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PROCEEDINGS OF THE ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892



1937

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of the

ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892



1937

Summer Meeting on Board S. S. Golden Eagle June 11-12-13

and

Annual Meeting
SPRINGFIELD, ILLINOIS
November 5



W. J. JENKINS President, 1937

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James McSherry	W. P. Young

^{*} Deceased, December 17, 1937.

MINING SONG

(Tune: Auld Lang Syne . . . Old Times)

Old I. M. I. meets once again
With a program, extra-fine,
Good fellowship and a friendly quip,
And a song for auld lang syne.

CHORUS:

To auld lang syne and mining men,
To underground days in the mine—
So here's our toast with a prideful boast:
Mining men! and auld lang syne!

The President likes an argument
When the members so incline,
So do your stuff 'til you've had enough,—
Then it seems like auld lang syne.

(Chorus)

Our roll of honor never dims,
Many mem'ries fond entwine
With the names of those who carried on
In the days of auld lang syne.

(Chorus)

E'en as our fathers fought of old, Faith and courage to combine, We'll dig the bloomin' B. T. U.'s 'Til we merge with auld lang syne!

(Chorus)

Then let each day bring what it may
To our sturdy battle line—
Here's "Bottom's Up" with a cheerful cup,—
To tomorrow and auld lang syne!

(Chorus)

OUR RIVER TRIPS

•

Just why the poets always sing of rivers clear and blue, With graceful sail-boats gliding by; perhaps a birch canoe Moving along on the crystal stream, as the evening sun is low, Making a picture grand to see, is something I don't know.

They never sing of muddy streams, with rough and rugged shore, Where packet-boats ply to and fro, as in the days of yore, Where more romance is found each day than in an entire year On all the little "sissy-boats," on waters blue and clear.

Give me a he-man's river, with currents deep and wide,
Like the grand old Mississippi, with bluffs on either side;
Or where rich farm lands bound its shores, with fields of verdant hue,
And giant bridges span its width, where towns come into view.

Then give me a boat to sail this stream, in charge of Captain Leyhe, With a group of Illinois Mining Men, of the good old I. M. I. We've sailed together, many years, and each trip seems to be More glorious than the one before—at least it does to me.

Although we have our work to do, there's always time to play

And view the grandeur of the stream, as we sail along our way.

Old friends we greet, new friends we make, and yet we keep in mind

The memory of those missing friends, whom we have left behind.

And when the time comes, as it will, when I am left on shore,
And the Golden Eagle sails away, as she has in years before,
I want those dear old friends to know, I loved them, every one,
And I'll greet them, on that other shore, when their day's work is done.

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, III.
1916-7	FRED PFAHLER, Gen. Supt., Superior Coal Co., Gillespie, Ill.
1917-8	Patrick Hogan, State Mine Inspector, Carbon, Ill.
1918-9	WILLIAM HALL, Miners Examining Board, Springfield, Ill.
1919-20	WILLIAM HALL, Miners Examining Board, Springfield, Ill.
1920-21	FRANK F. TIRRE, Supt., North Breese Coal & Mining Co., Breese, Ill.
1921-22	Prof. H. H. Stoek, Mining Dept., University of Illinois.
1922-23	JOHN G. MILLHOUSE, State Mine Inspector, Litchfield, Ill.
1923-24	D. D. Wilcox, C. E., Superior Coal Co., Gillespie, Ill.
1924-25	H. E. SMITH, Gen. Supt., Union Fuel Co., Springfield, Ill.
1925-26	E. G. Lewis, Supt., Chicago-Sandoval Coal Co., Sandoval, Ill.
1926-27	WM. E. Kidd, State Mine Inspector, Peoria, Ill.
1927-28	James S. Anderson, Supt., Madison Coal Corp., Glen Carbon, Ill.
1928-29	JOHN E. JONES, Safety Engineer, Old Ben Coal Corp., West Frankfort, Ill.
1929-30	Prof. A. C. Callen, University of Illinois, Urbana, Ill.
1930-31	Joseph D. Zook, Pres., Illinois Coal Operators' Assn., Chicago, Ill.
1931-32	Geo. C. McFadden, Asst. Vice-Pres., Peabody Coal Co., Chicago, Ill.
1932-33	Chas. F. Hamilton, Vice-Pres., Pyramid Coal Co., Chicago, Ill.
1933-34	HARRY A. TREADWELL, Gen. Supt., C. W. & F. Coal Co., Benton, Ill.
1934-35	C. J. Sandoe, Vice-Pres., West Virginia Coal Co., St. Louis, Mo.
1935-36	T. J. Thomas, Pres., Valier Coal Co., Chicago, Ill.

1936-37 W. J. Jenkins, Pres., Consolidated Coal Co., St. Louis, Mo.

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A WORD TO THE MEMBERS FROM THE SECRETARY

I doubt whether our members realize the tremendous amount of work connected with getting together the Yearbook which is presented herewith.

Probably none of the members have ever stopped to consider what is necessary to make this book possible.

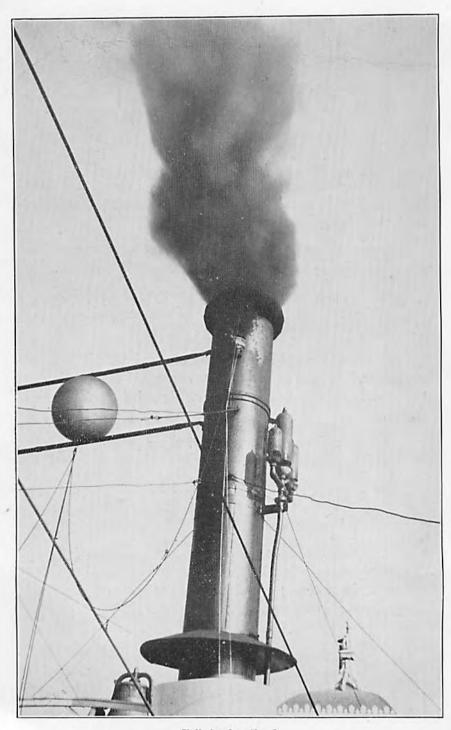
First of all, we are dependent upon the suppliers for advertisements in order to defray the expenses of the Yearbook.

This is our ninth issue. Many of our advertisers have contributed to each issue and have expressed satisfaction in the results obtained from the space carried in the publication.

We are anxious to have this feeling prevail with our supporters, the advertisers.

It will be of great assistance for future issues if you will give the advertisers that support to which they are entitled and patronize them by using their products.

The success of this publication depends materially on this cooperation. The advertising committee has done a fine job in their untiring efforts; their cooperation with the suppliers makes this publication possible.



Full Smoke Ahead.

ILLINOIS MINING INSTITUTE BOAT TRIP

June 11-12-13, 1937

Nineteenth Annual Summer Meeting and Boat Trip of the Illinois Mining Institute held on S. S. Golden Eagle, leaving St. Louis Friday, June 11, 1937, at 10:30 o'clock P. M., and returning to St. Louis, Sunday, June 13, 1937, at 7:30 o'clock A. M.

MORNING SESSION

Meeting called to order at 10:00 A. M., by W. J. Jenkins, President. President Jenkins: Gentlemen, we will come to order. The first business of the morning is the call of the roll. We will hear the gentle voice of our most esteemed Secretary.

ATTENDANCE

ILLINOIS MINING INSTITUTE NINETEENTH ANNUAL BOAT TRIP

St. Louis, Down the Mississippi River, and Return June 11-12-13, 1937

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

Secretary Schonthal: I have just a few that I want to read. I have a letter of regret from Dean Charles Thompson who is known to most of you. I have a letter of regret from Paul Weir who is also known to most of you and from Henry Hebley, who prepared a discussion on Mr. McCullogh's paper.

I have a wire from A. S. Knoizen who says:

"Sorry to miss boat trip but business will detain me in New York balance of week. No you're wrong, loading machine business."

I have a wire from Milton Duff who used to make our trip regularly:

"Best wishes for a pleasant trip and profitable meeting.

You'll discover good merchandise advertised in this good publication.



Sunset on the Mississippi.

Sorry I cannot be present. Just had my tonsils removed this week. I will be with you in my thoughts and I hope to be remembered to all the boys and Captain Buck."

I have a wire here that I want to read to you, from my office; it says:

"Cancel Crawford reservation on account of illness and be sure Thomas has non-alcoholic bunkmate."

President Jenkins: I would like to have a report on that particular request; Mr. Thomas, is there a report?

Secretary Schonthal: Mr. President, this matter which I am going to present now is one which I think we are all very vitally interested in. It has to do with the appro-

priation for the Safety Section of the Bureau of Mines. The appropriation this year has been cut down considerably or it is attempted to cut it down, and I think that anything that is done to cut down the appropriation for the Safety Work should be avoided if there is any chance. I had a letter on it and referred it to Mr. Thomas, and I understand he has communicated with the Senators from Illinois at Washington. The reason I referred it to Mr. Thomas was that he had had this matter up several years ago.

I happened to be at the Rocky Mountain Coal Mining Institute at Denver and that is a live Institute. Among other things they adopted a very strong resolution objecting to this reduction in the appropriation. They have taken it up with their people at Washington, I was at the Indiana Coal Mining Institute and they also adopted a resolution similar and they have taken it up with their people. I have prepared a resolution and would like to see this Institute adopt it and take the matter up with those people that have to do with the cut or the attempt to cut the appropriation. The resolution reads as follows:

"Whereas, The United States Bureau of Mines has rendered invaluable service to the coal mining industry over a long period of time; and

"Whereas, The United States Bureau of Mines is the only organization in the Federal Government charged with furthering the health and safety of the men employed in the mining and mineral industries; and

"Whereas, The records of accidents and accident prevention are indispensable to the further progress of safety in the industry; and

"Whereas, The research and development of safety measures are essential, and of such nature that they cannot be successfully carried on by the industry; and

"Whereas, The appropriations for the health and safety work of the Bureau of Mines have in the past been inadequate to carry on this important work, an additional appropriation of \$28,135 to the 1937-38 Bureau appropriation was passed by the Bureau of the Budget, \$18,835 of which was allocated to the Safety Section and \$9,300 to the Explosives Section. This additional appropriation, which appears in Report # 786 in H. R. 6958, was cut by the Appropriations Committee of the House to \$5,635, which would leave only approximately \$3,800 for the Safety Section;

"Therefore Be It Resolved, That the Illinois Mining Institute, in meeting assembled on board the Steamship 'Golden Eagle,' at St. Louis, Missouri, June 11, 12, and 13, 1937, disapproves any reductions in the appropriation for the maintenance and carrying on of the work of the Bureau of Mines; and

"Be It Further Resolved, That this Institute respectfully requests the Senate Appropriations Committee to restore the above appropriation to its original amount of \$28,135; and

"Be It Further Resolved, That a copy of this resolution be sent to the Chairman of the Appropriations Committee in Congress now assembled."

I would like to move the adoption of this resolution.

Mr. T. J. Thomas: I want to second that motion but I would like to suggest that a copy of this resolution be sent at least to the Senators of every mining State in the Country. Also a copy to the Director of the Budget.

Secretary Schonthal: I might add to that, Mr. President, that I would expect, if agreeable, to send a copy of the resolution to each coal mining institute in this Country and have them take some action similar to that taken here and similar to that taken in Denver and Indiana.

President Jenkins: You have heard the resolution and the motion and second, together with the suggestion of Mr. Thomas. Is there any further discussion on the resolution? It might be well if we pass this resolution, to take it up with the American Mining Congress because they have contact with a great many Senators in the coal producing districts.

Mr. T. J. Thomas: I take it, Mr. Chairman, that the suggestion made will be carried out and a copy of the resolution will be sent to every Senator in every coal mining State in the United States.

President Jenkins: All in favor say "aye"—contrary "no"—Carried unanimously.

Any other resolutions?

Secretary Schonthal: No, that is all.

President Jenkins: This is where I have you at a disadvantage. I have a right to talk but I am not going to make a long talk at this time. I am reserving that for the Fall meeting, at which time, if you don't want to listen, you may avail yourselves of the privilege of

"ducking out," which you cannot do at this time.

It was with pleasure that I listened to our esteemed secretary when we went into a huddle recently and learned that it was really necessary to hang up the "SRO" sign, so welcome to theatrical and showpeople.

The 100% utilization of the facilities of the good ship Golden Eagle and the large number present, representing, I believe, a greater number of Producers, and likewise a greater number of Suppliers, than at previous Spring sessions, is indicative of your greater interest in the Illinois Mining Institute. To say that your officers, along with the program committee, are pleased, is to put it mildly. We are, in fact, "puffed up" about it, and hope before the trip is completed that each of you will have not only received some gain, but that we will all be better acquainted with each other.

These conferences will be beneficial to the extent that we participate in them. It is your own affairs that are being discussed, and we hope you will comment freely on the subjects covered by the papers.

This is your meeting and if we are going to get anything out of the meeting, we must participate in it and I hope that after a paper is read if a question is in your minds, you will direct it to the author or the individual presenting the paper. A lot of times you hear the paper read

and if there is anything in your mind, you buttonhole the author of the paper and ask him the question. The rest of us may be interested in the same question and I hope that after a paper is read, if a question arises in your minds, you will make it known in the hope that the matter may be of help to other fellows.

The Chairman of your morning session who will take charge of the papers is Roy Adams of the Old Ben Coal Corporation. The Chairman for the afternoon session will be your Vice-President, Mr. H. H. Taylor, Jr., and I hope that you will all give the young man of the afternoon session a big hand.

Chairman Adams: Gentlemen, I don't propose to take up any time in preliminary remarks. It is apparent that all of the time that we have available for this session will be taken up and I propose, with your consent, that we proceed at once with the stated program.

The first number on the program is "Selling of Accident Prevention to the Management," by H. G. Westerland, Director of Compensation for C. W. & F. Coal Company, West Frankfort, Illinois. Mr. Westerland.

Mr. Westerland: Chairman Adams and Members of the Institute and guests: This is my initial trip. It seems I had to be on the program in order to make the trip; nevertheless I am glad to be here with my little offering.

SELLING OF ACCIDENT PREVENTION TO THE MANAGEMENT

By H. G. WESTERLAND

Director of Compensation, Chicago, Wilmington & Franklin Coal Co., West Frankfort, Ill.

Before a successful safety program can become a reality, the management must first be thoroughly sold on the idea. Since safety is solely a question of organization, education and supervision, it is imperative that the entire supervisory personnel, through conference meetings inaugurate a definite form of procedure for the prevention of accidents. With this accomplished, the management can resell the idea to his workers. Safety must originate at the top, much the same as a work program. It is not to be expected that a worker should be any more safety-minded than is the boss who gives him proper instructions for work to be performed and by the same token the worker looks to his boss for the proper instructions for the prevention of accidents.

Before the management can be expected to organize and promote a successful safety program, there must first be complete understanding, just what the cause of accidents and effects are, and what part accidents play in determining the final cost in each department per ton produced. It must not be taken for granted that the cost of an accident is confined solely to the amount of compensation the injured man is paid, for there are numerous other indirect expenses chargeable to most every type of injury. When a man belonging to a work crew is injured during the day, another man must be substituted who is probably not so familiar with the work. This

causes a loss of efficiency in the performance of that particular job, thereby reducing the efficiency of the entire unit and reducing the tonage with resulting increased cost. This expense continues for a perriod of time until the injured man returns to work or his substitute becomes as proficient as was the injured man.

The management first of all must realize that successful accident prevention can be accomplished only through cooperative effort and before workers can cooperate effectively they must first sincerely believe that that which they aim to accomplish is well worth the effort required. The management and workers must further realize that they have much in common in furthering the cause of accident prevention.

The management must possess the knowledge of salesmanship as it is applied to selling the idea of workers thinking and acting safely, for the idea of safety will go much farther if put over by persuasion and understanding rather than by forceful methods without the cooperation of the workers. If the management will set the example and show the workers that prevention of accidents means more to them than to the management itself, the greater part of the workmen will appreciate the interest shown in them for their safety and by this example influence other workers who may be backward in accepting safety.

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With this form of organization in view, we inaugurated a course in accident prevention. This course was sponsored by the U. S. Bureau of Mines under the personal direction of Mr. A. U. Miller. A meeting was held each week for a period of 34 weeks, in which the entire supervisory staff was enrolled. Every phase of operation was covered by this course and papers on questionnaires selected by the Bureau were submitted by all members of the class. Each weekly period was spent in presenting these papers, and each paper was followed by open discussion by all the members, together with an instructive talk by the Bureau representative. At the conclusion of this course, the members were awarded a certificate by the Bureau of Mines, indicating their proficiency in accident prevention training.

With the safety idea well on its way toward being sold to the management, we started first aid training for all workers though the cooperation of the State Department of Mines and Minerals and the U. S. Bureau of Mines. Our entire personnel accepted this training, all of whom hold certificates, both State and Federal, for their proficiency in administering first-aid. The training has a further significance. Not only did the men receive instructions in first-aid, but it has made them Safety Conscious.

Accident statistics play a very important part in accident prevention work. Such figures as frequency, severity, tons produced per accident, tons produced per lost time accident and tons produced per compensable accident, presents to the department head, a vivid picture of the part accidents play in his production and costs records, and is one of the greatest factors for impressing him with the importance

of accident prevention. These statistics must be presented in such a way that they can be easily understood and are most effective when presented on graphs or charts and properly explained. Through our statistics, it was made evident that losses from head and foot injuries constituted a very large percentage of our compensation costs and immediately brought about the introduction of safety shoes and hard Since the adoption of this safety equipment in our mines, the material reduction in accidents of this nature has proven, from a practical standpoint, the advantages and benefits to be gained from selling safety to the management. Following this, a close study of our accident statistics revealed that the percentage of eye injuries was comparatively high and created the necessity for providing safety equipment for the Workmen's eves as well as for their heads and feet. Accordingly, we started a campaign for the introduction of safety glasses in our mines.

In addition to selling the safety idea to the management for the prevention of accidents, we are confronted with a new hazard that will require further salesmanship. Occuputional Diseases. Much literature and data on this subject has been presented by various authorities, some of whom have taken the position that all dusts are harmful and that every precautionary measure must be taken for the control of the dusts. The most serious of these industrial dusts being silica. It is the general opinion among mining men that silica is not present in Illinois coal mines, at least not in harmful quantities. It is not sufficient to say that we have no harmful dusts in coal mines, but must be proven by competent evidence beyond every reasonable doubt. In other words.

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the proof must show accurately the analytical contents of the dusts and this can only be done through periodic sampling. Further than this, it is difficult to outline the exact precautionary measures to be taken against dust disease claims, since this is an entirely new field of hazard to industry. It must not be taken lightly by the management as was the Compensation Act at its inception, for whoever thinks that because he has not yet been called upon to defend himself against a dust claim or that he never will be. is filling his mind with a false sense of security.

From data issued by the National Safety Council, the severity of mining injuries is six times as great as that of all industries, fatality and permanent total disability severity rate 71/4 times greater than that of all industries, permanent partial disabilities 31/3 times as much as the average of all industries and temporary disabilities are more than five times the average. Many industries, other than mining, had an equally high accident rating a few years ago, but through safety organization by the management, primarily because of the ever increasing costs, they have been made to rank with those in the lower brackets.

Accidents in coal mines can and must be reduced. Through organization and education of workers, the accident rate can be made comparable with those of other industries.

Chairman Adams: Thank you, Mr. Westerland. The discussion on this subject will be led by a man who has made a place for himself among the operator members of the Institute. He needs no introduction, and I am merely announcing that Mr. A. U. Miller will lead the

discussion. Mr. Westerland has virtually issued a challenge. It is up to us who have the responsibility for the operation of mines in this State to meet that challenge, and if we are not doing so we are not the best men for the jobs that we are holding. This question is now open for discussion, and it is a big question and should invite discussion by every member here. I don't want to call on you as individuals; I feel there will be a voluntary response to consume all of the time we have, and I await your response.

Mr. Raymond Mancha: Mr. Chairman, what is the tonnage rate per fatality now on a million tons?

Chairman Adams: What is the tonnage rate per fatality in the State at the present time? Who can give that figure?

Mr. Miller: Between 750,000 and 800,000 tons is correct.

Chairman Adams: May I ask this question, Mr. Miller, are we making progress?

Mr. A. U. Miller: From my observation from traveling around mines, I think that we are, but giving credit for what has been done, I want to say again, I don't think we are making the progress that we should.

Chairman Adams: Anyone else?

Mr. John E. Jones: I am interested in the entire paper given by Mr. Westerland. The few remarks that I am going to make are on some points in the paper, that is with respect to the United States Bureau of Mines. I was astonished to find such a cut proposed in the

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appropriation by the Government for the very good work being done by the Bureau of Mines. I have been especially interested in what they have done in the experimental mine in regard to explosives and in the safety instruction accomplished by that Department. The Government, I am quite positive, spends more money on dogs and race horses than on the safety program in the coal industry, certainly one of the basic industries of the nation. I am quite sure that this is not the time to make a motion and I am not going to make a motion, but it seems to me that we should go further in the effort to impress the members of Congress that this appropriation should not be cut and I think we should get more than just our Institute to try to impress those Senators. As you boys know, this almost is a labor government and if we can get labor organizations back of our proposition, it would be of greater influence than a Mining Institute. It appears to me that the President of the Institute should appoint a committee of three, the job of the committee to get the two operator associations to do their best in regard to stopping this cut, but more especially to get the two labor organizations of our State to do the same thing.

Mr. J. A. Jefferis: Mr. Chairman, is it true there are more accidents per ton on coal mined in the small mines than the larger—I mean the mines of less than 1,000 tons? Are there more accidents per ton mined in the small than the larger mines?

Chairman Adams: Who has the answer?

Mr. John E. Jones: The Illinois Mine Investigating Commission, of which Mr. Cape and myself are members, has made a rather thorough study of that problem and in answer to Mr. Jefferis, the fatality rate in the wagon mine is double the rate per 1,000 men employed. Whether you know it or not, I suppose you do, take St. Clair County also, there were twice as many wagon mines in 1936 than in 1928. There were 48 in 1936 and only something like 21 in 1928.

Mr. Norman Prudent: Mr. Chairman, I agree with Mr. Jones in having our labor organizations get behind and use their influence to stop the cut in the U. S. Bureau of Mines appropriation. I think it would be in order for this Institute to go on record and contact the officials of the two labor organizations to use their influence toward stopping this cut in the appropriation of the United States Bureau of Mines.

I want to say a word about the two papers we have just heard on "Selling Safety to the Management." It brings to my mind a conversation I had last week with an insurance compensation adjuster in one of the neighboring states. He was telling me that he was going to take an insurance policy to a mine official and when he delivered the policy the rate was increased one-half and the operator threw it on the desk and said, "I will not sign that." The adjuster said, "Don't you think if you would get behind a safety movement, the rate would not be increased?" and the operator said, "You cannot get the miners to do a thing," and he said, "Before I leave I want to leave a thought with you: before you can train a dog, you must know more than the dog," and I want to leave that thought with you.

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Mr. James S. Anderson: I would like to discuss the education necessary for the management and for the men. The gentlemen that read the papers discussed it a little but I would like to enlarge on it. From the standpoint of the management. I believe we will all agree that is more a dollars and cents proposition. I believe it is necessary to instruct the management, to educate them to know what is the best thing to do to safeguard the men at the face and see that they get the right kind of materials, get the right size of rails, right kind of track, proper size of props and know where to put them, and the same could be said about machinery and equipment of every kind, and he must have first hand information of what to do to safeguard the men at the face. He must not only have a general practical knowledge but also a technical knowledge. He must know where the props go and the rails go and that ought to be one of the fun-

damentals in the education of the management with a very effective result on the men. When they go to the face and find the props provided when needed and proper instructions where to put the props and from daily meetings with the management they will find that they are somewhat interested in their safety and will show that they really know what they are talking about and are really putting it in effect, it brings about a confidence in the men at the face. They go on trusting them, and it isn't only a matter of doing something extraordinary and becoming a martyr, it brings about not only methods of efficiency and safety but they do the things in the best way because the management does it in the best way. The miner is not a stupid man. I find that if he sees the management taking care of things it will educate them to the point that they are really interested in the things themselves, there



Thirty Minutes for Telegrams.

is no question about the result that will happen to the man at the face. I find that every day, and he finds out the best things to be done and finds that the management knows them. If you do that there is no question about the result. The part that the men play in this thing is not a dollars and cents thing. They cannot see that if you put in a certain prop it will save five cents a ton, but if you sell him the idea that the proposition might save a life, he will have confidence in the thing and do it automatically himself. There is no question about it. and he will not only talk about it with his buddy but he will go home and say that face manager knows his stuff and from now on I will do the thing he wants me to do.

Mr. E. H. Johnson: We are in the midst of a discussion of a safety paper and a suggestion was made here that should be taken up at a business session. I am afraid if that is dropped now it might go on until some later time and be lost in the discussions rather than action being taken. I think the resolutions that will be adopted by the various Institutes will have an effect but I am afraid the amount of effect will be about equivalent to a circular letter. I think something more energetic should be done, such as the appointment of a committee to do some rather hard hitting on the proposition of following through with labor organizations and other agencies that we can contact that will impress their wishes and will on the people that represent us at Washington. If it is in order I should like to make a motion; if not, it should be brought up at a business session.

Chairman Adams: With your permission, I will declare Mr. Johnson in order to make his motion. State your motion.

Mr. E. H. Johnson: I move that a committee of three be appointed by the President of this Institute, to contact the two labor organizations in this State and the two operator organizations in this State and to influence them, if possible, to use all of their efforts to further our wish as expressed in the resolution earlier adopted.

Mr. Harvey Smith: I second the motion.

Chairman Adams: Gentlemen, you have heard the motion which has been seconded. What is your pleasure? Is there any discussion on the motion?

Are you ready for the question. All in favor make it known by saying "aye"—those opposed—the motion is carried unanimously.

Does anyone else have a thought on this question of safety? I will be obliged to call on you by name if you do not volunteer. Mr. Ed. Berger.

Mr. E. L. Berger: Mr. Chairman, I didn't get up because I didn't have any thoughts on it. I thought the time was going fast and you would want to get on something else. This question has been discussed so thoroughly that it is almost impossible for anybody to get up and say anything that has not been expressed. I think that most of us are going through that period when we think that nothing can be done about it, it is too bad. There is one thing I have thought about in selling the idea of safety to the management. It has been my duty one or two times to go and notify a family of a bad ac-

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cident, and I think with the ordinary fellow who is in a managing position who has to do that job, it is surely going to sell him on the idea of accident prevention. If that isn't one of the hardest jobs that anyone in a managerial capacity has, then I don't know anything about it.

Mr. James Powell: Mr. Jenkins keeps nodding to me to say something. As our speaker said, he is with a company that has a 100 per cent school in first aid and accident prevention and likewise our employees at Gillespie are 100 per cent. A few years ago, on the old boat, I gave a paper on first aid and accident prevention and the position I took at that time was, we should practice what we preach with the management first. If you show the employee, he stands ready to do his part in accident prevention. I mean by that, if a driver or motorman has a bad track and complains of it, or complains of a loose top or faulty door or low trolley wire, and if that complaint is given by one of the miners, the management should see to it that that particular complaint is corrected at once, not tomorrow or the next day. I think that as mechanization goes on it will decrease accidents materially. I mean by that that the installation of a new cutting machine will cause a decided decrease in accidents. We still have our accidents, and every month our safety inspector makes a report of time lost due to accidents of every kind and description. He gives the number of hours' lost time in each assistant's district and the tonnage per lost time. I think that the thing that confronts the coal mining industry today is the problem of how to make men think. Lots of our accidents happen in our best work, up where there is the best top, and the problem that we are still trying to solve is how to make men think safety.

Mr. T. J. Thomas: I would like to ask if I understood you to say that mechanization of mines will increase accidents?

Mr. A. U. Miller: They will decrease them.

Mr. T. J. Thomas: All that I might say is that the program that Mr. Miller has been undertaking to inaugurate in Illinois we put into effect at our properties about seven years ago. We reduced the number of our accidents at our property in the seven years, in comparison with the seven years preceding, by a rate of eighty per cent.

Chairman Adams: I think that I realize as strongly as I realize anything that this matter of safety and the prevention of accidents is here to stay and is just as permanent a fixture as any of our matters of production. I get worried a little sometimes when I begin to think about what we are going to do next year or the next year to keep this matter alive and to continue to maintain whatever standards of perfection we may have attained in prevention of accidents. I am wondering if some of you gentlemen who may be in close touch with the equipment and manufacturing end of our industry might not be able to give us something new, at least something different concerning the matter that may be used in our plants, what you do in the prevention of accidents, something that we might adopt in our coal mines to good advantage.

Mr. Sam Jenkins, I think you have something on your mind.

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Mr. S. J. Jenkins: Mr. Chairman, I am not closely in touch with what is going on.

Chairman Adams: Isn't there someone here, Mr. Jim Miller?

Secretary Schonthal: Jim is not on the boat. Don Sutor is here.

Chairman Adams: Don Sutor, all right, we appeal for volunteers. Who will be the first one who has something on his mind to contribute on this subject?

Mr. Prudent: Mr. Chairman, if time will permit me, I would like to tell you of our experience. Our Number 1 Mine at Peoria is 100 per cent equipped with safety hats and shoes and our Number 1 Mine is 100 per cent equipped with safety goggles and has been for eight months. Eight months ago when all of the men at Number 1 Mine had purchased goggles, standing most of the expense (more than two-thirds) themselves, and in regard to this incident if anyone is in doubt as to how to sell the safety idea to miners, I might clear that up. After all of the men had purchased goggles, I being the safety engineer at the mine at that time, and the foreman or the faceman would see miners at any time doing hand work or pick work without their goggles on, we would ask where they were and they would say they left them in the wash house or left them at home. At one of our regular meetings we decided that every man must wear them, they must have them with them all the time, and we took the life check racks out and replaced them with goggle boards. There are 500 slots on the goggle boards. We riveted the check on the goggle cases. The men go in the mine in the morning and receive their goggle case with the life

check on it and the goggles inside the case and not a man enters Number 1 Mine who does not have goggles. If a foreman comes along and sees a man doing hand work without his goggles on, he says, "You must put them on before you do any more work." We have been in this over eight months. We find that through salesmanship we are able to sell the men on the idea of going along with the goggles. The advantage we find in this is that we can get a good check on the men wearing the goggles. The goggles are available to be repaired and cleaned on idle days. The Safety Engineer cleans them and puts in a clean wipe cloth every day. It prevents goggles being stolen in the wash house. It prevents men entering the mine without them. We have noticed during the eight months time that we have reduced our eye injuries 25 per cent. We have reduced our severe eye injuries 40 per cent. We have two definite cases where goggles have saved eyes. There is no question about it, if enough salesmanship is put forth you can sell the men on the idea. We believe that you can get miners to do almost anything you want them to do, if you want them to badly enough.

Chairman Adams: If there is no further discussion on this subject, we will pass to the next number of the program which is a paper on "Electric Arc and Oxy-Acetylene Welding" by Carl Lee, Chief Engineer, Peabody Coal Company, Chicago, Illinois. Mr. Lee is not present and Mr. Raymond Mancha has consented to present his paper.

Mr. Raymond Mancha: Mr. Chairman and fellow institute members: It is a kind of tough spot for one to be in, even to read as good a paper as Carl Lee's.

ELECTRIC ARC AND OXY-ACETYLENE WELDING

By CARL LEE

Chief Engineer, Peabody Coal Company, Chicago, Ill.

The dictionary defines "weld" as "To unite, as heated metal, in one mass under a hammer or by pressure." You will recognize this as referring to the type of work done by the old village blacksmith in the horse and buggy days. Such type of welding has become almost obsolete, having been superseded by the type which is more properly described as "fusion" welding, and which is the kind to be generally referred to in this article.

In fusion welding the metal is brought up to a molten condition and actually flows together to form the "fused" weld. Two rather different methods of heating are in common use, namely; the electric are and the oxy-acetylene torch.

The electric arc as used in early days was formed between a carbon rod and the base metal to be welded and the filler metal was added from a separate metallic rod. This method has now been supplanted almost entirely by using a metallic electrode and causing the electrode to serve the double purpose of holding the arc and supplying the filler metal.

Recent improvements in the technique has been to film coat the rod with a compound which reduces the oxidation of the molten metal. Carrying this still further, some rods are actually wrapped with a heavy chemically treated covering which aets more or less as an envelope for the arc itself, thus more effectively excluding the air and hence the oxygen, which latter has a very bad effect on the vaporized metal passing from the rod to the base metal.

Other variations such as atomic hydrogen welding permits unlike metals and alloys to be fusion welded with success.

Other types of electric welding such as spot, seam and percussion welding have been perfected for use in joining thin sheets, but so far these have been applicable principally to manufacturing.

In oxy-acetylene welding, heat is generated by the combustion of a mixture of acetylene and oxygen in suitable proportions to give a reducing, neutral or oxidizing flame. The filler metal in this process is added from a separate rod which is fed into the flame. In this type of welding there is a wide variety of alloy rods available with which to accomplish different results. Both types of welding are now commonly used. Both have preferred fields of application.

You, who are in managerial positions, know that on a new project, you first of all things pick your key men for the subordinate positions, choosing types with qualifications suitable for the work to be performed. You then establish the conditions and surroundings under which they are to perform and then you sway their minds to think and act along the lines desired to accomplish the desired results. Similarly in welding, the man who is to produce uniform good results must know how to size up the job to be done, then select the type of welding to use, choose the correct rod, provide the proper arrangement, and for gas welding, choose the right

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tip and the proper proportions of gas to use; or for electric welding, the right voltage and amperes to produce the correct heat. Finally with either process the right technique then has to be used to cause the metal to flow and solidify at the right time and place.

The foregoing analogy is merely to stress the point that the results to be obtained depend on the experience, training and skill of the operator as well as the tools, rods and equipment available for the particular kind of job to be undertaken.

The application of welding is very extensive on both production work and repair or maintenance. In production work mention might be made of the arc welding of complete steel structures, building frames, steel boats, etc. Motor and generator frames of the larger sizes are nearly all fabricated from shapes and then welded. The manufacture of machine tools is rapidly switching to fabrication instead of casting. Some work on strengthening of cages and skips has been done. Possibly in the near future we may see a complete cage fabricated from high strength. light weight alloy steel and all rigid connections made by welding instead of bolting and riveting.

For repair work both types of welding have proven quite versatile. Hundreds of different kinds of jobs have been successfully done. Repair work may require filling, hard facing, splicing, joining, extending and strengthening the broken, worn or bent parts. A few typical examples of such work may be cited.

Dipper teeth on shovels and drag lines encounter abrasive sand and rock. Ordinary steel or even manganese steel does not last long. A surface or tip of very hard, wear resisting metal can be added very readily with the oxy-acetylene process. These teeth are so large and have so much backing that the hardest kind of surfacing may be used.

Mining machine bits may be shaped in a sharpener and then tipped with shock and wear resisting metal which will hold the point from five to ten times that of the ordinary carbon steel point. This has already been quite fully discussed before the "Institute."

Recently a shaker shaft 4-15/16" diameter by 16' 8" long broke suddenly. This carried four eccentrics for shaker screen. This shaft was electric are welded and placed back in service with only a day and a half lost time. It is doubtful if a new shaft could have been secured and installed in less than a week's time.

The drive head bolts on a shaker screen came loose, broke and caused the boxings on the shaker screen to break. In two and a half hours these were repaired and the mine resumed operation. Otherwise this would have been a two days job of replacement.

We had a case of both cages being wrecked at the same time and all the trunnion irons being broken. With two hours work these were repaired, whereas even if four spares had been on hand the time required to replace them would have caused another day of lost time.

A 66" diameter V-belt pulley failed. Welding three spokes at a cost of \$6.87 salvaged it for immediate use. A new one would have taken time and expense to secure.

A pump housing costing \$240.00 burst from one side to another. At a cost of \$4.00 in labor and material this was put back in service promptly, saving an indefinite delay.

Welded boiler flues have lasted seven years without a leak, which is quite a contrast to our usual experience with rolled flues. Flue sheets have been repaired "in place" saving the removal and replacement of flues.

The installation of piping systems for water or steam may often be facilitated by making tees, elbows, or other more complicated fittings by cutting the shapes with a torch and are welding. Forged shapes are obtainable for quite complete are welded piping systems.

A connecting rod on a hoisting engine had the eye to crack without warning. It was welded and a reinforcing strap put around the end and welded to the rod. This proved so satisfactory that the other rod was stengthened the same way. Each rod cost about \$500.00.

The foregoing illustrates some emergency jobs where both time and cost were considerable. We have routine maintenance and repair jobs where the time element does not enter into the picture so much, but where frequent repetition of the welding work does amount to a nice saving over other methods of replacement.

Thus for locomotive tires, solid wheels and axles we have two installations of automatic are welding heads, with rotating device for the wheels. The worn treads on tires and wheels are filled and where the axles are worn they are brought back to standard size to fit the journals and axle brasses.

Since 1931 we have filled 2,744 tires and wheels and 492 axles. We figure that the saving has more than amortized the cost of the equipment, and carried all labor and material costs.

In this connection a peening hammer was designed, built and so mounted as to continuously peen the fresh bead of the weld. The operators state that this has improved the quality of the weld, by knocking off scale, flattening the bead and relieving stresses.

Other routine repair is undertaken on jobs where there appears to be a relatively large saving. Our repair labor and supplies costs when combined average about 12% of the new cost of the items welded. For each of the last seven years we have repaired a yearly aggregate of about \$90,000.00 worth of parts based on new cost. It is not claimed that all repaired items are as good as new. However we feel that many of them are strengthened and improved so as to be better than new.

Hence our conclusion is that this line of work is entirely warranted by the savings in routine work plus the great savings in case of emergency break down. If we did not maintain a regular routine of such work we would not be prepared nor have trained men for emergency work, hence the further justification for the routine repairs.

It is conceded and expected that good judgment has to be used to prevent this type of work from being carried to impractical and uneconomical extremes on jobs that should not be undertaken. By keeping records of all jobs we are able to analyze the results and thus concentrate our efforts on the more practical and profitable jobs. There is no doubt that this type of work is still expanding to new and probably more difficult jobs.

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Chairman Adams: We have twenty minutes. If you care to take it up in a discussion of this subject, may we have volunteers.

