PROCEEDINGS

of the

ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892

Sixty-fourth Year

1956

Annual Meeting
SPRINGFIELD, ILLINOIS
October 26, 1956

F. E. SNARR
President, 1956

In Loving Remembrance

WILLIAM ORTMAN, Feb. 22, 1931
S. W. FARNHAM, March 12, 1931
H. C. PERRY, April 13, 1931
A. J. SAYERS, Oct. 11, 1931
C. E. KARSTROM, March 24, 1932
JOSEPH D. ZOOK, May 28, 1932
EDWARD CAHILL, Aug. 4, 1932
JOSEPH VIANO, Dec. 12, 1932
JOHN ROLLO, Feb. 6, 1933
DAVID I. ROCK, Aug. 2, 1933
WM. HUTTON, Aug. 18, 1934
FRED K. CLARK, Oct. 24, 1934
ERWIN CHINN, April 16, 1935
ADAM CURRIE, June 12, 1935
W. H. SLINGLUFF, Sept. 10, 1935
CHAS. B. SPICER, Oct. 26, 1935
NELSON P. MORRIS, Sept. 3, 1936
DON WILLIS, Dec. 9, 1936
T. E. COULEHAN, Jan. 11, 1937
ALBERT WEBB, March 5, 1937
H. B. COOLEY, March 23, 1937
C. W. SWANSON, July, 1937
JOSEPH McFADDEN, Sept. 15, 1937
E. G. LEWIS, Sept. 21, 1937
E. L. STEVENS, Sept. 28, 1937
W. C. ARGUST, Dec. 17, 1937
H. H. TAYLOR, SR., Dec. 28, 1937
E. L. BERGER, May 27, 1938
J. I. THOMPSON, June 24, 1938
P. W. MacMURDO, July 11, 1938
J. A. EDE, July 26, 1938
M. C. MITCHELL, Sept. 11, 1938
C. F. HAMILTON, Sept. 22, 1938
H. C. LONGSTAFF, Oct. 12, 1938
JOHN JOHNSON, Jan. 2, 1939
C. A. BLOMQUIST, Jan. 9, 1939
JOHN WHITE, April 15, 1939
CHARLES HAFFTER, May 21, 1939
BRUNO F. MEYER, July 21, 1939
JOHN A. GARCIA, Aug. 11, 1939
A. J. MOORSHEAD, Oct. 16, 1939
HARVEY E. SMITH, Nov. 6, 1939
C. W. McREAKEN, Nov. 30, 1939
C. C. HUBBART, March 4, 1940
SAMUEL HANTMAN, Sept. 13, 1940
SIMON A. BOEDEKER, Oct. 12, 1940
JOHN H. DAVIS, Oct. 21, 1940
S. J. WILLS, Oct. 22, 1940
HARRY HANTMAN, Nov. 5, 1940
J. W. GLENWRIGHT, Nov. 27, 1940
J. C. WILSON, Dec. 18, 1940
NICHOLAS CHRISTENSEN, Dec. 26, 1940
JOHN W. POLING, Jan. 31, 1941
JOHN T. RYAN, Feb. 20, 1941
M. F. PELTIER, April 2, 1941
F. M. BEAN, April 30, 1941
C. J. SANDOE, Aug. 29, 1941
F. M. SCHULL, Aug. 20, 1941
F. F. SCHLINK, March 15, 1942
FRED F. GERMANN, March 31, 1942
JOHN MENTLER, April 28, 1942
HUGH MURRAY, June 5, 1942
G. D. COWIN, June 14, 1942
JAMES M. ROLLO, June 15, 1942
SYDNEY A. HALE, Aug. 12, 1942
BYRON BROWN, Sept. 17, 1942
J. E. SEYMOUR, Nov. 21, 1942
OTTO AWE, Dec. 6, 1942
A. F. ALLARD, Dec. 29, 1942
THOMAS R. STOCKETT, Feb. 15, 1943
A. R. JOYCE, April 7, 1943
W. S. BURRIS, April 9, 1943
A. H. MALSBERGER, May 7, 1943
J. B. FLEMING, May 19, 1943
H. T. MORGAN, May 29, 1943
E. W. HASENJAEGER, July 29, 1943
C. W. WATERMAN, Aug. 7, 1943
J. R. HURLBURT, Sept. 6, 1943
JAMES S. ANDERSON, Sept., 1943
F. F. JORGENSEN, Nov., 1943
E. W. BEARD, Jan. 5, 1944
W. M. ELDERS, Jan. 22, 1944
THOMAS ENGLISH, April 3, 1944
FRANK TIRRE, May 22, 1944
*J. K. CHILDS, June 10, 1944
W. S. STINTON, Dec. 6, 1944
E. W. HAWLEY, Jan. 29, 1945
J. C. ANDERSON, July 7, 1945
F. A. FLASKAMP, Aug. 12, 1945
JOHN M. DILLAVOU, Aug. 19, 1945
STANLEY A. TRENGOVE, Dec. 28, 1945
H. A. ZELLER, Jan. 22, 1946
H. E. MABRY, Nov. 8, 1946

* Killed in Action

In Loving Remembrance

M. K. HERRINGTON, May 11, 1946
L. W. BALDWIN, May 14, 1946
C. P. HOY, May 30, 1946
STUYVESANT PEABODY, June 7, 1946
PETER A. CASSADY, June 18, 1946
JOHN F. GOALBY, June 7, 1946
OSCAR WINTER, Sept. 21, 1946
GEORGE HOOK, Sept. 29, 1946
E. J. KRAUSE, Sept. 30, 1946
J. R. PEARCE, Dec. 10, 1946
E. R. ARMSTRONG, Feb. 17, 1947
JOS. P. LENZINI, Feb. 20, 1947
JOHN H. BAUER, March 12, 1947
ARTHUR PHILLIPS, June 27, 1947
LEE HASKINS, Sept. 19, 1947
C. H. BURKHALTER, Oct. 18, 1947
JETT J. WEST, Nov. 11, 1947
THOMAS MOSES, Feb. 20, 1948
W. H. HUBELI, April 3, 1948
G. E. LYMAN, April 27, 1948
WALTER M. DAKE, May 13, 1948
ARLEN "ZACK" JENNINGS, July 30, 1948
ERNEST L. STEPPAN, Aug. 7, 1948
KENNETH DONALDSON, Aug. 18, 1948
PAT HEAP, Sept. 23, 1948
F. E. FINCH, Nov. 2, 1948
J. E. BARLOW, Nov. 5, 1948
J. W. STARKS, Feb. 3, 1949
D. W. MARSHALL, March, 1949
JAMES WHITE, March 17, 1949
W. W. PAAPE, March 18, 1949
JAMES W. BRISTOW, April 14, 1949
GEORGE F. CAMPBELL, June 18, 1949
E. J. BURNELL, July 22, 1949
LOUIS W. HUBER, Aug. 7, 1949
JOHN RODENBUSH, Nov. 1, 1949
R. G. LAWRY, Dec. 24, 1949
WALTER A. BLEDSOE, March 1, 1950
A. S. KNOIZEN, April 29, 1950
H. C. FREDERICKS, Aug. 16, 1950
JOSEPH E. HITT, Sept. 21, 1950
ARTHUR C. GREEN, Oct. 31, 1950
A. P. TITUS, Nov. 9, 1950
A. W. DUNCAN, Nov. 20, 1950
GILBERT W. BUTLER, Nov. 26, 1950
FRED W. RICHART, Dec. 10, 1950
CHARLES L. BOWMAN, Jan. 30, 1951
B. P. MELTON, February 22, 1951
A. F. KEENAN, March 18, 1951
GEORGE M. LOTT, April 12, 1951
D. F. McELHATTAN, April 12, 1951
M. J. CHOLLET, April 20, 1951
WILLIAM BURNETT, JR., June 14, 1951
E. J. COFFEY, July 20, 1951
A C. CALLEN, July 30, 1951
F. E. WEISSENBORN, August 7, 1951
R. A. BARTLETT, November 26, 1951
D. D. WILCOX, November 30, 1951
A. D. BUSCH, January 1, 1952
F. H. SEYMOUR, February 20, 1952
C. M. O'BRIEN, April 16, 1952
JOHN L. CLARKSON, June 9, 1952
HARRY VOGELPOHL, June 15, 1952
HECTOR HALL, August 21, 1952
J. J. RUTLEDGE, September 11, 1952
NORMAN PRUDENT, September 18, 1952
WALTER WHITING, September 25, 1952
D. W. JONES, November 26, 1952
G. H. BERGSTROM, December 11, 1952
E. J. STERBA, December 31, 1952
W. J. JENKINS, January 12, 1953
FRED J. BAILEY, January 16, 1953
A. C. BASS, Feb. 10, 1953
A. R. JAMISON, Feb. 25, 1953
ANDREW JUNELL, March 4, 1953
HARVEY CARTWRIGHT, June 4, 1953
L. A. DUNBAR, July 30, 1953
R. W. WEBSTER, August 10, 1953
L. A. TROVILLION, Sept. 4, 1953
H. A. REID, October 20, 1953
GEORGE MEAGHER, November 6, 1953
WILLIAM J. McDOWELL, Dec. 12, 1953
L. E. YOUNG, Dec. 27, 1953
O. V. SIMPSON, March 25, 1954
CASPER D. MEALS, April 27, 1954
T. W. PEARSON, May 11, 1954
HARRISON H. JOHNSON Jr., July 20, 1954
BEN H. FIRTH, October 21, 1954
JACK BULLINGTON, October 29, 1954
LOWELL T. MALAN, December 29, 1954
H. KENNETH VOGEL, January 4, 1955
CHARLES H. DUESING, January 8, 1955
JOHN LAND, June 5, 1955
C. W. BROOKS, September 21, 1955
JOE LITTLEFAIR, September 27, 1955
O. J. FLESCHNER, December 10, 1955
GLENN A. SHAFER
HENRY M. MOSES, April 1, 1956
CAPT. W. H. LEYHE, July 4, 1956
J. A. JEFFERIS, July 14, 1956
JOHN A. EMRICK, July 27, 1956
ROBERT M. MEDILL, January 27, 1957
JAMES W. MORGAN, February 1, 1957
JOSEPH F. JOY, February 19, 1957

OFFICERS 1956

PRESIDENT

Earl Snarr
Hinsdale, Illinois

VICE-PRESIDENT

Paul Halbersleben
Harrisburg, Illinois

SECRETARY-TREASURER

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102 Natural Resources Building,
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Byron Somers**

* Term expires 1957
** Term expires 1958
*** Term expires 1959

PAST PRESIDENTS OF ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892

1892-93 JAMES C. SIMPSON, Gen. Mgr., Consolidated Coal Co., St. Louis, Mo.
1893-94 JAMES C. SIMPSON, Gen. Mgr., Consolidated Coal Co., St. Louis, Mo.
1894-95 WALTON RUTLEDGE, State Mine Inspector, Alton, Ill.
1895-1911 Institute inactive.
1912-13 JOHN P. REESE, Gen. Supt., Superior Coal Co., Gillespie, Ill.
1913-14 THOMAS MOSES, Supt., Bunsen Coal Co., Georgetown, Ill.
1914-15 J. W. STARKS, State Mine Inspector, Georgetown, Ill.
1915-16 WILLIAM BURTON, V. P., Illinois Miners, Springfield, Ill.
1916-17 FRED PFAHLER, Gen. Supt., Superior Coal Co., Gillespie, Ill.
1917-18 PATRICK HOGAN, State Mine Inspector, Carbon, Ill.
1918-19 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, Litchfiield, Ill.
1923-24 D. D. WILCOX, C. E., Superior Coal Co., Gillespie, Ill.
1924-25 H. E. SMITH, Gen. Supt., Union Fuel Co., Springfield, Ill.
1925-26 E. G. LEWIS, Supt., Chicago-Sandoval Coal Co., Sandoval, Ill.
1926-27 WM. E. KIDD, State Mine Inspector, Peoria, Ill.
1927-28 JAMES S. ANDERSON, Supt., Madison Coal Corp., Glen Carbon, Ill.
1928-29 JOHN E. JONES, Safety Engineer, Old Ben Coal Corp., West Frankfort, Ill.
1929-30 PROF. A. C. CALLEN, University of Illinois, Urbana, Ill.
1930-31 JOSEPH D. ZOOK, Pres., Illinois Coal Operators Assn., Chicago, Ill.
1931-32 GEO. C. MCFADDEN, Asst. Vice-Pres., Peabody Coal Co., Chicago, Ill.
1932-33 CHAS. F. HAMILTON, Vice-Pres., Pyramid Coal Co., Chicago, Ill.
1933-34 HARRY A. TREADWELL, Gen. Supt., C. W. & F. Coal Co., Benton, Ill.
1934-35 C. J. SANDOE, Vice-Pres., West Virginia Coal Co., St. Louis, Mo.
1935-36 T. J. THOMAS, Pres., Valier Coal Co., Chicago, Ill.
1936-37 W. J. JENKINS, Pres., Consolidated Coal Co., St. Louis, Mo.
1937-38 H. H. TAYLOR, JR., Franklin County Coal Corp., Chicago, Ill.
1938-39 PAUL WEIR, Consulting Mining Engineer, Chicago, Ill.
1939-40 ROY L. ADAMS, Old Ben Coal Corp., West Frankfort, Ill.
1940-41 DR. M. M. LEIGHTON, State Geological Survey, Urbana, Ill.
1941-42 J. A. JEFFERIS, Illinois Terminal Railroad Co., St. Louis, Mo.
1942-43 CARL T. HAYDEN, Sahara Coal Co., Chicago, Ill.
1943-44 BEN H. SCHULL, Binkley Mining Co., Chicago, Ill.
1944-45 GEORGE F. CAMPBELL, Old Ben Coal Corp., Chicago, Ill.
1945-46 JOSEPH E. HITT, Walter Bledsoe Co., St. Louis, Mo.
1946-47 ROBERT M. MEDILL, Dept. Mines & Minerals, Springfield, Ill.
1947-48 HARRY M. MOSES, H. C. Frick Coal Co., Pittsburgh, Pa.
1948-49 J. ROY BROWNING, Illinois Coal Operators Assn., Chicago, Ill.
1949-50 T. G. GEROW, Truax-Traer Coal Co., Chicago, Ill.
1950-51 G. S. JENKINS, Consolidated Coal Co., St. Louis, Mo.
1951-52 CLAYTON G. BALL, Paul Weir Co., Chicago, Ill.
1952-53 WILLIAM W. BOLT, Pawnee, Ill.
1953-54 HAROLD L. WALKER, M. & N Engineering Company, Alton, Ill.
1954-55 J. W. MACDONALD, Sahara Coal Co., Christopher, Ill.
1955-56 EARL SNARR, Freeman Coal Mining Corp., Hinsdale, Ill.

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Reprints from *Coal Age* through courtesy of McGraw-Hill Publishing Co., Inc.

Reprint from *The Illinois Engineer*

PROCEEDINGS OF ILLINOIS MINING INSTITUTE
SIXTY-FOURTH ANNUAL MEETING

Held in Springfield, Illinois

FRIDAY, OCTOBER 26, 1956

MORNING SESSION

The Sixty-fourth Annual Meeting of the Illinois Mining Institute, held in the Ballroom of the Hotel Abraham Lincoln, Springfield, Illinois, on Friday, October 26, 1956, was called to order at 10:15 by President F. E. Snarr.

President Snarr: Good morning, gentlemen. I want to welcome you to this Sixty-fourth Annual Meeting of the Illinois Mining Institute. It looks as if we have a good crowd, and the registration, they tell me, is running something ahead of last year.

We have our minutes of last year's meeting, and if you don't mind, we will dispense with reading them because they were published in the *Proceedings*. We have a short matter of business here that we will take care of first.

I would like to call on Mr. George Wilson, Secretary - Treasurer, for his report at this time.

REPORT OF THE SECRETARY

Secretary - Treasurer George M. Wilson: During the year 1956, your Institute had 822 paid members. As of 9:45 this morning, there were 409 members registered — a gain of 85 at the same time last year.

At the banquet tonight, the total registration will be announced.

The cash balance of your organization as of October 26, 1956 was $6,697.47. We have $14,000 in Government interest-bearing bonds, as well as one $1,000 Missouri-Pacific bond.

The *Proceedings* for 1956 are being compiled. The excellent response for advertising copy has given us 105 advertisers, as of yesterday. The Advertising Committee extends a most hearty thanks to you manufacturers for your cooperation.

We wish to thank the Officers and the Members of the Executive Committee for their wholehearted cooperation during the past year, and to our Honorary Secretary and Treasurer, Mr. Schonthal, my thanks for wise and valued counsel.

I thank you very much. (Applause)

President Snarr: Thank you, Mr. Wilson.

Gentlemen, you have heard the reading of the Secretary's Report. What is your pleasure?

William R. Chedsey (University of Illinois): I move that the Secretary's report be accepted.

Ben H. Schull: I second the motion.

President Snarr: The motion has been made and seconded to accept the Report of the Secretary. All in favor, let it be known by saying "aye"; opposed, "no."

The Report of the Secretary-Treasurer is accepted.

The next order of business will be a Report of the Nominating Committee, headed by Mr. John Foster, as Chairman. Mr. Foster.

NOMINATING COMMITTEE REPORT

John R. Foster (Freeman Coal Mining Corp., West Frankfort, Illinois): Mr. Chairman and Members of the Mining Institute: Your Nominating Committee has met and made the following nominations for officers for the ensuing year:

OFFICERS

President: Paul Halbersleben, Sahara Coal Company, Harrisburg, Illinois.

Vice-President: H. C. Livingston, Truax-Traer Coal Company, Chicago, Illinois.

Secretary-Treasurer: George M. Wilson, 102 Natural Resources Building, Urbana, Illinois.

EXECUTIVE BOARD

For the Executive Committee, to serve three years:

E. Gammeter, Paul Weir Company, Chicago, Illinois.

Joseph Schonthal, B. E. Schonthal & Co., Chicago, Illinois.

Murrell Reak, Assistant Director, Department of Mines & Minerals, Springfield, Illinois.

R. J. Hepburn, United Electric Coal Company, Chicago, Illinois.

Signed: Howard Lewis, Sheldon Jones, and John R. Foster.

* * *

President Snarr: Gentlemen, you have heard the Report of the Nominating Committee. What is your pleasure?

J. W. MacDonald (Old Ben Coal Company, Christopher, Illinois): I move that the report be accepted, the nominations be closed, and we elect by acclamation.

Ben H. Schull: I second the motion.

President Snarr: Is there any discussion? . . . All those in favor of accepting the report of this committee, closing the nominations, and electing those named to office, say "aye"; opposed, "no."

They are elected, Mr. Secretary.

Our next order of business should be a Report of the Scholarship Activities Committee. We will now hear from Dr. Read, from the University of Illinois, who will report on that for the *State University*. Dr. Read.

SCHOLARSHIP REPORT

Thomas A. Read (Professor of Metallurgical Engineering and Head of Department of Mining and Metallurgical Engineering): Mr. President, and members of the

Illinois Mining Institute: It is indeed a pleasure to be here this morning to report to you on the scholarship program that you support, and on the current situation in our Department, Mining and Metallurgical Department, at the University of Illinois.

One of the most noteworthy events of the past year has been the action taken by your Executive Board in increasing the stipend of the Illinois Mining Institute Scholarship from $200 to $400 a year. This action also has been taken by the Sahara Coal Company with respect to the scholarships which they support.

We are most grateful for this increase, and I assure you that it is appreciated by the scholarship holders.

One of the most valuable features of these mining scholarships is that they draw the attention of our youth, particularly in the high schools, to the importance of the coal industry in our nation's economy and the important role that the mining engineers play in the coal industry.

The increase in the scholarship award will, of course, further affect the effectiveness of the scholarships.

In connection with that matter of making known to high school students the career opportunities in mining engineering, and in the coal industry in particular, I would like to take just a moment to tell you about the new University bulletin, "Careers in Mining Engineering," a copy of which I have here, and additional copies of which have been distributed in the room. We hope any of you interested in this will take one. This is a complete revision and, we believe, a substantial improvement on a bulletin issued under the same name a few years ago.

The cost of preparing this bulletin was paid jointly by the Illinois Coal Operators' Association, the Coal Producers' Association of Illinois, the Sahara Coal Company, and the National Coal Association, for whose generosity we are very grateful.

This bulletin describes engineering career opportunities in coal mining and describes a course of study at the University of Illinois. A particular point is made of the availability to well-qualified students of the $400 scholarships supported by the coal mining industry. This bulletin has been widely distributed, including all high schools in the State of Illinois.

Anyone who is interested will please help himself to a copy and see, if possible, that it is put in the hands of some high school junior or senior who might be interested in a career in mining.

I would like, now, to introduce to you the students who have received the Mining Scholarships this year: Will you rise, please?

(Applause)

Illinois Mining Institute
Robert Anton Henn

Sahara Coal Company
Gary D. Bone
Thomas R. Brown
Robert I. Pinney

(Applause)

As is always the case, a group of students and faculty from the University of Illinois have come over for this very valuable experience of the Annual Meeting of the Illinois Mining Institute. In conclusion, I would like to ask them to rise. Will you all please stand up? (Applause)

Thank you. (Applause)

President Snarr: Thank you, Dr. Read.

I have asked Dr. Clark, Head of the Mining School at Rolla, if he would say a word to us about the scholarship activity over at Rolla.

Dr. Clark.

George Clark (Chairman, Department of Mining Engineering, Missouri School of Mines): Mr. President, and members of the Institute: I have attended this meeting eight times out of the last ten years, and it has always been a pleasure to be here and to meet the members of the Institute and to hear the papers that are presented.

I would like to report very briefly on what we are doing in mining at the Missouri School of Mines.

First of all, we are grateful for the Illinois Mining Institute Scholarship, which was reinstated this year at the School of Mines, because we have a large number of students who come from Illinois to study mining at the Missouri School of Mines. And the scholarship this year was given to one of those students who was well-qualified to receive it. I would like to introduce him at this time:

Missouri School of Mines
Richard C. Dendler

Will you please stand? (Applause)

I would like also to report briefly on the status of our studies and curricula at the School of Mines.

About six years ago, a specialized curiculum in coal mining was instituted at the School of Mines. A large number of students graduated, during the high flux of veterans returning to school, in this curriculum.

Then the interest dropped off in the coal program, with the drop in the welfare and economics of the coal industry in the United States, until two years ago we had only two students who were interested in taking the straight coal mining curriculum, and, consequently, we had to drop it as a specialized curriculum and incorporate the coal material in our straight mining engineering program.

There is an evident increase in interest in coal mining at the present time. We have about ten students who have evidenced interest in going into coal mining work.

The total enrollment in the curriculum which teaches both petroleum engineering and coal mining engineering is 270, and I believe you might note this—the enrollment in petroleum is 160 and the enrollment in mining engineering is 110, and enrollment in petroleum classes is increasing much more rapidly than in mining engineering.

I think this should sound a warning note to us, that we have to do a little more in the way of creating the interest of qualified high school graduates in mining engineering as a curriculum.

Again, I would like to express my appreciation and my pleasure at being here at the Institute, and thank you very much. (Applause)

* * *

President Snarr: I might say,

in connection with Dr. Clark's remarks, that we need to wake up to the need of encouraging these high school students to study engineering, and your Executive Board voted to cooperate with other agencies, manufacturers, and so forth, in the production of a movie for distribution and use among the high schools of the country. That is in line with what Dr. Clark mentioned.

The only other thing I have to report is the Executive Board last night in its annual meeting took care of re-investing the bonds which have matured, and so forth. That is about all we have. I see Ben Schull, of the Department of Mines and Minerals, here. I wonder if he has a word he would like to say at this time? (Applause)

Ben H. Schull (Department of Mines and Minerals): Thank you, Mr. President, and members of the Mining Institute: First, I would like, in behalf of Governor Stratton, the Mining Board, and myself, to thank all the miners, operators, and the coal industry for their cooperation in helping in our safety record.

The only way we can have safety is through the cooperation of the whole industry. We cannot do it in our office, and no one man can do it at the mines. It takes all of us.

I certainly appreciate the cooperation we have had. I cannot tell you that I am satisfied, but with the cooperation of the industry, we can certainly improve our record.

We have a man in here I would like to introduce—I never get this opportunity—a man who produced a million, one hundred thousand tons of coal without a lost-time accident underground. Is George Stachura in here?

