511,167 | 90.17 |
| 5.94 | 125 | 3,517,997 | 6.48 | 867 | 4,224,017 | 7.82 | 15 | 43,298,013 | 79.76 |
| 10.82 | 219 | 11,434,835 | 19.36 | 1,909 | 5,250,501 | 8.89 | 17 | 35,995,126 | 60.93 |
| 19.66 | 256 | 13,025,482 | 25.05 | 1,982 | 6,220,336 | 11.97 | 15 | 22,526,391 | 43.32 |
| 23.65 | 289 | 12,258,373 | 28.46 | 2,131 | 6,548,798 | 15.21 | 16 | 14,078,460 | 32.68 |
| 25.13 | 302 | 7,519,089 | 23.95 | 1,978 | 6,628,228 | 21.11 | 17 | 9,361,515 | 29.81 |
| 30.76 | 290 | 6,880,906 | 19.44 | 1,462 | 5,599,006 | 15.82 | 20 | 12,025,455 | 33.98 |
| 30.08 | 281 | 6,974,107 | 18.04 | 1,340 | 6,008,218 | 15.54 | 26 | 14,047,135 | 36.34 |

from the manufacturers of loading machines and pit-car loaders of the various types, which has resulted in extremely beneficial improvements to such equipment.

This pioneering, as explained above, has proven to the coal producers of this nation the necessity of producing coal mechanically.

In conclusion I wish to predict from my experience with this type of mining and the progress made in the States of Indiana and Illinois, as shown in the above-quoted tables, that within the next few years but very little coal will be produced by hand-loading method and the operators who wish to remain in the coal industry will see the necessity of complete mechanization for the purpose of decreasing the cost of production, thereby off-setting the encroachment in our markets of competing substitute fuels.

# MODERN TRUCK HAULAGE

By C. F. HAMILTON
Vice President, Binkley Coal Co.

Unquestionably during the past year operators having open pit mines have given more attention and thought to the transportation of coal from pit to tipple by means of motor trucks than by any other system.

At the convention last year interesting and instructive papers treating of this method of transportation were read and it is difficult to report to you new developments without repeating some of the information then presented.

In general, one fundamental factor of cost applying to transportation by rail and water applies also to transportation by motor truck, namely, "The larger the bulk load per carrier, the lower the unit cost of commodity transported" providing large capacity loads can constantly be handled, and other plant equipment is properly balanced in relation to capacity. As an example it would not be economical to have a 20-ton truck operating in conjunction with a 1 yd. shovel. A 20 or 25-ton truck coordinates its capacity economically with nothing less than a 3½-yd. shovel. It will be seen, therefore, that plant size and balance in relation to motor truck size is an important fundamental of coal haulage by motor truck.

Let us briefly consider seven points which have had investigation and study by all operators interested in this type of transportation.

*Length of Haul*—The length of haul, or the distance from pit to tipple. I believe that there is a very definite limit to the distance any size motor truck can haul coal economically from pit to tipple. In general, I believe this distance at the present time is within a three-mile radius, or six-mile round trip. A haul beyond this distance may be very properly a coordinated truck and rail haul. Time and more experience may prove this conclusion in error, as so many other factors have an important relationship. Hauls under three miles show unquestioned economics.

*Grades*—The ability of motor trucks to negotiate relatively severe and short grades, and thereby shorten the distance from pit to tipple, is one of the outstanding values of motorized transportation. The proper grade limit out of the pit seems to be somewhere in the neighborhood of 6 percent. Trucks of proper power can maintain a reasonably fast cycle between pit and tipple over a 6 percent grade. Length of grade is, of course, dependent on the amount of overburden. If trucks are properly powered in relation to their total gross weight, grades of as high as 15 percent can be negotiated, so it will be seen that a wide factor of safety is maintained if a 6 percent grade is provided.

*Roads*—Roads from the pit to the tipple should be well graded and provide the least amount of rolling resistance to tires. They should also be well ditched for drainage, and wide enough to permit passage safely of two units going in opposite directions. Roads on the surface are highly important, and if the mine layout can be such that a fast hard-surfaced highway can be permanently used for the duration of the mine operation, considerable expense is justified in good road construction.

*Flexibility*—The flexibility of trucks to meet the peaks and valleys of production is most pronounced. They are more easily speeded up, and with less expense, can be reduced in capacity. Contrary to the old axiom that "A chain is as strong as its weakest link," if a truck for any reason is forced out of service the chain is not broken. The link automatically removes itself and the chain continues operation, and can be speeded up to close the gap in production.

*Life*—The definite economic life of trucks in mines, I do not think is known, but it seems reasonable from factors already determined that a well-designed truck, or truck and trailer, if properly maintained, should have a successful and economic life of at least 10 years. I am of the opinion that you receive in value just about what you spend in capital. I do not think that undersized trucks, or large trucks loaded beyond the capacities their manufacturers' engineers are willing to guarantee in writing will prove economical. Mine operation is rugged, hard work and truck equipment must be well designed and be made of the best material to withstand the service we demand of them.

*Choice of Type*—Choosing the make and type of equipment has confused many operators. After a visit to many mines their confusion was greater than ever. No two operators seemed in accord. Each operator defended his particular choice and made his recommendations to the visiting operator accordingly. We all defend our own judgment and conclusions. The same situation probably exists in our choice of passenger cars. Possibly there is one best type and make. Time will develop this, and type and make will gravitate in one or two directions. In the meantime, it seems to me that there are several basic principles of purchasing that can be used. The problem in the first instance is an engineering problem. No amount of sales enthusiasm will put performance or low cost operation into any equipment. Salesmen disagree rather widely. Most designing engineers do not disagree very much on basic principles or known quantities.

We all want low cost. What type shall we adopt? What make shall we buy? Shall it be truck and trailer? Shall it be truck only with dump body? If tractor, shall it be four-wheel single-axle drive for one trailer or two trailers? If tractor, shall it be six-wheel tractor four-wheel drive and large single trailer? All of these types are in service in various mines, each with the operator's endorsement.

This, I am sure, will convince you that engineering is more essential on the part of the manufacturers than salesmanship. Purchase price is not significant; operating cost is extremely important. The total purchase cost of a truck represents only 20 percent of its actual cost over its life of operation. Therefore, it seems desirable that we pay most attention to the 80 percent factor of cost.

*Important Factors of Design*—There are certain factors of design that seem to me to be important. Turning radius is of outstanding importance for short turning in congested mine areas.

An engine not so large as to be expensive in maintenance and unbalanced in design in relation to driven units that must absorb its power output, yet not so small as to be compelled to operate beyond its normal capacity to handle the gross loads involved.

A rear axle, or final drive, that must have capacity for extreme abuse and an allowable torque and horsepower capacity much in excess of the torque and horsepower output of the motor, and have a radial load carrying capacity in keeping with the severe operating conditions that are encountered in mine operation. The same can be said of clutch and transmission.

Tires must be oversized in relation to rated capacity to obtain maximum mileage at low cost. Wheel diameters should be largest available to provide greatest overall diameter of tires for axle clearance and to reduce wheels dropping into uneven levels on coal vein to the maximum.

# MECHANICAL LOADING AT VALIER COAL COMPANY

By T. J. THOMAS
President, Valier Coal Co.

Mechanization of coal mines is not altogether a new problem. Increased cost of production by obsolete methods has brought the question actively to the minds of those charged with the responsibility of effectively operating their properties, in the hope they may continue to sell their product in the competitive market, and at the same time make a profit.

I maintain that most, if not all mines, can be mechanized with profit to both management and employes. While it is true fewer men are required in the mechanical operation of a property, yet those employed after mechanization takes place are surrounded with safer conditions in that, generally speaking, the hazard from accidents is minimized. The great majority of the men engaged at the face under mechanization are able to maintain a safe distance (in the performance of their work) from wedged or tight coal. I have had occasion to check the performance of a number of companies operating on a hand basis, as well as those which have become mechanized, and in every instance the mechanically operated mines have experienced fewer accidents per million man hours of exposure.

Mistakes can and have been made by too rapid expansion in mechanizing. Every mine is a study unto itself. Management must be actively brought into play to determine what unit or units should be introduced, consistent with existing physical conditions. It is frequently found that a machine that may be used advantageously in one property does not lend itself in producing an efficient operation in another. This fact is strongly emphasized because practically all properties in operation today have been laid out and their development or advance work maintained by the hand method of operation. It is this problem that calls for the exercise of managerial ability, in other words, common sense.

When this is met, it is important that the question of underground transportation and power requirements should be studied, so that a substantially high perfection, from the standpoint of these two problems, may be reached, because in the mechanized production of coal, unless all phases of underground operation are synchronized with the hoist, much of the saving will be lost.

I am acquainted with a certain property where apparently all of these problems had been met and intelligently solved. The loading units were not operated to reasonable capacity. The haulage was efficient, but a condition arose whereby the productivity per mechanical loader and per man-day was not brought to a sufficiently high standard of efficiency. This plant originally had been laid out to operate on a hand basis. It was believed there was sufficient pit car ownership to serve the mechanical loading machines so that their reasonable capacity might be reached, but a study developed that because of less weight placed upon the mechanically loaded car, contrasted with one loaded and "chunked" by hand, the actual carrying capacity was substantially reduced. Later when the ownership of pit cars was increased, the productivity per unit of machine and per man-day expended rose in direct ratio to the increase in carrying capacity, because the limit of the hoist had not been reached.

These operating problems to which attention is called are not new, but they are manifestly important in the matter of successful mine mechanization, since all properties so operated are obliged to pay their workmen a daily wage; at least this is true in Illinois. Delays encountered through lack of power, faulty haulage, too few pit cars, or other causes, and the consequent loss in production (by reason of these factors), contrasted with the total wage expended, plus fixed charges, run into a large sum of money. There is nothing mysterious about it. It simply resolves itself into a question of applying effective supervision. Again, just common sense.

Too much emphasis cannot be placed on the proper maintenance of the machine. Money intelligently spent to increase the availability of the mechanical unit is reflected by reduced production costs.

While there admittedly is a decrease in labor costs through mechanical loading as compared with hand loading, it is a fact that more material, machinery, and power lines offset (to a substantial degree) a portion of this decrease.

# DISCUSSION ON INCREASED EFFICIENCY IN TRANSPORTATION

By LEE HASKINS
Superintendent, Bell & Zoller Coal and Mining Co.

Haulage has been quite a problem in mining for years. Speaking of main-line haulage maximum tons per hour safely and economically produced require that the main-line haulage be so laid out and operated that the cages or skips are supplied with coal at all times.

In order that such a condition may be maintained there are a large number of items to be considered. The grades have to be taken care of, the ties should be of proper size to support the loads, and should be treated. The rails should be overweight rather than underweight. The track should be kept in good condition and well cleaned at all times. There should be a sufficient number of passing tracks, and on the main bottom as well as on the inside there should be ample space for the storage of loaded cars and empty cars. Turns should not be so sharp as to cause undue restriction of speed, and the frogs and switches should be of the proper design and well maintained. The locomotives should operate at full voltage at all times. They should not be overloaded, and every locomotive should be given a limit as to the number of cars to be hauled. Also tire wear, both tread and flange, should be kept within practical limits to prevent derailments.

Also in this connection it is desirable to have sufficient mine cars, and it is better to have a surplus of cars of maximum carrying capacity. Excessive speed should be avoided, and every precaution taken to prevent derailments and accidents.

A system of dispatching and signaling should be provided, so that the motormen are informed of the number of empties to be picked up and to what parting to be taken. With good track and haulage equipment, the greatest problem in haulage is car distribution and the most efficient method of *distributing* cars is with a dispatcher, who controls the movement of every piece of equipment on the main-line system. The dispatcher should be located near the bottom, with a dependable telephone service to all points where loads are to be picked up, empties taken, trips made up, passing points, motor repair shop, and, in fact, to all points where the movement of cars or locomotives is started or may be interrupted.

The movement of any equipment on the haulage system should be at the order of the dispatcher up to the point where the gathering locomotive is to take the cars from the sidetrack. Then it is up to the gathering-locomotive crews and the section foreman to manage the placing of single cars.

As soon as the dispatcher comes on duty he should know where all the haulage equipment is located. This information should be left for him by the foreman on the night shift. Then he must be supplied with simple forms, so he can keep account of the cars and can quickly determine where he stands at any time during the shift.

Selection of the type of mine car to fit conditions will aid haulage. In large mines the largest mine car consistent with the conditions, and equipped with good bearings, is justified. Mine cars in bad condition cause a lot of wrecks, and poorly kept-up cars add to the cost of track upkeep.

Selection of locomotives to be used requires careful planning. Also every haulage system will have locomotive failures; so to prevent locomotive failures being turned into lost tonnage, it is necessary to have extra locomotives of each class, and the number of locomotives as extras is determined by the necessity for constant tonnage. Careful inspections and expert maintenance of locomotives will do a lot towards preventing locomotive failures.

It used to be an easy matter under the old hand-loading system to crowd the mine full of men and to have enough extra haulage equipment in service that one hour delay did not mean anything and it was easy to *distribute* cars under those conditions. But to get full capacity and to service a loading machine that is loading 550 to 600 tons in seven hours with a single car change is almost a science and takes a lot of thinking.

Mechanical loading presents the most difficult problem in gathering haulage because of the increased tonnage per place, fewer working places are served, and greater efficiency must be attained in order to maintain a steady production. The use of a larger car greatly reduces the time lost in changing cars, thereby increasing the loading time of the loading machine. As I stated before, it is the gathering-locomotive crew and section foreman's job to take care of the placing of cars when they reach the inside sidetrack.

Our mine is 100 percent mechanical loading, and the roof conditions are so that it has to be worked on the room-and-pillar system, therefore making it a one-car change proposition. Last year our company put in some very high-speed loading machines—11-BU Joys and one Goodman track machine. These machines will, in a fresh fall of coal, load a 4 to 5 ton car in 30 to 40 seconds. Therefore, it was up to the operating department to speed up our car change to keep the coal away from these machines.

After trying out several different plans of car changes in different panels with some success, we have found that the double motor car change gives us the best results. With this system we use two motormen and one trip rider on each machine. All the rail and switches in the panel entries are 35-lb. steel up to the car change, from there on to the face it is 25-lb., except on the Goodman track machine, which is all 35-lb. The cross cuts for car changes are driven on 45-degree angle and the track in these panels and cross cuts cannot be laid in a hit-and-miss layout, but must be up to a standard, so that the locomotive can speed up and make a rapid car change without much danger of derailment. With this system we have been able to make car changes within 10 to 15 seconds.

We also put a small piece of trolley wire in each room up to first cross cut. This keeps all cables off of the entry, and the locomotive cables are independent of each other while running, as they use different rooms going in and out to the entry; puts cables out of the way of swing locomotive that comes into panel to get loaded trip and place empties; and also helps the loading machine and cutting machines, as they do not have to go out on the entry when they change places.

We have a rather long chain, track and equipment maintenance, cutting, drilling, loading, power distribution, placing the proper men in the right place. Any one or more of these left to take care of themselves will not make a good haulage.

# TRACK CONSTRUCTION ON SHORT AND LONG LIFE HAULAGEWAYS

By PAUL HALBERSLEBEN
General Superintendent, Sahara Coal Co.

The Sahara Coal Company has operated four shaft mines for the past few years. Previous to that they had as many as nine mines in operation. This is mentioned so that you will have the background of abandoned mines with used material recovered as an explanation for certain practices followed.

There are three basic policies followed in track construction at these properties which are tempered by available material and equipment. These are the elimination of abrupt grades, regular curves of long radius, and the use of treated ties on all main and intermediate haulageways.

The room tracks are a mixture of 16 and 20 lb. rails laid on untreated wood or steel ties. The mixed rail creates a problem with the use of steel ties, but where necessary to use steel ties because of headroom the rail is segregated as to weight. Short-wall machines are used for undercutting, which, combined with the lighter 8-BU Joy, allow a satisfactory service from these light rails. Close proximity to a timber-producing area permits the purchase of hewn room ties at a cheap price. We have experimented some with the treated room ties and find that the regularity of the sawed tie is an advantage, especially in laying the switches. However, the class and size of timber making up hewed room ties is such that the low price at which these are available and short life of room track considered, it was decided to continue with the raw ties locally available.

The No. 5 vein, in which we operate, is extremely rough in some sections, with a general rise as the coal approaches the crop. This roughness, together with faultings, makes permanent entry track construction expensive and slow for an Illinois mine. Our practice in these rough areas is to eliminate the local unevenness, generally through brushing the top. This is of shale, which can be readily drilled by the same electric post drill as used in the coal, with the same bits and augurs. The loading is done with loading machines at a fractional part of the cost of the same work by hand. Wherever coal levels permit, no grade of over 2 percent is established. However, many of the main-line tracks are laid at slightly over 4 percent.

The tendency is naturally for high speeds in going with the grade. We do not find this especially harmful with track to gauge and with suitable curves and alignment.

We have finally adopted a plan of our engineering force laying out all curves and track deflections on the secondary as well as the main haulageways, after many failures in trying to do that without adequate engineering. This results not only in regular curves but generally saves pillars and the cost of slabbing and shifting the track where the mine foreman depended on his own eye. A well-laid curve permits the motorman to maintain his trip at speed without the effects generally attributed to too much speed on poor track.

The abandonment of the mines has made available the tipple rail, ranging from 60 to 80 lbs., for use on the main entries. The mixed light rail is used in rooms. There is a considerable tonnage of 30-lb. rail formerly used in main-line haulage which we use for both intermediate haulage lines and in room entries.

The light frog and switch equipment is all 20 lb. or less, so we only use 30-lb. rail in the room entries on the one straight rail away from the frog. In addition to using available material, we find that this heavier rail substantially stiffens the track and keeps it in better alignment.

One of the biggest gains from track being placed in alignment with regular curves together with the heavier weight rail, aside from the ability to move the trips with speed and safety, is the ease with which this track can be maintained. Resurfacing of newly laid motor roads is done as quickly as unevenness develops in the track and is continued until the fills and road bed have become fixed.

These are generally dry so that we have had little experience with holding roads on soft bottoms. Wherever we do encounter a wet condition arrangements are made to keep the water out as the fireclay bottom quickly softens to a considerable depth and the track starts moving. It has not been found necessary to introduce any ballast except cinders occasionally to overcome some local soft condition caused by an accumulation of water.

It is our opinion that the one greatest single factor in the improvement of mine tracks at these properties has been the introduction of treated motor-road ties. The fact that a motor road is laid on ties which are 100 percent good and which hold the track to gauge will overcome many mistakes in installation or laxness in maintenance.

The mines are adjacent to a timber producing area so that mine ties of all sizes are available at very favorable prices. This probably accounts for our slowness in adopting the treated ties which were not introduced until about eight years ago. After a period of trial to determine the most suitable woods for our particular section, and especially after we found that our raw ties were not wearing but simply rotting, treated ties were adopted generally.

We buy ties sawed from any of the southern hardwoods, including gum, and find them so far equally satisfactory. We experimented with yellow-pine ties but believed that wood was too easily splintered and crushed if a car were derailed. The gum ties give the least trouble from this cause where cars pass directly over them.

We have done very little experimenting with different treatments having started out with zinc chloride using timber where ½ lb. per cubic foot had been applied. Later we used some timber treated with ¼ lb. zinc meta arsenite. These two treatments were selected because there was no odor or residue on the timber due to treatment and eliminated the possibility of encountering trouble from the miner if creosoted ties were brought in. The partial flooding of one of our properties quickly convinced us that the zinc chloride treatment leached out rather rapidly in water.

Since then we have started to introduce ties treated with creosote and have had no comment from the miner either as to odor or any effect the treatment might have on his skin from the rather intimate handling of these ties which is necessary in low coal.

Practically the only failures in treated ties have come in the zinc treated where they were covered with water for several weeks. There is no other reason for changing from zinc to creosote except that we occasionally may encounter water.

We find that the evenness and regularity of the sawed ties give much greater rail bearing surface than the average of hewn ties. Because of this we use only small ties, the largest being 4½ in. x 6 in. We have one main line laid on these ties with 60 and 70-lb rail with a grade of slightly over 4 percent favorable to the load over which an 18-ton locomotive operates. In about six years of operation no tie replacements have been made or track work because of the gauge widening. The track is kept surfaced and in alignment with little labor.

Generally, track should be constructed for the service and equipment to which it will be subjected allowing for the overall life and tonnage in a general way. But the main fact which should not be lost sight of is that the track is installed to get coal out. The one thing we have done which more nearly does this than any other one thing—build a dependable track at a reasonable cost—is the use of treated ties, with whatever help we get through eliminating abrupt grades and establishing long radius curves.

# WELDED TRACK JOINTS IN COAL MINES

By G. STUART JENKINS
General Superintendent, Consolidated Coal Co.

With the event of mechanization at one of the properties of the Consolidated Coal Co., came the usual trouble of insufficient power, which was unusually accentuated by the fact that we concentrated mechanization at this property in one corner of the mine.

We took care of the power question at the loading units by the installation of motor generator sets, but the some 1½ to 2 miles of main-line haulage with a 1½ percent grade against the loads was a constant source of aggravation, especially when the loading was at its peak and the haulage heavy.

We rebonded and had some relief, which was short-lived, due to a wet condition on the haulage road and the fact that we carried a "dog" on the back car of each trip as a safety precaution against the grade conditions.

In the early part of 1933, we decided to arc-weld the rail joints in a short section of track where the trouble was at its worst. After so doing, we watched the section for a few months and decided that we had the trouble licked; and since that time all main-line track has been arc-welded, with the exception of the switches and frogs, which are double-bonded to make replacements easier in the event of a wreck.

We used storage-battery locomotives on the secondary haulage, which precludes the necessity of any bonding on that track.

As to the arc-welded joints on the main-line motor road, we find that we have a "unity" bond test at the joint, as compared with about 5 ft. of rail equivalent with bonds and also a joint that is practically permanent.

The procedure in putting in the main-line motor road is to lay the track and put on the necessary angle-bars and get a section of track all surfaced up and the trolley wire hung, the rails having been butted with about ⅛-inch gap, the ball is then "V'd" out clear down to the angle-bar with an oxy-acetylene cutting torch. This "V" is then arc-welded, using a general purpose rod and building up to within about an eighth of an inch of the top of the ball.

The angle-bars are then arc-welded to the rail all along the top and down the sides, the thought being that the price of the angle-bars would be more than offset by the additional time that would be required to jig the work were angle-bars dispensed with. Having welded all available contacts of the angle-bars with the rail, the depression that was left in the "V'd" section is then built up with a manganese rod to level with top of the ball. This gives a hard surface at the joint and does away with depressions wearing in the rail at the joints.

As to the actual procedure, the equipment necessary is somewhat cumbersome. Two men work together, each being equipped with a locomotive and truck. The front man has oxy-acetylene cutting equipment and grinding and cleaning equipment mounted on his truck. He "V's" out the ball and cleans the work along the line of contact of the angle-bars with the rail, then moves along to the next joint.

The second man has the M. G. set electric arc-welder truck, which is equipped with a trolley pole to furnish power to the motor of the welder. The welding machine is provided with a polarity reversing switch, and one line is grounded to the axles of the truck, so that all that is necessary is for the welder to put a rod in his electrode holder and strike an arc.

After making all his welds with the general purpose rod, he puts a manganese rod in his holder and throws the polarity reversing switch and applies the hard-surfacing rod, and moves along to the next joint.

As to the amount of material used and the time involved, the following is an average comparison of arc-welded joints vs. bonded joints:

COST OF 100 WELDED JOINTS

| | |
|---|---|
| Acetylene | $ 4.14 |
| Oxygen | 5.34 |
| 123 lbs. gen'l purpose rod @ .06 | 7.38 |
| 9¼ lbs. manganese rod @ .76 | 7.03 |
| 56½ hrs. labor @ .78½ | 44.35 |
| Total | $68.24 |

or 68¼ cents per joint.

COST OF 100 BONDED JOINTS

| | |
|---|---|
| 100 28″ 4/0 copper bonds @ .63 | $63.00 |
| 29½ lbs. copper electrodes @ .33 | 9.74 |
| 35¼ hrs. labor @ .78½ | 27.67 |
| Total | $100.41 |

or $1.004 per joint.

In both cases, the cost of necessary power and overhead for equipment has been omitted, as the difference in power consumption would be negligible on a cost basis; and, as for the equipment, we already have it, and the depreciation involved is negligible, as well as the maintenance.

However, the resulting joint, when arc-welded, is one that is free from trouble, as it does not loosen up and gives a conductivity equal to the rail section.

For cross bonds, we have utilized the regular copper 4/0 cross bond, installing one every 500 ft.; also, we have used bar iron 4 in. by 1 in. by 54 in. and welded it right to the base of the rail. This gives a permanent cross bond and also holds the track to gauge. It serves remarkably well on turns.

The material for these bars is obtained by utilizing the broken draw bars out of the mine cars.

The question that is so often brought up is probably foremost in your minds: "How about track repairs?" We find that the welded track gives practically no trouble and is much more rigid than the bolted joint. When a section of rail must be replaced, it is merely necessary to take the torch and cut out the section to be replaced and cut the new rail to proper length and burn some holes in it and the adjacent rails and then proceed as mentioned above.

As for taking up the track, the main-line haulage remains in place for such a period of time that this can almost be overlooked. However, we have taken up a few miles of welded track, and we find that by taking out the bolts and driving a chisel between the angle-bar and the web of the rail the angle-bar may be wedged loose, then the rail can be cut at the welded section of the rail; or, if it is light track, say 40-lb., the rail may be raised at one end after the angle-bars are removed, and the length of the rail gives sufficient leverage to bend the welded ball until it snaps.

As for our service out of the welded joints, we have not had a failure to my knowledge in the three years we have been utilizing this method. Excessive expansion is no factor, since the temperature is practically constant.

# REDUCING COSTS WITH MODERN MINE CARS

By C. J. SANDOE
Vice President, Perry Coal Company[1]

Designing mine cars today has developed into an engineering problem which in the end means lower cost. In endeavoring to effect lower cost, the problem of transportation has become a very important cog in the wheel, for coal cannot be marketed until it is brought out of the ground.

Economical haulage over first-class track has, in recent years, been very helpful in getting coal out; also in recent years the coal companies have given more thought to their mine cars. Need for this thought on mine cars is due to several things, such as economical transportation and mechanical loading.

A mine car is a most important mechanical link in the production of coal, it being the transportation item from the face to the tipple.

Car manufacturers have been working with the operator on this particular part of the transportation problem and have been able to develop car designs which give additional capacity, more economical haulage, which is certainly advantageous where coal is loaded mechanically.

Mine cars are of different types as to construction. There is the old-type car with wood body constructed with formed bars and held together by bolts. This car has been used by the operators on account of the first cost, and they can be repaired and maintained by their outside mine labor.

Another type of car which has come into use during recent years is known as the composite type, in which the sides and ends are made of steel and wood. The bottoms are made of wood and fitted with bumpers of the same construction as the all-wood car. This car is somewhat stronger and will carry more coal for the same overall dimensions in comparison to the wood car. The advantages are similar to the wood car, in that it can generally be repaired in a regular mine shop with exception that when they are badly damaged they have to be entirely rebuilt in the mine shop.

The modern type of car, which has recently come into use, might be classed as an all-steel car. This type car compares favorably with other types of cars when the carrying capacity is compared with the cost and upkeep. This steel car has been designed to give maximum capacity with the overall measurements, and in obtaining this additional capacity cars are designed with low bottom clearance from the rail. Of course, in this design it is essential to use steel construction and bracing in the car bottom, in order to obtain the required strength to carry the load.

After considerable experimenting with high-capacity cars and the effect they had on the costs, the coal companies are reequipping their mines with modern cars. This saving in costs is reflected throughout the entire mine on either a mechanical-loaded basis or hand-loaded basis.

Let us first take it on a hand-loaded basis: With the additional capacity gained, it is necessary to place fewer cars in the rooms for the loaders, thus increasing the efficiency of the loader and reducing the operator's expense of motormen and electricity.

Another advantage is that the loading height can be reduced and still gain capacity, thereby giving the loader a less lift to the top of the car, and there is no question but what a loader will shovel more coal into a low car than he will into a higher car.

Another advantage is that the operator will see his percentage of lump increased, for the loader will lift the lumps in a low car where he will break it up before he will lift it into the higher car.

Modern cars are still more advantageous in mines using mechanical loaders, for it is practically impossible to obtain any degree of efficiency out of any loader with small-capacity pit cars, due to car changes.

I agree that new methods of mining and loading have helped the percent of efficiency of the loading machines, but on any system the coal must be loaded in the cars, and every time the loading machine stops running, to allow a car change, it is costing money. This may not appear to be very much of an item, but when you consider that the loading machines are capable of loading so many tons of coal per hour in continuous operation and any time the machine is stopped it means less efficiency.

So much for the savings from a loading standpoint. Now let us consider the haulage. With modern haulage systems, which includes large locomotives, excellent track, anti-friction bearings, and in some cases a complete dispatch system, the same number of modern cars can be hauled per trip as the old ones, so if the old cars held 2 tons and they hauled 50 cars per trip, or 100 tons of coal, they will be hauling 200 tons of coal with the modern cars.

We now have the coal either at the dump or at the bottom of the shaft, so let us see what savings are made with the modern cars. In the case of the drift mine, the dump is capable of dumping a certain number of cars per hour, so a 4-ton load can be dumped in the same time as the obsolete car, thus increasing the coal going over the tipple per hour. This is also true of shaft mines, where the speed of the cage is so many hoists per hour, and with the obsolete car the output of the mine cannot be over the number of hoists per hour times the capacity of the mine car, but by using modern cars with greater capacity the capacity of the mine can be increased and the particular advantage comes in the fact that this increased tonnage from the face to the tipple does not increase the overhead.

I have endeavored to give you a few of the advantages of modern cars from the face to the tipple, but there are still other savings which are accounted for by modern cars.

Modern car design is fast moving to all-steel cars, and these all-steel cars are very low in upkeep. I had an occasion to compare the new modern car with the old-style wood car—both cars being used in the same mine—and I found the old car had 275 bolts and the new car 87 rivets and 4 bolts, which is quite an elimination of parts which can come loose, allowing the car to get in bad condition. You also gain by the fact that new cars are practically all equipped with new-type bearings against the plain bearing on the old cars.

What I have endeavored to bring out in this short talk is the fact that modern cars play a great part in helping to lower costs, not only in loading but in every department of the mine, from the face to the tipple.

# THE HITCH DRILL—ITS RELATIONSHIP TO SAFE AND ECONOMICAL MINE TIMBERING

By FRANK M. SCHULL

General Superintendent, Binkley Mining Co.

Like practically all other pieces of modern machinery, the hitch drill was developed and perfected due to necessity and with the idea of eliminating accidents and personal injury hazards, and reducing mine timbering expenditures.