Mr. T. J. Thomas: Mr. Chairman, I would like to say one thing. I think Mr. Lee dealt with the ques-

tion of aluminum alloy. For the last year we have been experimenting with aluminum alloy and the introduction of nickel in the metal. and we have about reached the point now where we are ready for laboratory tests. It has developed that the alloy is 25 to 40 per cent greater in strength than steel and what we intend to do with the test finally, providing it is satisfactory, is to introduce the light alloy metal in connection with our skips. We feel that we can reduce the weight of every skip by approximately four tons and convert that dead weight into coal.

Chairman Adams: Anyone else?

Mr. C. C. Conway: Mr. Chairman, I would like to know if anyone has any figures on the results they have obtained in the building up of steel tires.

Mr. T. J. Thomas: I think I can answer that. We have been building up tires for seven or eight years and there was some question about the matter of cost in doing it. Last year the matter was brought to our attention and we went into it very carefully and figured that our saving in building up the tires is approximately \$12.50 per pair.

Mr. C. C. Conway: Further on the same question, I would like to know if Mr. Thomas, or anyone else, is experiencing any trouble from tires breaking, causing wrecks and danger to employees.

Chairman Adams: Who has the answer to the question?

Mr. T. J. Thomas: We went into that from the time we commenced to build up tires and have had very, very little trouble from the tires breaking. No difficulty except when you allow the wheel to wear down you tend to damage the frogs in the switches.

Mr. G. E. Marble: I don't remember talking to Mr. Lee about the breaking of tires. My recollection is if a tire does break it does so from being back in service. There is some breaking of tires but it is a small per cent.

Mr. Norman Prudent: Maybe you fellows will get tired of my talking. Our experience with the welding of locomotive tires has proved to be a false economy. The experience we had required the turning of a tire before welding. Nine months was the average life of our welded tires. We could put on a new tire and run it eighteen months. It required three man days in order to change the locomotive trucks up to 12, 13 and 15 ton locomotives and when you set the trucks out you have your axle which might be worn. It requires three man days to do that and you don't have enough wear on the bearings to discard them in nine months, but you don't feel like putting a worn bearing back in on the trucks. If you do, you are liable to have to pull that out again. You feel justified in discarding those after eighteen months and getting new ones. When you weld a tire I think the accident hazard which you build up is far too great to make for any saving you may have.

Chairman Adams: Anyone else?

Mr. B. K. Wentworth: Mr. Chairman, I would like to know, if anybody has the information, whether the tire welding has any advantage over wheel welding or

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whether it is vice versa. I understand that in many cases the tire swells after the second weld. I would like to know if you have any information on this subject.

Chairman Adams: Who can reply to the gentleman's question, is that within the experience of any of you?

Mr. B. K. Wentworth: Have I made my question clear? Is it better to weld the steel wheel than to weld the tire to replace later? Is it safer to buy a steel wheel or safer to buy the tire and weld them later than to replace them with new tires?

Mr. E. O. Wiederanders: Mr. Chairman, I have watched that, and I find there never has been an accident with a steel wheel that has been welded, but I have seen quite a few with a repaired tire. I believe the steel wheel is better.

Mr. D. W. Greene: Mr. Chairman, in line with the conversation, a few years ago we tried east tires and we found in welding the cast tire the rim would break off. We changed one particular motor and put on steel wheels and we never had any trouble. It is still in service after seven years. My opinion is, it is more practical to change to solid steel wheels.

Mr. A. E. Pickard: It may interest you fellows to know that at our place we have an x-ray for looking at welds and in my opinion it is the operation in the welding and not the job that causes the trouble.

Chairman Adams: I am inclined to agree with Mr. Pickard. Our own company, ten or fifteen years ago, began the practice of building up worn tires with electric welding and discarded it after a

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short time. The reason it was discarded, as I recall, was that the material which had been welded on came loose, strips were welded on the worn tires. We are now turning them down and having no trouble and so far as we can see, we will continue the practice on tires which are not too badly worn. We replace a lot of worn tires with new ones, yet we take off the wheel centers and build up the tire and put them back in service.

Does anyone else have a thought?

Mr. Norman Prudent: I would like to ask if anyone has any definite costs between the building up of tires and new ones?

Mr. T. J. Thomas: We put an engineer on this to work it up. With anything new introduced in the mining industry, when we undertake to develop something, we don't go into it sufficiently; we take this man's word and that man's word and reach the conclusion that the welding of tires is not so good as a solid steel tire. But this came to our attention in such a way that we felt we ought to develop the fact as nearly accurately as we could, and we put an engineer on it to study it. We studied it for three or four months, and we figure that per pair there was a saving of approximately \$12.50.

Mr. Norman Prudent: Did you have any trouble with breaking?

Mr. T. J. Thomas: No trouble at all.

Mr. J. S. Anderson: I have had some experience in selling tires, and I happened to make it my business in going to Chicago to see how tires were made and discovered to my own satisfaction that the reason so many welded tires fell down is due to the process of welding. If they could attain the same efficiency in welding the tires as in making the tire in the first place, there would be no question about it lasting just as long as the original tire. The process of making a tire is this: A chunk of steel is taken out of the furnace and they put it on a block shaped like a tire and a press comes down and punches the tire in shape right then. After that it is chilled. That is a very simple thing, and they have developed the idea of chilling the tire to stand up under considerable use. In welding a tire (I went into that thoroughly), I find with the welded tire, whether mechanical or automatic or just the simple easy way of doing it, they heat one part of the tire at one time and rotate the tire around and by the time the tire is around that place is chilled and a false strength is set up in the tire. Sometimes that has a serious effect and sometimes it works out well, depending on the nature of the steel and the man operating the machine. If that tire is going to be welded, it should be done at a uniform heat all around at the same time and welded at the same time and chilled at the same time. Then there is no question about it being as good as the new tire. But as it is now I cannot see it; I don't understand how a man could expect to get the same result out of welding a tire as a new one. The process is entirely different and in my opinion is entirely false. From a safety standpoint, I believe the new tire is best. I know of numerous places where tires have bursted after being welded. Not only on the top but down in the mine. I think one of

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the speakers today, had a tire that bursted in operation on one of his properties. That is a serious affair and dangerous. Not only from a safety factor but from a dollars and cents view, I believe the new tire is better than welded tire.

Chairman Adams: Gentlemen, our time is up. This has been interesting, and I want to thank all of you who participated in the discussion and also to make the statement that the program this afternoon will begin promptly at 2:00 o'clock and Mr. H. H. Taylor, Jr., our Vice-President, will preside.

Mr. Frank Schull: I was asked to convey the regrets of Mr. C. F. Hamilton and Ben Schull at not being able to be present. Mr. Hamilton was not able to attend on account of his being tied up in a meeting,—I think trying to make a contract with the miners. Ben has a young son who is graduating this week from Washington & Lee College, and of course he and his

wife want to attend the graduation exercises, so they could not be here. They asked me to convey their regrets.

Chairman Adams: I am sure that we regret the absence of these gentlemen.

If there is nothing further we will stand adjourned until 2:00 o'clock p. m.

AFTERNOON SESSION

At 2:00 o'clock p. m., the afternoon session was opened by Mr. H. H. Taylor, Jr., Vice-President, who acted as Chairman.

Chairman Taylor: May we please come to order. The first paper this afternoon will be presented by Mr. Wm. C. McCullogh, Chief Chemist of the United Electric Coal Company, DuQuoin, Illinois. Mr. McCullogh's subject will be "Recent Developments in Bituminous Coal Cleaning."

RECENT DEVELOPMENTS IN BITUMINOUS COAL CLEANING

By WM. C. McCULLOGH

Chief Chemist, United Electric Coal Companies, DuQuoin, Ill.

Coal preparation since its inception nearly three-quarters of a century ago has undergone numerous waves of activity and recession.

In Illinois, particularly, this has been true. We observe in a study of the records that this state varies from first rank to last in washed coal tonnage. Illinois is credited with having the second bituminous coal washery in the United States, a plant built in East St. Louis in 1870. The first washery used to prepare coal for purposes other than metallurgical coking was built in Streator in 1883. Later, in 1908. Illinois ranked first in production among the coal washing states with over three million tons of washed coal. In the decade following the war nearly all of the washeries were abandoned and the washed tonnage became practically nil. The present growth of construction activity, which started in 1933, has again placed Illinois as one of the foremost states in annual washed tonnage.

In the early promotion of coal washing in Illinois most of the washeries were built to prepare coal for coking or metallurgical purposes. There have been some rather monumental failures in this respect chiefly because of the lack of washability data on the coal which would have shown that it was not suited for metallurgical uses. The influence back of the present growth is exclusively the need for better preparation in the steam

sizes for use in both industrial and domestic stoker installations.

The problems of coal preparation have varied but little over the years of development and we find in looking back over the literature that the men who were largely instrumental in bringing coal washing to the advanced stage that it is today were discussing the same problems that are still foremost in the minds of preparation engineers. To illustrate, I wish to pay tribute to the late J. R. Campbell by relating a story which he was pleased to tell us younger men in the industry. His first initiation into coal washing was in a calcium chloride washery in Pennsylvania and, as he expressed it, "We had a skull and crossbones painted over the door to the washery with the caption below 'Death to Slate'." should still be our motto because we are primarily interested in the problem of slate removal or its equivalent although our problems of today are not so much the actual mechanical removal of slate as they are the economical removal of impurities in large capacity units with a minimum loss of coal. Mechanical progress with the application of engineering design has resulted in the growth of the little ten tons per hour plant built in 1870 into the recent thousand tons per hour plants operating at much higher efficiency. The development of new facilities for washing coal has been so rapid with such fre-

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quent changes that the student of coal preparation today has no other recourse than to visit operating plants or to search the journals and technical society papers for his information. It is a sign of the rapid growth of new ideas that there has been only one book on Coal Washing published in America, a book which was out-of-date within five years after publication. Today, ten years later, a study of its pages shows no reference to the coal cleaning units at present being installed for coal preparation except in such generalities as jigs, or launders, or tables, very few of which are recognizable as being forerunners of the later types. There is a much felt need for a recent reference book to show the developments of the last decade.

Concerning the problems of auxiliary equipment, we can refer to the literature and itemize the additional subjects that gave difficulty in the early days, such as sludge recovery, water clarification, dust control. uniform rate of feed, storage facilities, dewatering of fine coal, prevention of freezing, sampling, screening, and crushing, only to find that we are confronted with the same problems when contemplating new plant design today. However, we find that modern engineering has adapted the old equipment to fit in with the new requirements and has housed the plant in a building of modernistic design which is a far cry from our early conception of a coal washery. The modern preparation plant is no longer a dark and dirty place dripping with water but is well lighted, easily accessible, and open to visitors.

The most obvious feature of new washing plant design is the automatic principle of operation. Automatic controls have almost entirely eliminated the human element in

coal preparation. Interlocking electrical devices. remote switches with signal lamps, photoelectric cells, automatic slate gate mechanisms, and streamlined floats all contribute to continuity of operation and uniformity of results. Special alloy steel for pumps, valves, chutes, and screen plates and cloth reduce maintenance and permit uninterrupted flow of material. No manual effort is required and attendance is reduced to mere supervision and push button control. If we visualize that one minute's operation in large plants means fifteen tons of coal or 500 pounds every second we can appreciate the value of continuous operation and the spill that would occur if any unit failed.

I shall not discuss the underlying theory back of the recent developments in bituminous coal cleaning but shall review the principal ideas that have been developed in the application of modern equipment to coal preparation problems. It is not necessary to show the need for coal cleaning or the economic benefits resulting from it since that has been covered in other papers recently presented. We shall, instead, take the raw coal as it comes from the mine and follow it through the preparation plant, discussing the various units necessary to its travel and the several methods available for each step.

Raw coal storage bins are provided to give uniform feed to the plant and are ordinarily the only surge bins provided for taking up the irregularities of haulage. Fifteen minutes supply of feed is probably the maximum size. Rotary dumps or automatic drop bottom cars are used to speed up the operation.

Reciprocating variable speed feeders are most common and these

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are followed by run-of-mine crushers. These crushers of the single or double roll slow speed type are large enough to receive the maximum size lump anticipated in the raw coal and can be adjusted to crush all lumps to 6" egg coal or to a standard 12" size. With present-day mechanical loaders underground and five cubic yard coal loading shovels in open pit mines the throat to these crushers needs to be about five feet wide.

The crushed run-of-mine is transported to the sizing shakers almost exclusively on rubber belt conveyors although some operators still prefer flight conveyors. For the belt convevors, antifriction bearings are universal with some manufacturers installing greased-for-life rollers. Raw coal sizing screens for producing lump, egg, and washery feed are without exception of the inclined shaking type suspended from hangers although the driving mechanism may be cranks or eccentrics depending on manufacturers' choice. Continuous pressure lubrication is provided.

Domestic coal, which may include all sizes above three inches, is mostly prepared by handpicking on shaking type picking tables with facilities for crushing and returning to the washery feed any pieces containing laminated impurities. Some operators are washing sizes up to six inches but it should be noted that in such instances where the coal enters the domestic markets handpicking follows washing on egg coal to remove pieces objectionable in appearance which have passed over with the washed coal. Care is exercised to prevent degradation in domestic sizes. Rescreens are used to remove casual breakage, and hinged booms, preferably of apron type, are used for loading in railroad cars.

For the season of the year when domestic coal is not in demand, ernshers are installed to convert all lump and egg to screenings size. These crushers may be ring type pulverizers, single roll crushers or pick breakers. If desirable to limit the output of the mine to the washery capacity, the crushed lump can be diverted to the washery feed in which case it would be crushed to the top size of material washed. Following the trend of smaller markets for domestic lump some operators are not equipped to load this size and crush the entire output of the mine to washery feed. However, although the season is short, the lump market is very desirable and should be taken advantage of if the quality of the lump is satisfactory.

In the cleaning units alone there is wide diversity of choice and individual preference may be just as important as the specific application of any one type to coal of definite washability characteristics. We have available pneumatic cleaning systems as contrasted with water washing systems. In both systems there are reputable manufacturers whose types of cleaning equipment have been satisfactorily operated under certain conditions. Conversely, there are certain natural conditions which make some types of cleaning equipment less suitable than others. For anyone to specify the kind of cleaning equipment for a definite job he must be familiar with the conditions of producing the coal and its ultimate market as well as its washability characteristics.

To fully describe each type of cleaning unit is not within the scope of this paper but each must be mentioned if we are to keep abreast of present developments in Illinois. The greatest tons per hour capacity is in jigs of the Baum type. There are three different Baum type jigs on the market, each one having features in design which distinguish it

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from the others. Second in installed hourly tonnage is the Rheolaveur launder system with the Chance sand flotation system ranking third. Pneumatic cleaning is assuming a prominent place although a distinction must be made between pneumatic concentrating tables which remove high density impurities, and pneumatic dedusters which remove only the fine dust. Of lesser importance but new in design are such machines as diaphragm jigs, chloride solution washers, flat pickers, and air-sand separators. Wet concentrating tables, although not in use in Illinois, are one of the older types of cleaning equipment still gaining in importance in other fields.

The tendency to wash a wide range of sizes in a single operation seems to have reached a practical limit and there is at present a swing back to a narrower size range. Where a maximum size above four inches is washed there is ordinarily a screen-size division made at about 2" for feeding a second unit. With a top size of three to four inches, added recoveries are obtained by a separate treatment on the fine coal less than three-eighths inches in size. Where the coal is dry enough to permit raw coal screening a combination wet and pneumatic process may be used with pneumatic cleaning on the fine coal and wet washing on the coarse coal.

Washed coal screens are arranged to produce the five standard nut sizes. Combinations of these standard sizes are obtained by mixing conveyors, and flap valves fitted appropriately in the screen itself. Most commonly shaking screens of the Parrish hanging type similar to the raw coal screens are used but vibrating screens and high speed inverted Parrish screens operating in counterbalance are becoming increasing-

ly popular for dewatering and for crushed coal screening.

In closed circuit with the screens we find additional crushing equipment for preparing screenings from the larger washed nut sizes. These crushers are also of the ring or single toothed roll type which produce a minimum amount of fines. Some mines are equipped to load the entire output as 11/4" screenings.

Fresh water sprays over the washed coal screens are essential to remove the slimes and fine clay remaining after washing. The water and small coal from the main shakers are sluiced to elevator boots. sludge tanks, or shaking wedge wire screens to recover the coal from the water. Where desired, this fine coal may be further rinsed and dewatered over vibrating screens, centrifugal dryers, and heat dryers. Each unit reduces the moisture progressively until the final product may be entirely free of surface moisture. Natural screen drainage is the only dewatering used on the larger sizes although it may be supplemented by additional heat drying.

Loading booms may be apron, belt, or flight conveyors and are used for loading nut coal as well as the screenings combinations.

It has become evident that the removal of fine dust, whether accomplished pneumatically or as a step in the washing process, improves the combustion characteristics of the screenings. Dedusters are still much in evidence for those mines where the natural characteristics of the raw coal show no necessity for cleaning. The dust recovered has very little market value but special uses for it have been developed in several instances. In wet washing, dust removal is obtained in the overflow from the elevator boots and sludge tanks or the underflow from the wedge wire screens.

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Circulating water is clarified in Dorr thickeners and sludge cones or tanks from which the sludge is pumped to settling ponds for future recovery when economic conditions permit. In other states, where the fine dust is of value for metallurgical coking, the sludge may be recovered in filters but there are no instances in Illinois where such equipment is in use.

Heat drying installations are of varied types identified as rotary kiln, rotary louvre, travelling pan, tilting pan, and shaking screen. Here again, complete description of each type is precluded but the principal purpose of heat drying is to prevent freezing in railroad cars. In lieu of heat drying chemical treatment has been used quite extensively to prevent the freezing in railroad cars of wet washed coal. Oil spray application has met with some success in this connection. Oil treating for dust prevention has been so fully covered in recent technical meetings that I need only to refer you to those papers. However, there is still need for a great deal of research work in dust prevention on Illinois coal if the industry is to profit by its development.

Chemical control laboratories have become a part of the modern plant and the operation is no longer the haphazard thing of the past. Samples of the washed products as well as the refuse are taken periodically during the day for analysis. These results give not only a continuous record of the quality of coal being delivered but permit adjustments to be made in the plant, which insures uniformity of operation.

The consumer of coal is not interested in the efficiency of a cleaning plant nor in the lowest ash that it is possible to produce from a seam of coal. He is interested in low cost per pound of steam and uniformity is the basis of that low cost. It remains for the coal producer to establish the economic point of separation for his particular coal and once the quality is established it should be maintained rigidly. The ability to produce, day after day, coal of definite combustion characteristics, unvarying in quality, is the purpose of modern coal preparation and those plants designed to give these results regardless of the variable characteristics of the feed coal are the ones that will operate most successfully,

Chairman Taylor: Thank you Mr. McCullogh. This is a very live and interesting subject. Mr. Henry F. Hebley, Preparation Engineer, Commercial Testing and Engineering Company, Chicago, has prepared a discussion of this paper and was unable to be here. In his place Mr. Joseph Pursglove, Jr. will read the paper.

DISCUSSION OF MR. W. McCULLOGH'S PAPER, "RECENT DEVELOPMENTS IN BITUMINOUS COAL CLEANING"

By H. F. HEBLEY

Commercial Testing & Engineering Company, Chicago, Ill.

The writer regrets that he is unable to present this discussion in person; however, in reading over the paper, the following points were considered worthy of comment:

Many points have been touched upon in this paper, and the questions which come to one's mind are innumerable. Take, for instance, the use of coal for steam generation purposes. In recent years there has been considerable activity in preparation and cleaning of coal to be used for the manufacture of steam. This has been brought about in great measure in Illinois through the development of stripping operations. Clearly, the coal as produced from these operations would have to be cleaned in order to meet competition. However, the question does arise regarding the benefits accruing from the use of the cleaned coal. It costs money to clean; a certain portion of the raw material obtained from the mine is discarded, and, consequently, if the whole transaction is to be economically sound, the increased value of the coal in the plant must be sufficient to defray the cost of preparation. Is that extra value actually obtained? It is granted that the coal comes to the steam plant with a less ash content and there is no freight to be paid on the inert material which has been discarded; but the moisture content is in many cases higher.

Then comes the question of the sizing of the coal for use in the boiler furnaces. There are indications that the removal of the extreme fines does improve the efficiency; but, technical efficiency is not always economically sound, as some market must be found for the material which is removed, or someone must sustain a loss.

The question of uniformity of product, as well as ash content, is of very great importance in steam generation plants, as most of them would be quite content to burn coal with 1 or 2% more ash content, providing the fuel being received varies within narrow limits. It is sometimes a mistake to try to obtain an extremely low ash percentage, as the percentage of discard involved in such attempts is far too great a penalty to pay. Again, there is the possibility that the rear end of the grates may become exposed to the higher furnace temperatures, because there is an insufficient protecting layer of ash, and burning of the grate bars will take place.

Domestic stoker coal which has increased in tonnage recently is another product which will bear considerable investigation.

In the last analysis, it is the housewife who determines whether or not a coal is dustless. We in the coal industry can talk all we like about what we do to prevent dust; we can carry out innumerable experiments to prove that dust has been removed; and yet, after the load of coal arrives and is discharged into the home owner's basement, if the housewife takes a white cloth and runs it

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along the basement clothesline and finds a black streak on the cloth, then the coal is dirty and dusty, and all scientific arguments are of no avail.

Mr. McCullogh mentioned the washing of large coal; that is, 6x4" or 6x3". This product generally goes to the domestic market, and for years it has been sold on appearance. One must remember that the householder is not at all familiar with coal preparation and coal cleaning. In many cases he has not altered his habits and still purchases his coal by appearance. It is quite possible, with a lump 6x4", to have some extremely clean coal attached to a lamination of bad looking iron pyrite. If the piece is subjected to a density test it will probably float at 1.45; and, as practically all cleaning equipment depends on a difference in density, this piece would float. Yet its appearance would condemn it. Some cleaning plants, in order to obtain a good 6x4" product, have to wash at specific gravities as low as 1.4. This brings about a very high loss in the reject, which, in many cases, is crushed and recirculated so that it is passed to the finer sizes.

The question which has been in my mind regarding this method of treatment for the larger sizes is whether or not we are justified in asking coal cleaning equipment to work on these large sizes. The manufacturer of coal cleaning equipment will always strive to provide the coal operator with equipment which will perform duties which the operator requests; but in the light of the results obtained, and we have checked many of them, are we justified in asking coal cleaning equipment to perform work which could possibly be done more efficiently in other ways? The foregoing statement may be considered heresy by many, but I do feel that the subject of cleaning plus 4" material should be studied candidly, balancing the reject entailed, the high pumping costs, against satisfactory appearance of the clean coal product.

Another point brought up by the author of the paper is the lack of washability data; this is quite true. Many plants are designed on the most meagre information, and it is often expensive, after the plant is running, to revamp and redesign in order to fit the coal which is actually coming to the plant, A common mistake is to try to reduce the ash content below its stable point, resulting in higher refuse losses and nonuniform ash contents. Most of the operating personnel understand this point clearly, but in the stress of competition the sales department will often ask for a reduction of half a point in order to get a certain contract, without realizing the heavy penalty which must be paid in throwing so much material away.

There is a tendency, among all of us, to take one coal analysis which reports the ash content to the nearest hundredth of 1%, and, as Mr. Morrow words it, "invest it with an accuracy which it doesn't deserve." After all, one analysis is only a result which has been found on a certain piece of work which has been accomplished. It is one observation, and should be accompanied by many more which have been ascertained by exactly the same routine, in order that one can obtain a true picture of the coal being shipped. A coal analysis is no better than the sample from which it was obtained, and it is misleading to report ash contents to a hundredth of 1% when the error in sampling may be 5%. The proper method of revealing the results of a cleaning plant is to check the variation from car to car of the coal being shipped. If the coal is

uniform, then the plant is performing satisfactorily.

Coal, in its natural state, is a heterogeneous material and the higher the ash, the greater will be the variation between different samples. Coal washing in reducing the ash will also reduce the variation between different samples.

In considering the tonnage washed, the author stated that "the greatest tonnage per hour capacity is in jigs of the Baum type." What he probably means is that the greatest tonnage per annum in the State of Illinois is cleaned in jigs of the Baum type.

The consideration of measures to prevent the freezing of wet washed coal during the winter time, when the consignments are being forwarded to locations subjected to severe winter weather, is very important. Normally, centrifuges will reduce the moisture to about 7% in the 5/16x48 Mesh size. The No. 4 Nut. or 3/4"x5/16" in most plants is dewatered over screens of the shaker type, and is dependent mostly on gravity for moisture removal. When this latter size is mixed with centrifuged No. 5 Carbon, to yield 3/4" Screenings, the resultant moisture content may cause trouble due to freezing in the winter weather. Therefore, some further moisture removal or treatment should be adopted to overcome the objection, Generally speaking, centrifuging is cheaper than evaporating the moisture; so consideration should be given in the design of a plant to the installation of both types of equipment, placing the centrifugal dryers ahead of units of the thermal type.

Heat drying, as at present practiced in the coal industry, is worthy of a great deal of study. For the most part the units installed are based on very meagre data.

A subject which Mr. McCullogh has not discussed, but which is crowding to the fore rapidly, is the consideration of dust elimination in cleaning plants. The dust hazard, both from the safety and health points of view, will have to be seriously studied in the very near future. Washery designs embodying the control of dust are at present being made, and the efficiency of their operation when installed will be watched with interest.

In conclusion, the writer wishes to congratulate Mr. McCullogh on the broad manner in which he has discussed these recent developments in coal cleaning.

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Chairman Taylor: Thank you, Mr. Pursglove. The subject of coal cleaning and preparation is of utmost importance because it affects our operating time and cost very materially. I am sure that there must be some questions that some of you have in your minds that Mr. McCullogh or Mr. Pursglove, or someone else would be glad to answer. I would like to throw the floor open for such discussion at this time.

Do I understand that right now it is the practice to use calcium chloride for anti-freeze purposes?

Mr. McCullogh: This last winter, yes, sir.

Chairman Taylor: I am sure there are some of you who operate wash plants that might throw some light on this subject. It might be well to have some discussion on the amount of calcium chloride necessary to produce the anti-freeze effect. I wonder if anybody would care to say anything about that. Is it necessary to use it throughout the year or just in the winter time? Mr. McCullogh: I can give you an idea of what we use in treating our own coal. We apply to the coal either the dry or centrifuge treatment, to all of the coal and to the bottom of the car to give such a concentration to prevent that from freezing.

Chairman Taylor: You mentioned something about oil treatment of wet coal. Just what experience have you had, or anybody who has oil treated wet coal? Can it be done as successful as dry coal?

Mr. McCullogh: We are conducting experiments now to find out the benefits of oil treating coal but we are not ready to say what the results will be. I don't know about the oil treating of dry coal as compared with the oil treating of wet coal.

Chairman Taylor: Is there any further discussion on this subject, the general subject of preparation and cleaning?

Mr. Jos. Pursglove: There are several points I would like to discuss in both Mr. Hebley's paper and Mr. McCullogh's paper. They mentioned, in both of them, the fact that it is not economical to wash coarser coal than 3 to 5, up to 6 inches and Mr. McCullogh mentioned that some plants are cleaning 6 inch coal to remove the objectionable features. That will be quite a large subject in Illinois. They don't make the 3 to 6 size in the east. They generally stop at 41/2 to 5 inch but in Illinois with this 3 to 6 inch size, it should be a big subject. The coal as it comes from the mine, particularly mechanized mines, contains a great many pieces of objectionable matter. It occurs to me that you can build a table a mile long and put a man every foot on it and yet not get all of the pieces out of it. There is, I think, a reluctance among coal operators to build a cleaning plant and have their pickers on the side. I don't think that reluctance comes from the sales department, as they like to say their coal is cleaned. That is a problem that should be studied carefully in every case where cleaning plants are being considered in the State of Illinois because coal of 3 to 6 inch size must be cleaned in some manner. Mr. McCullogh also mentioned the wide range of sizes in single units. Now the tendency is to split these sizes. If you are washing all of your coal to 6 inches, you split it in two parts, 2 inches and up and 2 inches down. That of course depends also on the individual case. For instance, in small plants for small mines where one big unit would take the whole tonnage without the trouble of splitting, it is useless to spend the additional amount of money necessary to put in a second unit. As a result they must suffer a certain penalty because of cleaning the coal in one size; nevertheless in some cases the tendency is to have it in one unit though it may not be the most economical. One thing that Mr. Hebley touched on and so did Mr. McCullogh, that I would like to mention. There are so many plants talked about in which there is not sufficient washable data available. We in the coal cleaning business,—I think that all of my competitors will agree with me,—we find a great many cases where the coal operators are reluctant to get all the possible information before they build an expensive cleaning plant. The tendency is to take the first analysis and say, "we are going to build a big washer and

that is the test; so we will get 6.8 ash;" that is the trouble. Mr. Hebley pointed out that that usually led to a disappointment because you don't get 6.8 because of error in the original data. We often get some funny requests from coal operators and an extreme case was one received from western Canada. They had seen one of our advertisements and they were interested in a cleaning plant to handle 60 tons of coal. They said their seam was 6 inches thick and contained clay and shale and what ash can they wash the coal to. That is an extreme case, of course.

Chairman Taylor: Thank you. Those remarks are interesting. I would like to hear some more. I am sure some of you have some pent up energy which is ready to be released.

I am informed by the President that the Committee mentioned in the motion this morning has been appointed. They are to take up with the Labor Organizations the question of the appropriation for the Bureau of Mines. That committee consists of Mr. John E. Jones, Chairman, and Mr. T. J. Thomas and Mr. F. S. Pfahler.

The next paper will be presented by Mr. K. C. Richmond, editor of "Coal-Heat." I might tell you something about this fellow Richmond. Mr. Richmond's publication is one of the finest in the country. It is read very widely by retail dealers and by those interested. particularly interested in the sale of coal. He has built up a great magazine with lots of information of interest to all of us. I am sure that we are all glad to have Mr. Richmond here. It is a privilege to hear him, and I will call on him to tell us something about "Coal Selection from the Consumer's Viewpoint."

COAL SELECTION FROM THE CONSUMER'S VIEWPOINT

By K. C. RICHMOND Editor, Coal-Heat, Chicago, Ill.

Whether one's fuel works or whether it doesn't depends quite largely on the age, condition of the heating or power plant, and how it is used.

High operating economies are not to be had in an antiquated plant or with inefficient, unskilled, indifferent operating personnel.

To make one's coal work—right—there is no choice but to recognize the equipment and utilization factors, as J. G. Bentley has so often pointed out.

Conditions change, Fuel users become more sophisticated. They get crankier. They want more. One way or another they expect to get it. What they wanted or accepted in coal yesterday may have little or no bearing on what they want or expect today or what they will want tomorrow.

The Situation Changes

Costs increase. Markets widen. Plants open. Equipment fails. Wants change. Competition changes. Many fuel users buy from

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one producer today and from another the following week. Fuel is necessary, of course. It is a basic need. But the fuel user doesn't have to buy a particular coal. Certainly, he doesn't have to buy from a particular producer. (We are not discussing, of course, the situation where captive mines, frozen tonnage or the various reciprocal relationships come into the picture.)

Fundamentally, the value of one's product depends on what the customer gets out of it, or thinks he does. But what one gets out of any product depends on how it is used. How one's coal works depends on the customer's equipment and its operation. Whether it works or not then depends on the load, equipment and utilization factors.

More Than Friendship

The salesman, dealer or operator may be a "swell guy," a fraternity brother, or a chap from one's home town. But that isn't always enough. It helps sometimes. Friendship or personality isn't enough — always — to hold the tonnage. It is the way one's coal works that counts. It is the cost of steam, the amount of water evaporated, the freedom from trouble or operating difficulties, these are the factors that count. Performance tells the story.

Customer turnover is what happens when the coal fails, when the equipment in which it is used is neglected, when the method of operation isn't up to par, when the operator ships the wrong coal, or neglects to follow through on the use of the correct coal for the plant.

Depends on "Utilization Factors"

So whether one's coal succeeds or not depends on a lot of factors. Complaints, customer turnover, loss of tonnage to others who have taken business at lower or higher prices, various competitive contingencies, frozen prices, recognition of various marketing, equipment and fuel utilization problems have influenced more and more coal producers and shippers to hire engineering personnel.

List, for instance, the factors that affect the sale and use of one's coal. How many are there? Which are the most important? Over how many have we any control?

What have we got to sell that the other fellow hasn't? What has he got that we haven't? Study of these factors readily discloses why the coal industry is rapidly going on an engineering basis. Insignificantly informed many of us have overlooked some of these fundamentals.

Factors Affecting the Choice of Steam Coal

Among the factors affecting the choice, use, continued sale and utilization of one's coal, not necessarily in order of their relative importance, are:

- The human equation—psychology of the fuel buyer, user, seller, and their associates.
- The particular needs of the user, real or imaginary, actual and potential — normal, peak and seasonal loads.
- Experience with a particular coal or coals, or other fuels.
- General reputation of or confidence in various fuels or of a particular coal, producer, shipper, salesman, or fuel engineer.
- Age, character, condition and relative obsolescence of plant equipment, facilities for steam production and distribution, instrumentation.

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- 6. Coal and ash handling facilities.
- 7. Maintenance costs.
- 8. Operating personnel, their ability, interest in the job, relative efficiency, special concepts.
- 9. Competitive price and freight rate structures. Delivered cost per million B. t. u. 's. Steam cost accounting methods.
- 10. Sales and engineering service.
- Geographic location of the fuel user, as well as the location in the particular community. Geographic complexes.
- 12. Freedom of choice of various fuels, their availability, adaptability and desirability.
- 13. Uniformity of deliveries, month in and month out.
- 14. Special preparation, sizing, treatment, handling.
- Chastity of the coal analysis. 15. Misrepresentation.
- 16. Attitude of the architect, builder, consulting engineer, heating contractor, furnace, boiler and stoker manufacturer and dealer, city smoke departments.
- 17. Strikes, labor difficulties or other factors that preclude, on occasion, regular deliveries.
- 18. Legislation, federal, state, city and organizational trade practice activities.
- Reciprocal relationships.
- 20. Graft, palm greasing, or inside deals.
- 21. Competitive fuel savings contracts.

The Domestic Market

want a lot of things they haven't

been getting. Explain otherwise the sale of over a million oil burners, innumerable oil-fired space heaters, kitchen ranges and water heaters. Over 80,000 home owners had electric hot water heaters put in during 1936, by the way.

How many of us appreciate what the domestic fuel market involves? Visualize:

- 1. 81/2 million furnace heated homes.
- 2. 31/2 million homes heated with steam, hot water or vapor.
- 15 million homes or so heated with stoves, or no heating facili-
- 4. The need of hot water, 12 months in the year.
- 5. The cooking load.
- The new home market and how it is being heated.
- The countless thousands of stores, shops, plants, and various buildings in which fuel is required for heating purposes.
- 8. The age of the average home or building—32 years.
- 9. The age, character, condition and operation of the average heating system—90% of which are obsolete, judged by modern standards.
- 10. The glamour and appeal of air conditioning - the combined unit, the model basement, the keeping up with the Jones's.
- The rapidly increasing use of stokers, indirect hot water heaters, the stoker-furnace and the stoker-boiler.
- Domestic fuel users, it appears, 12. The entrance of new manufacturers into the heating field.

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What The Home Owner Wants

Just what does the home owner want in fuel? What is he up against? What are his problems? What are his needs, wants, likes, whims, fancies, social concepts?

He wants heat. Comfort comes first. To get greater comfort many are now having their homes insulated. Building construction is improving. Builders of new homes are buying packaged heating systems, automatically fired. Many of us are lazy—that is, we don't want to do some of those things that can be We want better heating avoided. facilities. This is the reason that automatic burners for coal or oil are selling so readily. With stoker sales doubling annually it is obvious that stokers meet a distinct need.

In fuel we know that the stoker user puts dustless treatment first, ease of operation second. A major factor in the selection of stoker coal is the recommendation of the stoker dealer or salesman.

Buying New Heaters

Coal men have been concerned a lot about the sale of oil or gas burners. Few have even recognized the probably greater loss of coal tonnage because of the sale of oil-fired space heaters. Remember, half the homes in this country are still stove heated. The small oil-fired space heaters are selling by the hundreds of thousands.

Why is the public buying them? The reasons are obvious if you analyze the situation. One reason the small space heater has been selling in such numbers has been due to the difficulties in handling large lump coal, the necessity of cracking or breaking up large lumps and the

consequent dust and dirt. The sale of small nut, proper dustless treatment, better delivery facilities, will help eliminate one of the major sources of difficulty in handling the hand-fired stove or heating plant. Large lump coal is definitely on the way out. Smaller sizes are preferable.

The public wants the best coal it can get at a fair price. And John Doe doesn't care where it comes from if the price is in line. Price counts. When the price reaches a certain point, the cost of oil or gas may prove no higher. Check Anthracite and oil prices for proof. Dealer margins, freight rates, wage schedules explain the shift in many a coal market.

What They Want in Stoker Coal

"Dustless treatment", "ease of operation", and "recommendation of the stoker dealer or salesman" stand out in order as major preferences in the selection of coal by household stoker users.

To find out what we could about the selection of stoker coal, we asked several hundred stoker dealers, retail fuel merchants, stoker manufacturers, stoker engineers, fuel engineers, and others what factors govern the selection and purchase of both household and commercial and semi-industrial stoker coal.

Here is what we asked:

"From the stoker user's viewpoint, what factors now govern the selection and purchase of stoker coal for (1) household, (2) commercial or semi-industrial use?

"Check these factors numerically—1, 2, etc.—in order of their descending importance:

Our advertisers are selected leaders in their respective lines.

		Commercial,
	Household	Semi-Industrial
A. Dustless treatment		
B. High B. t. u. content		***************************************
C. Ease of operation		
D. Freedom from fines		
E. Low freight rate	***************************************	
F. Minimum non-combustible or low ash content		
G. Price per ton (Low)(Medium cost per season)		
H. Recommendation of the stoker dealer or salesman		***************************************
I. Recommendation of the coal merchant	***************************************	
J. Recommendation of other stoker users		
K. Special sizing		***************************************

Thanks to the enthusiastic cooperation of the major stoker manufacturers, key coal producers, retail coal associations, stoker dealers and others, we secured a cross-census of opinion from the men who are selling 80% or more of the stokers and stoker coal in the United States.

The result of their experiences, observation, and judgment is shown in the following tabulation, a summary of summaries, each group being accounted for separately. The final order of relative preference is given on the bottom line.