From the floor: He is not here.

Mr. MacDonald: The mine foreman is here, though.

Mr. Schull: I think the mine foreman ought to stand up and get a hand. That is a job. (Applause)

I thank you, and I thank you, Mr. President.

President Snarr: Thank you, Mr. Schull.

This brings us to the close of our business session and we have a program arranged here. Your Program Committee, I think, has tried to have something that would be of interest to everybody in the various branches of the coal mining industry in the state. We will get into that technical paper session at this time, and I will ask Mr. C. C. Bailey, of the Old Ben Company, who will act as Chairman of this morning's session, to come up here, please.

Mr. Bailey.

C. C. Bailey, of the Old Ben Company, assumed the Chair.

Chairman C. C. Bailey (Old Ben Company): Thank you, President Snarr. I feel somewhat like someone who just had a tooth extracted, or something. The shock is about to buckle my knees. I was kind of hit with this job on short notice, but I will do my best.

I can see the Program Committee was hard at work and has prepared what appears to be a very interesting program. Before we start, there will only be two papers presented instead of three, as shown on your program. The first two papers will be presented. So, without any further ado, we will get into the meat of the session.

The first paper will be entitled, "Freeze-Proofing of Coal," which will be presented by—I don't think a stranger to most of us—Mr. Laning Dress, Preparation Engineer of Truax-Traer Coal Company, of Ceredo, West Virginia.

Mr. Dress. (Applause)

FREEZE-PROOFING OF COAL

LANING DRESS
Preparation Engineer
Truax-Traer Coal Company
Ceredo, West Virginia

The title on the program which you have in front of you is "Freeze-proofing of Coal." The word "Freeze-proofing" I just don't believe. (Laughter)

Most of us know that the various types of anti-freeze that we have used throughout the Midwest in the past few years, and the information that I am about to give you, mostly pertains to plants without heat dryers.

However, there is one trick that we use quite a bit in our heat-drying facilities—the use of calcium and salts. That is the old standby, and they have been using it for years. There are two methods of applying it. One, the dry form, where you meter it in by a feeder or spray it into the car dry, with air, which is quite high in labor. That has been more or less done away with. However some people are still doing it.

As developed in large production mines over the last eight or nine years, one of the best methods of applying calcium chloride, or salt in brine, was to spray it on. You either took the dry flake and mixed a solution and put it in your tanks and sprayed it onto the coal, or bought tank cars of pellets that you would mix into a liquid form. The normal application for industrial screenings would be two gallons per ton. Usually it is put on about 1.30 specific gravity.

That solution, in a dry form, would carry four and a half pounds. That would be nine pounds per ton of coal.

We have found, however, in the past two or three years, that in our plants—where the sprays have been flowing, the pipes have been eaten out, and the maintenance was high, and we were certainly not satisfied with liquid calcium chloride.

The cost of liquid runs approximately seven cents a gallon in a tank. Two gallons per ton is fourteen cents, which is fourteen cents per ton for treatment.

You get into all kinds of trouble. Actually, you think you are doing something, but we were not impressed with it. Everybody is looking for a way out, and, of course, without heat drying, the next best thing would be an anti-freeze of some kind.

Truax-Traer has been using oil in the wet coal requirements in West Virginia for quite some time, and we have had a great deal of experience in applying oil to coal.

Having the idea in mind to spray coal with oil, we went to the Standard Oil Company, and between the Standard Oil Company and Truax-Traer, we tried to develop a light oil that was applicable to washed coal. After a couple of years of experimenting, and applications, and so forth, we did come up with something. This is a light oil—a light oil that is to be used without heat.

Of course, one of the lightest oils that we have used in the past to spray oil in cars, and so forth, is a light distillate of either kerosene or fuel oil. We wanted an oil that was light enough to be handled in all kinds of weather, easy to store, and that would have the particular qualities that we wanted—that would give an oily coat to the coal, would facilitate drainage, and would adhere to steel surfaces in cars.

The light oil that we selected has a viscosity of 80 to 100 seconds at 100°F. The pour point of the oil is minus 35°F. It seldom gets cold enough that we can't handle the oil. At least, we have used it for two winters, and have had no problems as yet.

The Btu of the oil is approximately 18,900. The oil itself weighs 7.8 pounds per gallon. It has an A.P.I. gravity of 15 to 20. The oil flows well. It has a slight odor, but it is easy to handle. Our method of application in the last two years has been very successful, and I will show you how we apply it.

The tanks can be either vertical or horizontal. We like a 20,000 gallon storage tank. All you have to do is get it delivered in tank-car quantities, and all the tank car has to do is come up at any time and hook onto this point (indicating), load your tank, and pull away. It is not necessary to have any personnel on the job.

You have to have a gear pump—they are rated from 200 to 300 psi at this point; 15 horsepower is ample to handle that pressure. At the maximum, you wouldn't use more than five or ten gallons a minute. It depends on the tonnage. If you want to meter the oil, and you don't want to meter it from the tanks, there are all kinds of setups you can use. The one we like delivers the oil through this loop line, and we set the pressure at 180 psi. That is to keep the thing flowing. It goes through your regulating valve, and regardless of any delays you have in your plant, it is always available.

Then you can run it off the loop line to various points. We like to have a meter in that so we know what the volume is that is going to the coal, whether it is minus ten mesh coal for industrial plants or otherwise.

A half-inch solanoid valve is at this point—a meter here, and a valve here—this is a solanoid valve. Then you can take off this line for as many points as you want (indicating).

We have found it best to treat the carbon sizes all the time.

For instance, the normal plant would have ⅜ by zero carbon. You have it at one point, whether it goes in screening or is loaded by itself. We usually apply it to the carbon at the rate of six quarts per ton.

The larger the coal sizes are, the less quantity of oil you need. I will put the quantities down because it may be helpful to you. The ⅞ by ⅜ portions—if the coal happened to be broken in that portion—would take five quarts per ton.

The next portion, $1\frac{1}{4}$ by $\frac{7}{8}$, will take three quarts per ton. We never use more than two quarts per ton on the crushed sizes, because there is relatively little moisture on them.

However, if we are loading a combination of sizes, we seldom exceed a gallon of oil per ton of coal.

Six quarts per ton will go on the carbon. This is five quarts per ton, but this (indicating) might run twenty or twenty-five per cent of your industrial screenings, or whatever you have, but we very seldom exceed four quarts per ton.

One of the reasons we went to oil, as you can see, is because when you have liquid calcium chloride or any liquid, you are adding water. For instance, on a fifty-ton car of coal you are adding 8/10 of a percent of moisture and lowering the Btu.

As you see here, you add four quarts of oil, or one gallon per ton. You are adding material that has a value of 18,900 Btu's. It hasn't any particular odor. In fact, at destination, after two or three days, you can't detect the oil. You have to pick it up to smell the oil.

This oil is delivered, in round figures, at 10 cents per gallon. It depends on which part of southern Illinois—but from Peoria all the way south, it is 10 cents per gallon, delivered at this point (indicating). We generally like to have another storage tank in case the roads are icy and delivery is slow.

I had a call one time when we had several hundred cars of frozen coal at the Alton docks last winter. It was cold, five below zero. We had one mine on liquid calcium. The liquid calcium depends a lot on the temperature at the mines. If it is real cold you won't get any drainage. All the concentrate was at the bottom. All we did was put a little heat on the car, without opening the doors, and when we opened the doors a rush of concentrated liquid came from the bottom of the car.

In other words, it ran right out and it was a terrible mess. That was one of our reasons for doing away with the liquid calcium.

The next thing we noticed was that the oil-treated coal would roll over. The coal had the same ingredients, same moisture, except that it had been treated with about four quarts of oil per ton. The coal didn't come out because it was 5° below zero, and we put just a little heat under the car, opened it up, and the coal broke off in chunks. I was standing up along the car on the platform and looking at it, and I saw little white pellets in the coal. It looked as if someone had thrown rice into the coal. I didn't know what it was—whether it was gravel or chat, or something thrown in. I picked it up and found it was frozen pellets of water. In other words, instead of freezing around the coal, the water pulled away and froze in a solid mass alongside of it. That impressed us very much and we immediately stopped the other two plans and changed to oil antifreeze as fast as we could hook it up. That just about tells the story on the oil.

We have several properties in Illinois, and we think oil treating is very good.

The only other thing that I can tell you is what I have noticed about oil treating normal cars. In one plant, that didn't use any oil or liquid calcium but that has centrifugal dryers, the coal didn't drip at all when the cars were ready to be taken down to the scales.

The minute we started using oil on the coal, the water started to run off. You wondered where all the water came from. It poured out of the coal, the minute the load was like this (indicating). So we got a lot of added drainage immediately. That is how the oil affected the coal.

That just about tells the story of the application of a little oil to coal, and even to crushed coal. We thought we might have problems with conveyor belts in various properties, power plants, and so forth, but you couldn't tell the coal had been even oiled.

Last winter I inspected a good deal of treated coal being unloaded. In Beloit, Wisconsin, you get pretty low temperatures, as low as 20° or 25° below zero. One of their problems was dust. They would buy 2″ by 1¼″ coal. The reason they bought that size was so they could unload it. But the dust was terrific, and it was a real problem for them.

We came up with the idea that we would load the same size or 4″ by 2″, but crush it first. We pressed the 2″ by 1¼″ at the mine. It had the same moisture that the other would have. Right at the point of crushing, under the crusher, we applied two quarts of oil. That is a nickel's worth of oil.

We got up to Beloit, and the coal unloaded nicely. It cut down the dust, and there was evidently just enough oil on that so it went through the hammer mills and the dust was negligible, and it wound up the problem. That is some of the advantages we have gained by using oil.

I think the most attractive advantage is that if you are putting antifreeze on a coal or a fuel, 18,-900 Btu's is the material to add. Of course, we all need some Btu in our coal in southern Illinois. (Laughter)

That is about it for the application of oil or a light oil to the coal to prevent freezing.

The other thing is, if you have a heat-drying plant, I think the cheapest way to load is to oil the inside of the car. When you oil the inside of the car it seals the slope sheets of the railway car. You can notice any water that drops off the coal. There is moisture that collects on the side. I am speaking now of heat-dried coal.

It aids in any drainage, if there is any drainage of heat-dried coal. You would be surprised at how much there is, under certain atmospheric conditions.

I might add, this can be set up at the plant the same way (indicating). The same oil that is applied to the coal just works wonderfully in spraying the sides of the cars (indicating). You can have as many cars and tracks as you want, some mines have eight, some two. One man can spray the cars. It takes only approximately 20 seconds to oil the inside of a car.

I will show you a picture of the hose facilities. You take an oil, like diesel oil. Sometimes when you spray a car that is on the tracks, you have greasy tracks and then you have to use sand, and so forth. This particular oil that I told you about sticks the minute it hits the car.

The pressure under which we put it on is somewhere between 180 and 200 pounds, in this one mine. The oil doesn't run out the bottom. It doesn't mist and go out in the air, unless you have high winds.

In fact, we have one man who can do a few other things and then go back and oil half a dozen cars, and then do something else, or go over to another track and oil another car.

When you want to oil the car, all you do is drop an oil line down, like this (indicating). We have tried all kinds of expensive nozzles, but we have found the best nozzle is a $1.50 garden hose, bronze nozzle. As you know, it is a tapered nozzle and you adjust the end of it.

It has a loose line here (indicating), with a pipe. You wouldn't think this is much of a problem, but it is a problem when you are handling that pipe all day. It becomes quite heavy. The best idea we have found is to have a pipe six feet long, made out of aluminum, with a quick opening valve right here. You come down about eight inches here (indicating), and have 45° right there, and right here is your garden-type nozzle (indicating).

The reason you have it like that is that when you stand above the car you come down one side, and you turn the nozzle and go up the other side, like this (indicating). You shouldn't oil within 18 to 24 inches of the top of the car. If you get a piece of lint, or a particle, you just give the nozzle a half turn. You can have a small cone spray or a large one. This is very effective. (Indicating)

And here you can have as many platforms as you want (indicating).

The quantity is something I want to tell you about. We clocked several hundred cars being sprayed. It takes six gallons of oil to coat a 50-ton hopper car. The oil comes out at terrific pressure, and it only takes a few seconds to use the six gallons average. A 70-ton car uses 7.5 gallons. That is just slightly more than a cent a ton to coat the inside of a railway car.

It is the most important single factor that we have found to help in unloading coal.

Don't misunderstand me now, or think that we have licked all the problems of frozen coal, because we still have a lot of them. But we have made progress in the last couple of years, and we feel we have helped ourselves.

I will be glad to answer any questions for anybody interested.

That is about it. (Applause)

* * *

Chairman Bailey: Any questions?

If there are no questions, Laning, we want to thank you for a very fine paper. It is of extreme interest, I dare say, to 98 9/10 percent of those here today.

We will proceed with the second paper of the morning. The title of the paper is "Low-Cost Barge Loading Installations—Their Part in Coal's Increasing Market," by C. W. Waterman, Jr., General Sales Manager, McNally Pittsburg Manufacturing Corporation, Pittsburg, Kansas.

Mr. Waterman.

LOW-COST BARGE LOADING INSTALLATIONS

C. W. WATERMAN, JR.
General Sales Manager
McNally Pittsburg Manufacturing Corp.
Pittsburg, Kansas

Mr. President, Mr. Chairman, members of the Illinois Mining Institute, friends: Your secretary had quite an argument as to who was going to tackle the problem that has been assigned me, and frankly, gentlemen, I tried to push it off on three or four other fellows, but they were a little smarter than I. They were very, very busy and, of course, I might say that fools walk in where angels fear to tread, and that might classify me very rapidly.

You know, if there is one axiom that is proving out, it is the saying that "history repeats itself."

In the early days of my experience as a peddler of coal preparation equipment, I recall driving through the eastern part of our country where many a highway paralleled our river systems. Between the highway and the river would be an old barge canal, with the horsepath running alongside. I will admit that I looked on the old picturesque barge canals with a little disdain while, at the same time, I marveled at our modern high-speed rail and highway transport facilities—actually I thought what rapid strides we had made in our mass tonnage movements.

After some twenty-five years, I have to admit that I, as well as many others, was clear off base on my thinking. To prove this point, one has but to look at the record of the past ten years to see what has happened to transportation, principally as it concerns coal.

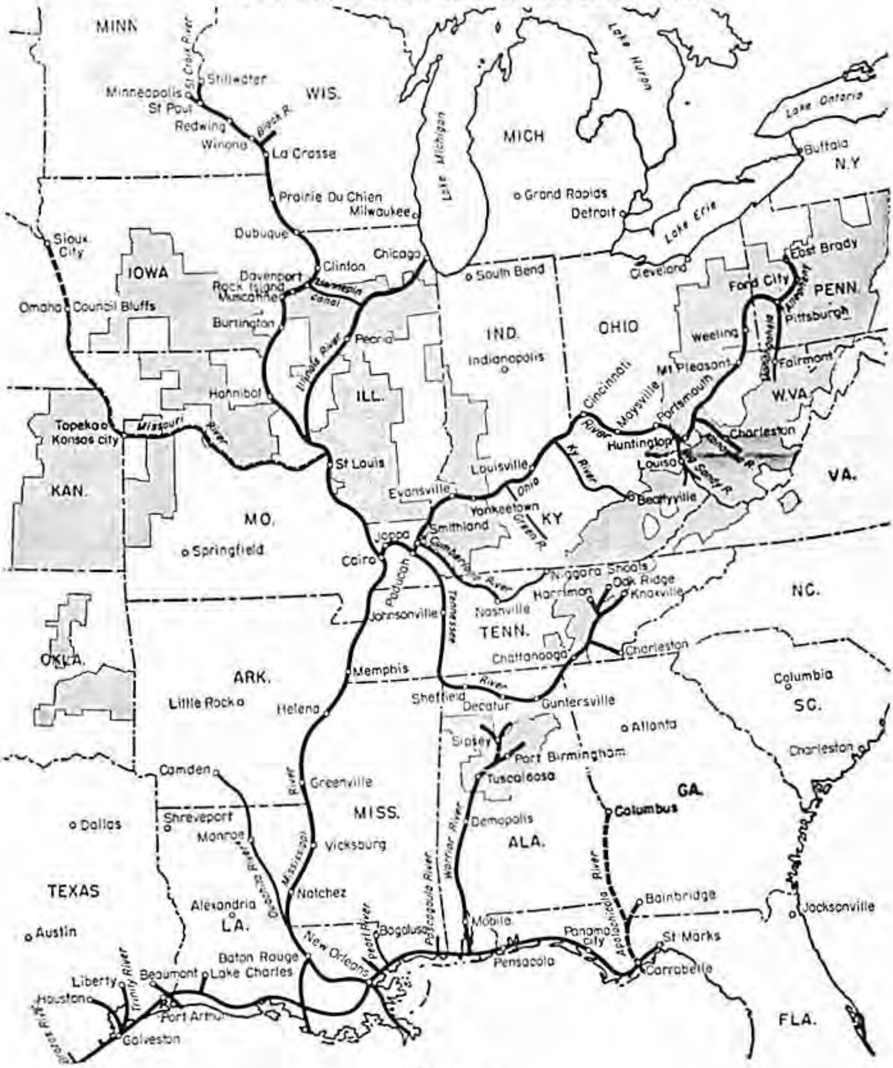
(Slide No. 1.) Here you have the map of the navigable rivers of our country—a traffic way that feeds the vast industrial basic empire of our country.

The waterways are now teeming with high-speed mass barge movements. As an example, the traffic on the Tennessee River has increased 20 percent, with an increase of 38 percent in the past ten years. The Allegheny River has increased 20 percent in barge traffic. Taking the common carriers as a whole, we find that railroads, barge, pipelines and trucks have made the following increases over the past ten years.

Railroads have maintained a steady rate. Barge transport increased 50 percent; pipelines about 100 per cent; trucks about 150 percent.

The increase in truck haulage cannot be directly chargeable to coal, and certainly pipelines are

NAVIGABLE RIVERS, INTERCONNECTED INLAND WATERWAY SYSTEM
AND ADJACENT COAL FIELDS OF THE UNITED STATES



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not looking to coal for their increase in tonnage. On the other hand, coal can be held almost wholly responsible for the increase in barge traffic.

Certainly, if there had been no advance in material handling, both from the standpoint of barge loading and unloading, we would still be back with the old horse-drawn

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barges of our forefathers.

Fortunately for us, and for the nation as a whole, we have made steady progress in improving both barge loading and unloading. Since we are concerned mainly with low-cost barge loading, let us take a look at one of today's modern barge loading operations.

(Slide No. 2.) Here you see Yankeetown Dock Corporation's installation on the Ohio River. This is a joint venture operation providing barge loading facilities for Ayrshire Collieries operation at Wright Mine, five miles south of Booneville, Indiana, and Peabody Sinclair operations at Victoria Mine, located nine miles south of Booneville. Coal is transported via standard railroad 70-ton hoppers that average 75 tons per load, dumped by railroad rotary car dump, and discharged at a rate of 1500 tons per hour.

(Slide No. 3.) The run-of-mine coal is then discharged into two 12′ x 27′ McNally Pittsburg rotary breakers that reduce the rom to 1¼″ x 0 for ultimate powerhouse use. The rotary breakers remove the coarse rock and slate during breaker operations for ultimate truck disposal. The broken 1¼″ x 0 is then transported by belt conveyor carrier on elevated structure to waiting 1500-ton capacity river barges. The main conveyor and loading boom are supplied with a single endless belt that is about 2250 feet in length.

(Slide No. 4.) This picture is taken at comparatively high water stage, while the following picture was taken at a much lower level.

(Slide No. 5.) The elevating

loading boom permits loading from pool stage to the highest recorded flood stage, thus insuring an uninterrupted flow of river coal. The barges are shuttle loaded, being positioned by tow cables, hooked fore and aft on the barge and actuated by hoisting mechanism under control of loading operator housed on the tower.

(Slide No. 6.) The motorized swinging loading spout assures transverse distribution, while the shuttle loading maintains an "even keel." Feed rate, rotary breaker, and main belt are controlled by the dump operator. Total manpower of the Yankeetown Dock operation is seven, including superintendent and two men on the river boat that keep the dock supplied with "empties" and assemble the loads into tows. The tows consist of an average of 15 barges.

An outstanding example of a simple high-tonnage dock loading facility is located at Grand Rivers, Kentucky.

(Slide No. 7.) This is owned and operated by Badgett Terminal Corporation. Since they do not have to account for a large variation in water level, it was possible to dredge a "slip" for barges to be shuttled beneath a railroad crossover. Here 50-ton hoppers are transferred at the rate of one car in less than two minutes, with the assistance of a vibrating shakeout. On February 16th of this year, they established a record loading of 493 cars in 14½ hours—this adds

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up to 27,115 tons for this period —certainly a record to be proud of.

Let's go back on the Ohio again, just below Huntington, West Virginia, at Ceredo.

(Slide No. 8.) The operation is owned by Truax-Traer Coal Company. This barge loading installation is unique in that it employs a shuttle loading belt and spar barge to follow the water level from pool-to-flood stage. The spar barge is so named because it has four motor-operated spars mounted at each of its four corners and can walk up and down the sloping river bank with the rise and fall of the river proper. As the shuttle belt retracts, the unused portion of the shuttle belt retracts on an overhead structure on the down track side of the preparation plant. The spar barge contains the loading boom and barge positioning hoists. The river belt is under control of the preparation plant operator, whereas boom belt and barge positioning hoists are under control of the spar barge operator. This installation handles all grades from broken ROM to stoker and prepared grades. Maximum rated capacity is 800 tons per hour of 6 x 0 washed or raw coals.

While we are up the Ohio River, we can have a look at the Kenova Terminal barge loading installation.

(Slide No. 9.) This is a privately-operated terminal facility and was among the first of the elevating boom type barge loaders installed in the Huntington, West Virginia, area, in 1950.

(Slide No. 10.) You will note from these two views the rather utter simplicity of this installation. Coal is dumped from railroad cars to the barge and transferred by belt conveyor to the barge. You will note the boom houses the loading operator.

Dropping back now to the Green River, we come to one of the latest additions to the barge fraternity—the recently completed preparation plant of the Gibraltar Coal Company, near Central City, Kentucky. Since this paper is devoted to barge transport, we will concern ourselves with that part of the Gibraltar plant having to do with this particular aspect.

(Slide No. 11.) In the foreground, the tunnel belt is transferring coal from a 5000-ton washed coal storage pile to the barge loading facility at the rate of 850 TPH. The transfer house in the foreground houses the automatic sampling and pulverizing devices. The sampler is so designed that five, ten or fifteen percent of the sample can be crushed to 8 mesh x 0 and can be taken at intervals anywhere from three to one hundred minutes. From the "transfer sample house" the coal is conveyed out onto the barge loading pier.

(Slide No. 12.) At the barge loading pier, by means of a travelling tripper and reversing shuttle

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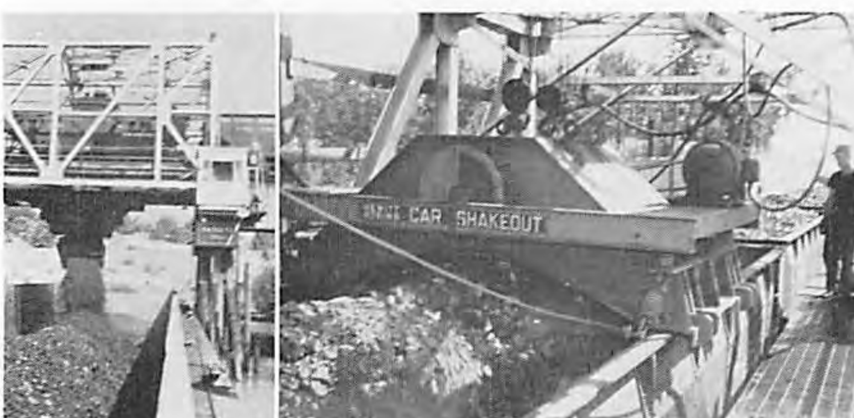
Slide No. 6



Slide No. 7

belt, coal can be loaded into any one of eight barges placed four on either side of the pier. You will note the house on the travelling tripper that houses the controls for the barge loading operator. The telescoping chutes are equipped with paddle switches that automatically retract the chutes as the coal approaches the blocking point. This dock loading facility will be responsible for more than two million tons per year of new coal to power the generation equipment for the Portsmouth Atomic Production Center.