Until the year of 1929, crossbars at our No. 8 mine were supported on wooden legs or hitched into the rib with picks. Approximately 6 in. was the deepest these hitches could be driven with this method. This procedure was not only expensive but it also provided a constant source of danger to our employes, due to its inability to serve the purpose for which it was intended. Not infrequently these hitches would break out, simply for the reason they were not driven deeply enough into the rib. Hitch holes, breaking out from this cause, would release tons of slate from the top, endangering the lives of employes and sometimes damaging equipment. In addition we were always confronted with the additional expense of cleaning up the "falls," coupled with a tonnage loss that generally follows any delay or failure in and about coal mines. Several times these falls, due to hitch holes breaking out, caused severe wrecks, with resultant damage to our rolling stock. The use of crossbars supported on wooden legs, especially on main lines, we found to be quite expensive, for the legs, if not treated, had to be renewed from time to time as they disintegrated.

Our experience with this method of timbering, then, quite naturally led us to a point where something had to be done to effect a solution to the problem confronting us. Our thoughts turned to drills and we carefully examined two such units. We found, however, that in addition to being quite expensive, they would not, in our opinion, stand the abuse of mine handling; so we decided to build a machine, which machine was later patented.

The machine which we built is mounted on a truck, the wheels being set rigidly on the axles, and is propelled from place to place by a 7-hp. motor through a sprocket and chain drive. However, on long moves, we attach the drill to a haulage motor, in which case the propelling mechanism is thrown out of gear by disengaging the clutch. The drill proper is anchored on a turntable which revolves on roller bearings about a king-pin. This pin holds the table centered on a heavy base plate which can be slid crosswise to the truck, thus adding to the reach of the drill bit. The front and rear edges of the plate are held by guide channels, and movement is accomplished by two ropes on a windlass shaft under the truck. A 25-hp. motor, regulated by controllers, drives the drill through a sprocket and chain; speed reduction is effected by a pinion and gear drive. The drill is mounted on the end of a boom which is raised and lowered by a steel cable and hand-operated worm-driven reel. Once elevated to the desired position, the boom is supported by a screw jack beneath it. There is no differential between rotation and feed, as both motions are effected simultaneously by a positive feed. A 2½-in. splined thread bar, of chrome nickel steel, is rotated by a key in the bore of the chain sprocket, and two heavy nuts, one on each side of the sprocket, guide the feed. The average speed of the drill is about 120 r. p. m. Drill steel, 1¼ in. square, is fastened to the thread bar by a heavy socket sleeve and one or more intermediate sections can be similarly mounted to extend the reach of the drill. The boring end of the drill is comprised of two parts; namely, the pilot or augur point and a rectangular block. The rectangular block is 8 in. or longer, depending on the size of hole desired, and is held in place on the drill steel by a seated set-screw. Into this block is inserted ordinary cutting-machine bits, and the drill is held in position by a horizontal, telescopic jack.

Two holes can be drilled without changing the position of the machine, one on each side of the entry. The first hole having been drilled, the bit is placed on the free end of the thread bar, the boom is moved to the opposite side of the entry, the horizontal jack is set, rotation of the drill reversed, and the second hole is started. In this manner no time is lost in feeding the thread bar out or swinging the drill through an 180° arc which is necessary when drilling can be done only on end of the thread bar.

Only in moving from one drilling location to another is the turntable revolved, and then only 90°, and this permits the drill boom to travel within the clearance of the heading. It also saves the time which otherwise would be consumed in centering the thread bar.

There are several ways in which timbering can be performed following the hitch drill. One is to drill holes on the opposite sides of the entry, one hole being drilled 3 ft. and the other 18 in. in depth. The reason for the deeper hole is so the bar can be shoved to the back end of same, then raised into position and moved 18 in. into the more shallow hole, which procedure allows an 18-in. support on each of the ribs. In timbering across breakthroughs or room necks, the collar bar rests on pegs, for which 90-lb rail is used. These are sunk and cemented, or braced, in a hole in the rib approximately 5 ft. deep, with about 12 in. of the rail protruding from the rib of the entry.

It is my judgment that it would be more economical to do all the timbering by using pegs, allowing the long bar that parallels the entry rest on two or more pegs and the crossbars would be on top of these, flush with the top or roof. Especially would this be true in rooming entries, or short-life entries, where these bars would all be of uniform length and could be easily and safely recovered. Hitch holes can be drilled any reasonable size with this unit, which makes it possess an appeal to those who still prefer the wooden crossbar. In timbering main bottoms with large I-beams, hitch holes of corresponding size could be drilled to receive the ends of the beams.

The possibilities of this machine are not limited to timbering, since it has been used to drill a 24-in. hole through a chain pillar 20 ft. thick. In my opinion, holes drilled at short intervals, especially in the chain pillar in main headings, would make for a more firm pillar and also greatly improve the ventilation, with resultant economies.

We have timbered approximately 10 miles of entry with two of these machines at our No. 10 and No. 8 mines, the latter now being abandoned. This was accomplished at approximately one-third the cost of timbering by older methods.

We abandoned a mine which had been timbered with the aid of the machine we have been describing. Six months later we had occasion to enter this mine and were able to operate a haulage motor to a parting 2 miles from the bottom within 30 minutes. From this experience, one can readily see the timbering in the mine possessed the characteristics of permanency.

These hitch drills, making possible a better timbering procedure, have enabled us to do this phase of our work in a safer and much more economical manner.

I will be glad to discuss this machine fully with anyone having a particular interest in it.

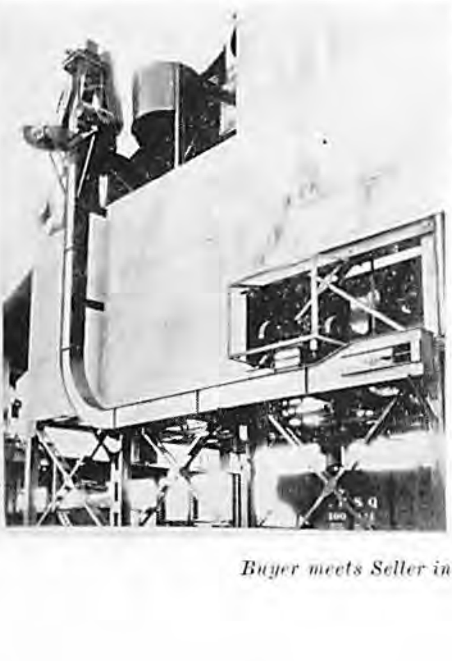
## CONVEYORS IN THE NEW ORIENT PREPARATION PLANT

By THOS. GARWOOD
Chicago, Wilmington & Franklin Coal Co.

In and about the preparation plant of the New Orient Mine the various types of conveying equipment have proven themselves well chosen for the type of work each has been called upon to perform. In the cases where the coal is loaded on the conveyor at more than one point, but where the load is delivered to one common unloading station; where there are no short radius bends in the path of the conveyor and where there are no large pieces of coal being handled, belt conveyors were chosen as the most desirable. Where the delivery from the conveyor is made to more than one point as in the distributing conveyors feeding a battery of screens or where various sizes were to be assembled in bins at different points along the travel and where there were rather short bends in the design, flight conveyors were selected to do the work. Pan types were selected for handling coal containing large lumps and were installed as feeders from the skip dump hoppers to the main shakers, on the lump coal picking tables and on all domestic coal loading booms.

In the recently designed dedusting plant added to the preparation plant, the machinery for dedusting our 5/16 in. by 0 in. coal was placed in already complicated arrangement of coal handling apparatus. It became necessary to carry two streams of coal horizontally for a short distance, then up steep inclines and finally in a vertical path to feed surge bins from which the primary dedusting units received their raw coal. The available space was so constricted that it appeared an almost hopeless task to arrange such a conveying system and space prohibited the installation of separate conveyors and elevators to do a job of this kind. The Redler conveyor, which at that time was being developed for use in the coal industry to handle the smaller sizes, was then investigated and being new to the trade presented room for doubt that it could maintain the high capacity for such a small section as was reported, and which would be necessary in this case. For our installation the units chosen had a cross-section of but 19 in. width and 21 in. height and were required to handle 165 tons each of this 5/16 in. by 0 in. coal. Two units were installed to feed the dedusting plant as an existing conveyor divided the space where this feed must be carried. This, however, allowed symmetrical units to be used and helped simplify the final design.

The Redler conveyor is an entirely enclosed system, the loaded run and the return strand traveling in one enclosure. The return strand is held separate in horizontal sections by rails supporting the chain and in the highly inclined, curved, and vertical portions by a partition between the carrying run and the empty side. It has one feature which was to be desired in our case. The feed to the units is made from a full bin, choke feed to the return strand which acts as a feeder to the carrying run and having a plate which may be adjusted to allow considerable regulation and variation in the amount of coal carried by the conveying unit, makes possible the maintaining of a uniform feed measured as desired. The entire chain is made up of alloy steel cast links with no fastening pin or bolt, but having one center link with socket end which mesh with each other and having a U-shaped piece at one end of approximately the same dimensions as the inside of the carrying chamber. The appearance of the link and assembled chain gives anything but that of conveying machinery. The action of such a conveying unit depends upon the fact that it would require more force to drag the chain through the coal body than to pull the coal through the casing and so transfer the coal along the length of the conveyor or up the elevator. The power required to convey coal in a Redler system is comparable to that used in a flight conveyor, but has the advantage of being a much more compact machine, dustless in its operation and allowing close control in feeding a uniform amount to the conveyor.



It may be used as combination horizontal, inclined and elevator conveyor or as any one type.

Four units of this kind were installed in the originally designed dedusting plant. Two units were used to feed the coal to the surge bins as explained and two were used to convey and distribute one of the sizes to a storage bin when not being loaded. Another has since been added to handle the collected dust from the dust bin to dust car loading point. In the operation of our rescreener 2 in. screenings are divided into four sizes normally, the smallest being the 5/16 in. by 0 in. coal which is again divided pneumatically by dedusting to remove the minus 48 mesh material and by vibrating screens to separate the dedusted coal, making a 5/16 in. by 10 mesh product and 10 mesh by 48 mesh middling size. The screening operation making the 5/16 in. by 10 mesh is performed to make what has been found the most desirable size coal for operation of the small domestic stokers. Other sizes from the rescreener may be loaded separately or may be reassembled with any other and with either or both coarser and middling sizes from the dedusting plant to give uniformly sized screenings of constant preparation with sizing range suitable to practically any condition that might be called for by the customer. This reassembling is done by drawing from the sized coal bins through mechanical measuring devices and loading uniformly along a belt conveyor transporting the reassembly to the carloading point. This loading point is also constructed with quick-change door to allow loading consecutive cars without stopping the operating equipment.

The conveying machinery about the preparation plant embraces most all types with the exception of screw and vibrating conveyors each suited to its work and performing very well. This summer finds one 48-in. belt being replaced that has been handling 850 to 1,000 tons of 2-inch screenings per hour for the past 12 years of normal operating time and working on a straight incline of 21 degrees. Picking tables of the belt type handling the smaller domestic sizes receive occasional damage by severe abrasion when a piece of coal becomes lodged in close clearances and catches in the rubber, with consequent short life. One short conveyor carrying high tonnage and having the feed at right angles to the belt and operating at

steep inclination receives probably the greatest wear in the entire tipple and is replaced at shorter intervals. Our Redlers, being among the first to handle coal, were designed with a somewhat light casing and having operated for considerable periods have worn at points along the bottom, but replacements of these parts have been made with heavier section and will give much longer service. Flight chain is replaced with chain of the roller type and all are giving a remarkable service.

# COAL PROCESSING PLANT OF PEABODY COAL CO.

By JACK R. VERHOEFF
Construction Engineer, Peabody Coal Co.

Slightly over a year ago, if one were driving along the highway between Taylorville and Kincaid, Ill., he could not have avoided noticing next to the highway a huge, smoldering rock dump so typical of coal mining regions. If interested to the point of inquiring the reason for this refuse pile so far away from a mine, the nearest shaft being more than a mile away, he would have learned that the Peabody Coal Company owns four mines in the coal measures to the west of Taylorville.

Each of these mines supplies its own plant on the surface, where there are the usual tipples, sizing screens, picking tables, and loading equipment, but no facilities for the further refinement of their products, such as washeries. Under these circumstances the refuse from these plants contained a large quantity of combustibles due to all laminated material being rejected as refuse. This refuse was loaded into railroad cars and transported to the dump about two miles east of Kincaid. Here the cars were emptied into receiving hoppers and the refuse hauled away to the refuse pile in ten-ton larry cars. As is very frequently the case, this material spontaneously ignited when the pile became sufficiently high. This pile rapidly assumed large proportions and at present covers an area over a mile long and a half mile wide, to an average depth of about 30 ft. At the first glance one is prompted to remark what an eyesore is this great burning scar on the face of the earth. At this point our inquiring person gets out of his car and walks over to the dump hopper. Here he sees large lumps of coal with a good appearance, marred only by an occasional band of pyrite or bone running through. He is also impressed by the presence of a great number of pyrite lenses or, as the miners know them, "sulphur balls." These range in size from a few inches in diameter to over a foot. His previous thought as to the utter absence of beauty in this spectacle

is now followed, and since he is a practical man, is supereeded by the realization that here before him are literally thousands of dollars going up in smoke. These thoughts, or some similar to them, occurred to our Peabody Coal Company officials and prompted them to take steps to stop future waste by installing a plant to separate particles of rock, bone, pyrite and coal, and to provide for reclaiming the latter two. The statement "latter two" is made because there is a very ready market in the sulphuric acid industry for pyrite. Thus the headaches acquired when these hard, heavy nodules are encountered in drilling and handling underground are repaid by turning them into hard cash.

A plant was erected by Link-Belt Company which includes essentially a Bradford breaker to accomplish the above-mentioned unlocking of particles; a Link-Belt shaking picking table, where the larger lumps of pyrite are picked out of a mixture of rock and pyrite; and a Link-Belt Simon-Carves wash box, which separates coal from a mixture of four constituents; pyrite, rock, bone and coal. At present the rejects from the wash box are discarded but provision has been made for the future installation of another wash box and screens, which will make possible the reclamation of pieces of pyrite too small to be hand-picked. The washed coal passes over a set of flexible hanger scalping screens and a set of dewatering shakers before being conveyed to telescopic loading chutes over the two railroad tracks.

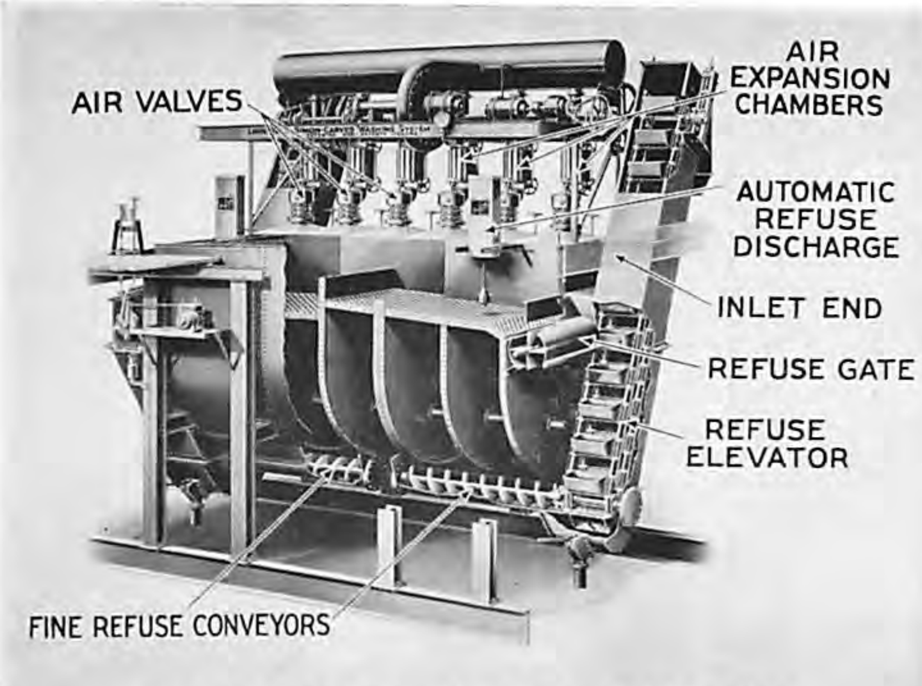
Thus, if our friend of a few minutes past were to travel that same road again today, he would find a well-proportioned building partly obstructing his view of the rock dump. If he were to stop and make a tour of the plant he would find it a compact, efficient and exceedingly versatile unit, and the time spent in its inspection would not be begrudged.

To turn from generality to particulars, let us make a similar inspection trip and note the details and functions of the various units.

The logical way to make such a tour of inspection is to start at the point the raw mixture enters the plant and follow the flow of all products to the points of their disposal. The first things to be seen are two steel dump or receiving hoppers directly beneath a railroad track. One of these discharges directly beneath into the larry cars which run out over the waste pile. This hopper is for the disposal of rock from the mines when cleanups are made underground. The other hopper discharges through an adjustable rack and pinion gate onto a 36-in. wide apron conveyor. This conveyor is designed for the high strength necessary in the handling of such heavy and abrasive material as rock and pyrite. The pans overlap and are mounted on high carbon steel bar chain fitted with heat-treated steel pins, case-hardened steel bushings and chrome iron rollers. On these pans the material is transported up a 20 degree incline and discharged at right angles into the primary raw coal flight conveyor and elevated about 30 ft. At the head end of this conveyor is a manually operated rack-and-pinion gate opening into a by-pass chute. Under normal conditions, that is, when the conveyor is bringing up the mixture of coal, pyrite, bone and rock known locally as "band," this gate is closed. Then the raw material is carried beyond the gate and fed to the Bradford breaker. This unit is a cylindrical drum 9 ft. 0 in. in diameter by 17 ft. 0 in. long, mounted horizontally to rotate about a shaft through its center. The wall of this cylinder is made of perforated plate, the perforations being $1\frac{1}{2}$ in. in diameter. Inside the breaker are several shelves which lift, drop and break the material within as the drum rotates. Any substance which is tough enough to withstand this shock will travel along inside and be discharged at the other end onto the sulphur picking table, where pyrite is reclaimed. This picking table is one of the outstanding features of the plant because it accomplishes effectively and with a minimum of

machinery what is usually conceded to be a job for a heavy and expensive apron feeder. The table is approximately 5 ft. wide by 12 ft. long and stands on top of vertical yellow pine boards. At about the middle of the under-side is a cross-head connected by a 4-in. pipe to an eccentric shaft. The table is set at a slight angle so that gravity and the reciprocating motion of the eccentric propel the material on the table. High carbon liner plates insure a minimum of replacement costs. On each side of the table are pickers' boxes opening into the sulphur conveyor directly beneath. One very interesting feature of this section of the plant is the application of ultra-violet light to aid the pickers in distinguishing between pyrite and rock. Certain substances have their atoms and molecules arranged in such a position that, while appearing dull and drab in ordinary light, they will exhibit very unusual colors when under ultra-violet light. When a picker sees a lump showing very bright colors coming along, he knows it is a "sulphur ball" and picks it out, dropping it in the box chute at his side. All other material is allowed to pass by and fall off the end of the table into the refuse conveyor.

The sulphur conveyor elevates the pyrite to the sulphur bin, where it is accumulated and then loaded into

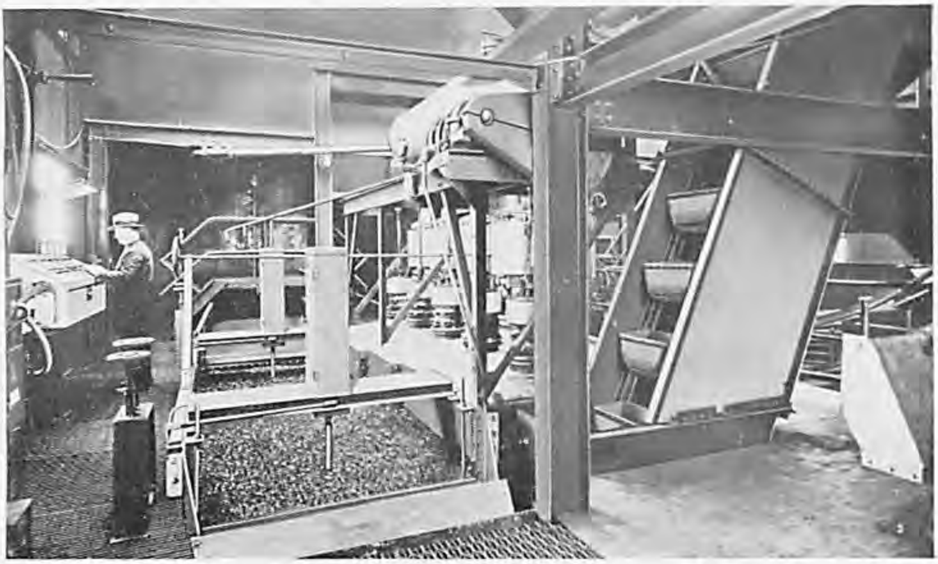



THE LINK-BELT SIMON-CARVES WASH BOX

railroad cars through an undercut gate operated by a rag wheel and chain from the ground.

Having traced the course of rock and pyrite lumps which were of sufficient size and toughness to pass through the breaker, let us now return to the breaker and follow the material which was reduced to less than $1\frac{1}{2}$ in. round. This will pass through the perforations in the breaker and fall into the secondary raw coal conveyor. This is a horizontal flight conveyor which moves its load to the inlet sluice, where it is dropped into a stream of water and fed to the wash box.

A detailed description of the Link-Belt Simon-Carves washer would readily consume far more time than is allotted here, so only a brief discussion shall be presented. The wash box is essentially a U-shaped steel tank with a partition parallel to the sides of the "U," but not reaching the bottom. On one side is a perforated plate along which the coal passes from end to end during the washing process. The other side is sealed off and opens only to a series of slotted air valves and pistons. The alternate admission and release of air by these pistons imparts to the water surface beneath them an up and down pulsating motion. The motion is transmitted around the "U" to the washing bed. Thus the material in the bed is subjected to a sharp upward thrust and is then allowed to fall back onto the sieve plate under the action of gravity alone, avoiding the bane of washing, back-suction. This up and down motion causes the heavy particles of rock and pyrite to sink to the bottom of the bed, leaving coal at the top. Material of an intermediate specific gravity will accumulate between the layers of coal and rock. The stratification is thus accomplished according to specific gravity and is independent of size. In other words, it is impossible for small particles of rock to remain in the coal bed and conversely any small pieces of coal mixed with the rock layer will not remain there, but will eventually rise to the top. The wash box at Carter is divided into two compartments, primary and secondary. The pistons admitting the air to these two compartments are set 180 degrees apart, so that while the bed is rising in the primary, it is falling in the secondary, and vice versa. A vertical dam prevents the bed from surging back and forth, due to this difference in phase. Each compartment is divided into cells having individual air and water adjustments. The primary compartment is divided into two cells, and the secondary into three. The usual practice is to use more water and a higher air pressure, in other words, agitate the washing bed more severely, in the primary compartment. The purpose is to bring down the heaviest refuse as soon as possible. Then the material carried over the dam consists largely of coal and bone. In the secondary compartment the bed is treated more gently and the final separation is made. At the inlet end of the primary and the outlet end of the secondary compartment is a rotary gate which draws off refuse from the bottom layers of the washing bed. These gates are positively driven by speed reducers and motors. The refuse bed, through aluminum hydrometer floats adjusted to the desired specific gravities and "Auto-Constant" controls, actually maintains itself at a constant level. That is to say, if a surge of heavy material builds up the refuse layers in the washing bed to an undesirable point, the rotary gate is caused to speed up and draw off faster, thus quickly restoring the bed to normal. Also, if the bed of refuse thins out so that the possibility arises of coal passing out with



the refuse the float drops and the gate is stopped. At Carter, capacity relays are used to effect this control. When refuse is removed it falls into a boot at the bottom of the wash box and is raised by dewatering elevators and discharged into the refuse conveyor. Compressed air is furnished at the rate of 2,500 c.f.m. at a pressure of 3 lbs. by a Root-Connersville positive blower. As has been stated before, provision has been made for the future installation of a second wash box. When this is brought about, the heavy refuse from the primary elevator will be rewashed at a higher specific gravity and more pyrite recovered.

The coal, which remains in the upper layers of the washing bed, passes over a weir and thence by flume to the scalping screens. There are two of these, being of the flexible hanger type, driven in opposition to each other from an eccentric shaft. The first of these screens is double-decked. The upper deck is made of perforated plate, having ¾ in. perforations. Coal ¾ in. by 5/16 in.

passes on over the lower screen, where more surface moisture is removed, and then falls into the washed coal conveyor. Water and minus 5/16 in. coal is gathered in the hopper beneath the screens and is sluiced to a pair of dewatering shakers. These shakers are made of brass wedgewire 6 ft. wide by 10 ft. long. They stand on hickory slats and receive a shaking motion from opposite throw eccentries. Coal passing over them is discharged into the washed coal conveyor and remixed with the 1¼ in. by 5/16 in. coal from the scalping screens. This mixture is then carried over the railroad tracks, dropped through rack and pinion gates onto telescopic loading chutes and into railroad cars.

The slurry passing through the dewatering screens is discharged into a sump, from which it is pumped into a 40-ft. diameter settling cone for clarification.

Before this plant was designed a careful study was made of all the materials which might conceivably be treated in it. It was noted that the substance likely to cause the most trouble was pyrite. This is a

hard compound of iron and sulphur, having a density of about 5. Due to this hardness and density, all conveyor lines in which the materials are dragged are equipped with Link-Belt drop-forged rivetless chain and the conveyor troughs are lined with high carbon plates. Some of the advantages of rivetless chain are the ease with which it may be dismantled and the fact that there are no belts or rivets to become loose or wear off and permit the chain to break while in use.

A description of the machinery in a plant of any kind is logically followed by a statement of what that plant can do.

While the washing of picking table refuse has been the principal activity of this washery, it is also capable of washing screenings. When it is desired to wash 1¼ in. by 0 in. screenings, the by-pass gate ahead of the breaker is opened and the screenings dropped directly into the inlet sluice to the wash box. An idea of the versatility of the washer may be formed from an inspection of some of the results obtained in test runs shortly after the plant was put into operation in March, 1935. These test runs were made to determine the adjustments necessary in changing over from one type of raw coal to another in order to yield washed coals of different ash content. It was desired to wash picking table refuse and produce a 13.5-14 percent ash product, 1½ in. by 0 in. screenings and produce a 10.5-11 percent product, and 3 in. by 1¼ in. nut crushed to 1¼ in. by 0 in. in the breaker and obtain a 9.5-10 percent ash coal. The ideal way to make such tests would have been to run any one of these raw materials through the plant for a whole shift in order to maintain uniform conditions of operation throughout the test. Instead of this, however, several cars of band were run, then two of 1¼ in. by 0 in. screenings, then three of 3 in. by 1¼ in. crushed screenings, then more band. In view of the fact that the washer had very little time to reach an equilibrium before an entirely different material was introduced into it, the results obtained were surprisingly good.

| Materials Washed | Actual Ash in Washed Coal | Desired Ash in Washed Coal |
|---|---|---|
| Band | 13.51 | 13.5—14.0 |
| 1¼ in. x 0 screenings | 10.05 | 10.5—11.0 |
| 3 in. x 1¼ in. screenings—crushed | 9.44 | 9.5—10.0 |

The results of the first test, that outlined above, were as shown in the foregoing table.

After these first results were obtained from "guess-adjustments" is was a comparatively easy matter to readjust the Auto-Constant controls and get the exact results desired. It is now an everyday affair for the wash-box operator to receive instructions while washing band, for instance, that a car of screenings will be brought in and a certain ash content, say 9 percent, is specified in the washed coal. He can then make a few simple adjustments and feel quite confident that the results of the chemist's analysis on that car will be very close to the anticipated figure.

Some idea of the economies resulting from the installation of this plant may be gained by the realization that in every eight-hour shift about 750 tons of coal are saved from the refuse pile, to say nothing of several tons of pyrite. For each carload of picking table refuse brought to the washery from the mines, about half a car of coal of 13.5 percent ash or better is salvaged. Since the rejects are heavier than the coal, the recovery is probably in the neighborhood of 30 percent by weight, or 50 percent by volume. While such reclaimed coal is slightly too high in ash to be sold as a domestic coal, it finds a ready market in large users of steam coal. However, a domestic coal can be produced from the band by drawing off a little more of the intermediate gravity material in the wash box. This plant affords the Peabody Coal Company a central cleaning plant where we reduce the ash content and enrich the heating value of Central Illinois screenings.

# ACCIDENT RECORDS IN ILLINOIS

By JAMES McSHERRY
Director, Department of Mines and Minerals, Illinois

Mr. Adams has given us a very interesting discussion of the accident record of the coal industry, which, together with his well prepared tables of statistics, provides us all with much to discuss and study. Naturally the interest of the chief of any state mining department will be more or less centered on the record of the industry in his own particular state; and it is gratifying to me that according to the conclusions reached by Mr. Adams, Illinois' accident experience in coal mine operation compares favorably with that of the other large coal producing states and with the combined record of the United States.

Illinois is making progress in the work of accident prevention. The data compiled by Mr. Adams bear out the industry's claim to a steadily improving record for the period under discussion. Of course, our accident experience is not everything to be desired. There is much good work which can be done—many improvements which can be brought about. But as a general thing Illinois coal operators are showing the right disposition about this business of accident prevention, are meeting squarely their responsibility to maintain their properties in the safest possible condition. Illinois can boast of some of the largest and finest coal mines to be found anywhere; and I can say without fear of contradiction that in the industry in our state we have a good percentage of the "Cream-of-the-Crop" of safety men, whose efforts have the encouragement of some of the most sincerely safety-minded operating officials to be found in any industry. Of course it is such organizations who are making and will continue to make the records for Illinois. We have plenty of operators and safety supervisors who are keenly alive to the problems presented by the introduction of new machinery and production methods, etc., and the low accident rates of some of our most highly mechanized mines place them definitely in a class by themselves, judged by any standard of comparison. When Mr. Adams has our 1935 figures for consideration and review I am sure he will find Illinois operators generally—and a few of them in particular—have contributed their share to the downward pull on the accident rate curve.

I must leave the discussion of accident statistics pretty much for men who compile and work with them—I believe I have a proper appreciation of their value as indices of accident trends, "pointers" for concentration of effort of safety men, etc.; but in all my mining experience I have learned to think of accidents in terms of but one thing: "Prevention!" When a man becomes a subject for a hospital or a coroner's inquest—in short, becomes just another one of Mr. Adams' accident statistics—surely the industry and the men engaged in it should endeavor to profit to some extent from the sad experience—we should take steps to prevent similar accidents again. Human misery and just common, ordinary round dollars and cents out of the miners' pockets and off the operators' profit sheets are too dear a price to pay for accidents and lack of prevention measures. It does not pay. We all know that; and this phase of the question has been written and talked about innumerable times and from every conceivable angle. But I am frankly optimistic about the future accident rate of the industry. Every year more and more mining men are becoming converts to the belief that "Accidents should and can be prevented;" and it is one of the most encouraging signs in the coal mining game today.

One of the most helpful factors in bringing about a reduction of accidents in our Illinois coal mines has been first-aid training. If I had the time to analyze for you the most outstanding safety records established in our state, in almost every instance I should point to organizations who keep the majority of their men—in some cases all of them—trained in first-aid. Give me a management "sold" on the value of safety and accident prevention, with "live-wire" safety supervision—and I repeat, we have lots of such management and supervision in Illinois—and first-aid training will round out the program. We have trained a lot of men in first-aid in Illinois, particularly during the two years just past; and while perhaps only a small percentage of these men will become expert "first-aiders," we know that almost without exception men who take this training become "safety-minded"—and "safety-minded" men cause fewer accidents.