As will be noticed this tabulation gives the viewpoint of each group as a group. In other words, it shows the consolidated viewpoint of quite a number of combustion or fuel engineers as a group, chief engineers of major stoker companies, sales managers of leading stoker manufacturers, members of the St. Louis Coal Exchange and other groups.

In order of preferences, "dustless treatment" stands out first, closely followed by "ease of operation". The phrase "ease of operation", of course, takes in considerable territory. Low ash content, clinkering characteristics, coking tendencies, amount of fuel required, frequency and amount of clinkers to be removed, the way the coal burns or holds fire in mild weather—early fall or late spring—all come under this heading.

"Recommendation of the stoker dealer" is a big factor. Several groups marked it first on the list. A few coal operators put this way down the list—which indicates that they are not quite as close to the stoker industry, the dealers, salesmen, engineers, manufacturers, as they might well be in view of the rapid growth of the industry and increasing demand for stoker coal.

"Low ash content" came fourth. "Recommendation of the coal merchant" fifth. "High heat content", sixth. Only one group—the Canton stoker dealers—put "high heat content" in first place. Several groups put it near the bottom of the list.

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FACTORS GOVERNING THE SELECTION AND USE OF STOKER COAL

FROM THE HOUSEHOLD STOKER USER'S VIEWPOINT

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FACTORS GOVERNING THE SELECTION AND USE OF STOKER COAL

FROM THE VIEWPOINT OF THE USER OF COMMERCIAL STOKERS

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As to Special Sizing

Despite all the conversation and propaganda about "special sizing" of stoker coals, it was rated seventh. Technically, this may be erroneous. Practically, special sizing is a concomitant of "ease of operation" In studying the summary you will notice that only one group put special sizing at the head of the listthe salesmen and representatives of a leading Illinois coal operator. Outstanding fuel engineers put it in third place. A group of fuel engineers in New York put it in second place. Pittsburgh dealers put it in third place. However, the final summary shows "special sizing" in seventh place in order of preferences.

"Price per ton" is not much of a factor within certain limitations, of course. By various groups it was ranked 4th, 11th, 10th, 7th, 5th, etc. "Recommendation of other stoker users" came ninth. "Freedom from fines" tenth. Only a few groups listed "freedom from fines" near the head of the list, chiefly a group of Cincinnati coal operators and their men and coal merchants in Wisconsin.

At the bottom of the list came "low freight rates". This indicates that the household stoker user is not particularly concerned about the cost of freight—it is the cost of the coal in the bin, the cost of heating per season, freedom from complaints, it is the satisfaction in use and ease of operation that counts.

One of Chicago's oldest and best posted fuel engineers, the representative of a company with a large stoker tonnage in the city, told me recently that well over 60% of their stoker users didn't care particularly what the delivered price of stoker coal was, they wanted the best coal they could get. In some of the foreign sections where there are quite a number of stokers in use, they want the cheapest coal they can get, irrespective of the quantity of ash or the amount of clinkers to be removed.

Ease of Operation

What stands out in this study of household stoker coal is the marked agreement, the demand for proper dustless treatment, for the coal that gives you the maximum ease of operation.

Among commercial or industrial users, on the other hand, the situation is different. There the "price per ton" is the number one factor. "Recommendation of the stoker dealer" second. "High heat content" third. "Ease of operation" fourth. "Low freight rate" fifth. "Recommendation of other stoker users" sixth. "Recommendation of the coal merchant" and "dustless treatment" seventh. "Low ash content" eighth. "Special sizing" ninth, and "freedom from fines" tenth.

Such are the conclusions of a number of groups selling well over 80% of the stokers and a major percentage of the stoker coal tonnage based on their experience and observation.

What the coal merchant wants in stoker coal, what factors lead him to handle a particular coal, is shown in the accompanying table. It gives a summary of the impressions, opinions, and preferences of coal merchants in Chicago, St. Louis, Cincinnati, and various key cities throughout the country. In our investigation we had the co-operation of such groups as the Illinois Fuel Merchants Association, which circularized its membership, the St. Louis Coal Institute, the Extension Service of the University of Wisconsin, members of the Chicago Coal Merchants Association, and others.

The final order of preference is given in the last column:

252	01	H	**	22	0	1~	lio.	.9	or.	17.
Order of Pref erence					T			-	7.	-
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	30	-	21	00	6	10	1-	7	10	
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A. Acceptance of a particular coal in the long accommity by stoken users	stocker dealers or manufacturers		C. Margin of profits.		E. Geographic "complexes"		G. Prestige or standing of coals from a particular district	H. Reputation of the coal producer	I. Competitive price and freight rate structures	I Smarial enlas halus
0.	44	. "	-	1.			. "	_	- "	6

As will be noticed, the major factors governing the selection of stoker coal are in order:

- Dependability and freedom from fines.
- 2—Acceptance of a particular coal in a local community by stoker dealers and manufacturers.
- 3-Special preparation or sizing.
- 4-Margin of profits.
- 5-Prestige or standing of coals from a particular district.
- 6-Reputation of the coal producer.
- 7—Present tie-up with a producer or producers.
- Competitive price and freight rate structure.
- 9-Special sales helps.
- 10—Geographic complexes—such as the use of Iowa coal in Iowa, or Ohio coal in Ohio.

Practical business expediencies transcend state lines. Economically there are doubtless many advantages in trying to burn local coal in stokers, but practically, can the stoker dealer or coal merchant jeopardize his relations with customers by recommending a coal the chief virtue of which is that it is produced in the same state, particularly when other coal (in certain geographic areas), can be purchased at approximately the same prices and which actually delivers greater value per fuel dollar?

This is not to be construed in any way as a direct slap at any coal, or any market. All coals can be used. Human nature being what it is, however, just as long as we have any freedom or choice of action, just as long as no dictator forces us to burn this or that coal, just as long as economic barriers are not set which tend to freeze markets, the ultimate consumer will normally burn that fuel in his particular community which works the best.

Economics is a factor. Price counts. But there is a lot more to

this question of household stoker coal than price per ton. The quantity of clinkers to be removed has a lot more to do with whether one's coal is used or not than the price when there isn't a big difference in the delivered price—which happens to be the case in certain communities.

More Than Price

In general, stoker manufacturers and dealers are price conscious. They want to take advantage of every opportunity to give the home owner the maximum in heating comfort at the lowest possible cost but not at the price of satisfactory operation.

Just because a coal works well in a stoker in East St. Louis, just because the customer there is well satisfied. doesn't justify the notion that the same coal will appeal equally to the stoker user in Oak Park, Evanston or Milwaukee. Just because certain coals can be used in Indianapolis, doesn't necessarily mean that the household stoker user will find them preferable to a high-grade, low ash East Kentucky coal.

The ultimate consumer is the boss. He wants the best he can get. And the best stoker coal is not necessarily the coal with the finest analyses. Many of us question the chastity of the average coal analysis. Inherent quality alone will not give a particular coal the stoker business.

If one's coal through lack of sizing, insufficient preparation, usually results in noise in crushing or segregation of sizes, the home owner won't continue to buy it if he can find anything else. Whether or not the new coreless feed screws will revolutionize feed screw design or not, no one knows. Theoretically, the coreless stoker feed screw makes

possible the use of considerably larger sizes even up to three inches, but can such coals be handled without segregation of sizes?

Segregation of Sizes

Segregation with screenings is as inevitable as the immutable laws of physics. To ignore segregation as so many individuals have done, is silly. To say that dustless treatment will eliminate segregation is stupid. Segregation occurs even with deliveries of small quantities of stoker coal (under four tons) if there is any marked difference in top and bottom sizes.

The closer the limits are brought together, the less the segregation. D. R. Mitchell and Henry Hebley may well be congratulated for the work they have done in study of segregation. Use of Mitchell's nonsegregating chute helps correct the problem in the larger plants. Since building a four ton bunker in my own basement four years ago I have had an excellent chance to study segregation. I know what happens. E. D. Benton of the Elk Horn Coal Corporation covered this subject of segregation pertinently, if briefly, in a discussion on stoker coal in the May issue of Coal-Heat.

Marketing and Utilization Trends

Looking at the varied problems of fuel utilization, sales and production objectively and analytically, one soon discovers several significant trends, such as:

- Rapidly growing appreciation of the consumer's need, likes and dislikes.
- Apperception of the many equipment and utilization factors.
- Growing emphasis on fuel engineering.

- Recognition of the need of better selection and training of man power.
- Desire for simplification or standardization of coal sizes.
- Increasing use of the smaller sizes of coal, steam, stoker and domestic.
- More general use of steam cost accounting.
- Coal evaluation on a use basis as contrasted to delivered cost.
- Replacement of obsolete heating and power equipment.
- A broader outlook, less provincialism, more concern about what's going on and what can be done to meet shifts in marketing practice.
- Less worship of the past, more intelligent planning and preparation for the future.
- 12. Increased mechanization.

Mutuality of Interest

There is a mutuality of interest between:

- 1. The fuel user.
- 2. The general public.
- City health and smoke departments.
- The coal operator, shipper and their representatives.
- 5. Retail fuel merchants.
- Manufacturers and distributors of heating and power equipment.
- Builders, real estate and financial interests.

Such mutual interests include the desire and need for;

 More satisfactory heating facilities or more economical sources of power.

- 2. Better sales representation.
- Development, sale and proper installation of improved heating and power equipment.
- Replacement of obsolete heating and power equipment.
- Restriction against the sale, purchase or installation of inadequate equipment for use with any fuel.
- Expansion of fuel engineering service.
- 7. Lower overall operating costs.
- Simplification and standardization of coal sizing.
- More orderly production of coal.
- More equitable price structure between coals of various sizes.
- Reduction in transportation costs.
- Elimination of smoke and air pollution evils.
- Freedom from uneconomic or arbitrary governmental or other regulation.
- 14. Freedom from unequitable price fixing.
- Better building and housing construction.
- Better control of temperatures, greater conservation of heat or steam after it leaves the boiler.

No Umbrella

"The Guffey-Vinson Act does not remove the competition of oil, gas and hydro-electric power. It does not provide for a reduction in freight rates nor does it prohibit more efficient utilization. Certainly it does not contemplate lower wages for miners," as Paul Weir pointed out recently at the Mining Congress in Cincinnati. "The necessity for

decreasing costs of production continues to be with us regardless of this legislation. The operator who considers this act to be an umbrella for the protection of inefficiency is certain to be disillusioned. The dilution of weighted average costs by efficiently operated mines will most certainly remove protection from the inefficient. This act does contemplate the elimination of unfair competition between those in the industry."

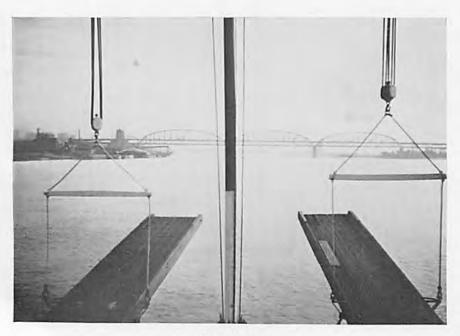
Legislation is only part of the answer. Consumer satisfaction is what counts. Meet their needs and the business is yours.

群 縣 縣

Chairman Taylor: I thank you very much Mr. Richmond, I think now, you know why the consumer public reads "Coal-Heat", and I think there is a lot of comfort in knowing that he is carrying our banner.

Mr. President, if there is nothing further, the meeting will be adjourned.

The following chart will be of interest in connection with the preceding paper by Mr. Richmond.



Home Again.

COAL SELECTION CHART NO. 1

MIDWEST STOKER ASSOCIATION

RECOMMENDATIONS

MAXIMUM TOP SIZE OF COAL FOR USE IN UNDERFEED STOKERS OF DIFFERENT SIZES AND MAKES FOR BITUMINOUS COAL THROUGH ROUND HOLE SHAKER SCREENS

	Name of Stoker		ESCRIPTION OF STOKER	Residential	Commercial and Industrial
			Capacity-Lbs. Coal	Size Stoker	Stokers
Name of			Feed per Hour	TOP Size Coal	TOP Size Coal
AUBU	RN				
"		D	30	1"	
**		1	40	1"	
		1A	60	11/4"	11/4"
**	***************************************	2	80	11/4"	11/4"
		2A	100	11/4"	11/4"
6.6	***************************************	3-3C	150		11/2"
	***************************************	4	200		11/2"
"		5	250		11/2"
4.6	***************************************	6	500		2"
		7	600		2"
**	Hydraulie type, all si	zes fo	r commercial and	industrial us	e 2"

COMBUSTIONEER

44	***************************************	25FS	25	1"	
"		35FS	35	1"	
	***************************************	50FS	50	1"	
"		71/2	75	11/4"	11/4"
66		10	100	11/4"	11/4"
	***************************************	15	150		11/2"
44		25	250		11/2"
	*************************************	35	350		11/2"
		50	500		2"
"	***************************************	70	700		2"
		90	900		2"
44		120	1200		2"

NOTE: While 1" TOP size coal is recommended for household size stokers up to 50 lbs. coal feed per hour maximum capacity as shown in the chart, 11/4" TOP size may be used with satisfactory results when the smaller 1" TOP size is not available.

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COAL SELECTION CHART NO. 1-Continued

_	DES OF	CRIPTION STOKER	Residential	Commercial and Industria Stokers
	No.	apacity-Lbs. Coa Feed per Hour		TOP Size Coa
Е				
	K20	20	1"	
STEP A PROPERTY OF	K30-J30	30	1"	
	K40-J40	3 40	1"	
	17500000	60	11/4"	11/4"
200-200-000-000-000-000-000-000-000-000	22/	80		11/4"
The selection of the se	J90-H9	0 90		11/4"
2007 215 - 316 - 3111 11 - 2	135	135		11/4"
			* /*	11/6"
THE PERSON NAMED IN				11/5"
				11/5"
	41.61.8	- N P 20		9"
CONTROL OF THE PARTY OF THE PAR	7.7.07			9"
CONTRACTOR CONTRACTOR				2"
200100000000000000000000000000000000000				9"
	200	1200		- 4
	H2	20	1"	
	H3	35	1"	
	H5	50	1"	
	H7	70	11/4"	11/4"
CONTRACTOR OF THE PARTY OF THE	H9	90		11/4"
	1	125		11/4"
REAL PROPERTY.	0.2	7.70	~~*	11/4"
				11/4"
				11/5"
				2"
72520 7052 7 DOCA5121 ID-				2"
Articular superior su				2"
				5"
	12	1200		- 4
	R20	20	1"	
	R30	30	1"	
	R40-JR	40 40	1"	
	R60-JR	60 60	11/4"	11/4"
C10-01 (1-24) 5-01 P.D.	R75	75		11/4"
AND SHEET STATES AND ADDRESS OF THE		90	114"	11/4"
	8977	150		11/5"
	3-3D	250		11/4"
	0.510-20-	350		11/2"
2010/10/01/2011/10/11	171			2"
	and the same			9"
				2"
		No. C No. No	No. Feed per Hour	No. Capacity-Lbs. Coal Size Stoker Feed per Hour TOP Size Coal

Our advertisers, who make this volume possible, will appreciate your inquiries.

COAL SELECTION CHART NO. 1-Continued

		DESCRIPTION OF STOKER	Residential Size Stoker	Commercial and Industria Stokers
Name of Stoker	No.	Capacity-Lbs, Coal Feed per Hour	TOP Size Coal	TOP Size Coa
LINK-BELT				2 12 34 34 34
LINK-BELT	-	4-		
• • • • • • • • • • • • • • • • • • • •	- 5	25	1"	
***************************************	7	40	1"	
	9	60	11/4"	11/4"
***	11	80	11/4"	11/4"
- "	12	.90	1¼"	11/4"
"	16	125	11/4"	11/4"
	22	175		11/2"
- 64	52	250		11/2"
"	72	375		2"
**	102	500		2"
11	152	825		2"
**	202	1250		2"
WHITING				
- "	2	20	1"	
	4	40	1"	
	- 6	60	11/4"	114"
"	9	90	11/4"	11/4"
1.6	12	120	11/4"	11/4"
11	15	150	/*	136"
4.4	20	200		11/6"
	25	250		11/2"
***************************************		40.0		
	35	350		11/2"
	50	500		-
**	65	650		2"
	75	750		2"
"	100	1000		2"
	125	1250		2"

"Auburn" Auburn Stoker Sales Corporation
"Combustioneer" Steel Products Engineering Company
"Fairbanks-Morse" Fairbanks, Morse & Company
"Free-Man" Illinois Iron & Bolt Company
"Iron Fireman" Iron Fireman Manufacturing Company
"Link-Belt" Link-Belt Company
"Whiting" Whiting Corporation

All coal for use in above stokers should be DUST-PROOFED.

NOTE—This chart applies ONLY to CHICAGO and immediate vicinity. It is published through the courtesy of the Midwest Stoker Association (an organization of Chicago retail stoker agencies). It is intended as a guide for coal merchants and coal and stoker salesmen in the Chicago area in an effort to simplify the selection of coal for use in underfeed stokers of the sizes and makes shown above. The Association reserves the right to revise or change this chart and to request its return when such revision or changes are made or when a new chart is issued.

MIDWEST STOKER ASSOCIATION Chicago, Illinois

The following papers by Paul Weir, G. S. Jenkins, J. G. Crawford, H. H. Taylor, Jr., F. Earle Snarr, J. H. Fletcher, Henry F. Hebley, W. H. Price and M. M. Leighton—all members of our Institute—were presented at the 1937 meeting of the American Mining Congress at Cincinnati and were published in "Coal Mine Mechanization," yearbook for 1937. We are grateful to the American Mining Congress for their full permission to give these papers to you herewith.

THE FUTURE OF MECHANICAL MINING

By PAUL WEIR Consulting Engineer

Prophesies and predictions of futures are almost invariably based upon an understanding of what has transpired in the past and what is taking place at present. This discussion having to do with the future of mechanical mining will follow this usual procedure. The past will be reviewed and analysed. The present status will be set forth. Based upon these, some things concerning the future will be stated.

The development and application of labor-reducing machinery and equipment in any industry comes largely from necessity. When no necessity for decreasing costs of production exists, there is no interest in mechanization. The economic need comes before the engineering urge to do things. The future of mechanical mining depends first upon the economics involved and secondly upon the technical skill of engineers.

If coal had a monopoly on the energy market, the necessity for low production costs would not have been so acute in the past nor would it be so acute today. Gas, oil and hydro-electric power are worthy competitors. In addition to this, high costs of coal result in greater efficiency in utilization with a reduction in amounts used per unit of work performed. These things

call for the lowest possible cost of production so that coal may not only hold its competitive position but also, if possible, improve upon it. With the almost complete unionization of labor employed in the coal industry during the past four years has come relatively high wage scales which are considered to be competitive as between districts and as between mines in the same district. Collective bargaining is now the law of the land. No chance for reducing costs of production by lowering wage scales exists. The delivered price of coal naturally includes the transportation charge. Downward revision of freight rates is unlikely. These are general economic considerations.

The State of Illinois presents a rather complete case history of mechanization, the reasons for it and results obtained. For the ten years prior to 1934, the coal industry in this state had to combat oil, gas, more efficient utilization, increased freight rates and low nonunion wage scales in competing fields. The battle consisted in reducing costs of production by means of mechanization while still paying the prevailing union wage scale. Table I presents the history. During the 13-year period, the percentage of hand loading has declined

to an all-time low of 25.6 per cent, Mechanical loading has increased to 55.6 per cent and strip mining to 18.8 per cent. The gross sales realization which can be considered as a measure of cost of production has declined from a high of \$2.27 per ton on the Jacksonville scale in 1924. to \$1.56 per ton for the year of 1935. This reduction of 71 cents per ton in gross realization during the 12 year period, while the net decrease in the wage scale was approximately 16 per cent, indicates the dilution of the state-wide realization by those mines favored with lower costs aceruing out of mechanization. By means of intensive mechanization Illinois has attempted to maintain its competitive position.

What has happened in Illinois has also taken place in Indiana, Ohio. Wyoming and other states and to a lesser extent throughout the coal producing districts of the United States. The percentage of hand loaded coal in the country as a whole has steadily declined during the past nine years. This is shown on Table II. While data for 1936 is not available, a continuation of the decline is certain. The effect of mechanization on gross sales realization throughout the country is certain to be felt. Table II also shows the increase in the amount of coal being mechanically cleaned. Part of this increase is due to the erection of cleaning plants at strip mines and mines employing mechanical loading. To some extent mechanical cleaning goes hand in hand with mechanical loading.

Illustrative of progress in mechanization in 1936 is the State of West Virginia. Mechanical production during the month of December was three times that of January. Table III shows these two months as well as intervening

months. A similar growth occurred in Pennsylvania.

The Guffey-Vinson Act does not remove the competition of oil, gas and hydro-electric power. It does not provide for a reduction in freight rates nor does it prohibit more efficient utilization. Certainly it does not contemplate lower wages for miners. The necessity for decreasing costs of production continnes to be with us regardless of this legislation. The operator who considers this act to be an umbrella for the protection of inefficiency is certain to be disillusioned. The dilution of weighted average costs by efficiently operated mines will most certainly remove protection from the inefficient. This act does contemplate the elimination of unfair competition between those in the industry.

If the analyses of the past and present are accurate, there is an economic necessity for lower costs and mechanization offers the best solution to the problem. The problem now becomes one of engineering. From an engineering standpoint the basic consideration in the mechanization of production methods is a proper balancing of capital charges of labor-reducing equipment against reductions in net operating cost which accrue through the use of such equipment and against the possible increase or decrease in the sales realization of the coal produced. The application of this principle is not always an easy task.

Almost without exception existing mines have man-made limitations. The layout and plan of the mine and selection and design of equipment undoubtedly represented good practice at the time the mine was opened, but progress during even the past five years has rendered

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TABLE I.—STATE OF ILLINOIS, SHIPPING MINES, ANNUAL TONNAGES PRODUCED WITH DIFFERENT METHODS OF LOADING, BASIC HOURLY WAGE AND GROSS SALES REALIZATION—1924-1936

Year	Total Production (a)	Hand Loading Tons (a) F	ng Pet.	Mechanical Loading Tons (a) Pet.	oading Pet.	Strip Mining Tons (a)	ing Pet.	Basic Hourly Wage	Gross Sales Realization (b)
1924	67,470,976	64,915,532	96.2	259,584	4.0	2,295,860	3.4	.9375	\$2.27
1925	65,314,834	60,622,746	8.26	1,293,929	5.0	3,398,159	5.2	.9375	2.19
1926	67,836,441	(x)		(x)		3,466,098	5.1	.9375	2.14
1927	44,926,433	(x)		(x)		2,814,024	6.3	.9375	2.16
1928	54,284,184	43,298,013	8.62	6,742,154	12,4	4,244,017	7.8	.7625 (c)	2.00
1929	59,075,995	35,995,126	6.09	17,830,368	30.2	5,250,501	8.9	.7625	1.87
1930	51,996,608	22,526,391	43.3	23,249,881	44.7	6,220,336	12.0	.7625	1,74
1931	43,073,000	14,078,460	32.7	22,445,802	52.1	6,548,798	15.2	.7625	1.70
1932	31,402,399	9,361,515	8.62	15,412,656	49.1	6,628,228	21.1	.6250 (d)	1.53
1933	35,390,677	12,025,455	34.0	17,766,216	50.2	5,599,006	15.8	.6250	1.46
1934	38,655,527	14,047,135	36.3	18,600,174	48.1	6,008,218	15.6	.7143 (e)	1.56
1935	41,410,414	13,272,699	32.0	20,656,366	49.9	7,481,349	18.1	.7857 (f)	1.56
1936	47,285,587	12,095,940	25.6	26,316,418	55.6	8,873,229	18.8	.7857	(x)

Illinois Coal Reports.

Bureau of Mines Reports. Includes local mines as well as shipping mines. 9

Effective September 16, 1928.

Effective August 10, 1932. 0

Effective April 1, 1934. 0

Effective October 1, 1935.

Not available.

TABLE II.—UNITED STATES ANNUAL TONNAGE OF BITUMINOUS COAL PRODUCED WITH DIFFERENT METHODS OF LOADING, AND ANNUAL TONNAGE OF BITUMINOUS COAL MECHANICALLY CLEANED, IN THOUSANDS OF NET TONS, 1927-1936.

	Total Production	Hand L	nading	Mechai		Strip M	fining	Mecha	
Year	Tons	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
1927	517,763	482,885	93.3	16,500	3.2	18,378	3.5	27,692	5.3
1928	500,745	459,397	91.8	21,559	4.3	19,789	3.9	28,783	5.7
1929	534,989	476,841	89.1	37,862	7.1	20,286	3.8	36,799	6.7
1930	467,526	400,702	85.7	46,982	10.0	19,842	4.3	38,800	8.3
1931	382,089	315,595	82.6	47,562	12.4	18,932	5.0	36,172	9.5
1932	309,710	254,252	82.2	35,817	11.6	19,641	6.3	30,278	9.8
1933	333,631	276,238	82.8	37,820	11.3	19,573	5.9	34,558	10.4
1934	359,368	297,146	82.7	41,433	11.6	20,789	5.8	39,827	11.1
1935	372,373	301,549	81.0	47,177	12.7	23,647	6.3	45,361	12.2
1936	434,070								

Compiled from the United States Bureau of Mines Coal Reports.

many methods and much equipment obsolete. The remaining life of the mine must be considered in any program of mechanization. It represents the time over which depreciation of capital investment may be spread. The design and size of the mine car, together with those things the size and design of which are based on the mine car, usually represent the man-made limitations.

A new mine presents an opportunity for the correction of these man-made limitations. There is a choice between the conventional track mines and the trackless mines. together with variations of each. The balancing of the capital charges plus operating costs of the conventional mine with its locomotives, mine cars, wire and track against those of a conveyor or trackless mine is an intricate engineering problem. This is especially true when the size and design of the mine car is limited only by natural conditions of the coal vein, roof and bot-

The development of the small loading machine for use in loading coal onto a conveyor in veins as thin as 36 in. is quite recent and opens up a new opportunity for increasing productivity of workmen in these thin seams. This same combination is finding an application in thicker veins, the roof conditions of which are inferior.

Improvements on self-loading heads for shaking conveyors are being constantly made. At the same time, the drives are being improved. Weaknesses of earlier belt and flight conveyors are being corrected. Special wear-resisting steels are being used.

Universal track-mounted cutting machines are doing splendid work under conditions conducive to their use. The undercutting unit employed in conveyor mining is a greatly improved shortwall machine moved from place to place on a caterpillar-mounted truck.

Until recently, to a large extent, mechanization was confined to those mines having relatively superior natural conditions. This is no longer the situation. Under inferior conditions, costs on hand loading

Establish your identity-mention this publication when dealing with Advertisers.

TABLE III.—STATE OF WEST VIRGINIA MONTHLY TONNAGE OF BITUMINOUS COAL PRODUCED WITH DIFFERENT METHODS OF LOADING, 1936

Month	Total Production	Hand Lo	ading— Percent	Mechanica Tons	d Loading Percent
January	9,680,000	9,307,494	96.3	372,506	3.7
February	10,103,000	9,640,150	95.4	462,850	4.6
March	8,807,000	8,391,621	95.3	415,379	4.7
April	9,443,000	8,017,317	95.0	425,683	5.0
May	8,745,000	8,215,709	93.9	529,291	6.1
June	8,697,000	8,064,972	92.7	632,028	7.3
July	9,488,000	8,800,257	92.8	687,743	7.2
August	9,401,000	8,634,115	91.8	766,885	8.2
September	10,440,000	9,521,157	90.3	918,843	9.7
October	11,528,000	10,409,575	90.3	1,117,425	9.7
November	10,895,000	9,778,183	89.8	1,116,817	10.2
December	11,258,000	10,001,801	88.8	1,256,199	11.2
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Compiled from State of West Virginia Department of Mines Reports.

are higher than those under good conditions. With equipment now available, substantial savings can be made in them as well as in those having favorable conditions.

Past experience and present developments indicate the trend of future mechanization. Several manufacturers are now engaged in the design of a combination machine which will dig coal from the solid face and load it into mine cars or onto a conveyor, thereby eliminating the cutting, drilling and shooting operations. Mine cars of a capacity up to 10 tons have been designed and in one instance are under construction. Diesel-engine powered locomotives are being used in European mines. Recently our own Bureau of Mines has reported on them. This report was not adverse. The use of such locomotives eliminates trolley wire and bonding of rails. Conveyors from face to preparation plant are being found economical under certain condi-Such usage presents the tions. trackless mine. Rubber-tired machine trucks, locomotives and cars are being developed. Cutting machines which are capable of cutting out and gobbing draw slate and bands in the coal vein in one operation, while now available, are certain to be improved in the future. Above all, present construction of equipment embraces the best in design and materials, thereby reducing maintenance.

Mechanical mining usually results not only in loading out of impurities found in the coal vein itself, but also of extraneous materials from top and bottom. Mechanical cleaning becomes a necessity because of this and also because customers demand a product even better than that they received prior to the advent of mechanical loading. The old time tipple is now a preparation plant with elaborate screening, sizing, cleaning, mixing and loading devices. With washing has come a greatly increased amount of knowledge of the physical and chemical properties of coal. This knowledge leads to an improved understanding of customer requirements. Out of this understanding will probably come the making of several different classes of coal from the same mine by mechanical cleaning at different specific gravities.

Perhaps all of these trends can be summed up by saying that the coal industry is definitely heading toward the use of a maximum amount of labor-reducing machinery and a minimum amount of labor. This transition naturally will take place over a long period of time. The battle to maintain a proper competitive position will continue for many years.

NEW DEVELOPMENTS WITH MECHANICAL LOADERS

By G. S. JENKINS

General Superintendent, The Consolidated Coal Co.

This subject which has been assigned to me covers such a wide range that I have picked out only a few of the high points for this paper. The most important phase in the mechanization program at any property is to secure a continuity of coal flow from the discharge of the loading machine.

During the past few years, 50 percent loading time would be considered excellent progress in the majority of coal mines. The remaining 50 percent of time is consumed largely by car changing, with moving of the loading machine, poor face preparation, emergency timbering, etc., taking up a small portion. In an effort to secure a greater loading time during the 7-hour shift, several innovations have appeared. Among these is the use of conveyors for handling the coal from the face, and the adaptation of rubber-tired haulage as used in the strip mines to conditions such as are encountered in the underground mines. Individual papers on each of these two methods have been given, so considerable of this may be repetition.

These installations provide what is commonly known as a trackless mine, and surprising as it may seem, a detailed cost sheet will indicate approximately 5c a ton including labor and material for track laying, at mines not so equipped. Results from the earlier installations indicate an approximate increase of 30 percent in machine capacity or loading capacity. Such an increase in output or reduction in cost offers incentive for such development. I am not going to go into the details of operation in considering the use of conveyors to handle the output from the loading machine at the face, since it has been discussed in previous papers. I am, however, going to outline a few of the difficulties encountered.

Owing to the cost of the equipment, a minimum of units is essential. Suppose we consider an installation incorporating three conveyor units in a loading machine territory. This will enable the rooms to be loaded out several times each shift, and will require "on shift" shooting, which precludes the use of powder or permissible explosives at the present time in the states of Illinois and Indiana. Therefore, other means of

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breaking down the coal must be utilized.

Then again, the absence of track and the greater production on a loading unit make necessary the use of an undercutting machine that can be readily transferred from one room to another, and incorporating high-speed travel across the face while cutting.

Having this in view, the manufacturers have designed a cutting machine truck which travels on caterpillars and utilizes self-contained propelling motors. The initial installation of these trucks has been in service only 60 days but has increased the number of places cut by 25 percent. The cutting machine used was about 15 years old and, of course, was not equipped with a fast feed. This type of truck should, however, prove very handy in a conveyor installation since it may be utilized for dragging equipment and for transporting material. Another available cutting machine incorporates the features of a track-cutting machine while mounted on caterpillars, but no detailed information is available as to the possibilities of this machine. However, our own company has one in transit.

With a conveyor installation it must be realized that the lack of track and a conveyor extending back from the face make it necessary for the units to travel from face to face through the crosscuts. The use of caterpillar-mounted equipment is an ideal solution for this problem. As to other savings possible under this method of mining, the quick extraction from the working room tends toward improved roof conditions. Rooms will be worked out and equipment removed before the air

has had the opportunity to weaken the roof. Rooms in which water is encountered will be eyeled more often and excessive water accumulations avoided.

In utilizing an adaptation of rubber-tired haulage, the same necessity for a mobile cutting machine is encountered. The cutting-machine truck as mentioned above works ideally in this layout. One of the main advantages in rubber-tired haulage is the possibility of having more working faces and the utilization of "off shift" shooting. With this system 10 rooms may be worked by the same loading unit with the trucks dumping into the same convevor. Proposed layouts show two loading machines utilizing the same dump pit, each unit working approximately 10 rooms on each side of the entries. The important thing in a setup like this would be handling of the traffic, as in all probabilities about three semi-trailer outfits are going to be necessary to handle the output of each loading unit. This means six semi-trailer trucks utilizing the same dump pit and all operating in a concentrated area, One difficulty which may preclude the use of this type of transportation is low seams, and excessive water, where a fire-clay bottom is exposed. Timbering methods must, likewise, be adapted to this type of haulage as the important feature is ready entrance and exit for the loading machine.

At the present moment both the conveyor transportation and the rubber-tired haulage from the loading unit are in early stages of development and within the next 12 months the desired detailed information should be available.

EFFECT OF MECHANICAL vs. HAND LOADING ON DEGRADATION OF COAL

By J. G. CRAWFORD General Manager and Purchasing Agent, Valier Coal Co.

"Degradation". I assume, means the reduction of the percentages of those sizes of coal selling at the higher prices, and the increase of the ash content in one or more sizes, the net effect being to decrease the mine run return.

It seems best to base comparison on one coal field, and I shall, therefore, confine my remarks, in general, to the Franklin County field of southern Illinois.

In the November 15, 1915, issue of the Black Diamond appears a paper on "Cost and Revenue of Franklin County Coal," by Mr. John A. Garcia. It is interesting to note that the average revenue on a mine run basis at that time was \$1.07. The average "mine cost." covering labor, material, supervision, clerical, engineering, liability insurance, etc., was 88 cents per ton. The "general overhead," which included depletion, depreciation, interest on investment, selling cost, etc., was 17 cents per ton, making the total cost of producing coal \$1.05. This left a margin of only two cents per ton.

Coal under 2 in, at that time sold for about 60 cents per ton, and coal over 2 in, for about \$1.50 per ton, and, as the mines were then producing 48 percent of coal below 2 in, and 52 percent above 2 in., the average mine run return was about \$1.07.

Long before the advent of mechanical loading the percentage of 2-in, screenings increased from 48 percent to something over 50 percent, at mines having sufficient screening capacity to make a clean separation. By 1927 the percentage of 2-in, screenings was about 52 percent, and those mines which became fully mechanized found that there was a further increase due to this mechanization, and probably 55 percent of 2-in, screenings is a fair average for mechanized mines at present. This leaves about 3 percent increase of coal under 2 in, as the result of mechanization.

Any figures such as I have just stated will be subject to criticism because screening conditions, for example, the method of feeding coal to the screen, pitch, speed and area of screen, materially affect the screenings percentage and have been undergoing changes before, during, and since mechanization.

Also, any investigation covering sizes must take into consideration the fact that operators often control the percentage of screenings by varying the amount of explosives used.

In many cases the operators have been subjected to a further burden as the result of having to divide the coal below 2 in. into six or more sizes, whereas before mechanization it was customary to divide the coal into only four sizes. Any added separation must, of course, be offset by increased selling price and/or the ability to move an otherwise slowmoving size of coal.

I should like to give you the approximate yearly average realization on each size of coal being produced in Southern Illinois, the approximate percentage of each of

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these sizes, the approximate yearly average mine run return, and thus the effect on the mine run return as the result of the aforementioned 3 percent increase in coal below 2 in. in size, but because this information is considered confidential, I am unable to do so. However, I believe we can assume that from 70 cents to 90 cents will cover the difference in realization between coal under 2 in. and coal over 2 in. Thus, in itself, this difference in realization is not enough to warrant a large investment in preparation plants.

The matter of sizes is becoming one of less importance with stokers increasing in numbers. Mr. Marc G. Bluth, executive secretary of the "Committee of Ten — Coal and Heating Industries," stated at the recent meeting of the Illinois Mining Institute that a number of manufacturers of domestic and similar small stokers advocated the use of coal not larger than 1 in. round.

I have considered increase in ash as an element of degradation, in fact, it is often more important than the matter of size which I have just discussed.

Some operators are mechanically loading coals over 2 in. in size with no more ash than when these coals were hand loaded, the only change being an increase of the area of picking tables, thus permitting the use of more pickers. These operators are without doubt very carefully watching the preparation of the coal, especially the undercutting, drilling, and shooting. There has also been little, if any, change in the ash percentage in coal below 2 in, at these mines.

Other operators with less favorable conditions have not been so fortunate.

Every mine is a problem in itself and careful study must be made to determine the most suitable preparation plant to size and clean the coal, always bearing in mind that the object is to increase the margin of net profit. The simpler the plant the better, and often it may be best to avoid making some sizes, and not thoroughly cleaning other sizes in the interest of minimizing investment, operating cost, and time lost due to breakdowns. I recall a district in Wyoming wherein five companies operated. One company persistently took the stand that it would not subdivide the coal below 11/4 in. round. All of the four other companies did so, but in the long run I believe the company which maintained their standard of 11/4 in. round fared the best, certainly by no means the worst.

DISCUSSION ON EFFECT OF MECHANICAL vs. HAND LOADING ON DEGRADATION OF COAL

By H. H. TAYLOR, JR. Vice President, Franklin County Coal Co.

Mr. Crawford defines degradation as the reduction of size of particles of coal and/or the increase in ash content of one or more sizes.

I think this is a very fitting definition and in connection with a comparison of degradation as between mechanical and hand-loaded coal, it occurs to me that there are just two factors in mechanized loading which deteriorate coal loaded in this manner as against coal shoveled by hand, viz., machine action and harder shooting.

The action of the machinery has a tendency to increase the percentage of coal screening out under 2 in.. increases the percentage screened out under 5/16 in. to a greater extent, and creates a considerable amount of additional dust or extreme fine material below 20-mesh, which in addition to adding to the minus 2-in, output of the mine run coal, reduces the quality of this minus 2-in, output by addition of the dust mentioned above. Machinery also has the effect of increasing the maximum size of lump coal produced because of its ability to handle larger lumps than a man can lift. It is also a well-known fact that while hand mining is selective in loading the pure coal as against impurities, a loading machine picks up any material in its path without discrimination. Consequently, it sends to the surface plant more pure rock and laminated material than is received by cleaning plant when handloaded coal is being sent out of the mine.