I do not feel that any paper on coal's newest mode of transportation would be complete without a short look at the rail-to-water terminal in Chicago located on Lake Calumet.

(Slide No. 13.) Here 3000 tons of coal per hour are transferred from rail to lake vessels. This facility serves the great coal fields of Illinois, Indiana, and western Kentucky, and has contributed much to entrenching coal in the upper Lakes market.

Now, we have reviewed briefly some of the outstanding loading and transfer facilities with this one purpose in mind—to see what improvements have been made in methods employed. In each and every installation the keynote is reduced manpower, which reflects the cost per ton. In investigating this segment, I found so many variables that it was most difficult to pinpoint costs. Such items as river conditions, barge positioning, the particular humor the river captain

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is in at the time he "spots" his tow, and other less ridiculous factors, affect cost. I will say that, as a general statement, I found costs varying from eight to twenty cents per ton. This includes loading installations other than those mentioned in this paper.

With today's modern high-tonnage loading facilities, coupled with what we can now term "high-speed river transport," as compared to grandfather's day, the buyers of large tonnage contracts are looking more and more to operations having either river or rail-to-river facilities to furnish the bulk of their tonnage requirements.

Look at what has happened, and is happening now, to the boiling Ohio, Atom Valley or Voltage Valley that has had its big spurt in atomic energy, electric utilities, aluminum, chemical and electro-metallurgical industries since 1950.

The Ohio Valley has attracted an expenditure of one and a quarter billion dollars of investment per year since that year. The answer—coal. Cheap, dependable water transport.

After all, gentlemen, the buyer of coal is concerned with his coal costs delivered—he is not concerned with F.O.B. mine costs.

John Evers, President of Commonwealth Edison, recently stated there was a savings of $1.42 per ton

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in barge over rail transport from identical points. This is a factor, gentlemen, that must stay paramount in your thinking—"Keep the delivered cost down."

Faced with rising rail freight tariffs, we will be forced to look to the rivers. I would say that before long, instead of such descriptive phrases as the "Boiling Ohio," Voltage Valley, Atom Valley, and the like, we will be hearing more about the "Magic Mississippi," the "Wonderful Wabash," and like coined phrases that will assist coal in expanding and reaching beyond the high tonnage goals that have been predicted.

History sometimes has a funny way of repeating itself—so long as it repeats to the benefit of mankind, just that long we will all be for it.

Thank you. (Applause)

* * *

Chairman Bailey: Are there any questions that anyone would care to ask Mr. Waterman? I think he would be available to expand anything he put forth in his speech. If not, we want to thank you for a very fine paper.

That is the last paper on preparation. I would like, since I am on my feet, to take the opportunity of seconding President Snarr's welcome to the students from the University of Illinois and from the Missouri School of Mines, under Dr. Read and Dr. Clark.

Fellows, I can assure you that we are happy to have you with us, and we are interested in you, because we know that you are our future, and, indeed, we are interested in our future.

Again, for those who have taken part in the program this morning, Cliff and Laning, I want to thank you for your fine papers.

. . . President Snarr resumed the Chair . . .

President Snarr: Thank you, Mr. Bailey, and I also want to thank the authors of the papers this morning. We are going to get through a little early, I see.

I want to call your attention to the fact that we are going to resume at two o'clock this afternoon. We think we will have quite a long session this afternoon, and the papers are all important.

We have talked something on preparation of coal this morning, and now we have talked about transporting by water.

This afternoon, we are going to get into the newer stripping methods and something on mine safety developments. Then we are going to get into this continuous haulage development.

I also would like to remind you, if you don't have your tickets for this evening's banquet, you should try to get them during the lunch hour. We like to close that sale at one o'clock so they know how many to prepare for.

Also, I call your attention to the fact that if you are going to the football game, we are on Central Time here, and the game is on Daylight Savings time.

We will adjourn now until two o'clock.

. . . Whereupon the meeting recessed at 11:25 o'clock . . .

CAPTAIN WILLIAM H. LEYHE

AN APPRECIATION

Captain William H. Leyhe—Captain Buck, as he was known all up and down the Mississippi River, its tributaries and all stops along their shores—passed away at the age of eighty-three on July 4, 1956.

He was well known to the membership of our Institute between 1918 and 1947, for beginning May, 1918, our annual Spring meetings were held with him and his crew (except one on Lake Michigan), including a vacation trip, first on the S. S. Cape Girardeau until 1935 when that ship was sold. The following year Captain Buck had the S. S. Golden Eagle ready for us which we used to the year 1947. His active years as a riverman ended on May 18, 1947, when the Golden Eagle went down, a total loss, on Grand Tower Towhead, seventy-eight miles above Cairo, Illinois, when he was seventy-four years of age. The nine years since elapsed saw Captain Leyhe keep up his interest in the river by assisting his son, Fred H. Leyhe, in the management of the Eagle Boat Store on Wharf Street, St. Louis, the oldest of its kind in the Midwest dating back to 1837.

At first our Spring trips lasted two nights and the greater part of three days, but later they were reduced to one night and two days. Morning and afternoon Institute meetings late into the evening were held on deck in full view of the beautiful scenery up or down the river. Usually some far away place of interest was chosen, such as a port where we could take an automobile trip to the lead mines in Missouri, when going downstream. It was in those mines that roof bolting was first used.

Going upstream we'd either stay on the Mississippi, the Ohio, or the Illinois River. Such locations as Nauvoo, the village of Mormon historical interest, or LaSalle County with its Starved Rock and the County's industrial mining developments of limestone quarrying and mining for cement mills, and longwall coal mining were often our goal. However, the Captain would make stops wherever we chose, such as Hannibal, Missouri, to inspect the underground hideouts of Tom Sawyer and Huckleberry Finn.

Proceedings of our Institute, except 1892 to 1895 and the 1913-14 issue, were not printed until 1929, so many pioneer articles of our Institute immediately following its reestablishment in 1912, including those earliest of the boat trips, are omitted, although some were printed in later *Proceedings*. Fortunately, in 1939, twenty-one years after the start of the Boat Trips in 1918 by Sam Jenkins, our poet and historian, Jeff (who also "turned again home" this year) wrote, with Sam's assistance, that 21 years' history of our Boat Trips. That five pages of history begins on page

89 of the 1939 issue of our *Proceedings.*

The members still living who attended those boat trip meetings have many fond and lasting memories. The food and stateroom service were equal to those of an ocean liner. Old and new friends eventuaully caught up with their visiting and recollecting of old times, locations enroute often assisting in the reminiscences.

Curfew at 11:00 p.m. was well in the hands of Sandoe, Garcia and Jenkins, who would lead in a goodnight song and a march toward the staterooms. Those with the Captain on deck visiting and playing and otherwise quiet were allowed to loiter longer.

Recollections of those early days and the interest taken by labor and management leaders recall prophecies that have since materialized. University Mines Department, Geological Survey, Manufacturers, State and National Mines Departments and Safety Associations all joined labor and management in successful accomplishment in each of those twenty-eight river trip annual Institute meetings.

We'll never forget the Mark Twain and other river recollections by the Captain, even demonstration of pre-Civil War pleadings and language by colored members of his crew in "throwing them bones." His recollections of barge coal deliveries to Grand Tower and elsewhere for a generation or two would inevitably lead to his lifetime wish and desire, also his prophecy that his water lanes would eventually become a most important factor in our coal industry.

We are indeed happy that Captain Buck, our host and prophet for over a quarter of a century, lived to see the beginning of his prophecy come true.

—JOHN E. JONES

On the 1935 boat trip—left to right: Bela Schonthal, Captain Buck, R. D. Sandoe, George McFadden, Dave Jones, John E. Jones, Frank Schull, and Tom Allen.

FRIDAY AFTERNOON SESSION

October 26, 1956

The meeting reconvened at 2:10 p.m., President F. E. Snarr presiding.

President Snarr: Gentlemen, can we come to order now and get started on our program? We have quite a long program for this afternoon, and we want to get into it.

Our program chairman for this afternoon will be Mr. Bill Fletcher of the J. H. Fletcher Company, Huntington, West Virginia. Mr. Fletcher.

. . . Mr. William Fletcher thereupon assumed the Chair . . .

Chairman William Fletcher (J. H. Fletcher Company, Huntington, West Virginia): Thank you, Mr. Snarr.

Gentlemen, once again, welcome to this afternoon session of the Sixty-fourth Annual Meeting of the Illinois Mining Institute. We have, as Mr. Snarr stated, a long program—six papers. We are going to go through them and have our questions afterwards, if you do not mind. We have a group of papers here that will be of particular interest, we think, to every mining man in the room.

Without further ado, we will go into the first speaker's address, Mr. W. A. Weimer, Chief Engineer, formerly with the Northern Illinois Coal Corporation and now with Peabody Coal Company, who will speak on "Recent and Future Stripping Machines and Methods in Illinois." Mr. Weimer.

. . . Mr. W. A. Weimer thereupon presented his paper entitled, "Recent and Future Stripping Machines and Methods in Illinois" . . .

RECENT AND FUTURE STRIPPING MACHINES AND METHODS IN ILLINOIS

W. A. WEIMER
Chief Engineer
Northern Illinois Coal Corporation
Belleville, Illinois

Mr. Chairman and fellow miners. I am pleased to have been invited here today to discuss the present and future stripping machines and methods used and needed in Illinois. I do not pretend to be Criswell and predict the future of strip mining, but by examining the past and noting the present trends, perhaps we can foresee the future possibilities of both the machines and methods needed in our industry. Strip mining and the methods of excavating the overburden from coal and ore at greater depths and different strata are adaptable to a variety of conditions, and the correct machines must be employed to fit the conditions in order to get the most economical production.

Strip mining accounts for approximately 42 percent of the total coal production in Illinois today and about 25 percent in the United States. Strip production has been gaining percentagewise over shaft production, but strippers do not feel too secure that the gain will continue. This gain is due to the fact that shaft coal production has been declining and that strip coal production has been holding nearly uniform. The decreased market and economic factors have given the advantage in the past few years to the strippers. You are all aware that the market experts have predicted that coal has a very bright future, some evidence of which we are already beginning to see. As the coal market expands and the shaft mines introduce such new machinery as mining machines and extensible gathering belts and have men like Squib McCullom, Joe Craggs and Tony Shimkus, the strippers are in for a challenge costwise. This will greatly affect the machines and methods of strip mining as the overburden becomes deeper and the strata harder. Shaft mining and strip mining are not particularly in a race with each other but both are attempting to mine the future expected volume of coal as economically as possible.

The past 30 years has been the age of large stripping shovels and some of us have seen the bucket capacities grow from 8 cubic yards in 1925 to 70 cubic yards today. That is roughly an 800 percent increase. Yardage handling capacities have increased in the same relative proportions, as also has the weight of the machines. The new Marion 5760 and the Bucyrus 1650 shovels weigh about 2500 tons. These new shovels are so large and high that an elevator is required to get the operating crew on them, and the replacable parts are so heavy that they can no longer be handled by the men of the operating crews. The bolts and nuts now require two men to lift them and we have to use a tractor to turn over a rope socket on the large draglines and a 16-pound sledge will scarcely set the wedge socket on the drag rope. It appears that our newer shovels are rapidly approaching their maximum weight.

If we compare the ranges of the large shovel of 1927 with the largest shovel today we see a much different picture. The 1927 shovel could strip to a depth of 48-foot cover, but the present machine will strip a 72-foot maximum cover. That is a 50 percent range increase in 30 years compared to an 800 percent increase in capacity. The capacity increase was a natural occurrence due to better design, higher strength of metals, better bank preparation by blasting, and good over-all engineering. The increased capacity is still not enough because the low-ratio coal, that is, the coal under shallow cover, is being exhausted and fewer stripping fields are being discovered every year. Two men working in a trench with dirt hand shovels will double the work of one man, but the two will not dig any deeper. We all try to get as much work out of the first man as he can do before we hire the second man. If we have to dig deep we then hire a long, tall fellow. Along with increased yardage must go a greater range of digging depth and stacking reach. Stripping equipment for a new mine, when we have a choice, should take advantage of the different types that have been invented and developed during the past 15 years.

In the past when the stripper dug into a hill or low spot in the coal and the pit began to narrow critically, he put a small dragline on the spoil and pulled the spoil back, enabling the pit to continue, but the dragline handled the same spoil that the main stripper had already cast. Some companies have further developed this method and are now handling the spoil very efficiently by this method. But the helper was usually ¼ the size of the main stripper, and ¼ of a 70-cubic yard bucket is 18 cubic yards, quite a sizable machine to double-handle spoil.

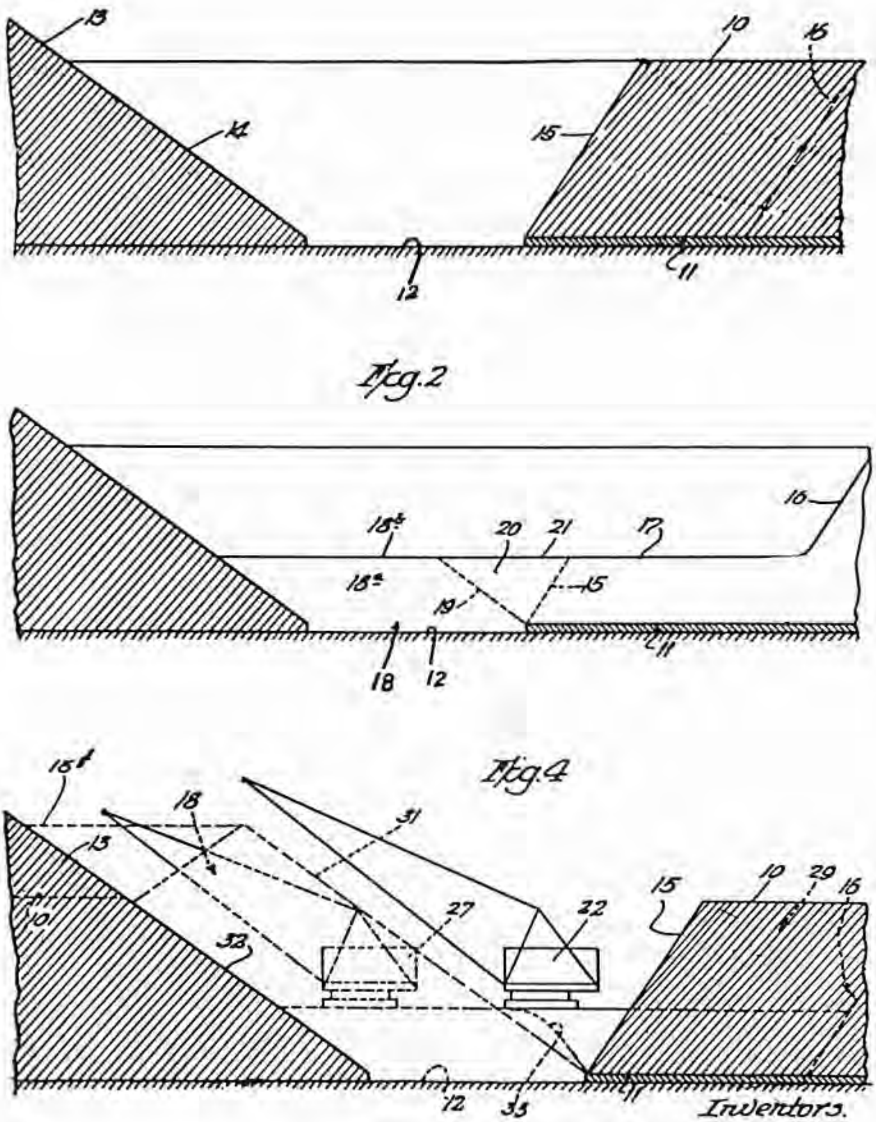
In 1927, the Northern Illinois Coal Corporation introduced the tandem method of stripping, whereby a 12-yard shovel was followed by a 10-yard dragline, both working on the coal with the shovel digging the lower, harder strata and the drag the upper one-third of the bank. This combination could and did strip to 72 feet for a 3-foot seam of coal. This combination worked successfully for 25 years when the machines became obsolete because of small yardage capacity as compared to the later machines.

Necessity proved to be the mother of invention at Wilmington as both the wheel excavator and the walking dragline method were conceived and patented there. The wheel excavator substitutes the dragline in the tandem method of stripping and greatly increases the volume of the removal of the upper overburden. This adapts it for use with a higher capacity shovel and balances the combination for greater efficiency. The walking dragline method employs one or more machines to work on a bench and fill the "V" between the spoil and the highwall, permitting the dragline to walk at right angles to the direction of the cut and increase the spoil room by spoiling higher and farther. Pits more than 150 feet deep and 80 feet wide can be worked by this method. A company in Texas is now stripping to a depth of 160 feet by using this method. Several methods of working two walkers together and even a large shovel on the bench in combination with the dragline have been successful, as I will show in a slide later.

The wheel excavator was developed by the United Electric Coal Company near Canton and is very successful in combination with a large shovel. This also is similar to two men working in a trench but with one man twice as tall as the other, and the combination doubles the yardage handled. This combination will strip a maximum cover of 100 feet and has a combined capacity of 4,000 cubic yards per hour. The wheel has a possibility of increasing its output to 3,500 cubic yards per hour, which would boost the total capacity of the combination to more than 5,000 cubic yards per hour and which would certainly make a yardage cost of less than 3 cents per yard.

It appears that the wheel has tremendous possibilities of increasing yardage capacities for the type of overburden that it can handle in combination with a shovel, due primarily to the fact that the wheel is a continuous excavator and so does not use valuable time to swing from the highwall to the spoil bank. In overburden that has unconsolidated material or soft shale in the upper portion of the bank, the wheel will outperform any of the swinging type of excavators. The walking dragline, which has its greater range due to the fact that it can move crosswise to the direction of the pit and increase the spoil cross section, will have the advantage in deep stripping and would be the choice where very deep overburden is to be removed.

With the development of better blasting of overburden, we are rapidly approaching a condition where hard stratified materials in the bank are broken up for the stripper. Better bank preparation calls for a machine that can dip or bail out the overburden, and this method and dragline is about the best bailer-outer known. Coupled with its greater range it will no doubt mine the deepest of any of the stripping combinations in the foreseeable future. The shovel will no doubt be the prime mover for many years to come, even though it has to have a spoil helper on the bank to assist it over the deep places. Many machine manipulations such as double cutting of the high wall have been used for years, and pit design to introduce outside spoil curves will increase the shovel's range by a small percentage. Opening wide in contour stripping and losing width will also help, but increasing the shov-



Slide No. 1

Fig. 3

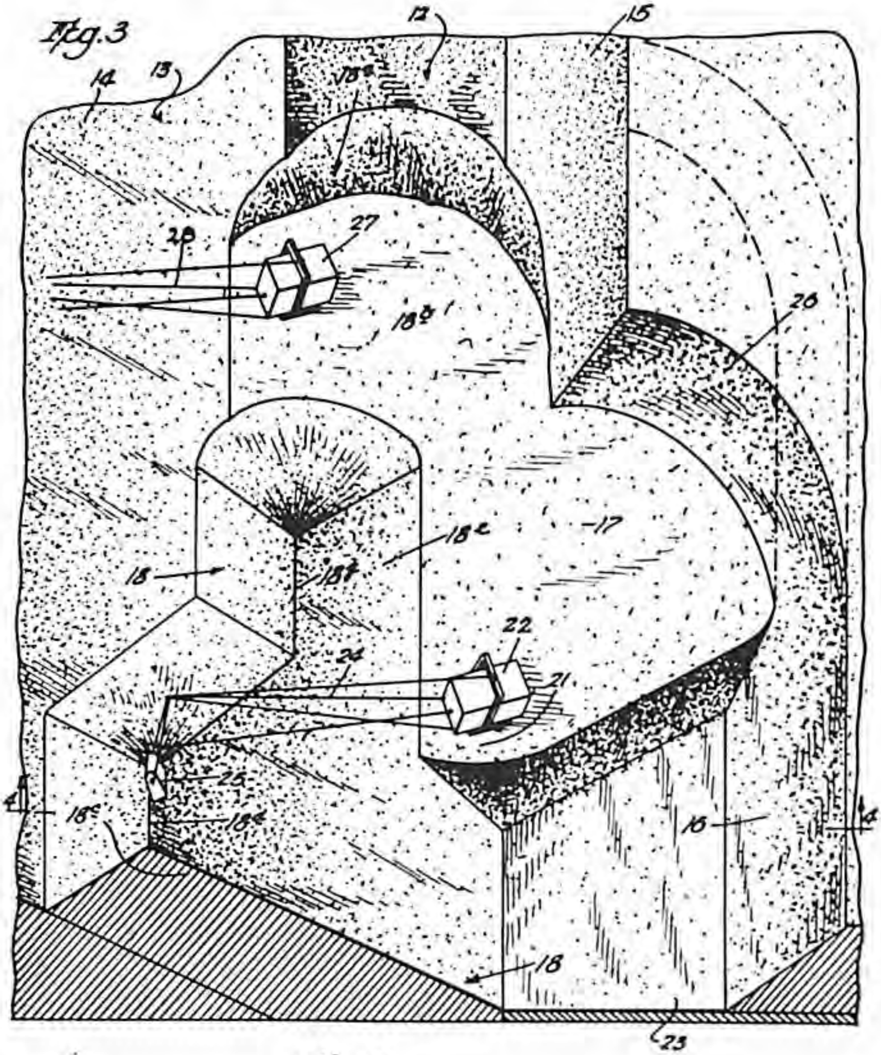
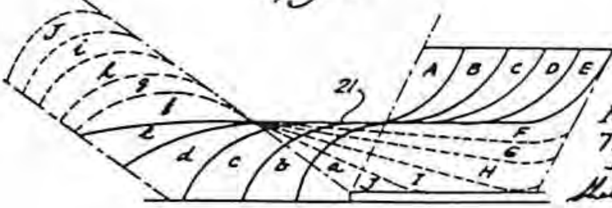


Fig. 5



Inventors.
Raymond S. Weimer
Thomas C. Mullins
By
Attys.

Slide No. 2

Slide No. 3

Slide No. 4

el's overburden range capacity by these manipulations are a disappointing method when employed continuously to dig deep overburden.

In summarizing, it appears best to use a shovel in hard strata of less than 60-foot cover, a shovel and wheel in overburden from 50 to 90 feet, and the walking dragline method where the cover is from 80 to 150 feet thick. We have also come to the conclusion that the stripping industry needs a machine that has the digging qualities of the shovel, the range of the dragline, and the continuous performance of the wheel. I know that there are people working on such a machine, but until it is built we will have to choose the excavator that will suit our conditions.

My company, the Peabody Coal Company, has recently purchased four 60- and 70-cubic yard shovels. Two of these machines will begin working in old strip pits to recover that extra 25- to 30-foot depth of cover that was not possible with the older machines. The first machine, a 70-yard Marion 5760 shovel, is to be delivered starting this December and will work in the old United Electric Coal Company Red Ray property near Freeburg, Illinois, where it will work in overburden ranging from 50 to 90 feet deep uncovering a coal seam 7 feet thick. This will be known as the River King strip mine, and coal will be hauled three miles northeast to a new tipple that will also serve a slope mine. Work has been progressing for the past year in the building of this washer, a railroad from Belleville to the mine, and a river loading dock in East St. Louis.

The second shovel, also a 5760 Marion, to enter old strippings, will be delivered next summer into the old Sunlight Coal Company pits near Boonville, Indiana, where it will mine the Millersburg seam and also have a bank 30 to 90 feet thick.

As a pictorial part of this discussion I would like to show some slides of the different methods of the strip mining that we have been discussing.

Slide Number 1.—The upper part of the picture shows a typical strip pit that has had the coal loaded out. The center picture outlines a benching operation and the filling of the "V" denoted as the triangle numbered 20. In the lower cross section the walking dragline is capable of moving from position 22 to 27.

Slide Number 2.—The upper portion shows a plan of two draglines working together on the same bench. Drag number 27 can have a relatively short boom and very large bucket for excavating the upper five-eighths of the bank. Machine number 22 should be a longer boomed machine carrying a smaller bucket to dig the lower three-eighths part of the bank and capable of stacking to the necessary height. In the lower part of the picture is a diagramatic cross-section of the flow of the material from the highwall to the spoil that is in a large measure the secret of efficient stripping by this method. This is the system used in the Texas mine.