The United States Bureau of Mines has been pounding away for years with "First-Aid-and-Safety" as their theme song, and state mining organizations and progressive operators have kept up the chorus. The results were proven long ago. Experience of years has only served to strengthen the conviction of all observers that a first-aid training campaign must be made a part of every safety program if the maximum benefit is to be realized. Just as results in "selling" safety to the men in the mines sometimes are slow in showing up, so, too, some operators are a little backward in real accident prevention work. But every year more of them are seeing the light. In Illinois we believe there is an awakening interest on the part of operators generally in first-aid and accident prevention work. The training figures show it. We are fortunate in our state in having the cooperation of Charlie Herbert, of the Bureau of Mines Safety Station at Vincennes, Alex U. Miller and several other mighty fine, able men of the same organization. If operators in Illinois do not go for safety in a big way it is not for lack of effort on the part of these men to drive the lesson home to them. They are keeping up with the times. If our accident curve for mechanized mines is a little high on the chart they will figure out what it takes to make this kind of work safer. And with all their other activities they can still find time to take our state mine inspectors through a course of a week in advanced mine rescue training. They did that last summer at Benton and this year we shall have the boys at the mine rescue stations take the work. It is valuable safety and accident prevention training and work that the Bureau boys take in their stride. And the hotter the weather the more they make the boys like it. They help us keep on our toes in safety work with the operators. Our Illinois department considers itself mighty fortunate in its associations with the Bureau. Mr. Adams, we will certainly keep working to give you more favorable figures.

# BONUS SYSTEMS

By ERNEST TODD
Chief Clerk, Bell & Zoller Coal and Mining Co.

Many things have been attempted and accomplished in the field of accident prevention work and in the past few years it has spread from teaching safe practices and the equipping of men with safety equipment to the awarding of bonuses to both foremen and men for results obtained.

Before going into the bonus systems in effect at our properties, I would like to explain our accounting system of our compensation costs. Our company operates five mines in the State of Illinois: two in Zeigler; two in Peoria; and one in Centralia. Our Zeigler and Centralia mines are mechanical mines and our Peoria operations are hand loading mines.

In a group of independently operated mines such as we operate, the conditions and system of mining differ and naturally the tonnage per man-shift varies with a resultant variation in the cost per ton. In order to put our compensation accounting and to compute our bonus systems on an equal basis, our compensation costs are based on cost per man-hour of exposure. I believe this system of compensation accounting is somewhat of a departure from the general practice of accounting costs on the cost per ton or cost per hundred dollars of payroll.

To arrive at the cost per man-hour of exposure, we add to the actual expenditures for the year the net increase for the year in total liability, both estimated and determined. (If the total liability shows a net decrease, it is subtracted from the expenditures). This amount divided by the total man-hours worked during the year gives the cost per man-hour of exposure.

Our system is operated on an accrued basis; that is, our liability is set up on a cash basis and the whole amount set up is charged into the cost. In computing our compensation cost we take into consideration the following expenses:

1. Hospital maintenance (we operate our own hospital at Zeigler).
2. Office (this includes the salaries of the safety engineer and compensation adjuster).
3. Outside medical.
4. Legal.
5. Compensation paid.
6. Excess insurance.

In January 1935, we adopted a bonus for our foremen based on the savings effected on the cost per man-hour of exposure. The plan in brief is the awarding of a percentage of the difference of the cost per man-hour for the year, over a bogey set up by our company. This plan was formulated on a graduating participation. In other words, the greater the saving the higher the percentage of the savings effected is given to the foremen as a bonus.

It should be noted that the bonus for our foremen, which I have just outlined, is not a pre-arranged specific sum of money given to our foremen for keeping their men free from injury, but is a participation by the foremen in a percentage of the savings effected on the cost per man-hour of exposure over a given figure.

The results obtained by the adoption of this bonus to foremen in 1935 brought about a very satisfactory reduction in our cost and the result can better be conceived by the fact that a total sum of $22,710.61 was paid to our foremen as a bonus at the end of the year 1935.

It is perhaps fair to mention that during 1935 there were many contributory factors involved in our accident prevention work such as equipping our men with safety clothing, the furnishing of goggles, safety meetings and posters, and just what portion of the results obtained was directly attributable to the payment of this bonus to our foremen is a matter for conjecture. The fact remains, however, the resultant figures were gratifying.

While the management must depend upon its foremen to carry out various plans for the prevention of accidents, we were convinced that the man to sell was the miner himself and to deal with him as an individual. Too often, the miners are not reached and the full purport of various plans is not put over to them, and they are not particularly interested in participating in any plan just to see a foreman get a bonus, and it was concluded that every miner as an individual must be interested in order to reach our goal. With this in mind, it was decided to adopt a bonus plan for our workmen in addition to the bonus in effect for the foremen. The essential factors of the bonus system we felt should be:

1. A simple plan easily understood.
2. A payment of cash sufficiently often to keep the interest of the men keyed up.
3. A plan which would not entail elaborate bookkeeping.

After careful deliberation it was decided to adopt a bonus plan for our workmen whereby they would receive $40 in cash on the basis of every 2,500 manshifts worked without a lost-time accident. To briefly outline the plan: Whenever the number of days equivalent to 2,500 man-shifts are worked at any of our mines without a lost-time accident, we have what is known as a "bank day" when eight $5 bills are drawn for. This bonus is available only to our workmen. Supervisors, clerical and technical men are not eligible to participate in the drawing.

The only qualification necessary for an employe to be eligible for this money is that he has worked all the time he is entitled to work during the 2,500 man-shift period.

At least two days elapse after the end of a no-lost-time-accident period before the money is awarded to check the possibility of accidents which happen during the "bank day" period being reported at a later date. On the day previous to the drawing, a notice is posted at the mine advising the men the drawing will take place on the following day.

At our Zeigler and Centralia properties the mines are equipped with a radio installation and the drawing at those mines takes place in the broadcasting room. At the other mines the drawing is made in the miners' washhouse.

The drawing is scheduled for about 30 minutes before starting time of the mine while the men are congregated on the bottom waiting to go to their working places. The drawing usually takes place in the presence of the mine superintendent, mine manager, safety engineer, chief clerk, and assistant cashier representing the company, and two or more officials of the local union representing the miners.

Small metal rimmed paper discs with the check number of every eligible employe working at the mine are put into a container. The drawing is made by the assistant cashier who in turn hands the disc to the mine superintendent. The superintendent hands the disc to an official of the local union for verification of the number and the number is then broadcast by the safety engineer.

This procedure is repeated until 12 numbers have been drawn. While only eight prizes are distributed, 12 numbers are drawn in case one or more of the first eight numbers drawn do not qualify. After the broadcasting, a notice is posted on the bulletin board confirming the numbers drawn, and the $5 bills are available from the chief clerk on the same day.

On the surface this bonus might appear to be an expensive item to the cost of operation, but for mines averaging 200 work days a year, the maximum amount payable would not exceed $1,600 per year. It can readily be deduced that the cost of one severe injury would exceed this amount of money, and in figuring the cash outlay for such a plan, due consideration should be given to the inestimable value of the psychological effect a bonus has on the men in keeping safety before them at all times and helping them to become "safety conscious."

One of the major problems in accident prevention work is to get miners enthused to a point where they not only look out for themselves, but also for their fellow workmen. The reaction of a bonus system for the miners, we believe, does much to accomplish this. The fact that if a lost-time-accident occurs during the prescribed bonus period, the bonus for that particular period is wiped out and a new start must be made on the next work day, does much to keep the individual miner's interest to see that his fellow workmen are safe workers.

Thus far, the response of our employes to this bonus system is one of wholehearted and sincere cooperation. Our men are showing an interest in safety which heretofore they have not displayed.

It is an established fact that bonuses have decreased accidents and while it is too early in the year to predict the results of a bonus for our men such as outlined above, we feel sure that the payment of this bonus will do more to get our men into a frame of mind to cooperate with us in our safety work than any other plan we have yet tried.

## BONUS PAYMENTS

By EUGENE McAULIFFE
President, Union Pacific Coal Co.

With the belief that a bonus paid for meritorious service, expressed in the form of additional output per man hour, would not only reduce the unit cost of production, but would also tend to relieve the monotony of the day's work by creating an incentive toward better team work, the management of The Union Pacific Coal Company began, in 1930, to pay to the men employed on shaker conveyors equipped with duckbills, Joy loaders, pit car loaders, and scraper loaders, for coal loaded over a stated tonnage per man shift, a sum per ton equal to one-half the labor cost previously paid for work done on each class of equipment, such payments, when earned, credited to the loading machine crew and thereafter divided between the members of the crew, on the basis of relative hours worked during each semi-monthly bonus period.

Extreme variations in output due to changing conditions made it undesirable to continue the arrangement insofar as the Joy loader and scraper crews were concerned. The bonus paid men using pit car loaders was also discontinued when a straight tonnage scale was arranged for, but payments were continued on the shaker conveyors with duckbills, until December 31, 1934, when the payments on a tonnage basis were discontinued entirely.

May I interpose here by saying that we did not take the bonus off the Joy machines because the situation as far as the machine is concerned was different from that of the shaker conveyors, but because of the peculiar condition under which they were working, which perhaps could not be duplicated in very many places in the United States. Our Joy machines located at Hanna, Wyo., were driving first pioneer cut say 7 ft. high to the ultimate end of the room; thereafter the top coal some 16 ft. in thickness was shot down, and with no delay for cutting and with the capacity of the machine, the load, only limited by our ability to furnish cars, the output per machine shift, under the top coal loading situation, was very much higher than it was in driving the pioneer cuts, and that situation set up such distortions as to make it impossible to defend the arrangement as being consistently accurate.

Effective January 1, 1935, a new basis of bonus payments was established, with the view of eliminating past irregularities, that of paying the sum of $25 to each underground employe of the mine showing the lowest relative cost, for "labor, material and power" during 1935, compared with similar costs for the same mine during the year 1934. A bonus of $20 was likewise paid to all underground employes of the mine showing the second lowest relative cost for the same items during 1935, compared with those of 1934.

The plan in effect during 1935 was an improvement on the prior plan in that it embraced all underground workers, but it lacked the capacity to maintain a sustained interest, 12 months being too long a period to wait for any nominal reward. To correct this condition, further changes were made effective January 1, 1936, the new plan providing for a first prize of $150, a second prize of $100, and a third prize of $50, each of such awards based upon a comparison of costs of "labor, material and power" during the month, compared with similar costs for the 12 months immediately preceding same, the individual winner determined by lot.

As a result of suggestions made by the mine's staff and interested employes, the plan was later amended with regard to the basis of comparison, and the splitting up of the award among a greater number of employes, thus affording more employes a chance to participate in the awards. The rules so amended and yet in effect read as follows:

EMPLOYES ELIGIBLE

1. All underground and surface employes paid on a day wage or tonnage basis. Men paid on a monthly basis, whether employed above or below ground, will be excluded.

2. To be eligible, the employe must have worked not less than five days during the calendar month covered by the award.

3. Employes who are unable to work on account of sickness or accident, or who have been given a leave

of absence for a good cause, will be considered as being in service.

### Basis of Bonus Payments

4. As soon as possible after the close of each calendar month during the year 1936, the auditor will prepare a statement of the cost for "labor, material and power" only, for each mine for the month just closed compared with the cost for the three items for each such mine during the preceding 12 months' period, that is, February, 1936, will be compared with the 12 months' period beginning February 1, 1935, and ending January 31, 1936, and so on throughout the year.

5. The mine showing the lowest ratio of cost for "labor, material and power" for the month, compared with similar costs for the 12 months' period immediately preceding that covered by the award, will be adjudged the winner of the first prize, $200, which will be divided into 15 awards of $10 each and 10 awards of $5 each. The mine showing the second lowest ratio of cost will be adjudged the winner of the second prize, $100, this money to be divided into five $10 awards and ten $5 awards.

6. The names, or a designating number, of all employes of the mine winning first prize, eligible to participate in the awards (Rules 1, 2 and 3) will be placed in a box or other receptacle, thoroughly mixed, and the 15 awards of $10 each will be given to the first 15 names or numbers drawn from the box, while the 10 awards of $5 each will be given to the next 10 drawn. The winners of the cash bonus awards for the second-prize winning mine will be determined in a similar manner.

The distribution of the prizes not only serves to establish a greater measure of cooperation between the men with a resultant increase in output per man shift, and without hardship, but likewise an increased measure of safety has been developed, each individual more disposed to do his part. In addition, the occasion of the award brings the men and their families out for the evening, an attractive musical program preceding the drawing, which is conducted in a dignified, formal manner, local union officials usually taking part in same, taking the names as drawn by a blind-folded child, making the announcements, etc.

Since the bonus payment plan was established in 1930, payments totaling $128,282.95 have been made. During this period, a total of 14,784,293 tons of coal were mined, the cost of the bonus on all coal mined 0.87 cent per ton. Of the total tonnage mined, 12,280,855 tons were loaded mechanically, the bonus payments distributed over the mechanically loaded tonnage averaging 1.04 cents per ton. The management of the properties has felt that substantial returns have been received for every dollar expended.

It should be borne in mind that men who are engaged in what might be called repetitive tasks, those which bear a day after day sameness with but limited chance for change, welcome even a nominal incentive toward effort, something to look forward to and to talk over with their immediate fellow workers. We read and hear much of the "more abundant life," and while life is continually growing more abundant, the greater changes are accepted insensibly and without much thought. It is the small things in life which count most, a word of thanks for a task well done, a brief expression of kindly appreciation and some evidence that the lowest paid and least responsible employe is a real part of the enterprise. We have found our bonus payment system affords an opportunity to convey in a tangible way, the good will that almost all employers feel for their employes, but which in the hurry and turmoil of the day, is too frequently left unexpressed.

Mr. Bayless is in direct contact with our operating matter and I would be glad if he would amplify his more recent experience with the bonus.

## DISCUSSION ON BONUS PAYMENTS

By I. N. BAYLESS

Assistant General Manager, Union Pacific Coal Company

Mr. McAuliffe has given you figures and facts on the bonus, but there is an indescribable relationship that is caused by giving a bonus that is only brought out through association of the men themselves. It makes them more anxious to attend safety meetings. It makes them more receptive to suggestions, and it also makes them suggest more things in the line of safety.

I hesitate at this time to try to describe how much benefit is obtained from any direct effort put forth. Up until the 1st of May this year we have made a very good record. We think that a great portion of it is due to the different method of giving bonuses, although in instances they are small. We are having nearly 100 percent attendance at safety meetings. The men do not hesitate to give suggestions and they do not hesitate to criticize the management if they think the management is doing anything that is not good operating practice as well as good safety practice.

There are a number of things that happen around the mine that are rather funny. As an illustration, in Hanna, one of our large properties, they were last month really trying for the efficiency award, the bonus award, for the lowest cost. On the last day of the month there happened to be a carload of 40-lb. rails going down and some of the men coming out of the mines got together and decided that they had an opportunity to win that award. They did not think the rails should go into the mines until after the first of the month, it being the last day of the month. They protested to the mine manager or mine foreman about taking the rails in. That shows to me at least that there is a definite interest taken in winning the safety award.

Then there is the matter of chance. As you know, we are all gamblers. The matter of chance in the drawing gives them quite a kick.

I think there is a definite benefit to be obtained from the bonus.

**The following article appeared in the February, 1936, issue of *The Chicago Purchaser.* We are grateful to that publication for full permission to reprint it in our yearbook.**

# UNDER THE SURFACE

By PAUL WEIR
Vice-President, Bell & Zoller Coal Company

For the past three years, most of that which has been written and said concerning the bituminous coal industry has had to do with the application and effect of N. R. A.'s Coal Code and more recently the Guffey Coal Conservation Act. To many it might appear that these represent almost all that is happening in and to the industry. Such is not the case. At an ever increasing rate, mechanization and modernization of production and preparation are taking place. Changes are proceeding so rapidly that even those within the industry are constantly confronted with the necessity for revising their own ideas of what constitutes the best practices in organization, methods and machines. Very definitely, the competition of natural gas and petroleum products is challenging the resourcefulness of producers of bituminous coal. They must give to purchasers of fuel an acceptable grade of coal at a price which results in a greater number of effective heat units per dollar expended than can be had with any other fuel. At the same time they must pay a substantial wage to employes and return a reasonable profit to investors after paying the constantly increasing tax bill. Men who have devoted their lives to the extraction of mineral products from the earth's crust are, because of the very nature of their employment, extremely resourceful. This resourcefulness can be depended upon to meet any equitable challenge of other fuels by means of mechanization and modernization, a combination of which will bring to consumers of coal, a better product at a cheaper price.

Just a decade ago, the loading of coal underground by machines was in an experimental stage. A few machines were being tried out by hardy and ambitious operators with indifferent success. The judgment of the majority of mining men was that the loading machine would probably be perfected at some distant date, but that for some years to come could not be profitably substituted for a number two shovel in the hands of a strong miner. Strip pit mining in Indiana and Illinois was being practiced on a small scale with overburden shovels having a dipper capacity of approximately eight cubic yards. The engineering and technical staffs of coal companies consisted largely of a limited number of men whose chief duty was surveying on the surface and underground. The supervisory forces were recruited almost entirely from the ranks of miners and consisted of those outstanding practical men who had gained some technical knowledge by tedious night study after working underground during the day. The miners themselves were men who had learned from their fathers the expert use of a pick, the trick of hand shoveling, the use of explosives, the placing of timbers for support of the roof and the laying of track for transportation. Each miner performed these many individual operations during his day's work. Mechanical cleaning of coal in Indiana and Illinois was limited to several not too modern plants of relatively small capacity. The coarse sizes of coal at some mines were being hand picked. At others, the only cleaning of coal was being done underground by the miner. While some mines did have efficient screening plants, others had practically none. Few, if any operators were willing to listen to requirements of buyers for special sizes and preparation. The smugness of the post-war period had not been erased. Only a very few combustion engineers were on the payrolls of coal companies. Such was the picture only ten years ago.

A phenomenal change has taken place during this decade in men, methods and machines. Production by hand methods in Indiana and Illinois has been steadily supplanted by mechanical methods until in 1935, seventy percent of the total annual production came from mines which had been mechanized. Mass production, as spoken of in manufacturing industry, is being applied to the mining of coal. The experimental underground loading machine of ten years ago has been developed into an efficient unit capable of loading four to five hundred tons per shift. In strip mining, the size of overburden shovels has jumped to those having dipper capacities of thirty-two cubic yards. Accompanying this has been the necessary development of all accessory equipment such as undercutting machines, drills, locomotives and mine cars. With mechanical methods of loading and because of ever increasing freight rates, together with consumer demand for a better product, has come the need for improving the preparation. It is logical that mechanical cleaning go hand in hand with mechanical loading. Attempting to clean by manual means that which is loaded mechanically is costly and inefficient. The daily capacity of mechanical cleaning plants or washeries in these two states has grown from practically nothing in 1925 to the imposing total of 42,000 tons at the end of 1935.

With the great changes in equipment has come just as great changes in methods and organization. While the old time miner was skilled in many things, today the miner is trained to do expertly one of the many things which he formerly did. He is a driller, a shooter, an operator of a loading machine, an operator of a cutting machine or of one of the many other mechanical and electrical devices. He works on the "assembly line." Many of the mine superintendents are now technically trained. The engineering and technical staffs of progressive companies have been greatly expanded and now commonly include civil, mining, electrical, combustion and mechanical engineers. Less common but increasingly important are preparation engineers, chemists and industrial engineers. The traditional ways of our grandfathers carry less and less influence on present day methods. The tendency now is to seek out facts and to pursue a course of action based on proper engineering instead of hacking away by rule of thumb. While research work is still closely confined to institutions having the necessary staffs and equipment, more and more are coal producers attempting to apply this academic knowledge to their every day problems.

During this ten year period, in the mines of Indiana and Illinois alone, there has been spent on modernization of equipment the imposing sum of approximately $40,000,000. A further sum of approximately $8,000,000 has been spent on new mechanical cleaning and washing plants. These expenditures evidence the fact that coal operators are not leaning too heavily upon miracles to save themselves from being eliminated as purveyors of fuel.

We marvel at progress in the automotive industry. Our 1936 car evidences the ingenuity and resourcefulness of automotive engineers. Changes in methods of production of bituminous coal are just as marked as changes which have taken place during the past twenty-five years in the production of automobiles. Few coal mines are now "holes in the ground" or "holes in the side of a hill." Rather they have become more or less industrial establishments with the problems of a factory in addition to the problems inherent to the extraction of minerals.

The purchasers of fuel may well study the progress of the coal industry during the past decade. While coal's problems are momentous, there is every reason to believe that those problems can and will be solved. The next decade will bring even greater developments in production methods and equipment. As these developments come, the purchaser of fuel will benefit.

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# PROCEEDINGS OF ILLINOIS MINING INSTITUTE FORTY-FOURTH ANNUAL MEETING

Held in Springfield, Illinois

**FRIDAY, OCTOBER 23, 1936**

## MORNING SESSION

**10:00 O'clock A. M.**

President T. J. Thomas: Gentlemen, will you please come to order?

We are bringing to a close one year and beginning another year of the activities of the Illinois Mining Institute. This organization, comprising as it does 569 members, has been and is a fine instrumentality for good, one where the executives and operating men may gather and exchange views with benefit to all.

Coal, probably more than any basic industry, has felt the effects of the depression from which we are emerging. It is gratifying to know that for the twelve months ended September 30, 1936, the mines of this State produced a total of 45,389,849 tons of coal, being an increase of 5,747,323 tons or 14.5% over the corresponding period ended September 30, 1935.

I have faith in this industry and our Country as well, and am sure that as prosperity returns, and it is returning, coal to a large extent will come into its own, but it behooves all of us to give support to those agencies devoting their time and energy in finding broader markets and new uses for this basic commodity.

I welcome you to this meeting, and trust that all will enter into the discussion in connection with the various papers that will be presented. Also, on behalf of the officers and directors, I wish to extend my thanks to you for your co-operation throughout the year just ended and your presence here tonight, and particularly to those who have contributed so generously of their time in an effort to make this meeting a success.

Now, we have a few items of business we must take care of. First is the reading of the minutes of the last meeting.

A Voice: I move we dispense with the reading of the minutes of the previous meeting.

(Which said motion was duly seconded and unanimously adopted.)

President Thomas: I wonder now if we may have the report of the Secretary?

Secretary B. E. Schonthal: The affairs of the Institute remain in a very satisfactory condition.

Our membership has been maintained. Although the total membership has not been increased, we feel that the fact that we have held our own is a very satisfactory showing.

We have had occasion to cooperate with many organizations throughout the country in an endeavor to further the interests of the Coal Mining Industry, and from time to time have sent various notices to the membership.

The boat trip proved highly satisfactory, and it is hoped that these boat trips will be continued as an annual event.

During the year one of our members, Mr. Nelson P. Morris, passed on. Letter of condolence was dispatched to the bereaved family.

I wish to express my appreciation to the officers, executive board, and members for their helpfulness throughout the year.

President Thomas: Brothers, what will you do with the report?

A Voice: I move its adoption.

(Which said motion was duly seconded and unanimously adopted.)

President Thomas: Are there any reports from the various Committees? If so, may we have them at this time? If not, may I ask for the Treasurer's report at this time?

Secretary Schonthal: This is the report of the Auditing Committee:

## REPORT OF AUDITING COMMITTEE
## ILLINOIS MINING INSTITUTE CASH STATEMENT

*October 23, 1936*

| | |
|---|---|
| Balance in Bank November 1, 1935 | $3,480.84 |
| Total receipts 1936: Dues, interest on bonds, yearbook, boat trip (including Western Union matured bond $1,032.50) | 5,566.80 |
| Total cash | $9,047.64 |
| Total Disbursements 1936: Printing, postage, telephone and telegraph, etc., including $4,149.72 for purchase of U. S. Treasury Bonds | 7,779.50 |
| Balance in Bank October 23, 1936 | $1,268.14 |
| Investment in bonds, as above | 4,149.72 |
| | $5,417.86 |
| Balance in bank November 1, 1935, as above | 3,480.84 |
| Profit for year 1936 | $1,937.02 |

**Life Membership Account**

Balance October 23, 1936 ........................................................$ 209.63

The foregoing is found to be correct:

D. H. DEVONALD,
W. J. AUSTIN,
JOHN A. GARCIA,
*Auditing Committee.*

**Bonds Owned by Illinois Mining Institute**

One—Chicago, Burlington & Quincy Railroad Co. ..............................$1,000
One—Missouri Pacific Railroad Co. ........................................................ 1,000
Six —U. S. Treasury Certificates, $1,000 each ..................................... 6,000

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A Voice: I move the report be received.

(Which said motion was duly seconded and unanimously adopted.)

President Thomas: We have a pretty good Treasurer, and he knows how to take care of the money. Is there any report in connection with unfinished business? May we have the report of the Nominating Committee?

Secretary Schonthal: The report of the Nominating Committee is as follows:

**REPORT OF NOMINATING COMMITTEE**

West Frankfort, Illinois
October 16, 1936

Mr. B. E. Schonthal, Secy.
Illinois Mining Institute
28 East Jackson Boulevard
Chicago, Illinois

Dear Sir:

The three members of the nomination committee of the Illinois Mining Institute have unanimously agreed to the following men for the positions as shown for nomination at our annual meeting in Springfield on October 23, 1936:

OFFICERS

W. J. Jenkins, President
H. H. Taylor, Jr., Vice-President
B. E. Schonthal, Secy.-Treas.

EXECUTIVE BOARD

| | |
|---|---|
| R. L. Adams | James McSherry |
| W. C. Argust | F. S. Pfahler |
| W. J. Austin | C. J. Sandoe |
| C. F. Hamilton | H. A. Treadwell |
| C. T. Hayden | T. J. Thomas |
| M. M. Leighton | W. P. Young |

Very truly yours,
JOHN E. JONES,
*Chairman.*
D. D. WILCOX.
F. S. WILKEY.

Mr. John E. Jones (Chairman, Nominating Committee): I move the nominations be closed, and the Secretary instructed to cast the ballot for the ticket as read.

(Which said motion was duly seconded and unanimously adopted.)

President Thomas: Gentlemen, I believe the Secretary has one or two communications he would like to read at this time.

Secretary Schonthal: I have a letter from our good old friend and supporter F. F. Jorgensen, whom most of you know. I have been in correspondence with him, and had this letter yesterday:

"October 21, 1936

Mr. B. E. Schonthal, Secy.,
Illinois Mining Institute,
c/o Hotel Abraham Lincoln,
Springfield, Ill.

Dear Ben:

I thought that I had it all planned to attend your meeting Friday, Oct. 23rd, but I find that I cannot do so. I am therefore sending my very best regards and wishes to you and all members of the Institute.

Yours very truly,
(Signed) F. F. JORGENSEN"

I received a telegram here from George McFadden, whom all of you know as having been very active in the affairs of the Institute, a past President, and who has not been very well. He says:

"B. E. Schonthal, Secy.,
Illinois Mining Institute,
Abraham Lincoln Hotel,
Springfield, Ill.

Regret my inability to be with you all today. I am grateful for your good wishes. I sincerely trust that the benefits to the Illinois Mining Industry thru the accomplishments of today's proceedings will far exceed the highest expectations of Institute Officers.

G. C. MCFADDEN"

I also have a wire from Mr. Knoizen:

"B. E. Schonthal,
Abraham Lincoln Hotel.

Very sorry, but business here makes it impossible to be at Institute. You know I would rather miss any meeting in the Country than the Springfield Session. Best of luck for a very fine and successful meeting.

A. S. KNOIZEN"

President Thomas: I would like to ask all of those present who have not paid their dues to be sure to see you do before you leave. If there are any of those here, and I am sure there are, that want to belong to the Illinois Mining Institute, won't you join this Institute today?

Now, gentlemen, I turn the meeting over to Mr. Herbert H. Taylor, Jr., who will act as Chairman for the morning session.

Secretary Schonthal: May I make one announcement? Professor Smith of the University was good enough to bring up a few tickets for the football game tomorrow. Any of you members or guests who have not purchased tickets and want to go to the game might see him after the meeting. He has a few very choice tickets.

President Thomas: Mr. Taylor.

Chairman H. H. Taylor, Jr. (Franklin County Coal Co., Chicago): Gentlemen of the Illinois Mining Institute, it is our pleasure to hear from Mr. John Parker, Superintendent of the Inland Steel Company, Wheelwright, Kentucky, who will read us a paper on "New Developments in Improving Undercutting Machine Bits." Mr. Parker.

Mr. John Parker (Inland Steel Company): Mr. Chairman, Gentlemen of the Mining Institute, this paper deals with hard surfacing of bits at the mine of the Inland Steel Company, located in Eastern Kentucky.

# HARD-FACING MINING MACHINE BITS AT THE WHEELWRIGHT MINE OF THE INLAND STEEL COMPANY

By JOHN T. PARKER, Superintendent

It might be of interest to preface this paper on the hard facing of mining machine bits at the Wheelwright Mine by a few facts concerning the Wheelwright operation.

The Wheelwright Mine of the Inland Steel Company of Chicago is located in the Big Sandy Elkhorn District in Eastern Kentucky, about fourteen miles from the Virginia line. While the Town of Wheelwright is in Floyd County, the mine workings extend into the adjoining counties of Pike and Knott. The mine operates in the No. 3 Elkhorn seam, which has an average thickness in this locality of about 44″ and is at an elevation of 1,225 feet.

The acreage embraced in this property is approximately 14,000, and at the present time the active mine workings are spread over an area of fifteen square miles. To mine and transport to the surface the average daily production of slightly over 5,000 tons requires 26 gathering locomotives, 4 haulage locomotives, and 24 mining machines. All machines are of the short-wall, bottom cutting type.

Early in 1934, after an unsatisfactory experience with the type of bit in use at that time, we decided to change to a Sullivan roller type bit sharpening machine, and at the same time we had the Sullivan Machinery Company run a test of a hard facing method that appeared to offer a more satisfactory bit at a substantial saving. After a convincing demonstration had been carried on for a week, we adopted their method, which utilized "borod" as the hard facing metal, and have continuously used it since that time.

Borod seems to possess special properties which contribute to a good cutting edge. It approaches the diamond in hardness with the Borium particles acting as the cutting media, and at the same time can be applied with an acetylene torch by an employe of average intelligence after very little instruction.

After we had decided to adopt borod for the facing of bits, it was necessary for us to design our own plant, as at that time there were none on the market. We had on hand the natural gas furnace which we had used with our previous bit machine; also an emery grinder. This made it necessary that we construct only a table on which to mount the bits for tipping. The table, which we made in our shop, measures 36 inches square with angles on the outer edge to hold the bits in the proper position for tipping. The table has a solid top so that the bits can be poured from the boxes on to it. It is 27 inches high, and is mounted on a ball bearing to permit easy turning by the bit sharpener, and has a capacity of 265 bits.