Our experience indicates that there is some increase in ash in sizes under 2 in, with mechanized loading as against hand loading, although this increase is probably due to a certain amount of added bottom clay or floor material picked up by the machines which the hand loader would carefully avoid. We have not been able to determine that loading machines increase the ash in the coal material alone by any of its actions as against hand loading.

With respect to the factor of harder shooting and its effect upon degradation, I might point out that in our field it is necessary to shoot the coal in a different manner for loading by machines than by hand loading, and it is essential that coal is broken up sufficiently so that no machine time is lost in breaking up extremely large pieces. In hand loading one often sees falls of coal in which large sections of the face are merely "set down," leaving the hand miner to break off pieces with his pick while loading. The type of shooting necessary in conjunction with mechanized loading definitely helps to decrease that percentage of the output screening out plus 3 in., but for some unknown reason seems to increase the intermediary size between the 3-in. and 1/2-in. dimension.

SHEARING AS AN AID TO MECHANICAL LOADING

By F. EARLE SNARR Resident Engineer, Chicago, Wilmington & Franklin Coal Co.

As a preface to my remarks on this subject, I would outline briefly the conditions under which my observations were made and on which the calculations are based. The Orient mines are operated in the No. 6 vein of Franklin County, Ill. This seam is fairly flat, with an average pitch of 1 percent to the northeast, having only local dips and grades. The thickness of the coal runs from 81/2 to 12 ft., with an average of 9 ft. We mine about 8 ft, of this, leaving top coal above a natural parting for protection of the roof slate. We operate both the caterpillar and track type loading machines.

Our workings are projected on the enclosed panel method at both mines. On the advance sections we employ five loading machine units, four of which are assigned to room work and one to entry development at the head of the cross-entry. The four room machines are worked in two panels opposite each other on the cross entry. One loader is placed on either side of a panel and the panel divided into an inner and outer half. The inner half on either side is worked out first with enough pillars drawn to cause a local squeeze. The outer half is then worked, leaving a solid pillar between it and the inner half. Under this method we are able to keep both loaders in the panel until it is completely worked out and move all four machines ahead at practically the same time. The working area for each machine is quite restricted and requires systematic movement of preparation and loading equipment to keep traffic congestion at a minimum. We use track loaders in the advance entry development, becase of their better moving time, where we have from 7 to 11 entries that must be cut and loaded every day in order to keep development in step with the advance of the four room loading units. This method keeps our loading units closely grouped for better efficiency and closer supervision. Our coal is all shot with permissible powder, and the advantages of shearing I shall try to bring out will be limited to the relation it bears to this type of face preparation.

While shearing as well as undercutting are simply aids to better shooting, the proper control of these operations probably has a greater influence over the ultimate success of mechanical loading than any other phase of production, with the possible exception of supervision. When we first introduced loading machines to our mines, like most other operators, our first thought was the production of a high tonnage per unit. As improvements were made in haulage, power distribution, and panel projection methods and the personnel of the loading machine crews became more proficient in their duties, the tonnage gradually came up. Finally it reached a point where it stood still for a time and we realized that any further improvement in tonnage must come largely from stepping up the loading rate of the machine. since the major part of our loading cycle was chargeable to the actual loading of the coal by the machine.

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This would have been a simple matter had we been permitted to ignore the fact that to use more powder and increase our screenings would decrease our final net realization to such extent as to greatly reduce the benefits of mechanization. Our problem then was to hold the percentage of screenings down as close to hand loaded coal as possible while raising the loading rate to within economic limits.

At this time we were undercutting all our coal with shortwall machines. We found that coal shot sufficiently hard to permit easier loading using the old hand-loading methods of drilling and shooting was giving us 10 to 15 percent more 2-in, screenings than we were accustomed to under hand loading. This caused us to conduct some extensive experiments on drilling and shooting practice which resulted in the improvement of the size of the coal and a slight increase in the loading rate. We were still far from the goal we sought.

Our next move was to try shearing of this shortwall coal with the idea of creating additional free face for a better balancing of shots and providing a point of attack for the loading machine. We overhauled two old shearing machines for this purpose. These machines cut a 6-in. kerf and the two machines were able to shear all the places cut by four shortwall machines for four loading units. Having an additional cutting machine moving about the panel added to congestion, but the benefits obtained made their use very much worth while. We reduced the screenings 5 percent and increased the machine tonnage from 10 to 15 percent. These shearing machines require 20 ft. of straight track in making a shear, so will not shear room necks or cross-cuts.

We later used a track mounted undercutter with a universal head which would shear over the righthand rail where it has as much as 20 ft, of straight track, but would not shear cross-cuts and room necks on curved track. This machine cuts a semi-circular face 25 ft, wide and 9 ft, deep, with a 6-in. kerf. The arc-cut gets away from the gripping square corners characteristic of shortwall cutting and permits radial drilling, both of which are beneficial to shooting and loading. The yield of tons per pound of powder used was 50 percent better than in shortwall-nonsheared coal. While the shear cut increased the amount of undercuttings some 30 percent, the elimination of considerable digging and reduction of powder-burned coal about the shot holes resulted in this arc-wall sheared coal containing 7 percent less screenings than the shortwall - nonsheared coal. The loading machines were able to load 25 percent more of this coal and when the track is made ready so as not to delay this machine it will cut and shear 75 per cent more coal than will a shortwall. Of course, part of the increase in loading machine tonnage is due to the increased yield per fall, which is more than 30 percent more than a shortwall cut room, allowing the loader to make fewer moves during the day. If these places were not sheared, however, we would not be able to prepare a suitable grade of coal with powder shooting nor load a reasonable tonnage, so in the end credit for these improved results must be given to shearing. Where this type of cutter is used in development at the head end of cross entries we use the track type loaders and the cutting machine serves but the one loader. On room terri-

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tories we have used three cutting machines to serve four loaders.

We are using another track cutter of the arc-shear type very similar to those described but having additional features which permit shearing from a curved track. This machine is used in entry development and makes an ideal partner for the track type loader, since it shears all entries and cross-cuts alike and permits shooting a grade of coal equal to our best room coal. Our loaders in entry development are among the highest producers, which goes to prove that narrow work is no drawback to quantity or quality in mechanical loading where the places are properly sheared and shot.

The past year we installed two cutting machines which are an improvement over those previously mentioned. These machines have a 9-ft, bar which will cut anywhere from about 1 ft. below to 8 ft. above the track and will shear any place on the face between 21-ft, rib lines. After trying various methods with this machine, most satisfactory results were had by cutting the rooms 24 ft, wide and double shearing. One shear is made 11 ft. to the right of center and the other 3 ft. to the left and gripping to the left about 4 ft. Both shears are made starting from the top and shearing down. This machine cuts a 4-in, kerf. The undercut and two shear cuts make about the same quantity of cuttings as does the undercut alone with a 9-ft, bar and 6-in, kerf and about 17 percent less than a place with a 9-ft, undercut and one shear with a 6-in, kerf.

The second shear cut provides two additional faces to shoot to and permits the use of lighter powder charges. The yield per pound of powder is about one-third greater than arc-wall coal and 100 percent more than shortwall-nonsheared coal. The loader will load about 35 percent more of this than shortwall coal and 10 percent more than arc-wall coal with one shear. The grade of coal produced is equal to the best of arc-wall sheared coal, and the machine will cut 40 percent more of it. One of these cutters will serve two loader units when located on opposite sides of a panel, and the removal of a track unit from the panel materially relieves traffic congestion.

From our experience at the Orient mines, we know that shearing is a definite aid to mechanical loading. It has been the means of reducing our screenings, thereby giving us an increased tonnage of higher priced domestic sizes. It has increased our loading machine capacities and reduced the per ton cost for loading machine maintenance and explosives. In the case of the later type cutting machines it has reduced cutting costs also.

The extra free face created by shearing cuts down the size of powder charges, which in turn reduces the amount of powder shattered roof and ribs, making for safer working conditions and lowered timber costs. Where shearing is used and shooting controlled to utilize all the benefits of shearing it has been found that the product is less powder shattered and will stand transportation shock better. arriving at destination in more nearly the form it leaves the mine, and will not slack so badly in storage. We believe that all the benefits of shearing are not confined to mechanical loading, but rather may be traced to the various stages of tipple preparation and marketing even to the consumer.

LOWERING COSTS BY "RUBBER TIRED" MINING

By J. H. FLETCHER Consulting Engineer, Chicago

We have known that the weak link in efficient mechanical loading has been the inability to adequately serve the loading machine with transportation facilities so as to obtain a greater percent of profitable work from the crew assigned to the loading unit. The tonnage that passes over the loading machine conveyor determines the production The employees are on an hourly wage basis and every minute that the loading machine is idle waiting for cars, or moving from room to room, the benefits from mechanical loading are diminishing.

In seams of 6 to 9 ft. in thickness, accommodating large mine cars and large capacity loaders, the daily production has appeared to be satisfactory when utilizing only a small percentage of the loader capacity. In seams of 5 ft. or less in thickness there is not the allowable clearance to build as powerful loading machines, or as large mine cars. The results—thick seam mines and open pit mining had a decided advantage over the thinner seam mines.

From Saline County, Illinois, there has come a different type of mining. The producing territory in the mine has been cut loose from the restrictions of mine rails or conveyor belts by combination tractortrailers equipped with pneumatic tires of such size that they float the load on the normal mine floor. In bringing out this system the writer and the organization at Blue Bird Mine, apparently, were the only ones who believed that coal could be hauled on the mine floor.

The Blue Bird Coal Company were open pit operators but controlled a large tonnage of coal 50 to 58 in, thick under cover too deep to profitably strip. The underground mining was to start by drifting in from the strip pit. The plan decided on in February, 1936, called for a caterpillar mounted cutting and shearing machine, caterpillar mounted 8 B. U. Joy loader, three storage battery tractors, three bottom dump trailers, a portable transfer station with hopper, feeder, and a belt extending from the transfer station to 70-ton railroad cars operating on the old strip pit track.

The underground development plan was based on drifting in along a 1,200-ft, face from the abandoned strip mine with the rooms worked 90 degrees to normal practice, so that all room breakthroughs were cut, then the room slabbed the full length. With the exception of the caterpillar type cutting and shearing machine, which has not yet been delivered, requiring substitution of two used short wall machines, the equipment went into service on August 11, 1936.

The loading machine was standard equipment of the Joy Manufacturing Company. The 8 B. U. size was selected as best suited for the seam that varied from 50 to 58 in. in thickness. The tractor was a different problem. Our design called for a maximum height of 42 in., a length of not over 96 in., dual pneumatic tires, the ability to handle a 3-ton trailer with an unbalanced load, and primarily, to have a motor, gearing

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and axle that had been tested in industrial service. The Baker Raulang Company of Cleveland agreed to absorb the development cost and bring

out the mine type tractor.

The trailer was quite a problem. The most satisfactory height was a unit of 30 in., with a body having a top, 6 ft, 3 in, wide and 10 ft, 6 in. long. The first attempt at design was along mine car practice. The dead weight was out of proportion to the carrying capacity. Further study of the case revealed that the first assumptions were wrong. The trailer did not have the impact of cars in trips and with pneumatic tires, was free from most of the jars. The weight was reduced to a minimum, gauge material was used for sides and ends, with adequate bracing to secure rigidity. trailers were built from the writer's designs, at the Blue Bird Coal Company shops with the exception of the drop bottom doors which were purchased from the Sanford Day Iron Works, Inc.

The 4-ton capacity hopper, feeder and conveyor frame are specially designed units that can be unbolted in sections and moved within the entries of the mine, and reassembled with minimum labor. These were furnished by the Barber Greene

Company.

The first 30 days' operation demonstrated that the system was sound. The tractor-trailers with dual tires rolled their own roadway, the drivers handled the units within the limits of the entries, around timbering and backed into exact position for loading with speed and accuracy. During loading they followed the movement of the loader nearly perfectly. After nine months of service a duplicate unit has been ordered for August, 1937, delivery, with no major changes in design of the equipment.

Starting with a personnel unskilled in this type of mining (that had been transferred from openpit mining, and handicapped with heavy draw slate to handle that required stopping the loader to remove the slate at the back of the fall), the production from the 8 B. U. Joy has gradually stepped up from 200 to 300 tons per shift, with hour runs of 75 tons when operating on the slab where the draw slate had been removed, so that the loader was not required to stop. The same type of machines loading into mine cars in a neighboring mine produced between 175 and 200 tons per shift.

The second installation went into a mine of the Hart Coal Corporation, Mortons Gap, Ky., and the third installation into the mine of the Moffat Coal Company at Sparta, Ill.

Mr. Brent Hart, president of the Hart Coal Corporation, having previously attempted mechanical loading in competition with the hand loading at the Moss Hill mine and having abandoned two practically new loaders to return to hand loading, naturally studied this system very critically. He ordered a duplicate of the units used at Blue Bird Coal Company mine, the first unit going into double shift operation on March 3. It was immediately followed by unit two and, on the performance of this set up, units three and four have been ordered for fall delivery. The equipment is operating in a 60-in, seam delivering coal into mine cars of 1.4-ton capacity at the rate of 28 tons per man employed, based on coal delivered at the tipple.

Messrs, J. D. Moffat, Jr., and Andrew Moffat were operating 7 B. U. Joy loading machines in a 62-in. coal seam, loading directly into 2ton capacity mine cars and securing 250 to 300 tons per shift. The ad-

ditional equipment placed in the mine consisted of two caterpillar trucks for the shortwall cutting machines, three tractors, three 5-ton capacity trailers, a transfer station. and an automatic battery charging station. The system was placed in service March 17 and after having operated but 12 shifts with the tractor-trailers, with all loading from narrow work, Andrew Moffat produced 413 tons at the rate of 27 tons per man for coal on cars ready to move to the tipple. The ease with which this tonnage was secured in narrow work warrants belief that 500 tons per shift will be secured

from the 7 B. U. Joy loader. It was also found that the tonnage from shortwall cutting machines was stepped up about 30 per cent by being able to move over the shortest route from place to place.

An attractive feature is that the difference between production cost on hand loading and this system of mechanical loading, based on the installations now in service and others estimated, will apparently return the investment on the total cost in changing from hand to mechanical loading in approximately 200 single shifts and proportionately shorter time on double shift operation.

DEDUSTING OF COAL

By HENRY F. HEBLEY

Coal Preparation Dept., Commercial Testing & Engineering Co.

So much has been written regarding the removal of dust from coal that there seems little excuse for additional papers. However, as experience has grown, modifications have been required and therefore it is felt that a short review of the subject may be helpful.

The early attempts at the removal of dust from coal were developed in Europe, especially in Belgium and Germany, where dry coal allowed a considerable measure of success to be attained. Thence the practice spread to Great Britain and the United States.

Practically all the European installations were considered as auxiliary equipment for removing the fine material from the raw coal prior to cleaning. It was felt that existing coal cleaning units, either of the wet or dry systems, did not improve the coal materially when working on the Minus 48 Mesh fraction. Also, due to the very great

restrictions regarding stream pollution, washery water often had to be circulated in a closed circuit. Therefore, the removal of any dust contaminating the washery water was considered beneficial.

In the United States, dedusting developed as a separate process treating coal for dust removal only, in order that a domestic stoker coal or dustless coal could be available. It was soon realized that dedusting alone would not yield a satisfactory dustless fuel. Various modifications and additional treatments were adopted generally consisting of deliquescent salt solutions which were sprayed on the coal in the hope that the hygroscopic properties of the salt would effectually hold the dust to the coal. Later. hot oil sprayed on the coal was used for the same duty.

Recently there have been a number of installations at coal cleaning plants using the dedusters as ad-

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juncts for improvement of the washery water, or as a preliminary treatment of coal that is to be air cleaned.

Roughly, there are three major methods of dust removal: Pneumatic, Screening and Hydraulic. In many cases a combination of the first two, or the last two, is adopted in order to better the efficiency.

Everything considered, the pneumatic system, or a combination of the pneumatic and screening systems, will yield the best results.

Considering the use of an air blast first. All gases moving at a sufficient velocity will carry dust. Many formulae are available for the calculation of the velocity required to support or transport dust of various specific gravities and sizes; but they are only applicable to a limited size range. The Stokes formula has been widely used for determining the terminal velocity of dust falling in air; but it is only of limited application in size range. It is illustrated in Figure 1.

H. O. Croft in the Transactions of the A. S. M. E., 1935, furnished a formula in his paper on "The Calculation of the Dispersion of Flue Dust and Cinders From Chimneys' which gives good results. However, the actual velocities required in practice are as much as six times that given by the formulae, as the dust must be disentangled from the coarser particles of coal, and there must also be taken into account the difference in specific gravity between particles of coal and particles of dust. The screen analysis and the percentage of ash in each size fraction will indicate how formidable a problem is to be solved. Screen analyses vary with the coal under consideration, but Figure 2, showing Illinois coal, will serve as an illustration.

J. M. Dalla-Valle in the Journal Section of the American Society of Heating & Ventilating Engineers (September, 1932) gave the following formulae for the minimum velocity at which a stated size and density of material can be transported:

Let

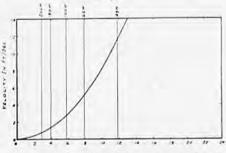
V=Air Velocity in dust in F.P.M. S=Specific Gravity of the particles. d=Average Diameter of largest particles conveyed (inches)

then for vertical ducts:

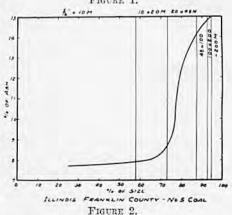
$$V = 13,300 - \frac{S}{S+1}$$
 (d) 0.570

for horizontal ducts:

$$V = 6,000 - \frac{S}{S + 1}$$
 (d) 0.398



Diameter OF PARTICLES (THOUSANDTHS OF AN INCH)



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A study of the expressions will reveal that they are based on the "average diameter" of the particle. Unfortunately, flaky pieces of material which are large in one dimension and small in another will tend to be lifted by the air blast.

It is in trying to treat coal that is high in surface moisture that disappointing results are encountered.

In coal, free moisture is a surface phenomenon, and the moisture present is in proportion to the surface of the coal particles. Fraser, in the Transactions of the American Institute of Mining & Metallurgical Engineers, has stated that in a particular coal minus \(\frac{1}{4}\)" in size, having an average moisture content of 3\%, the moisture contents of the various fractions were as follows:

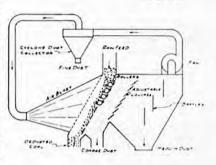
1/4 by 14 Mesh 1.5% Moisture 14 by 28 Mesh 4.0% '' 28 by 48 Mesh 6.0% '' 48 by 100 Mesh 8.0% '' Minus 100 Mesh 12.0% ''

For good results the surface moisture in the dust should not exceed 3 to 4%.

Another drawback in the use of moving gases is the inability to remove completely the layer of fine dust particles which adheres to the coarser pieces. No amount of air blast is successful; but, on the other hand, it furnishes sufficient drying to allow the dust particles to fall away during subsequent handling, causing a concentration in the fine sizes.

In order to overcome the foregoing difficulties, a blast of hot air may be used, or the coal may be heat dried before treatment. Both systems are in use at the present time. It should be remembered, however, that when using heated gases their density is changed, and a modification of the velocity should be made which will take this factor into account. Many pneumatic systems ad-

HUNTER DEDUSTING SYSTEM



Con Deliver System

Lessons Debusting System

vocate a fully closed system. While the continued recirculation of air over the coal for dedusting has the advantage of reducing the dust nuisance, if the coal is at all damp, the air will pick up water vapor until it reaches saturation, causing trouble with recondensation when the temperature drops.

FIGURES 3 AND 4.

As previously mentioned, particles larger than desired are lifted out with the dust fraction. The insertion of an expansion chamber in the gas flow will lower the velocity and allow most of these coarse pieces to deposit. Thus a three product separation may be obtained: dedusted coal, coarse dust, and fine dust.

A common form of pneumatic deduster consists of a series of baffles over which the coal cascades. Air is passed through the material as it falls. Such a type is shown in Figure 3.

Another method allows the feed a free fall down a tube, through which an upward current of air is rising at a velocity sufficient to overcome the gravitational movement of the dust and carry it up and out of the coal stream. The Lessing system is of this type, and is shown in Figure 4.

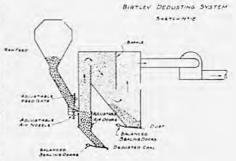
A still further method allows the coal feed to deposit on a ledge in a thin layer, from which it is blown by a strong blast of air. The dust is lifted over a baffle; while the coarse coal deposits in a pocket below the ledge. It is illustrated in Figures 5, 6, and 9.

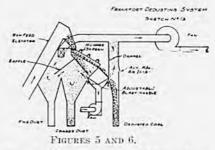
A fourth type depends on a fan rotating in the horizontal plane inside the deduster casing, and as the material spins off the feed plate, air is blown through the falling circle of coal.

The use of screens for dust removal is sometimes adopted; but they are subject to the influence of free moisture to a marked degree. Generally the vibrating type gives the greatest satisfaction; but the screening area should be very generous, and the coal very dry to obtain satisfactory performance. According to Slade and Hirst in



FIGURE 9.





Colliery Engineering (1928) the screening efficiency of 1/16-in. to 1/32-in. coal dust varied as follows:

Free moisture Screen efficiency 0.4% 84.3% 5.0% 17.7%

With sensitivity such as this, even the atmospheric conditions will influence the performance.

Screens find their best application in conjunction with dedusters of the pneumatic type, and two of the most successful installations in the United States are arranged in this manner.

The removal of dust hydraulically; that is, by passing the feed over screens and subjecting it to the influence of numerous sprays which carry the dust away through the screen apertures, has been used in some cases in dedusting plants; and of course there is always some dedusting effect on the wedge wire dewatering screens in use in practically all washeries. Unfortunately,

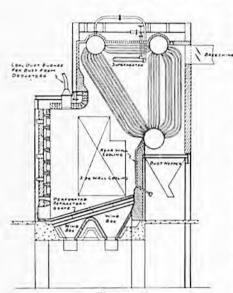


FIGURE 7.

water in the minus 1/1-in, sizes is extremely hard to remove. Capillarity will prevent its being drained to a sufficiently low percentage; therefore, dryers either of the centrifugal or thermal type must be used. Such equipment is expensive and hard to maintain.

In many cases the problem of dust disposal is acute. Those installations which have contracts for its disposal are fortunate; but it is felt that insufficient attention is paid to the use of the dust in the mine boiler plants and drying furnaces.

Two furnaces, shown in Figures 7 and 8, were developed to take just such dust without further grinding or treatment, and burn all that was fine enough in suspension; while letting the coarser particles be consumed on a perforated refractory deck.

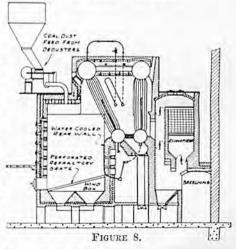
The furnace volumes should be made ample to keep the heat release down and allow the furnace to be of the dry bottom type.

Stokers of the spreader type, with but slight modifications, can be made to handle this material successfully. Of course, if a pulverizer is installed, the results will be similar to other furnaces of that kind; but that is often a major alteration of existing equipment which is not warranted.

In summing up the use of dedusters in the United States it may be said that recently more installations have been made for the removal of dust prior to the treatment of the coal in cleaning equipment. It is becoming an auxiliary to the cleaning plant rather than a treatment of the product itself. Care must be taken in the treatment of wet coal; it should not exceed 4 percent free moisture.

The feed to the dedusting unit should be regular, and the screen analysis of that feed should be as even as possible.

Dedusting, while not entirely removing the problems of washery sludge, will help considerably in the solution. Similarly, in the reduction of a dust nuisance in dry plants. This latter problem is such a large subject that it should form the basis of another paper; but dust collection and dedusting should be studied in conjunction with each other.



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DRYING COAL AT THE DELTA MINE

By W. H. PRICE Delta Coal Mining Co.

A little over two years ago a seven-track coal-preparation plant was completed for the Delta Coal Mining Co. at their strip mine near Marion, Ill., by Link-Belt Co. The plus 3-in. coal is hand-picked on three shaking type picking tables, while the minus 3-in. coal is cleaned in a Simon-Carves wash box, after which it is accurately sized on flexible hanger type classifying screens.

It is the object of this paper to discuss the dewatering treatment and drying of the minus \(^3\fat{4}\)-in, washed coal, and since the preparation plant has been described in a previous paper, we shall confine our remarks to this size of coal only.

During the past winter the Link-Belt Co. has installed a Rhoto-Louvre dryer designed to reduce a rated maximum load of 90 tons per hour of 3/4 in. by 0 coal from 10.5 percent to 4 percent surface moisture content.

Undersize coal from the classifying screens is sluiced to two pairs of 6 ft. by 10 ft. dewatering trays, where water and minus ½ mm. material is removed. Lever-operated gates at the discharge end of dewatering screens permit loading of this size of coal direct to railroad cars or into a 24 in, by 10 in, flight conveyor for delivery to a 10-ton capacity surge bin located ahead of the Rhoto-Louvre dryer.

The Rhoto-Louvre dryer introduced to this country a new method of drying which has been extensively used in Europe. This dryer employs a different method of heat transfer. The heated gases are brought into intimate contact with the wet surfaces of the coal and the water is so quickly vaporized that the coal absorbs very little of the available heat.

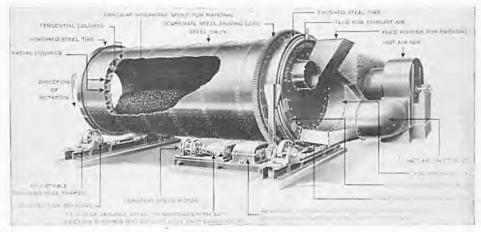
The dryer consists primarily of an outer solid shell and on the inside of same are longitudinal fins or plates with louvre plates fastened to them, so that the inner surface of the drum is entirely made up of these over-lapping louvre plates. This arrangement provides longitudinal channels for the hot gases underneath the bed of material in the dryer, and the hot gases are then passed through the louvres into and up through the bed of material being dried.

A stationary distributor head is located on the feed end of the dryer. The hot gases are admitted through this head in such manner that they can only pass through that portion of the gas channels which are underneath the bed of coal in the dryer. No gas passes through louvres which are not covered with coal. The exhaust gases are also brought out through this head, and the coal is fed into the dryer by means of a screw through an opening in this same head.

A labyrinth seal formed by means of a floating ring running in a groove (half in the stationary head and half in the revolving head of the dryer) seals the leakage of the hot gases at this point.

The dryer shell is 11 ft. 6 in, diameter by 30 ft. long and has a

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The Link-Belt Rhoto-Louvre dryer.

cast-steel tire on each end supported on heat-treated steel rollers. It is driven by means of a gear ring on the drum through a pinion mounted on the extended shaft of a Herringbone Tandem-type reducer. It is provided with a 40-H.P. four-speed motor, so that the speed can be varied to suit the fluctuations in the feed.

The depth of bed in dryer can be varied by means of removable rings in the discharge end. These rings are arranged to make either a 6-in. increase or decrease in the depth of bed. After the dryer is set up and adjusted it is not necessary to change the rings again unless a different size of coal is handled.

The Rhoto-Louvre dryer runs at comparatively slow speeds. When operating at a maximum capacity of 90 tons per hour the top speed of 1.8 R.P.M. is used. The four-speed motor provides changes in speed down to .617 R.P.M. Since the dryer does not cascade the coal, degradation is reduced to a minimum.

Heat is supplied to the dryer at 950° F. from a Bigelow Liptack Hollow-wall furnace. This furnace is provided with special openings in the walls, admitting dilution air so as to bring the gases down to the above temperature. These openings are arranged with dampers so that the amount of dilution air can be controlled.

A by-pass stack is provided for the furnace so that the gases can be by-passed in starting up and closing down the furnace.

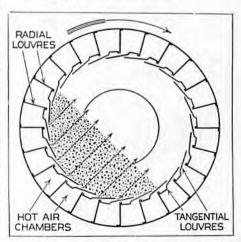


Diagram illustrating flow of gases through bed of material.

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The furnace is fired by the burning of pulverized coal. A Strong Scott No. 20 Uno-Pulverizer capable of pulverizing 2,500 lbs. of coal per hour is provided.

The conveying system is so arranged that some of the dried coal can be passed through a bucket elevator to a storage bin for feeding the pulverizer.

This bin will hold sufficient quantity for a day's run, and can be filled by the elevator in about an hour.

The pulverizer receives the coal from the bin, prepares it and passes it through a blower, into the furnace. It is provided with an automatic feed and a damper in the suction pipe of the blower so that it is very easily controlled. The fire can be lighted by the use of oily rags.

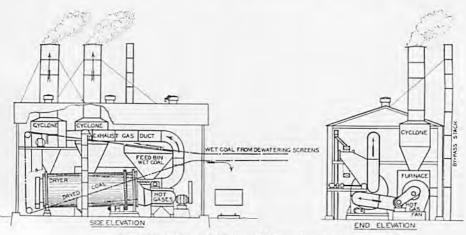
The hollow-wall furnace and use of pulverized coal for fuel makes a unit that is flexible. It can be started easily, and when shut down, cools off readily because there is no fuel bed in the furnace.

The hot gases are drawn out of the furnace, as stated above, at 950° F., through a specially constructed fan with heat-resisting blades and water-cooled bearings driven by a 150-H.P. motor, through a silent chain drive. The ducts connecting the fan, the furnace, and the dryer are provided with expansion joints. The fan and ducts are insulated.

The exhaust gases are drawn out of the dryer at about 175° F, through another fan and are passed through two 12 ft. diameter cyclones, with stacks high enough to pass the vapor-laden gases above the tipple.

A double control is provided which limits the maximum temperature of the input gases. This control is also regulated by the temperature of the exhaust gases. It has been found there is a close relationship between the temperature of the exhaust gases and the temperature of the coal being dried.

If the feed becomes heavy and the bed builds up, it will be noticed that the temperature of the exhaust gases will fall, and also the temperature of the coal. If the exhaust gases continue to fall in temperature due to the thickening of the bed the coal will not be dry. If



Dryer building-Delta Coal Mining Company.

the reverse condition is true, that is, if there is a rise in temperature of the exhaust gases, then the coal will be too dry and will also rise in temperature.

There are two ways in which this change in temperature can be controlled.

One way is that alluded to above, in which the controller on the exhaust gas instrument can be set at whatever temperature works out the best (which in this case was found to be 175° F.), and if the temperature falls below this point. then it will automatically raise the temperature of the inlet gases until the 950° F. limit is reached. This is done by simply moving the damper in the suction pipe of the blower connected with the pulverizer. This controls the amount of pulverized coal delivered to the burner in the furnace. If the reverse is true, that is, if the exhaust temperature rises above 175°, then the inlet temperature of the gases is automatically cut down.

A float, riding on top of the bed of coal, within the dryer, registers by means of lights the actual depth of the bed within the dryer at all times. The speed of the dryer can be varied by the operator to suit the feed rate, so that a uniform depth of bed can be maintained at all times.

With these safeguards it is possible to hold the temperature of the coal from about 120° F, to 135° F.

Some of the advantages of drying coal are:

- 1. Prevention of freezing in the cars in wintertime and consequently making unloading conditions the same all year round.
- The elimination of deductions in shipping weights due to arbitrary allowances of moisture in the coal.
- Greater tonnage of coal per car permissible, amounting to about half a car per shift.
- 4. Improved steaming qualities of the coal due to the saving in B.t.u. of vaporization of the moisture and superheating of same up to the temperature of the flue gases of the power plant.

SOME RECENT RESULTS FROM THE ILLINOIS GEO-LOGICAL SURVEY'S PROGRAM OF COAL RESEARCH

By M. M. LEIGHTON

Chief, Illinois Geological Survey

Since 1931 the Illinois State Geological Survey has been engaged in an expanded program of research on the coals of Illinois. Previous to that time the Survey had concerned itself primarily with the occurrence, quantity, and quality of the coal beds. With changes in specifications for coals to meet new combustion requirements, and with opportunities on the horizon for new and improved uses of coal, it became imperative that the state employ the full powers of science to develop its coal resources.

It has been said by some one: "Tell me what your resources are, and I will tell you what your society is." As we review in our minds the diversified regions of this country, we feel the force of this statement. But I should like to turn this statement another way, and give it a form which has motivated our new program or research. My revision of this statement would be, "Tell me what can be done with your resources, and I shall tell you what your society can become."

Certainly this applies to the state of Illinois and other states which possess enormous quantities of bituminous coals. A much more effective utilization can be made of the coal beds than has been made if we fully understand the properties of these coals and the possibilities that reside in them. If their utilization can be improved and the percentage of recovery increased, the result will also be conservation of

our nation's resources in a very real sense.

OUR PROGRAM OF RESEARCH

Our new program of research was so shaped that it would draw upon the resources of modern sciencethe resources of geology, of chemistry, of physics, of botany, of coal microscopy and the X-ray, and of mineral economics. It also was so shaped that the cooperative effort of the applied sciences of mining and mechanical engineering of the University of Illinois would be employed. It was shaped with a recognition of the fact that no one science is sufficient to meet the needs of industry and of society. Researches today must not only be comprehensive, but thorough-going and creative.

The first step in our new program of research, is research on the physical constitution of Illinois coal.

The second step is research in the chemical constitution of Illinois coal.

The third, classification studies, with reference to rank and type of coal.

Fourth, determination of the resources of coal in the various beds, their geological occurrence, their geographical distribution, their structural characteristics, the conditions affecting ease of recovery, and an evaluation of these resources.

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Fifth, studies of the constitution of the various prepared sizes, particularly those sizes below the 2 in.

Sixth, studies in utilization, including briquetting without a binder, and the preparation of smokeless fuels through coking and briquetting for domestic use.

Seventh, studies in the competitive position of Illinois coal in its market area.

RESEARCHES IN THE PHYSICAL CON-STITUTION OF ILLINOIS COALS

In this study we have taken complete columnar sections of our coal beds from the floor to the roof for the purpose of determining the percentages of those components known in the recent literature as vitrain. clarain, durain, and fusain. The botanical constitution has also been studied in order to throw light on what parent materials entered into the making of the coal beds, what changes have taken place in them, to what extent certain parts of plants have become concentrated because of their resistance, and to what extent variations in the types of coal are related to the original constituents.

A detailed study has also been made of the mineral content of one of the coal beds in one of the large mines in the state to determine what kinds of mineral matter are present, what their distribution is vertically and horizontally, and how they affect the properties of the ash in coal combustion.

Work on the components of Illinois coals has resulted in a better understanding of the nature of these coals and the reasons for variations among them. It has demonstrated that the components vitrain, clarain, and fusain—durain (splint) being an unusual ingredient in Illinois coals—differ in physi-

cal properties and that the preparation processes affect the proportions of the components, considerably modifying the character of the coal produced in the different sizes. The old conception that the various sizes of fine coal were simply different sizes of similar coal is an error. Since they have different combustion properties due to the proportion of components present, it seems probable that the time is near at hand when the percentages of the components will be considered in the specifications.

Careful studies have been made of the extent of segregation effected by gravity and size separation which indicate that there are large unrealized possibilities in producing coals of a variety of definite types from a single bed. Incidentally, various laboratory tests have been applied to concentrations of each of the three ingredients, to determine the characteristic composition of each, and their behavior under a variety of conditions. Proximate and ultimate analyses are available and the results of coking and briquetting tests. Such studies indicate the range of possibility in coal segregation and provide an explanation of the variable behavior of Illinois coals in combustion, which proximate analyses alone will not explain.

Study of the botanical constitution of Illinois coal requires even a more skilled technique and is more refined in its character than the study of the components. This has resulted in an even better understanding of the nature of the differences among the components and an appreciation of the possibilities of utilization residing in the physical heterogeneity of coal. Each of the plant components that contributes to the coal as a body determines to a greater or less ex-

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tent, depending upon its relative quantitative importance, the character of the coal as a whole. It seems quite possible that this is more true of the high volatile bituminous coals such as are characteristic of the Illinois basin than it is of the higher rank bituminous coals in which differences have been more or less obliterated by metamorphism.

Studies of the spore content of the coal of No. 6 bed in southern Illinois are furnishing very definite evidence of the character of the vegetation from which the coal in the different coal beds and in different parts of the same bed was derived. They will probably also eventually provide a means of correlating coal beds from district to district and even from basin to basin.

The study of the mineral matter present in Illinois coals has demonstrated that No. 6 coal bed near West Frankfort contains only three important minerals; calcite, pyrite, and kaolinite, which make up more than 95 percent of the mineral matter. Much of the remaining 5 percent is silica. These studies and later ones made under private direction in an adjacent mine show that in No. 6 coal at least, there are characteristic concentrations of one or more of the three more important minerals from bench to bench, so that the character of the coal and particularly of the ash could be materially modified by selective mining. It is doubtful whether an intelligent understanding of the coal being mined by any mine and of the effect of mixing coals from different parts of the bed and different parts of the mine can be obtained without a knowledge of the distribution of the mineral impurities in the bed.

RESEARCH IN THE CHEMICAL CONSTITUTION OF COAL

Only a start has been made along this line. Proximate and ultimate analyses have been made of the various coal components — vitrain, clarain, durain, and fusain; also a chemical study of the coal ash, and the relationship of the composition of the ash and its fusion point.

A study has also been made of the nature of moisture in coal.

Analyses of the vitrain show very definitely its characteristic low ash content while those of fusain show a high ash content. Vitrain has a lower B.t.u. value, on the mineral matter-free basis, than the clarain or fusain, and its rank index is lower. The B.t.u. value, on the moisture and mineral matter-free basis, is relatively uniform irrespective of the rank of the coal from which it is derived, the unit coal value being about 15,000 B.t.u. in southern and northern Illinois coals alike. Clarain has a relatively high calorific value, believed to be due to the high hydrogen content of the waxy materials which it commonly contains.

CLASSIFICATION STUDIES

Over a long period of years the Illinois Geological Survey has accumulated a large fund of information concerning the proximate and ultimate analyses of the State's coals. This information has been brought together and a classification made of all of the coals of the State, on the basis of the tentative standards recently adopted by the American Society for Testing Materials. As a result, there can be very little uncertainty relative to the rank of any coal produced in the State. Claims in regard to quality can be readily checked.