Slide Number 3.—A picture of a Marion 7800 walking dragline working on a bench in approxi-

Slide No. 5

Slide No. 6

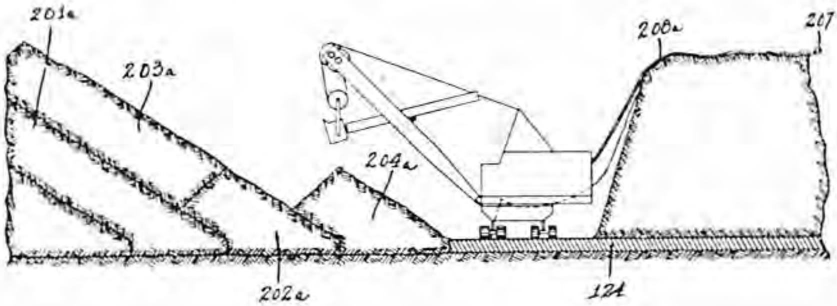


Fig. 12

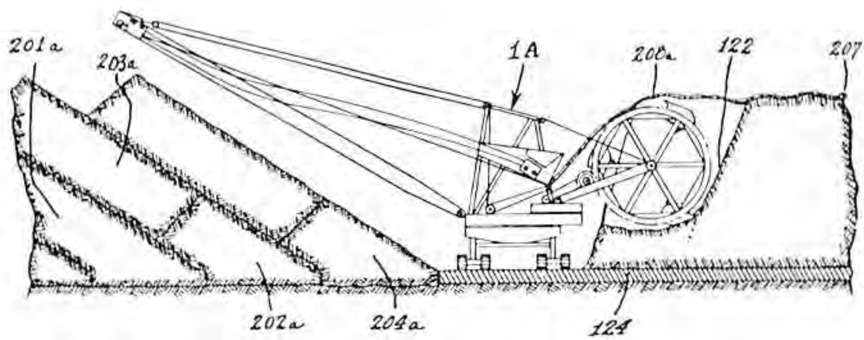


Fig. 13

Slide No. 7

mately 80 feet of cover. The machine has the bench too high in this instance as we only fill the "V" at this depth about every 4 or 5 cuts to widen out the pit.

Slide Number 4.—A view of another pit taken from the coal.

Slide Number 5.—Shows another position of the dragline in which the machine is on an elevated bench to pass a truck incline as it removes the lower portion of the cut. The shovel that digs the upper two-thirds of the cut is in the distance.

Slide Number 6.—A close-up picture of a 35-yard shovel working on the bench with one cat on the leveled "V" spoil removing the upper cut of the 85-foot bank.

Slide Number 7.—The scheme of the combination and method of

Slide No. 8

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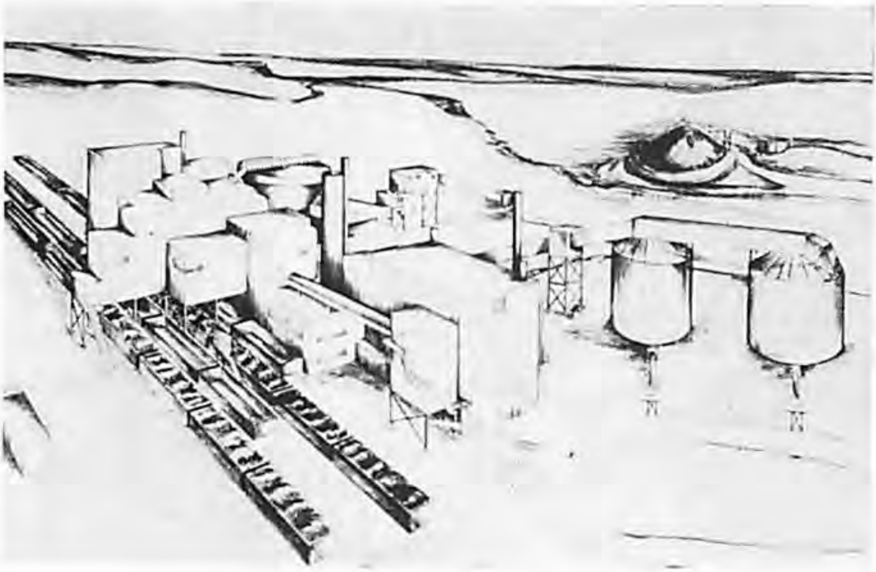
Slide No. 13



Slide No. 14

working a shovel and wheel on the coal.

Slide Number 8.—A view of the first Kolbe wheel which handles approximately 1100 cubic yards per hour.

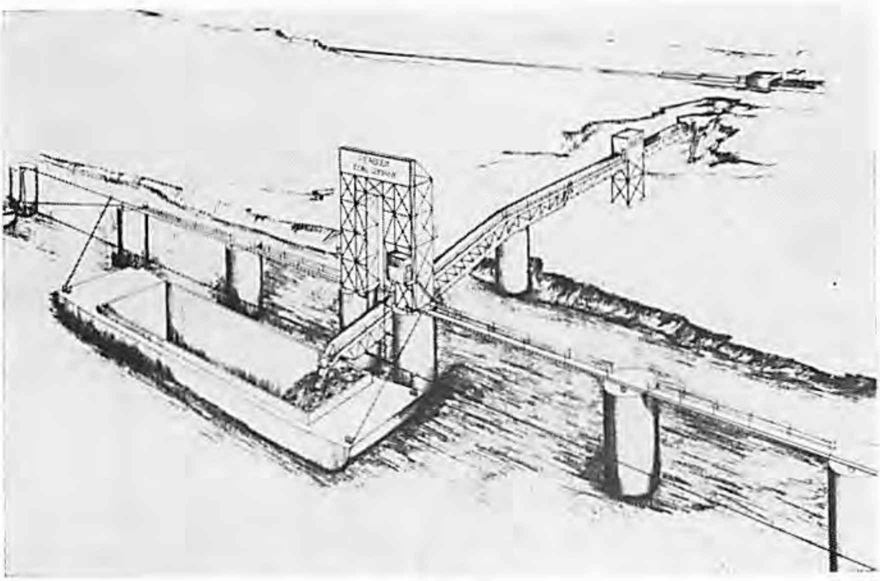
Slide Number 9.—The second U. E. C. Co's wheel at the Buckheart mine that handles 2000 yards per hour.

Slide Number 10.—The third U. E. C. Co's wheel at their Fidelity mine that uses the wheel in a downward cutting direction to scrape the loosened material onto the conveyor belt. This machine moves 1800 cubic yards per hour with the possibility of an increase to more than 3000 yards per hour.

Slides Numbered 11, 12 13. — Views of the Stonefort Coal Corporation Bucyrus 1050-B shovel when it first entered the pit several years ago. This machine has the crowd position mounted on the upper part of the boom so the bucket can be used to strip and clean up the upper seam of coal, known as the Dekoven coal, that lies about 12 feet above the Davis seam on which the machine is traveling. The bucket shown here is 26-cubic yard capacity and has an average of 21,523 cubic yard capacity per 24-hour day. A new T-steel, 32-yard bucket has recently been placed on this machine.

Slide Number 14.—A perspective drawing of the River King Mine tipple that we are building near Freeburg, Illinois.

Slide Number 15.—A perspective drawing view of our East St. Louis Mississippi River dock that we are building.



Slide No. 15

I was to have received some slides from the Hanna Coal Company and data on the performance of their 60-yard shovel, but they failed to arrive.

I hope that I have covered the highspots of the stripping problems in Illinois today. Perhaps some generous stripping operator or shovel manufacturer will develop a machine that has the digging qualities of a shovel, the range of the walking dragline, and the continuous performance of the wheel.

Chairman Fletcher: Thank you, Mr. Weimer.

Our next paper is entitled "Recent Developments in Mine Safety Practice in Illinois," which will be presented by Mr. L. H. Johnson, Safety Engineer with Peabody Coal Company. Mr. Johnson.

. . . Mr. L. H. Johnson thereupon presented his paper entitled, "Recent Developments in Mine Safety Practice in Illinois" . . .

RECENT DEVELOPMENTS IN MINE SAFETY PRACTICE IN ILLINOIS

L. H. JOHNSON
Safety Engineer
Peabody Coal Company
Taylorville, Illinois

Mr. Chairman, guests and members of the Illinois Mining Institute.

It is indeed a privilege and a pleasure to be invited to present this paper at your meeting. My hope is to promote safety to all miners, and I hope that some of this will be a help to others.

My company has a safety program in which we try to keep abreast of the times with incorporation of new, proved safety developments. Some of these we have originated.

Some recent developments follow.

(1) Our company starts mine safety with a 40-hour safety and accident prevention course which all of our supervisors are required to attend. Then all employees are offered a practical condensed course in mine safety and accident prevention for their voluntary acceptance and attendance.

These courses are conducted by men who know their business, from our own Company, U. S. Bureau of Mines, State Department of Mines and Insurance Company instructors. We are all very proud of the fact that every employee of our Illinois underground mines has been trained in these courses so that our training in mine safety and accident prevention is 100 percent.

In the training courses, workmen and supervisors are told and are shown, by descriptive movie films, slides, and actual demonstrations, how men have been killed and injured attempting to do their daily jobs in unsafe ways. And they are shown our own and the workers' own recommended ways to do these jobs the right way, *safely*.

All men, upon their completion of the course, are given pocket cards by the Company, State, and U. S. Bureau of Mines showing they have completed the course, and certificates for framing were given by the State, U. S. Bureau of Mines, and the United Mine Workers to the local union and the mine. Undoubtedly this training has paid off.

(2) The safety training went further to include fire prevention, and fire-fighting control and procedures for each man in case of a mine fire.

This course included fire prevention methods, fire-fighting methods using the fire-fighting equipment and the extinguishers at *their* mine. This was done by movie film, descriptive slides, talks, and actual participation in putting out fires of all types.

A standard of locations, and the proper people to promptly notify was established at each mine. The instruction shows the exact location of extinguishers, all other fire control apparatus, and telephones in and around their mine. What its limitations and uses are and the proper procedure for each man in combatting the fire, or his safe exit from the mine, if the fire raged out of control. More than 700 men and supervisors received this training, and were given pocket cards showing they had completed this course.

(3) Eighty-three men trained in the use of mine rescue apparatus and mine rescue and recovery operations, and a trained mine rescue team is at each mine.

(4) The first work day of each week on all shifts, the foreman of each work crew holds a short safety session with his crew *at their job* before the week's work starts.

(5) We have developed, and have in use a simple, effective method of rockdusting faces that advance rapidly, or more than 40 feet in a day, by applying liquid rock dust to the roof ribs and floors of these rapidly advancing places.

As the originator of this simple, effective method and its application, I think I have made a worthwhile contribution to mine safety for all coal mines. Rock dust can be applied on shift up to the face of any place during any cycle of operation without impeding any part of that cycle or hindering any other necessary work in that place. The only places that cannot be coated with this liquid mixture during the cycle of operations are, of course, places where blasting or breaking of coal is in progress.

The apparatus to do this job consists of a mixing tank or vessel in which up to 400 pounds of rock dust is mixed with water to form a liquid. The mixture is blown through a three-quarter inch or one-inch, rubber-lined hose from the mixing tank. The tank may be located at some suitable place that may be up to 1500 feet from the face. Experience has shown that a compressed air supply 35 to 45 cubic feet per minute, at 100 to 125 P.S.I. is sufficient to mix the rock dust and water in the tank and propel it through the rubber-lined hose without clogging, up to the nozzle at the face.

This method does not cloud the mine atmosphere with rock dust, or with coal dust blown from the mine surfaces, to create a nuisance or safety hazard to any worker in the mine. It is done on the work shift with proper supervision, and truly it is not, as you might suppose, a messy operation.

Experience has shown that this is an adequate, effective method. As after an interval of from three to seven days, the moisture content is practically the same as rock dust applied dry, and it has no more tendency to cake than dry dust applied to damp mine surfaces.

(6) This method of rock dust application is supplemented by a hopper and spreader arrangement mounted on a shuttle car, which does an excellent job of rock dust-

ing the mine floors and roadways wherever the shuttle cars are run, without clouding the air. This device was originated and put in use by men of our company, and makes adequate rock dusting up to within the legal distances from any face being worked.

(7) The hazard of open abandoned works is reduced to the bare minimum by early recovery and sealing. The recovery is accomplished with the help of a recovery machine crawler mounted, equipped with a power-driven winch, holding 500 feet of three-quarter inch steel cable, so the operators and other members of the recovery crew can be in a safe place when rail cross bars, timbers, or other valuable equipment is recovered or salvaged.

(8) Recently a ground detector and fault finder has come into wider use to locate exact points of trouble on cables and intricate wiring and electrical layouts, eliminating the old trial and error methods with its worker injuries, further damage to cables and equipment, and the creation of serious fire hazards. This is a manufactured device of the Ohm resistor, recorder type.

(9) A timbering machine mobile is mounted on rubber tires, crawler, or track that carries to the places of installation a supply of cross bars, rails, props, cribbing, cap boards and tools, and is equipped with a circular, power-driven wood saw. A hydraulic-operated lifting boom is capable of lifting, putting, and holding in place the heaviest rail cross bars until permanent legs can be cut and set under the bar. This equipment makes a safe, efficient method for a crew of two men to handle, transport, and install heavy roof supports, with a minimum of hazards to anyone.

(10) The requirement of at least one (and more if needed) safety posts to be set in the faces, good or bad, between the last permanent support and the face, while anyone works in the face, is very definitely a safety development and has come into use recently on a wider scale, with the definite and clear instruction to each man to see that the roof is safe at the place he works, wherever he works. This should, and does prevent roof-fall injuries.

(11) The recent developments in blasting are wider use of millisecond delay blasting caps, pretested blasting circuits, and the so-called insensitive explosives, such as Akremite, Nitramite, Olin-nite and others, contribute to both surface and underground blasting operation safety.

(12) A tape-recorded program, played back and broadcast through a system of amplifier speakers at man-trip loading stations to the workmen, while they are loading the man-trips to go into the mine, and a safety message, short and to the point, after they are loaded and seated, puts safety up to the workers every shift just before they go into the mine to their work.

This program consists of 15 minutes of a good recorded program while the men are getting to and in the man-trips, and after they are seated, ready to go, a two-minute safety recording by a Company, U. S. Bureau of Mines, State or Union official, in which the workers' own previous mishaps are discussed, and they are told the safe way to do the job that caused the man to be injured.

The man-trip station is 450 feet long, and requires six speakers so that every man can hear plainly, even when seated in closed top man-trip cars, and we do have perfect voluntary attention for the safety message.

Among safety people they say the accidents we prevent you never hear about, but the ones that happen you can be sure you will hear plenty about.

A quote from the short safety message: "The more you hear about safety the less you hear about accidents."

Do all of your work safely.

* * *

Chairman Fletcher: Thank you, Mr. Johnson.

Our next section this afternoon is a panel discussion on extensible conveyors. While I cannot claim to be an old-timer in the coal business, I have been associated with an old-timer for a good many years, Jim Fletcher, my father. I can remember when I first started listening, as a boy, to what he was talking about. Haulage was a problem then; haulage is a problem today. New methods have come in, and now with the continuous miners, haulage problems have increased. We hope that you will learn something of interest in this relatively new method of haulage.

The first paper will be delivered by Mr. Louis S. Ahlen, District Manager of the Goodman Manufacturing Company, Terre Haute, Indiana, who will speak on "Rope Belt Conveyors."

I am sorry, but there seems to have been an insertion on the program. Will you please pardon us. We have another gentleman who will address us first.

. . . Mr. Murrell Reak, Assistant Director, Department of Mines and Minerals of the State of Illinois, thereupon presented his paper . . .

SAFETY AND ATTITUDES

MURRELL REAK
Assistant Director
Illinois State Department of Mines and Minerals
Springfield, Illinois

Thank you, Mr. Johnson, for your very fine paper on recent safety developments at the Peabody Mines. Being connected and concerned with safety, as I am, I can verify the contents of your paper authoritatively and I want you to know the State Department of Mines and Minerals appreciates very much the effort that you and your company are expending toward safety. It would be well if all others would devote as much time and effort to this worthy cause.

The first coal in this country is said to have been mined about 280 years ago. Initial production, naturally, came from small mines. Thus the industry has had almost three centuries of experience. From the very beginning, men have been killed and injured by falls of roof and coal, by explosions of gas and coal dust, by improper use of explosives and, during later years, by electricity, machinery and faster haulage methods. Despite centuries of mining experience, the same type and cause of injuries prevail today.

Just what causes injuries and fatalities in our mines? Some of them can be attributed to individual attitude, namely:

1) *Chance-taking attitude* – "It can't happen to me"–the live dangerously concept, involving great faith in luck.

2) *Overconfident attitude* – "I'm good, I don't have to be careful"–the know-it-all attitude.

3) *Fatalistic attitude*–"You go when your number is up, and what you do doesn't make any difference."

4) *Self-important attitude*–The idea that "I'm too big for rules or regulations. They're for the other fellow."

5) *Hostile attitude*–The unfocused feeling of anger toward others, resulting in an aggressive attitude.

6) *Attitude of inferiority*–"I will not be pushed around."

7) *Selfish attitude* – The "me first" attitude responsible for lack of consideration for others.

There are other attitudes, but the ones mentioned are sufficient to illustrate the point. Seemingly insignificant factors affect employee attitudes and behavior. Management's problem is to convince the employee himself in the desire to be safe. Most injuries are preventable, and the safety supervisors should never be pessimistic.

The three main causes of accidents have been spoken of as the "three D's"–didn't see, didn't think, didn't know. Why not combat the "three D's" with the "three E's"—engineering, education, and elimination? Education is the chief weapon in the prevention of injuries not only in small mines but in all mines and all industry.

Education is the only manner in which to become proficient in allotted tasks. Therefore, better-educated personnel are necessary for greater safety.

In far too many cases the primary cause of injury and fatalities in mines is due to lack of intelligent understanding of laws, safety rules, and accepted safety practices on the part of employees, supervisory forces, and employers. All must become better educated in safety from all angles. With increased general knowledge comes better judgment, and with better judgment comes safer and more efficient results. Injury prevention can be considered a never-ending plan requiring the advice, guidance, experience, and cooperation of all concerned.

An Injury Is Not An Accident

One of the definite mental blocks to the unceasing drive to reduce injuries to our workers is the use of the word accident when we mean injury. Although many of us still talk of industrial accidents or work accidents, what we usually mean is industrial injuries, or (to use a better phrase) work injuries.

The very use of the word accident is unfortunate. The word has several meanings, but it is usually interpreted as something undesigned, sudden, and unexpected—something that happens quite by chance. But we know that injuries do not occur by chance. We know that injuries are caused.

There is another valid objection to the use of the word accident, as far as the injury picture is concerned: Federal, State and private and public organizations keep statistics of injuries, not of accidents. If no injury results from an accident, there is usually no statistical record kept. And if an accident brings injury, say, to a dozen people, statistics record 12 injuries, not 1 accident.

When the average man thinks of accidents, he thinks of something we have no control over; but we can actually control most so-called "accidents," and this fact is the very basis of injury prevention.

We know that if we have safe working environments, good supervision all along the line, adequate safeguards, and safe work practices, the overwhelming majority of injuries will be eliminated.

The important point is to first of all clear up errors in our thinking, and the word accident is a stumbling block except when used accurately.

Accident inclines us to think of mere chance. Injury is not only more accurate, but is something more vivid and tangible. It makes us think of a broken leg, a lost eye, an amputated finger; and so it hits home, and makes us realize the precious things we should protect.

An injury is an injury. An accident is an accident. But an injury is no accident. Let us use the term injury when we mean injury.

Your program of training in fire prevention and fire-fighting control, and procedures for each man in case of fire is highly commendable, and it is well appreciated that more than 700 men and supervisors have taken this training. Also more than 83 men have been trained in the use of mine rescue apparatus. I would call this quite an accomplishment indeed. I am also impressed by the mobile timbering machine you speak of, and I am sure it will take its place along with modern mining methods that are changing yearly in the industry.

It is my most earnest and constant desire to help prevent injuries and fatalities. I believe that safety programs are a big help toward preventing such, if the lessons learned are carried out by all of us. No safety program can succeed unless it has full cooperation from employees and management alike. Neither can enough laws be legislated to insure safety. I believe it is the responsibility of management to make a mine safe for men to work in, and that supervisors or face bosses are part of the management. The supervisor or face boss is charged with carrying out management's responsibility for safety because he is management's closest link to the actual operations. Although he may not have had a part in planning the system, he is the only authority close enough to change unsafe practices or conditions. Therefore, it behooves each of us to read and obey all safety rules in order that we may have many, many more years of happiness with our loved ones and friends.

Safety is more than a program. It is a brainy, vigorous effort to see that we live our full share of time on the good earth; that we live it to the fullest extent while we are at it. Safety is a series of constant, man-sized steps along the sunny side of life. It is more ability, more time, more dollars, more security, so enjoy SAFETY.

* * *

Chairman Fletcher: My apologies to you, Mr. Reak and to you, Mr. Ahlen. That was Mr. Murrell Reak, Assistant Director of the Department of Mines and Minerals of the State of Illinois.

Now, we will try it once again—we will hear from Mr. Louis S. Ahlen, District Manager of the Goodman Manufacturing Company, on Rope Belt Conveyors.

ROPE BELT CONVEYORS

LOUIS S. AHLEN

District Manager
Goodman Manufacturing Company
Terre Haute, Indiana

The past decade has witnessed an increasing trend toward systems of underground mining which provide concentration of machinery and production from fewer working sections. This trend was greatly accelerated by the successful application of machines that can mine coal from the solid face.

The industry then recognized the economical need for a conveyor transportation system that could be installed quickly, extended cheaply, and at the same time reduce supply line traffic and maintenance cost.

As a result of this need, the Goodman Manufacturing Company decided to depart from the conventional rigid, structural type pan line conveyor and develop a belt conveyor that would be suspended on two parallel stationary wire ropes.

Early in the year 1955, an experimental rope belt conveyor, 36 inches wide and 750 feet long, was installed and put in operation underground in an Illinois mine. Instead of the usual heavy support frames, side channels, covers, roller supports, etc., the carrying idlers on this conveyor were nested in rigid cross frames and the frames were cradled between two parallel horizontally stretched wire ropes. It is important to note here that this first design permitted vertical deflection only of the carrying idlers as the ropes were held on gauge every 4 feet, which was the original carrying idler spacing.

This conveyor was used on development work and was installed in 150-foot increments. Before the entire 750-foot belt was installed, the rigid cross frames were discarded and a chain link carrying idler assembly was developed. This development is the most important feature of the rope belt conveyor.

As a general statement, the terminal units of a rope belt conveyor are the same for a given application as they are for a conventional type belt conveyor. This discussion, therefore, will be confined to the intermediate run or that portion of a conveyor which connects the terminal units.

Slide 1, (conveyor line—empty).

Slide 2, (conveyor line—loaded).

The intermediate run consists of two parallel wire ropes, the ends of which are either individually fastened to the head and tail units or are anchored to the roof or to the mine bottom. Carrying idler assem-

Slide 1. Conveyor line—empty.

Slide 2. Conveyor line—loaded.

Slide 3. Carrying idler assembly.

blies are normally spaced on 5-foot centers. Ground supports for the rope also carry the support member for return idlers and are normally spaced on 20-foot centers. A spreader is installed midpoint between the ground supports. The width between wire ropes is equal to the belt width plus 12 inches. Thus the rope gauge of a 36-inch conveyor is 48 inches.

Slide 3, (carrying idler assembly).

As mentioned, the chain-linked carrying roller assembly is the most important feature of this new concept in conveyor design. It consists of three rollers joined together, with their shafts drilled to receive a roller chain connecting link. The outer ends of the wing roller shafts are fitted to a rope clamp so designed that it firmly clamps the wire rope. The roller chain connecting link between the wing rollers and the rope clamp permits horizontal movement of the carrying idler assembly. The roller chain connecting link between the wing rollers and the center roller permits vertical movement of the assembly. Precision pre-lubricated bearings are used on all rollers.