Before submitting any data covering our first year's experience with borod, it might be well to detail the routine followed to prepare a bit for mine service. A bit that is badly worn or broken is placed in the natural gas furnace, and about $\frac{3}{4}$ in. of the tip is brought to a bright red heat. It is then placed in the bit machine and forged, or rolled, to the proper shape. The type bit used at our operation is that formed by using a No. L-1155 Sullivan die and has a clearance angle of 30°, a back slope angle of 30°, and a side slope angle of 7°. It is the standard high carbon mining machine bit which we buy already formed and measures 1″x½″ x4½″. It has a face length of 1½″ and a ⅛″ point.

We have found that very often in rolling the bits "fins" are formed along the edges. The forming of these fins is due to the bit sharpener failing to properly gauge the position of the bit in the machine and to the fact that we use the bit twice after each rolling, which makes it necessary to roll the points out more than would ordinarily be the case if the bits were used but once. After grinding off these fins, the bits are ready for tipping, and after tipping are ready for service. We use no quenching bath, and the bits are not tempered but are allowed to cool to room temperature before tipping by scattering them on the shop floor.

If a bit sent out to be sharpened is one that has been tipped and it is but slightly worn, it is ground to the proper shape on an emery wheel and is then ready for further service without heating or retipping. Our experience has indicated that a bit can be ground once after the original tipping before it is necessary to retip it. A bit can therefore be used twice after each tipping. Of course there are exceptions to this as some bits are broken in service, and we have had some of the borod tips break off, although it is an unusual occurrence.

During the twelve month period, from July, 1935 until the end of June, 1936, we sent to the mine from the supply house 4,250 bits at $.0344 each, or $146.20 worth of new bits.

During the same period we produced 1,100,314 tons of machine coal, which gave us a bit life of 258.9 tons.

During the last twelve month period preceding the adoption of borod as a hard facing agent, we sent to the mine 7,750 bits at $.0344 per bit, or $266.60 worth of new bits. During this same period we produced 840,981 tons of machine coal, or a bit life of 108.5 tons.

The saving on the cost of new bits after the adoption of borod compared to the preceding twelve months was $120.40, and the increase in bit life was 150.4 tons per bit or an increase in bit life of 138.6 percent.

During the first twelve month period of hard facing, we averaged 1,137 points per day of which 583 were tipped and the balance of 554 reground.

The daily labor charged to bit sharpening is seven hours at sixty-two cents per hour, or $4.34. During the above period the mine worked 245 days, and we pointed 278,565 bits with a labor charge of $1,063.30, or .0038 cents per point.

From our experience we have found that we can satisfactorily tip 4,000 bits per pound of borod. During the period under consideration we used 35.71 pounds of borod at $5.50 per pound, which amounts to $196.41 or .000705 cent per point for 278,565 points.

In arriving at this cost per point for borod we must not lose sight of the fact that although we tip but 583 points daily, we also grind 554 points that are already tipped, making a total of 1,137 borod tipped bits that are prepared for the mine each day.

The combined cost of oxygen, acetylene, and emery wheels amounts to .00113 cent per point. This gives us a total cost per point for labor and material of .005635 cent.

Going back to our experience preceding the adoption of borod, we find that in the preceding twelve month period we sharpened on an average of 3,200 bits per day with an expenditure of eighteen hours of labor. Based on the wage scale prevailing in our first twelve months of hard facing, this would amount to $11.16 per day.

During this twelve month period the mine operated 223 days, and we therefore sharpened approximately 713.600 points at a labor cost of $2,-488.68. or .00349 cent per point.

During the first twelve months of our experience with borod, we pointed 278,561 bits at a cost of .005635 cent per point, or a total expenditure of $1,569.69. Therefore in the first twelve month period following the adoption of hard facing, we saved the difference between $2,-488.68 and $1,569.69, or $918.99 in labor and material, which is in addition to the saving in the purchase of new bits amounting to $120.40, making a total saving for the year of $1,039.39. We must not, however, lose sight of the fact that while there was the actual saving of $1,-039.39 in labor and material in the twelve month period after we started the hard facing, that we also produced 259,333 tons more coal. On a tonnage basis the saving amounts to $1,888.74.

Possibly this saving does not equal that made by other companies by the adoption of hard facing of machine bits, but it does indicate that there are substantial savings to be made by those who are willing to change, and in the light of what we have accomplished, we do recommend hard facing of bits.

To permit those who operate in a thick vein to compare their own work with the work at Wheelwright, I have reduced our figures to square feet of kerf per bit point with our old and present type of bit. In the twelve month period before adopting hard facing, we produced 840,-981 tons of machine coal. In the thickness of coal at our operation this would require the cutting of approximately 5,744,406 square feet of kerf. During this period we used 713,600 points, or an average of 8.05 square feet of kerf per point.

After adopting hard facing, we produced 1,100,314 tons of machine coal in twelve months, which required cutting 7,515,806 square feet of kerf. In this period we used 278,561 points, or an average of 26.98 square feet of kerf per point, an increase of over two hundred percent compared to our previous number of square feet per point.

I might mention the Sullivan Bit Sharpening Machine, which we use, turns out a bit that lends itself well to hard facing and that the cost of maintenance of the machine is very low as compared with an unusually high upkeep cost on the machine we discarded.

Our practice and what success we have enjoyed at Wheelwright with hard facing has not yet reached the goal that I feel shall finally be achieved in machine bit treatment. If an increase of over one hundred percent in tons per bit life can be accomplished at Wheelwright in one step, I believe that a much greater improvement can be attained by experimental research, and bits that will cut a full shift or even two or three shifts without replacing are altogether possible.

In our application of borod we use a style No. 9900 Airco type D. B. Oxygen Acetylene welding torch with a style No. 89 No. 5 tip. We use welding rod size 1/8 inch by 14 inches and tip on an average of 260 bits per rod.

I might mention in conclusion that due to the large amount of rock drilling carried on in our mine, we have experimented somewhat with hard-facing the detachable air hammer drill tip and have been pleased with the results attained so far. During the first six month period of tipping these bits we purchased 95 percent less bits than in the preceding six months; and while that saving is partially offset by the necessary material and labor for reconditioning these bits, the reduction in total cost is substantial.

* * *

Chairman Taylor: Thank you, Mr. Parker. Mr. John H. Evans, of the Wasson Coal Company, Harrisburg, Illinois, has been good enough to come up here today to discuss Mr. Parker's paper. Mr. Evans.

Mr. John H. Evans (Wasson Coal Company): Mr. Chairman and members of the Illinois Mining Institute, the Chairman said I was here for the purpose of discussing this paper. Before entering into any discussion I desire to read a few remarks I have written out here with reference to our experience in hard surfacing bits and regarding our system of hard surfacing.

The Wasson Coal Company is located at Harrisburg, Illinois, mining coal in the Illinois No. 5 seam. Practically all cutting since the introduction of coal cutting machinery has been done at the bottom of the seam, which has been considered easy cutting compared with other Illinois coals, and therefore very little attention was paid to the cutting bits.

With the installation of coal loading machinery, it was found advisable, in order to handle the draw slate which lies on top of the seam, to experiment with different systems of cutting the coal, and finally a track cutting machine was decided upon which permits the cutting to be done at the top of the seam, making it possible to remove the draw slate before shooting. It was then discovered that the most difficult part of the seam to cut was located at the top, which brought on cutting bit difficulties which had not been encountered before.

It became necessary to experiment with different types of steel for making bits, but none proved satisfactory. Consideration was given to the proposition of tipping the bits with hard-facing materials, and Borod was decided on as the one to be used. This materially increased the life of the bit as far as abrasion at the point was concerned; however, we found that the bit bent so often that the efficiency was destroyed. And then the question of tempering the bit was tried out, and we went from bending to breaking, which was difficult to control.

The question was then put up to a representative of E. F. Houghton & Co., and their suggestions were followed. This consisted of the following method: The bits were first formed by a Sullivan forming machine and allowed to cool, and then the borod was applied to the tip of the bit and the bit pre-heated to about 1400 degrees, then quenched in oil until cool which makes the bit hard and brittle. Then the bits were placed in a pot of draw salts furnished by the Houghton Company which is heated to around 450 degrees, for the purpose of creating a toughness which controls the breaking and bending difficulty. So far we have found this to be the most satisfactory bit for our conditions.

In order to determine the efficiency of the bit that we are using now, as compared with the one we had always used, we ran a test on bottom cutting and found the following results: With the old bits 342 feet was cut, using 619 bits. With the new bits as now treated and hard-faced, 342 feet was cut using 106 bits. The same working places were used for this comparison. Inasmuch as we did not use the old bits on top cutting but for a few days, we did not get any comparative figures.

I notice in Mr. Parker's paper he makes the statement that any ordinary fellow—he did not say it in those words,—but that any ordinary fellow around the mine can learn to tip these bits in a short time. I cannot quite agree with that statement. It may be they have those fellows around a mine, but they do not do the work as it should be done.

I have some specimens here of types of bits that have been hard-surfaced. In my opinion, one of the greatest troubles with hard-surfacing material on cutting bits has been caused by wrong application.

I have been around quite a few mines where the hard-surfacing of bits has been practiced, and find a lot of bits like I have here, where the material is what I call just daubed on it and has more the shape of a bore than a cutting bit. On the other hand, I have a bit here which I think has the proper application of hard-surfacing material. It is spread over it, and still leaves this cutting point.

Our heat treating system may appear to some of you that we have gone to an extended length in order to create a bit to cut coal with. We haven't figured up any cost on our bits, because we have not been in this game long enough and have done a lot of changing from one thing to another trying different kinds of steel that have been recommended by the steel companies and different types of bit forms and things like that, but we finally find that this bit here as we treat it and hard-surface it has given us the greatest amount of cutting per bit.

We have not been able, through all our changing around, to make any comparative figures like those Mr. Parker has in his statement in regard to cutting, but in order to satisfy our own curiosity we shoved some of these bits into another mine where they were cutting on the bottom, as has been the custom in that field.

In order to determine the efficiency of the bit we are using now as compared with the one we had always used, we ran a test on bottom cutting and found the following result: With the old bits, 342 feet was cut, using 619 bits; with the new bits as now treated and hard-surfaced, 342 feet was cut using 106 bits. The same working places were used for this comparison. Inasmuch as we did not use the old bits on top cutting but a few days, we did not get any comparative figures.

I made reference in the article I just read about the difficulties or trouble we ran into with the bending and breaking of the bits. We also found that after applying this hard-surfacing material under our severe cutting conditions, some bits gave way at the back of the hard-surfacing. That we overcome to a very large extent with this heat treating method we are following.

Our theory of that is, of course, that of building up the foundation on the back of the point of the bit to sustain the structure and for the hard-surfacing material that is put on. As I said, we have been jumping from one thing to another in cutting bits, trying to find one that will give the best results.

I have nothing more to say. If there are any questions anybody would like to ask, if it is possible for me to answer as the result of our experience I will be very glad to do so. If anybody cares to examine these bits, I have brought them here. Some are in the old, unsatisfactory way, and some as they should be done.

* * *

Chairman Taylor: I am sure there must be questions possibly concerning the interesting cutting problems they are working on down at Harrisburg. We would like to hear from any of you who have anything to say.

Mr. D. D. Wilcox (Superior Coal Company, Gillespie): There are two or three questions I would like to ask either Mr. Parker or Mr. Evans. In Mr. Parker's case I would like to find out if with his experience he would recommend this heat-treated bit in all cases. I mean for all fields.

Then while he is talking, I would like to know if he tried the idea after he got this bit formed of using it without hard-facing. The idea I have in mind is whether or not this treatment they gave the bit or the hard-surfacing they gave the bit or shaping they gave the bit brought the results.

Then I would like to know from Mr. Evans if he tried the idea of doing away with the treating of the point after he run into the idea of the oil treatment. I have the idea it is the oil and sand treatment that furnished the result instead of the hard tip. I question very much how much work the pick has to do. Most of it is pick work. In order to get any results from hard-tipping the bit, the bit has to be put to abrasion work or rubbing work instead of pick work.

If I have made myself clear, I would like to have an answer from those fellows whether they figure the shaping or the heat treatment or the bit-tipping brought the results.

* * *

Chairman Taylor: Mr. Parker.

Mr. Parker: In our case, I believe it was the tipping of the bit that produced the result. We used the bit preceding the tipping, and from the figures I gave it would indicate we got much better results after we started tipping the bits. Of course, considering what Mr. Evans has said, our cutting must be comparatively easy in comparison with what he does. We seldom ever break a point from a bit unless there is a flaw in it. It is a matter of cutting the coal. From our experience, I would say we are getting our results from the tipping of the bit.

Mr. Evans: From all the fellows in this meeting, I would expect that out of him. Why, our experience has run something along this line. We first started out in this cutting with the ordinary bit we had been accustomed to using, and did not get anywhere with it. Then we tried the heat treatment, and got some good results out of that, and finally the other fellow came along with the proposition about the hard-surfacing. Anyway, we applied the hard-surfacing material to the heat-treated bits. Then our heat treating plant went down on us, and we went along with the hard-surfacing without the treating. I had a good bit of information as to the different places they tried out where heat-treating wasn't necessary with the hard-surfacing. We run along three or four weeks under those conditions, just hard-surfacing without heat treating, and then got our plant fixed up and went back to the heat treating and hard-surfacing, and found we got better results from the combination.

Although that is a long way to go in preparing cutting machine bits, and I doubt the feasibility of doing it unless you had extremely hard cutting conditions like we encountered where we are cutting this coal at the present time, I would not say they had to do it in the hard cutting conditions unless it is as hard as we have to cope with. Does that answer your question?

Mr. H. A. Treadwell (Chicago, Wilmington & Franklin Coal Company, Benton): Mr. Chairman, in regard to Mr. Wilcox's question, we have been hard-surfacing our bits for quite a long time. We have not changed the form of our bits in any way.

I think the experience of Mr. Wilcox in Southern Illinois is the regular bit made with the rule of the bit for the ton of coal. It figures out generally true. Since we started hard-surfacing, we have cut the number of bits in service down to about thirty-three and one-third percent. I am quite sure it is the hard surfacing that makes our saving.

There is another question I would like to ask Mr. Evans. You have some bits up there that do not resemble anything like the cutting edge. You have another bit with a smooth cutting surface, as I take it. How did you obtain that? Was it due to the use of a smaller torch or something, some other die or rod, or what was it? Was it the handling of it? Did you get that result with an ordinary acetylene torch used for general purposes around the room with a quarter inch or five-sixteenths inch rod?

Mr. Evans: We are using our torch and instructions from the Sullivan Machinery Company, and they furnish a man to instruct our men and teach them how to apply it. They sent a torch in for that purpose.

In regard to the two different methods of application, the same fellow applied the material on all those bits. The bit with the surface as it should be, as I think it should be, is done by the fellow we had employed doing that as he was told to do it. The other is the result of his negligence after learning. Or perhaps, in fairness to the boy doing the work, I might say in his desire to create more speed in tipping he did this, using the same torch all the time. I think you will find in almost anybody employed to do the work that he cannot do it right quite as fast as he can do it the other way. That is our experience.

Mr. Treadwell: The reason I brought this up is we have these, and I have been told if you use a smaller bit and smaller diameter rod you eliminate it, and I just wondered if someone would say they have done it that way and got the result.

Chairman Taylor: Any other questions?

Mr. J. E. Jones (Old Ben Coal Corporation, West Frankfort): I think it would be interesting to know whether Mr. Parker was endeavoring to use the minimum amount of borod, or whether they have adopted and strictly adhered to the 4,000 bits per pound standard.

Mr. Parker: We have tipped more than that and have tipped fewer than that. From our experience, 4,000 makes the satisfactory bit. We have not had much success when we got more than 4,000.

Mr. Jones: Did you notice any difference in the life of the bit?

Mr. Parker: When we exceeded 4,000, we found the tip breaking off the bits. The only thing we can account for there is the fact we did not put enough on. When we get back to what we are doing now, our experience was satisfactory.

Mr. H. E. Treadwell: I am doing a lot of talking, but am trying to get information. I wonder if anyone has tried anything except borod? At present we are using stellite. I wonder if anybody tried that? We have also tried borod.

Chairman Taylor: Does anybody use other than borod?

Mr. Parker: I would like to find out if anyone has tried any of these things in comparison with the borod. I am familiar with stellite and stoodite as well as the borod.

Chairman Taylor: I am interested to know, Mr. Evans, whether you are cutting in the coal or in the rock at the top of the seam.

Mr. Evans: We are cutting in the coal seam, but cutting some rock, too. Our condition is mostly—

Chairman Taylor: You haven't attempted to cut entirely in the rock?

Mr. Evans: No. It is simply, you might say, iron pyrites encountered in the coal seam.

Chairman Taylor: Any further questions? We are fortunate in having as the President of this organization a pioneer. Without the pioneers in the industry in this State, we would not make much progress. Mr. Thomas and his company have pioneered a great many phases of our operation, and have made a success in their pioneering. Mr. Thomas has agreed to tell us today of the "Importance of Personal Health in Good Safety Practice; Duties of the Employer and Employe."

President T. J. Thomas (Valier Coal Company, Chicago): I would have you know that what I may say represents my opinion only. I have not undertaken to confer with many of the people in the mining industry, but have undertaken to set out some things here which I believe will be of interest to us in helping us to find the correct answer.

## IMPORTANCE OF PERSONAL HEALTH IN GOOD SAFETY PRACTICE: DUTIES OF THE EMPLOYER AND EMPLOYEE

By T. J. THOMAS
President, Valier Coal Company

Man always has been surrounded with hazards against which he has been compelled to provide himself with some effective means of protection. In the beginning he lived in caves and trees and resorted to the use of clubs and stones to combat the wild beasts of the field and forest which were ever present.

Although an ingenious creature, there were long periods of time when he made little apparent advancement, but always he has instinctively sought to provide himself with the finer things of life. As time progressed he discovered,

fire,
the wheel,
a way to quarry stone,
a way to make brick, and
to smelt ore,

all of which, in a larger sense, were used to provide himself with the comfort he so eagerly sought.

Perhaps the most important of these discoveries was the wheel, since it has had more to do than any other medium in removing the drudgery and burden from the back of labor. Then too, it brought about an evolution in transportation and machinery so essential in providing him with the necessities of life.

With all of his inventions and discoveries, he created new hazards, the outgrowth of which brought about the advent of the "safety movement." Then, through his cooperative effort with management, he has saved the lives and limbs of many of his fellow workers.

Is it not appalling to think of more than 36,000 killed and 107,000 permanently injured annually through the use—reckless or otherwise—of one instrumentality of transportation (automobile), the product of his creative mind!

Now, as important as the safety movement may be, I call to your attention a matter that is equally as essential, one that as time transpires will require intelligent action on the part of both management and worker if a proper solution is to be found. I refer to the employment of a workman in an extra hazardous job, liable to be stricken while so engaged with fatal results to himself and fellowman. I ask you this question, reserving unto yourselves the answer.

How would you like to have those persons dear to you travel on a train, an automobile, or some other high speed conveyance, operated by a man having a serious heart ailment, apt to strike him down without a moment's notice while he is engaged in performing his duties?

Now let me relate to you a case in point (occurring outside the State of Illinois) which, when it came to my attention, produced a severe shock:

> An examination was being made of a certain mining property. The examiner carried a safety lamp, had examined several places and called to his "buddy"—"It is as clear as a bell." He was asked to make another test with the awful discovery that the room examined contained sufficient gas to cause an explosion.

The serious implication involved in this case was the fact that the examiner was not only color blind, but his vision was otherwise seriously impaired. Another instance which came to my attention some time ago was that,

> of a motorman, practically blind in one eye, with the vision of the remaining eye so impaired that he had difficulty in daylight in recognizing (distinguishing) objects even at a short distance.

There are no doubt similar instances with which you are familiar, where serious hazard has been created by an employe, not only to himself but to his fellow workmen as well.

These are problems that, in my opinion, constitute a challenge to both Management and Labor. There is a remedy, namely, a fair and impartial physical examination, one that will not work a hardship on either employe or employer, and at the same time provide protection for those suddenly stricken or physically impaired who, because of their condition, are liable to cause injury (perhaps fatal) to themselves and other employes.

Finally, I suggest that both management and employes address themselves to the task of discovering the correct solution and mutually agreeing upon a policy in dealing with it—one that will not work an injustice to anyone, and in the end result in benefit to all.

Chairman Taylor: Thank you very much, Mr. Thomas. This is a subject in which we all should be interested. We are very fortunate today in having with us Mr. T. E. Lightfoot, who has charge of all safety work for the Koppers Coal Company, Pittsburgh, Pa., in their various properties in the East. He comes to us from Pittsburgh to tell us something about the work his organization has done, and to discuss Mr. Thomas's paper. Mr. Lightfoot.

* * *

Mr. T. E. Lightfoot (Koppers Coal Co., Pittsburgh, Pa.): Gentlemen, I am here today in the place of Mr. P. C. Thomas, our Vice President, who was completely unable to discuss this paper.

After talking with Mr. Taylor this morning, I realize what I might have to say is quite radically different from the conditions in Illinois. I am not familiar with Illinois mining practices or properties, but in Pennsylvania, West Virginia and Kentucky we have been doing there for some time the very thing Mr. Thomas brings out in his paper, and that is the physical examination of men. We would not want to be without this if we could possibly help it.

When I say we have a pre-employment physical examination, it is not a case of a hard-boiled examination, but it is an examination that reacts to the benefit of the man who is examined and the management as well. We do reject some people who apply for employment, but in rejecting them our doctors make an effort to explain to those men that it is not a safe thing for them to undertake working in a coal mine. If they have high blood pressure, or if they have certain other heart ailments that are liable to cause sudden death, our doctors tell the men, "You are not going to die, but if you undertake this job in the coal mine you will be running the risk of shortening your life and possibly causing injury or death to your fellow workmen, and what you had better do is try to find a job in some other line."

It is pretty tough medicine to be told something like that, but after all it is a kindness to a man to be told it isn't safe for him to undertake that kind of work. I imagine there is not a man in this room who does not know of some case where a sudden heart failure has caused an accident or a near-accident when a hoisting engineer or a person in some capacity of that kind was suddenly stricken with apoplexy. I know of two or three cases. While all our hoists are equipped with sufficient safety devices and all that sort of thing, there are none of us that does not shudder to think of what might happen if one of our hoisting engineers was suddenly stricken. It is to prevent just that sort of thing that we try to get in our physical examination before employment.

We classify the men that apply for employment. We do not turn a man down even if he has one eye only, but are careful he does not go into the kind of job where he needs two eyes. We do not turn down a man necessarily because he has a wooden leg, because, as you know and as I know, there are plenty of men working in the coal mines with only one leg or even one arm who can outdo in production many others who have all their members.

We find no difficulty in enforcing this regulation, possibly because it is more or less a custom in West Virginia, but we recently took over a mine in Pennsylvania where that had not been done and where there was some antagonism to our proposition. But after explaining it to the men and explaining to the labor organization what we were after, we went ahead with it, and we feel that the general health of our people has been materially improved by this physical pre-employment examination.

We do not stop there in the case of hoisting engineers, locomotive engineers and motormen and expect to carry on indefinitely. We have six-month periodical physical examination. If we find a man suffering from syphilis, we do not fire him but tell him syphilis is curable, and he shall go and take treatment. We make it possible for that man to get treatment at a nominal cost. The treatment of venereal diseases has been a legitimate graft among doctors for many years, for men are fearful and will pay any fee for treatment. We hold our doctors down to a fee of $1.00 for a treatment, which when the Neo is considered and the breakage of needles and other expenses leaves the doctor about forty cents for his skill. And we find men usually are glad to take the treatment in order to hold a job.

If we find a man running a hoisting engine who has high blood pressure, we try to find some other job for him, and put someone in his place who will not be a hazard to the men he is handling.

The same thing is true of doing any other work where the handling of men is involved. If we find a man who upon examination we feel is not safe to go underground and who is a good worker, we try to get him some job outside if we have a vacancy. We are not hard-boiled about casting off everybody coming up who does not measure up one hundred percent. There are very few that do measure up to one hundred percent. But we try to place those men in the kind of jobs where they will not be a menace to themselves and to their fellow workers.

Personally, considering this periodic physical examination of hoisting engineers and others who have the handling of men in their hands, I realize bus drivers are examined every six months in bus companies like the Greyhound System and other modern bus concerns, realizing the hazard involved in letting a man who is not physically fit drive a bus with some ten to fifty passengers. In this particular instance, these were men who had not been examined when hired. We bought the property and took over the payroll, and those men were not examined, so that we were really breaking into a new field when we started the physical examination of those men, but we had no trouble at all for the simple reason we went out of our way to help correct or cure the men from disabilities we found existing in those examinations.

If you simply examine men and cast aside the men who do not pass the required test, you will be putting yourself in a very unenviable position, for that is not the thing to do. Men must work, and if they are not physically fit for the work they are trying for, surely there is some other work they can be given to do, and many men can be cured of the disabilities that are found.

We find cases of hernia. You would be surprised to find how many men are examined and found with hernia. Whether there is such a thing as traumatic hernia, I don't know. Compensation companies pay thousands of dollars for traumatic hernia. Whether a man can suffer hernia in his work is a question for medical opinion and not you and me. It isn't a debatable question. But anybody, everybody, our doctors tell us, has potential hernia. All it needs is the last straw to cause it to break forth. We do not reject men on account of hernia. We make a note on our examination card, and urge them to take treatment.

In West Virginia we have an advantage I understand you do not have here, in that we have hospitals where men contribute so much per month to a hospital which in turn gives them the required surgical and medical care for themselves and their families. As soon as a man comes on our payroll, he is able to go ahead and get that treatment. However, that is not true of all of our operations.

In Pennsylvania we do not have it. Our method of handling it there is to go to the hospital that handles our compensation work. Hospitals have had a hard time in the last few years, and are willing to listen to any reasonable proposition. We go to that hospital and say "We are giving you our compensation work for which you are allowed a very fair fee, and we want you to do something for us. We will send you people who need treatment, and we will see you get your money if that man stays in our employ. However, you must be satisfied to accept that at $1.00 per month, or whatever the man can pay. We collect that for you. We do not deduct it from the payroll, but require him to pay it to us when he gets his pay. We will pay that to you."

We do that bookkeeping and service without commission of any kind, for we realize it does two things: builds up the relationship between our company and the hospital that does our compensation work, and makes it possible to correct many things of a surgical nature necessitating surgical treatment that we could not get at in any other way. I have yet to find a hospital superintendent or manager that will not go along with you on that kind of program. They do lots of work for which they do not get a penny, and to be assured they will be paid even in dribbles is much better than not being paid at all.

The same thing in the case of our children. I may be a little off the subject of Mr. Thomas's paper when I say we carry our health work even into the families and the children. We have quite an elaborate program which starts right with the delivery of the child. Our nurses look after the mothers and babies and we have free school clinics and things of that sort that we feel will make better and safer miners for generations to come. Most of our properties are set up for twenty-five or more years of life, and we know the children born today will operate our mines in the next generation.

Getting back to the subject of physical examinations, you may have difficulty in putting it in, but I doubt very much if it is as much of a problem as many of you may feel it is, for the simple reason if you sit down and talk to your men and tell them you will not be hard-boiled about it and will not discharge every man who does not come up to your requirements, but will help him to try to get back to good health, I think most of them will go along with you. That has been our experience in Pennsylvania.

I know it has a whole lot to do with your safety record. A man who is not in good health, who has something inherently wrong with him that you do not know anything about, or maybe he does not know anything about, carries a safety hazard with him all the time. He is not a good producer. He cannot be a good producer. Even little ailments like constipation and things of that kind cause men to lag in their work, and a health program established and carried out with a kindly, thoughtful attitude toward the men will do a whole lot toward increasing your productiveness and strengthening your problems.

We know that safety and productiveness are the warp and woof of the fabric that makes for progress, and through that fabric will run or should run a thread of health care that will strengthen and help you a whole lot in making your company's profit a real profit.

How much money our health program has meant to us I don't know. I like to use the comparison I made between our health program and the matter of a merchant's display of goods in his windows. I have never yet been able to find a merchant who could tell me just how much profit is represented by his window display, and yet I would say I do not see a single merchant boarding up his windows. They all put stuff in their windows, and all evidently receive some profit from it.

I cannot give you any dollar and cent valuation as to what our health program has meant to us, but I do know, and I speak for our management, that we would not be without it under any circumstances. There may be some particular phase of health work our company has been attempting to do that may be of interest to you, and if there is I would be only too glad to answer any questions.

I thank you.

Chairman Taylor: Thank you. That is something worth while. I am sure there must be some questions. Does anyone here care to discuss this subject?

Mr. Thomas, I will turn the meeting back to you.

President Thomas: Gentlemen, is there any other business to come before the meeting?

Mr. D. D. Wilcox (Superior Coal Company, Gillespie): Mr. President, I would like to present a resolution.

President Thomas: I think you had better come to the front of the room.

Mr. D. D. Wilcox (Gillespie): This is a resolution urging research on Illinois coal as a source of gasoline and oil.

A shortage of petroleum for the production of gasoline and oil appears to be a distinct probability within the next decade or two. The coal deposits of the United States appear to be the next most available source of supply for gasoline and oil, and it is probable that those sources of motor fuel lying closest to large consuming centers will receive first consideration when needed.

The State of Illinois has the largest reserves of bituminous coal deposits of any State east of the Missouri River. One-seventh of the motor fuel produced in the United States is refined in the vicinity of the Illinois coal deposits.

"Whereas, The United States Bureau of Mines is erecting a plant at Pittsburgh to test the possibilities for making gasoline and oil from the coal deposits of the Nation by the process of hydrogenation, similar to that now operating in England and Germany, and the Bureau of Mines has indicated its willingness and desire to have the Illinois State Geological Survey cooperate with it in the tests on Illinois coals, the expense of which study would be otherwise prohibitive for the State at this time if it were to undertake the study alone; and

"Whereas, The suggested cooperation between the United States Bureau of Mines and the Illinois State Geological Survey would provide the desired information many years earlier than would otherwise result, and would in all probability react to the benefit of the Coal Industry and other industries of Illinois, and

"Whereas, The Illinois Mining Institute has always held and continues to hold the best interests of the Illinois Coal Mining Industry as a prime factor in the economic welfare of the State of Illinois;

"Therefore, Be It Resolved, That the Illinois Mining Institute, in meeting assembled, does therefore urge that the Illinois State Geological Survey give due and careful consideration to the proposed cooperation with the United States Bureau of Mines on this matter of vital interest to the Illinois Coal Industry, and that the State Geological Survey act in accordance with their considered judgment in the matter."

I move the adoption of the Resolution.

President Thomas: Before we call for a vote on that, I wonder if Dr. Leighton would take a few moments to tell us about this.

Professor M. M. Leighton (State Geological Survey, Urbana): Mr. Chairman and members of the Illinois Mining Institute, we cannot always tell what is going to come out of a venture. I am reminded of the story of the man who was riding with his wife through the Smoky Mountains, and the man became very thirsty. He told his wife he thought he would have to stop at one of those cabins and get a drink of water. His wife urged him not to, knowing that water supplies were not apt to be safe.

As they drove on, however, he became so thirsty that he just had to stop, so he did. He stopped at a shanty, and it turned out that a darky family was living there. When he went in and met the head of the family and told him he would like to get a drink of water, the darky replied "Yassuh, yassuh, I sho will give you a drink." So he called out to his granddaughter, a little piccaninny, and said: "Diplomy, Diplomy, come here." Diploma came. He said, "You all run down to de spring and git this man a drink of water."