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It is worthy of note that the basis of classification is primarily that which was advocated some years ago by the late Prof. S. W. Parr. The recent studies in our laboratories have yielded results which confirmed his opinions.

Still more recent studies of the fine sizes of coal produced from the several mining districts, representing several beds of coal, have provided new and reliable information regarding the probable ash and sulfur content in such sizes of coal.

During the past year discovery has been made of an optical method for determining the rank of a coal. A piece of vitrain may be taken from a coal bed, polished, and the angle measured at which light, reflected from its polished surface, is most completely polarized. The device is relatively simple. This method provides a means of mapping variations in rank where coal beds have been considerably affected by metamorphism, without the bother and expense of analyses.

It is now recognized that a coal bed of a given rank may produce more than one type of coal. This is due to variations in the botanical components of the coal. This study, which is being actively pursued, is resulting in a better understanding of the causes producing variations among coals of the same rank and of the possibilities of producing different types by controlling the processes of preparation.

COAL RESOURCE STUDIES

An accurate inventory of the coal resources of the State is being pursued by geological investigations. The extent and thickness is being determined by a study of the field outcrops and an extensive collection of drill records. The variations in quality are being determined by

systematic sampling and chemical analysis.

This information is proved to be fundamental for other kinds of researches and valuable for purposes of selecting areas for future mining.

Maps are also being prepared of those areas where coal of workable thickness lies under shallow cover and can be mined by the stripping method. Several sets of special maps have been prepared showing in considerable detail the position of the outeropping margin of the important coal beds in different parts of the state. These maps considerably narrow down the search for such areas and are proving highly valuable to the stripping industry.

STUDIES OF THE EFFECT OF VARIOUS METHODS OF PREPARATION IN PRO-DUCING DIFFERENT TYPES OF COAL

Reference has already been made to the fact that our studies on the physical constitution of the coal beds of Illinois have revealed that special types of coal may be produced by controlling the processes of preparation. This has been substantiated by a study of representative Illinois screenings during which size and gravity fractions were produced. This work has shown that fairly definite laws control the concentration of the coal components in the various fractions. In some there was a high concentration of vitrain, in other, fusain. and in others, clarain. It was not uncommon to find certain fractions with a vitrain concentration as high as 50 to 60 percent, although the bed concentration was not over 20 percent. There was also corresponding variation in the character and amount of ash. Not uncommonly the ash content of concentrations high in vitrain is below 4 percent, although the ash content of the coal bed is 15 percent.

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UTILIZATION STUDIES

Special briquetting studies along new lines have been conducted, as a result of which it has been found that fine sizes of coal below 1/4 in. may be converted into firm briquets under a certain pressure after heating the coal to a certain temperature for a brief time. Details of this study have already been published and therefore will not be reviewed here, but it should be pointed out that we believe it is now possible to commercially produce smokeless briquets out of any Illinois fine coal, and that the processes for briquetting dedusted dust into smokeless briquets, having a smoke index less than Pocahontas coal, is fairly simple, due to its relatively high content of fusain. Mechanical problems in the large scale production of such fuel are advancing to a solution. The importance of this for the domestic market in cities having smoke abatement ordinances will be readily appreciated. Heretofore, it has been possible through the required use of stoker equipment to control the production of smoke by industries, but not by residences.

A systematic study of the coking, gas making, and by-product making properties of the No. 6 coal bed of Illinois has now been completed, and a report has been prepared. The coking of Illinois coal at West Frankfort for the domestic market is on an increasing scale, and it is believed that these coking studies will materially hasten a more extensive production of coke for the domestic market. Coke production for metallurgical purposes appears to have reached its maximum, but it is believed that in Illinois coke for domestic markets will become increasingly important.

ECONOMIC STUDIES

The addition of a trained economist to the Survey staff in 1931 made possible careful study of the production and consumption statistics of Illinois coal, and the relation of Illinois coal to competing fuels and sources of energy in the energy market. Studies of the competitive position of Illinois coal in the Illinois coal market area resulted in the preparation and publication of a Survey Bulletin (No. 63) under that title in which the relation of Illinois coal to coals from the eastern field, fuel oil, natural gas, and water power is thoroughly discussed with respect to electric utility, manufacturing industries, railways, and domestic market, and the trends and influences determining trends are indicated. There is thereby provided a comprehensive survey of the market for Illinois coals and the influences that have affected it in the relatively recent past and will affect it in the not too remote future. With the completion of this general coal market survey, detailed studies are now being undertaken on the domestic fuel market, giving consideration to the trend of demand for higher home heating standards and the comparative position of bituminous coal, hand and stoker-fired, coke, fuel oil and natural gas in this important market outlet.

SUMMARY AND CONCLUSION

It has not been possible in the time and space allotted to present a complete picture of the results obtained by our coal research. This brief account reveals, I hope, our major objectives in our research undertakings, which is that of accumulating fundamental factual data upon which a more substantial building of coal utilization can be raised. It must be borne in mind

that researches are only part of the service to be rendered by such an organization as the Illinois State Geological Survey. Of undoubted equal importance is the supplying of information to the coal industry and the public, the stimulation of new points of view, and the making known of new and unexplored re-

serves of possible advantage. Through these means, important changes in the coal industry are taking place. A large factor in such success as the Illinois State Geological Survey has achieved is the sympathetic attitude and hearty cooperation of the coal industry of the state.

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BULKHEADS FOR COAL MINES

By JOHN A. GARCIA and SAMUEL M. CASSIDY, Members American Institute of Mining & Metallurgical Engineers

In some districts of the bituminous coal field the problem of constructing bulkheads to seal off water under pressure is becoming increasingly important. Recently this matter has been brought very much to the front by the loss of a large Illinois mine due to failure of a bulkhead that separated it from several old, flooded mines. As this great misfortune has provoked much inquiry about proper bulkhead design, it is felt that a description of the successful and extensive water-sealing practice at three mines that have different natural conditions will be of considerable interest to those connected with properties having a present or future water problem and to engineers that may have to design safe bulkheads of economical construction.

These three mines are the Saxton and Dresser, near Terre Haute, Ind., and the Hegeler, near Danville, Ill. All three have water conditions that make it necessary to

regularly seal off all worked-out sections of the mine, and there are considerably over a hundred bulk-heads in each. As far as the writers know, these three mines are the only ones in the bituminous coal fields of the United States with anything like so large a number of water seals and experience, although a number of other mines are known to have a few bulkheads. More detail will be included herein on the Saxton mine than on the others, as the writers are more familiar with it.

General Mining System

All three of the mines use the same general panel room-and-pillar system, which consists of rooms turned both ways off room entries and a solid block of coal left on all sides of the completed panel except on the cross-entry side, where a heavier pillar is pierced by two entries for haulage and air. On completion of the panel the two entries are scaled and the panel

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is then isolated from the rest of the mine. Owing to water conditions, no pillars are pulled; recovery inside the panel barrier pillars is approximately 65 per cent.

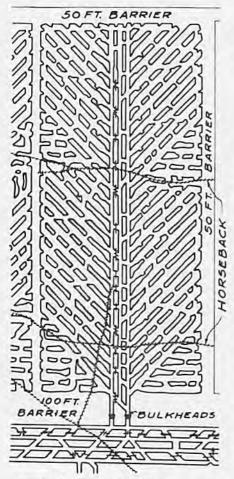


Figure 1.—Saxton typical room panel, showing bulkhead location.

Room entries are generally driven to the line, then the rooms are turned and all are driven simultaneously to their full depth, following which the material is recovered and seals are built. Such a plan affords a maximum tonnage from the least number of rooms and no room territory is open except for a short time. Even with this plan all three of the mines have had serious water breaks that required speedy work in constructing bulkheads. One of the mines has also had sudden inrushes of quicksand, which extended several hundred feet in a few minutes. Fig. 1 shows the typical actual panel as worked at Saxton mine.

SAXTON BULKHEAD PRACTICE

Saxton produces approximately 2400 tons daily, mechanically loaded, from the Indiana No. IV seam, which averages 5 ft. in thickness. Overburden generally ranges from 150 to 225 ft. and is composed of two main divisions; a water-filled bed of sand and gravel from the surface down for 100 ft. or more, then solid strata of variable thickness over the coal, composed mainly of shales, as outlined in Fig. 2. All of the minable acreage lies entirely under the Wabash River valley and this stream therefore keeps the thick gravel bed filled with water to within a few feet of the surface. When the river floods, all of the surface over the mine workings, except at the shafts, is covered with water to as much as 20 ft, deep,

Average thickness of solid cover over the coal in the past has averaged 50 or 60 ft. but rooms have been and now are being driven under solid top as thin as 30 ft. About 900 acres of the mine has been worked out and of this approximately 500 acres is full of water under pressure, most of it around 60 lb. per sq. in. Maximum pressure measured is 72 lb. In panels with unchoked breaks, the gauge reading at the bulkhead has been observed to closely correspond to the known head of the water level and to increase or decrease in proportion to the rise and fall of the river.

Roof over the coal is usually a fairly good gray slate or sandy shale and the floor is a hard, sandy fire clay of variable thickness, usually from 1 to 5 ft., below which is sandstone. Numerous horsebacks and roof slips frequently complicate the location of the bulkheads, and cause

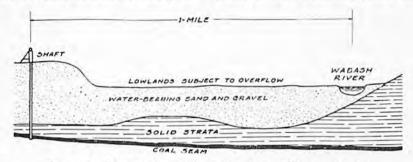


FIGURE 2.—Ideal section to illustrate water condition over mine.

considerable extra expense in construction as well as in heavy timbering on each side.

Where slips are present it is often necessary to cut hitchings much deeper than normal, thereby also requiring more concrete. In some particularly bad cases it has been necessary to construct concrete walls with an arched concrete roof outside of the seal, and several bulkheads have had to be as much as 16 ft. from top to bottom of excavation.

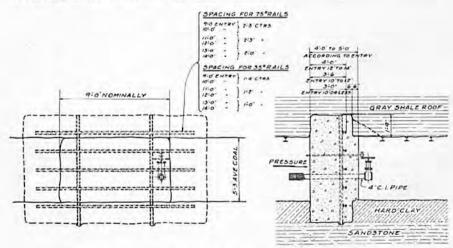


Figure 3.—Design of primary bulkhead formerly used at Saxton.

Two general designs of permanent or primary bulkheads have been used. Fig. 3 illustrates a type in use before 1932. For this, the

hitchings were cut mainly with an old air-driven punching machine, with a low set of wheels for sides and bottom and a high set for the

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top. A pneumatic concrete breaker was used to make the hitch in the bottom.

The design shown in Fig. 4 has been in use since the mine changed from shortwall to track-mounted cutting and shearing machines. The latter made it possible to cut the hitching entirely by machinery at a much lower total cost than with

pneumatic tools, despite the cutting being rather hard on bits.

It is felt that the present type of seal (Fig. 4) is safer than the old design because it gives twice as much support to the roof and has twice as long a distance for water to seep along roof, rib and floor, which are believed to be factors of primary importance. Another ad-

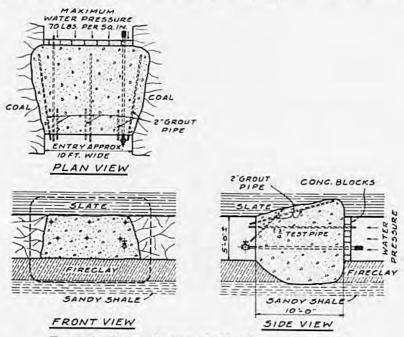


FIGURE 4.—Design of primary bulkhead now used at Saxton.

vantage is simplicity and ease of placing concrete in one solid mass rather than tamping it around steel reinforcing and formwork. Also, it is a type well adapted to ordinary mine labor unskilled in such work.

A concrete block wall is used to close the rear end, because of gas. Both walls are built together and when the ventilation is stopped the two entries are sealed simultaneously, so that gas will not back out, as it would through ordinary wooden forms.

To seal territories where there is no apparent likelihood of a water break, and where the cross-entry will be sealed again outby within a few months to a year, a secondary, inexpensive type of bulkhead is used. Because of the layout of the mine, with most panels turned off advancing entries with a number of years of life, it has not been possible in the past to construct many of the secondary seals, but now some of the cross-entries have been developed to the boundary and panels

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are being mined on the retreat, so the use of temporary, low-pressure seals has increased. This seal (Fig. 5) is not intended to hold water under much pressure but is merely a safeguard against a sudden break when the cross-entry is not yet sealed outby. If a break should come within a territory containing only secondary bulkheads, a large pump would be connected immediately to try and hold down the

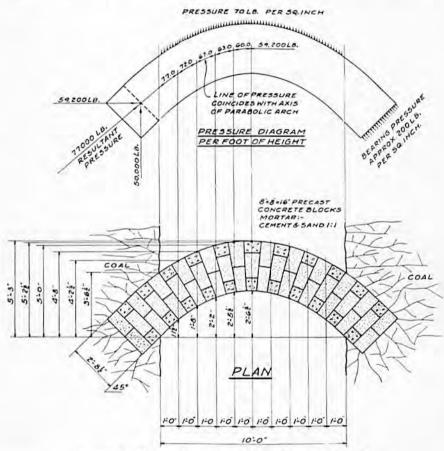


FIGURE 5.—Design of secondary bulkhead in use at Saxton.

pressure while a primary bulkhead was being constructed.

Secondary bulkheads have been built in several different ways, of poured concrete, concrete blocks and brick, in both straight and curved shapes arched against the pressure side. Because conditions are not the same at different sites, it has been difficult to determine which is the least expensive. In present practice, the seal is often of poured concrete where track already exists, so that the mixer and material cars can be brought up close, and of interlaced solid concrete blocks where track is not laid or there is close timbering. In actual

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practice the concrete blocks are laid to a simple radius. Not much of a hitching is made at top and bottom if they are hard and unbroken.

Another interesting type of bulkhead with an emergency floodgate is shown by Fig. 6. This design was developed to protect the mine from possible water inrush in panels that are being driven under solid top with thickness down to 30 ft., possibly less. Special portable wood forms are used for the concrete, which is reinforced by rail bars across the top and slots arranged on the inside to make a good bond when later filled with concrete. The seal is also grouted and provided with both drain and test pipes. The door is built up of 2 by 4-in, timbers nailed together on the wide side, with hot tar spread between and four long, heavy bolts to tighten all the boards. Hinges are simple hooks, so that the lowered door can be pulled snug against the concrete. Eyebolts at each corner draw the door tight and through them it is wired to upright rail pieces, which can be quickly inserted and wedged into slots in the concrete. Ties and cap pieces are placed between the rails and wooden doors, as braces. The closed door could be caulked if necessary and would provide a back form for pouring concrete to finish the seal.

On the entry side the track and wire would have to be cut to lower the door; on the air-course side the door could be lowered merely by removing props, the vertical rail braces being already in place. The bulkhead opening at the haulage entry is 5 ft. high by 8 ft. wide and the air-course opening is 4 by 7 feet.

It is the practice to timber the roof for 20 ft, or more on each side of the Saxton bulkheads, depending on the conditions. As a rule the timbering consists of 60-lb, rail bars on 4-ft, center set into each rib for about 2 ft., in holes 9 in, in diameter, placed with a hitch drill. The space between bars is lagged with 5-ft. lengths of 3 by 5-in, ties treated with zine chloride, which have been used in track, or with light junk rail. All of this is wedged tightly with cap pieces. Where track is not available or it is not desirable to use the hitch drill, the bars are supported on treated legs of which the minimum diameter is 6 in. Cribs are often built of old, mechanically injured, treated ties, especially at wide places adjacent to a breakthrough or cutoff. Heavy timbering is usually necessary where horsebacks (more or less vertical clay veins) are present or there are slips in the roof.

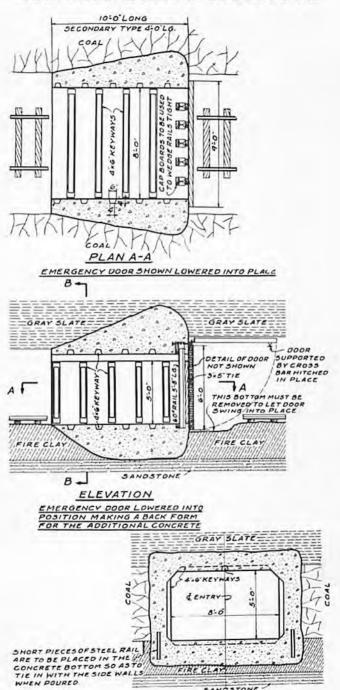
There have been places where the clay veins and slips were so bad that it was necessary to construct concrete walls and a reinforced arched roof for as much as 32 ft. in front of the bulkheads. Portable steel forms are used. Water sometimes comes out of slips several hundred feet from the flooded area. Arches are grouted in the same way as the regular bulkhead. Where only secondary, or short-life, bulkheads are required, the timbering is usually composed entirely of ordinary props and cribs of untreated ties split by spiking.

Saxton barrier pillars ordinarily are 100 ft, thick where bulkheads are to be located, with a chain pillar 23 to 56 ft, thick between the seals.

Dresser Bulkhead Practice

Dresser mine produces about 2000 tons daily from the Indiana No. V coal seam, which averages 4 ft. in thickness and has 3 or 4 ft. of a seamy, black, slate roof,

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SECTION B-B

FIGURE 6.—Emergency flood door, haulage side. Secondary type is only 4 feet long.

above which is sand shale. The fireclay bottom is from 3 to 5 ft, thick and is underlain with sand shale or poor limestone.

Average cover over the mine is around 200 ft., with normally 80 ft. of solid over the coal. The mining territory lies under the Wabash River valley and the general relation is practically the same as shown in Fig. 2. Although Dresser has thicker average solid cover, the nature of the main roof is apparently not as strong as Saxton, and water breaks are nearly always experienced with less than 60 ft. solid top over the workings.

The Dresser permanent or "highpressure" bulkhead design is shown by Fig. 7. This is used to seal off main sections of the mine, such as cross-entries, on which all of the room panels are finished and sealed with secondary bulkheads.

In making the excavation, a series of holes 12 in. in diameter is placed by the hitch drill and squared up with a pick, the black slate top is brought down with light shots and then trimmed with a pick, while the bottom clay is lifted by use of a pneumatic concrete breaker.

A feature at this operation is the mixing on the surface of sand, gravel and cement in a dry state, by means of a regular concrete mixer and storage plant built for that purpose. This is loaded into the steel mine cars, which are immediately taken inside to the bulkhead and shoveled into forms, while water is added and the whole mass treaded and tamped thoroughly. Advantages of dry mixing are claimed to be better and faster mixing; less equipment in the mine; one shoveling operation direct into the forms, except for the upper quarter, which has to have water added in a mortar box before being thrown in; less

expense and faster construction after pouring is started. Length of time before the cement would seriously lose its effectiveness is set at 5 hr. for standard cement and 2 hr. for quick setting.

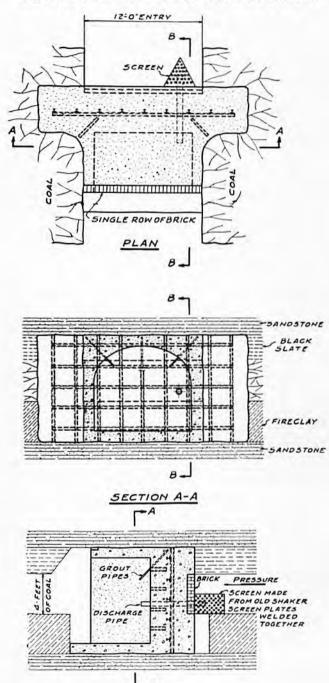
After the concrete is all poured and as much as possible rammed into place at the top, the last step is to blow grout through the pipes provided for that purpose, so as to fill the space over the top and the voids in the concrete. An air-driven piston pump is used to force the grout under pressure; before an air compressor was acquired, the same blower was run by water pressure from drainage pumps.

Dresser secondary or "low-pressure" bulkheads are practically as shown in Fig. 7, but thinner and without the arch. They are not grouted and hitches are not as deep -sometimes only coal-seam height. This type is used to seal room panels that eventually will be sealed again ontby on the cross-entry by the permanent type. The natural conditions at Dresser are quite difficult and the over-all dimensions of the primary bulkhead are large, This permanent design of bulkhead has a very pleasing appearance and has given entire satisfaction. Ordinarily, maximum pressure is 70 lb. per sq. in., but 84 lb. when the river is at flood stage and 90 lb. maximum recorded when pumping mine water behind the seal.

HEGELER BULKHEAD PRACTICE

The water condition at Hegeler is different from that previously described, as it is reported to consist of a 4 ft. water-bearing gravel bed about 70 ft. uniformly above the Illinois No. 7 coal seam (average 5 ft. 8 in. thick) and with 30 ft. of more or less impervious clay and subsoil above the gravel. The wa-

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ELEVATION B-B

Figure 7.—Design of Dresser primary bulkhead.

ter, therefore, is confined to this gravel, and is said to produce artesian wells in some places. This is further borne out by the fact that one or two of the panels have a pressure of 53 lb. per sq. in., which corresponds to a water head higher than the total overburden. Normal pressure is around 40 lb. per square inch.

Hegeler has such a bad roof of variable draw slate and shale that entries are driven only 6 ft. wide, and even then it is necessary to place crossbars almost skin to skin, with thick lagging above, Even with this narrow width, falls will continue upward indefinitely unless timbered. The roof apparently deteriorates rapidly after exposure to air. Because of the bad roof, the shafts, shaft bottoms, main haulage entry and main air course are all lined with concrete, arched top and side walls. The bottom is fire clay, reported to be 5 ft. thick, that swells considerably when wet.

All the coal is hand-loaded. The mine produces about 550 tons daily, in a 4 to 5-hr. shift, the output going to bins in an industrial plant.

Fig. 8 shows the standard plan of bulkheads. As a rule the arch and walls are built ahead of time and are the same in cross section as along the main entries. A crew of men is kept solely on concrete work.

In constructing the Hegeler bulk-heads, full advantage is taken of the swelling nature of the clay. Bulkheads and walls are not sunk through the floor clay, as the management states that the clay swells so tightly that it is impervious and that there is no danger that it will be washed out. An interesting feature is the use of the clay to seal the top of the bulkhead. Clay for this purpose is tamped in place in a moist condition, as, if put in dry,

it swells too much, when water is absorbed, and cracks the concrete arch. There were several visible instances of this cracking.

Another interesting detail is the use of a wedge-shaped manhole, which is almost necessarily left in the bulkhead so that the back end can be properly tamped. After the seal is complete the manhole is plugged with concrete.

All mixing is by hand inside the mine on mortar boards, and hitchings are made with picks. Sand and gravel are a good washed grade obtained from near-by commercial pits.

Construction Details

As the location of future bulkheads is generally known ahead of time, it is advisable to narrow the entries as much as possible for a distance each side of the site. After the developing entries have been driven a sufficient distance past the location, it is usually highly desirable to break the track and cut the hitchings, especially the bottom, This practice is common at Dresser and Saxton, where usually the base is poured before the track is relaid, while at Hegeler the arch portion is built ahead of time. At Saxton it is also customary to build the air-course bulkhead up to onethird or one-half the total height of the entry, so as to have that much work ready ahead of time. In such work it is well to roughen the top surface of the concrete, to leave short pieces of metal sticking out, and to make slots in the top, all for the purpose of providing a good bond for the new concrete. Where combination cutting and shearing machines are available (and the strata can be cut) the advance preparation of hitches is both quick and inexpensive.

Although every mine has conditions requiring different depths of hitchings, the essential point is to carry the concrete into solid, strong material and to remove all loose pieces before placing the concrete. It will also be necessary to blow out with air or flush with a water hose

all the surface of the excavation, so that no dust or slime will prevent the concrete from making good contact with the solid surface.

A paste of cement and water, painted over all the hitching surface, if not bleeding water, long enough ahead of time to dry, is be-

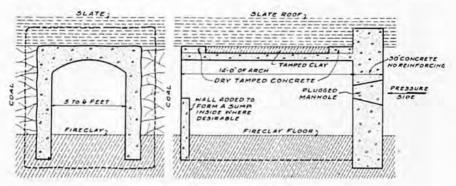


FIGURE S .- Hegeler standard bulkhead,

lieved to help in making a better bond between the concrete and natural strata. Often the excavation is wet, and it may prove difficult to keep water entirely out of the bottom. In such a place, it is best to spread a few sacks of cement over the bottom just before starting to pour concrete.

Proper proportioning and mixing of gravel, sand, cement and water are essential to avoid a leaky seal. General rules for waterproof concrete construction will apply. Dresser uses equal parts of 11/2 by 1/4-ingravel and 1/1-in, sand to make a 1:21/2:21/2 mix. Saxton uses practically the same, but buys the sand and gravel already mixed. This material should be a good grade, washed and sized. In pouring, a simple way in which to check against segregation and too much water is to use the regular slump test with a cone. Good concrete practice, as recommended by the

cement manufacturer's association, will well repay the effort of constructing waterproof seals that will not cause future trouble when the pressure builds up against them. With limited height, width and the bulkhead accessible only from one restricted side, it is much harder to follow good practice underground than on the surface. Close supervision is required until the crew is thoroughly trained and considerable study is necessary of the particular conditions at each property.

Grout used is a soupy mixture of 1 part cement to 2 parts sand. "Celite" in the proportion of one gallon per bag of ordinary cement is useful to reduce shrinkage and make a tight seal. Formerly a Ransome pneumatic grout blower was used at Saxton, but in present practice an air-driven plunger pump is used, modeled after the one at Dresser. Objections to the pneumatic blower

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were its slow speed and the compressed air that blew into the seal with the grout, and consequently had to come out again, making it harder to fill all spaces.

If bulkheads leak water through the concrete or around the edges, holes can be drilled and the porous places filled with the grout. Sometimes it is necessary to finish on pure cement or quick-setting cement. The grout pump can be constructed to give almost any desired pressure, although from 75 to 200 lb. per sq. in. is sufficient in the cases cited. This pressure is enough



FIGURE 9.—Typical timbering at Saxton primary bulkhead.

Bottom portion had been poured several months ahead of top part. Note small test valve and pipes used in grouting.

to force cement through fissures in the coal, floor or roof for a surprising distance. Care must also be used in timbering in front of the bulkhead, as the pressure has been known to force down large slabs of slate and to break 70-lb. rail crossbars.

At least two pipes, besides those used for grouting, should be placed to each set of seals; a small pipe about 3/4 in. in diameter, with valve

and nipple for gas testing, and water-pressure measurements with a gauge, and a large pipe of 3 to 6 in. diameter fitted with a strainer inside and a gate valve outside. The large pipe is very useful when it is desirable to pump mine water into old workings to get rid of it or to pump water out of a panel in which there is a roof break that is admitting water in large quantities; the pressure can be kept down on a

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partly or newly finished bulkhead while the pour is completed, grouting finished and concrete is setting. All three mines have had such instances. The kind of pipe needed will depend on the nature of water and the life of the property. None of the three mines described has acid water, although there is slight corrosion, and cast-iron pipe, acid-resisting alloy-steel pipe and plain steel pipe have all been used.

After completion of bulkheads and timbering in front, date boards should be installed for the fire bosses' daily inspection, entry or bulkhead number signs hung up, and brattice lines built to sweep the air past each seal in mines that have gas. The most permanent and inexpensive air deflectors at Saxton have been thin galvanized iron or zinc sheets bolted to light steel straps hung from the crossbars, or



Figure 10,—Concrete arch in front of Saxton primary bulkhead.

Because of bad roof slips and horsebacks. Note timbering and grout pipes.

nailed to a center row of treated legs. Dresser and Saxton are gassy, Hegeler is not.

Entries leading to bulkheads should have walkways kept open and drained so that the fire bosses can make careful inspections. If seep water does not drain away naturally, sumps and ditches should be installed or a suction line laid. It pays to do all such work in a substantial manner, depending naturally on the life of the mine, to avoid future maintenance, which is apt to be expensive.

BULKHEAD DESIGN

Proper design of the bulkhead is important, but no more so than a careful study and adaptation to the particular nature of the roof, floor, coal, mining system and location of the seals. If these factors were not so important, it would be possible to design a simple bulkhead of reinforced concrete, 18 to 30 in. thick for pressures up to 80 or 100 lb. per sq. in., which would be amply safe. However, the failure of bulkheads nearly always is more likely to be through the roof, floor or ribs

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than from actual collapse of the dam itself.

As the strata next to the bulkhead generally offers the shortest and easiest passage for water, it is consequently the point of greatest possible danger unless amply supported, and unless the hitchings are cut deep enough into the unbroken, solid material so that there is no chance for the water to fracture, soften, wash out or erode next to the seal.

Usually the roof is the greatest source of danger, if it is not supported on each side of the seal. Unless the top is exceptionally strong, it should be timbered for a distance



Figure 11.—Emergency floodgate, air-course side.

of 20 to 40 ft. each side of the seal, to prevent falls that eventually might expose the roof directly over the bulkhead and cause it to fracture and ride across the concrete.

If the floor is of clay or any material that will soften when damp, it is highly important to sink the bulkhead hitching through to a solid stratum. Failures in this regard, as well as from the roof over the seal, are known to have occurred.

As far as the ribs are concerned, the hitching should be sunk into them sufficiently to be well into the solid, unfractured coal. The exact size of hitches is a matter for each installation.

Pillars of sufficient thickness should be left in which to place the seal, so that there may be no chance of subsidence within the panel to affect the bulkheads or the area immediately around it. Water

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under pressure will seep through several hundred feet of solid coal, or clay bottom, or some kinds of roof, and with a thin pillar there is an increase in leakage.

The actual design of bulkheads offers varied problems, and although figures help a great deal in some types, common sense and experience must also be used.

For the plug-type bulkhead (Fig. 4), calculations are hardly neces-

sary. It is simply a solid mass of concrete poured in a wedge-shaped plug, the strength of which is probably greater than that of the surrounding stratum.

The parabolic arch-type bulkhead (Fig. 5) lends itself more readily to calculations. If the external pressures are known, the internal stresses may be obtained fairly closely by the ordinary analysis of a two-hinged arch. No re-



Figure 12.—Saxton emergency flood door, haulage-road side.

straining action was assumed at the supports in the case illustrated, as it was feared the coal would break away if subjected to a bending moment. It is desirable to have the line of pressure coincide closely with the axis of the arch. The pressure at the base of the arch shown in Fig. 5 is probably too high for the coal to sustain safely; but the base may be spread until a safe bearing pressure is obtained.

Another type of bulkhead (Fig. 3) might be classed as a reinforced concrete slab, to which ordinary rules of design apply. Light mine rails were used for reinforcing, be-

cause they are usually on hand at most mines. Regular reinforcing bars are desirable, because they afford a better distribution of steel and, consequently, a better design.

BULKHEAD CONSTRUCTION COSTS

Costs vary with each installation, but the following are believed representative:

At Dresser, two pairs of secondary or low-pressure seals have been recently completed; one pair of 420 cu. ft. at a total cost of \$298, or \$19.12 per cubic yard; the other pair of 533 cu. ft., \$324 total cost, or \$16.39 per cubic yard.

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TABLE 1.—COST OF FOUR PRIMA	ARY BULKHEADS IN	1933
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Material:		Cost	
12 sacks quick-setting cement @ 95¢	4	11.40	
	*	641.44	
933 sacks standard cement @ 68%¢		4.10	
10 sacks lime @ 41¢		2000	
1000 large brick @ \$5 per M		5.00	
188 cu. yd. sand @ \$1.05		197.40	
184 cu. yd. gravel @ \$1.25		230.00	
15,940 lb. 60-lb. rail @ \$15 per ton		119.55	
6-in. Tonean iron pipe		13.30	
6-in. galvanized valve		43.87	
Total material			\$1,266.06
Labor:			
183 shifts bottom labor @ \$4.571/2	\$	837.23	
23 shifts top labor @ 4.20		96.60	
Total labor			933.83
Total labor and material			\$2,199.89
Contents of seals			
Cost per cubic yard concrete \$ 11.91			
Total average cost per seal\$549.97			

A pair of primary seals recently built cost \$1260, or \$16.52 per cubic yard. The volume was 2044 cu. ft. This set was built under worse conditions than normal, as costs usually run from \$12 to \$15 per cubic yard of concrete, with a total cost of \$1000 to \$1300 per pair.

Details of cost on one set of four primary bulkheads (Fig. 7), built in 1933 with labor and supply rates then applying, are interesting and show which items are included and which are not (Table 1).

Saxton costs on primary type bulkheads (Figs. 3 and 4) have been as given in Table 2. Total cost of all bulkhead work, including maintenance, arches and adjacent timbering, has been \$0.015 per ton of coal hoisted, from 1922 through 1935. Cost of eight secondary seals at Saxton, built in 1934, was \$9.32 per cubic yard, and \$114.72 total

each. These were all built under good conditions, so it is believed that the cost will be close to \$150 each under average conditions and present prices.

Detailed cost of two primary bulkheads (Fig. 4), built in 1935,

TABLE 2.—COSTS OF PRIMARY BULKHEADS AT SAXTON

Yea	ır	Average Cost per Cu, Yd.	Average Cost per Single Bulkhead
199	26		\$401.85
195	27		543.51
195	28		612.93
19:	29		484.57
193	30	. \$9.51	495.41
193	31	. 9.71	394.66
193	32	. 9.10	308.26
193	33	9.05	323,33
193	34	. 8.29	257.58
193	35	8.29	314.79

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typical except for concrete block forms on both ends, is as shown in Table 3.

At present price of materials and labor, the same pair of bulkheads is calculated to cost \$710.86, or \$9.83 per cubic yard.

No figures were available at Hegeler, although the management believed the seals to cost approximately \$700 per pair.

ACKNOWLEDGMENTS

The writers wish to thank the following for assistance in gathering data for this paper: Mr. Arch Cross, Superintendent, and Mr. Wright Gaston, Assistant Superintendent, Dresser mine; Mr. James Dubois, Superintendent, Hegeler mine; and especially Mr. William Trommer and Mr. A. Pietrowski, Allen & Garcia Company.

TABLE 3.—COSTS OF TWO PRIMARY BULKHEADS AT SAXTON IN 1935

Material:		Cost		
66 cu. yd. concrete mix gravel @ 70¢	\$	46.20		
382 sacks cement @ 53.5¢	1	204.37		
5 cu. yd. grout and mortar sand @ 90¢		4.50		
293 solid concrete blocks @ 8c		23.44		
90 ft. 2-in. dia. pipe @ 0.1735¢		15.61		
24 ft. 1¼-in dia. pipe @ 0.1028¢		2.47		
12 ft. 4-in. pipe @ 63¢		7.56		
4-in. gate valve		9.30		
4-in. strainer		1.30		
1¼-in. stopcock		1.47		
Total material			\$	316.22
Labor:				
Cutting and cleaning hitchings	*	30.61		
Building forms and timbering		41.17		
Pouring concrete		151.50		
Grouting		50.40		
Total labor				273,68
Total labor and material			*	589.90
Total volume				
Cost per eu. yd \$ 8.16				
Cost per bulkhead \$294.95				

PROCEEDINGS OF ILLINOIS MINING INSTITUTE FORTY-FIFTH ANNUAL MEETING

Held in Springfield, Illinois FRIDAY, NOVEMBER 5, 1937

MORNING SESSION 10:00 O'clock A. M.

President Jenkins: The meeting will please come to order.

This is the forty-fifth anniversary of the Illinois Mining Institute. Probably some of you do not know it is that old, but it is.

The secretary has called my attention to the fact that there are a number here who have not as yet registered. During the day and between the meetings we hope you will register and also secure your banquet ticket at the same time. It will be appreciated.

Inasmuch as we have a late start this morning, he is not going to make any formal attempt to discuss the affairs in general as affect the industry. We will take up the program and first carry out the business requirements as provided for in the by-laws. Then we will take up the regular program.

Under the by-laws, the first item is the reading of the minutes. The minutes have already been printed in the year book, and a motion to dispense with the reading will be in order; the Chair will entertain such a motion.

A Voice: I so move.

(Which said motion was duly seconded and unanimously adopted.) President Jenkins: The second report is that of the Executive Board. The Executive Board is not to make a formal report, but we do want to mention the activities and splendid work done by some of our Committeemen.

The Advertising Committee in particular has done a mighty good job. Those of you who really want to appreciate what was done last year can just refer to the year book, and you will see the result of their work. There are more pages of advertising in the year book this year than any previous year. We were so well pleased with the work done by that Committee that we re-appointed them for a second year, and no doubt they will do equally well and we hope even better than they did last year.

The Membership Committee has also been active. I was asked to make a brief statement. The secretary's report will indicate that the membership is larger at the present time than at any previous meeting. Consequently, they should be entitled to full credit.

We are not going to ask for formal reports from several of the other Committees but will take up the question of the reports of the officers now. The only individual to report under that head will be your Secretary-Treasurer. We

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would like to have you pay more or less attention to that, because you will find we are not only in the position of having the largest enrollment in our history, but he will inform you that we closed the year at a profit and that the financial condition of the Institute is in good shape. Mr. Schonthal.

Secretary-Treasurer Schonthal: I would like to announce, in connection with Mr. Jenkins' statement, that the membership of the Institute when I left Chicago on the first of November was 597. When I say 597, I mean 597 paying members. Of course, included in that are thirty-five life members, who by the way numbered twenty-five a year ago. Through Mr. Jenkins' efforts we secured ten life members in the past year. Our honorary members number three or four. I think with those thirty-nine added to our regular membership we have 597.

I might say for your information that last night ninety-nine registered, which is the largest we ever had register the night before the meeting began.

The affairs of the Institute are in very good shape, I think. You might be interested in these figures—there are not many of them.

We had in the bank at the close of the year, October 23, 1936, \$1,477.77. We have in the bank at the close of business on November 1, 1937, \$2,646.61, with all bills paid, showing a profit for the year of \$1,168.84.

We have in addition to that, one Chicago, Burlington & Quincy Railroad Company Bond, \$1,000; we have one Missouri Pacific Railroad Company Bond, \$1,000; we have six United States Treasury Certificates of \$1,000 each, \$6,000; or a total of \$8,000. So that the quick assets of the Institute are about \$10,646.61.

About the only thing I have to say is that we have had quite a few things up during the year. We have some things lined up for the coming year which we were not able to get at this year. The secretary has been busy lately, but I guess maybe I can stand it. I want to thank everybody I did call upon for the ready help which they gave me. I appreciate it very much.

President Jenkins: You have heard the report. What shall be done with it? A motion that it be filed is in order.

A Voice: I move we accept the report.