Idlers of $2\frac{1}{2}$ inches, 4 inches or 5 inches in diameter may be used with either $\frac{5}{8}$-inch or $\frac{3}{4}$-inch diameter shafting. Either a $\frac{3}{4}$-inch or 1-inch pitch roller chain link is used to connect the carrying idlers.

Slide 4, (chain links).

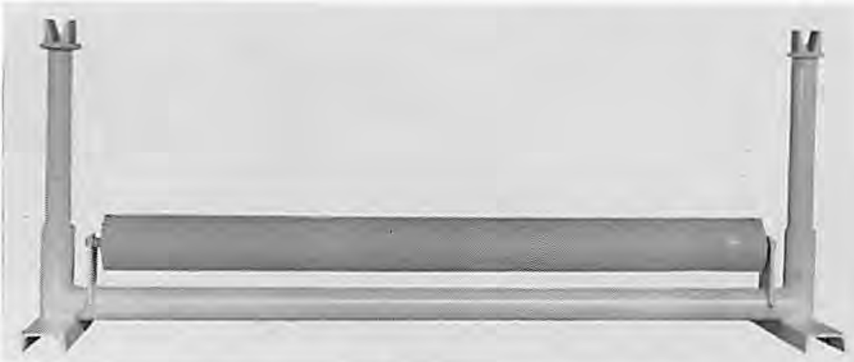
Slide 5, (chain links).

Slide 4. Chain links.

Slide 5. Chain links.

Slide 6. Empty belt.

Slide 7. Loaded belt.



Slide 8. Support stand.

The carrying idler assembly allows complete flexibility of load by conforming to the load pattern, no matter how light or how heavy. The angle that the troughing idler makes with the horizontal continually changes from approximately 12° when the belt is empty to 30° when the belt is fully loaded. Thus the belt contour changes from practically a flat belt to a deep trough belt that pockets the load. This tends to automatically center the load on the conveyor.

Slide 6, (empty belt).

Slide 7, (loaded belt).

On a conventional type conveyor the idlers are rigidly mounted and, because a loaded belt sags, the load must be lifted up over each set of idlers. Thus there is an impact against each carrying idler. In order to reduce this impact the tendency by designers and manufacturers has been to increase the diameter of the idler.

In the case of a rope belt there is no component part that is rigidly mounted. The rope flexes with the load and the position of the idlers continually changes with the load pattern. Thus there is nothing rigid to cause impact. This fact has resulted in the tendency by rope conveyor users to go to smaller diameter idlers with a consequent reduction in weight and price. As an example, a 2½-inch diameter carrying idler assembly for a 30-inch conveyor weighs 19 pounds. A 4-inch idler for a 36-inch conveyor weighs 30 pounds, and for a 42-inch conveyor it weighs 40 pounds.

Slide 8, (support stand).

A three-piece pipe stand supports the wire rope. It not only supports the rope, but in addition it withstands the horizontal force tending to squeeze the wire ropes together. The base of the stand consists of a steel shoe on each side for ground support and a sturdy cross member that supports the return idler. Two upright legs slip into sockets in the base. Each leg has a grooved cap piece that holds and clamps the wire rope. No tools are needed to assemble or disassemble the support stands. A 36-inch conveyor support weighs 42 pounds. Normal spacing of the support stands is 20 feet.

Slide 9, (spreaders).

Slide 9. Spreaders.

The spreader, which is $1\frac{1}{2}$-inch diameter piping, is located mid-point between the ground supports, and its function is to control the folding action of the carrying idlers and hold the ropes on gauge. It is shaped or curved so as to clear the carrying belt as well as the return belt. It is not connected to the ground and thus does not support the load—it merely floats. A spreader for a 36-inch conveyor weighs 14 pounds.

Slide 10, (roof anchor).

A method of anchoring the rope is shown on this slide. This type of anchor may be bolted to the roof or to the mine bottom. It consists of a channel plate that is bolted to the roof. Cap-screwed to this plate is an adjustable height leg, on the bottom of which is a shoe. Rope from the outby anchor goes under the shoe and is attached to the inby end of the channel plate and tightened by a turnbuckle. When an extension is made, the new section of rope is attached to the outby end of the same channel, goes under the shoe and on to the next anchor. A roof anchor for high coal completely assembled weighs 340 pounds.

Slide 10. Roof anchor.

Here it should be pointed out that the channel plate itself is bolted to the roof and installed on sight line prior to extending the conveyor. A pair of anchors are normally spaced from 150 to 300 feet apart. This spacing depends upon the length of conveyor extension required.

The rope itself may be either $\frac{5}{8}$ or $\frac{3}{4}$ inch in diameter, depending upon the type of unit required and the stress that will be put on the rope. A 6 x 19 rope with regular lay and steel core is used. Normal tension on the rope for a 36-inch conveyor is approximately 1200 to 1500 pounds.

Following the development of rope belt conveyors for panel and main line haulage, the next progressive and logical step to take was the development of the rope belt to extensibility. Our boring-type, continuous-mining machine development and application had progressed to the point where shuttle car haulage as intermediate transportation was a limiting factor in producing the tons per man shift potential of the machine. Thus with this in mind the development of our Ropex conveyor was started. The Ropex conveyor consists of a crawler-mounted, self-propelled head section and a crawler-mounted, self-propelled tail section with an intermediate run of 36-inch rope belt conveyor line similar to that previously mentioned. A bridge conveyor is attached to the rear conveyor of the continuous borer and travels on wheels over the Ropex tail section. A prototype model was put in operation underground earlier this year. Two production models are now in operation. Experience to date is too brief to provide accurate cost comparisons. However, the Ropex conveyor will definitely and substantially increase the percentage of operating face loading time.

The first use of rope belt conveyors was started about two years ago. The range of application has not as yet been fully developed. However, certain benefits and advantages of the rope belt, as compared to a conventional, rigid type conveyor, have been found.

1) One of the most important advantages has been the very drastic reduction in installation and extension time. One mine operating in the Midwest uses a mining system in which the panel entries are driven 1550 feet deep. In order to keep shuttle car haulage time to a minimum, conveyor extensions are made on the basis of 150 feet. Their time-studies show that 150-foot extensions of 36-inch rope belt conveyor takes six men 60 minutes, or six man-hours. This same mine also has in operation several conventional type 36-inch conveyors. Their time-studies indicate that it takes 30 man-hours to extend 150 feet of conventional pan line. Thus the rope belt conveyor shows a saving of 24 man-hours per extension. The same relative labor saving is made when recovering the conveyor on the retreat. Between shift conveyor extensions, when operating on a three-shift basis, can thus be accomplished. Another example of savings was recently noted when a 4000-foot, 48-inch rope belt conveyor was installed. The installation cost of the rope belt conveyor was only one-third of what it was for a conventional type pan line 4000 feet long and 48 inches wide.

2) The flexibility of the entire unit provides impact resistance, and has eliminated the need of impact rollers at loading stations. This, together with an anticipated reduction of friction losses, will undoubtedly result in minimum belt specifications and a corresponding saving in belt life. Belt edge wear is greatly reduced due to ample side clearances for the return belt. As an example, one coal company who has been using a 4-ply, 42-ounce belt on their 36-inch conventional type panel conveyors is now using 3-ply, 42-ounce belting on their rope conveyors.

3) A pan line is not required. Thus much material is eliminated and supply line traffic is reduced.

A conventional rigid type 36-inch pan line with 5-inch side channels and 4-inch diameter idlers will weigh about 64 pounds per foot. A 36-inch rope belt conveyor with 4-inch diameter idlers weighs approximately 14 pounds per foot. Thus in a conveyor 2000 feet long there is approximately fifty tons less weight to be handled. This also means that less underground storage space is needed. Here again actual accurate mine experience showed that in one mine when installing 4000 feet of a 48-inch main line conventional pan line it required 60 mine car loads to haul the material underground, but 4000 feet of 48-inch rope belt conveyor material required only 18 mine car loads.

4) Spillage is minimized due to the hinged action of the carrying idler which permits the belt to hug the load.

5) This type of construction conforms readily to normal undulations in the mine floor. It also reduces the cost of underpassing since no superstructure is required to support the ropes.

6) Conveyor can readily be installed and maintained on sight lines. Roof anchors are placed on sight line and when ropes are tensioned, the belt has to be on sights.

7) Last, but not least, there is a lower first cost.

I have presented the highlights of this new concept in belt conveyors. As is usually true, this conveyor as it has been discussed today, is not the same as the one which was first started early last year. As a result of field tests, design changes have been made. The original basic principle of the conveyor has not been altered, but details of the design on such component parts as stands, spreaders, rope clamps, etc., have been changed. Problems have been solved and many benefits have been found. Several miles of rope belt conveyors of various widths are now in operation. Unquestionably the future will bring many new and different applications and the full potential of this new design will be realized.

* * *

Chairman Fletcher: I counted 39 empty seats up here in front, and about that many men standing in in the rear. Would you like to move up here and stretch your legs at the same time? I guarantee you, you can hear as well up here and even better.

We will carry on with our panel discussion. Our next speaker is Jack Stevenson, Sales Engineer of the Jeffrey Manufacturing Company in Evansville, Indiana, who will speak on "The Jeffrey Molveyor." Mr. Stevenson.

. . . Jack Stevenson, Sales Engineer, Jeffrey Manufacturing Company, Evansville, Indiana, thereupon presented his paper entitled "The Jeffrey Molveyor," after which a short movie on the operation of the Jeffrey Molveyor was shown . . .

Molveyer in Semicircle.

JEFFREY MOLVEYOR SUPPORTING CONTINUOUS TYPE MINING MACHINES

J. W. STEVENSON

The Jeffrey Manufacturing Company
Columbus, Ohio

The Jeffrey Molveyor is a train of portable belt conveyors with the framework mounted on solid rubber tires and permanently connected. The method of mining determines the length of the train, and once established, the train functions as a unit. It consists of a 19½-foot long receiving section, a specified number of 15-foot intermediate sections, and a 28-foot discharge section that includes a 9½-foot swinging boom for loading onto the center of the mother belt.

In operation, the molveyor follows the colmol or other type of continuous mining machine into the place with the receiving end operator tramming the machine under the end of the discharge conveyor of the continuous mining machine. He then signals the operator on the discharge end by telephone or electrically operated

Receiving Section.

gong to start the belt conveyors. The belt starts in sequence with the discharge boom conveyor belt starting first and the receiving section belt starting last. With this arrangement, if any belt should stop, all inby belts will automatically shut down and not bring coal to the stopped belt. The continuous mining machine continues to advance until it is stopped because of roof bolting or timbering, ventilation, or because the discharge end can no longer reach the mother belt. The discharge operator then trams the machine back down the entry paralleling the mother belt. The receiving operator can only advance the train and the discharge operator can only retreat or pull back the train. After the train is pulled back, the continuous mining machine either makes a secondary cut or trams to another place where the cycle is repeated.

The maximum height of the molveyor is 32 inches with a road clearance of 6 inches. The maximum width is 66 inches and the hopper on the receiving section is 56 inches. The receiving section is hydraulically steered. A hydraulic power pack furnishes fluid for steering. Other controls on the receiving section, in addition to tram forward, are the emergency stop button on both sides shutting off all motors, hydraulic pump motor switch, button to operate the gong signal, headlight switch, and telephone to communicate with the discharge operator. There are manually reset circuit breakers for magnetic and thermal overload protection for the belt motor, the traction motor, and pump motor. The approximate weight is 7000 pounds.

The intermediate sections have the emergency stop button on each side and the manually reset circuit breakers on traction and belt drive motors. The units can turn at 45° to the preceding or following unit. The approximate weight is 6300 pounds.

The discharge section has the same controls as the receiving section except the tram is opposite to that of the receiving section. In addition, there are hydraulic controls to swing the discharge boom 45° to right or left of centerline and to raise and lower it. A Vickers hydraulic power pack provides fluid for all the hydraulic operations, including steering. The discharge operator controls the starting of the belts. The estimated weight is 11,000 pounds.

The conveyor belt is 30 inches wide and is driven at 400 feet per minute. We have arbitrarily established a carrying capacity of 4½ tons per minute, which is a little less than ⅔ of the carrying capacity of a 30-inch belt at 400 FPM belt speed according to Nema specifications. Each belt is driven by a 5 HP (continuous rating) line start motor. The belts are driven at the head end and the drive pulley is 4½ inches in diameter, neoprene lagged. Carrying and return idlers are 2 9/16 inches in diameter with sealed-for-life bearings. Neoprene (flame resistant) covered endless belts are used. As previously indicated, manually reset circuit breakers protect the belt motors against overload.

Intermediate Section.

The wheels on the receiving end of all units are driven by a 1 HP (continuous rating) motor. The tramming speed is 33 FPM. Each traction motor has a manually reset circuit breaker to protect the motor against overload. The traction motors operate in parallel through one step of starting resistor with automatic acceleration. All motors operate through contactors. Contactors are also used for reversing the traction motors. The discharge end of each unit has an equalizing axle to give a three-point suspension to each unit. Tires are solid rubber throughout.

The above basically describes the molveyor. Its purpose is obviously the continuous transportation of coal from any type of continuous mining machine, thereby increasing the percentage of operating time, and at the same time have the flexibility and mobility necessary for both development work and pillar extraction.

We now see a slide indicating one method of a proposed mining plan with the molveyor and belt haulage in support. With such a setup, belt structure is advanced in 40-foot increments and any type of temporary belt structure can be employed so long as it can be installed relatively rapidly. This outline can be effectively employed in either development or room work and is particularly adaptable to pillar extraction.

Although we have only one 30-inch molveyor in operation at this time, our experiences prove that the molveyor is a successful mining machine—a machine that will be accepted by the mining industry as one solution to continuous haulage that is becoming so necessary in order to approach continuous mining.

* * *

Chairman Fletcher: Thank you very much, Mr. Stevenson.

Our next paper will be by R. U. Jackson, Sales Manager of the Hewitt-Robins Company, of Chicago, Illinois. He will speak on "The Extensible Belt." Mr. Jackson.

. . . R. U. Jackson, Sales Manager, Hewitt-Robins, Inc., Chicago, Illinois, thereupon presented his paper entitled "The Extensible Belt" . . .

EXTENSIBLE BELT CONVEYORS

R. U. JACKSON

Manager, Mine Conveyor Sales & Development
Robins Conveyors Division
Hewitt-Robins, Incorporated
Chicago, Illinois

The always present problem of producing coal at the lowest possible cost per ton is still with us today, only more pronounced than ever, due to a number of current factors, including the increased labor rates and increased fringe costs.

The producer need not worry about a reduction in the annual requirements of coal tonnage in the United States (unless all our expert analysts are crazy) but he must keep abreast of new market developments.

The cost-of-labor issue is different, as here you have a positive increasing cost factor that can be overcome only by increasing the tonnage output per man-hour of labor input.

The coal mining industry is equipped with exceptional managerial talent, and present day conventional mining systems have been developed to nearly the maximum extent of their efficiency. This, then, is to imply that more efficient mining systems must be developed in order to improve tons-per-manhour and cost-per-ton.

How many of you realize to what extent other mining industries (not coal) are following your developments in order to improve the efficiencies of their industry? This is particularly true for their transportation problems and definitely relates to the extended use of belt conveyors.

Referring to mining systems, it will not be many years before the most modern methods of so-called continuous mining will be in universal use, and any haulage system being considered today should be designed to include the possibility of a continuous mining system. This is true for new mines being developed or for old mines being extended. Mining systems will continue to use track haulage under certain conditions, but very frequently they will be supplemented with belt haulage units.

Haulage systems will continue to use shuttle cars as one of the major feeding units to the transportation system, but they will be used more universally with belt haulage than with track.

Where shuttle cars are used, their travel will be held to a very minimum, utilizing extensible belts for control of the shuttle car travel. With the successful advent of a permissible diesel powered shuttle car, this unit may become a more definite factor in the belt haulage system because it will eliminate the trailing cable and permit more maneuverable operation. However, its success will again be governed by short haul shuttling service to extensible belts.

Mining will be developed around concentration of working faces with larger tonnage from these concentrated areas, where proper control of roof will permit. This will mean better concentration of both power supply and supervision, both of which are a prime factor in cost analysis.

Projected panels will be larger; panel entries fewer; rooms deeper. With continuous mining, or possibly better described as progressive advancement of each mining unit, why place a miner that can advance 200 feet per day in a 300- or 350-foot room just to satisfy maximum shuttle car haul? Why not an 800-foot room, or 1200-foot room, using extensible belts?

A number of manufacturers have developed extensible type belt conveyors for more efficient room haulage and more efficient entry driving when serving the continuous mining unit, or for more continuous operation of the conventional loader.

A few of these units might be classified as follows:

a) A shuttle belt conveyor, employing a fixed discharge point or fixed tripper. You are all familiar with the normal belt tripper that travels on wheels over a belt conveyor, discharging continuously as it travels, into a long storage pocket or hopper.

The shuttle belt conveyor is opposite to this principle, as the tripper unit is fixed and guides the belt conveyor which is mounted on wheels and travels under the fixed tripper. All drive equipment is fixed and mounted on the tripper frame and no elaborate belt storage unit is required for advancement of the inby loading section.

While the tripper discharges to a cross belt or a train of cars in an adjacent heading or room, the inby loading section can advance and follow the miner, either by its own power or an auxiliary power unit.

The initial limiting factor for advancement of the inby loading section is the amount of storage space available outby the fixed tripper. With 50 feet available outby, the loading section can advance 50 feet without adding belt. If 100 feet is available, it can advance 100 feet without adding belt, etc.

When used in entry driving, assume the shuttle unit to be 800 feet long and you can start the initial setup with 100 feet storage outby the tripper. It would then require 7 belt insertions of 200 feet each before the full 800-foot conveyor would be installed and the loading section advanced the 800 feet.

To advance the next 800 feet, it would only be necessary to move the tripper 800 feet over the conveyor, without removing any conveyor sections or the belt. Each successive advancement would be the same, no disassembly of equipment, only move the tripper.

If this is used for driving long multiple entries, the main or panel belt would no doubt be installed in the adjacent heading with a short cross belt or portable feeding the main belt, through a cross-cut or break-through.

With this arrangement you are provided with sufficient time to extend and align the main haulage belt conveyor preparatory to moving up the fixed tripper and crossbelt every 800 feet of entry advance.

If you are using track in the mains, with a track loop for cars, you need to advance the track loop only once every 800 feet and you have sufficient time to do this properly and with minimum labor and cost.

With the above arrangement, it would probably be most economical to use one or two shuttle belts, advancing from one break-through to the next, permitting the shuttle cars to load over the tail from heading faces, via the nearest break-through, with a minimum of shuttle car travel.

From room work the procedure would be similar to entry work, with one shuttle belt serving at least three adjacent rooms.

It might be added that the shuttle conveyor can be retracted in the same manner as advanced, should the mining system require retreating and slabbing of the pillars or blocks.

b) Rigid type extensible with discharge over the outby terminal pulley. This type requires a method of belt storage usually back of the drive terminal and the insertion of intermediate sections adjacent to the tail section as the conveyor is advanced. I know that you will receive a thorough description of this unit elsewhere in this program.

c) The rope-type extensible belt, which operates in a manner similar to the rigid intermediate type, except that the supporting stringer medium is a pair of steel cables that are extended continuously by a crawler-mounted inby loading section.

This type requires a continuous cable tensioning medium to maintain cable tensions during advancement between anchor stands, with these anchor stands placed on centers of 150 to 200 feet and with intermediate floor stands spaced at about 10 feet, using a troughing idler spacing of about 5 feet and return idler spacing of 10 feet or 20 feet, depending upon floor contour conditions. Here again you will receive a more detailed description from other speakers on this program, who have the rope conveyor as their principal subject.

I might add, however, a few features of our design: chain link attachments for cable anchorage; motorized belt tensioning and belt supply control; inby crawler unit, independent of tail pulley section; and either cradle type or flexi-roll type troughers. Another extensible unit is the sectionalized power units or "Moleveyor" which has already been explained in detail.

There are other extensible types of conveyors, some proved in practice, others being developed and in the experimental stage. Service haulage at the face is relatively new, as required for continuous mining operation. As new continuous type miners are developed, a service transportation system and mining system must be developed for them.

Several methods of transportation might be suitable for each individual operation, but only you or your consulting engineers, who know all your requirements and conditions, can make the proper selection and establish the proper system of mining. However, to make a successful operation you must have a good installation, good operation and maintenance, and, above all, good housekeeping.

* * *

Chairman Fletcher: Thank you, Mr. Jackson.

May I ask that you all take a good deep breath? We have one more paper on this subject, and then we are going to want some questions from you.

Our final paper will not be presented by William Hanson, who is absent today, but by Richard E. Paddock, of the Joy Manufacturing Company, who will speak on "Belt Conveyors—Key to High Production." Mr. Paddock.

Richard E. Paddock (Joy Manufacturing Company, New Philadelphia, Ohio): Mr. Chairman, Institute members and guests: This afternoon it is my pleasure to present a paper that was prepared by my boss, Bill Hanson, who is Manager of Conveyor Products of the Joy Manufacturing Company.

For several months Bill has looked forward to attending this Institute, but, as many of you know, Bill and his wife, Marge, are momentarily expecting a new addition to the family. As late as Wednesday of this week, Bill still had hopes that the stork would cooperate so he could be here. However, for the last several weeks—as our Cleveland Browns professional football team knows—the quarterback just hasn't called the right signals. (Laughter)

BELT CONVEYORS KEY TO HIGH PRODUCTION

WILLIAM HANSON

Manager of Conveyor Products
Joy Manufacturing Company
New Philadelphia, Ohio

The coal industry, according to all the people who like to speculate about things to come, has one of the rosiest futures it has ever faced. There are, however, a few reservations tossed in with these pleasant forecasts which must bear some serious consideration. The boom won't be automatic. It is going to take an immense amount of hard work to improve all phases of the production, transportation, and marketing of coal, as well as a strong dash of bold planning. The coal industry must not only produce an ever increasing amount of coal but it must do it in the face of keen competition, higher taxes, higher wages, higher freight rates, and higher costs of its tools.

Fortunately, the coal industry has always been a leader in its progressive attitude toward adopting new methods and in working with the manufacturers. It is going to take a lot more of this to get the *actual* to match the *forecast*. It is my purpose to emphasize some of the latest developments in new machinery which may lead to increased productivity per man, to offset some of these higher costs.

The entire concept of the use of belt conveyors has changed radically in the past three years. Belt conveyors used to be restricted almost entirely to semi-permanent or permanent installations where they were, in effect, tools of main line transportation. We now have belt conveyors which can be properly classed as mining machines since they are a basic part of the coal digging team. It is this class of equipment that offers the mine operator one of his best chances to stay afloat.

The Joy Manufacturing Company has now sold some 73 extensible belt conveyors. Fifty-one of them are now operating, the other twenty-two will be operating in the near future. There is nothing experimental about this kind of business, it's big and getting bigger. One of the most effecive indications of the success of the program is the fact that 85 percent of the orders received in the last six months have been repeat orders from hard headed coal miners who are out to make a buck. This is what we've been saying all along.

The unit which we call an extensible belt conveyor is not properly titled, since all underground conveyors are, in reality, capable of being extended. When we say extensible, we really mean a unit that can be extended while in the process of transporting material. It is, in effect, continuous haulage to go with continuous mining.

I'll not burden you with a description of the extensible belt because you can get that information pretty readily if you are interested. Suffice it to say that it is quite a machine. It has a crawler-mounted drive and tail, automatic belt storage, idlers you can add or take out while the belt is carrying coal, and a means for making it longer or shorter without shutting off the flow of coal.

When it is combined with high capacity mining machinery, it results in a production team that is hard to beat for day-in, day-out tons per man. Recently, one mine issued some figures covering one year's operation. They compared production of a ICM-shuttle car operation against a ICM-extensible belt combination. Total tons mined for the year with shuttle cars was 150,770. Total tons with the extensible operating the same number of shifts was 171,158. Average tons per man per shift with shuttle cars was 50.5; average tons per man per shift with extensible was 76.6. It is interesting to note that both systems worked under the same conditions, had about the same amount of down time, and had crews which were deemed to be of equal capacity. It doesn't take a mathematical genius to realize that this man might make a little money if he keeps it up.