After she had left, this gentleman said to the darky, "I heard you call her Diploma." He said, "Yassuh, dat's her name, Diplomy." "How did you happen to give her the name of Diploma?" The darky answered, "Well, suh, it was like dis. Our daughter went to de Booker T. Washington School to git a diploma and dis am what she brung back."

It is evident that the oil and gas industry of the country is a temporary industry. No one can safely predict just how long the present reserves of petroleum will last. But this fact, however, is true and has been true for the last four or five years at least, that the amount of petroleum that is being produced is greater than the amount of petroleum that is being found.

There is also the condition that a lot of work has been done over the country in the finding of oil and gas coals, and therefore it is proving to be harder and harder to find it. Also, it is true that deeper drilling is necessary, which entails greater expense both in the drilling and in the recovery of oil.

On the other hand, there is a possibility of improvement in the cracking of oil so that greater quantities of gasoline can be produced, but it does not look, to those who have made a study of this question, that the life of oil and gas throughout the State is likely to be within a rather surprisingly short period of time. It appears the Illinois field will pinch out within ten or fifteen years.

In view of that, the Bureau of Mines is erecting a hydrogenation plant at Pittsburgh, and is going to test the coals of the United States to determine the possibility of production of gasoline and oil from those coals.

Now, they have indicated they would be willing and glad to have the State Geological Survey cooperate with them in the testing of Illinois coal. If this were done, it would mean probably that Illinois coals would receive possibly earlier attention than otherwise, and probably more attention than would otherwise be possible. If the State were to undertake such a study on its own initiative, it would mean a much bigger outlay of money to reproduce the plant like that in Pittsburgh.

And so, serious consideration is being given to this matter. As the resolution shows, the Illinois Coal Field lies in this great Middle West, and is highly industrialized, where gasoline refineries are operated on a very large scale. Therefore, the thought behind all of this is that it is well to look into this new process and be ready for eventualities.

President Thomas: Thank you, Dr. Leighton. It has been regularly moved that the resolution be adopted. Is there a second?

(Which said motion was duly seconded and unanimously adopted.)

President Thomas: And the resolution is adopted.

Now, I want to call your attention to the banquet tonight. Tickets may be obtained from the young lady outside the door.

And also to the football game at Urbana tomorrow, between Illinois and Northwestern. There are a few tickets left, and if you want them I suggest you see Mr. Schonthal or Professor Smith.

Gentlemen, the meeting is adjourned until the afternoon session, which will be at 2:00 o'clock.

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

## AFTERNOON SESSION

### 2:00 O'clock P. M.

President Thomas: The Institute will please come to order.

I take pleasure in introducing to you Mr. Charles Hamilton, who will be your Chairman for the afternoon session.

Chairman Charles F. Hamilton (Pyramid Coal Corporation, Chicago): Mr. President and members of the Institute, we will continue this interesting, well-rounded program, so ably prepared by the Program Committee, with a paper "The Coal Industry's New Opportunity," by Mr. Marc Bluth, Committee of Ten, Coal and Heating Industries, Chicago, Illinois.

Mr. Marc Bluth (Chicago): Mr. Chairman, Mr. President, and members of the Illinois Mining Institute:

# THE COAL INDUSTRY'S NEW OPPORTUNITY

By MARC G. BLUTH

Executive Secretary, Committee of Ten, Coal & Heating Industries, Chicago

The coal industry's new opportunity is obscure perhaps to many men in the operating end of the industry. Not only is this new opportunity obscure, but generally it is difficult for us to fully realize the changes which have taken place and which are taking place in the fuels market. Upon markets we depend for our livelihood. Without markets a meeting of this character would be useless. Men in the operating end of the coal industry have their own important and serious problems and consequently they have not always had the opportunity to study or to observe the changing trends in the market and demand for fuels.

This new opportunity is obscure even to those in the marketing end of the industry, but there is unfolding a broad vista of opportunities that is constantly changing the mining, operating and marketing of coal into an exact science. Competition from other fuels has been largely responsible for the new thought and action in the coal industry today. The difficulties of operators and retailers in recent years have been compounded because it has not only been necessary to hold customers from competitors within the industry but from the oil man and the gas man as well. It is this complexity that brought me into the picture about five years ago and set up what is at the present time my job—that prompted the organization of the Committee of Ten.

Briefly, I shall describe our activities and the phases of work which we have engaged in during these past few hectic and uncertain years. Only comparatively recently has come the realization that no fuel may presume to occupy the general market through "divine dispensation" and that each fuel will share the market largely in the measure it is aggressively and intelligently merchandised and contributes to consumer comfort, convenience and economy. The Committee of Ten is the culmination of a realization of the interdependency of solid fuel and related equipment interests in the solution of problems affecting consumer satisfaction. Its organization was prompted by self-interest, but of that shade termed by our friends and enemies both as "intelligent self-interest." The Committee of Ten is a sort of clearing house or national chamber of commerce for solid fuel and related equipment industries. It is an advisory body without administrative authority over any of its related groups set up to study mutual problems and offer suggestions and recommendations to the related industries for coordination of activities to the common end of consumer satisfaction in solid fuel utilization.

The name was suggested by the number of industrial elements identified with the formation of my organization which was ten. They were the National Coal Association, Anthracite Institute, American Wholesale Coal Association, Institute of Boiler and Radiator Mfrs., National Warm Air Heating Association, National Retail Coal Merchants Association, Heating and Piping Contractors National Association, National Sheet Metal Contractors Association, Midwest

Stoker Association and Heat Control Manufacturers. Subsequently, there has been added to the membership the American Society of Heating and Ventilating Engineers, the National Association of Power Engineers, the National Association of Building Owners and Managers and the National Stoker Manufacturers Association. The active membership of the Committee of Ten comprises one duly designated delegate and one alternate from each member organization. Information is submitted by each delegate covering research and other activities of his own group along with any other suggestions and recommendations which may appear appropriate for consideration and discussion among the whole group. As a result of these contacts our organization has been able to prevent unwarranted duplication of effort in some instances and to offer helpful and constructive suggestions to individual groups as it pertains to the problems of the solid fuel industry.

Early in our history, we adopted and offered three general recommendations to all groups which reflect quite clearly our policies. They are:

> "That each industry as represented through its membership in the Committee of Ten establish standards if such are not already in existence by which its products and practices may be judged;"
>
> "That each industry confine itself to solving its own problems and the marketing of its own goods without indulging in unfair criticism of other allied industries;"
>
> "That each industry advocate and plan cooperative service to the public through personal contact among the respective members in any community."

In line with the idea of standardization, the National Warm Air Heating and Air Conditioning Association has adopted excellent codes covering plant installation. The Heating and Piping Contractors National Association has taken similar action in its certified heating program and in boiler ratings. This same association is also active at the present time in helping to establish, locally and nationally, standards covering the installation of air conditioning equipment. The Institute of Boiler and Radiator Manufacturers has standards covering certain classes of installation and the stoker groups are working on a number of standardization problems in cooperation with the coal industry including sizing and application of coal for stoker use, proper dimensions for boilers and furnaces when stoker fired and ratings for capacity. The Anthracite Institute has operated its own laboratory for testing and approval of equipment designed for anthracite burning. The National Coal Association, which is our chief supporter, representing the majority of production of bituminous coal in the United States, is now working on a research program of deep importance to the entire industry through a laboratory which has been established in connection with a famous research institution at Columbus, Ohio. Already stokers and coals of various kinds have undergone and are undergoing tests at this laboratory and at the present time standards of performance covering equipment for the utilization of bituminous coal are about to be established. All of this work has been undertaken by the individual groups, but through our office it has been possible to coordinate a great deal of the activity and in many cases to eliminate duplication of effort along engineering, research and marketing lines.

A considerable part of our work has concerned educational activities. This phase has resulted in the distribution of hundreds of thousands of specially prepared booklets and bulletins on many subjects having to do with the use of coal. We have cooperated with a number of universities in presenting this material to students and with the coal and allied industries in placing vital information in the hands of salesmen, coal dealers, engineers and many others engaged in allied businesses.

Time will not permit a thorough discussion of our activities. I have only indicated a few important points to which we have given our attention in the past few years. Our close contact with the heating equipment industry—boilers, stokers and all the various accessories—has given us the opportunity to study and observe many phases of our problems in the marketing of solid fuel which so vitally concern those engaged in production and preparation. Particularly is this true of the domestic market, or in plainer terms that part of your production which moves through the retail coal dealer and usually referred to as the heating load. Oh, the retailer has had his problems and still has them. Reams upon reams of paper have been used in discussing this particular part of coal marketing. If you think that you have all of the problems in the world, just hesitate for a moment and think what the retailer's problems are who is at the mercy of the coal preparation manager, the railroads, equipment for burning the coal, local legislative matters that are always present in any town or city and the personal likes and dislikes of the consumer. But it is through this man that the coal operator must operate and the retailer's problems are your problems.

This new opportunity which is so vague is being grasped by retailers and operators who are not afraid to face the actual facts. Our new opportunity is to take advantage of the tremendous resources which exist in our industry. By resources I mean not only the coal in the ground but the power that rests with you, your executive officers, your salesmen, your engineers and your retail and wholesale outlets, to present to the American consumer the story as it should be told about coal as a fuel. We have this new opportunity today because our friends in the heating equipment business have made it possible. Without equipment which has been and is being developed in the research laboratories of hundreds of companies, and then by experimental research and field experience, we would be sunk. But thank our lucky stars these men are friends of the coal industry and are as deeply interested in this problem as producers and retailers of solid fuel. They have had their troubles, too, but steady progress has been made even during the years when the prospects looked the darkest. You must know by now that I am referring to the automatic coal stoker industry, to air conditioning and to all of the innovations which have been introduced in recent years.

The small mechanical coal stoker was not known until about fifteen years ago. It was pioneered out on the Pacific Coast thousands of miles from large consuming coal markets and was gradually brought into this market after a few years of fairly successful operation in the West. In those days coal operators in the Rocky Mountain fields suffered terribly from a lack of market for their

2-inch and $1\frac{1}{2}$-inch screenings. They had a good market for prepared coal sizes for handfiring but for many years dumped hundreds of thousands of tons of screenings in each of these fields because they did not have a demand for their 2-inch and $1\frac{1}{2}$-inch screenings. The small stoker came along. True, it was a crude affair compared with the present day automatic coal burner but it was something different. It was new and as sales of the small machines increased, it helped the operators in those fields move an increasing tonnage of screenings. The small stoker was brought into the Middle West and the East. It was also introduced into the anthracite territory. A few far-sighted coal operators and retailers in the Middle West invested their money in stoker plants and manufacturing facilities because they believed it promised a future not only to enhance their own pocketbook but because they were beginning to lose tonnage to oil and gas and this machine apparently had the earmarks of something that would meet that competition.

So we bring the stoker up to the present day. What do we find? 1935 sale of stokers of all sizes and kinds for burning of all kinds of coal—bituminous, anthracite and lignite were the largest in the history of the industry. Oil burners, even in spite of being a record year in 1935, sold in the ratio of only $3\frac{1}{2}$ to 1 as compared to stokers. This year we more or less expect a sales volume of about 100,000 units, double 1935 business. The big market for bituminous stokers is in the territory comprising Illinois, Wisconsin, Michigan, Ohio, Pennsylvania, Indiana, Iowa, Minnesota, Missouri and Nebraska. Over 42 percent of the stokers sold last year were sold in this territory, according to a survey which our organization made the first of this year. These sales are being made to plants in every industry; to commercial structures of all kinds; and thousands of thousands to home owners and apartment building owners. Handfired plants are being converted to stoker firing. Wherever possible, stoker manufacturers and their sales outlets are attempting to convert oil and gas users back to coal.

Small stokers have been and at the present time are being represented as and sold as basic units. Comfort, convenience and economy have been attributed directly to the performance of the stoker itself. However, the stoker is not a basic unit. It can only be used in connection with a heating or air conditioning system. The performance of the boiler and the heating system determines almost entirely what may be expected from the stoker. Stoker manufacturers are now taking steps to combine with their machine a boiler or furnace as an integral part of the modern heating and air conditioning system. This is being brought about by the knowledge that we have been woefully weak in applying to new homes and modernized buildings modern equipment that places coal on an equal basis with competitive fuels. The combined unit today offers not only to the stoker manufacturer a new opportunity to present his equipment to the prospective buyer in a very favorable light but it offers to the coal industry a new opportunity to cooperate with the stoker manufacturer and allied organizations in showing the public that coal is an automatic fuel; that it is clean; that it can be made dustless and that an architect or a builder can offer to his clients attractive equipment all in one single unit.

The architect and builder wield a lot of power. Remember they are salesmen, too. They are selling their services in competition with others. It is to their advantage to specify and build into their homes and apartments equipment that affords their clients the maximum in the way of comfort, convenience, cleanliness, ease of operation and economy. Upon the coal industry's shoulders along with the stoker people and manufacturers and designers of boilers and furnaces, falls the responsibility of driving home to the consumer the plain fact that coal is an ideal fuel when used with equipment adapted for its use. We are facing in this country a nation-wide building and modernization boom. Government statistics show that for the first seven months of 1936 the number of new home building permits increased 101.3 percent over the corresponding period in 1935. Surveys made have shown definitely that stokers as a general rule have not been installed in new homes now being built. There are exceptions of course, but generally this is true. This indicates that buying methods have changed. The engineer, architect, builder and home owner no longer buy their heating plants piece by piece. Modern systems of different types have been designed and the entire plant is purchased at one time which has done more than any other single factor to raise the standard of home heating. We can compare this with the purchase of an automobile today. Not so many years ago when we bought new automobiles, it was necessary to go to another store to buy a set of bumpers. All the other accessories were handled by different dealers. Today an automobile is sold as a single unit. Everything is attached. The bumpers are an integral part of your car. The spare tire is included. You can walk into a display room of an automobile dealer in the morning, order a new car and that afternoon drive it out completely equipped. All of the guarantees of the various manufacturers of the different parts in the automobile are contained in one envelope. That is the trend in heating equipment today. And it presents to the coal industry its real opportunity to share and to keep its business as this lusty building industry continues on its way up. Without this equipment we cannot hope to maintain our competitive position in this most important market.

Manufacturers and distributors of coal burning equipment are beginning to realize its importance but I am deeply disturbed when I learn that a survey conducted by an independent, reliable agency disclosed that of 500 new homes built this year in an eastern city only two were constructed so that coal could be used as the fuel. A check of 75 homes in Detroit shows that not one single stoker installation was made. In 117 new homes built in Madison, Wisconsin this year, only one coal bin was specified. In 600 new homes built in Milwaukee during the last two years, only 25 coal-burning boilers and stokers were installed. In the city of St. Paul in 1935 over 1000 oil burners were installed and most of these were a combined boiler burner unit. The pitiful part of this story is that the initial investment which a buyer makes in a combined unit for oil or gas is so high that he is very hard to convince that a change over to coal is the economical thing to do. I have kidded myself during the past few years, and others in the industry have also kidded themselves, that an oil burner installation or a gas burner installation is easy to convert to automatic fired coal when the sales presentation is properly made. I must confess that this opinion which I held has been knocked into a cocked hat. Why? People don't buy oil burners or gas burners for economy. They buy for convenience, comfort, cleanliness and sometimes from sheer downright laziness.

Some there are in our industry who still feel that the sale of stokers burning the smaller sizes of coal is reducing their market. Where they have customers using prepared sizes for hand-firing, a deliberate effort is made to prevent these customers from going to automatic coal burning equipment until they learn that they contemplate the purchase of oil or gas burners. This is a mistake. It is well to remember that every industry has grown as values and volume have increased and costs have decreased. On the other hand many in our industry realize that this is an automatic age; that everyone is interested in equipment which will eliminate labor and reduce costs. These men know the value of their new opportunity, but for those who have not recognized this plain fact, they must discard their prejudices and tell their customers about this new equipment before they turn to competitive fuels.

All of this discussion is incidental to your main problems. Acknowledging that the consumer is the final judge, let us look back a few years to see what effect the installation of small stokers has had on the production and preparation of coal. A statement which came into my hands about eighteen months ago showed that there was a large increase in the percentage of fine coal and a corresponding decrease in the percentage of lump coal from mines in Indiana and Illinois. When this statement was issued, an explanatory note was carried to the effect that this trend was not alone attributable to the increasing installation of small mechanical stokers. Increased mechanization of mines, higher production rates and crushing of run of mine and coarse sizes were important factors. In 1932, Illinois produced 57.7 percent of railroad revenue lump coal according to this statement. In 1934, the fine coal production had jumped to 58.5 percent and lump coal production dropped to 41.5 percent. Indiana showed even a greater percentage increase in the production of fine coal during this same period. Lump coal production of railroad revenue shipments in that state in 1932 was 54 percent and fine coal production 46 percent. In 1934 lump coal production had dropped to 34.5 percent and fine coal rose to 65.5 percent. Since I have not received a similar statement covering the year 1935, it is reasonable to assume that, in view of the record year for stokers in 1935, at least the 1934 percentage ratio was maintained and very probably increased. That is, toward the larger production of fine coal with a corresponding decrease in larger sizes. We do not have statistics on other producing fields but it is believed that the increase in fine coal production will not be as great as shown for Illinois and Indiana. However, the trend nationally is definitely toward increasing production of small sizes adapted for use in mechanically fired equipment and this development is continuing to have a greater bearing on the economic and commercial status of the coal industry. Undoubtedly it means that a readjustment will eventually be made in the price structure of bituminous coal both at the mine and delivered in the consumer's bin. The revenue from the sale of fine sizes will automatically be increased to offset the declining revenue due to the decreased sale of lump and coarse sizes which ordinarily command a higher price in the consuming markets.

Now some people might say that this is alarming to the stoker industry because sales of thousands of stokers have been based on its economy appeal and in most of these cases on the difference between the delivered price of prepared sizes as against the smaller sizes for stoker use. But the stoker manufacturer today is placing his greatest emphasis on the convenience of automatic coal heat and he can do this and is doing it because the equipment is gradually being perfected to afford completely automatic heat. Along with the coal man he is right up against the competition of other fuels, but we are witnessing the gradual rise in the price of oil as a heating fuel. A balance can be and will be maintained between the prices of these competitive fuels that will make it possible now and in the future to keep coal in its present competitive position regardless of the increasing demand for stoker size coal as the stoken industry correspondingly increases its volume of business. I was interested to read a short article in the Chicago Journal of Commerce only last week by its coal editor as to the market for screenings. I believe that this article speaks volumes and I quote:

"It's happening. It's happening sooner than expected. It was pointed out here two or three years ago to happen.

"Best grades of screenings are scarce and tight at the mines!

"The scarcity is at a time when screenings have been plentiful and soft in former years.

"The answer is the small stoker.

"Three years ago when stoker installations multiplied almost like rabbits, operators concentrated more on perfection of stoker sizes. Since the output of screenings decreases as the stoker sizes are made, it was predicted freely that within a few years screenings would come into their own. They are.

"Previously screenings were a drug in the market where production began to gain as the domestic movement increased. Screenings had to be sacrificed. In many cases they were sold at ridiculously low prices f. o. b. the mines. It was not uncommon for large buyers to obtain tonnages at the freight alone. Some mines virtually gave the screenings away in order to be rid of them.

"Came the small domestic stoker and a producton race to increase outputs on stoker sizes and refine the product for the small automatic coal firing devices. Operators are spending millions to improve stoker coals and production on the stoker sizes.

"During the last two years screenings supply was fairly balanced with domestic. It was a rare experience for the producers. This year, clearly, with the much greater increase in the stoker installations and the preparation of stoker coals screenings already appear to be leading the domestic sizes. At any rate several operators report screenings in as good, if not better, demand than the domestic lump, egg and nut. It comes at a time too when the domestic market is just about at its height.

"It seems fair to predict in the light of doubled stoker installations this year over a year ago and another record year indicated for next year that by next fall and winter many operators may be compelled to break down certain of the larger domestic sizes of coal for the increased requirements on the stoker coals. Some producers are already crushing lump for the purpose."

One exceedingly live subject today is the proper size of coal to be used in small mechanical coal burning stokers. This subject is being discussed in every coal producing field of the United States, and not only discussed but "cussed" by retailers and consumers in many markets who are floundering because of the lack of authoritative and unbiased information on the proper size or sizes or character of coal for stoker use. I do not believe that it is an impossible situation. I do not concur with some who think that some standardization of coal sizing for stoker use cannot be accomplished. I do state and have stated many times that it is necessary to correlate information and opinions from each coal producing field in order that the problem can be better understood before starting any activity in this direction.

This problem of establishing the most suitable sizes of coal for use with stokers involves the engineering, commercial, economical and psychological phases of the coal and stoker industries. Fragmentary solutions have been offered and perhaps the best solution is a combination of such fragmentary findings. The answer can only come through a development over a period of years while facts are determined, mine equipment modified, marketing methods developed and inefficient stokers replaced.

An examination of a few phases of the problem might be helpful: stokers differ in type; stoker types differ in characteristics as sizes change; moreover there are about 250,000 to 300,000 stokers in service today. Many of these are of antiquated design so proportioned and installed as to require selected fuel. There is as much difference in old stokers of the same type and size as made by various manufacturers as there is between a modern high priced car and some of the early automobiles which are now obsolete.

Some of the factors involved in sizing stoker coal from the utilization viewpoint are worth consideration. They are:

1. Steam or heating requirements of the fuel buyers.
2. Character, condition or operation of the plant as well as the mechanical stoker itself.
3. Geological location of the fuel user.
4. Competitive fuel prices.
5. Psychology of the buyer or user.
6. Freedom of choice of various fuels, relative desirability and adaptability for a particular requirement—real or imaginary.
7. Relative ignorance and indifference as well as something of the irresponsibility on the part of some sellers to the buyer as well as the fuel user to the public as to smoke or air pollution.
8. Operating characteristics of various fuels which influence the choice of a particular coal or a special size—to avoid certain use or operating factors such as

*a.* Excess amount of fines requiring extra power to operate some stokers and higher pressure of forced draft fan.

*b.* Variation in coal sizes due to inability to duplicate deliveries —difficulty in adjusting for uniform air to coal ratio.

*c.* Excess amount of dust or dirt in delivery or otherwise.

*d.* Excess ash.

*e.* Segregation of sizes.

*f.* Noise of coal crushing with small underfeed stokers due to the use of larger sizes and requiring more power to operate the stoker.

*g.* Hopper smoke due to too large percentage of coarse sizes.

*h.* Dense fuel beds due to abnormally fine coal with formation of occasional blow holes resulting in concentrated high temperatures and resultant clinkers.

*i.* Excessive fly ash through use of coal with a too high or too low percentage of small size.

The right size of a given coal for any one stoker installation is easy to determine but to prescribe sizes to cover a field, taking into account various types, designs and vintage of stokers and embracing those built by inexperienced designers and manufacturers is truly a complicated problem. To this problem must be added the various classes of coal available with the producer's and retailer's problems of cost, disposal of other sizes, special equipment and preparation. The problem, however, does lend itself to some analysis and by studying all of the elements, some average solutions may be worked out in planning for the future. It may be possible to establish a trend toward certain sizes as mine equipment will permit and economic factors dictate.

Small stokers having a capacity of 100 pounds of coal feed per hour or less present the most troublesome sizing problems. Here price, while a factor, is not the entire problem nor the major problem, and is limited only by the price of competitive fuels. Cleanliness, comfort and convenience are very important. Noise is a nuisance. Power is important. Fuel for the small underfeed stoker must be separately considered from stoker sizes for other types and sizes of machines; particularly those stokers operated in industrial and power plants. In this classification there are three classes of small stokers to consider: first, old stokers installed before stoker design, building and installing had reached the fine art that it is today; second, stokers of unbalanced design being built and installed by some companies untrained and inexperienced in stoker engineering and manufacture. Third, stokers built and installed by companies spending money and time on research. Such companies help both the stoker and coal industry. It is inevitable that only such companies can eventually survive. As the result of such research, 1936 models have, and 1937 models will have, more latitude than ever before in the matter of coal sizes and quality.

Some testing work on sizes of coal has been done at the laboratory of Bituminous Coal Research, Inc. located in Columbus, Ohio. This work is far too technical and the report too extensive to elaborate on here, but the immediate practical significance of these conclusions is that the top size of coal for small stokers need not be greater than ¾-inch or at the most 1-inch. This work has concerned only sizing tests or the relation of the size of coal in the hopper to that which is burned in the retort. Four typical coals were obtained for the tests. Screening analyses were made of coal from various sections of the retort as well as before feeding coal and after feeding it. Two of the coals were treated with oil as is common practice with a large tonnage of coal today to render it dustless and the effect of the treatment on the crushing and segregation was determined. Burning tests on the various sizes of the four coals are now under way. The elimination of the larger sizes which can be retained by the producer for his nut size, the report states, will not only reduce the work spent on crushing in the stoker but will decrease the difficulty with segregation of the large and small coal each time that it is handled between the loading at the mine and delivery to the consumer's bin. The report further states that oil treatment of coal did not affect the reduction in the size of coal but it did decrease the segregation both in the hopper and in the retort. These are only two of the general conclusions reached as a result of this work.

The work which has been done in your own field and the sizes of stoker coal which are being screened today indicate that some of the Columbus work agrees with the studies and experience of operators in this field and that at least some standard top size or sizes may eventually be designated as the standard size or sizes for the industry. This subject has been given a great deal of attention recently in technical conferences all over the United States. It has also received some publicity in trade and technical magazines. The stoker manufacturer must and can devote his technical and field experience to this problem in cooperation with technicians and others in the coal industry who realize its importance to both industries.

In Illinois the coal industry is indeed fortunate to have such agencies as the Illinois Geological Survey headed by Dr. M. M. Leighton and the Department of Mining and Metallurgy at the University of Illinois, under the direction of Professor Callen. Some of the fundamental research which has been conducted by these two agencies has been and is of inestimable value to this industry but unless these findings are applied and developed commercially, they become of little value. However, in this instance the research work conducted by your state institutions under the direction of technically capable and commercially minded men has made it possible to apply these results in the marketing of your coal as a refined product. More than anyone else you know the desirable properties which are developed or enhanced by the preparation of your coal to meet market demands. Professor D. W. Mitchell of the University of Illinois has listed seven of these properties as follows:

1. Enhanced value due to careful sizing.
2. Freedom from rock impurities and sulphur balls.
3. Dustless.
4. Low ash and high calorific value.
5. Smokeless.
6. Sootless.
7. Uniform as to physical and chemical properties.

In removing impurities and by the proper sizing and cleaning of your coal, you are removing freight rate barriers. We all know, and it won't hurt to repeat again, the importance of transportation rates. It is part of the economic structure of our industry and expert attention is being focused on it by national, state and local organizations within the coal industry. The removal of impurities is one way to reduce freight rates. Accomplishing this, then we step to the expansion in the market which an improved product will create. In turn, an improved product reduces the cost of coal delivered and by converting a ton of coal into pounds of steam or millions of B.t.u.'s, it effects a saving for the consumer and places coal in a firmer position insofar as the competitive fuel situation is concerned. To illustrate, assume $2.00 mine price for a prepared and treated stoker coal; assume $3.00 freight rate to destination; delivered cost in dealer's yard $5.00; assume $2.00 gross margin to dealer; delivered price into consumer's bin $7.00. Now what elements are present in this breakdown?

1. Cost of mining, preparation, loading and taxation;
2. Wholesale selling, administrative costs and profit;
3. Transportation costs and profit;
4. Dealer handling cost and profit;
5. Cost to consumer.

The American industrial system has been lax in providing intelligent publicity to illustrate in a simple manner to its ultimate users the distributing costs of any product. Thus a consumer who buys your coal at destination for $7.00 a ton on the assumed basis shown above—which is a prepared, dustless stoker coal—pays $7.00 a ton delivered in his basement. This consumer thinks this price too high. He complains even though he may secure heating comfort and satisfaction by using a good quality product. But he forgets unless it is simply illustrated that this $7.00 includes the costs of doing business and to afford a service that cannot be purchased in any other way. The fault does not lie directly with the coal operator or with the retail distributor. There is no fault to find except that there is a need for consumer education in our industry as in all other industries, to sell if you please, the average consumer on the merits of the delivered cost to him due to all of these factors which I have enumerated. Then if proper preparation, sizing, and intelligent selling of our product are carried through, the consumer will be a strong advocate because he is told and understands the simple reasons for the distribution cost of our product.

Now to illustrate another hypothetical case of an average customer residing in any one of the middle western states. He does not have modern coal burning equipment in his basement. He buys coal and it is sold to him on a price basis. His burning equipment is old or in bad shape. Perhaps he has not had his furnace or flues cleaned in ten years or more. Perhaps he has a poor installation or perhaps he does not care. At any rate, how can he find out that he can improve his situation and eliminate his troubles if we do not tell him? But wait a moment. In the meantime, he will be approached by a clever salesman to interest him in an oil burner or gas burner. What will he do? This depends largely, of course, upon his own financial condition, but this salesman does not care about that if he can sell him on the idea of better, cleaner and more convenient heat. He won't be able to save him money, but this salesman has another argument to offset the economy factor which is in favor of the prospect's present plant. This is, "don't burn this old-fashioned fuel in this old-fashioned furnace in this old-fashioned way. Throw away the coal shovel. Install our 'super-super-super-burner' and we will eliminate your cleaning bills. You won't have to send your curtains to the laundry nearly so often; your upholstery and your rugs will be kept cleaner. Your wife will have more time for her bridge games and Monday will be eliminated as blue washday." "Well," this man thinks, "Why not? My coal dealer has never told me about any new devices for handling and firing coal automatically. I have dealt with him nigh on to twenty years and I haven't had any suggestions on how to improve my basement or heating plant." So he installs this burner—is proud of it. Now this is not an actual case. It is purely hypothetical but actually there are hundreds of thousands of cases that are "in the bag" insofar as competitive fuels are concerned. There wouldn't be over one million oil burners in this country if some appeal of this sort had not been made. There wouldn't be nearly a quarter of a million gas heating plants if the gas utilities had not recognized the tremendous importance of proper equipment in the application of their fuel and there wouldn't be a couple of hundred thousand stokers installed if it were not for the aggressiveness and merchandising ability of a handful of coal men who were losing their markets to other fuels a few years ago.

Another important point which we have been somewhat slow to grasp is the fact that the ordinary and average consumers are not interested in supporting any particular branch of the fuel industry. Because hundreds of thousands of men are dependent upon the mining of coal as a livelihood is no indication that people are just going to buy coal because they are contributing to the employment of miners and others interested in the industry. Coal is bought as a means to an end. So are oil and gas but there is a lot of difference between these fuels physically although their intention and purpose in life are the same.