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

President Jenkins: Now we come to the Committee reports. We have only one Committee report to receive at this time, and that is the Auditing Committee. We have other Committee reports, but they will be taken up a little later in the session. The secretary will read the Auditor's Report.

Secretary Schonthal: The Auditor's Report is the same as the financial condition which I read to you, and it is signed by W. J. Austin, D. H. Devonald and H. A. Treadwell.

(Which said Report of the Auditing Committee is in the following words and figures, to wit:)

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REPORT OF AUDITING COMMITTEE November 5, 1937

Balance in Bank October 23, 1936 Receipts 1937	\$1,477.77 5,581.95
Total eash	\$7,059.72
Balance in Bank November 1, 1937 Less Cash in Bank October 23, 1936	\$2,646.61
Profit for year 1937	

The foregoing is found to be correct:

W. J. Austin, Chairman,

D. H. DEVONALD,

H. A. TREADWELL,

Auditing Committee.

Bonds Owned by Illinois Mining Institute

One-Chicago, Burlington & Quincy Railroad Co	\$1,000.00
One—Missouri Pacific Railroad Company	
Six -U. S. Treasury Certificates, \$1,000 each	

President Jenkins: What is your pleasure regarding the report of the Auditing Committee? Is it moved it be made a part of the minutes?

A Voice: I so move.

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

Secretary Schonthal: I have a letter from John E. Jones, Chairman of the Committee on United States Bureau of Mines Appropriations. Among the activities of the Institute on the boat this last summer, there was a resolution adopted to appoint a Committee to take some steps to assist in securing the necessary amount of funds for the Bureau of Mines Safety Division—I think that is what it is called, isn't it, Mr. Herbert?

Mr. C. F. Herbert: Yes, sir.

Secretary Schonthal: There was an attempt to, and I do not know whether they did, cut down the appropriation considerably. John E. Jones, T. J. Thomas and F. S. Wilkey were members of the Committee. Mr. Jones was unable to attend this meeting, and sent this report to me. I will read it:

(Which said report was in the following words and figures, to wit:)

REPORT OF COMMITTEE ON UNITED STATES BUREAU OF MINES APPROPRIATIONS

November 5, 1937.

The Illinois Mining Institute:

Your committee upon U. S. Bureau of Mines appropriations acted at once as authorized in the June meeting, 1937, in an effort to prevent contemplated reduction of

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Federal funds for the Safety Department of the Bureau of Mines. The committee contacted our United States senators from Illinois, state and national labor leaders, and others whom we considered would be of assistance. Replies were gratifying.

The contemplated reduction in finance was changed and the Safety Department of the Bureau of Mines is functioning normally.

Report in detail will be furnished your secretary for printed publication.

> John E. Jones, Chairman, T. J. Thomas,

T. J. Thomas, F. S. Wilkey.

President Jenkins: You have heard the report of the Special Committee of which Mr. John E. Jones is Chairman. What is your pleasure? That it be accepted and filed? Is there a motion to that effect?

A Voice: I move that be done.

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

President Jenkins: There is no unfinished business, and now we come to new business.

Mr. Reed desires to make an announcement at this time.

Mr. Frank Reed (State Geological Survey, Urbana): Mr. Jenkins and Gentlemen of the Illinois Mining Institute: I came over this morning with Dr. Leighton. When we got here, he said he had found it was impossible for him to attend the first part of this meeting and asked me to make an announcement. Whether he has gone out to look for Prosperity or Relief, I don't know.

However, he wanted me to call to your attention the fact that some few years ago, about six years ago, the State Geological Survey started upon a program to increase research work. Your former President, the late Mr. Zook, was very desirous at that time that work be done upon the coking properties of Illinois coal. That program was put through the Legislature in 1931. After about five years, we are glad to make our first report in the form of our Bulletin No. 64, which is in the hall for distribution. If any of you are interested in obtaining this Bulletin upon the coking properties of Illinois coal, with a description of the domestic coking plant at West Frankfort, we will be glad to give you that Bulletin and would like for you to leave your name with us on a card there so that we do not duplicate.

There is also a pamphlet on a short talk which was given before the Short Course in Urbana last summer in regard to the chemical aspect of coal utilization. This short pamphlet deals particularly with the part that Illinois coal will probably play in furnishing synthetic motor fuels when our petroleum reserves die out. That is also there for free distribution.

I thank you.

President Jenkins: I thank you, Mr. Reed, for arranging to have those pamphlets here.

Mr. Reed: They are in the hall right now.

President Jenkins: I think Mr. Bristow has something he would like to present.

Mr. James Bristow (Illinois Reciprocal Trade Association, Belleville): Mr. President and members

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of the Illinois Mining Institute: For the past three years I have been working with the Illinois Reciprocal Trade Association in Belleville, and, as I believe some of you know, our work has been directed principally toward the competition of competitive fuels with coal. We have had the whole-hearted cooperation of the State, the Mines and Minerals Department, and the Geological Survev, but at times we run across situations in the administration of State affairs that seem as though the State Officers themselves were not educated to the Mine Industry.

We have a very fine program today, and I do not want to encroach upon the time of any of the speakers, but there is one situation I want to call to the attention of this organization for such action as this Institute might take, and it is the matter of suggesting a policy to the Governor. The State Highway Department is erecting a building down at French Village, which as you know is right in the heart of the Belleville District, the district of a hundred mines where there are about 5,400 miners employed.

In looking over the plans and specifications for that building the other day, I found that there is a provision for a gas fired boiler. Here is a State building going up within two miles of operating mines and where there are just mounds of coal suitable for such use which can be bought for just what-have-you. You probably know more about that than I do.

I talked to the engineer in charge of the building, who told me that the architect for the State Highway Department was a gas-minded individual, and it was their intention to proceed right on with their gas installation in this building, and they would probably build others for which they would specify gas.

In talking with stoker people who have tried to sell this job, we find that this particular building would use, if stoker equipment were put in there, in excess of two hundred tons of coal a year, and at prevailing gas rates into that district the State would probably lose about \$2,000 per year, or would pay \$2,000 more for gas heat than they would for coal which could be used right from that area, or obtained right in that area.

I believe that this Institute should go on record protesting that policy, and asking the Governor in the future to instruct the State Architect and the architects for the various departments that Illinois buildings should be heated with Illinois coal.

I thank you, gentlemen.

President Jenkins: A committee will be appointed a little later on to give the matter referred to by Mr. Bristow due consideration.

I believe Mr. Weir has something he would like to bring to the attention of the Institute.

Mr. Paul Weir (Chicago): Mr. Chairman, in accordance with the provisions of the by-laws of the Illinois Mining Institute, I would like to propose an amendment to Section 3 of Article III. It is my understanding that no action can be taken in such a proposal at this meeting, but that it is filed with the secretary and will be voted upon at the June meeting.

Secretary Schonthal: That is correct.

Mr. Weir: The specific proposal is that the following replace Section 3 of Article III in its entirety:

"The President, Vice-President and Secretary-Treasurer shall be elected by ballot, annu-

ally, at the regular November Meeting, and shall hold office for the ensuing year.

"Four Executive Board Members shall be elected by ballot, annually, at the regular November Meeting and shall hold office for the ensuing three years.

"To make effective this change, at the regular November Meeting in 1938, in addition to the four Executive Board Members who shall be elected for the three year term, there shall also be elected by ballot eight other Executive Board Members, four for a two year term and four for a one year term."

The intent of the proposal is to place the term of office of the elective Executive Board Members at three years, and then to elect four members each year.

The present practice is to elect the entire Board of twelve members annually.

While nothing is said in the proposal about limiting the term of office of the Executive Board Members to a single term, there is a feeling among a number of members with whom I have talked that the best interests of the Institute may lie in changing the Board a little more regularly—that is, change the members of the Board a little more frequently—than it has been done in the past. I think if such were done it would give more of the members an opportunity to serve, and undoubtedly would contribute much to the work of the Institute.

President Jenkins: Thank you, Mr. Weir. A motion to place this in the secretary's hands for action at the June meeting of the Institute is in order. Do I hear such a motion?

A Voice: I make such a motion.

President Jenkins: We have heard the motion. All in favor indicate by saying "aye".

(Which said motion, having been duly seconded, was unanimously adopted.)

President Jenkins: The secretary has several communications he would like to read before we take up the next order of business.

Secretary Schonthal: We have a letter and a wire from our loyal member, Eugene McAuliffe, who had hoped to be here. He says:

"Regret exceedingly inability to be with you today, my letter third. Best wishes for a most successful meeting."

We have a telegram of greeting from Henry Hebley, of Chicago, another member.

We have a wire here from our good friend and past President, George McFadden, who says:

"As much as I would like to be with the old gang tonite and tomorrow, my better judgment dictates that I had better forego this year's meeting. My sincere wishes to you and all officers for the swellest meeting ever."

I have an announcement here that Mr. William R. Chedsey, who has just recently assumed the Directorship of the School of Mines, Rolla, Missouri, who is with us today, and who is now a member of the Institute and also president of the Coal Mining Institute of America, brings the good wishes of that Organization, and invites anyone who might be able to attend their Annual Meeting in Pittsburgh to do so. I am sure, Mr. Chedsey, all of us who can be will be there. I have attended the meetings myself and have always had a good time.

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That is all of the communications. but I would like to make this announcement. The authorities in Springfield have become tough on parking, and it has been suggested that the members be advised of it if they do not read the signs. They have one hour parking out here and two hours parking over at the White House. Mr. Wills is taking it up with the Chief of Police, but has not been able to get him to change that. He did suggest this, that Jackson Street from Fourth to Fifth has unlimited parking, and Fourth and Fifth Streets from Jackson to Cook has unlimited parking. They have a habit here if you are there too long of pulling your machine in, and you have to pay the fellow who pulls it in the same price as you do these fellows who buy up tax warrants. If you have your car along, you had better get it in an unrestricted section.

President Jenkins: Is there anyone who has any other business he desires to bring up at this time? If not, we will proceed to the next order of business, the election of officers. In connection with that, we have a Nominating Committee that has been appointed, and we will hear their report.

Secretary Schonthal: The report is dated October 11, 1937, and is as follows:

Terre Haute, Indiana October 11, 1937

REPORT OF NOMINATING COMMITTEE

The three members of the Nominating Committee of the Illinois Mining Institute have unanimously agreed to the following men for the positions as shown, for nomination

at the annual meeting in Springfield, Illinois, on November 5, 1937:

OFFICERS

President: H. H. Taylor, Jr.

Vice President : Paul Weir

Secretary-Treasurer: B. E. Schouthal

EXECUTIVE BOARD

R. L. Adams
W. C. Argust
Charles F. Hamilton
Carl T. Hayden
M. M. Leighton
James McSherry
Fred S. Pfahler
C. J. Sandoe
L. D. Smith
T. J. Thomas
Louis Ware
W. P. Young

Very truly yours, Jas. S. Anderson Chairman

John E. Jones George C. McFadden

President Jenkins: You have heard the Nominating Committee's report. What is your pleasure? Any nominations from the floor?

A Voice: I move the report be accepted.

President Jenkins: The motion is made that the report be accepted. Is there a second to it?

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

President Jenkins: That completes the business requirements, and we will now proceed to that part of the program that brought

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us here, and that is the program itself.

The Chairman this morning does not need an introduction to a great many of us. He has been outside the State for a few years, and possibly some of the newer members are not acquainted with him. I would like to say at one time he was President of the Institute. For a great number of years he was General Superintendent of one of the largest and most progressive coal mining companies in the State of Illinois, the Madison Coal Corporation. He is now Superintendent of the Saxton Coal Mining Company, Terre Haute, Indiana. I refer to Mr. James S. Anderson. We will turn the meeting over to Mr. Anderson. who will conduct the program, Mr. Anderson.

Chairman James S. Anderson: Mr. President, and Members of the Institute, I have found through many years that in the introduction of someone on the platform they generally select all the nice qualities about him and like to tell about them. I think in this case there must be some mistake. Last night I came in at five o'clock, and find my reputation is better known as a traffic policeman at Fourth and Madison. Some of you will probably remember that, and that is the outstanding reputation your Chairman has.

Now, this program is quite an important program, and I am sure that we all want to hear it and all

want to get the full benefit out of it. We want to make it just as short and snappy as we can. We do not want to take too long. We want everybody to have an opportunity to enter into the discussions. I have always tried to figure out about costs, and I find most of the papers here are fundamentally dealing with costs. I always try to figure out how cost is so low—I mean so high and tonnage so low. I presume after the papers have been read we will all find out something.

The first speaker on the program is Mr. C. F. Herbert, Superintendent of the Safety Engineering Department, Bituminous Casualty Corporation, Rock Island, Illinois, That will be a slant from the insurance point of view, I am sure. Mr. Herbert's dad we all know very well. He has been connected for a long time with the Bureau of Mines. and has been an active worker in the State and in the Institute here. This is a chip off of the old block, and we are very glad to initiate him and introduce him to the audience of the Institute here, and I believe after we are through we will all be better off by his being here. With that introduction, Mr. Herbert.

Mr. C F. Herbert (Supt. Safety Engineering Dept., Bituminous Casualty Corporation, Rock Island): Thank you, Mr. Anderson and all. My talk today is "Mine Management's Responsibility in Safety."

MINE MANAGEMENT'S RESPONSIBILITY IN SAFETY

By C. F. HERBERT

Superintendent Safety Engineering Department, Bituminous Casualty Corporation, Rock Island, Illinois

The American people as a whole have in the past and still do take a great deal of pride in their various accomplishments, yet little regard is given to the utter wastefulness of accidents and accidental injuries. This fact is quite pronounced as is indicated in the recent figures published by the National Safety Couneil which show that all walks of life contribute more or less to the huge accident toll. Incidentally, this fact is also true in practically every industry and is more pronounced in our own mining industry. Figures published by the National Safety Council for the year 1936 indicate the mining industry is still sharing honors for last place with the logging and lumbering industry. This standing has been essentially the same since any statistics have been compiled by the National Safety Council. The mining industry in Illinois, while as a general rule is quite aggressive with respect to modernization, is yet still taking the path of least resistance by accepting the theory that as long as there is a mining industry, there will necessarily be mine accidents. This particular theory may be factual only so long as it is believed. There are, of course, exceptions to this trend of thought and in those few instances definite progress in accident prevention has been accomplished. These exceptional organizations in which there has been progress accomplished are really in the minority-in fact, they are the

pioneers in mine accident prevention work. They have demonstrated quite conclusively that an organized effort must be established and perpetually maintained in order to attain a satisfactory result in the elimination of accidents.

The responsibility of the safe operation of any mine rests largely with the managing personnel of that mine or group of mines and it is first necessary to have this personnel sold on the basic principles of safety before any definite progress will be made. It has always been the management's problem in the past to formulate the various plans for development of the property which should effect production at the least possible cost or by maintaining the utmost efficiency.

Rather than discuss the humanitarian viewpoint at this time, because we are all familiar with the disastrous results that usually follow mine accidents, it will perhaps be better to refer to the actual losses to the industry from a monetary viewpoint, since most operations are conducted for the express purpose of making a reasonable profit and not just to give employment to a group of workmen. Some wellknown authorities on accident prevention have, after considerable study, indicated that for every major injury there are twenty-nine minor injuries, which may or may not involve loss of time, and 300 noinjury accidents in which no apparent loss was sustained by reason of these accidents. There enters into this particular picture the fact that there is a hidden cost of accidents which ordinarily does not appear as the result of any particular accident.

It might be well to indicate some factors entering into the hidden cost feature. A very good example and a common one would be the wreeking of a motor trip in which the motorman or trip-rider or possibly both were either seriously or fatally injured. There will necessarily be considerable work expended in restoring the haulage to again allow the transportation of coal, including possible retimbering, straightening and aligning the track, rebuilding wrecked cars and motor, all of which costs money. If all rolling stock or the track is not properly taken care of, some defect caused by the first wreck may be responsible for additional wrecks or trouble which would effect a loss in production. Wrecked motor trips have precipitated coal dust explosions effecting the entire mine and a large number of employees.

This hidden cost usually amounts to approximately four times the amount paid for compensation and medical care. Assuming, then, that the hidden costs should enter into the compiling of accident costs, then it is well to arrive at the cost of accidents by a reasonable deduction. In referring to the accidents reported and recorded in the Illinois Annual Coal Report of 1936, there were 93 fatal accidents that occurred in the mines in Illinois. The average coal mine fatal accident in Illinois cost approximately \$3500 per case; hence, we have the sum of \$325,500 expended by the industry on fatal accidents alone. In further reference to the coal report, there were 3165 mine accidents reported. From past experience it is known that only

compensable cases are reported, and that the ratio of non-compensable to compensable cases averages about 10 to 1, and in some cases much greater. With this fact in mind, we may deduce that there have been approximately 31,650 coal mine accidents during the year 1936. Over a period of years, it has been definitely determined that the average accident cost in and about Illinois coal mines amounts to about \$100 per case. This cost naturally takes into consideration all fatal and serious accidents as well as the many minor injuries that are reported. With this experience in mind, the cost of Illinois coal mine accidents may be definitely demonstrated. Assuming that the number of accidents that have occurred and the cost per case are correct, we may then demonstrate that the cost for compensation and medical care for injuries during 1936 amounts to approximately \$3,165,000, or to refer to cost per ton mined, it will amount to about 6.1 cents per ton of coal mined in the State during that period. If we were to include the aforementioned hidden costs of accidents as a factor, and it certainly should be considered, then the cost to the industry would amount to the appalling sum of \$15,825,000, or 30 cents per ton of coal mined. Since these figures seem rather extravagant, it would perhaps be quite worthwhile to consider the responsibility for such staggering losses or costs to the industry and devote some time to analyzing the cause.

It might be interesting to note that the rates for coal mine compensation insurance are on the whole compiled as rates for any type of insurance such as fire, automobile, etc., on the basis of loss experience. The loss ratio of the entire industry is also to some extent taken into consideration in establishing the va-

rious coal mine rates. Consequently it is extremely desirous that all coal mine operators in the state strive to better the accident experience in order to establish lower insurance rates.

In the average mine, both large and small, it is still quite necessary for the various mine inspectors or company safety engineers to continually bring to the management's attention certain major or minor infractions pertaining to the State Mining Laws. Perhaps the most notable of these failures are the lack of adequate supervision and inadequacy of sufficient ventilation, the absence of necessary timbering or roof control, and the poor maintenance of haulage. There is no question but what executives in any mining organization, inclusive of the president of the organization, mine superintendent and the various mine foremen have been delegated the authority to see that these essential factors pertaining to mining are properly executed. Surely if the most flagrant violations of the mining law effect the safe operation of the mine, then it is reasonable to believe that the other mining laws are likewise being ignored and are contributing no less to the production of accidents. If it were not for the fact that inspectors and other safety engineers were busily engaged in correcting or attempting to correct such violations of the law. much more of their time could be given to training by educating the individual foremen and miners in mine safety. The predominance of violations perhaps could be excused if there were not specific state requirements for all mine managing personnel, but since there are certain definite requirements, and one of which is to have a thorough understanding of the mining law, then such laws should be adhered to, since these various laws have been brought into existence by reason of accidents that have occurred in the mines of our State, and certain minimum requirements have been established to eliminate insofar as possible any recurrence. The foregoing statement does not apply only to the Illinois operations but to mining operations in practically every State in the Union, Hence, it is quite obvious that it is a national problem to comply with the various regulations set forth in maintaining the minimum requirements of the safe operation of the mine.

If the attitude of the mine management in establishing a safety organization or accident prevention program is taken as a matter of course, and the interest manifest by the various mine officials is not too sincere, then the results obtained from the organization will be in direct relation to the effort expended. Consequently, very little progress toward eliminating accidents will be made.

There are several principles that any coal mine executive, whether he be president of the company or face boss, should believe in. First—that accidents can be prevented if determination and effort to do so is expended along that line. Second—that mine safety and efficiency are synonymous and by having efficiency there will necessarily be a safe operation.

Miners will cooperate whenever they are convinced that an operator is sincere in placing his own house in order. Safety is simply the result of organized cooperation and eternal vigilance. Sincerity and frankness are vital to every operation, and it should be particularly expressed in placing responsibility for any accident that might occur. Safety is as much a part of every boss's duties as the production of coal, and he is responsible for the safety of those whose work he supervises.

Perhaps it would be well for any operator or mine foreman to take stock of his own particular organization to see whether or not he is actually giving every effort that is necessary to establish a safe or efficient operation.

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Chairman Anderson: You have all heard Mr. Herbert's paper. The object in reading the paper, of course, is not just the reading of it but to bring out some point that really connects itself with your own operations and which will be helpful in the carrying out of some of the principles in safety that influence cost. I want everybody who can to get into this thing, and as soon as you are through we will start on another paper. We do not want to make it too long.

If any of you gentlemen have anything to discuss, I am sure Mr. Herbert will be more than glad to do the best he can to answer you properly. The meeting is open for discussion.

Let's hear something, now. I am sure Mr. Herbert would like to have somebody get up and say something about the subject. Let's hear something that might help us all. We are all interested in safety, more or less.

A Voice: I would like to ask Mr. Herbert if there is a trend downward in insurance cost which would tend to decrease values in Illinois mines.

Mr. Herbert: The general trend is downward, because of the increased interest on the part of the various mine managements.

Chairman Anderson: Any other member have anything to say? I presume from the quietness of the audience we are all quite safe. I do not want to restrict the time at all for any of you gentlemen who want to talk. Anyone else now? If you are all through with this paper, we will proceed with the next.

"Present Day Mining Accounting," by Mr. John W. Broadway, Auditor, Bell & Zoller Coal & Mining Company, Chicago. I am sorry I do not know the gentleman. I know almost everyone else, but not Mr. Broadway. If he is here and will come up, I will introduce him.

Mr. Broadway is the Auditor of the Bell & Zoller Coal & Mining Co. That is quite an important part of the coal industry in the State, one of the large operations. I am sure Mr. Broadway knows something about mine accounting.

Mr. John W. Broadway (Auditor, Bell & Zoller Coal & Mining Company, Chicago): Thank you, Mr. Anderson. Mr. Chairman and Members of the Illinois Mining Institute, the subject of my paper is "Present Day Mining Accounting."

PRESENT DAY MINE ACCOUNTING

By J. W. BROADWAY

Auditor, Bell & Zoller Coal & Mining Company, Chicago, Ill.

To fully discuss this subject would require quite a lengthy paper as well as include matters that may not be of interest to many of you here today. For these reasons, I have confined my paper to that phase of accounting that is performed at the mine and the local mine office.

In the past ten years we have seen many changes in the methods of coal mining. These changes, together with new legislation affecting the industry enacted in the past two years, including the National Bituminous Coal Act of 1937, have presented many problems to the accounting department, in order to make the accounting methods and practices fit the situations as they arise. The changes in the methods of mining have affected the manner in which costs are assembled to properly reflect any savings that may be de-The new legislation has rived. affected the manner in which the payroll records are assembled. The Social Security Act imposes severe penalties, if records are not maintained that will truly and clearly reflect the proper amount of tax to be collected as well as paid under the Act.

My practical experience in coal mine accounting has been confined to the Bell & Zoller operations, therefore I would like to explain our methods of accounting to you. Our operations present some variations in methods of mining and types of mines. The two mines at Zeigler and the one at Centralia are deep shaft mines and fully mechanized. The two mines at Peoria are

slopes, one mine is partially mechanized and partially on hand loading, while the other is all on hand loading.

Our present system of accounting is flexible enough to meet these different mining methods and types of mines. The reports and forms are so standardized that they can be used at any of the mines, thus reflecting a saving in the supply cost for this department. The general books are kept in our Chicago Office, where all the financial statements are compiled. The detailed accounting is done at the local mine offices, therefore, these records must coordinate. Where more than one mine is operated, as at Zeigler, a central office is maintained to handle the payrolls and accounting for these mines. The centralization of this work minimizes the personnel and increases the efficiency.

I will discuss our payroll, cost statement and compensation departments:

PAYROLL

Recent statistics show that coal mining is the highest of labor costs in a sales dollar, being 65.9%. A competing industry, oil refining, is the lowest, being 6.2%. Labor costs, plus taxes in connection therewith, plus compensation insurance, often amount to 70% of the total production cost. The payroll, therefore, must be given a great deal of attention. Precaution must be used in the methods of compiling it to guard against costly errors and dishonest practices.

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The payroll form is a sheet lined for forty names and columned for the employee's check number, name, occupation, hours worked by days (or in case of hand loading, daily tonnage) total hours worked or tons loaded for the pay period, rates of pay, gross carnings, deductions (itemized as to the nature of the deduction) and net earnings. Each payroll sheet is balanced separately and a recapitulation is made to obtain the grand totals.

The information for the payroll is gathered in the following manner: Each foreman is required to keep the time for the men over whom he has supervision. He is provided with a time book, which has spaces for the employee's check number and name, the hours worked each day, the rate of pay and occupation, This book is of a convenient size so that the foreman can carry it in his pocket for reference at any time during the day. He retains this book in his possession until the end of the pay period at which time it is turned in to the central office, where it is checked with the payroll. This book is then left at the central office as the original record of entry. For the daily postings to the payroll, the foreman fills out a daily time sheet in duplicate. This sheet shows the employee's check number, a description of the work performed, hours worked and rate of pay. One copy of the time sheet is given to the timekeeper at the mine daily, who posts it to a general time book. The timekeeper in turn sends the general time book to the central office periodically throughout the pay period, for posting to the payroll. The periodical posting to the payroll is necessary where daily issues are made against the employee's earnings. The second copy of the same sheet goes to the cost department. Any discrepancies found when

checking the foreman's time book against the daily postings are called to the attention of the foreman and satisfactory adjustments are made before the payroll is closed. This helps to eliminate errors on the employee's statement.

A payroll supplement sheet is used to compile the deductions which are known as daily issues. This sheet is columned for the nature of the deductions by days and is so lined as to coincide with the payroll to facilitate the posting of totals to the payroll after the supplement is balanced at the end of the pay period. Deductions such as the Old Age Benefit under the Social Security Act and the Union check-off, are posted direct to the payroll, as they require only one posting for the period.

A separate card called the Earning Card is made for each employee. This card shows information necessary for the Social Security Act. such as: The employee's earnings listed for each pay period, the amount of tax collected and the days worked. The earnings are carried forward and balanced, so that the Social Security Form S. S. 2-A, which is the report of each employce's earnings quarterly, can be quickly and accurately compiled. The total amount of the earnings as shown on all the S. S. 2-A reports must balance with the grand total of taxable earnings as shown on form S. S. 2, which is a recapitulation of the monthly returns, form S. S. 1. For this reason, it is very essential that this record be accurate. The earning card is also used by the compensation department in compiling average annual earnings of employees who are injured. It is also used for reporting employee's earnings to the Internal Revenue Department for Income Tax purposes.

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The payroll check and employee's statement is combined and perforated, so that the employee may detach his statement and retain it for his records.

COST STATEMENT

The cost statement is in the form of a daily report and is for the use of those in charge at the mines. To make this statement valuable and answer the purpose, it must be detailed sufficiently to reflect the costs of the different phases of the mine operations. This is especially desirable to determine any gain in efficiency or reduction in costs due to changes in methods of mining, and also to give the operating executive a finger-tip control daily of the several departments of the operations.

The daily cost statement is divided into twenty-one general accounts:

- 1. Yardage and Deadwork
- 2. Face Loading
- 3. Cutting
- 4. Drilling and Shooting
- Haulage
- 6. Underground Power
- 7. Tracklaying
- 8. Timbering
- 9. Ventilation
- 10. General Underground
- 11. Hoisting
- 12. Power Generation
- 13. Preparation
- 14. General Top
- 15. General Safety
- 16. R. R. Tracks, Cars and Engines
- 17. Storage Coal
- 18. Electric Cap Lamps
- 19. Supervision
- 20. Engineering
- 21. Office and Clerical

These general accounts are subdivided into sub-accounts that pertain to the general headings. For example, the general account of Face Loading is sub-divided into:

> Hand Loading Undercut Coal Conveyor Loading Operating Loading Machines Maintenance of Loading Machines Clean Up

You will note that these subdivisions are general enough to cover different methods of mining.

The charges to these accounts are separated as to Labor and Supplies daily and month to date. They are classified under three headings:

> Fixed Charges Operating Cost Non-Recurring Expenses

Fixed Charges are those which we commonly term as overhead and those daily charges that are necessary to keep the mine in operating condition, whether it operates or not.

Improvements, new equipment or rehabilitation work, are classified as Non-Recurring Expenses. The cost of all such work is first estimated and a request is made to the Board of Directors for their approval of the expenditure. If it is approved, a work order is established, and all expenditures are charged accordingly. They are distributed on the cost statement to the proper account under this classification.

With the Fixed Charges and Non-Recurring Expenses segregated, the Operating Cost should reflect the efficiency of the operations as well as any gain or loss due to changes in operating methods.

Future costs over a given period of time based on an estimated tonnage can be determined by applying

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the following formula, providing the same degree of efficiency is maintained:

Fixed Charges

Tonnage

plus Operating Cost per ton plus:

Non-Recurring Expenses

Tonnage

Equals Production Cost Per Ton.

In addition to the general costs, there is provided on the daily cost statement spaces for Sectional or Machine Costs.

A daily issue sheet of the supplies used is furnished by the Warehouse Department. This sheet details the items, the unit price and the accounts to which they should be charged. I might say that the idea of centralization is again used in our Warehouse Department. The Zeigler and Crescent Operations have central warehouses. The one at Zeigler was established in June 1936. Prior to that time separate warehouses were maintained at both mines. The results of the centralization of the stocks of material and supplies and the accounting pertaining thereto have reflected quite a saving in dollars and cents through the purchases and issues of the supplies. The control of the stock is by a perpetual inventory for which a Shif-Dex visible record binder is used. This supplants the old loose card system.

A pro-rate sheet is used where more than one mine is located, to take care of the charges that are necessary to be pro-rated to the different mines. Accounts that have such charges are listed on this sheet. The sheet is columned the same as the daily cost statement. Our washer at Zeigler cleans the coal from both of the Zeigler mines. The detail of the costs of the operation of this plant is carried daily on the pro-rate sheet and at the close of the month, the charges are pro-rated and transferred to the cost statement. We also have our own switch engines and railroad cars to handle the raw coal from our No. 1 Mine to the Washer. These charges are handled in the same manner.

Compensation Department

Our compensation department is operated as a separate unit. In computing our mining costs we set up a reserve for this department on a per ton basis, an amount approximating the cost per hundred dollars of payroll as charged by Insurance Companies. All expenses incurred by this department are charged against the reserve.

Each reported injury is given a case number, these numbers running consecutively starting with number one the first of each year and supplementing the last two numbers of the year. For example, injury number one for this year, was designated 1-37. The case number is used on all reports and records pertaining to the case. Each case is filed separately.

A payroll form is used for payment of compensation. This form is columned to show the employee's check number, name, occupation, date of injury, nature and extent of injury including all permanent disability or disfiguration, number of children under the age of 16, dates of disability, average weekly earnings, rate of compensation per week, number and amount of the award or settlement, amount of previous payments, amount of this payment and the balance due. A separate payroll

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is made for each mine in order to properly segregate the charges to the mines.

A monthly cost statement form is used. Our expenses are divided into six general accounts:

- Hospital (This account is subdivided into fifteen subaccounts, for a detail of the costs of our own hospital, operated at Zeigler)
- Office (This includes the salaries of the adjuster, safety engineer, office supplies and miscellaneous expenses)
- Medical (This is for all medical fees, other than the Doctor in charge of our hospital)
- 4. Legal
- 5. Compensation Paid
- 6. Excess Insurance

In a space provided at the bottom of the cost statement, these charges are summarized to show the cost per ton, cost per hundred dollars of payroll, the amount of reserve set up and the balance in the reserve. All items are shown for the month and year to date. The reserve balance is carried forward from year to year. In another space is a summary of the outstanding liabilities such as:

Balance Due on Adjusted
Claims
Compensation Due But Unclaimed
Bills Due But Unpaid
Estimated Outstanding Liability on Unadjusted Claims
Estimated Medical and Hospital on Unadjusted Claims

To arrive at the estimated outstanding liabilities on unadjusted claims, an estimate is made each month on cases that are not completed within the month. A list of these is made and attached to the cost statement. Each of these cases is carried on this list until the time limit for the employee to file his claim before the commission has expired, or the case is disposed of by settlement or arbitration. The estimate for the outstanding medical and hospital charges is furnished by the doctor. The doctors and hospitals are required to render their invoices monthly. If the case is not completed, the doctor is required to furnish an estimate of future charges necessary.

A card record is maintained for each employee. On this card is listed each injury reported, the nature of it and the cost.

Other valuable information pertaining to the individual is also noted in a space provided on the card.

A comparative statement is furnished our executives each month, showing the standing of the compensation department at each mine.

To summarize:

The methods of mining are changing. New legislation requires many special statements to be compiled from the records. There are new methods in the merchandizing of coal brought about by the demands for different sizes and better quality at minimum prices due to competing fuels. Therefore, it behooves the management to see that accounting practices are installed and maintained to keep abreast of these changes, and at all times reflect intelligently to the Superintendents. Sales Department and Directors the true costs. * * -

Chairman Anderson: I am sure you have been interested in the paper just read by Mr. Broadway. I find Mine Accounting is really an industry that belongs to itself. It is a variable matter and each company depends upon it to find and locate and so forth how to adjust itself to its own method of handling costs. As to the system of the Bell & Zoller people in their method of mine accounting, I am sure all of you will find something in this paper you can take along with you, and probably some of the phases of it need a little explanation. I am sure Mr. Broadway will be glad to answer any questions any of you gentlemen want to put. The meeting is open for discussion.

Mr. T. J. Thomas (Valier Coal Company, Chicago): I would like to ask a question. I would like to ask you how you control the element of material. Can you go too far in getting too much material, or too far in another way in not using enough?

Mr. Broadway: If I understand you right, you want to know how you can control—do you mean making it—the allowance?

Mr. Thomas: In your accounting you have a certain account dealing with the matter of materials used in mine operation.

Mr. Broadway: That is true.

Mr, Thomas: And you reduce it to the item of cost per ton?

Mr. Broadway: That is right.

Mr. Thomas: This question goes to the Mine Manager, and the Superintendent. How do you know whether he is ordering too much material?

Mr. Broadway: I do not think that would be under the head of the Accounting Department. That would be under Mine Management.

Mr. Thomas: You see your expense going too high for material, You would call that to his attention?

Mr. Broadway: Oh, yes, we would do that.

Mr. Thomas: You stop right there?

Mr. Broadway: Yes. We would want to know what is going on.

Chairman Anderson: Any other member have any question to discuss?

Mr. E. H. Johnson (Jeffrey Mannfacturing Co., Columbus, Ohio): Mr. Chairman, I would like to know something about the warehousing question. You say you have considerable saving of dollars by having a central warehouse. You mean in administration particularly, or particularly in inventory where you have two mines nearby? I would think in a single warehouse handling materials to and from mines it might be a little expensive thing, a warehouse at each mine.

Mr. Broadway: I might answer that in this way. It isn't so much the saving you make in administration as the saving you make in the inventory in the amount of stock you have to carry on hand. Also, where you operate two mines, it gives you more standardization of your parts, and in other words if one part will work at one mine, there is no reason why it should not at the other mine. Therefore, with standardization of parts, you can order in quantities sufficient to supply

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both mines, and also keep more and better control of your stock.

Chairman Anderson: There are some members here who belong to the operating end down at the bottom who probably would like to ask questions. I know there are a lot of fellows who have to handle and be responsible for these matters. Now is the time to get after the accountant and find what you are about. Let's move along. Whatever is in your mind, let's hear it.

Well, we all appreciate that paper, Mr. Broadway. I think it is a fine paper, and explains the methods and things that really amount to the ultimate in running the coal mine.

The next paper is on "Modern Trend in Coal Mining," by Mr. James H. Fletcher, a Consulting Engineer of Chicago. Most of you men know him. I was fortunate in being down where Mr. Fletcher is right at the inception of this meeting. He has some new and revolu-

tionary ideas about it that I do not think many people have thought about in the Coal Industry, especially the people who have to do with rails and track, with all due respect to our friend Mr. Schonthal. I don't know just how he feels about the elimination of rails, but he seems to be quite agreeable and quite satisfied to let it go along.

We would like to hear from Mr. Fletcher.

Mr. James H. Fletcher (Consulting Engineer, Chicago): Mr. Chairman, and members of the Illinois Mining Institute, I am afraid Mr. Anderson has confined the subject of "Modern Trends in Coal Mining" to rather too close a field. The subject was suggested by your Chairman, and in going into it I found it should have been a book rather than the few pages I have here. It is only possible to touch in a very general way upon the modern trend in coal mining.

MODERN TREND IN COAL MINING

By JAMES H. FLETCHER Consulting Engineer, Chicago

The trend in mining may emphasize the necessity of securing an increase in the "tons per man day" index, but this is the resultant of many factors.

Coal producers have accepted the challenge of other fuels and sources of power and have decided not to give up their markets. If the buying public wants a manufactured product, of definite quality, size, and with a specified coating, they shall have it delivered in the latest approved wrapping.

Though natural gas and oil are demanding a place in the field as a reliable and convenient source of heat, Diesel engines and hydroelectric plants as a source of power, "yow still can do it better with coal." Though continual research into more efficient equipment for burning coal has caused the coal requirement curve to lag not only the increase in population, but also the human demand curves, it has kept coal in a competitive position.

Coal has been stored in a most erratic manner. The deposits are not of uniform thickness, or quality, or distance from the market. These factors have kept the industry in a state of competitive unrest. The oils, gas and hydro-electric power with a minimum percent of labor represented in the sales price are competing for a market in which, under hand loading, the cost to the producer was principally labor, in a rapidly rising labor market. Borrowing a term from aviation, oil and gas form a ceiling to the coal price structure. John Public will buy coal only so long as he can secure a bargain in coal that has been prepared to meet his desires. Coal producers have been caught between rising wages and an exacting market that will not absorb or permit passing on to the consumer, except in unusual cases, the increased cost resulting from continuing on hand loading basis. In some fields it has been comparatively easy to find a way out through installing mechanical loading equipment, but in the majority of seams this has been more difficult.

In the period between 1910 and 1920 the midwest shaft mines were watching a new competitor enter the coal market. From a difficult struggle with inadequate equipment, adapted to open-pit mining from the field of railroad and contractors' excavation machinery, this infant industry found itself in a competitive situation to its liking. A system of mining with potentialities of a large output per man employed, a system of mining with low labor cost per ton of coal marketed though high wages were paid. This undoubtedly developed a new type of coal producer, one that demanded constantly improved equipment and got it.