The extensible belt, however, is just one item in an ever increasing group of highly mobile conveyors which can offer improved production at reduced cost. This economy is not due to one or two small improvements. It stems from a long list of advantages in almost every phase of the operation. Let's take a look.

1) These units can provide the nearest thing to continuous haulage yet devised. This means more effective operating time.

2) The units are cheaper because they're simpler. Fewer idlers and less structure are employed. Since they are simpler, they require less time to set up, thus reducing set-up charges and increasing time for mining. A Joy Limberoller conveyor can be set up with less than half the number of man-hours required for any other conveyor.

3) Cheaper maintenance because there is less to go wrong and it's easier to replace worn out equipment.

4) Mobility means *less* lost time in moving; also *less* equipment to do the job. One mine reports the following: Time lapse measured from last piece of coal flowing from one room until first piece was flowing from the next, using six men and 1000-foot rooms —75 minutes.

5) Long rooms require fewer panel entries, hence fewer moves and, therefore, cheaper development.

6) Conveyors can and are being used with some conventional systems to shorten shuttle car haul.

7) Where soft bottom occurs, conveyors only move into and out of a room once.

8) Lighter and, therefore, cheaper belts are possible. We're using 3-ply, 32-ounce duck on *some* 30-inch mine-run belts.

9) Compactness means easy storage, also quick moves from place to place because there's less to move.

10) High production permits concentration, hence fewer men, closer supervision.

11) Safety.

There are a good many more reasons that will make it worth your while to investigate thoroughly before you plan your next move.

Having now convinced you that the only way you're going to make any money is to stock up on these conveyors, I would like to issue some precautions.

The use of these conveyors requires a change in thinking on the part of some operators. For one thing, it is essential that you approach them positively. If you start with the attitude that there is no such animal, you won't get your money's worth. Economy is the prime factor but don't expect too much. The most important item in the economy of belt conveyors is the one most frequently ignored. This item is proper use. The idea that they will do more work than they were designed to do, that they will perform under the most impossible conditions without complaint, is dead wrong. There is no easy road—yet. If you overload them, the coal will spill; if you don't train them, they won't run straight; if you don't put the load on them correctly, it won't ride well. It doesn't make good sense to plan to use conveyors to save money and then throw the advantages away by abusing the equipment.

The biggest headache to a manufacturer is trying to find out what is wanted. It is impossible to do a good job in recommending equipment if you don't know what will be required of it.

Therefore make the most of the economies to be realized from mobile conveyors *but* make some plans to go with the deal.

1) Train your men in the proper use and handling of conveyors.

2) Develop regular inspection and maintenance programs.

3) Remember that the belt is the most expensive item in the conveyor. Make full use of all the devices provided to protect it.

4) Get the equipment to do the job, don't try to send a boy to do a man's job.

5) Set up regular procedures for all phases of operation.

6) Establish the rules, then see that they are obeyed.

Belt conveyors are still the cheapest method for hauling bulk materials. The economy comes not only from inherent qualities but from wise selection and rigorous programs for operation, maintenance, and training.

* * *

Chairman Fletcher: Thank you, Mr. Paddock.

Now we are open for questions from anyone on all of the conveyors and systems discussed this afternoon. Do we have any questions?

If not, I want to thank all of you for having given us a very fine survey on what is being done in this field of conveyor haulage immediately behind production units.

I will turn the meeting back to Mr. Snarr.

. . . President Snarr thereupon resumed the Chair . . .

President Snarr: Thank you, Bill.

Gentlemen, that concludes our fine program of papers. We have had a fine program. We have listened to the boys tell us how to use the slide rules; I think we have a man tonight who is going to tell us how to improve our personal rating. Let's be here on time tonight—at six-thirty. We will see you then.

. . . The meeting thereupon recessed at 4:05 p.m. . .

FRIDAY EVENING BANQUET SESSION

October 26, 1956

The Meeting reconvened at 7:45 p.m., President Snarr presiding.

President Snarr: Gentlemen, before we go into our program for tonight, I want to make an announcement. We have 501 attending today, active members, and 13 students and 25 life members. That is against 456 last year, so we are up about 50 this year. We are proud of that. (Applause)

I want to introduce the people at the speakers' table here. I am going to start on the right, down here (indicating), and I am going to ask them to get up and bow and not say much, and sit down again. (Laughter. Applause followed each introduction.)

First is Bill Campbell; Jack Weir; Dr. Read; "Rock Dust" Johnnie Jones, Old Ben, retired; Murrell Reak, Assistant Director, Department of Mines and Minerals; W. C. McCollum, of the Peabody Coal Company; Bill Fletcher, of the J. H. Fletcher Company; J. W. MacDonald, Old Ben Coal Company, our Past President; Ben Schull, on my left here, the Director of the Department of Mines and Minerals.

Now, starting on the left down here, with the press representatives, we have George Soll, of the American Mining Congress; next, W. A. Raleigh, of Coal Age; Dr. George Clark, of Rolla School of Mines; George W. McFadden, of Paul Weir Company; Dr. John Frye, Chief of the Geological Survey; George Wilson, your Secretary-Treasurer; "Mr. Illinois Mining Institute," Bela Schonthal.

I think that is everybody here.

Now we come to the good part of our program—I hope. We have a man here that some of you heard four or five years ago. I do not think he needs much introduction. If you do not remember him now, you will when he starts talking to you. Mr. Edward McFaul of Chicago is going to speak to you on "What's Your Washroom Rating?" (Laughter and applause)

. . . Mr. Edward McFaul then entertained members and guests . . .

* * *

President Snarr: Thank you, Mr. McFaul. I am sure that applause will express our appreciation better than I possibly could.

We have one more thing left. My last official act, which is a pleasant one, is to introduce to you your incoming President for next year, Mr. Paul Halbersleben.

. . . The Assembly applauded as President Snarr turned the gavel over to President-Elect Paul Halbersleben . . .

President-Elect Paul Halbersleben: I am greatly honored to be elected your President, and in the true line of procedure here, I will proceed to adjourn this meeting with no speaking. (Laughter and applause)

. . . The Meeting thereupon adjourned at eight-fifty p.m. . .

THE IMPORTANCE OF ELECTRICAL CONTROLS IN A MODERN COAL PREPARATION PLANT*

WILLIAM G. CARNEGIE, JR.
Chief Electrical Engineer
Roberts and Schaefer Company
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Semi-Automation

The importance of electrical controls in a modern coal preparation plant has increased greatly in the last ten to fifteen years. This has been caused by increase in size of plants due to handling larger tonnages per hour and to requirements for coal preparation.

With more and improved mechanization of mining methods coming each year to meet the increasing coal demands, your problems have multiplied also.

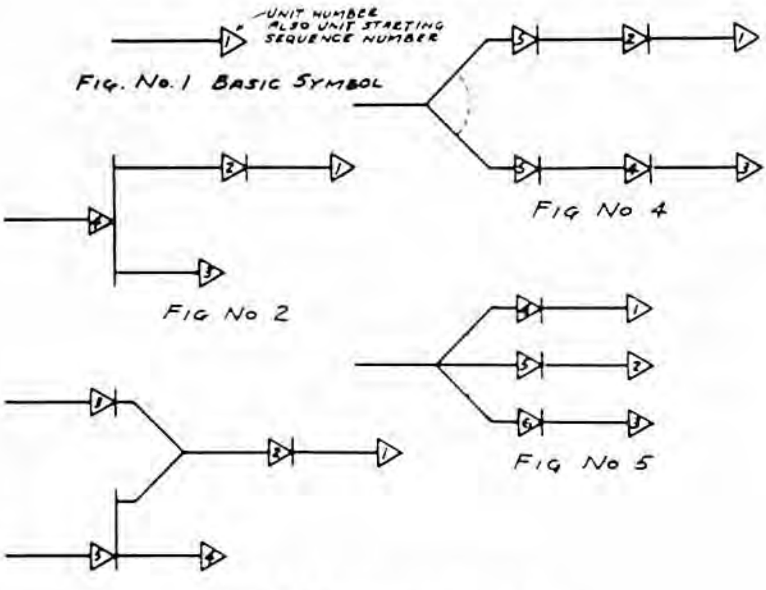
Another factor relating to the importance of electrical controls in a coal preparation plant is the trend to centralized operation of a process for handling materials. The term automation, which is heard more and more each passing year as the automatic factory nears reality, has a definite relation to the centralized operation of a process such as coal preparation. At this time, we cannot see how a coal preparation plant can become an automatic process. But who can deny that with further improvements in reliability of equipment and methods of control, some of the processes that need periodic attention by an operator, skilled technician, or a laborer, will be redesigned and make possible a semi-automatic preparation plant?

About eight years ago, Roberts and Schaefer Company designed and built a coal preparation plant that has a capacity of 200 tons per hour and was operated by four men. This plant contained mine car dumping facilities, crushing, jig, bird filter, heat dryer, loading on three tracks, and water clarification equipment. In addition, four more men were used to transport coal from the face of the mine by conveyors to mine cars outside and then to dump hopper at preparation plant. This is certainly an example of a semi-automatic plant.

Interlocking Systems

This evening, we wish to discuss with you how we at Roberts and Schaefer Company develop a

* Presented before the meeting of the Illinois Society of Coal Preparation Engineers at Benton, Illinois, October, 1956.



Slide No. 1. Interlocking Symbol.

control scheme for a modern preparation plant. We will start with an explanation of the system of symbols that we use to develop an interlocking diagram.

But before we get into this, there is an important source of information for the electrical engineer who designs the interlocking system, that is the flow sheet. This diagram which graphically tells what is to be accomplished in the preparation plant is the result of a knowledge and background of men of your profession.

In addition to the flow sheet, there are a few operating characteristics of the different pieces of equipment used in a preparation plant to be kept in mind. The first of these is a crusher. A crusher should never be interlocked to the conveyor receiving the crushed product. The receiving conveyor is interlocked to the unit feeding the crusher. If the crushed coal conveyor is stopped, the feeding unit stops and the crusher is allowed to clear itself.

It is not necessary to stop auxiliary units such as gland water pumps when the main interlocked system stops.

The fans used on a Roberts and Schaefer Company Super Airflow are left running if coal conveying units stop.

However, if any of the last two mentioned above stop, the feeding units will stop by interlock.

What are the reasons for interlocking? First, it establishes a definite starting order which must be followed. Secondly, it provides automatic shutdown of all units preceding one that has stopped, thereby preventing spillage of coal.

The first slide illustrates the basic symbol used in our interlocking diagram. The arrow represents a unit to be interlocked. In the arrowhead is a number which indicates the unit's place in the starting order. As you will note, later on, the starting sequence order starts at the discharge of clean coal or refuse from a preparation plant. The other figures on this slide are to illustrate simple interlocking and how the basic symbol is used.

Before going on to discussion of slides showing several flow sheets and their respective interlocking diagrams, we wish to point out some of the difficult interlocking conditions that have to be met.

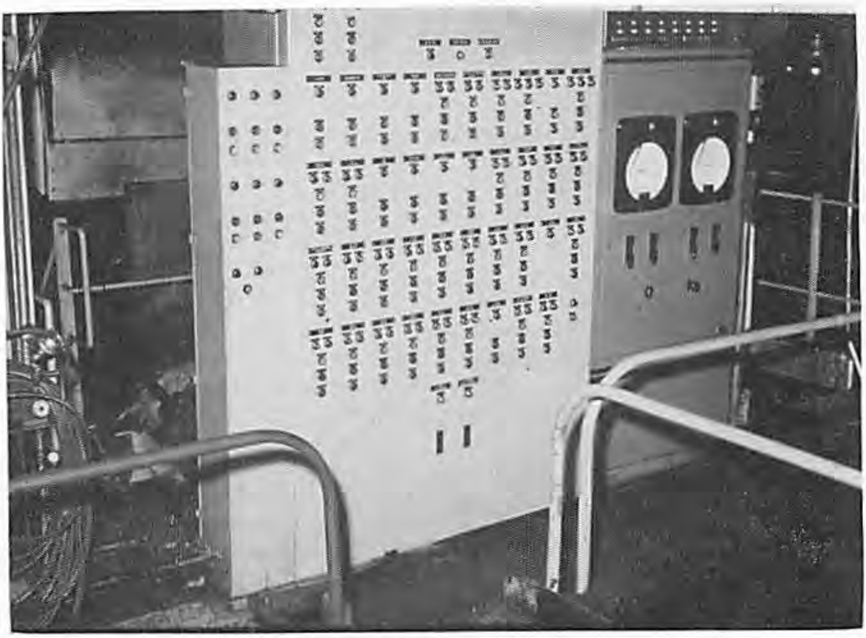
One of these is what we call a "circle interlock." By this is meant, a certain unit as indicated on the flow sheet should be started early in the starting sequence, but we find that part of its product is being fed to a unit near the end of the starting sequence. A flight conveyor that carries coal on both the top and bottom strand is an example of this.

As stated earlier, one of the main reasons for interlocking is to prevent coal spillage. So a close study must be made of the physical make-up of equipment to determine what can be done. Electrically we have a simple solution. That is to use a timer to by-pass the interlock on the later unit. This is fine for the initial start up, when no coal is in the circuit. Our problem is to find out where coal can be piled up for a short time and not cause any unnecessary spillage. Some surge capacity at such points would be helpful.

From my personal viewpoint, the less flight conveyors are used in this manner, the simpler the interlocking system can be made. However, we recognize that economics in plant design must be considered. It is to be noted that the day when one large motor is used to drive a line shaft with belting to run several machines is about gone, and this gives us hope that multi-purpose equipment will disappear.

A second problem in interlocking is what to do with loading boom conveyors. It is our opinion that the boom operator should be able to stop loading conveyors and plant quickly in time of emergency. This can be done by interlocking the units. There are pros and cons as to whether they should be interlocked. If backloading chutes are used we have no problem, the conveyors can be interlocked. When layer loading is done, it is necessary to stop loading conveyor between cars. We have solved this problem by the use of a multistage, four-position selector switch with pistol grip handle. The first position is called "by-pass" and is used when loading boom is not being operated while plant is running. The second is the stop position. The third is the starting and running position. The fourth position is called "momentary by-pass."

To start loading conveyor the operator turns selector switch to start and running position. When a momentary stop is to be made as between cars, the handle is moved to position four and must be held there or the switch will return, by means of a spring, to



Slide No. 2. Operator Panel.

position three. To stop for any reason, the selector switch is moved to position No. 2, which will stop all preceding interlocked units.

What is it that provides the major interlocking? It is the electric controls used for starting and stopping motors.

The controls for a motor are made up of a starter and pushbutton. The starter consists of three parts (1) a circuit breaker or fused switch, which provides a disconnect from the power source and motor short circuit protection, (2) a magnetic contractor which is an electrically operated switch, (3) an overload relay which senses when a motor is drawing more current than its rating, and therefore shuts down the motor.

Auxiliary contacts are provided on the magnetic contactor which closes or opens as required, when the starter is energized. These auxiliary contacts are used for the basic interlocking of motors.

The pushbutton operates the control circuit which energizes the electro-magnet in the contactor.

In order to have central control of the motors in a preparation plant, each motor must have a pushbutton located at a strategic point. These pushbuttons, grouped together, are known as the operator's panel.

The next slide shows one of the operator's panels in the preparation plant at the No. 4 Mine of the Freeman Coal Mining Co. near Pittsburg, Illinois. Each motor controlled from this panel has a start and stop pushbutton and a red indicating light, which indicates when power is on motor. In addition, each motor that is interlocked, has a selector switch and a green indicating light. This light is illuminated if the unit is operating in interlock.

The selector switch is used to take a unit out of interlock so that it can be run independently for maintenance purposes or perhaps, while plant is idling, it should be running.

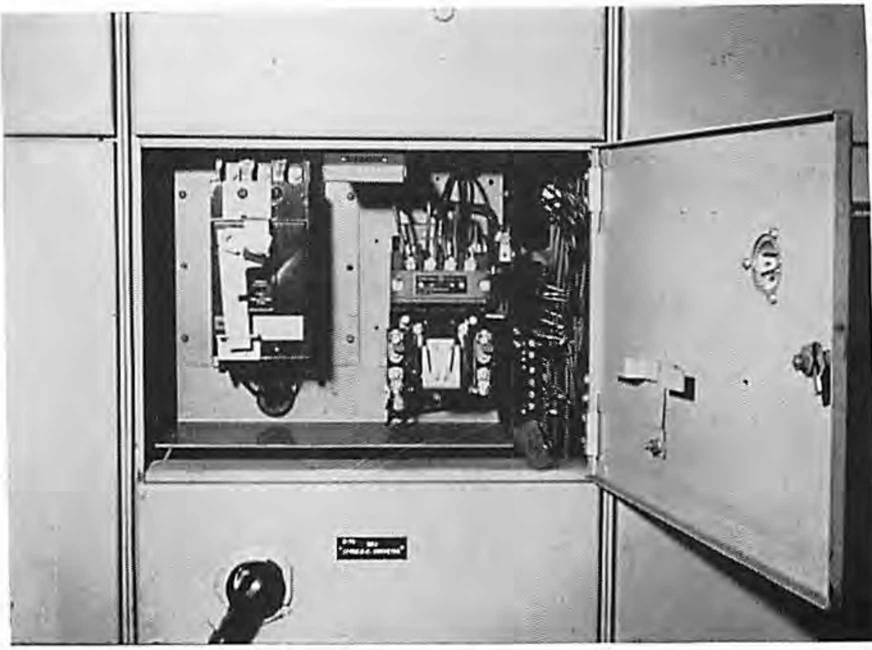
Sometimes multi-position selector switches are used to change the interlocking scheme if equipment in a preparation plant permits change in coal flow by shifting of gates, or as noted before, when one of several parallel units is shut down.

The pushbutton, selector switch and indicating lights for each unit are grouped together and arranged in starting order, starting at the upper left hand corner of the panel. Each of these groups has an engraved legend plate that contains the unit name and unit number.

Because of the wiring between motor starters to provide interlocking, grouping of the starters becomes an economic must. At one time, it was the practice to mount the starter in sight of the motor.

The electric control industry has provided a factory-assembled starter panel, known as a control center, which is adaptable to the most intricate interlocking systems. The next slide shows the control center

Slide No. 3. Control Center.



Slide No. 4 Starter Cell in Control Center.

in the No. 4 Mine of Freeman Coal Mining Co.

Panels such as these have factory-wired starter interlocks and are proving to be the least expensive in comparison with using individual starters racked and wired in the field.

When there are less than ten motors in a plant, individual starters can be used with some cost advantage, but not much.

The next slide shows the interior of one of the starter cells of the Freeman Mine No. 4 control center. Please note the three parts of a starter, circuit breaker, contactor and overload relay. Also the interlocking auxiliary contact.

Another advantage of a control center is that it reduces the amount of space required for controls. Starters for five 440-volt motors up to 25 H.P. or five 220-volt motors up to 15 H.P. are mounted in a cubicle that has a floor area of 20 x 20 inches and is 90 inches high. The control center for the Freeman Mine No. 4, which contains starters for 59 motors totaling 1003 H.P., measures 29 feet, 5 inches in length. It is located in a dust-tight room 15 x 33 feet and is accessible only to electrical maintenance personnel.

The National Electric Code requires that the controller must be provided at the motor. The code allows a pushbutton that has an attachment to open the control circuit and to lock it open, the pushbutton to be used if the controller is not in sight. We have used a remote jog-stop pushbutton with lockout provision on stop in the plants designed by Roberts and Schaefer Company. The jog is provided for the use of maintenance men so that a unit can be operated locally. The motor will run as long as the jog button is depressed. This button is wired so that the interlock of preceding units is ineffective, but does not permit taking away from the plant operator complete starting control.

A locking out attachment is provided on the stop button which can be padlocked and thereby conforms to the code.

Protection Interlocks

Interlocking is used also for protection of equipment. Some examples are lubrication systems on crushers and bird filters; control of fire in coal dryers; thermoguards in motor windings; bearing temperature detection relays; conveyor belt breakage and misalignment.

These protective interlocks range from a simple connection of oil pump motor to crusher motor so that oil pump starts with crusher motor, to a complicated system that will be described later for a bird filter. However, we would like to point out that the interlocking of the oil pump motor as noted above only assures that motor has been energized and if no oil flows due to lack of oil or pump failure no protection has been afforded crusher bearings. This can be accomplished by the insertion of no-flow relays in the tubing that carries oil. These relays have contacts that are inserted in the crusher motor circuit. When oil flow stops, these contacts open and shut down the motor.

The 54 x 70-inch bird filter is a good example of the extent protective devices have been used. This machine has an expensive planetary gear arrangement for rotating the internal helical screw. This gearing must be protected by proper lubrication and against overloading.

There are two separate lubrication systems on the machine, each with its own oil pump. One furnishes oil to the gear box, the other to the bearings that support the drive shaft. Each oil system has flow relays that shut down machine if the lubrication system fails.

Protection against overloading is provided by a torque-measuring device which operates as follows: A shear pin shaft extends from the center of the gear box to which a torque arm is attached. The end of the torque arm makes contact with a strain gauge. The strain gauge is connected by a shielded cable to a Foxboro instrument that records torque values on a circular chart.

The Foxboro instrument contains two pilot relays which are energized by a drum switch that rotates as the instrument receives torque signal. There are three operating points on the torque range of the instrument, (1) a no-load torque, when machine is operating with no coal feed; (2) coal-feed shut-off torque; and (3) main motor shut-off torque.

Operation of a bird filter is as follows: the filter is started and the torsional effect on the strain gauge raises the torque value to the no-load value. When the filter has reached its top speed, the coal feed (which has been delayed by a timing relay) starts, and the torque raises to normal value. If the filter starts to plug, the torque will increase and if it reaches the coal-feed shut-off valve, the Foxboro instrument relay will cut off the coal feed. If shutting off the coal feed alleviates the plugging condition, the torque value drops, and when it is lower than the feed shut-off point, will start the coal feed again.

If the plugging conditions do not clear up and the torque increases to the main motor shutdown torque, the instrument opens this motor control circuit and stops the motor.

The shear pin mentioned above will break if for some reason the motor is not stopped by the Foxboro instrument. The breaking of this shear pin releases a limit switch that shuts down the main motor.

The Foxboro instrument chart reading has another use. When the torque value is correlated with the ampere reading of the drive, the operator can tell whether the filter is handling the proper coal and water mixture.

Instruments, such as manufactured by Foxboro, Brown Instrument Division of Minneapolis-Honeywell, Bristol, are used on heat dryers for temperature control and fire protection. This field is extensive and could well be a topic for discussion alone. It is mentioned here, because heat drying equipment must be taken into consideration in the design of an interlocking system for a coal preparation plant.

Although temperature control of heat dryers is important, the coal feed to the dryer and fans used with the dryer must be shut down if a fire starts in the dryer. This condition is detected by a thermocouple mounted in the exhaust of the cyclone which, by means of an instrument or a relay, will shut off the exhaust fan when a certain temperature is reached. The coal feeding equipment will be stopped by the normal starter interlock described above.

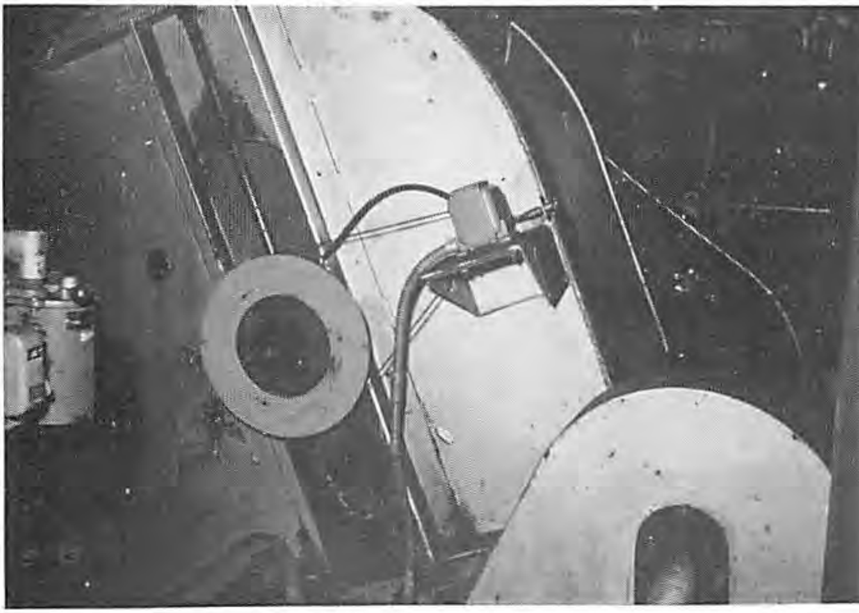
Other Interlocks

There are a number of other electric control devices used for interlocking which will be noted at this point.