In summarizing the trend in the preparation of coal to meet consumer requirements as demanded by all of these important marketing factors, it can be stated that every coal producing field today is devoting its best engineering talent to improve consumer acceptance by the careful sizing and preparation of stoker coal. The midwestern fields have led the parade insofar as washing and dedusting are concerned. Lower grade coals are being improved; medium grade coals are being improved and in turn, the higher grade coals are being improved thus competing with each other, yet at the same time improving the standard of the industry to afford more satisfaction with solid fuels against a common enemy. In the oil burner industry the problem of the proper fuel for use in heating plants has been simplified by the preparation and adoption of standards covering burning fuels. Before the adoption of these standards the oil burner industry was so confused that it was necessary for oil refineries to step in and help the oil burner industry in devising standards for oil fuels which could be adapted to the large majority of burners which were being marketed. These standards have been revised from time to time and to the credit of the oil industry it should be stated that the fuels have been improved through perfected processing methods and what is more important through improvement in oil burning equipment. In gas the problem is more simple but even so the gas burner manufacturers and gas producers and pipeline companies have cooperated remarkably well in designing equipment and perfecting it for the burning of natural and manufactured gas. Our problem is more difficult. We have many coal fields in the United States; fundamental differences in the grade and quality of coal and important differences as to burning characteristics particularly as applied to automatic stokers. There are many opinions held by capable engineers and executives in one field that differ violently with opinions within their same field and of course with the general opinions in competing fields. But these differences insofar as engineering opinion and application are concerned must be coordinated and adjusted even though it will not be possible to change the physical characteristics of the various coals in the various fields. Surely through careful analysis, through study of consumer markets and through well directed publicity selfish interests can be buried in order that the whole can be benefited. This must be done in spite of economic advantages enjoyed by one field as against another. Standardization of product is a most important factor in selling the product of one industry as against another but this cannot be accomplished without the correlation of the different schools of thought within an industry.

Permit me in closing to quote from a statement recently made by Mr. A. W. Robertson, Chairman of the Board of the Westinghouse Electric and Manufacturing Company. It tells a big story—so simply and yet so thrillingly if we are prepared to accept the challenge which research and science daily present:

"I am tempted to throw out a few suggestions of what we may hope for in the future. Within the next few years all unhealthful air will be purified. That is, we are going to undertake to purify our air just the same as we pasteurize our milk and purify our water and food.

"In the course of time, people in this country will develop migratory instincts like the birds * * * our food will gradually become so different that we will hardly recognize it. Everything we like to eat will be available the year around.

"Radio will become largely individualized so that for a little extra money, separated families and friends may talk to each other when and as often as they please.

"Cities will continue to be the focal point of admiration and despair. They will be practically noiseless. They will be intersected by great boulevards of fast moving traffic. Double deck streets will be common. It is even possible that our buildings in cities may be flat so that by the use of lifting devices automobiles will be taken off the streets and stored on the tops of buildings.

"None of these things is very revolutionary but to a certain extent they will change our habits and standards of living. Any deeply basic change is beyond anyone's vision. However, we may be certain that science will discover new ways to heal and save, new ways to kill and destroy and out of it all, we will have new joys and new sorrows."

Let's apply this to our own industry. The small automatic coal stoker has brought the coal industry new joys and new sorrows. It seems we cannot have the joys without the sorrows but at least it provides a new opportunity to forge ahead in the increasingly exciting battle for our share of the heating business. How else can it be done? The small stoker is only a part of the picture. Perhaps there is a place for development of low-cost methods of producing smokeless fuels from bituminous coal. The tremendous market which air conditioning is opening up will be helpful to the coal industry providing we will take advantage of these new opportunities. The modernization and building program presents a real challenge to our industry and with the new thought it will be successfully met. There are others in these various industries who have a huge stake in this market and they are spending the money to get their share of the business. The gas industry is already started upon a nationwide advertising campaign to promote the use of gas for heating and other purposes. Stoker manufacturers will spend over $5,000,000 in consumer advertising in 1937. Organized groups of stoker manufacturers and dealers contemplate publicity and public relation campaigns nationally and locally next year. They are seeking more public acceptance of their products and when they do this coal will benefit.

* * *

Chairman Hamilton: Unquestionably this very able paper by Mr. Bluth will develop questions for discussion. The meeting is open for such purpose.

Mr. C. Christianson (Springfield): Mr. Bluth, what about the market for coal that might be created through the promotion of steam jet refrigeration?

Mr. Bluth: Steam jet refrigeration will provide, in my opinion, considerable benefit in some communities. I have known of two examples in Chicago. The Chicago Tribune Tower is using coal for steam jet refrigeration in the summer time. They used almost as much coal this past summer to cool the building as to heat it last winter.

Carson Pirie Scott has installed the same thing with automatic stokers. Their consumption will not be as large as the Tribune Tower.

Steam jet refrigeration, under certain conditions and circumstances, with a limited application, can be used. Wherever coal is an economic fuel to select, it will provide an additional tonnage in the summer time. There are several well known companies that have steam jet refrigeration equipment. We have had a great many inquiries in the past year, too, particularly from the Southern field and in the East for technical data on it. We have a considerable file on the subject, and information from all manufacturers as to the application of the equipment. The building must be of good size and construction so that steam jet refrigeration can apply. It isn't every place it can be applied, but it does present to the coal industry considerable tonnage in my estimation, tonnage we do not now have.

Mr. R. J. Oldham (Centralia Coal Company, Centralia): I would like to ask a question. Where do stokers fit in the smoke abatement picture?

Chairman Hamilton: May I ask that as you ask your questions you kindly introduce yourselves so that we can get a record of your question?

Mr. Bluth: In my opinion, stokers are one of the big assets to smoke abatement abuses. There are a number of towns right now in the United States, and St. Louis is one of them, in which this smoke abatement problem is a live subject. A lot of our work has been trying to cooperate, because we are the shield between the local abatement inspector and the Coal Industry. I do not believe some coal men realize the importance of the work which these smoke abatement people are doing.

Stokers very logically fit into any picture where there is trouble due to smoke and air pollution. Of course, stokers themselves also create somewhat of a problem which the stoker manufacturers themselves admit they have not solved. It will take research, and that is the creation of the fly ash, which means air pollution. But in St. Louis, Chicago, Toledo and all industrial centers stokers have been a wonderful help in the last five years in helping reduce the smoke measurably, particularly in the commercial apartment buildings, office buildings, greenhouses, laundries, and that type of plants.

In the smaller field, in the homes where hand-firing coal is now used and inefficient methods of hand-firing are used, stokers do help the smoke abatement situation tremendously. I think the stokers as one of the methods of elimination of smoke must be promoted all over the United States.

I have in mind instances of that in Salt Lake City a number of years ago where an expert from the United States Bureau of Mines made a survey at the request of the city. He suggested low carbonization of coal. Today a great deal of that situation has been eased in Salt Lake City because the stoker has come into the picture and made it possible for the city to clean up.

Mr. M. S. Lambert (Robins Conveying Belt Co., Chicago): Mr. Bluth, you made several references to what I concede to be the desire for standardization of sizes of stoker fuel for various grades of coal. Is there any organized effort along that line being undertaken now?

Mr. Bluth: I mentioned, I believe, in my remarks something about the work which they are undertaking over at the Memorial Institute of size screen tests and the like, in which they indicate that three-quarters of an inch or one inch type is sufficient, and they have indicated the size mesh as 10-48. In addition to that, I would like to illustrate on the blackboard here a project being promoted in Chicago at the present time, which I think is not only of interest to coal operators but to preparation managers in the mines who sometimes wonder why in the hell this fellow sends in orders for this thing today and another thing tomorrow. There is a reason for it.

It was a realization of this problem in Chicago where we are selling six to seven thousand stokers this year that the retailers are floundering on all over the place. They are trying to handle fifteen or twenty stoker coals. It is silly. I spent a week ago Saturday in the office of a prominent Chicago retailer attempting to revise a description of the fourteen stoker coals this man handles. He is trying to meet the whole field from low to high-priced coal.

But I would like to illustrate what the local Chicago stoker agencies are trying to work out as an experiment with the coal dealers, to get a better understanding what to furnish on these orders when a man puts a stoker in his home. To that end, we are working with the Chicago dealers in devising a chart. (Illustrating on blackboard.)

Up here is the name of the stoker, and each of the agencies in Chicago are cooperating in the project. I will take the first one, starting with A, which is the Auburn. It lists the sizes available that they sell in the Chicago market. Let's take their small stoker, which is a thirty-pound machine for small homes and flat buildings, a No. 5 stoker. Up on this side, on the top, we have "household," and over here "commercial and industrial." Those are separate. We are not thinking about household stokers and commercial stokers together, but are separating them.

That is our first effort. It is probably subject to criticism, but we are trying to get a better understanding between the retailers, stoker men and consumers and shippers of coal on top size only. Stoker men do not want to put their necks out by saying there should be a three-eighths bottom or a three-sixteenths bottom or a ten mesh bottom of a forty-eight. They know their stokers will take the top size without crushing the coal too much or creating too much noise.

In this particular case, Auburn has certified this is the top size, one inch. All right, we have these other stoker coals sold on this market. This applies only to the Chicago market, and has nothing to do with Peoria or Pittsburgh. Then we take this. Their No. 25 commercial stoker they say they probably take one thousand tons per hour, or twelve hundred or fifteen hundred, and will take two inch screening top size. They do not want anything larger than that on the stoker.

We have two committees working on this between the coal retailers and stoker men to work this out, and this chart is pretty well ready for the printer now. We print this on a card and put it over the scale house in the coal yard. Mr. Consumer comes up or calls up and says "I have an Auburn stoker, and I want coal for it." The chart says one inch top. They order a certain coal three-quarters inch, which is within this classification here, and they will send it. They will not send two inch coal, for they cannot use it.

We are limiting this only to the top size for the stokers, and believe it will be a good step as an experiment to see what we can do in Chicago. I will be happy, when these charts are completed, to send any one interested a copy of it.

Mr. A. E. Pickard (Mt. Vernon Car Co., Mt. Vernon): What is the difference between burning raw coal and de-dusted coal in the stoker? What is the advantage of de-dusted coal over the raw coal? Take three-quarter inch or one inch screenings.

Mr. Bluth: That is pretty difficult to answer, for there are a lot of opinions on that subject. Some of our tests have indicated the size one inch top or three-quarters or three-sixteenths or small bottom-size, getting away from the extreme fines. I do not like the word "bug dust." I think that has been used for many years, and is accepted by some people as one inch. Our tests in a preliminary way have indicated the removal of these bottom sizes, 10 mesh and 48 mesh, is a great help in the burning of the coal in the retorts of the present stokers. It is a pretty technical subject and a lot of experiments going on. By next summer we will know more about it due to our results at Boutelle that will be available. We do not refer to screenings in this chart. We want to keep it up to the top sizes. The stoker men are not interested in getting mixed up in this, but it is up to the engineers in the coal industry as to what should be removed.

Mr. I. D. Marsh (Alcoa Ore Company, Belleville): Mr. Chairman, there are a great many cases where homes are heated with coal where the hot water heating is done with gas or some other fuel. What is being done to enter this market? What would it mean if coal was able to get into this water heating?

Mr. Bluth: You mean for Illinois only, or nationally?

Mr. Marsh: Nationally.

Mr. Bluth: Well, we have figures compiled by a great many different organizations that show if the coal industry had a hundred percent of the water heating market we would increase our domestic consumption by about seventeen percent. That is a big market. At the present time the gas and oil people have a great part of that market. Coal gets some of it in these stoves, monkey stoves. But in the case of a stoker in the plant, there are devices on the market called indirect water heaters which provide year-around hot water at a very low cost compared to gas. It means in the summer time with these hot water heaters on your steam boiler, you can produce twenty-four hour a day hot water with very minimum attention to the stoker, perhaps once a week in the summer time, at about one-fifth or one-third of the cost of gas in this particular one in Chicago. I think the stoker manufacturers—in fact, I know they are doing little to promote the use of hot water heaters when they sell stokers. However, there are several things combining to make the stoker man not so willing to sell it in conjunction with the stoker.

When he goes out and puts a stoker in the home, he is already inviting price competition. He hesitates to put another $50.00 on the cost to the user or purchaser for fear of losing the stoker order. The manufacturers of hot water heaters have no connection with the stoker industry but have more or less relied on the stoker people to do the selling. We believe the indirect water heater manufacturer should do his part. However, they are doing it in some cases and where they have done it the sales have been tremendous. I believe that is one market that can be promoted aggressively all over the United States except in territory like Oklahoma and Texas where we cannot compete so far as natural gas and oil is concerned.

Mr. Paul Weir (Bell & Zoller Coal & Mining Co., Chicago): With reference to the chart, have you made any effort to distinguish between the top sizes of Illinois coal and the top sizes of Eastern Kentucky coal?

Mr. Bluth: We are keeping away from any reference to coal. I might say in reference to the chart the stoker dealers of Chicago—these represent the eight companies combined in this project—our Committee recommends all stoker coal be treated for dust. They were wanted to say oil only, but we kept away from that. They did state calcium chloride treated coal.

Mr. Weir: I had literature on tests being made, and I noticed quite a difference in the manner in which the coals are treated. I wondered if that is the reason you were interested in top size of Illinois coal or top size of Kentucky coal.

Mr. Bluth: The top sizes will range from one inch to one and a quarter inches on household stoker coal. If we can make this first chart work, it is the first effort anyone has made. It is complicated to get everyone to agree to put their names on the same sheet. If we can go that far, we can then go to the burning chemistry of the coal.

Chairman Hamilton: Mr. M. M. Soule has prepared a discussion of this paper from a salesman's angle, and I would be glad to call upon him.

# DISCUSSION ON "THE COAL INDUSTRY'S NEW OPPORTUNITY"

By M. M. SOULE
Vice President, Coal Sales Corporation, Chicago

I have been asked to comment from the standpoint of a coal salesman on the remarks just made by Mr. Bluth, Executive Secretary of the Committee of Ten.

My reaction is no doubt the same as yours, that he has covered very thoroughly an extremely difficult subject, complicated by its many ramifications. He is better able to do this than anyone I know, for his duties as Executive Secretary of this very important Committee of Ten has given him an unusual insight into a large subject that he has so ably discussed.

Mr. Bluth has explained that this Committee of Ten is a sort of clearing house for ten different associations comprising all branches of the coal industry, both bituminous and anthracite, and that portion of the stoker industry devoting their time and energy to the development of the smaller type stoker and boiler, as contrasted with the larger industrial stoker in general use for many years prior to the advent of the small stoker.

The Committee of Ten has done splendid work for the coal industry as a whole in the comparatively short time of its existence, which began, I believe, in 1931.

Mr. Bluth's opening remarks in connection with the coal industry's opportunities I heartily agree with and I believe that those of us who are in the selling end of this growing industry, and I use the word "growing" advisedly, do not fully appreciate c e r t a i n fundamental changes that are taking place now and which will develop in the next few years.

Quoting from an address made by Mr. R. C. Goddard, President of the Stoker Manufacturers Association, before the American Bituminous Retail Coal Merchants Association Convention held in Chicago in September, it was neither an enterprising stoker manufacturer nor a farseeing coal man with whom the idea of the small stoker originated but rather a florist on the West Coast who did not like the idea of getting out of bed to throw coal on the fire at all sorts of ungodly hours. He was a man who wanted his sleep and decided to do something about it. This man's ideas about the importance of his rest, combined with huge quantities of screenings that operators in the Western part of the Country had to dump annually, brought into being what we now call a "primitive" stoker that worked. It found acceptance first in the territory where it was conceived and worked its way East. All this happened only 12 years ago.

Such records as are made available by the Department of Commerce, and I believe they are not complete, show that up to 1930 sales of these small stokers averaged from a minimum of 1,200 annually to a maximum of 1,700. In 1931 annual sales jumped to over 12,000; in 1935 sales jumped to 48,000, of which in excess of 41,000 stoker units were in Class One, which is the residential stoker with a consumption capacity of less than 100 tons per hour. It is estimated that total stoker sales, all classes, and the sales are divided into four classes, will aggregate in 1936, 100,000 units. I might also add, in connection with the figures given you on residential stoker installations in 1935, that this type of stoker did not appear on the market as a competitor of oil and gas burners in the home until 1928 and the acceptance of the smaller stoker for residential use has been remarkable in such a short period of time.

This splendid showing is something for which Mr. Bluth and his Committee of Ten can take a great deal of credit. Without the cooperation of the various units comprising this Committee such a record would not have been possible.

I want to digress for a moment to electric refrigerator sales, not to disparage by comparison the splendid record of sales by stoker manufacturers but to show you what is ahead, as I see it, for the coal and stoker industries. As an illustration I will use the records of one of the better known electric refrigerators, Kelvinator, that 18 years ago, in 1918, sold in their first year 67 refrigerators. At the end of 1920 they had 600 units in operation. In 1929 they sold 100,000 and in 1935 this one company sold 240,000 units. In that same year, 1935, total sales of electric refrigerators, according to figures released by the National Electric Manufacturers Association, 15 reporting companies sold 1,688,600 units and 1936 figures show they are 30% ahead of 1935. Do you think the Kelvinator Company back in '18, or any of the other larger companies manufacturing electric refrigerators visualized such a sales volume in the future or that this industry as a whole could foresee their sales running at the rate of 2,000,000 units per year from all manufacturers? I do not.

Let us look into the sale of oil burning equipment for domestic use, which will give us a much more conservative goal to shoot at. The sale of such equipment dates back to about 1919, five years before what might be termed the start of the small coal stoker. The usual slow start was made in that year, the sales insignificant, and I believe unrecorded. By the end of 1921, the total number of domestic oil burners in use is placed at 21,500; by the end of 1931, 646,000 were in operation. It is estimated that by the end of 1935, 1,155,000 were in use for domestic heating. In 1936 sales will presumably run around 200,000, making by the end of this year approximately 1,350,000 in operation. This, as contrasted with the coal fired stokers in operation by the end of this year of 350,000 to 375,000.

These figures on electric refrigerators and oil burning equipment for the domestic home sharpens my imagination to the point where I can see that this great ally of the coal industry is just getting under way.

I can accurately state that Illinois operators have been forehanded in this progressive movement to provide for these modern stokers the proper size and consist of coal and that such preparation has been made possible only through the extremely close cooperation of the various operating departments who have kept in step at all times with this progress.

Another very interesting thing is that approximately one-half of the sales outlet for automatic coal stokers is the retail coal dealer. Retail coal dealers have a close personal contact in a majority of cases with their residential customers. The purchase of coal by the average home owner is an item to him of importance, not only from the standpoint of the money involved to keep his home properly heated but the kind of coal that will give him the best service. It is logical that these retail dealers contact users of coal who are not equipped with stokers and interest them in the present day modern type of stoker before the oil or gas man gets to him. Distribution by retail dealers is perfectly logical where the dealers provide the necessary personnel for intelligent and aggressive representation and keep in position at all times to promptly and efficiently service the stokers they have installed.

Another item that it might be well to bring to your attention is that the development of the small stoker has been in the main accomplished by the smaller manufacturer, as contrasted with the development of electric refrigerators, for example. Many of these small stoker manufacturers who started out in a small way have had in the few years they have been in the business to substantially increase their plant capacity to take care of increased business and further increased development will no doubt continue at an accelerated rate.

The up and coming stoker manufacturer, as Mr. Bluth points out, is extending his activities beyond that of the stoker which has been used in the past quite generally as a modern accessory to old heating plants. Research on the part of the Committee he represents, and also on the part of some of the larger manufacturers, has shown that the ultimate goal for the automatic coal fired stoker cannot be reached until a complete coal burning unit is offered, which will include not only the stoker and boiler unit but proper air conditioning facilities and including the domestic hot water heater. I am, of course, referring to residential stokers and particularly the installations in new homes, which it has been pointed out is passing up coal at the present time.

In an address made by Mr. Hughes, American Radiator Company, at a meeting of the American Bituminous Retail Coal Merchants Association Convention held in Chicago in September, he gave some interesting facts, among which are the following:

It is estimated that bituminous coal produces approximately 41% of all heat used in domestic buildings, annually, and that anthracite and bituminous coal combined account for 74% of such heating. Mr. Bluth referred to the increase in residential building activity by quoting figures covering a survey made this year showing that for the first seven months home building permits increased 101% over the corresponding period of 1935. A survey recently made covering about 10,000 new dwellings, to show how coal stood with competing fuels, gave the following results: Houses costing less than \$6,000—77% used coal. Houses costing \$6,000 to \$10,000—26%. Houses costing \$10,000 to \$20,000—10%, and houses costing over \$20,000—7%. Mr. Hughes, who quoted these figures, makes the further observation that if coal were used to the extent of 50% in the three higher priced classes of homes, an increase in the demand for coal for domestic purposes would be around 20%. Quite a sizeable increase.

Mr. Bluth has also brought out one of the important ways in which coal companies can and have cooperated with stoker manufacturers and this is in the proper sizing and consist of coal to get the best results. Investigations made by the Committee of Ten, actual tests made in the Battelle Memorial Institute, Columbus, Ohio, and considerable research work done by the University of Illinois, and others, have all contributed to a better understanding of this problem.

It is true that some controversies still exist. In Illinois it is my experience that the maximum size suitable for these stokers is $1\frac{1}{4}''$. Some of the larger coal companies have gone to $1''$ as a maximum and other companies recommend $\frac{3}{4}''$. On the bottom end of all of these sizes, however, the extreme fines are being removed, generally through about a No. 10 mesh screen. Research in this connection has demonstrated that performance in the smaller stoker is substantially improved through the removal of extreme fines. Mr. Bluth points out that testing work performed under the direction of the Bituminous Coal Research, Inc. indicates that the top size for small stokers need not be greater than $\frac{3}{4}''$ or at the maximum, $1''$. It is perfectly obvious that in the restriction of size, its purpose is to avoid segregation in the stoker, which, when it occurs, decreases efficiency with consequent waste of heat.

From the standpoint of the salesman selling Illinois coal, or for that matter, any coal, new developments such as are continuously occurring require from a sales standpoint a new viewpoint and the present day coal salesman who wants to keep abreast of these new developments must take whatever time is necessary to read, study, and discuss with his competitors, not only coal competitors, but, if he can, competitors in the oil and gas industries, as well as allies in the stoker industry, to the end that he keep himself informed of all these changes, all of which means betterment for the industry.

In the time I feel I should take to comment on Mr. Bluth's address, several subjects he has brought up I have not touched upon, or if I have, very briefly.

In the latter part of his remarks he has referred to the subject of air conditioning, which also offers to the coal industry another entirely new outlet for coal. If the small type stoker is just in its infancy, air conditioning can be similarly classified from the coal man's standpoint. One of the larger buildings in Chicago, completely air conditioned except for its lobby and halls, burns during the winter months around 900 tons per month of Southern Illinois screenings. The figures given me as to the quantity of coal used for air conditioning this same building show that in the months of June, July, August and September of 1935 there was consumed approximately 1,400 tons of coal for this purpose. An entirely new outlet for coal and coming at a time of the year when production and sales are at their lowest ebb.

I received a letter the other day from a hotel in St. Louis in which I have a fleeting interest, and this letter puts up to its bondholders the question of mortgaging the property to air condition the entire hotel, which is one of the largest and most prominent hotels in St. Louis. Visualize, if you will, what air conditioning the larger office buildings, stores, and apartment houses will mean to the summer production of coal, provided we share, as we certainly should, in this development. In that area reached by Illinois coal many of the modern buildings I have mentioned are ripe for such improvement. This is another infant industry in which coal can and surely will share. Contemplation cannot help but make anyone acquainted with these developments exceedingly optimistic. We in the Sales Department, however, have our work cut out for us and we cannot let up.

Another situation that these smaller stokers have brought about is decreased sales of coarse coal, lump, egg and nut, offset by increased demand for smaller sizes, which means the eventual crushing of some of these larger sizes for stoker use. Screenings have always commanded the lowest price at which coal has been sold. Screenings, generally speaking, have always sold at less than cost of production. Through refinements made in the automatic burning of coal, smaller sizes suitable for stokers, properly refined, can now take their place with lump, egg and nut as a source of profit to the operator. The crushing of some of the smaller sized coarse coal is actually occurring right at this time in coals of higher quality. This crushing will, of course, develop and increase as stoker installations increase and it will reflect itself in increased realization for these smaller sizes, which the coal industry so badly needs.

One more item of optimism and then I am through. In the October issue of Coal-Heat, short space was devoted to an announcement made by Dr. H. R. Dittmar at a meeting of the American Chemical Society and an exhibit was shown of a new kind of glass manufactured from coal. This glass is promised to displace ordinary glass in uses requiring lightness and strength. The technical name is "Pontalite." It can be sawed, drilled, polished and moulded to any form. It is also interesting to note that Dr. Dittmar is employed by the DuPont Corporation.

In the same article, a Dr. T. E. Warren of Ottawa, Canada, in speaking of the development of oil and gas from coal stated the world's supply of petroleum is only about ten years. Recent figures issued by the Bureau of Mines indicate that the supply of oil in this Country would last another 15 years. While we have seen in the past fifteen years a substantial decline in coal production and sales, and we have seen oil and natural gas make heavy inroads into business formerly held by coal, it is conservative to say that from all indicators available this situation is due for an about face and that we will very shortly share in developments that mean increased production and, along with this, increased returns to stockholders.

I have a suggestion to make to Mr. Bluth and to the Committee of Ten and that is that periodical meetings, in my opinion, should be held in Chicago, St. Louis, or any other point that might be agreed upon, at which there should be present not only representative spokesmen from the coal, stoker and allied industries but that we might have present various operating officials to take part in such meetings, that all of us in the coal industry might know better than we do now the progress that is being made from various important angles and that we may keep more conversant with improvements as they are made.

I believe that to live up to the possibilities we in the coal business are confronted with, there cannot be too much intelligent discussion nor can there be too much information passed out on various subjects involved in these questions, that such meetings would result in increased knowledge, which naturally would enlarge the vision of those taking part in such meetings and, as a consequence, considerably increase the enthusiasm of all of us to the end that we might take full advantage of what undoubtedly lies ahead.

If I have any answer to make to Mr. Bluth or any message to leave with you gentlemen as coming from a representative of the Sales Department of an Illinois operator, it is that we in the Sales Department feel that the coal business is on the up-grade and that with your cooperation, which we always have had and must continue to have, and with hard, intelligent work upon our part, plus the continued cooperation of Mr. Bluth's Committee, the next few years will show results that will help to make us forget the drab period since the War and will be exceedingly pleasant and profitable to stockholders, to the management, and to employes. It will, further, give all of us who have had a hand in its success the satisfaction that comes from successfully handling a big job. The opportunity is before us and we must not fail.

* * *

Chairman Hamilton: The meeting is still open for discussion of this paper.

A Voice: What about the present status of space heaters? What is the coal industry doing about that?

Mr. Bluth: This year the records of the Institute show that 155,000 space heaters have been sold. We expect to sell about 250,000. These space heaters are sold and handled as merchandise and advertised by such firms as Montgomery Ward, Sears & Roebuck, and others over the United States. They are replacing in most cases a lot of the old anthracite base burners that were used. They are replacing a lot of stoves and circulating heaters at the present time.

They do present to the equipment manufacturers a challenge to produce and design a heater that will merit the support of the public. After all, those fellows are the judges.

In the past few weeks, particularly toward the burning season, not only in Chicago newspapers but where I have been the last few weeks I have seen many ads in the papers and different small communities where Sears & Roebuck and Montgomery Ward operate offering these on easy terms. They not only handle their own paper, but handle the paper from the dealer. The oil burners and heaters in that category will replace a lot of the small heaters.

One company just recently announced a stoker fired space heater. They announce a stoker control which will heat up to four or five rooms. They have about 150 of those stokers in various parts of the country, and have had for a year, but have not said much about it for they wanted to know where they were going. In various parts of the metropolitan area we attempt to work with this company in getting the stoker dealers to interest some neighborhood hardware store to try these out. I believe already they have orders for and have sold over five hundred of these. There is enough room—enough coal in the hopper to last an average of four rooms from one to three days without anything whatsoever in the way of attention, removing the clinker when it forms. That will be very helpful, I think.

There are a large number of oil burner manufacturers in the field of heating plants that have gone into that business. I believe the manufacture should be encouraged as much as possible by the coal industry and equipment designed so that we can compete with that sort of thing.

Chairman Hamilton: Any further discussion?

Mr. Louis Ware (United Electric Coal Co., Chicago): One thing in the sale of refrigerators and the rapidity with which the sales increase. The chart shows the sales went up very rapidly. The prices of refrigerators also went down. You know you can buy today an electric refrigerator for $150.00 that cost $300.00 a few years ago. Now, the initial cost of the heating unit is an item of great importance. The coal stoker device costs now, as I understand — that is, the small ones — what an oil burner costs. What is the opportunity for the reduction of the price of those stokers when you get a volume of sales?

Mr. Bluth: I think as the sales go up the cost goes down. Back in 1924, 1925 and 1926 and up to 1930, anybody who bought the residence-sized stoker had a real investment, $600.00 to $1,000.00. Today, those same stokers built by those same manufacturers are down around $300.00 to $400.00 or $500.00.

I believe within—I am putting myself on the spot here—within five years, with what is developing in the industry today, it will be sold at two-thirds of the cost of the present stoker today and a much better machine. I believe a complete unit, boiler, stoker and air unit, with this mass production—I believe we are going to reduce the cost of coal burning equipment and make it easy to compete with oil or gas burning equipment in the same category.

Mr. Weir: I was very much interested in Mr. Bluth's introductory remark about the new opportunities for coal being somewhat obscure. I am quite certain after he has made his very fine talk and added to it, that there is no longer doubt in the minds of any of us but that there is an excellent opportunity to increase our markets at the expense of competing fuels.

Stoker coal has been rightfully regarded as a special product. By this I mean that it cannot be considered to be just an ordinary run of mine product. It must have special preparation, special screening and be uniform. I do not believe anyone should overlook the fact that it is a special product and does require special attention. When your customer finds that your stoker coal varies from one car to another, he becomes dissatisfied.

We started out a few years ago with stoker coal having a top size of one and one-half inches to two inches and having a bottom size of five-sixteenth inches. Subsequently the bottom size was changed to 48 mesh and the top size to one inch or one and one-half inches. More recently the bottom size has become ten mesh and the top size three-quarters to one and one-half inches. Naturally the men in charge of preparation at the mines have wondered about the necessity for almost continuous changes in their sizing equipment. I think Mr. Bluth has pointed out to you in a very excellent manner the reason for such frequent changes. There has been a tremendous amount of progress made in stoker construction. Any coal company contemplating the production of stoker coal should make a very thorough study not only of their own coal but of the trend of the sizes which are likely to be required.

I have been amazed at some of the things I have found out the last few years about coal as it occurs in the vein. The Illinois State Geological Survey has done a wonderful lot of work in providing us with such information. Recently I was checking over a detailed columnar section of No. 6 coal in Franklin County. I found in that columnar section at least fifteen benches, some of them ranging from a few inches to a foot or more in thickness. The analysis of those benches tells just what a complex nature the coal in the vein has.

There were several benches with as low as two percent ash, and several that were approximately seven and eight percent. We found others that ran as high as twenty percent ash. If you take a full section of that vein in mining, I think you can appreciate the fact that your mine run output is apt to lack uniformity. Likewise there will be difficulty in maintaining uniformity in any given size unless the coal is mechanically cleaned.

I think one of the studies in connection with production of stoker coal should be the study of the coal as it occurs in the vein in the mine, and that might indicate the nature of the job ahead.