The records are full of glowing accounts of a "new strip mine" equipped with stripping shovels, "the largest in the world." It appears as though, before the new paint had worn off of the equipment, it had lost its prestige to a still larger machine. Undoubtedly the compelling force behind the first step

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from a three and a half to a seven cubic yard machine was to increase the range of operation, to bring a larger coal acreage within the commercial limits of strip mining. But in addition to that consideration, an important factor had developed. The necessity of balancing a unit organization so that it could function without loss of time. Open pit mines were probably the first coal mines, as a class, to operate on a completely day wage scale. Economical operation depended on utilizing the time of the employees on productive work; a brief examination of a modern strip mine indicates the principle. The lead off is the stripping shovel. The same man power is required to operate the small as the large units and the large units are slightly less expensive per rated dirt moving capacity, therefore the large units. By a three shift operation of these shovels over a ten year period they have equalled the duty performed by most shaft mine equipment over a period of thirty years. This system results in low labor cost and reasonable equipment cost per ton of coal uncovered. Single shift operation would undoubtedly render strip mining unprofitable. The size of the coal loading shovel, transportation units and all other equipment is selected for maximum production from the operating organization.

Early strip mine coal in general entered the market under the reputation of an inferior, dirty grade of coal. The large tonnage per manday permitted installing washing plants and still compete on price basis with underground hand loaded coal, and washing plants were installed. The rapid advance in strip mine performance rested largely on obtaining the improved equipment. The trend on the underground mining industry apparently

has been influenced by the open pit mine practice.

In changing from hand loading to mechanized loading there has been an adjustment in all departments. The safety, the mining system, the transportation, the power supply, and the face preparation as well as the actual loading of the coal.

SAFETY

The safety of the employees is the first consideration at a coal property. With modern methods of mining and the introduction of more machines, the managements have taken an aggressive attitude toward assuring safe working conditions and a safety conscious personnel. Full or part time safety engineers are becoming more numerous on the official staff of coal companies. While many companies have for years been most active in safety work others have been content to comply with the State laws requirement. Safety meetings and training classes for the men are becoming an economic necessity. More attention is being given to wearing of protective clothing and the use of goggles where there is danger of eve accidents. More rigid supervision is being given to the type of equipment that it is permissible to install in gaseous mines, also to the methods of installing the equipment.

MINE LAYOUTS

Over a period of years most districts had, through trial and error, adopted mine layouts that were suited to the local mining conditions under hand loading. The attempt has been made to fit mechanical loading to these layouts. The present activity in the mine engineering departments throughout the country, indicates that the managements

have at last decided to revise their systems to fit mechanical loading. With single shift mechanical loading, there has been an opportunity to materially reduce the required active territory in a mine of given tonnage over hand loading. With the double and triple shift operations the active area can be confined to a few working territories from which the coal is rapidly extracted. Where room and pillar mining is followed the task of fitting the mine layout to machine loading is much simpler than in fields seeking to secure maximum extraction through pillar recovery.

The more compact active mine areas for the given tonnage, and the use of a multiple system of air courses, changes the ventilating requirement, but it has also been found that many of the old theories regarding the size and type of the mine fans were based on the wrong conception of the problem and on too general data. Appreciable savings are being secured by installing ventilating units carefully selected for the particular service they are to perform as well as through the improved efficiency of the units now available for this service.

For many years, due to the low load factor and relatively few days per year operation at a coal mine, the trend was toward purchased power as the most satisfactory and economical way of securing the power requirements. The swing from the relatively simple tipple and hand loading to the complex preparation plant with mechanized mining and the multiple shift operation, has improved the mine power load to a point at which it is very difficult, if not impracticable, for the public service companies to compete with local mine station generated power. With the improvements that have been made in boiler water treatment, boilers and power generating equipment, it appears as though, in most localities, more coal companies will soon find themselves in the power generating as well as the mining business.

Through the earnest efforts of the manufacturers, the mine management and operating departments, there has been a great improvement in performance and in maintenance characteristics of equipment now available for mine use. While the first loaders, after the No. 2 shovels, made their appearance in the thick seams, there is now equipment for most all seams. Conveyor systems and mobile type equipment used singly or together are moving away from hand loading of coal where ever possible. The capacity of this equipment has increased to such an extent that it has reflected in the type of auxiliary equipment used in conjunction with it.

The demand for cutting machines, capable of preparing a larger tonnage has resulted in materially increasing the capacity of shortwall machines as well as track mounted and caterpillar mounted machines. While the increase in the length of the cutter bars used in thick seams has been general, it is rather unusual to find a twelve foot bar being used successfully on a shortwall machine in a thirty two inch seam.

With the speeding up of the capacity of the loading machines there has been a demand for a larger capacity mine car to assure the loading machine a greater percent of operating time and a smaller percent of lost time due to ear change. To meet this market the manufacturers have striven to bring out cars having maximum capacity within the limitations to which they are forced to build, due to seam characteristics.

With the utilization of heavier mine cars and heavier track mounted loading and cutting equipment, the track has been improved by the use of heavier steel, and the ease of installation by special features in the switch designs and the use of steel or composite ties.

BLASTING

The breaking down of the coal at the working face has been, and is yet, one of the major problems before the mine management. The market may be swinging away from large lumps but it is not anxious to absorb the lower brackets of screening sizes at production cost or to receive a car of sized coal with a large percentage of under size. Yet it has been found desirable to cut deeper kerfs, to increase the available tonnage at the loading point and to prepare the coal so that it can be loaded without digging from the solid. The variation in the texture of coals and seam thickness has made this a difficult problem. The safety features of explosives used in mines have been met by the so called "permissible powder," by Cardox and compressed air cartridges. It has been demonstrated that controlled shooting with these can be carried on in mines during the working shift, without danger to the employees in the territory and without smoke nuisance. Controlled shooting with the working shift on duty is now permitted in the majority of the coal fields and it is hoped Illinois coal mines will be allowed to follow the trend and have the same privilege as her competitors.

The installation of the improved type of equipment has raised the capital investment. Through recent legislation and the contract under which mine labor is employed there

is a tendency toward shorter work weeks which, in single shift operation is diametrically opposite to the ultimate welfare of the miner or success of the operator, as a greater percent of the sales realization from the output must be expended for the new equipment. In certain sections of the industry this factor has been recognized and arrangements made whereby the equipment can be employed in production for three shifts a day similar to equipment in other The recent contracts industries. consummated in the Illinois fields permit loading coal on the second shift, but there is the unfortunate provision regarding the hoisting of coal on the second shift. This has resulted in the peculiar situation of being privileged to operate the preparation plant and the production machinery with a stopper between the two functions of coal production. It is hoped that this restriction can be removed for the benefit of labor and operator.

With the numerous changes that have been mentioned, the aim has been to utilize more efficiently the time of the mine employee so that the market can be maintained and a fair percentage of employment made available. In all the above changes there has developed a unit organization collected around the loading machine to perform the various tasks required in mining, preparation, loading and transportation of coal. The efficiency of these units depends on balancing the several functions so that each employee has the opportunity of utilizing his time to the best advantage. The function of timing is very important in coal mining under mechanization. The delay in any of the operations, or the failure to have the detailed work performed on time may result in upsetting the days run.

Were it possible to change the equipment at a mine every two years as advocated in operating an auto. undoubtedly every coal mine operator would follow that practice. There are a few modern mines but a much larger percent of old ones: a few thick seam but many thin seam mines. The writer, in attempting to assist in solving the various problems introduced by mechanical loading, brought out "the Fletcher System of Automotive Gathering," (for which patents have been applied). This system aims at consolidating the development and recovery of a block of coal in one operation, and the securing of a large tonuage from a loading machine by the use of transportation units operating directly on the mine floor, between the loading machine and a transfer point, where it is placed on the main line haulage system.

The modern trend in mining is to secure a uniform product acceptable to the consumer at a cost to the producer that will permit competition with other fuels and return a fair profit on the investment, by equipping the mine for the greatest safety to the miner and with machinery that will permit the miner to utilize his time to the best advantage.

Chairman Anderson: On account of the acoustics of the room, I will ask Mr. Fletcher to stay here so that we can hear him better, and he will have better opportunity to talk to you.

Now, have any of you gentlemen any questions to ask in reference to Mr. Fletcher's paper? From my point of view, I think it is a wonderful history of the Coal Mining Industry in the last ten or fifteen years. I am sure we have all found something in it that we are interested in, and Mr. Fletcher will be glad to answer any questions you gentlemen want to ask. Any of you have any questions dealing with this paper?

Mr. Raymond Mancha (Jeffrey Manufacturing Co., Columbus, Ohio): I was interested in what you said about the importance of improving the load factors. You referred, as I understood, to the cleaning plant improving the load factor. Did that mean the plant would run at an off-peak time?

Mr. Fletcher: No. In our mine power plants we are faced with a large demand and a very few operating hours. I think with the double and triple shift of equipment and installation of larger preparation plants, they have increased the load at a good many mines to a point where they can really put in an efficient, economical power plant and burn the refuse or low grade coal. Some figures have shown the difference between cost of purchased power and mine-generated power repay the investment in thirty-four to forty-eight months. In a condition like that, you can searcely afford to purchase power.

Chairman Anderson: Any other gentleman have any question to ask now? We have about—well, we have about a minute now. It is twelve o'clock.

Before we adjourn, I would like to say that the meeting in the afternoon will begin promptly at 2:00 o'clock. This isn't a very large program, but we would like to have as many of you present as possible. The Committee appreciates the number here this forenoon, and also your attention to the papers.

I would also like to call your attention to the banquet this evening. Whether you are a member or not, you can come to the banquet. Of course, we all feel that the Institute itself in these meetings qualifies you by your being here, but we would like you to qualify also by becoming a member of the Institute. Mr. Schonthal is always willing to receive an initiation fee.

The meeting stands recessed until 2:00 o'clock P. M.

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

AFTERNOON SESSION 2:00 O'clock P. M.

Chairman Paul Weir: You will please come to order.

After the main paper of the afternoon, Mr. McCabe, of the Geological Survey, has a movie he is going to show. The reason I mention it at this time is that he informs me this machine is a rather noisy affair, and he would suggest you move up in front so that the noise of that machine will not interfere with your hearing.

The principal paper of the afternoon will be presented by the Director of the Engineering Department, National Coal Association, Washington, D. C. This gentleman has had much experience both in the sale of combustion equipment as a mechanical engineer, and for the past ten years up until a year ago was with the Pittsburgh Coal Company as a combustion engineer. He has an unusual knowledge of both sides of the game. By that, I mean he is thoroughly familiar with the producers' angle and also with the consumers' angle. I am certain that you men, who are primarily operating men, will find much of interest in what Mr. Reed has to say. I think

we are very fortunate in being able to secure the cooperation of Mr. Reed.

Mr. C. A. Reed (Director Engineering Department, National Coal Association, Washington, D. C.): Gentlemen, in order to put myself right in the beginning, I do not want you to think I am a Washington politician. I lived on a farm in Minnesota and rode horseback until I was bow-legged. I plowed corn and wheat, but primarily I burned anthracite coal.

I mention that because today anthracite coal is not used in Minnesota, proving that things do change if we make them change. As a kid, I remember the base burner, \$18,00 per ton, no smoke, lots of ash, lots of clinkers, perfect satisfaction, everybody living in one room, and if you went upstairs you put on woolen sleepers, wrapped up, and got in bed as fast as you could.

Today, that same little town in Minnesota is burning lots of Illinois coal. Up to a few years ago it burned southern and eastern coal, but there is some good reason why they now burn Illinois coal. Probably part of that reason was people found out how to make the best of what we could get for what they could afford to pay for it. Perhaps the depression had something to do with it. I hope for your sake it did.

When I left home I did not know anything about bituminous coal. Probably a few of them did, but we burned and bought that anthracite coal because that was the only kind of coal that was available. I left that part of the country because I had to eat. I got tired of working on the farm, and I went to Pittsburgh. I found there was easy money there, people bought more equipment, everything cost more money, food cost

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more money. I finally got into certain equipment, engineering and selling, and after fifteen years I became more mystified than ever, more so than I was at the beginning, by finding every time a piece of equipment went in it burned differently, and I didn't know why. I thought the best way to find out was to hook

up with some coal company. It happened the Pittsburgh Coal Company needed a man and I needed a job.

By the way, this name on the program is not my selection, it was selected by some of your committee. I do not know what the Will To Do means except to work like hell.

THE WILL TO DO-NOW

By C. A. REED

Director, Engineering Department, National Coal Association, Washington, D. C.

In looking over the program for this meeting I notice that all of the speakers' talks are on subjects related to operation, mechanization, costs and that there is an explanation of Governmental regulation of the industry (except that the Government will make a profit by the 1¢ per ton tax).

I want to go into some of the angles of marketing and merchandising which, while assuming that most of you gentlemen are more interested in operation and preparation, is a most important part in an industry's program to make a profit.

Modernized coal, furnaces, boilers, automatic controls and stokers along with modernized power plants and modernized and automatic houses come to the attention of old and new consumers of coal and so our opportunity is here to get our share of that market, large and small, by keeping in step with this automatic age.

The operating departments of mines give us good coal, the railroads give us good but very expensive transportation (in many cases more than the mine realization on the coal), the wholesale salesman and the retail dealers' organizations work and scheme to please the customer, the manufacturer of equipment puts in good coal burning grates or stokers or pulverizers. The efficiency engineers of our consumers, the home owners and the combustion engineers of our producers do their best to get the most out of our coal. Therefore, the producers must work through unified action, as do our competitors, and tell our story in understandable language and pictures and in manner which the consumer and the potential consumer, be he industrial or domestic, will read, understand and, most of all believe,—no mystifying claims, no unattainable guarantees, no promises beyond the ability to deliver the goods.

Many individual producers in the industry have been doing some of this type of work, but no unified front has been previously organized.

The Committee of Ten has been carrying on an educational program, the industry through the National Coal Association supplemented by several producing com-

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panies and the Stoker Manufacturers Association has been spending time and money through the Bituminous Coal Research, Inc. to develop more knowledge on better and more satisfactory ways to burn coal; other individual research organizations or corporations have been set up to do similar work, each along different lines, or for certain types of coal.

Early in the summer of 1937, the National Coal Association decided it was necessary to take steps towards a national market promotion campaign, directing its efforts toward the domestic and apartment house consumer, since those types of business are the ones which have been worked on most by competitive fuels.

Some of you gentlemen have no doubt seen the stories in newspapers that the National Lumber Manufacturers' Association has sponsored the building of a great many small homes-estimates place them at over 2,500 in number—built to conform to F. H. A. specifications for mortgage loans. The National Coal Association and the Stoker Manufacturers Association took space in the Small Home Magazine, the publisher of which, distributed these books in the demonstration houses all over the United States. The advertisement graphically told the many advantages of automatic burning of bituminous coal. Well over a million copies were taken by visiting prospective home owners and an additional two hundred thousand or more were sold on the news-stand to people who were interested in new developments and modernization. It was necessary to make a follow-up booklet to cover the information in this Small Home Magazine primarily because the advertisement was general in its character, but secondarily because within this book was a clip sheet which stated that further information could be obtained by writing to the National Coal Association or the Stoker Manufacturers Association. The follow-up was a smaller book entitled Heat with Bituminous Coal, the Modern, Economical Way, and these have been distributed to well over three hundred thousand interested people. This latter book told the story of convenience, economy, dependability, cleanliness and health attainable with automatic heat and bituminous coal.

Following this cooperative plan, and since many of the stoker manufacturers have a well-planned advertising campaign, the National Coal Association representing the bituminous coal industry, launched its market promotion plan by going direct to architects and builders through their magazines, taking considerable space showing wellplanned basements. Included in these basement plans were the driveway, the garage, the heating plant, and the coal bin, all conveniently grouped together for proper delivery and modern use of bituminous coal.

Good publicity is being given this promotional endeavor, with architects' and builders' magazines editorially telling interesting and true stories about its possibilities. The messages in the magazines advised the architects that basement plans could be obtained by writing for them and the architects' file number 30-G was assigned to the National Coal Association's booklet known to the architect and the builder as "A New Service for Architects and Builders." This book contains detailed plan drawings and isometrics of several types of basements from the small home with a single large room in the basement to the large, expensive home including recreation room, work shop, hobby room, etc. It also includes the design of coal bins showing all practical materials generally used in basement construction—wood, concrete, plywood, and hollow tile.

General distribution of reprints of all of the material published in the architects' and builders' magazines has been made to and through the producers and retail dealers, many of whom have interested the architect and builder to the extent of having these men write for the plans which we are offering.

In your work, perhaps many of you do not hear of the surveys that are released which indicate that new buildings in many cases, do not include plans for coal burning and coal bins and that most of the new coal-heating equipment being sold is only for remodeling. Therefore, we must go modern as fast as we can so that new home builders or new apartment house builders will realize that the burning of coal today should not be thought of in the same light as it was five or ten or fifteen years ago, but rather that it is just as automatic, and generally of much more worth and need than any other of the new devices which are being ballyhooed and sold as being a necessary part of a modern building.

The large industrial consumer is in himself becoming modern due to financial pressure or stress. He is asking more detailed questions of the coal producer, the coal salesman, the coal dealer, and the combustion engineer representing the coal industry. This class of coal consumer is not so easily swayed by smooth-running, competitive fuel stories. To help him become economically satisfied, the manufacturers of large boilers, stokers, pulverizers, air heaters and economizers, have in-

vented, designed, manufactured and installed equipment to his utmost satisfaction. At the same time, however, since transportation cost has increased, since governmental regulation may have a tendency to put uncertainty into the minds of large consumers, it is necessary to watch every development of competitive fuel. This is particularly true when such fuel is sold below cost to obtain the market, which when once lost to coal is difficult to swing back. Their investment in a changeover is too great, and inducements must be of high monetary value to interest them in reconversion. We have better coal, the consumer has better equipment, the engineer has better facilities, the salesman has better talking points, but fancy advertising and claims does a funny thing to some people's minds and so the interest in bituminous coal must be maintained by constant approach with proper selling talks and good, sound logic and engineering behind it. The story of the use of bituminous coal must be continually hammered home; there must be a will behind it, and there must be no feeling that we have a place in the customer's plan by Divine Providence. We must cooperate with our associated industries who are producing equipment to more satisfactorily burn our coal by endeavoring to help them over their problems and by giving them such information as they need. We must always be on the alert and make use of every modern device. Certainly our competitors with their much higher priced fuels must have had an extra supply of "Will To Do" when they started to step in on an entirely foreign field to manufacture automatic devices and to sell high-priced and unknown machinery and fuel.

Even though we have the cheapest and the best, it will not sell itself

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and we have got to keep behind it with a east iron constitution and a will to do—now! Toward this end I beseech complete cooperation from each and every one of you and in return promise that the market promotion program of the National Coal Association will not only proceed as started but will gain in momentum and magnitude as the days roll along.—Thank you.

. . .

Chairman Weir: Gentlemen, I think practically all of us in the coal industry have had our friends ask us at various times just what the coal industry is doing to create and maintain a market for coal. I think Mr. Reed has given us an outline of the very wonderful work which is being done cooperatively by the National Coal Association. Certainly it is on a par with the work which is being done by the oil and gas people.

I have asked Mr. Reed to rest himself a moment, and if there are any of you who have any questions that you would like to ask, Mr. Reed, I know, will be very, very glad to answer them.

Mr. Frank Tirre (St. Louis, Mo.): Mr. Reed stated most of us here today are operating men, but we are the men who sell the coal and have to produce it and bring home the bacon. Since this will undoubtedly go in our Year Book, and in answer to the gentlemen back home who have not heard the discussion, it might be well for Mr. Reed to tell us just how this advertising matter is being distributed. Please.

Mr. Reed: Well, to start with, we have given it to everyone who gets the National Coal Association bulletin, and that is some fifteen hundred coal producers in the United States. We have written to them through our bulletin that this material is available and have displayed the material telling them it is free of charge in any number they can use.

We get requests from coal producers, coal jobbers and coal dealers. Most of them are through the producers, who then distribute them to the dealers. The reason we prefer to put them through the producers is that we think the producers themselves and their salesmen have a better understanding of what this is for, and they can in turn explain them to the coal dealer, how he can make use of it, what it will do in his market, and how he can approach a home builder and architect.

This starts with the coal producer. We distribute to him, and he in turn, through his salesmen, through architects, builders, to structural salesmen, and everyone who has any angle of where coal can be sold. You might say one million pieces of advertising have gone out within three months.

I have talked-I think in the last six weeks I have talked as far as Denver—to three hundred and fifty people, and practically every one of them has referred to at least some single paper of this advertising. I talked to about thirty architects one day, and every one of them had been talked to by coal producer salesmen and had been handed these, so that they would write for the architectural folders. We do not want the architectural folder in the hands of home builders and dealers, for that is a confidential help to the architect. If we do give them to people who want to build, of course the architect may feel we are helping the man build his own home and we will lose the support of the architect. Those folders are only for the

architect, and we want the coal producer and dealer and salesman to tell the architect how to get them, and that is the reason we are distributing them the way we are.

Chairman Weir: Are there any other questions or any other discussion?

Mr. E. L. Berger (Bell & Zoller Coal & Mining Company, Zeigler): What is the present trend with automatic home heating?

Mr. Reed: Up to about five years ago, there were practically no domestic stoker sales to be realized. There was no such a thing. Up to about eight years ago, there was a limited supply of oil and gas burners sold. I notice in a recent survey that there are three hundred and eighty-five manufacturers of oil burners that make eleven hundred and thirty-eight, I think it is, different types of domestic oil burners. That means from the four room cottage to the twenty room house, eleven hundred and thirty-eight of them.

Now, if there are that many, and they have sold 365,000 oil burners in the last year and a half, you can see what the potential market can be. The figures on gas burners are unavailable, for most of that is controlled by the public utilities.

The stoker sales started, I would say, four years ago, and the year before last they sold 27,000, last year 86,000, and this year they have sold so far over 85,000. We are getting to a place where the oil burner used to sell three-to-one, and now the oil burner is dropping down and the stoker is picking up. The automatic control for hand fired burners has risen from four companies to forty-six companies. Those peo-

ple are not in business because there are no orders. They are in business because hand fired burners are becoming semi-automatic by the attachment of a \$25.00 or \$50.00 or \$75.00 automatic control where the stoker is not warranted.

Mr. W. Y. Wildman (Illinois Coal Traffic Bureau, Chicago): I would like to ask Mr. Reed if he will give us his opinion as to the displacement that domestic stokers are making. Does he feel the large number of stokers going in, and he has indicated the majority are going in older homes, are going in hand-fired units, or are they displacing competitive fuel?

Mr. Reed: I was to get that figure yesterday, but I did not get it. As I recall offhand, about 8 percent—and I do not have this figure for the record—about 8 percent of the stokers sold are being placed in where the oil burners are placed. The other 92 percent are going in new homes where their selection was between automatic gas or oil. There is no distinction by the manufacturer as to new and old homes. But 92 percent have gone in by tips from the salesmen where somebody was not going to put in coal going to put in oil and gas. We would rather have them put in stokers than we would not to sell the lump coal. The only figure I have is the 92 percent for either replacement of old hand-fired or going into new homes where either automatic oil or gas is going in, and where they would not consider hand-fired coal.

Chairman Weir: The title of the paper rather intrigued me, The Will To Do, intrigued me so much that I forgot to announce the title

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when I announced you. I am certain all of us thank you very much for the information on this cooperative work of the National Association. We certainly appreciate you coming down to Illinois this afternoon to tell us of that work.

Mr. Reed: If everybody has had as much fun listening as I have in telling it, you really enjoyed it. It is a hobby with me.

Chairman Weir: I think you are a salesman.

Mr. W. S. Burris (DuQuoin Iron & Supply Company, DuQuoin): Mr. Chairman, in regard to auto-We have a small matic stokers. town of 7,600. We have some five or six oil burners. The cost of oil was about three times what it was of the stoker coal. There have been placed in our town about thirty-five stokers now, and all of them are giving "A No. 1" service. I have had a stoker for four years and haven't had a minute's trouble with it. During mild weather, it only has to be attended to once or twice a week, in the middle and at the end of the week. It burns up the coal.

There are a lot of them with stokers who clean them out too fast. They will not wait for them to clinker, but want to take out the ash, which is a mistake. I have cleaned mine twice or three times this year, and have taken out only a few buckets of clinkers.

The advertising you will get is from the people where the stokers are now. They can go past my house and there is no smoke or gas or anything coming out. My neighbors say "When I put in a new furnace, it will be a stoker."

I feel the stoker age is in its infancy and will go on. So far as gas is concerned, we didn't have it in our town. Oil has been expensive. Women have found out and have advertised in our town that curtains get oily from oil burners, and I feel there will be a great demand for coal along that line. The price of oil is going up every year. I have friends in East St. Louis with oil burners, and they are ready now to take them out. It costs about twice as much over there as with us.

We have, of course, cheap coal in our town. I believe the operators have perfected the coal now so that it is practically workable. I have used stoker coal four years, and the only thing I use in my stoker is dedusted screenings and oil, and they make a perfect fuel.

I feel the operators have got to go after this coal business and advertise for it and get to the public in the new homes. We have one school house down there where we had to dismiss school whenever there was a cold day. They put in two automatic stokers and have never had a minute's trouble since. That is an advertisement in the town. As soon as we can get money enough, I am satisfied five more stokers will go in our schools.

I think the talk you made is wonderful. The operator has got to get behind it if he wants to sell more coal, get more stokers and burn this coal where there is oil and gas now.

Mr. Reed: I want to make one remark to you gentlemen who may not know a good deal about the small stoker. This gentleman has brought it up. A good many of you feel when you hear about clinkers it is bad for your sales, for industrial power plants of course do not want clinkers. The domestic does want clinkers. That is the way they take the ash out. In using Illinois coal and

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most of the bituminous coal in the United States, the coal burns to ash and the ash is then fused to a clinker away from the fire bed, and they pick it out of the door and throw it in the ash can. If you have fine ash you would have to get it with a shovel. When anyone speaks about clinkers in the small stokers, don't think that is bad, that is good for it.

Chairman Weir: From time to time our mineral research in Illinois has given us bulletins descriptive of the work which they are doing, Among this work there has been considerable on the constituents of coal. It is quite a load for me to pronounce, but the particular terms which are used are Durain, Clarain and Fusain. Mr. McCabe, from the Survey, has brought a picture which he is going to show this afternoon and which I think will bring out to you certain things in connection with the mineral constituents. That is the difference in combustion characteristics, principally.

I think we are ready to proceed with Mr. McCabe's picture, if the lights will be turned out.

(Whereupon a colored movie showing the burning of a stokerfired furnace was shown by Professor Louis C. McCabe, Assistant Geologist, University of Illinois.)

Chairman Weir: The secretary has several announcements to make.

Secretary Schonthal: The committee to be appointed to draft the resolution on Mr. Bristow's announcement this morning — Mr. Jenkins has asked me to announce the committee as follows:

Richard D. Sandoe, Chairman G. S. Jenkins T. J. Thomas

That is all.

Chairman Weir: The dinner this evening is scheduled for 6:30 o'-clock. The toastmaster or presiding officer will be Mr. C. J. Sandoe. I understand his tonsils are at the Jewish Hospital in preparation for the occasion. Is there any other business to come before the afternoon's session? If not, we will stand adjourned until 6:30 o'clock.

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

The following advertisers in the 1936 Yearbook displayed merchandise of their manufacture in the Exhibit Hall at the Forty-fifth Annual Meeting. The exhibits were very well attended and created a great deal of interest.

LIST OF ADVERTISERS EXHIBITING AT FORTY-FIFTH ANNUAL MEETING

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Timken Roller Bearing Co	Canton, Ohio
The Tool Steel Gear & Pinion Co	Cincinnati, Ohio
W. S. Tyler Company	Cleveland, Ohio
United States Rubber Products, Inc	Chicago, Ill.
University of Illinois, Mining Dept	Urbana, Ill.
The Upson-Walton Co	Chicago, Ill.
Utility Mine Equipment Co	St. Louis, Mo.
The Watt Car & Wheel Co	Barnesville, Ohio
The West Virginia Rail Co	Huntington, W. Va.

EVENING SESSION 6:30 O'clock P. M.

Following the annual banquet, the following proceedings were had:

President Jenkins: As retiring President, it becomes my duty to introduce the Toastmaster of the evening. I have been waiting for this moment for a long while, and I have a few things I would like to say to you.

I have known this Toastmaster for a long while, but I can't say anything particularly flattering about him. I will say he is the Beau Brummel of the Coal Industry. We will say he is even a handsome looking chap. We will admit he is a good entertainer. But we will also insist that his vivid imagination puts to shame even the fairy stories of Aesop. Quite recently he even had his tonsils removed in a Jewish hospital. Why say anything more about him?

All joking aside, our Toastmaster is a past President of our Institute. Most of you have known him for a good while. He has been out of office only about two years. However, he is one of the big shots in the Coal Industry. He has been one of three men selected by the Bituminous Coal Industry of Illinois to represent them in the handling of the administration of the Coal Stabilizing Act of 1937.

Now, I have told you all of the bad things and a few of the good ones. I will introduce to you the Toastmaster of the evening, Mr. Sandoe.

Toastmaster C. J. Sandoe: Mr. Chairman and gentlemen, I will try to say something about the retiring President. As a Board Member, I think I am entitled to certain information of what he is doing for his cold. He is not only treating the cold, but is putting sugar on it.

Bill is a fine fellow. We have lots of things to do this evening. We got started a little late. I will not attack him because of some of the things I know about him, but I will now proceed.

I wish some of you fellows in the back end of the room would get inside and shut the door. There is plenty of room on the inside. If you can't be quiet, anyhow close the door.

Gentlemen, the first man I would like to call upon is a man whom we have known for many years. Each year we come up here, with a few exceptions he has been here to welcome us in this most wonderful city. They have many advantages in Springfield. I do not want him to give us that bed-bug speech he usually gives, but I would like to have a few remarks from Buddy Kapp, the Mayor of Springfield.

Mayor John W. Kapp: Mr. Chairman, distinguished guests and gentlemen, I do not suppose I will be able to use No. 5 tonight. I will probably have to use No. 1, after the suggestion of my good friend Mr. Sandoe.

I noticed he used the microphone up there to speak to you gentlemen, and it reminds me of a story that happened with the late Speaker of the House, Mr. Henry T. Rainey. Speaker Rainey was down at his home town, Carrollton, Illinois, about six years ago when they first started using microphones in the way of public speaking. In that fine, old homey way of his, he pushed it to one side. He said, "I don't want to use this thing. I want to look these men right in their face and let them hear my natural voice." He said. "It reminds me of the boy and girl trying to make love over a rail fence. You cannot get the proper contact there, and you cannot get the proper contact with your audience."

Gentlemen, we are always happy to have this fine group of men with us, as a visitor, not only from the fact you come here and have your conference, but I noticed a moment ago a bottle being passed up and down the table, a fine feeling of friendship, and there is nothing finer in life than the thought of friendship, whether you get it out of a bottle or get it clasping a hand.

But we are happy to have you with us. I think these conferences and institutes do a great deal of good for any industry. You meet here and exchange ideas and enjoy some of the pleasantries in life we are all seeking, and I know that is for the good of one of our important industries, if you please, in the great State of Illinois.

We in Springfield, and we in Sangamon County, feel that the coal mining industry is one of our greatest industries, and we try to cater to it and help it at every opportunity.

Permit me to say, in conclusion, I hope you enjoy your visit here with us, and that you come back and stay with us many, many times. If any of you receive parking tickets, give them to Bill Ryan and Sam Wills. If they cannot take care of them, the three of us will meet in jail with a pinochle deck and have some fun out of it anyway.

Toastmaster Sandoe: Thank you, Mayor.

I want the following gentlemen to arise and take a bow as I call their name.

Mr. Harry Fishwick

Mr. Fred S. Wilkey, Secretary of the Illinois Coal Operators Association, of Chicago. Mr. Sidney A. Hale, of "Coal

Age," New York.

Mr. A. W. Dickinson, Amer-

Mr. A. W. Dickinson, American Mining Congress, Washington, D. C.

Dr. C. L. Smith, Editor, "Mechanization," Washington, D. C. Mr. James W. Bristow, Illinois Reciprocal Trade Association, Belleville.

Mr. J. R. VanPelt, Museum of Science and Industry, Chicago.

Mr. A. C. Carlton, of the Museum of Science and Industry, Chicago.

Mr. Harvey Cartwright, Secretary, Indiana Coal Operators Association, Terre Haute.

Mr. Howard A. Young, President of the American Mining Congress.

I want you to know Mr. James E. Fitzpatrick, Manager, District No. 10, also Art Johnson, his first lieutenant.

I would like to have you know and would like to have a few remarks from the next person I call upon. He is one of the oldest and one of the first Presidents of the Illinois Mining Institute. He was a resident of this State for many years but has taken a vacation and stayed away from us for a few years, and we are glad to have him back. Tom Moses, President of the H. C. Frick Coal Company, Pittsburgh, Pennsylvania.

Mr. Thomas Moses: Mr. Chairman and gentlemen of the Illinois Mining Institute, it is a great pleasure to me to have this opportunity to meet with you again and renew the acquaintance of the older members, and make acquaintance with the new members. I do not know of any pleasure in the world that I consider greater than in coming here to see the wonderful growth of this Institute since I first became a member of it. We used to have a terrible time to get enough to sit in the ante-room. But many of the men in the past have worked hard, and have recorded your experiences in the archives of this organization, and I think those of us who have lived through the trying times of the last thirty years of the coal industry in America will agree that those who are seeking to cure the ills of this great industry they call so sick could find food for thought by searching among the records of this organization to guide them in their deliberations.

I feel quite considerably better than I did the first time I came to this City. Some thirty years ago I received a State appointment. came here and worked in the State House and found I was to be about the third fellow in command of a small force. My friends at home who used to come to Springfield, being of Welsh descent, or principally Welsh, used to assemble at Dave Cromwell's, at the House of Dave. up on Seventh Street. After I had been here a couple of weeks, a couple of friends of mine came to town and said to Dave: "Do you know Tom Moses, over in the State House?" He said, "No." said, "Uncommonly smart boy. His father was a smart man before him and a fine man. We will go over and see him," That evening they went over to see me, and when they came back Dave said, "Did you see Tom?" They said, "Yes." They had come over to my office and tried to borrow money but did not get it, because I did not have it. They said, "His head is as big as a barrel. He is nothing but a damned black leg. as his father was before him."

I hope my friends will not feel that way about me after I have disappointed you in my few remarks. Suffice it to say my dearest love is located in the mining industry of Illinois, where I toiled more than forty years, and where I hope to lie at rest at the end of my days, in the soil of Illinois.

Toastmaster Sandoe: The next speaker I wish to call upon is one of the pompous individuals. I would like to have him make a few remarks.

I am going to call upon my good friend, Dean Charles M. Thompson, Dean of the School of Commerce of the University of Illinois, Urbana.

Dean Charles M. Thompson (College of Commerce and Business Administration. University of Illinois. Urbana): I have a feeling somewhat akin to the feeling Mr. Rainey is supposed to have had. During the past few years I have been able to classify public speakers by their use or lack of use of this loud speaker. I am beginning to believe those who refuse to use it are the ones who perhaps come from the localities where hog calling was the highest form of music. And yet, when I use it myself, I am thinking very much of the story which I told Paul Weir today-perhaps you have heard it, and I am going to impose on Paul again.

It has to do with a steeple-jack who had a job to fix the pulley on a flagpole on an office building. He could have gone up through the hatch and climbed the pole and done the job in private. But he thought he would give the customers a run for their money, and climbed up the coping of the building. Hardly had he got started when he noticed a man climbing up the building with him who apparently was pretty drunk. He thought he would quit pretty soon, but he did not. He reached the roof and started up the pole, and the fellow was after him. He could not kick him in the face. for he was afraid he would throw him off and kill him. After fixing

the pulley, he opened up a parachute to come down, and when he got about to the tenth floor the fellow went by him like a ton of bricks, and yelled at him, "You damned sissy."

You will notice on the program that this talk of mine is to be short and informal. And I guarantee it will be both. The one thing you do not see on the program is that I am to say nothing about the Secretary of this organization. That was agreed when I came over. Now, seriously, I will take a moment of your time to tell you what is in my heart. Some of the men sitting here have already heard me say it by mail.

I have dedicated the rest of my normal life to do what I can to collect business records, particularly in the State of Illinois. It is perhaps true that some of you gentlemen, perhaps most of you, do not realize what the inadequate knowledge is which we have of those business practices which have simply disappeared. Why, today we get a balance sheet of a bank of one hundred years ago, and we treasure it as if it was of great value, when we did have millions of them.

The last time I talked with Mr. Jenkins we talked about this, and he was very appreciative about it and very kind and was going to help me save some of these records.

We are interested, first of all, not primarily but in point of time, in historic records. They are going every day. They are being destroyed, sometimes inadvertently and sometimes intentionally to make room. They are worth nothing to anyone except a student of history, a student of economics. I say to you gentlemen if we knew more about the past we would not make so many erazy mistakes in the present.

Then, we are interested, if we can, and we know we can if we get your cooperation, you and men like youwe are interested in having sent to us regularly the records as they become obsolete. We are not looking for trade secrets. We will yield them if you want us to, or we will not bother you about them, but you have many records of years back, and they become obsolete so far as your business is concerned, and yet they will give the information the students want. Not that I would want, but my great-grandchildren years from now would like to have to reconstruct the coal industry of 1937.

Now, I will give a concrete illustration and then sit down. The one collection which I have made the most progress on, and maybe one that had not occurred to you, is what we call wheat ledgers, getting them from the Illinois elevators and the Illinois mills. I can say to you now that we know more about prices and know more about farm prices, we have a better appreciation of the transportation conditions by far than we had a year ago.

The fact of the matter is the wheat ledgers which we have been able to save from destruction are worth nothing to anyone. For more than a hundred years, we have had these wheat ledgers coming in from the old mills of Illinois, and we are now able to explain some of the things we could not explain before.