Float switches are used to control and indicate liquid level. Where float switches have not proved reliable, electrode type can be used. This type consists of two electrodes of different lengths mounted in a tank or sump. When the liquid level immerses both electrodes, an electrical circuit is made and a pump can be started and will run until the level goes below the longest electrode.

A similar system is used by a pump manufacturer to provide positive pump bearing protection. Seal water must be in the bearing housing or the pump cannot be started or will stop if water supply fails. An electrode is installed in the bearing housing to detect this condition.

Surge bin level conditions are determined by paddle-operated switches, diaphram switches, or by a new development that has just been put on the market. This unit consists of a small torque motor that rotates a flexible shaft with four blades mounted at 90 degrees. When material in bin fills in around the blades the motor stalls and trips a switch.



Slide No. 5. Plugging Switch.

Plugging switches are used to stop units if a rotating shaft stops on an elevator for a jig. The next slide shows such an installation.

This switch has been used to shut down conveyors when belting brakes. It is attached to an idler pulley that is in contact with the belt at all times.

A pulley-driven centrifugal switch has been used for belt breakage protection. The switch is mounted so that pulley is in contact with belt. The longitudinal motion of conveyor rotates the pulley which in turn operates a governor by means of a spring type belt.

On the more expensive conveyor belts, such as used in slopes, additional protective devices are required. These are misalignment switches and discharge chute antiplug switches. If the belt shifts so that it rubs on conveyor frame and the pile of coal or rock in the discharge chute, the belting can be damaged.

In addition to electrical interlocks, audible and visual signals are used in coordinating plant operation. Many times, a warning signal given in advance can prevent a condition that will cause shut down of plant. An example of this would be coal dryers, in which build-up of temperature could lead to a fire.

In our dry cleaning plants we use lights to inform the operator of a low level of coal in the feeding surge bin. Also, when more than one super airflow is being used, the progressive full bin indications provided by "Bindicators" and lights can enable operator to take steps to prevent plant shutdown before the last surge bin becomes full.

Industrial television is a new device that will be used in the coming years to assist in centralizing operation of coal plants. At present it is quite costly. We remember your May, 1956, meeting in which a demonstration of this equipment was given.

In conclusion, it is our hope that this paper has shown the growing importance of the electrical controls in a modern coal preparation plant. This equipment makes up the nerve system of the plant which in the hands of a skilled operator will allow him to run a plant in an economical manner.

PILLARING WITH CONTINUOUS MINERS

IVEN A. GIVEN, Editor

Coal Age

New York City, New York

ABSTRACT

Open-ending growing as a method of extracting single pillars. Splitting and pocketing still widely used, however.

Support in pillaring predominately the old-reliable posts and crossbars, with bolting employed to a limited extent.

Individual panel development with one or two machines the most-common system. Plans with several machines on a common pillar line extending over several rooms or panels much in the minority.

Mining plans divided about half and half between (1) advance on one side and retreat on the other, and (2) full retreat. Bleeder entries or openings almost universally employed.

Ninety-degree work over three times more prevalent than angle work or a combination of angle and 90-deg.

Block plans far in the lead. "Flat" pillar lines the most common, especially in one- and two-machine panels.

Pillaring with continuous miners so far is not too different from pillaring with loading machines or, farther back, pillaring with hand mining. One reason, perhaps, is the fact that the transportation equipment still is not radically different from that employed in the past. As new transportation devices—the bridge conveyor and the extensible belt, for example—find wider use, there may be a more-radical change. Even then, however, it is quite likely that the basic room-and-pillar pattern will still be apparent, as it has been so far in plans devised for the newer conveyor units.

Section Planning: Panel Systems Preferred

In part because the tendency so far is to use one machine—and not over two at the most as a general rule—per section, the panel is the most popular section unit. The exceptions are not numerous though there are a few. One is the plan illustrated in Fig. 1, which pro-

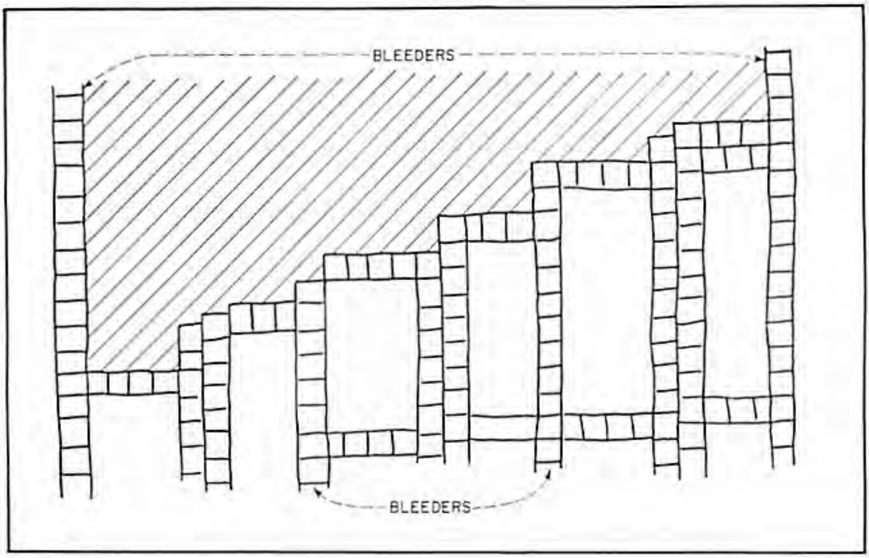


Fig. 1—Stepped pillar line extending over several entries permits several machines to be concentrated in a given working territory. Machines recover room and entry pillars and drive new rooms.

PLANS MAY BE DESIGNED FOR CONCENTRATION AND HIGH RECOVERY

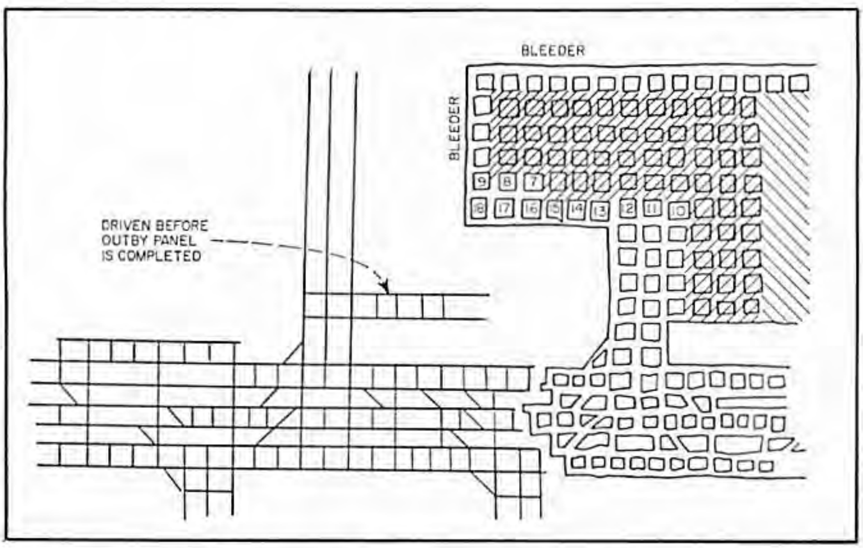


Fig.—2—Combination advance and retreat, as in this plan, is a widely used system of mining with continuous machines. This is designed for 85% to 90% recovery.

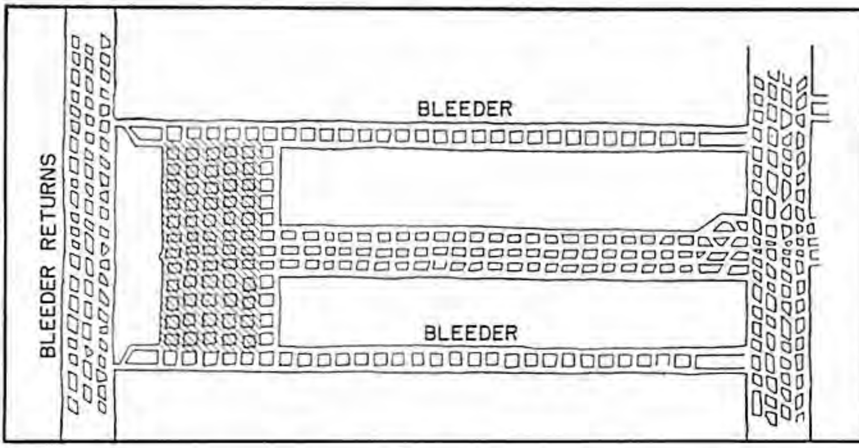


Fig. 3—Full-retreat system shown here provides for crisscross pillar extraction. Recovery of entry chain pillars are the final operation in retreat mining such as this.

vides for an extra degree of concentration in that there are several machines on one continuous pillar line—an average of one for every three blocks.

The ultimate in concentration so far proposed is up to 6 to 8 machines in a single panel consisting of several headings and working places turned to one side only. The basic plan is full retreat, with part of the machines recovering chain pillars, part recovering room pillars and part driving up new rooms to provide new pillaring places.

Ventilation and dust control became critical with such heavy concentrations, as does panel haulage and handling of supplies. This is in part because the entire mine production comes out of 12 to 15 places, which is nearly the ultimate in concentration. In this plan, even though work in the individual panels is full retreat, work over the mine is advance on one side to the boundary and retreat on the other, taking the main-entry barriers and chain pillars as the final operation in retreat.

Advance and retreat plans with one or two machines, usually one, vary considerably in detail though not in basic characteristics. Fig. 2 is an example of a recent plan designed for 85 to 90% recovery, using shuttle-car and belt haulage within the panel. One difference from the usual plan is the way mining is done on the retreat. One room is always open ahead of the one from which the pillars are being mined, and pillars are recovered from the headings out, working away from the gob section on the advance side. The machine is trammed back to the entry to start each new row of pillars. This keeps pillar mining going in one direction and thereby eliminates a V in the pillar line in the middle of the panel.

One form of full retreat with working places turned both ways is shown in Fig. 3. "Criss-cross" pillar extraction, as shown, is the

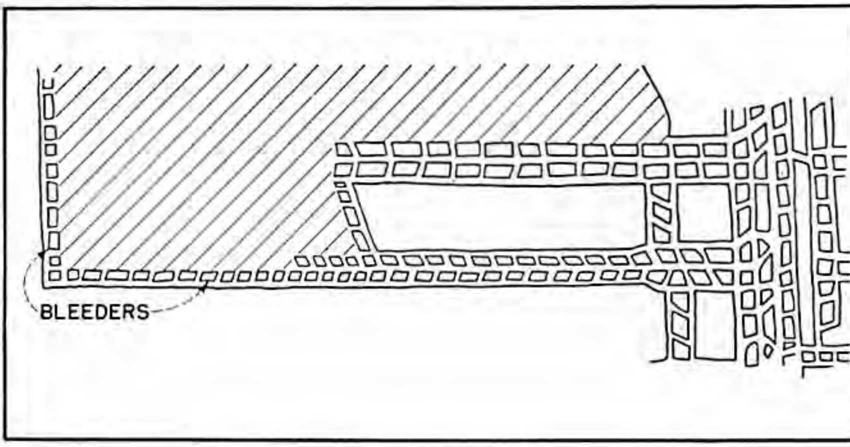


Fig. 4—Angle plans are employed at some mines, but are the exceptions rather than the rule. One aim in this system is to provide easier traveling for shuttle cars.

rule in this panel plan. No pressure or riding has been experienced, production is higher in the pillars, and excellent falls are obtained.

Panel plans providing for rooms on one side only are relatively infrequent in level coal. There are a few, however, mostly where rigid- or semi-rigid-head machines, which are less flexible in turning at 90 deg. are used. One, providing for full retreat, is shown in Fig. 4. One aim in angle work is easier travel for shuttle cars and easier turning of places with rigid- or semi-rigid-machines. Many operators, however, hold that even with such machines the advantages of angle projection are more than offset by those of the 90-deg system, leaving the latter in the preferred position. One advantage of 90-deg work is greater uniformity in pillar shape. A second is fewer complications in development and room-driving.

Alternatives providing part of the advantages of both the angle and 90-deg plans normally are based on driving entries and rooms on 90-deg, while crosscutting and pillaring in rooms on 45 to 60 deg. Figs. 6 and 13 are examples. Rigid-head machines are employed in both instances.

Practically all the plans illustrated include bleeder openings. Usually, as indicated, these are made by leaving in room or chain pillars, either permanently, as at the tops of panels (Fig. 2), or temporarily until recovering of the next panel starts, as in Fig. 4. Special bleeder entries may be provided between the regular production entries, as in Fig. 1, or between groups of panels, as in Fig. 3. These may be in addition to openings at the sides or tops of panels (Fig. 3).

Pillar Types: Blocks In The Majority

Coal mining in the past quarter century has been marked by a slow increase in the use of block systems.

The trend seems to have been accelerated by the advent of the continuous machine, which was accompanied by an increased need to get all the coal possible in view of rising costs.

Blocks can be diamond-shaped and also equal-sided. However, the tendency is to apply the term "block" to any pillar that is more nearly square than rectangular.

One of the plans studied in compiling this report of pillaring with continuous mining is based on 85 x 85-ft. blocks. The majority, however, run from approximately 60 x 60 to 70 x 70 ft. The smallest studied is 45 x 45 ft.

Establishing the size of the block, or the conventional rectangular pillar, involves, among other things, choosing between the risk of roof deterioration and other troubles in driving long pillar lifts, and the extra trouble and cost, if any, of establishing new lifts, including any extra timbering at the mouth of the lift and additional time in jockeying to get the lift started. If the plans developed to date are a reliable indication, the most desirable length of lift, in the absence of special conditions, is 60 to 70 ft.

Very thin pillars are provided for in some plans for both flat and pitching coal. One goal is fixing it so that the miner can reach through them with a minimum of timbering in addition to the regular room timbering and perhaps a crossbar or extra posts at the mouth of the lift.

Open-Ending: Basic Plans and Modifications

The speed with which a lift can be mined with continuous machines has been one of the factors contributing to the increase in open-ending of pillars. This eases the support problem enough so that opportunity can be taken of the other advantages of open-ending. One is that open-ending is, in many respects, much simpler not only in driving the lift but in ventilation and ease of maneuvering equipment.

Fig. 5 is a typical full open-end plan. Mines using it or modifications include the following:

1. Thick coal, 18 to 24 in. drawslate, 12 in. top coal left. Ripper-type machines used to recover old room pillars. Support in 12-ft. wide lifts provided by 5 x 6-in. crossbars on 5-ft. centers, with special 15-ft.-long bars at intersections.

2. Thin coal, 42 in., excellent top. Semi-rigid machines, 45 x 45-ft. blocks, support rarely required.

3. Thick coal, 7 ft. recovered, 1 ft. left against fair to bad top. Ripper-type machines, 80-ft. blocks, posts and crossbars.

4. Thick coal, soft gray shale top. Rigid-head machines, 52 x 52-ft. blocks, posts normally used for support in lifts.

5. Thin coal, 48 in. average, weak to fair top. Angle plan (Fig. 4) with rigid-head machines. Pillars 20 ft. through. Support by posts along gob edge of lift and at the face.

Modifications of the open-end plan include leaving pegs or small stumps of coal on the gob side at the start of the lift for extra support. Another variation is taking two or three lifts and then leaving a wing or fender, say 6 ft. through, to break the top and protect subsequent lifts.

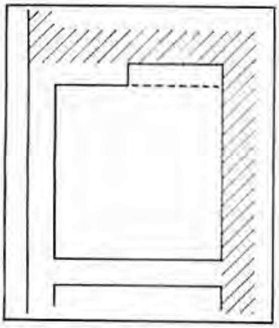


Fig. 5—Conventional open-ending for blocks and rectangles.

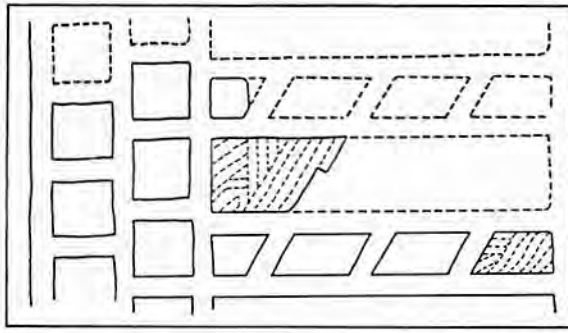


Fig. 6—Angle open-ending combined with 90-deg development. Solid pillars between pairs of rooms provide much of the tonnage.

OPEN-ENDING AND SPLITTING

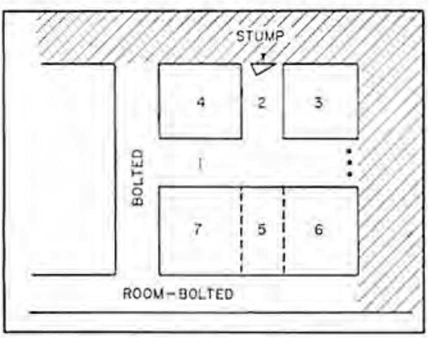


Fig. 7—Conventional splitting plan leaves big stumps on the corners for the final recovery operation.

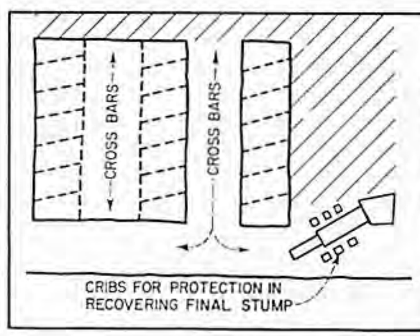


Fig. 8—Wings are open-ended in this splitting plan using cribs for final stump recovery.

A combination of solid and conventional room pillars characterizes another modification for rigid-head machines shown in Fig. 6. This plan also shows one method of combining 90-deg development with angle pillaring in rooms. The top is a medium-hard shale over which is laminated shale and coal. Rooms 16 ft. wide are driven on 50-ft. centers, leaving solid pillars 59 ft. thick on the gob side. These solid pillars are recovered by open-ending on 45 deg, using posts along the gob edge of the lift. Clumps of posts on close centers are interspaced with posts on regular centers as necessary. Room pillars then are extracted in the same manner. Room and pillar centers were arrived at after several trials, and provide maximum lift length commensurate with rate of roof deterioration and other factors, including cost of preparing for new lifts.

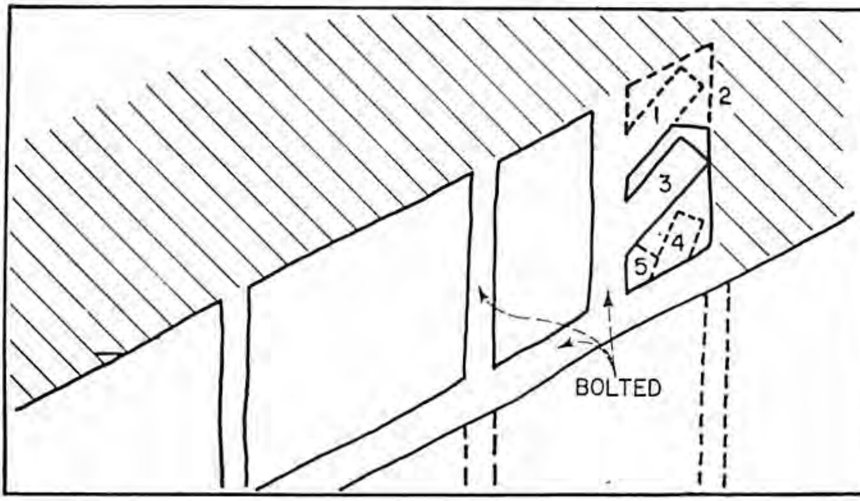


Fig. 9—Wings in this angle plan resulting in diamond-shaped pillars are mined by pocketing in five successive stages.

SPLITTING: USED WITH ALL TYPES OF MINERS

Splitting plans for continuous miners include the conventional one shown in Fig. 7. The coal is 8½ ft. thick and the top normally is a soft gray shale. Falls are fairly easy to get. Ripper-type machines drive places 14 ft. wide for 58 x 58-ft. pillars, which are mined in the sequence shown. Rooms and crosscuts are bolted. Props and small pegs or stumps are used for support in the pillar openings.

Modifications of the splitting plan include open-ending of the pillar halves at one mine (Fig. 8). Average coal thickness is 60 in. The top is 12 in. of drawslate and includes kettle-bottoms, slips and horsebacks. Semi-rigid machines drive rooms and crosscuts 17 ft. wide to form 56 x 53-ft. blocks, which are split lengthwise. The halves then are open-ended in lifts 9 ft. wide. Support in rooms and crosscuts is by crossbars held up by bolts. In pillar splits, the end of the bar next to gob-side half is held by a bolt, with the other end on a post. Thus interference is reduced and the posts act as breakers when the second half of the pillar is removed In taking the final lift in removing a pillar half, cribs are erected on both sides of the miner.

A splitting plan for diamond-shaped pillars and rigid-head machines is shown in Fig. 9. A similar plan also is used with square blocks and ripper or rigid-head machines at other mines. Rooms and crosscuts are driven to form 60 x 70-ft. pillars at the mine using the Fig. 9 plan. Coal thickness is 4 to 6 ft., with a firm shale top. Rooms and crosscuts are bolted, but fast extraction permits completing the 9½-ft. wide lifts in the two pillar halves with posts only.

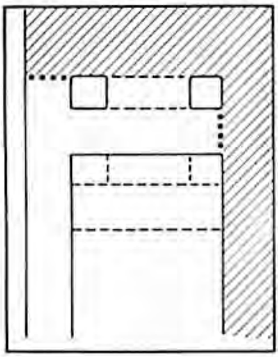


Fig. 10—Pocket - and - wing plan of the conventional type.

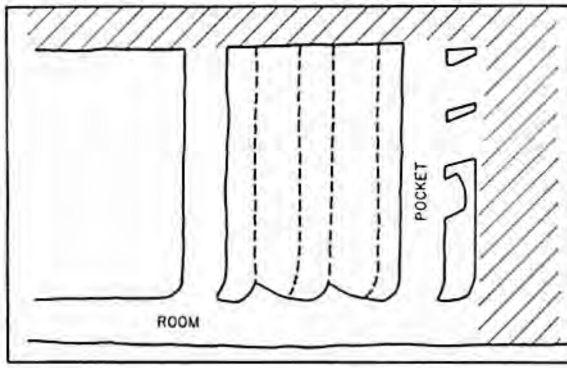


Fig. 11—Wings in this pocket plan are mined by subsidiary pockets leaving small stumps for protection in final extraction.

RECOVERY BY POCKETING

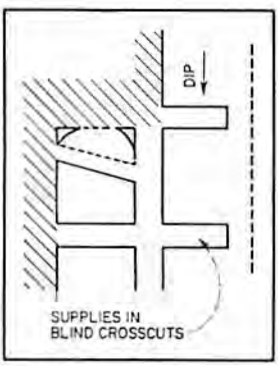


Fig. 12—Pitch plan employs pocket driven on slant.

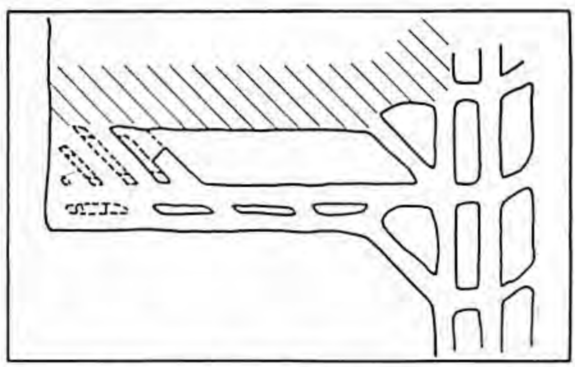


Fig. 13—Angle pockets with thin fenders distinguish this plan with basic development on 90 deg with rigid-head equipment.