I think Mr. Bluth made a wonderful contribution. I do not think there is anything obscure in the minds of any of us now as to the opportunities before us.

Chairman Hamilton: It is regrettable that we must bring the session to a close, in order that the room may be arranged for the banquet. On behalf of the Institute, may I express our thanks to Mr. Bluth and Mr. Soule and the gentlemen participating in the discussion in making this a very interesting and instructive session? Also, the Program Committee, consisting of Mr. Taylor, Mr. McFadden and Mr. Weir, for the thought and care they gave to arranging such a splendid program both this morning and this afternoon.

Mr. President, I turn the meeting back to you.

President Thomas: I just want to make one or two announcements. I would like to have all of you who have not registered do so just as soon as possible.

I also call your attention, as I did this morning, that Mr. Schonthal has a number of tickets to the football game. Those who desire to go to Urbana should see Mr. Schonthal.

In addition, we would like to have you get your tickets for the banquet tonight just as soon as possible.

Gentlemen, the meeting is adjourned.

(Whereupon a recess was taken until after the banquet on the evening of the same day.)

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**The following advertisers in the 1935 Yearbook displayed merchandise of their manufacture in the Exhibit Hall at the Forty-fourth Annual Meeting. The exhibits created a great deal of interest and were very well attended.**

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## EVENING SESSION

### 8:00 O'clock P. M.

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

As retiring President of the Illinois Mining Institute, I do want to extend my thanks to all the members of the various Committees that have made this session what it has been.

I take pleasure in turning the meeting over to the Toastmaster for the evening, Mr. Paul Weir.

Mr. Paul Weir, Toastmaster (Bell & Zoller Coal & Mining Company, Chicago): Mr. President, Members and Guests of the Institute, I think one of the first things I should do this evening is to say that there are no telegrams or letters to read to you.

Next, I think perhaps I should explain my presence here as Toastmaster on this occasion. For a long time, it has been a custom of the Institute — I do not think very many of you have been familiar with that custom—that in order to be Toastmaster you must make application for the job. In the past quite a few of my good friends have been Toastmasters and have had some things to say about me and my washer. In order to put a stop to that situation, I put in an early application for the job this year, and my application was acted upon favorably. I very gratefully and graciously accepted the job which was tendered to me.

You will recall that last year your Toastmaster, the "late" Mr. Harrington—I say that affectionately—had something to say about some of "Sandy's" stories that should be super-washed. I think it might be entirely appropriate if I served you warning that all stories tonight must pass the float and *sink tests.*

Gentlemen, Toastmasting tonight is a pleasant job for me. It is one of the prerogatives of the Toastmaster that he calls on whomever he pleases and shuts up everyone he does not want to talk.

Quite commonly, Toastmasters traffic in biographies. I am going to follow the established custom and procedure to do likewise. I want to do it for two reasons: First, I have some very excellent subjects upon whom to work; and secondly, I don't know any stories that will pass the test.

The man who has been elected President of your Institute for the coming year is so well known that I feel I might be presuming upon your knowledge in saying very much about him. He was born in Chicago and, following Horace Greeley's advice, "went west," and we find him in the Great Northwest holding a very responsible position at a time before some of us entered the first grade in school. I do not want any of you to construe that as meaning that this gentleman is even middle-aged, because I say to you that he has all the enthusiasm of youth, and so long as that prevails he is still young. His mines have established in Illinois wonderful records of efficiency and safety. I do not know whether I am divulging any confidence when I say to you that, not being satisfied with having his production records accepted as standard not only in this State but throughout the Country, at the present time I am informed he is planning on another mine which will be the most modern mine in the Middle West.

I might say a lot of other things about this gentleman. He has taken an active interest in Association work, and at the present time is Director of the American Mining Congress, Director of the National Coal Association, President of the

Illinois Operators' Association, and in these activities he is giving unstintingly of his time.

It gives me great pleasure to present to you at this time your next President, Mr. W. J. Jenkins, President of the Consolidated Coal Company of St. Louis.

President-Elect, W. J. Jenkins (Consolidated Coal Co. of St. Louis, St. Louis, Mo.): All I can say is I will do my durndest. The Toastmaster as well as the retiring President have intimated that I can talk all I want to next year, but following the established and most excellent custom in the past, as intimated to me and I agree with it, there will be no speaking by the incoming officers.

Toastmaster Weir: A young man who was born shortly after the turn of the century, at the time my good friend Bill Jenkins was operating mines in the Great Northwest, was today elected your Vice-President. He is a graduate of the University of Wisconsin and Massachusetts Tech. He has spent nine years in Southern Illinois in the production end of his Company. Several years ago he was transferred into the sales end. I know he will never sever entirely his connection with the boys with the picks.

At various times I have spent real money around various night clubs in Chicago observing the antics of various and sundry Masters of Ceremony. I do not think I am mistaken when I say to you if this young man ever decides to forsake the Coal Industry he will have his name on Broadway.

To those of you who know his father, I can only say that he is his father's son. I might add to that, to those of you who have not known his father, he is one of the finest young men in the Coal Industry today. I appreciate the opportunity of presenting to you your Vice-President for the coming year, who eventually, if nothing happens, will succeed Mr. Jenkins as President of the Institute. Mr. Herbert Taylor, Jr.

Vice-President Elect Herbert H. Taylor, Jr. (Franklin County Coal Company, Chicago): Thank you, Mr. Toastmaster. All I can say is that I haven't slept in a cross-cut for three or four years.

Toastmaster Weir: Well, Herb, I think you might make the story complete by telling us where you have been sleeping.

From many of us, the Illinois Mining Institute demands very little of our time. We attend the semi-annual meetings, we listen and learn, and then we indulge in good-fellowship. Presidents come and Presidents go, Executive Board Members come and Executive Board Members go, but there is one fellow who goes on forever.

At the time this gentleman accepted the office of Secretary in 1929, the membership of your Institute numbered 126, and had \$265.00 in the Treasury. Today the Institute has 569 members and \$10,000.00 in the Treasury. I gave you that \$10,000.00 figure for the reason that I believe you should figure out some way to spend the ten.

Your Secretary, in between meetings, is a very busy gentleman. He works for the Institute at all times. I think the Institute is to be congratulated upon having a gentleman who will do the work Mr. Schonthal has done for the Institute year after year. It is a real pleasure to present to you your Secretary, B. E. Schonthal.

Toastmaster Weir: At the meeting today, certain members of the Executive Board were re-elected. I would like to ask these gentlemen to arise as I call their names, and remain standing until I get around to the last one.

Mr. W. C. Argust, Peabody Coal Company, Taylorville

Mr. W. J. Austin, Hercules Powder Company, Chicago

Mr. C. F. Hamilton, Pyramid Coal Corporation, Chicago

Mr. C. J. Sandoe, West Virginia Coal Co., St. Louis

Mr. H. A. Treadwell, Chicago, Wilmington & Franklin Coal Company, Benton.

Mr. Hamilton, Mr. Sandoe and Mr. Treadwell are past Presidents of our Institute.

In addition to these gentlemen, Dr. M. M. Leighton, State Geological Survey, Urbana; Mr. James McSherry, Director of Department of Mines and Minerals, Springfield; and Mr. Fred S. Pfahler, Superior Coal Company, Chicago, were duly re-elected to the Board. Unfortunately they are not with us this evening.

I have heard it said from time to time that the membership of this Executive Board never changes. For that reason, I want to present to you separately the newly elected members. I will ask that they arise as I call their names.

Mr. Carl T. Hayden, Sahara Coal Co., Chicago

Mr. T. J. Thomas, retiring President, Valier Coal Company, Chicago

Mr. William P. Young, Bell & Zoller Coal & Mining Company, Chicago.

In addition to these men, Mr. Roy Adams, Old Ben Coal Corporation, Christopher, was elected to the Board as a new member today. Unfortunately Mr. Adams is not able to be here this evening.

We have this evening several distinguished guests. I am sure you will want to become acquainted with them. This afternoon you heard one of them deliver one of the best papers if not the best that it has ever been my pleasure to hear before the Illinois Mining Institute. The paper was presented by Mr. Marc Bluth, Committee of Ten, Coal & Heating Industries, Chicago. Mr. Bluth, will you arise?

One of the organizations which has done very valuable work for the Coal Industry in the State of Illinois is the Illinois Reciprocal Trade Association. The Executive Secretary of this organization is Mr. Bristow, of Belleville. I would like to have Mr. Bristow arise, please.

The speaker of the evening has been assigned a topic having to do with "Future Relations of the Bituminous Coal Industry and the Government." Inasmuch as there apparently was a limitation placed upon him, I will take the liberty of saying a few things about the past, inasmuch as he is going to talk on the future.

Some of us put in quite a lot of time on special legislation for the Coal Industry prior to the enactment of the N. R. A. in 1933. At some time or other, practically everyone in the Coal Industry has favored Government regulation of some description. The number of kinds of Governmental regulation which have been proposed is almost exactly equal to the number of coal operators favoring such legislation. In other words, everyone wanted to write the ticket to conform to his particular situation. They wanted to restrict the other fellow, but leave themselves perfectly free to act as they saw fit. Under those conditions, I want to say that the writing of any Coal Code or any special legislation which meets the approval of even small groups is very difficult.

The speaker for the evening was one of the early proponents of special legislation. He began his business career as a lawyer. However, during those good old days of the War, the Coal Pasture looked pretty green and I think that rather enticed him, and he became associated with the Erie Coal & Mining Company, Butler, Pennsylvania, which Company afterwards became the Butler Consolidated Coal Company. This Company developed one of the first completely mechanized mines in the entire industry.

When difficulties in the Coal Industry began to become acute, he became very much interested in corrective measures. In 1931, he was a member of Governor Pinchot's Coal Commission in the State of Pennsylvania. In 1932, he appeared before the Senatorial Commission in Washington as a proponent of the Davis Kelly Bill. When the N. R. A. went into effect, he was selected as a member of the Western Pennsylvania Code Authority, and subsequently became Manager of the Code Authority.

After the enactment of the Guffey Bill, he was appointed by President Roosevelt as a member of the National Bituminous Coal Commission. At the first meeting of the Commission, he was elected Chairman.

Quite a few of us were born in Pennsylvania and came to Illinois. This gentleman was born in Bloomington, Illinois, and went to Pennsylvania. For that reason, I am quite sure that Illinois will get that well-known "fair advantage." Perhaps I should add he was six months old when he left Illinois.

The Bituminous Coal Industry in this Country is fortunate indeed in having someone who has had practical mining experience as Chairman of the Coal Commission. I know that the Illinois Mining Institute is very glad, Mr. Hosford, to have you here this evening. We will be delighted to hear from you.

Mr. C. F. Hosford, Jr. (Chairman, National Bituminous Coal Commission, U. S. Department of Interior, Washington, D. C.): Mr. Chairman, members of the Institute, and friends, this introduction is quite different from one I had in Pennsylvania a year or more ago. At one time I was asked to go out to a small town to address a group of miners. I got there along about eight o'clock in the evening, in a rather dimly lighted hall, and the Chairman escorted me in due fashion to the platform. He was rather embarrassed about the position he occupied. He opened the meeting by telling my name and who I was, and then wound up by saying, "He isn't the dumb cluck he looks."

I plead guilty of all your Toastmaster has said about me. I have spent the best years of my life in the coal business — to my sorrow. But I am firmly convinced that this industry has a real future ahead of it. And I am actually convinced that that future can be attained when you men in the industry make it an industry that is worth while. You cannot rise any higher than the level that you yourself set upon it.

It is true, as your Toastmaster has said, that I am a member of the National Bituminous Coal Commission. That does not make me a bit different from what I was before. I am a coal man just the same as all of you. I have all of the weaknesses and all of the virtues that you have, and that is saying plenty. So that when I am here tonight talking to you, I feel that I am among my own people. Perhaps we differ in opinion. But for years I have been sold on certain things that the Coal Industry needs, and right or wrong, so long as I draw the breath of life I will keep on preaching the same old story.

# FUTURE RELATIONS OF THE BITUMINOUS COAL INDUSTRY AND THE GOVERNMENT

By C. F. HOSFORD, JR.

Chairman, National Bituminous Coal Commission, U. S. Department of Interior, Washington, D. C.

To deliver an address on the eve of a presidential campaign without introducing political issues of one sort or another is extremely difficult. However, in discussing the subject of future relations between government and the bituminous coal industry, I wish to emphasize my belief that politics in the ordinary sense of the term is not and should not be involved in any way. The real questions to be considered involve broad national policies and should never be allowed to become political issues, nationally or locally.

Bituminous coal is and will continue to be our greatest natural resource and basically the wealth and prosperity of our country are founded upon those resources with which nature has endowed us. Today, despite the inroads of competing fuels and forms of energy, coal furnishes the major portion of our power and energy throughout the Nation. From the coal mines of America comes a raw material essential to the operation of the steel and chemical industries, and in times of war the maintenance of adequate supplies of coal becomes a vital part of our program of national defense. In producing the coal required by our homes and industries more than one-half million men find their means of livelihood, and the transportation and distribution of coal gives employment to additional thousands. The railroads of our country look to coal not only as their chief source of power but also as a major freight revenue producer. Thousands of homes throughout the country depend upon bituminous coal as the most efficient and economical means of supplying heat, and generally speaking, no better test of the importance of coal in our national life can be given than to recall what takes place when the mines of our country are shut down.

The question of what can be done and what should be done for the bituminous coal industry has been one of widespread interest for many years. Congressional committees, experts from our colleges and universities, representatives of banking and transportation interests, and men from our own industry have made elaborate surveys and studies and the records are replete with reports of conditions in the industry and recommendations as to how these should be remedied.

I believe it will be universally acknowledged that the bituminous coal industry must be stabilized, and today with a growing appreciation of the value of our natural resources there is an increasing realization that the question of bituminous coal cannot be indefinitely deferred. The depression years, from which we are now emerging, taught us many lessons, but I feel that the most important accomplishment has been the creation of what might well be called a "national consciousness." Today, more than ever before the New England manufacturer realizes that prosperity in the farm belts of the Midwest directly affects his business. The cotton grower of the South recognizes the consequences of depressions in the steel industry. The fruit growers of California feel the reduction in demand when unemployed thousands roam the streets of eastern cities. The automobile manufacturer knows that the closing down of coal mines definitely affects his markets, and the farmer too has learned that idle factories and low wage rates seriously impair his ability to market farm products at reasonable prices. Business has become national in scope and in effect and the people of our country consider economic, social and political problems, not from a narrow local standpoint, but from the broader angle of their effect upon the country as a whole.

It is unfortunate that we in the coal industry, as the result of our depression years, and we have suffered far longer than industry and business in general, have never developed what I might call an "industry consciousness." We can all recall the time only a few years ago when many coal operators were unwilling to sit in the same room with their competitors and discuss matters of mutual interest. Even today many coal producers know nothing and desire to know nothing of producing fields and consuming markets other than those in which they are directly interested. The average coal man has paid little, if any, attention to the development of new uses for coal and the expansion of markets for his product. He believed that his sole function was to dig the coal and load it into the railroad cars and once this was done his responsibility and interest ceased. Nor was this viewpoint confined to the coal producer. For years many wholesale distributors thought of their relations with coal producers only in terms of the maximum profit which they might exact for themselves on each ton of coal. The retailer likewise was inclined to view the coal industry from his own individual standpoint, ignoring on the one side the inroads being made by competitive fuels and on the other side failing to realize that the coal producer could function successfully only on the basis of fair prices for his coal. And in recent years the coal consumers of the country in too many instances have taken the fullest advantage of prevailing industry conditions and in a buyers' market have sought to buy and have bought their coal supplies at the lowest possible prices, utterly disregarding their future needs and sources of supply and the future of the producers and distributors upon whom they must in fact depend. And last but not least, the rail carriers, a most substantial portion of whose freight revenues have been derived from transporting bituminous coal, have consistently closed their eyes to the changing conditions in fuel production, distribution, and consumption and by blind policy of seeking to cure their depressed conditions by constantly increasing rate levels have not only diverted millions of tons of coal from their rails to trucks but have encouraged many consumers to use natural gas or fuel oil instead of coal.

And this same lack of broad understanding and cohesive policy has prevailed in past years within many coal companies. The production department has made its decisions only in terms of tonnage and cost per ton. The purchasing department has bought its supplies only with a view to securing the lowest possible prices, and the sales department, thinking in terms of tonnage, has too frequently enthusiastically greeted a 2¢ per ton saving in production costs by a 10¢ per ton reduction in prices, intent only on outdoing its competitors in the record of tonnage sold.

It is indeed unfortunate for our industry that local and personal prejudices, that disputes over wage rates and labor relations, that differences of opinion as to the proper relationship of coal freight rates have revived and maintained individual and sectional prejudices which have kept the members of our industry apart and impaired the work of solving its problems through voluntary effort.

Sooner or later must come the realization that the industry as a whole cannot prosper without cooperation; that the producer must clearly recognize and assist in working out the problems of the distributor and that the distributor cannot successfully conduct his business without due regard for the producer; that the consumer cannot as a matter of permanent policy expect to purchase his coal at prices below production and distribution costs; and that the transporter of coal cannot maintain his tonnage when he imposes coal freight rates which are disproportionate to the cost of the service rendered, which impose a heavier share of transportation costs upon bituminous coal than upon other commodities requiring similar service, and which definitely handicap the bituminous coal industry in its competition with other fuels and forms of energy. And our industry must also realize that it has definite responsibilities to every member of the industry, to the men who earn their livelihood in the industry, to the consumers who furnish the market for its products, and last, but not least, to the investors whose money has made possible the development of producing and distributing facilities.

In past years I have been bitterly criticized for opinions which I have expressed as to the future of the coal industry and I have been told that my suggestions were utterly impractical and unbusiness-like. And because I have favored regulation of the coal industry by the Federal Government I have been called a "bureaucrat," a "brain-truster," and even a Communist.

Despite all the loud talking by opponents of regulation concerning free competition, rugged individualism, and the dangers of regimentation, I can assure you that control of business by government is not something which has just been invented since the beginning of the depression and that we, living in America under a democratic system of government, have always recognized the principle of government control of business in cases where the facts showed it to be necessary and in the public interest. In a recent address I traced the history of government supervision over business in this country and pointed out that with the increasing complexity in our national economic life, government control of business had become common-place and in many instances has been found to render an invaluable public service. And when you stop to think of it, there is today in one form or another some degree of governmental control in almost every form of business activity. The railroads, the power companies, the telephone companies, our banks and trust companies, insurance companies of every description, security exchanges, the meat packing industry, and grain elevators are only a few of the numerous private enterprises over which government has found it necessary to exercise some degree of control, and I doubt whether there is a single man in this room tonight who would be willing to have all business and industry go back to the days of so-called free competition and rugged individualism.

From a legal standpoint it is safe to say that government has a recognized power to control and regulate any industry or any business when the need for that regulation becomes evident and there is a sufficient public opinion supporting the demand for regulation, and I think that if you will trace the history of regulation in the various lines of business which I have mentioned you will find that government has intervened and exercised some form of control only when the business or industry failed to recognize its obligations and responsibilities and to put its house in order by voluntary action.

There is a great deal of loose thinking today as to the purpose and meaning of regulation. There are some men in the coal industry who, when the subject is discussed, talk of "rainbow" laws and of interference with something which they seem to consider as their particular private property, something sacred to themselves which has been vested in them by divine right. There are others who view the subject only from the angle of immediate and selfish interests, giving little thought either to their own future or that of their fellow members in the industry. There are others utterly lacking in any sense of moral or ethical principles who desire to be free to use any competitive method, fair or unfair, in conducting their business and whose sole ambition would appear to be the excelling of their competitors in volume of business without regard to the cost to themselves or to others. And last, but not least, there are men to whom human progress means nothing, who view every constructive measure with suspicion and who talk long and loudly of the good old days when might made right. They have reached a stage of frozen mental processes where any change from their viewpoint means destruction, utterly ignoring the immutable law that all life is a play of conflicting forces and that there must be a constant movement either toward improvement or toward decadence.

No one realizes better than I do the complexity of the problems involved in producing, distributing, and using bituminous coal and I fully appreciate the responsibility which rests upon any one who attempts a solution of these problems. Nor am I so foolish as to look forward to any Utopia in the coal industry. Neither do I desire a radical change in our present economic system. I do believe that the complexity and difficulty of our problems is not a sufficient excuse for a do-nothing policy.

Some men in the coal industry point to the recent improvement in conditions as a proof that regulation is not necessary, that if left to itself our industry will work out its own salvation. Unfortunately, the forces within the industry which brought about its demoralization are still at work and there is no reason to believe that they will be beneficial in the future rather than destructive as they have been in the past.

Other opponents of legislation urge that the industry is awakening to a realization of its problems and that solutions will come by voluntary effort. I have nothing but words of praise for those organizations and associations in various branches of our industry which are engaged in a campaign of education of producers, of distributors, and of consumers, and who are constantly urging and securing closer cooperation between industry members. The service which they render is invaluable, but I believe that our problems are so complex and the interests within the industry are so conflicting that there cannot be sufficient cooperative effort to accomplish a proper stabilization of the industry.

Early in my speech I said that it was almost universally recognized that our industry required stabilization but that when we came to policies and methods of accomplishing that result we encountered a hopeless conflict of opinion. Our industry is not merely local or state-wide in its scope. It is nation-wide, and we are dealing with a natural resource, the conservation of which is a matter of national public interest, and let me say that an annual waste of 50,000,000 to 100,000,000 tons is not a thing which can be permanently ignored. Furthermore, the time will come in the not too distant future when it will be realized that it is unsound practice to apply high grade coals particularly adapted to special uses for ordinary steam production purposes. Again, the matter of the relation between the use of coal, electric power, natural gas, and fuel oil very seriously affects the lives and prosperity of millions of our people.

In the production of coal labor represents 60% or more of the cost, and the matter of labor relations in the industry cannot be ignored, nor can it be dealt with on a local basis.

Since railroad freight rates charged for transporting coal constitute on the average at least one-half of the delivered cost of coal to the consumer, the level of those rates vitally affects every branch of our industry and experience has proven that this problem of our industry cannot be dealt with on an individual or sectional basis.

It is an unfortunate fact that the coal industry has failed to profit by the experience of others, and today in dealing with organized bodies in the transportation world and among coal consumers we still present the same divided front which the coal industry has shown on every important subject during the past 20 years. In short, I personally believe that in the United States we have attained that stage of economic development where government must interest itself in the conservation of our principal natural resources and in those cases if the industry as a whole continues to operate at a financial loss, if its operation results in unnecessary waste of the resource, if its efforts to survive under highly competitive conditions bring about the use of unfair trade practices and results in numerous bankruptcies and in conflicts between capital and labor over wages and working conditions, then government must interest itself and must intervene to the extent of preserving a proper balance between the conflicting economic factors which are constantly at work.

A great many people picture government control of business as necessarily involving rigid and detailed regulation. To my mind nothing could be more disastrous for our industry and, therefore, I am against any plan which seeks to accomplish a more rigid control than circumstances warrant. On the other hand, I am equally opposed to a continuance of the so-called free competition which we have enjoyed for many years past. It is the duty of government to so control the industry that a state of fair competition will be preserved. Otherwise, there will be a slow but sure trend toward monopolization of the coal resources of our country.

For years we have suffered from an unwise and uneconomic over-development of coal producing facilities. Today a new problem confronts us—mechanization. It requires no stretch of the imagination to believe that if mechanical loading methods can be applied generally throughout the industry, we will throw permanently into the ranks of the unemployed at least 100,000 miners during the next few years. With increased production made possible by mechanization, it is inevitable that numerous coal properties which have been able to survive the depression years will be forced to abandon operations, and the effect upon the communities dependent on these mines can easily be pictured. Call it Socialism, or Communism, or whatever you will, I personally believe that no industry has a right summarily to throw 25% or 30% of its employees out on the street. I further believe that no industry has a right to waste in a reckless and unnecessary manner a natural resource whose value to future generations is incalculable, and if free competition leads, as I believe it will, to an eventual monopoly in the coal industry, I say that these conditions are not only unsound economically but are un-American and government must intervene.

I do not mean to infer that we should ignore advanced methods of producing and distributing coal, and I do not deny that efficiency and ability are entitled to reasonable rewards in business. Nor do I believe that government should act as an insurer for every one who chooses to make investments in the coal industry, but I do insist that government has a definite responsibility to see that the people of our country are fed and clothed and that those who are physically and mentally capable should be afforded a reasonable opportunity of earning a livelihood for themselves and their families at wage rates which are consistent with American standards of living. And I also believe that our national life has reached a degree of complexity where it is the duty of government, when important economic changes are occurring in an industry, to regulate those changes so that they will occur in a gradual and orderly manner and with the least possible damage to all parties in interest.

If history affords us any guide for the future and if the experience in other coal producing countries is a criterion, we must conclude that the coal industry has never been able to stabilize itself and that, therefore, government must exercise some measure of control.

I am not here tonight to advocate any particular plan or manner. I have always realized that the Bituminous Coal Conservation Act of 1935 was not a perfect law, and I am also ready to admit that regulation by means of a minimum price plan cannot of itself cure all the ills of the industry, but I do believe that the strong hand of the Federal Government must guide our industry towards stabilization and that price control is a step in the path which we must follow if our industry is to survive and prosper.

At heart, I will always be a coal man. I am sincere in my belief that the only way in which your problems can be solved is through Federal regulation. Likewise, I believe today that some form of Federal regulation is just as inevitable as the rising of the sun in the heavens tomorrow morning.

You have your choice, where you men in this industry write the ticket and say what should be done, or you can leave it to others who are not familiar with your problems. There isn't much choice in that, gentlemen. Far better for you to write your ticket, far better for you to say what should be done for your industry, and then help to put it into effect.

And that is the message I leave with you tonight. I thank you.

* * *

Toastmaster Weir: Mr. Hosford, on behalf of the Officers and Members of the Illinois Mining Institute, I extend to you our sincere thanks for coming to Illinois and giving us this talk. I am certain all of us have learned something, and you have given us something to think about.

I think you know the industry in Illinois, prior to the N. R. A., made every effort to cooperate with the Federal Government in trying to find a rational solution for the problems of the bituminous coal industry. It goes without saying that cooperation will continue.

Mr. Hosford: Well, I sincerely appreciate what you have said, and I do not want you to feel I come out here as a bureaucrat. As I told you, I am still a coal man, and, pray God, I will always be a coal man. But unless the men in Washington have the cooperation and support and advice of you men back in Illinois and in the Country, you will produce a discord—well, you will get whatever comes to you and we cannot do much about it. We need your help, not only in preparing a law but in administering the kind of law our industry needs.

Chairman Weir: I will now turn the meeting over to the newly elected President, Mr. Jenkins.

President Jenkins: I have had very little to do with this meeting. All the business of the meeting having been attended to, a motion to adjourn will be in order.

(Whereupon, at 9:10 o'clock P. M., the Forty-Fourth Annual Meeting of the Illinois Mining Institute was declared adjourned *sine die.*)

# CONSTITUTION AND BY-LAWS

**Adopted June 24, 1913**
**Amended Nov. 12, 1926**
**Amended Nov. 8, 1929**
**Amended Nov. 8, 1935**

## 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 officers and executive board members shall be elected by ballot, annually, at the regular November meeting and shall hold office for the ensuing year.

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

BROOKS, C. W........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 & Machine Works, Inc., Alton, Ill.
GARCIA, JOHN A........Allen & Garcia Co., 332 S. Michigan Ave., Chicago, Ill.
GREEN, ARTHUR C........Goodman Mfg. Co., 4834 S. Halsted St. Chicago, Ill.
HAMILTON, CHAS. F., V.-P........
Pyramid Coal Corp., 230 N. Michigan Ave., Chicago, Ill.
HARRINGTON, GEO. B., Pres........
Chicago, Wilmington, Franklin C. Co., 332 S. Michigan Ave., Chicago, Ill.
JENKINS, S. T........Goodman Mfg. Co., 322 Clark Ave., St. Louis, Mo.
JONES, JOHN E........Old Ben Coal Corp., West Frankfort, Ill.
JOYCE, A. R........The Wood Preserving Corp., Marietta, Ohio
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., 20 N. Wacker Drive, Chicago Ill.
PELTIER, M. F., V.-P........Peabody Coal Co., 20 N. Wacker Drive, Chicago, Ill.
RYAN, JOHN T., V.-P. and G. M........Mine Safety Appliances Co., Pittsburgh, Pa.
SANDOE, C. J., V.-P........W. Va. Coal Co., Boatmen's Bank Bldg., St. Louis, Mo.
SCHONTHAL, B. E., Pres........
B. E. Schonthal & Co., Inc., 28 East Jackson Blvd., Chicago, Ill.
SCHONTHAL, D. C., Pres........West Virginia Rail Co., Huntington, W. Va.
TAYLOR, H. H., JR., V. P........Franklin Co. Coal Co., 135 S. LaSalle St. Chicago, Ill.
THOMAS, T. J., Pres........Valier Coal Co., 547 W. Jackson Blvd., Chicago, Ill.
THOMPSON, J. I., Pres........Koppers-Rheolaveur Co., Koppers Bldg., Pittsburgh, Pa.
WEIR, PAUL........307 N. Michigan Ave., Chicago, Ill.
ZELLER, HARRY, V.-P........West Virginia Rail Co., Huntington, W. Va.

## HONORARY MEMBERS

MOORSHEAD, A. J........Colonial Apt. Hotel, La Jolla, Calif.
MURRAY, HUGH........Equality, Ill.
STOCKETT, THOS. R........Alta Club, Salt Lake City, Utah
TIRRE, FRANK........7126 Northmoor Drive, St. Louis, Mo.

## ACTIVE MEMBERS

ABERLE, JOS. F........Consolidated Coal Co. of St. Louis, Mt. Olive, Ill.
ABRELL, JOHN, Supt........Peabody Coal Co., No. 7 Mine, Kincaid, Ill.
ACKERMAN, ROBERT, Mine Mgr........
Consolidated Coal Co. of St. Louis, 612 W. Main St., Staunton, Ill.
ADAMS, R. L., Gen. Supt........Old Ben Coal Corp., West Frankfort, Ill.
ADAMS, W. G........Central Illinois Public Service Co., Quincy, Ill.
ADAMS, WILLARD C...Koppers-Rheolaveur Co., 1301 Koppers Bldg., Pittsburgh, Pa.
ADAMS, W. G., Mgr........Dooley Bros., 1201 S. Washington St., Peoria, Ill.
ADAMSON, C. H........Stephens-Adamson Mfg. Co., 20 N. Wacker Drive, Chicago, Ill.
AITKEN, W. I., Slsmn........Dooley Bros., 1201 S. Washington St., Peoria, Ill.