I am going to illustrate what I mean. We started to find that, in the same mill, wheat prices will vary sometimes as much as \$1.40 or \$1.30 in as much as three weeks, which could not happen today. We have been able to determine, or think we have with certain accuracy, why there was such a spread of prices in wheat in our local mills and elevators, let us say in 1850, and the export in New York. That may all seem

to you to be a trivial matter, and yet I am willing to work at it if you will co-operate with me a little. If any of you are interested in this sort of thing, I wish you would keep in mind my first statement, that I have dedicated myself to it, and, God helping me, I am going to accumulate twenty million documents in the next ten years, and will build up a library of business records in this State that will be here one hundred years from now, so that students coming here can reconstruct the business history of this time. That will be the most invaluable or most valuable thing I as an individual could do.

I cannot sit down without thanking the men of this group for their courtesy and kind consideration always. I have no particular interest in common with you except the interest of wanting to see industry prosper and progress. But I think there isn't another group of business men in the State of Illinois, and I contact a lot of them, where I have been received with more genuine support and hospitality than I have in your group. I want to say to you it is one of the things I will never forget, and it has made life a lot easier for me. I certainly thank you for your attention.

Toastmaster Sandoe: Thank you, Doctor.

It is usually customary at this point to introduce the President, Vice-President and the Secretary-Treasurer. I think the Executive Board should come first, and I will call the names of the Executive Board and ask them to arise and take a bow and sit down.

R. L. Adams, of the Old Ben Coal Corporation

W. C. Argust, Peabody Coal Company

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That is all, I think, that are present. I will call those I do not think present at this time.

James McSherry, Director of the Department of Mines and Minerals

F. S. Pfahler, Superior Coal Company

L. D. Smith, C. W. & F. Coal Co.

Louis Ware, United Electric Coal Company

W. P. Young, Crescent Mining Company,

and your speaker.

I am going to ask the three gentlemen, the President, the Vice-President and Secretary-Treasurer to arise. For some time, these buzzards have been after District Board No. 10. We tried to classify the best we could, but we didn't know how good we were. We were going to classify mining. We went out and took southern Illinois, and had "S. I." for that. We had central Illinois, and we got to Belleville and had "S. B." for Standard Belleville. And they threw that thing out. They said it was a little over the heads of the fellows in the industry, and wanted us to give more expression and make the thing simple.

We discussed many things. We thought we would use colors, but somebody suggested some of them were color blind and some are in colors. Then we thought we would use figures. The figures of these buzzards did not mean anything, and they could not say a thing.

We thought we would start with A-B-C. Most of you have seen the A-B-C classifications, and we still think it is all right. But you would be surprised to know how many people do not know their A-B-C's. All those who do not know their A-B-C's will they arise, or remain standing?

This classification came out at 11:00 o'clock one night. Before 8:30 o'clock the next morning, I was over in the District Board Headquarters and the telephone rang. This buzzard that you elected as President here said, "Sandy!" I said, "Yes." He said, "This is Herb. I am over in Bill's office. Paul Weir is here. Where are you!" I said, "I am at the District Board Headquarters." I knew I was right there, for I went in. He said, "We have found the solution. We have the key to this classification."

These aren't the only ones. I have had trouble with fellows asking what we meant by A-B-C. We could have used the whole alphabet, but we knew some people wouldn't understand it, and we only used half of the alphabet.

Herb came in first, and he got the solution right now. He handed me the first four letters of the alphabet. He said, "A-B-C-D." I said, "What do you mean by that?" He said "The solution is Abie See De classification." I knew he was right. Then we had another fellow come along. This fellow is a member, an engineer, our Vice-President. They never agree with anyone. He said. "I won't take the first four letters, but will jump to the twelfth, and keep a series." I said, "L-M-N-O-P?" He said, "'ell, that am no elassification." That is all right.

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So then came Paul Weir, and he said, "I will take these letters, O-S-M-R." He said, "Oh, Ess, Em Are classification."

Then I had to live along with these fellows for awhile. I have something here, if I can find it and I have it, for I worked a solution out for them, and we finally got this kind of an answer. I said, "Gentlemen, you have made this combination to work this classification, O-I-C-D classification. So we say, "Oh, I see de classification."

Now, I would like to present these fellows to you. I will ask them not to say anything, but just arise and then be seated, for there is another fellow here I want to get out. I would like to introduce to you Mr. Herbert Taylor, Jr., as your new President, Mr. Paul Weir as your new Vice-President, and Mr. B. E. Schonthal as your old Secretary-Treasurer.

Now, I have beside me, to my left, a gentleman I have labored with, for we have tried to classify your coal, and we started out by trying to classify it so that we could understand it. We did not get very far. We tried to take the BTU's, the ash content, the volatile matter, fixed carbon and sulphur content. We did not consider the profit. Then we found we had considerable friable material, carbon, uniform ash analysis, physical characteristics, characteristic performance, and since Bill Jenkins got busy we have this sex appeal proposition. He helps the looks of this coal, putting sugar on it.

But the great thing is analysis. That is the thing they do in this coal business, that ultimate analysis. We tried hard to find this ultimate analysis. We called in all the wise combustion engineers, and after laboring with it a while they

gave their report. That did not satisfy the District Board.

But this fellow Reed is all right. He still stays with us, and we did the best we could. We marvelled at the ability they had, at what they put in that, the BTU's and the ash analysis and the volatile matter and so forth, in showing us how to elassify.

This has been more or less of a game. After we got this thing in front of us, I said, "George, can you figure out how in the hell they work this thing out?" He said, "You noticed how they have been counting things out of the windows?" I said, "I really don't know how it is." He said, "They count cows. They see one cow, thirty, or fifty, and see who has the answer. Don't you remember coming by the dairy farm the other day, when one of them said, 'There is two hundred and fifty cows'?" I said yes. I said, "How do they do that?" He said, "They count the tits and then divide by four."

Gentlemen, it does give me great pleasure to introduce to you-not introduce, but present to you a man who has not been in the Operating Department, but has been in the Sales Organization. And I do know he has given hours and hours to the work. I said, "George, how in the hell do you stand this stuff?" He said, "You get so you love it, if you live long enough." It is a hell of a job, and a thankless job. They fight for the job, they finally choose you, you work for nothing, the company pays your wages, you do not give them anything, and the company raises hell with you.

It is my great pleasure to introduce to you George W. Reed, Vice-President, Peabody Coal Company, Chicago, and Chairman of the Bi-

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tuminous Coal Producers Board for District No. 10.

Mr. George W. Reed: Mr. Toastmaster, and Members of the Illinois Mining Institute, and Guests, I have derived a great deal of comfort from what the Toastmaster has said about the classification. I was fearful while he was talking, for I thought of four or five things we had not considered yet, and we will get to that next week.

FEDERAL REGULATION OF THE BITUMINOUS COAL INDUSTRY

By GEORGE W. REED

Vice President, Peabody Coal Company Chairman, Bituminous Coal Producers Board for District No. 10

Your members have handled their part of the coal mining business in a way that has brought credit to your organization. The men in the operating and engineering departments can be justly proud of their accomplishments with Illinois mines during the last 25 years. No state now has better mines or better operated mines, and I am informed that this has come largely through the free exchange of ideas and experiences of the members of this Most of us who are Institute. charged with the duty of marketing and distributing the production of the mines have done little, if anything, in a collective way of which anyone may be proud. It is the manner in which coal has been marketed in this country that has brought about the deplorable conditions which have existed in the industry for years. It also is the direct cause of Federal regulation.

There are 28 important coal producing states in this country. The coal mined in every state competes with coal mined in other states. West Virginia ships to 31 states, Canada and tidewater; Pennsylvania ships to 24 states and Canada; Illinois ships to 14 states.

Because of the bulky nature and low value of coal per ton, transportation charges constitute an extremely high proportion of the total delivered cost. Between 1923 and 1933 the average freight charge per ton on coal ranged between \$2.36 and \$2.20, while the average f.o.b. mine price of the coal declined steadily from \$2.68 in 1923 to \$1.34 in 1933. Aside from low grade sand, there was no other commodity being sold at that time 15 pounds for 1 cent, which is equivalent to \$1.34 per ton.

The percentage of labor cost to value of the product is very much higher in the bituminous coal industry than in any other large industry, except anthracite coal. Wages in the coal industry in 1929 constituted over 59 percent of the total value of the product, and during the succeeding years the percentage of wages to total value of the product has been higher than it was in 1929. During that year the general average for the four other large mining industries was 21 percent, and for the 48 largest manufacturing industries 18.2 percent.

The Bureau of Internal Revenue reports show a deficit for the bituminous coal industry during the boom year of 1928 of \$24,000,000.00; the loss for 1929 was \$12,000,000.00; for 1930, \$42,000,000.00. It is estimated that the industry has been losing at the rate of \$40,000,000.00 per year ever since, except in 1934.

The action of Congress in passing the Bituminous Coal Act of 1937 came as a result of more than 21 years' consideration of the bituminous coal problem, and of a consequent conviction that the business of supplying the nation with this essential source of energy required government regulation. During the last 21 years there have been 20 investigations or hearings by Congress, or by specially created commissions, with respect to conditions in the industry. In these investigations and hearings, Congress has inquired into and obtained information in connection with every aspect of the bituminous coal industry.

Some of these investigations concerned shortages of coal and high prices. The shortage occurring during the World War impressed upon everyone the importance of a constantly adequate supply of fuel. For a time lack of coal became a limiting factor in the military program, and after extended hearings Congress authorized the control of distribution, and the fixing of maximum prices. When these maximum prices were removed prices rose to an alltime peak, and protests from consumers led to further congressional investigations.

The investigations after 1923 dealt with the disastrous effects of destructive competition in the industry. In the hearings held in 1926, 1928, 1929, 1932, 1935 and 1937, the plight of the bituminous coal industry, the surplus capacity, the destructive competition, the price cutting and the wage cutting, the consequences of the breakdown

of the machinery of collective bargaining, the continuous and heavy financial losses, and the violence, disorder and poverty in the mining districts, were all fully revealed.

The bituminous coal industry was among the first to submit a code under the National Industrial Recovery Act of 1933, and it operated under a code from September, 1933 to May, 1935. Conditions in the bituminous coal industry were greatly improved under the scheme of regulation which its code provided. Thus Congress had before it when it passed the Bituminous Coal Act of 1937, the experience of the industry and of coal consumers under a system of Federal regulation, a vast amount of information as to the problems of the industry in the past, and the decision of the Supreme Court and the opinions of its members on some of the important features in the Bituminous Coal Conservation Act of 1935.

The 1935 Law provided that whenever the maximum daily and weekly hours of labor were agreed upon between the producers of more than two-thirds of the annual national tonnage and representatives of more than one-half of the mine workers employed, such maximum hours of labor were to be accepted by all code members; and wage agreements negotiated in any district or group of districts between representatives of producers of more than two-thirds of the annual tonnage of such districts and representatives of the majority of the mine workers were to be accepted as the minimum wages for the various classes of labor by all of the code members operating in such district.

The members of the Supreme Court unanimously agreed:

"That the effect of the labor provisions of the Act, including

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those in respect of minimum wages, wage agreements, collective bargaining, and the Labor Board and its powers, primarily falls upon production and not upon commerce; and confirms the further resulting conclusion that production is a purely local activity. It follows that none of these essential antecedents of production constitutes a transaction in or forms any part of interstate commerce."

The majority of the Court held:

"The various provisions of the Act are inseparable; and, the labor provisions being unconstitutional, the price fixing provisions of the code are thus disposed of without coming to the question of constitutionality."

Mr. Justice Cardozo, in his opinion, which was concurred in by Mr. Justice Brandeis and Mr. Justice Stone, stated as follows:

"Part II of the statute sets up a valid system of price-fixing as applied to transactions in interstate commerce and to those in intrastate commerce where interstate commerce is directly or intimately affected."

"Part II, with its system of price-fixing, is separable from Part III, which contains the provisions as to labor considered and condemned in the opinion of the court."

"The price provisions being valid, the complainants were under a duty to come in under the code, whether the provisions as to labor are valid or invalid, and their failure to come in has exposed them to a penalty lawfully imposed."

Mr. Chief Justice Hughes, in a separate opinion, stated:

"The labor provisions are invalid; but the provisions of the Act are separable; the Act, and the Code for which it provides, may be sustained in relation to the provisions for marketing in interstate commerce."

The Bituminous Coal Act of 1937 became effective April 26, 1937. It provides for the creation of a National Bituminous Coal Commission of 7 members appointed by the President, two of the members must have had previous experience as producers, two must have had experience as bituminous coal mine workers, not more than one Commissioner to be a resident of any one state, not more than one Commissioner to be a resident of any of the districts.

Also provides for the establishment in the Department of the Interior of the office of Consumers' Counsel to represent the interests of the consuming public, and for the establishment by the Commission of a statistical bureau for each district, such bureau to be operated and maintained as an agency of the Commission.

It divides the coal mining sections into 23 districts and provides for the organization of District Boards for each district, the Boards to consist of not less than 3, and not more than 17 members, the number of members to be determined by the majority vote of the district tonnage for the year 1936. All but one of the Board members to be code members, or representatives of code members, truly representative of all of the mines in the district, one of the members to be selected by the organization of employees representing the preponderant number of employees in the industry of the district. The number of producer members to be an even number, one-

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half to be elected by the majority in number of the code members, the other half to be elected by a majority of the tonnage of the code members during the preceding year.

It divides the mining sections into 10 minimum price areas. The intention was to have in each minimum price area the districts which are in active and substantial competition.

Other important provisions of the 1937 Law are:

The classification of coals from all mines by District Boards, subject to the approval of the Commission.

The proposal by District Boards of minimum prices, such minimum prices to reflect the relative market value of the various kinds, sizes and qualities, shall be just and equitable as between producers and have due regard to the interests of the consuming public. Such minimum prices must yield a return equal as nearly as may be to the weighted average of the total cost of the tonnage of the minimum price area. Total cost is defined as the cost of labor, supplies, power, taxes, insurance, workmen's compensation, royalties, depreciation and depletion and all other direct expenses of production, coal operators' association dues, district board assessments, reasonable cost of selling and the cost of administration.

The coordination of prices in all common consuming market areas upon a fair competitive basis, such coordination to take into account values as to uses, transportation methods and charges, and their effect upon a reasonable opportunity to compete upon a fair basis, and the competitive relationship between coal and other forms of fuel and energy.

The Commission is authorized to establish maximum prices under certain conditions. No coal subject to the provisions of the Act to be sold or offered for sale at a price below the minimum or above the maximum established by the Commission, except coal shipped under lawful and bona fide written contracts entered into prior to June 16, 1933.

Price provisions shall not be evaded or violated through the use of docks, storage facilities, transportation facilities, subsidiaries, affiliated companies or other intermediaries or instrumentalities.

Exemption of coal consumed by the producer, or coal transported by the producer to himself for consumption by him, and for coal in intrastate commerce which does not in any manner directly affect interstate commerce in coal.

Several practices, known as "Unfair Methods of Competition" shall be considered as violations of the code.

The Commission has the power to inspect books and records of code members.

The Commission may revoke the membership of any producer and his right to exemption of tax of 19½ percent of the sale price of his production upon proof after hearing that such member has wilfully violated the provisions of the code.

Any producer whose membership shall have been revoked and cancelled may have his membership reinstated upon the payment to the Government of a tax amounting to 39 percent of the minimum price on the tonnage sold or disposed of in violation.

Any code member who shall be injured in his business or property by another code member by reason of the doing of any act which is forbidden, or the failure to do any act which is required by the Law, may sue in any court of competent juris-

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diction and recover three-fold damage by him sustained, and cost of suit.

Any code member or district board or member of a district board, or any state or political subdivision of a state, or the consumers' counsel, may appeal to the Commission at any time, and pending final disposition of such petition, and upon reasonable showing of necessity therefor, the Commission may make such temporary order as in its judgment may be appropriate.

Any person aggrieved by an Order issued by the Commission in a proceeding to which such person is a party, may obtain a review of such Order in the Circuit Court of Appeals of the United States within any circuit wherein such person resides or has his principal place of business, by filing in such Court a written petition praying that the Order of the Commission be modified or set aside in whole or in part.

The Commission is authorized to initiate, promote and conduct research to improve methods of mining, preparation, conservation, distribution and utilization of coal, and the discovery of additional uses for coal.

All of the mining sections in Illinois are included in District No. 10.

The Board for Illinois is unique in that it has the smallest number of members of any of the boards. Mr. Ray Edmundson, President of District No. 12 of the United Mine Workers of America, is the member representing the mine employees. Mr. C. J. Sandoe and myself were selected by the code members. We have appointed a Price and Classification Committee, composed of 20 code member representatives familiar with the sale and distribution of Illinois coal. Equal representation

has been given to the four producing sections of the State.

We were ordered on August 23rd to propose and file with the Commission not later than September 2nd schedules of minimum prices on all sizes from all mines for shipment into all consuming market areas, this schedule to equal as nearly as possible the weighted average cost of production of Minimum Price Area 2, which includes Illinois, such schedule of prices to serve as prices for coordination with all other districts with which Illinois is in active competition.

Illinois coal is in active competition with all of the coal produced in the country, except that from Maryland, Michigan, New Mexico, Utah and Washington. It competes in a small territory with coal from Utah, and in another territory with a small tonnage from Maryland.

In the same Order we were instructed to start coordination proceedings on September 8th, and have the prices coordinated with those of all of the competing districts not later than September 23rd. We have reached coordination agreements with all of the other districts, except one, and an agreement with that district will be reached as soon as we secure necessary additional information.

About the time we received the Order requiring us to file proposed minimum prices, we received another Order to classify all of the coals produced in Illinois. This Order directed that we classify coals at the time and place when preparation for market had been completed at the mine, or at facilities considered as an adjunct to the mine. The Order sets up certain standards to be observed and complied with, and mentions several factors which shall be considered as pertinent and shall

be given due consideration. Those factors are proximate analysis; analysis of ash; ultimate analysis of coal; physical characteristics; and characteristics of performance.

Proximate analysis shows the useful and detrimental factors in coal, moisture, ash, volatile matter, fixed carbon, sulphur, British Thermal Units and ash softening temperature. These factors have been used for years in determining the relative value of coal for ordinary heating and steam producing purposes.

Analysis of ash shows the constituents of the ash—iron oxide, alumina, silica, lime, magnesia, alkalies, sulphur trioxide and phosphorous pentoxide.

Ultimate analysis shows carbon, hydrogen, nitrogen, oxygen and sulphur and is used in the sale and purchase of coal for the manufacture of gas, coke, by-products and for metallurgical work.

Physical characteristics cover appearance, color, friability, etc.

Characteristics of performance factor was evidently intended to cover performance of the various classes of coal in actual use.

In order to start the classification work it was necessary to ask all code members to file with the Board proximate analysis of their various sizes of coal, information on physical characteristics and other information such as the percentage of the various sizes into which mine run separates. We gave due consideration to ultimate analysis and ash analysis, but did not ask for information on either, as we did not consider that such information as was then available could be used intelligently in connection with Illinois coal.

At that time companies with 157 railroad shipping mines, and companies with about 390 local mines, had accepted the code. We attempted to classify the coals of the railroad shipping mines first, and did not at that time ask for information on the coal produced by the local mines. This Order directed us to give every code member 10 days in which to file answers to the questionnaire.

We filed a Proposed Schedule of Classification shortly after September 2nd, and received 15 protests. Most of these protests claimed that the coal of their mines was improperly classified. Some of these protests were immediately adjusted and others are being investigated. These investigations consist of a commercial testing company taking representative samples of the different sizes on two different days and reporting to the Board the proximate analysis of those sizes, with other information. Other protests were on the ground that we did not use ultimate and ash analyses. had not established definite standards on some of the other factors. and it is on these protests that the Proposed Schedule of Classification was not approved when presented. Hearings in Washington have been held on the classification schedule proposed, and the matter of classifying Illinois coals is now being handled by the Bituminous Coal Commission.

The weighted average cost of producing coal in 1936 has been determined and adjustments have been made to cover the changes in the various cost items which have taken place since January 1, 1936, and the adjusted costs for Illinois coal, with necessary proof, have been filed with the Commission.

We expect to have completed within the next day or two the required proof that the coordinated minimum prices for Illinois will

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give a weighted average realization very closely approximating the adjusted weighted average cost.

Hearings on the coordinated price schedules of all districts have not been held as yet, but it is expected that such hearings will be started within the next week or two.

As the minimum price schedules must be adjusted so as to yield a return equal as nearly as may be to the weighted average cost, the statement has been made times without number that such adjustment of prices will give no profit to the industry as a whole and will put high cost mines out of business. The answer to that is that the prices to be established are minimum prices, and that there is nothing to prevent any producer from selling his coal at higher than the minimum prices established, except the provision in the Law that under certain conditions the Commission has the power to establish maximum prices, and such maximum prices shall be a uniform increase above the minimum prices in effect, and that no maximum price shall be established for any mine which does not yield a fair return on the fair value of the property. High cost mines have been able to survive only through superior quality, location or affiliation. The establishment of minimum prices for all coal should prolong the life of such high cost mines.

It is believed that the provisions of the 1937 Law are workable and enforceable. The code as provided in the Act should hold no terrors for anyone accepting the code and observing the provisions of it. The Act specifically provides for appeals by code members or districts to the Bituminous Coal Commission, hearings by the Commission, and review by the Circuit Court of Appeals of the United States of orders issued

by the Bituminous Coal Commission. For the code member attempting to evade the code there is the liability of penalties prescribed by the Act. For the producer who does not wish to become a code member there is a provision under which his coal may be exempt.

The coal industries of all other important coal producing countries of the world have been under some form of governmental regulation for several years. A newspaper article dated London, October 21st, states that English coal mines are prospering, that the improvement has been continual since the inauguration of the British Coal Mines Act of 1930, but has been most marked in the last two years since the introduction of a plan to control sales and production.

I know of no place where the scars of free and unrestrained competition in the coal industry are deeper or more pronounced than in Sangamon County, Illinois. Not many years ago Sangamon County had in regular operation 31 railroad shipping mines with 6.875 employees. producing about 5,000,000 tons a year, and that was prior to the War years. In 1936 there were 8 railroad shipping mines, employing 3,300 men, with a production of 2,600,000 tons. There has been no railroad shipping mine of any importance constructed in Sangamon County in the last 20 years. The last one was constructed in 1917, and that mine has been idle for the last 5 or 6 years. No one knows the amount of capital investment that has been lost in the coal mining industry in this immediate district, and there still remains thousands of acres of unmined coal immediately adjacent to the main lines of the railroads serving this district. A few years ago the Receiver of one of the companies with mines in Sangamon and Menard Counties advertised for bids on seven of those mines. Three bids were received, the highest being \$25,000.00, and the seven properties were sold for that amount. The capital investment in those properties must have been at least \$1,500,000.00.

I have yet to meet a buyer of coal who was not willing to pay a price which would yield a fair profit over cost. The difficulty has been that the sellers of coal have not permitted most buyers to pay a price which would yield a fair profit over cost.

The industry has spent virtually nothing on research designed to improve methods of distribution and utilization of coal and the discovery of additional uses for coal. A few of us have contributed from time to time to various institutions, but there has never been a well defined plan with sufficient appropriation to give promise of securing beneficial results.

Under the Law the industry is paying an additional \$4,000,000.00 per year to the Government, being at the rate of one cent per ton. I know it is the intention of the Commission to ask the industry to help it work out a comprehensive plan for research, particularly as to the further use of coal and its derivatives. One of the subjects I have in mind is the use of powdered coal in Diesel engines.

Federal regulation will require more sales intelligence, sales expense and sales effort than the industry has ever known. It is my opinion that when the minimum prices, with rules and regulations governing the sale and distribution of coal, go into effect and become an accepted part of the business, all of us will look back and wonder why anyone doubted that a practical regulatory law would be of benefit to all connected with the industry, and also a benefit to the coal consuming public generally.

The Toastmaster: I thank you, Mr. Reed.

Now, it becomes my duty to turn this meeting over to your newly elected President, Mr. Taylor.

President H. H. Taylor, Jr.: It is evident that our coal mining industry of Illinois has been through a very trying period and trying times during the last ten or twelve years, times which have demanded the utmost in operating efficiency and skilled knowledge. We are apparently now entering upon an era which will be changing entirely our methods of doing business. From the information we have received tonight, it seems that this should be to our benefit.

Our own Illinois Mining Institute is the one organization that I know of that well represents the mining industry in all its branches in this midwest section. It has grown in numbers and in strength and in prestige during the last eight or ten years, and it seems to me it has arrived at the point where it can be of real service to the citizens of this State.

I personally appreciate the honor of being your President for the next year, and the confidence which you have apparently shown in asking me to serve in that capacity, and I think I bespeak the sentiments of your Officers and the Board of Directors in saying that we will do the very best we can to carry on the traditions handed over to us by our predecessors.

The meeting will stand adjourned until our next meeting in the Spring.

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

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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

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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.

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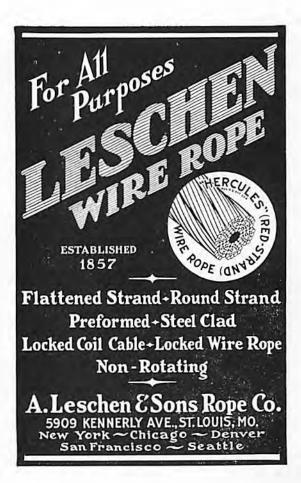
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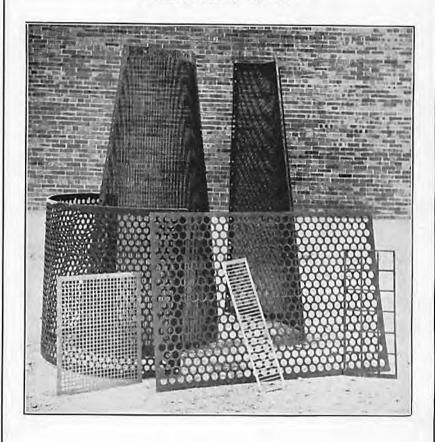
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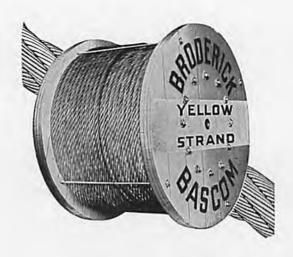
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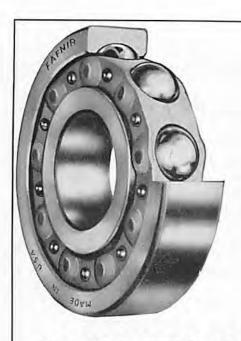
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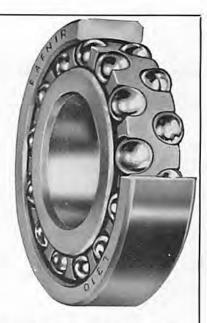
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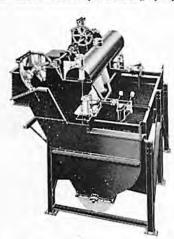
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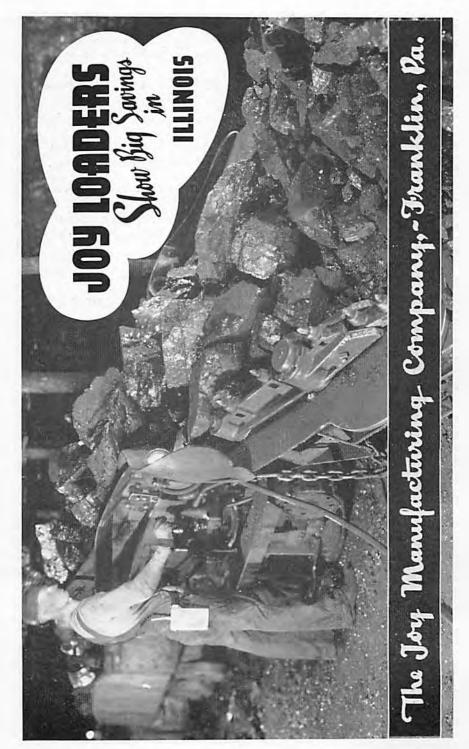
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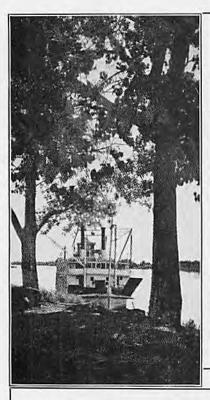


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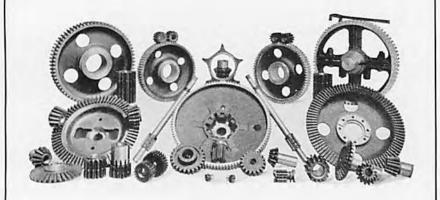
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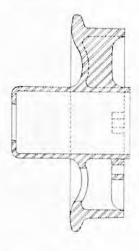
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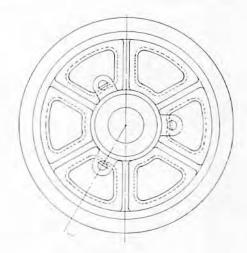
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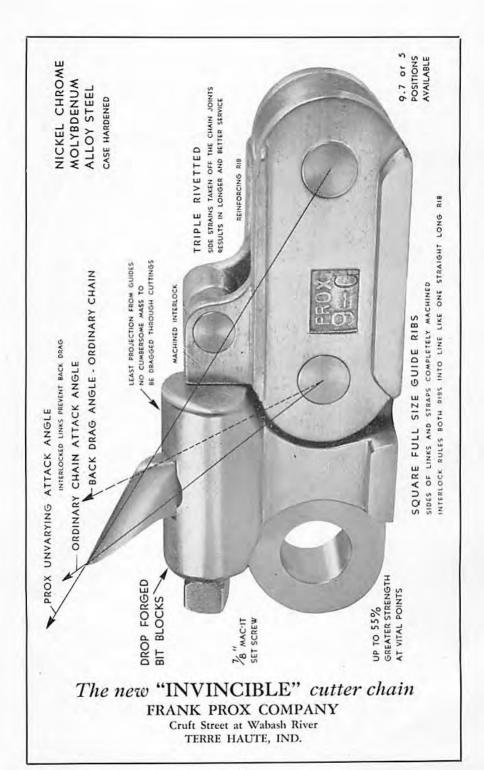
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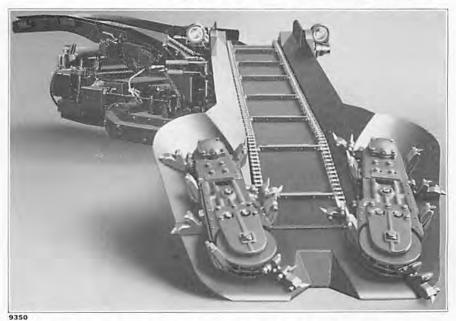
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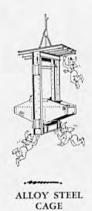
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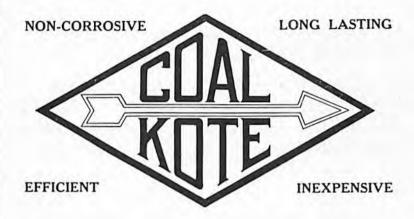
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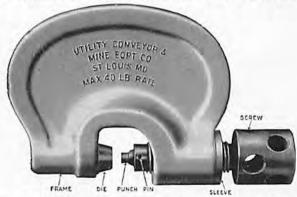
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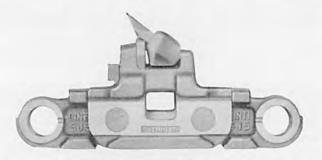
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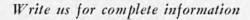
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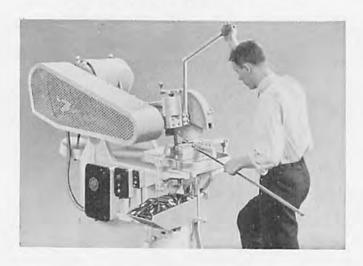
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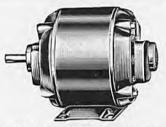
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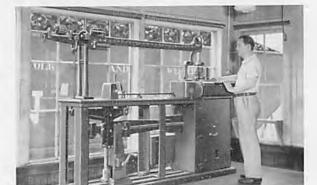
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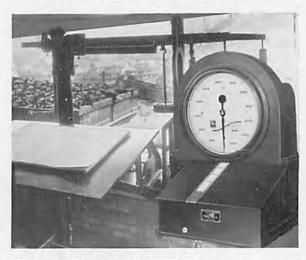


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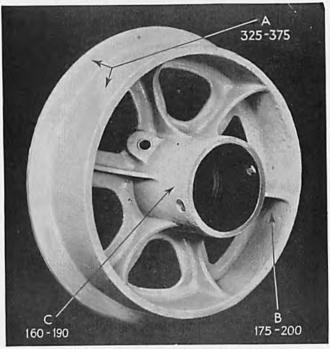
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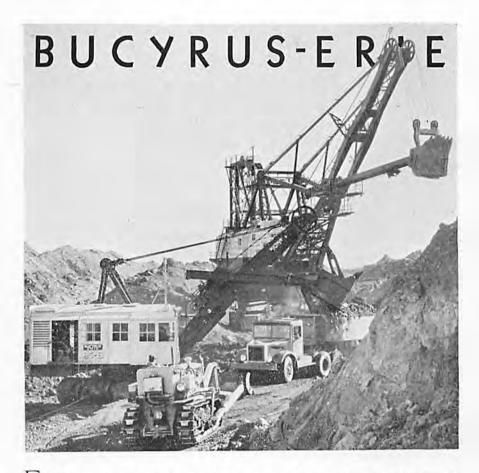


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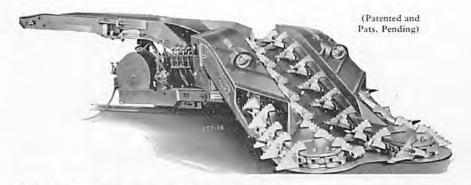
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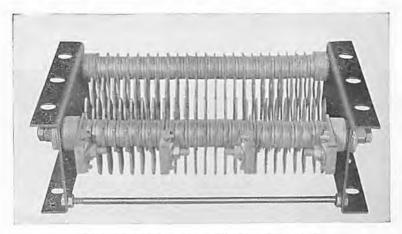
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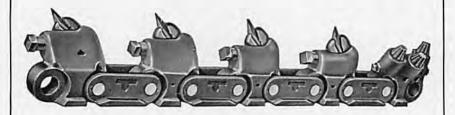
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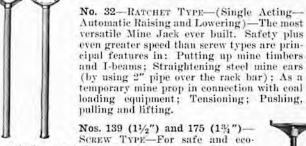
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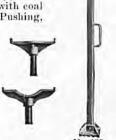
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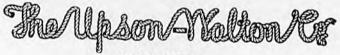
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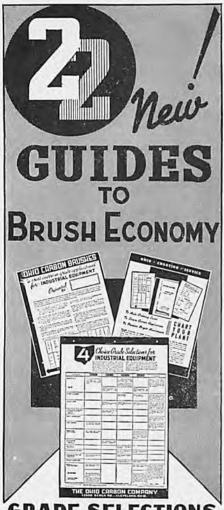
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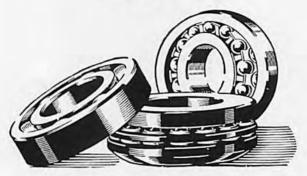
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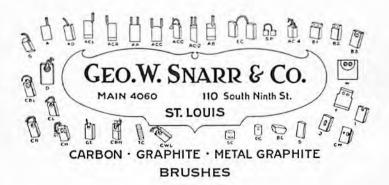
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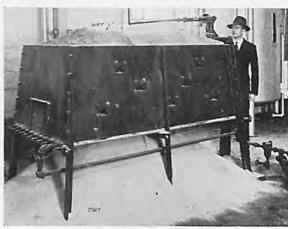
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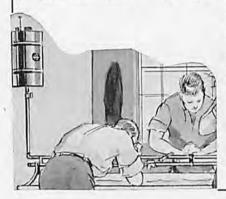
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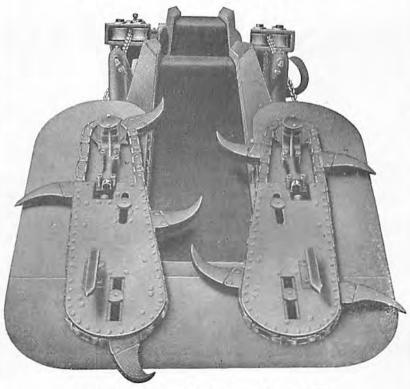
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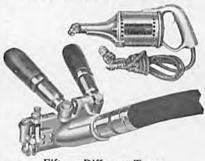
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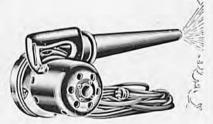


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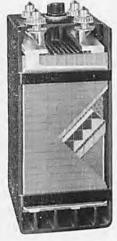
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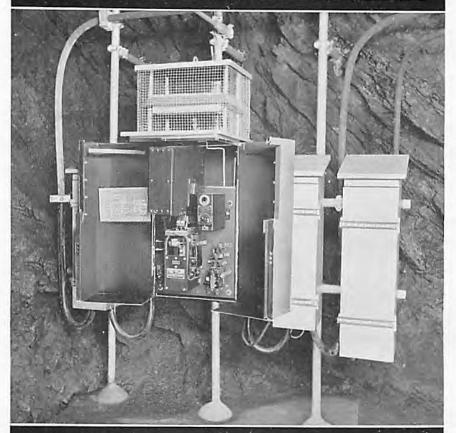
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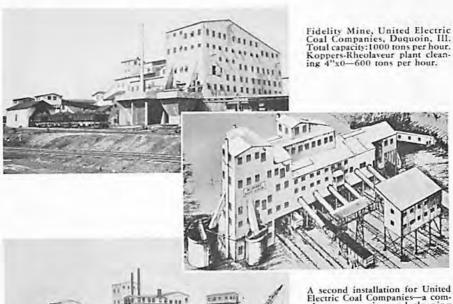
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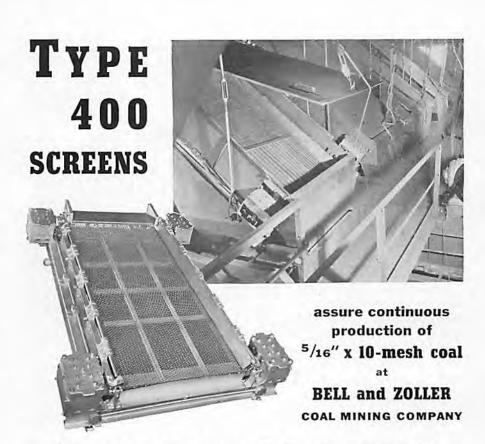
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