ALFORD, NEWELL G. ....................
Eavenson, Alford & Hicks, 2050 Koppers Bldg., Pittsburgh, Pa.
ALLARD, A. F. ....................United States Fuel Co., Danville, Ill.
ALLEN, H. G., C. F. A. ....................The Alton R. R. Co. & The B. & O. R. R. Co.,
Wells & Harrison Sts., Grand Central Station, Chicago, Ill.
ALLEN, W. T., Slsmn. ....................Hagerty Bros. Co., 406 College Ave., Apt. J, Peoria, Ill.
ALVERSON, RALPH, Gen. Supt. ....................Carney Coal Co., Harrisburg, Ill.
ANDERSON, J. C. ....................1633 N. Vermilion St., Danville, Ill.
ANDERSON, J. S. ....................Saxton Coal Mining Co., Terre Haute, Ind.
ANDERSON, W. F., Dist. Mgr. ....................
The Timken Roller Bearing Co., 3300 Lindell Blvd., St. Louis, Mo.
ARGUST, W. C., Div. Supt. ....................Peabody Coal Co., Taylorville, Ill.
ARMSTRONG, E. R. ....................Equitable Powder Co., Collinsville, Ill.
ARNOLD, MARK R. ....................
A. Leschen & Sons Rope Co., 810 W. Washington Blvd., Chicago, Ill.
AUSTIN, W. J. ....................Hercules Powder Co., 332 S. Michigan Ave., Chicago, Ill.
BALL, CLAYTON G., Geologist ....................
Bell & Zoller Coal & Mining Co., 109 Flora Ave., Peoria, Ill.
BARKER, CHAS., Supt. ....................Peabody Coal Co., 104 W. College St., Harrisburg, Ill.
BARLOW, J. E. ....................Goodman Mfg. Co., 1122 S. 11th St., Springfield, Ill.
BARR, ROY E., Coal Traffic Mgr. ....................
Illinois Central Railroad, 135 E. 11th Place, Chicago, Ill.
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, 1215 Washington Blvd., Chicago, Ill.
BAUER, ARTHUR ....................Coal Producers Assn., Pana, Ill.
BAUER, G. C. ....................B. & O. Railroad, 505 Temple Bar Bldg., Cincinnati, Ohio
BAYLESS, I. N., A. G. M. ....................Union Pacific Coal Co., Rock Springs, Wyo.
BEALL, C. W. ....................Beall Bros. Supply Co., Alton, Ill.
BEAN, F. M. ....................Egyptian Iron Works, Murphysboro, Ill.
BEAUMONT, G. L. ....................Mine Timber, Cowden, Ill.
BECKER, LESTER O., Sales Mgr. ....................
Utility Mine Equipment Co., 620 Tower Grove Ave., St. Louis, Mo.
BECKER, WALTER C., Mgr. Safety Shoe Div. ....................
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Egyptian Tie & Timber Co., 1803 Railway Exchange Bldg., St. Louis, Mo.
MALSBERGER, A. H..............................................Dupont Powder Co., Springfield, Ill.
MANCHA, RAYMOND.............................Jeffrey Manufacturing Co., Columbus, Ohio
MARBLE, G. E..................................General Electric Co., 230 S. Clark St., Chicago, Ill.
MARDIS, EARLE J.........American Steel & Wire Co., 208 S. La Salle St., Chicago, Ill.
MARSH, I. D., Supt...............................................................Alcoa Ore Co., Belleville, Ill.
MARTIN, ENOCH, Asst. Dir...........................Dept. Mines & Minerals, Springfield, Ill.
MASELTER, JOHN E., Shop Supt.....................................................................................
General Electric Co., 1110 Delmar Blvd., St. Louis, Mo.
MAYOR, E. S., Supt..................................................Crerar-Clinch Coal Co., Duquoin, Ill.
McALPIN, M. L...............................................................McLaren Coal Co., Marion, Ill.
McARTOR, GEORGE, Asst. Comm.................Illinois Coal Operators Assn., Herrin, Ill.
McAULIFFE, EUGENE, Pres...Union Pacific Coal Co., 1416 Dodge St., Omaha, Nebr.
McBRIDE, W. P.............American Car & Fdry. Co., Ry. Exchange Bldg., Chicago, Ill.
McCABE, PROF. LOUIS C., Asst. Geol..........................University Club, Urbana, Ill.
McCARTHY, JUDSON D., Vice Pres................................................................................
Republic Coal & Coke Co., 8 S. Michigan Ave., Chicago, Ill.
McCLOUD, DON B.....Liquid Oxygen Explos. Mfr., 119 N. Chestnut St., Duquoin, Ill.
McCOLLUM, H. C.......................Allen & Garcia Co., 1932 Lowell Ave., Springfield, Ill.
McCULLOCH, L. H...........Hulburt Oil & Grease Co., 429 S. Tenth St., Vincennes, Ind.
McCULLOCH, WILLIAM A....................................William M. Hales Co., Linton, Ind.
McCULLOCH, WM. C............................................United Electric Coal Co., Duquoin, Ill.
McCULLOUGH, E. W..........................American Car & Foundry Co., Terre Haute, Ind.
McELHATTAN, D. F., Saf. Engr...................................Peabody Coal Co., Duquoin, Ill.
McEVOY, F. E., P. A.......................................................................................................
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*McFADDEN, GEO. C., A. V. P.......Peabody Coal Co., 231 S. La Salle St., Chicago, Ill.
McFADDEN, JOSEPH...........................Peabody Coal Co., Plaza Hotel, Danville, Ill.
McFADDEN, NAT, Div. Engr..............................Peabody Coal Co., Taylorville, Ill.
McGONIGAL, LAWRENCE J...Mine Rescue Station Supt., 245 Buck St., La Salle, Ill.
McGRAW, W. C............Westinghouse Elect. Mfg. Co., 6625 San Ronita, St. Louis, Mo.
McGURK, SAM, Supt................................Mt. Olive & Staunton Coal Co., Staunton, Ill.
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McLAREN, A. B........................................McLaren Coal Co., Gas Building, Marion, Ill.
McLAREN, W. S...............................................................McLaren Coal Co., Marion, Ill.
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McREAKEN, C. W., Div. Supt...........................................Peabody Coal Co., Marion, Ill.
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MEISTER, V. S....................................................The Jeffrey Mfg. Co., Terre Haute, Ind.
MEISSNER, JOHN F., Dist. Mgr.....................................................................................
Robins Conveying Belt Co., 37 W. Van Buren St., Chicago, Ill.
MELKUSH, ONEY...............................Peabody Coal Co., R. R. No. 5, Springfield, Ill.
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MEYER, CARL...................................Consolidated Coal Co. of St. Louis, Mt. Olive, Ill.
MILLER, ALEX U., Assoc. Mng. Engr...........................................................................
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MILLER, FRED........................................................Franklin County Coal Co., Herrin, Ill.
MILLER, J. B.................Mines Equipment Co., 1909 S. Kingshighway, St. Louis, Mo.

MILLER, JAMES E.......Mines Equipment Co., 1909 S. Kingshighway, St. Louis, Mo.
MILLHOUSE, JOHN G.......Litchfield, Ill.
MITCHELL, A. G.......Burton Explosives, Inc., Mt. Vernon, Ill.
MITCHELL, D. R.......Transportation Bldg., Urbana, Ill.
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MOSER, M. M.......United Electric Coal Co., Ambassador Bldg., St. Louis, Mo.
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MOSES, THOMAS, Pres.......H. C. Frick Coal Co., 1322 Frick Bldg., Pittsburgh, Pa.
MULLEN, E. C., Pres.......E. C. Mullen Co., 2525 W. 21st St., Chicago, Ill.
MULLIGAN, JOHN.......Macon County Coal Co., Decatur, Ill.
MULLINS, T. C., Pres.......
Northern Illinois Coal Corp., 310 S. Michigan Ave., Chicago, Ill.
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NASH, R. O.......Westinghouse Electric Co., 1605 Ambassador Bldg., St. Louis, Mo.
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O'BRIEN, FRANK.......American Cable Co., 114 S. McKinley St., Harrisburg, Ill.
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OELBERG, E.......Bell & Zoller Coal & Mng. Co., Zeigler, Ill.
OGDEN, WALTER H.......Lubrite Refining Co., 900 S. Fifth St., Springfield, Ill.
OHLE, JOHN.......Franklin Hotel, Benton, Ill.
OLDHAM, R. J., Gen Mgr.......Centralia Coal Co., Centralia, Ill.
O'NEIL, CHAS.......DuPont Powder Co., McCormick Bldg., Chicago, Ill.
O'ROURKE, JOHN.......303 W. Lindell St., West Frankfort, Ill.
O'ROURKE, PETE.......William Hales Co., West Frankfort, Ill.
O'TOOLE, COLONEL E.......American Coal Cleaning Co., Welch, W. Va.
OVERSTREET, J. W.......National Electric Coil Co., Columbus, Ohio
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PENWELL, WARREN, Pres.......Penwell Coal Mining Co., Pana, Ill.
PFAHLER, F. S., Pres.......Superior Coal Co., 400 W. Madison St., Chicago, Ill.
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POLING, J. W.......Evansville Elec. & Mfg. Co., 600 W. Eichel Ave., Evansville, Ind.
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PRICE, W. H., Supt.....Delta Coal Mining Co., Marion, Ill.
PRINS, KLAAS.....Link-Belt Co., 5505 N. Winthrop Ave., Chicago, Ill.
PRITCHARD, W.....Goodman Mfg. Co., St. Louis, Mo.
PROCTOR, PETER, State Mining Board.....Marseilles, Ill.
PROFFITT, R. P.....Timken Roller Bearing Co., 2534 S. Michigan Ave., Chicago, Ill.
PRUDENT, ED.....Bell & Zoller C. & M. Co., Zeigler, Ill.
PRUDENT, NORMAN.....Crescent Mining Co., Box 23, Peoria, Ill.
PURDON, H. L., Dist. Sls. Mgr.....Link-Belt Co., 3638 Olive St., St. Louis, Mo.
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RHEIN, HERBERT E.....
American Brattice Cloth Co., 5652 Winthrop Ave., Indianapolis, Ind.
RHINE, F. E.....Duncan Fdry. & Machine Co., Alton, Ill.
RICHARDS, L. O.....Robert Holmes & Bros., Danville, Ill.
RICHARDSON, DORWIN.....Coal Producers Assn., Pana, Ill.
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Chicago, Wilmington & Franklin Coal Co., West Frankfort, Ill.
ROLLO, JAMES.....Egyptian Powder Co., Herrin, Ill.
ROMAN, F. W.....332 S. Michigan Ave., Hercules Powder Co., Chicago, Ill.
ROSAAEN, HUGH.....Daly & Craib, Locust at Ninth, St. Louis, Mo.
ROSENQUIST, G. C.....Wood Preserving Corp., 224 S. Michigan Ave., Chicago, Ill.
ROZANSKI, M., Mine Mgr.....Peabody Mine No. 8, 524 S. Cherokee, Taylorville, Ill.
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RUTLEDGE, J. J.....22 Light St., Bureau of Mines, Baltimore, Md.
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SCHLITT, FRANKLIN C..................................Schlitt Hardware Co., Springfield, Ill.
*SCHONTHAL, B. E., Pres.......B. E. Schonthal & Co., 28 E. Jackson Blvd., Chicago, Ill.
*SCHONTHAL, D. C., Pres.........................West Virginia Rail Co., Huntington, W. Va.
SCHONTHAL, JOSEPH, Sec...B. E. Schonthal & Co., 28 E. Jackson Blvd., Chicago, Ill.
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SCHULL, FRANK..........................................................Binkley Mining Co., Clinton, Ind.
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SEVER, L. G., Asst. to Pres..........................Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill.
SHACKELFORD, N. P................................Friedman-Shelby Shoe Co., St. Louis, Mo.
SHAFER, GLENN A., Pres........................................................Pana Coal Co., Pana, Ill.
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C. W. & F. Coal Co., 702 W. St. Louis St., West Frankfort, Ill.
SHAMBLIN, JOHN, Mine Mgr............................Consolidated Coal Co., Staunton, Ill.
SHERIDAN, H. A.........................H. Channon & Co., 149 N. Wacker Drive, Chicago, Ill.
SHERMAN, H. S..........................General Electric Co., Pierce Bldg., St. Louis, Mo.
SHERRILL, L. C................................................................Coal Sales Corp., St. Louis, Mo.
SHIMER, F. L.......................................................................C. I. P. S. Co., Marion, Ill.
SIMPSON, J. H..............Mines Equipment Co., 1909 S. Kingshighway, St. Louis, Mo.
SMILEY, E. B...........Illinois Gear & Machine Co., 2108 N. Natchez Ave., Chicago, Ill.
SMITH, BRUCE P.....................Austin-Western Co., 200 E. Chestnut St., Chicago, Ill.
SMITH, C. M............Research Assoc., U. of I., 214 Transportation Bldg., Urbana, Ill.
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SMITH, HARRY................................Consolidated Coal Co. of St. Louis, Mt. Olive, Ill.
SMITH, L. D., V. P.......................................................
Chicago, Wilmington & Franklin Coal Co., 332 S. Michigan Ave., Chicago, Ill.
SMITH, W. T., Mine Mgr.....Matthiessen & Hegeler Zinc Co., 514 11th St., La Salle, Ill.
SNARR, GEORGE W.....................Geo. W. Snarr & Co., 110 S. Ninth St., St. Louis, Mo.
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SNEDDON, JAMES, Asst. Mine Mgr...................Franklin County Coal Co., Valier, Ill.
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SOLOMON, G. W., Vice Pres.......................................................
Panther Creek Mines, Inc., 607 First National Bank Bldg., Springfield, Ill.
SOLOMON, H. A., Pres.......................................................
Panther Creek Mines, Inc., 607 First National Bank Bldg., Springfield, Ill.
SOMERS, BYRON, Supt......................................Truax-Traer Coal Co., St. David, Ill.
SONTAG, ROBT. E., Sales Rep.......The Okonite Co., 20 N. Wacker Drive, Chicago, Ill.
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SOUTHWARD, G. B., Mng. Engr.......................................................
American Mining Congress, 439 Munsey Bldg., Washington, D. C.
SPAHT, A. W.........................................................Old Ben Coal Co., West Frankfort, Ill.
ST. CLAIR, GUY N..........................................................Safety Mining Co., Benton, Ill.
STAREK, R. B....................................Old Ben Coal Corp., 230 S. Clark St., Chicago, Ill.

STARKS, J. W., Supt....Peabody Coal Co., Taylorville, Ill.
STEDELIN, JOHN W., Pres....Marion County Coal Co., 725 S. Elm, Centralia, Ill.
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STEFFENS, O. R., Asst. to Supt.... Indiana & Illinois Coal Corp., Nokomis, Ill.
STEIGER, A. E., Gen. Supt....Pyramid Coal Co., Danville, Ill.
STELLING, H. C....Union Carbide Co., 30 E. 42nd St., New York, N. Y.
STEVENS, E. F....Union Colliery Co., Union Electric Bldg., St. Louis, Mo.
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SWANSON, C. W., Sls. Mgr.... Illinois Powder Mfg. Co., 1752 Pierce Bldg., St. Louis, Mo.
SYERS, JACOB....Western Powder Co., 825 Jefferson Bldg., Peoria, Ill.
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TARLTON, G. L....Gundlach Coal Co., 808 Continental Life Bldg., St. Louis, Mo.
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TEMPLETON, J. B....Templeton, Kenly & Co., 1020 S. Central Ave., Chicago, Ill.
TEMPLETON, ROBERT A....Templeton Coal Co., 211 N. State St., Sullivan, Ind.
THIES, HENRY....Joy Manufacturing Co., Franklin, Pa.
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THIESSEN, GILBERT....Ill. State Geol. Survey, 505 W. Vermont Ave., Urbana, Ill.
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*THOMPSON, J. I., Pres.... Koppers Rheolaveur Co., 1550 Koppers Bldg., Pittsburgh, Pa.
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WASSON, L. A., Asst. Gen. Mgr.....Wasson Coal Co., Harrisburg, Ill.
WATERMAN, C. W.....
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WEST, JETT J., Trav. Auditor.....Peabody Coal Co., Box 224, Marion, Ill.
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WHENNON, W. K.....Hardsocg Mfg. Co., 705 S. Lincoln Ave., Springfield, Ill.
WHITE, FRANK L., Div. Engr.....Peabody Coal Co., Marion, Ill.
WHITE, JOHN.....Franklin County Coal Co., Royalton, Ill.
WHITE, JAMES.....Peabody Coal Co., Shelburn, Ind.
WHITE, LOUIS O.....Macon County Coal Co., Decatur, Ill.
WHYERS, EDWARD E.....Wyoming Tie & Timber Co., Metropolis, Ill.
WIEDERANDERS, E. O.....Jeffrey Mfg. Co., 1609 W. Cook St., Springfield, Ill.
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WILKEY, FRED S., Secy.....
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WILLIAMS, GARNER, V. P.....Cabin Creek Consolidated Coal Co., Kayford, W. Va.
WILLIAMS, RAY, Supt.....Ill. Mine Rescue Station, Benton, Ill.
WILLIS, H. F., Gen. Supt.....Truax-Traer Coal Co., Elkville, Ill.
WILLS, DON, Asst. Mine Mgr.....
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WILLS, S. J., Div. Supt.....Peabody Coal Co., Public Service Bldg., Springfield, Ill.
WILSON, J. C.....Ohio Brass Co., Mansfield, Ohio
WILSON, J. W., Engr.....
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WILSON, ROBERT S.....Consolidated Coal Co. of St. Louis, Staunton, Ill.
WINN, ISAIAH.....Valier Coal Co., Valier, Ill.
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..................................................Central Ill. Public Serv. Co., Marion, Ill.
WRIGHT, JOHN, Supt. Insp. & Del'y................Ayer & Lord Tie Co., Carbondale, Ill.
YERKES, J. H................Keystone Lubricating Co., 414 N. Fourth St., St. Louis, Mo.
YOUNG, ALEX..............................................................Superior Coal Co., Gillespie, Ill.
YOUNG, A. M.........................................Central Ill. Public Service Co., Springfield, Ill.
YOUNG, L. E., Vice Pres.........................................Pittsburgh Coal Co., Pittsburgh, Pa.
YOUNG, W. P., Gen. Supt..................Crescent Mining Co., Jefferson Bldg., Peoria, Ill.
*ZELLER, HARRY, V. P............................West Virginia Rail Co., Huntington, W. Va.
ZINKGRAF, J. W., Dist. Mgr.........................................................................................
Chicago Pneumatic Tool Co., 1931 Washington Ave., St. Louis, Mo.

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*Life Members.
†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 |
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who left the world better for their
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# ADVERTISING SECTION

To Our Members:

Please go over this section very carefully and take note of our very good friends, who are helping us to issue this book. Do not forget them when you go shopping.

# 2 New Coal Cutters

## *adapted to mining in Illinois*


BECAUSE *it is the fastest of all shortwalls*

**MACHINERY CO.**

**NEW HAMPSHIRE**


BUCYRUS-ERIE

# Simplex Mine Jacks

## Mine Timber Jacks

No. 32

**No. 32**—Ratchet Type—(Single Acting—Automatic Lowering)—The most versatile Mine Jack ever built. Safety plus even greater speed than screw types are principal features in: Putting up mine timbers and I-beams; Straightening steel mine cars (by using 2" pipe over the rack bar); As a temporary mine prop in connection with coal loading equipment; Tensioning; Pushing, pulling and lifting.

**No. 139**—Screw Type—For safe and economical cross-timbering with wood or steel beams. Powerful, rugged and light. Saves man-hours and greatly reduces accident hazards.

*Both No. 32 and No. 139 furnished with one of three types of heads, as illustrated.*

No. 139

## Mine Post Pulling Jack

### Double Acting — Automatic Reverse

**No. 327**—A 5-ton Jack that makes mine post pulling profitable. In addition to being a powerful, speedy, rugged and safe post puller, this Jack is recommended for pulling together broken chain hauls, drag lines, pipe lines, etc. Handy for stretching heavy cable and trolley wire, taking up slack on conveyor belts and pulling rails and cars from under falls.

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### Single Acting — Automatic Lowering

**No. 185**—A new 5-ton Simplex Mine Jack for handling coal cutting machines, and for rerailing mine cars and locomotives. It is similar to the No. 85 Simplex but is sturdier and speedier. The double, or 2-way, socket permits operation in close quarters. The cap is built to firmly hold a drop-forged auxiliary shoe (4 adjustments).

No. 185

**No. 56**—Similar to the No. 185 but has a capacity of 10 tons. The drop-forged adjustable shoe (5 adjustments) is built as an integral part of the Jack.

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| | Joy Jr. | 8BU | 7BU | 5BU | 10BU | 11BU |
|---|---|---|---|---|---|---|
| Rated capacity—tons per minute | ¾ | 1½ | 2 | 2 | 4 | 4 |
| Maximum capacity—tons per minute | 1½ | 2½ | 4 | 4 | 8 | 8 |
| Total weight of loader | 7,000 | 9,500 | 14,500 | 15,600 | 19,000 | 19,000 |
| Total height of loader | 26" | 35" | 40" | 53" | 54" | 48" |
| Total width | 4'4" | 4'6" | 6'0" | 6'0" | 7'0" | 7'0" |
| Total length | 20'2" | 22'2" | 23'9" | 24'6" | 25'0" | 25'0" |
| Maximum reach of gathering arms | 4'10" | 5'4" | 6'8" | 6'8" | 7'4" | 7'4" |

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U. S. A. Patent No. 1,579,449

Weigh less than ½ ounce. Made of Soft Rolled Aluminum, so pliable that they fit closely over the nose and mouth. Only clean "Cotton Gauze" (which may be changed daily) comes in contact with the skin.

Martindale Protective Masks are so light and comfortable that workers will wear them without objection under conditions where they will not wear the heavier, more cumbersome types.

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| Grain and straw | Cleaning powders | Fertilizer |
| Wood | Insect powders | Ash and cinder |
| Chemicals | Soap | Charcoal |
| Foundry | Fur and feathers | Bristles |
| Dry colors | Glass | Old paint |
| Lime | Rust | Salt |
| Coal | Paper | Aluminum |
| Drugs | Spices | Zinc |
| Carbon and carbon black | Tobacco | Gold |

An analysis of reports from several hundred users shows the following most frequent uses, in the order of their frequency:

| | |
|---|---|
| Paint spraying | Boiler cleaning |
| Material handling | Crushing and grinding |
| Buffing, grinding and sanding | Commutator grinding and undercutting |
| Blowing out motors and machinery | Sweeping |

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October 16, 1936.

Tool Steel Gear & Pinion Co.,
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Gentlemen: Attention: Mr. R. L. Reichling

We announce the preparation of our yearbook, covering the proceedings of this Institut... the year 1936, which will go to press about Decemb...

Approximately on... ...uted among the membership a... ...mining schools, ... ...tates, Great B...

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When the Institute picks 7 go-getters
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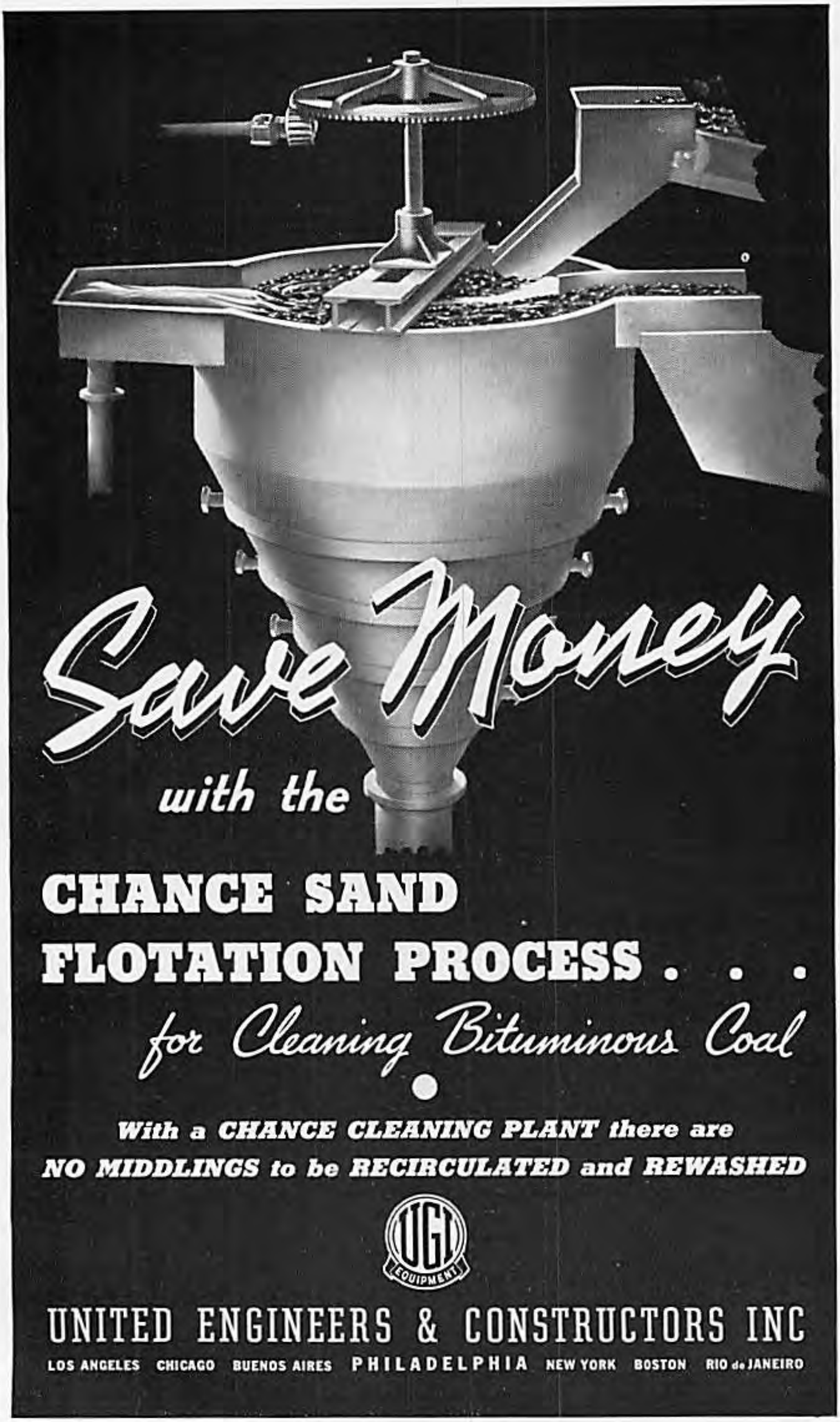
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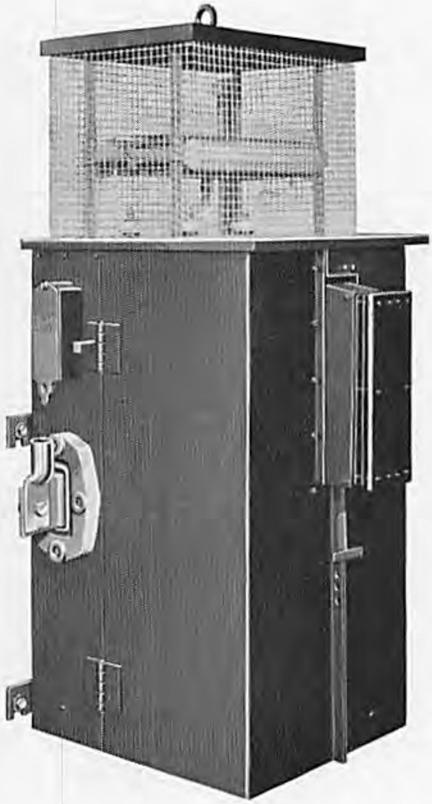

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I-T-E Circuit Breaker Company has added the Automatic Reclosing Circuit Breaker to the I-T-E line of electrical protective equipment and has merged ARCB sales and service personnel with the I-T-E organization.

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*Jobbers in All Principal Mining Centers.*

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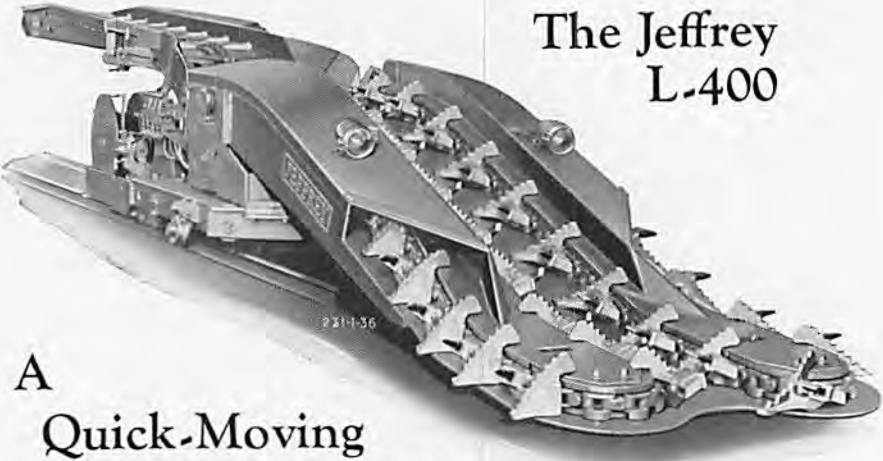

# A Quick-Moving Easily-Handled Coal Getter

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- 44-L for loading from a long face to conveyors
- 44-DD and 44-EE for room and also pillar loading, especially in close timbering
- L-400 (illustrated) a high capacity, frontal attack loader—with finger-tip Hydraulic Control

The Jeffrey L-400 is powered by a single motor—with modified 3-point suspension and automatic cable reel. With these features and its simplicity of design—sturdy construction, the Jeffrey L-400 is the ideal Loader for the average high coal mine.

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A Marion Type 5560 Coal Stripping Excavator, equipped with the largest dipper in the world—with a capacity of 32 cubic yards (level full)—is establishing new records in coal stripping service on the Northern Illinois Coal Corporation's properties near Wilmington, Illinois.

*In addition, Marion builds—*

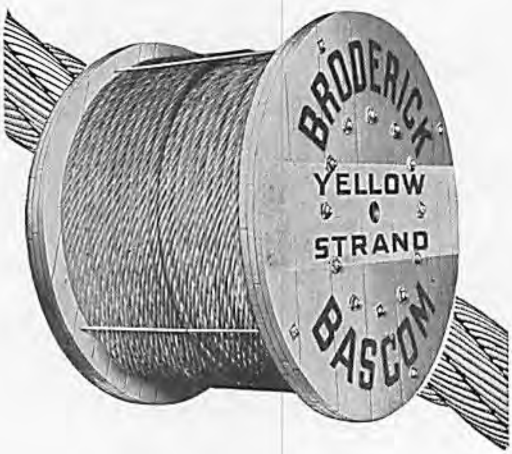
Type 5321.................... 8 to 12 cu. yds.

Type 5480....................12 to 16 cu. yds.

*—especially for coal stripping service.*

**THE MARION STEAM SHOVEL COMPANY**

*Marion, Ohio, U. S. A.*

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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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OPERATORS who have had difficulty with screen cloth blinding can usually overcome this trouble with the Type 400 Screen!

The intensely powerful vibration of this machine clears the openings of sticky coal without difficulty.

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The Type 400 Screen is ideal for removing dust from stoker coal.

It opens up a rich market for operators who are in a position to produce de-dusted stoker sizes.

Low power consumption, low maintenance and high output have opened up new opportunities for profitable screening of coal.

**The W. S. Tyler Company**
**Cleveland, Ohio**

WRITE FOR BULLETIN 515


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for their untiring efforts in connection with this Yearbook.

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*and*

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JUNE 11-12-13, 1937

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