Pocketing: Versatile System For All Units

Pocketing differs from splitting mainly in the thickness of the coal strip left against the gob, whether the strip be called a fender, a wing or by some other name. Some use the term fender when the pillar is thin—under, say, 3 ft. in thickness. Wings, under this system of terminology, therefore are pillars thicker than 3 ft.

What might be called the conventional pocket-and-wing system is shown in Fig. 10. It may be used with either rectangular pillars, as in Fig. 10, or with blocks. Fig. 11 shows a block plan. Block size is 85 x 85-ft., formed by driving places 15 ft. wide with ripper-type miners. Pockets are driven 15 ft. wide leaving wings 10 ft. thick, which are cut through at intervals to leave small stumps. The roof where this plan is employed is top coal and drawslate, with major support by roof-bolts installed by bolting units on the miners. Once a major break line is established, falls come regularly every 2 or 3 lifts.

Where stumps are left, their size depends on whether it is intended to take them out with the miner, in which case they can be fairly large, or whether it is intended that they crush, meaning that they would be fairly small. Since drilling equipment would normally have to be provided specially on continuous-miner sections, shooting of stumps is a relatively infrequent system, although done in some instances.

Mining pillars on pitches with ripper-type continuous machines has produced pocketing plans very similar to those employed in flat coal. Fig. 12 is an example. Coal pitch is 17 deg. maximum. Rooms are 18 ft. wide on 45-ft. centers. To recover the pillars a slanting chute, or pocket, is driven across the top end, with crossbars at the mouth to protect the operator while the machine reaches through. The machine then cuts through the wing in semicircular fashion. If possible, the stumps then are taken. If not, they are shot to insure the necessary roof break.

Pocket-and-fender plans include the one for rigid-head machines in thick coal and fair to good roof shown in Fig. 13. It will be noted that while entries and rooms are on 90 deg, final pillar recovery in rooms is on an angle. Rooms also are driven in pairs, with thin pillars between the individual rooms and thick pillars between pairs of rooms. These thick pillars are mined by driving successive pockets across the ends, leaving fenders 4 to 5 ft. thick. The final operation consists of mining out the centers of the fenders as the machine pulls back out of the pockets.

Special Plans: New-Unit Characteristics Utilized

There are three major reasons for the introduction and growth of the room-and-pillar plan in coal mining in the United States:

1. Room-and-pillar is simple and has been proved under a wide variety of conditions over many years.

2. Room-and-pillar is flexible. In one form or another it is used in thick coal and thin, flat coal and pitching, and with all types of roof.

3. Cover thickness seldom is over 1,000 ft. and usually is less than 500 ft. When the depth of cover averages more than approximately 1,500 ft., experience abroad shows that room-and-pillar is chancey at best and frequently cannot be used at all. This results from the fact that sufficient driving to make pillar mining possible removes so much coal that the remainder, even with reasonable timbering, cannot support the weight. Therefore, replacement of the coal by sufficient artificial support to retard, control and limit subsidence is necessary. Consequently, longwall with packwalls is most practical.

Coupled with the fact that the tendency is to design equipment for room-and-pillar aplication, it is not surprising to find that even the newest plans usually are based on some modification of the system. The major exception is longwalling with coal planers, which is pick-

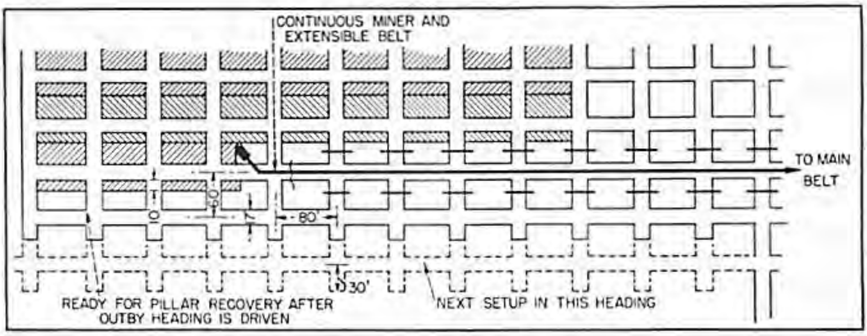


Fig. 14—Special modification of basic room-and-pillar plan is employed to take advantage of extensible-belt characteristics. Places are 1000-ft. deep.

ing up new recruits from time to time, particularly in the thinner seams.

One room-and-pillar modification designed to make use of the special characteristics of the extensible belt is shown in Fig. 14. Rooms in this plan become "headings" 1,000 ft. deep. As originally set up, the plan calls for extracting pillars on the right of the place completely, and for taking a 10-ft. cut off the pillars to the left. In this process, the miner alternates from side to side as it retreats out of the heading. After the pillars are recovered from one setup, the miner leapfrogs the next heading (previously driven to its limit), and drives a new heading 1,000 ft. to the limit of the extensible belt.

The next step is tramming the head and tail sections of the belt, as well as the miner, back to the previous heading. The intermediate sections and belt are left in place in the newest heading for use when the pillars are recovered in that particular opening. Therefore, only a minimum of time is needed to put the belt back into operation when the miner and end sections are trammed back.

Top Benching—Coal over, say, 9 to 10 ft. in thickness, has always presented a problem in pillaring, whether loading was done by hand, by loading machine, or by continuous miner. All the earlier systems, involving driving rooms and crosscuts on the bottom and then working up resulted in trouble and loss of coal, not to mention the extra hazard to personnel.

With the advent of roof-bolting, top-benching with both loaders and continuous miners has become increasingly the practice in thick coal. Development is the same as in the past, except that it is done next to the roof instead of along the bottom. This permits securing the roof by bolts and eliminates the need for long posts and heavy collars, which normally are inadequate for the job. After the rooms and crosscuts are driven in the top, the bottom coal is removed by ramping down in the rooms and also in the open-end or split places in the pillars.

OVERBURDEN PREPARATION TODAY

IVEN A. GIVEN, Editor

Coal Age

New York City, New York

What today's drilling units, drilling patterns and breaking mediums are, how they meet today's conditions, including heavier burden, and what they provide in stripping results.

The three major steps the coal-stripping industry has taken to reduce the cost of overburden preparation are:

1. Higher-capacity drills able to make much larger holes than in the past.

2. Lower-cost breaking mediums giving as good or, frequently, better fragmentation.

3. Better distribution of the breaking mediums to put the force where it will accomplish the most.

Drills: Up to 12-in. Holes, Over 250 FPH

Drilling in the coal-stripping industry has almost but not quite completed the circle. Around 25 years ago, the majority was handled by the old, slow, churn-type machine. Then, the sidewall unit, developed under the direction of the late R. H. Sherwood, moved in. Because of its ease of handling and greater drilling speed, it pushed the churn drill nearly out of the picture. But as overburden thickened and the breaking problem became more complicated, the vertical unit came back in the form of a rotary machine. As a result, the stripping industry now has a variety of machines to meet practically any conditions.

1. *Sidewall*—As originally designed, the sidewall machine was an augering unit with a molefoot-type bit. This design of bit, even though range and speed have been increased by alloys and tungsten-carbide, still is limited to penetrating relatively soft material, such as shale. Otherwise the drilling rate drops and bit wear increases.

There still is a lot of good sidewall drilling left and designers are moving to improve the machines to meet, among other things, the need for much-larger holes and higher speeds, cutting labor cost and, possibly, reducing the number of holes while making possible more-effective use of the explosive. Conventional units already are putting in holes up to 8 in. New types include a rotary for use in hard rock close to the coal. One such unit bores a 7¾-in. or larger hole and has a thrust of 40,000 lbs. on the bit.

Special designs that have or are being used include the two-story unit for thick burden where there is a hard layer high up. Another self-propelled unit includes special facilities for adjusting drilling height within a range of several feet to compensate for changes in the thickness and position of the drilling stratum over the seam.

2. *Vertical*—The rebirth of the vertical drill reflects, as previously noted, increased thickness of overburden. This brought in, among other things, the problem of getting the explosive closer to the material to be broken, especially hard layers high in the bank. Ability to drill holes 12 in. or larger in diameter at greatly increased speeds is another major asset. In the realm of speed, a report received at the time this article was being prepared on one new unit just put into the field showed that one operator, in a test run, put down 24 holes, aggregating 855 ft., in 3 hrs. 36 min., or approximately 328 fph. Maximum hole size for this machine is 9 in. With another earlier machine at another property, a three-man crew has been able to drill 1,000 ft. of hole and shoot 30,000 cu. yds. of material in a single shift.

Big-drill advantages also include an opportunity to use less-dense, lower-cost blasting mediums; clean, smooth holes; and excellent stem-

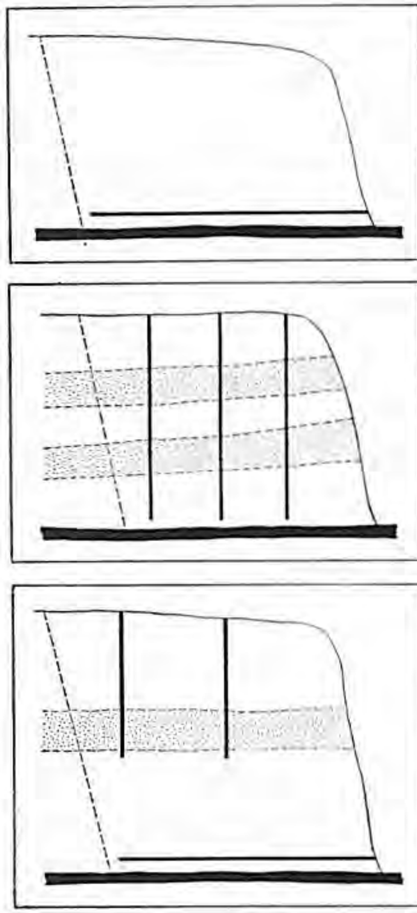


Fig. 1. Top—Horizontal drilling, normally for thinner cover with a minimum of hard material, especially up in the bank. Low in cost where conditions permit use.

Middle—Vertical drilling, preferred for deeper banks, especially where there is considerable hard material toward the top. Permits deck-loading. New drills provide high drilling speeds and big holes for higher concentrations of breaking effort.

Bottom—Combination patterns, normally employed in thicker-than-average cover and to meet special conditions. Patterns vary considerably. More frequently, vertical drilling may be employed in one part of the pit and horizontal in the other.

ming from the dry drill cuttings.

The success of the super drill has led to a number of advances other than in drill design itself. One is mounting drills with laydown masts on tractor chassis for greater flexibility and more speed in moving from hole to hole and place to place. Another is the development of lighter, smaller, more-mobile and less-expensive units for the smaller operator. Mountings include both trucks and crawler, with the truck widely employed. Drilling speeds are the same, though hole size has not yet reached the tops registered by the super units.

Gadgets and gimmicks designed to improve results with the vertical drill include extra-tall masts to permit drilling the entire hole depth without stopping; auger-type stems to help in the job of bringing the cuttings to the surface; and the use of augers to penetrate clay or soil which tends to squeeze and close holes, following with the regular rotary tool. An extra tool change is involved but overall hole time is reduced and there is less wear and tear on the rotary bit.

Vertical augers are another form of vertical drilling unit and have been improved to the point where they can drill a 9- or 10-in. hole in coarse-grained sandstone up to 100 ft. or more in depth.

3. *Specialized Units*—In the realm of overburden preparation, the specialized unit normally is a wagon drill or a tractor-mounted jumbo. The normal service is drilling a thin layer of hard rock over the coal where the major part of the overburden can be dug without blasting, or drilling a heavy parting or interval between two seams. Twin-unit jumbos mounted on tractors are a popular version.

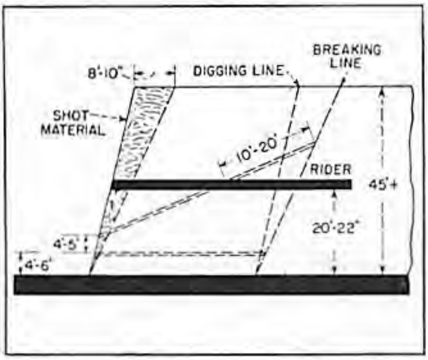
Sidewall Patterns: Over The Coal or Horizontal and Angle

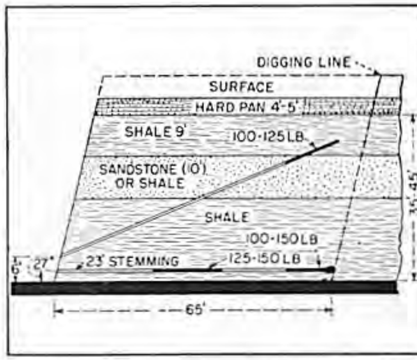
One coal-stripping operation recently featured in *Coal Age* (June, 1956, p. 60) provides examples of both single and over-and-under or horizontal-and-angle sidewall drilling. In one pit, where the cover is 65 ft. deep and consists primarily of shale, 6-in. horizontal holes on 18-ft. centers are drilled 2 to 3½ ft. above the coal. Even though the cover is thicker than that normally considered within the range of the horizontal drill, the fact that it is primarily shale permits good breaking.

Balancing charge and burden provides some problems in horizontal drilling, as well as in other types. Attempts to break hard layers high in the bank by closer hole spacing can result in shearing between holes, while increasing the charge also increases the possibility of blowing up through the burden or out to the front.

At another pit of the previous company, where sandstone is encountered, a closer approach to the desired explosive distribution is achieved by a combination of horizontal and upward-angle holes. Horizontal holes are drilled on 18-ft. centers, but only 45 ft. deep. Angle holes to break up the sandstone are staggered with the horizontals. The company, however, plans the purchase of a super vertical rotary for use where the sandstone is high in the bank.

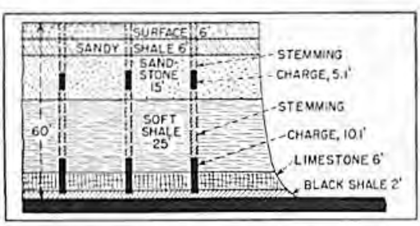
Decreased pit width, as in the previous example, may be necessary with horizontal-angle patterns





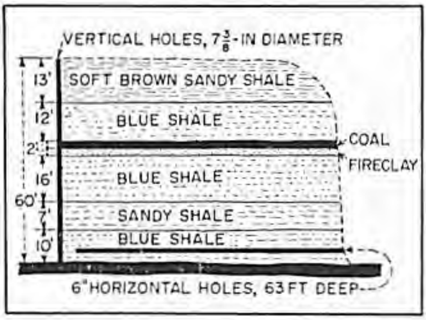
Horizontal and angle plans for sidewall machines include the two shown above. The objective of the upward-angling hole normally is to put part of the explosive up toward the top of a high bank or in a hard layer.

for either or both of two reasons (1) to keep the length of the angle hole within reasonable limits, and (2) to get the upper charge forward for better breaking of the front of the bank. Splitting charges can be easily done in the horizontal holes, but is less effective or efficient in holes that angle upward.

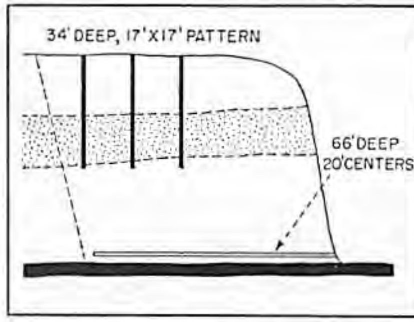


Deck loading to get part of the breaking force up into hard layers high in the bank is one of the major reasons for vertical drilling in thick overburden.

Placing explosives and stemming requires more time and labor with sidewall drilling. Even so, there have been few attempts to develop power tamping equipment. One of the few machines designed a few years ago used a system of quick-reversing rollers with friction grips to operate the tamping bar for placing explosive containers and stemming bags.



Full-depth holes at the back of the cut, supplement horizontal holes in this combination plan.



Short vertical holes to a hard band up in the bank supplement horizontal holes in 70 ft. of cover.

Vertical Patterns: Deck Loading or Bottom Placement

Basic patterns for vertical drilling have not changed greatly even though the vertical unit of today is radically different from that of years ago. Vertical drilling, incidentally, in contrast to horizontal, permits, if desired, establishing a buffer zone of a cut or more between the area being shot and the stripping front. Since the horizontal machine must always work in the pit, its operation must be synchronized with the progress of the stripper. Thus, a buffer zone is impracticable, though the drill may be able to work behind the excavator. However, shooting must be done against the open pit face, with consequent increase in the possibility of caves and slides where the material tends to be unstable.

The mobile drills, truck or crawler-mounted, are producing some modifications in technique, particularly in hillside stripping areas. At one property (*Coal Age*, August, 1956, p. 88) the first step is to bulldoze a road at the back of the new cut to accommodate the drill. Holes on 15-ft. centers are put down to depths that will yield a 50-ft. bench. When shot, the material is pushed over the bank and the bench is levelled off. Then three rows of holes 12 ft. apart in rows 15 ft. apart are drilled starting 5 ft. from the edge of the bank. The main bed in the overburden is 30 ft. of sandstone underlaid by 18 to 25 ft. of shale over one of the three coal beds recovered.

With a 115-ft.wide cut at another property (*Coal Age*, September, 1956, p. 64) three drill roads are cut by the bulldozer. Holes are put down on 20-ft. centers along the two lower roads, and on 14- to 20-ft. centers along the upper road. These latter holes are 55 to 60 ft. deep. The upper and middle-bench holes are decked with the charges in two zones—bottom and somewhat over half up, while the holes in the bottom section are bottom-loaded. The bottom bench is shot first, followed by the middle and top benches. Delays of 9 MS are used between rows.

A dragline operation using a mobile drilling machine bulldozes most of the softer top stratum (up to 20 ft. thick) on top of 25 ft. of hard material into the pit before drilling. However, a skin of soft material is left for easier starting of the vertical holes and as a blanket to reduce flying material (*Coal Age*, April, 1956, p. 82). The first row of holes is started 20 ft. from the edge of the bank, with 18- and 17-ft. spacing for the subsequent rows to compensate for harder material.

Freedom to deck load is, as noted, a major reason for vertical drilling. There are numerous variations on the basic plan. One, with the upper charges placed to break a layer of sandstone, is shown in an accompanying diagram.

Exact placement of the charges, particularly the upper, as well as variations to meet changes in thickness and location of the critical layers, has led to thorough logging of the holes at some properties, including the use of an automatic electric depth indicator. Drill-pressure indicators also show changes in the hardness of the strata and thus provide additional data for judging placement and quantity of charges.

Combination Patterns: Answers To Special Problems

Overburden at one operation using a combination of vertical and horizontal holes (*Coal Age*, March, 1956, p. 82) consisted of 10 ft. of shale over the coal, 8 ft. of lime, 6 ft. of weathered sandstone, rider coal, 4 to 8 ft. of sandstone (not always present), and shale to the surface. A bulldozer prepared a road at the back of the cut for a mobile drilling unit putting down 6-in. holes on 15-ft. centers (deck-loaded with 350 lbs.). Horizontal holes, 8 in., 66 ft. deep, were drilled on 18-ft. centers and loaded with 350 to 500 lbs. of 40% dynamite. Charges were set off with detonating fuse, with MS delays between vertical and horizontal rows, horizontal first. One objective of the plan was a smooth highwall for final augering.

Another plan for banks of approximately 60 ft. or more is shown in an accompanying diagram. The 7⅜-in. vertical holes are drilled on 15-ft. centers. The vertical holes bottom 12 ft. back from the ends of the 6-in. horizontals, which are staggered with the verticals and drilled 63 ft. deep. Hole loading is 0.4 lb. of Akremite per cu. yd., or 1,620 lbs per hole.

Short vertical holes are used at some mines to break hard layers high in the banks. The plan at one operation with 70 ft. of cover is shown in an accompanying diagram. Three rows of vertical holes 34 ft. deep are drilled on 17-ft. centers. Horizontal holes on 20-ft. centers immediately above the coal complete the pattern. A 70-ft. wide cut requires three rows of vertical holes and 66-ft.-deep horizontal holes.

Another mine has employed two rows of holes near the back of the cut to break a limestone layer about halfway up the bank. With the limestone broken the horizontal holes have an opportunity to heave the overburden their full length. Cover depth is less than 50 ft., with the bottom 20 ft. shale followed by the lime (3 ft.) and surface material. Under such circumstances, attempts to break up the hard band by heavier loading of the bottom holes can result in the charge blowing up through the overburden and losing much of its effectiveness.

Breaking: New Mediums Cut Overall Cost

The standard fixed explosives originally employed in breaking overburden still are used to some extent. Their cost, greater sensitivity and fast release of energy—too fast for many types of burden—have led to the development of less-dense, slower-acting and lower-cost blasting agents, and finally to the non-cap-sensitive mediums of today, which require a separate primer to set them off—Akremite as an example.

Some of the reasons, including less hazard and a less-sharp, more satisfactory rate of detonation, were responsible for the introduction of liquid oxygen in the 20's and for its continued use to the present time. Thus, the stripper has a wide choice of mediums and can, in effect, tailor-make his charges to the exact type and burden of material.

The detonating fuse and the MS delay have made considerable strides in blasting in the coal stripping in recent years. One reason is greater public sensitivity to blasting noise and vibration, in part reflecting the use of larger charges to break the heavier burden. Delays may be used between rows or between individual holes as well as between rows, depending upon conditions. In many instances these delays have reduced vibration to as low as 25% of the usual shot.

Other advantages of detonating fuse and MS delays include up to 15% faster detonation of the explosives with a reduction in requirements; as good fragmentation if not better; and less likelihood of an accidental explosion when digging into misfires as a result of the elimination of caps.

The characteristics of the rock and the drilling and stripping equipment control the type and quantity of the breaking medium and there no hard-and-fast rules can be laid down. In general, a dragline will require breaking the rock finer than for a shovel, and the larger the stripping unit the larger the size of the material it can handle.

THE STRATEGIC POSITION OF IRON ORE IN THE ECONOMY OF THE ATLANTIC BASIN NATIONS*†

WALTER H. VOSKUIL‡

ABSTRACT

Supplies of iron from domestic ores or from neighboring countries are no longer adequate to meet the needs of the industrial nations in North America and western Europe. Supplementary supplies must be obtained from more distant sources that usually involve ocean transportation. Numerous iron ore deposits are available and are being exploited in Latin America, North America, Africa, and northern Europe, as sources of the supplementary requirements of the iron ore consuming industrial nations on both sides of the North Atlantic basin.

Among the several iron ore deposits, four, and possibly five, have ore of high iron content in adequate quantities to justify expenditures on ore-handling and shipping equipment for large scale operation. The use of large vessels to effect economy in the ocean transportation of ore helps make it commercially feasible to use these distant ore bodies at Wabana, Labrador, Cerro Bolivar and El Pao, Minas Geraes, and Kiruna and Gallivare in Sweden. Conakry in Africa may also prove to be of some major significance.

The high-phosphorus ores of Sweden are of particular significance to western European iron manufacturers where the basic bessemer process is important. The economic usefulness of the unusually high-grade ore deposits of Brazil is vitiated by the high inland transportation costs and the long ocean haul to European and United States' markets.

NORTH ATLANTIC NATIONS

The North Atlantic Ocean is the world's busiest and most important main street. On each side of this main street are industrial nations which together produce 70 percent of the world's basic industrial raw material—pig iron.

For purposes of this discussion

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these nations comprise United States and Canada, the United Kingdom, and the European Coal and Steel Community.

The industries of the North Atlantic Basin nations were founded and built, in the main, on domestic supplies of ore, or ores obtained from nearby neighbors. These domestic supplies of ore are now being supplemented, in increasing amounts, from sources in Latin America and Africa. This is partly a matter of necessity and partly a matter of economics.

The nations in question are highly industrialized, they have each developed a certain degree of specialization in manufacture, and have come to depend upon one another economically. They interchange food products, textile raw materials, ores, fuels, manufactured goods, and transportation services.

The economic pattern that these nations have developed can be sustained and expanded only so long as they can get ample supplies of iron.

This need for iron ore has brought about an increasingly important economic role in the Atlantic Basin economy for the continents of South America and Africa from whom the additional iron ore must come. To their long-time role of supplying industrial raw materials—copper, oil, nitrates, bauxite, iron ore—to the industrial north, is the added possibility of industrial development based on their own vast deposits of iron ore. If this happens, it is almost a certainty that these nations will depend upon North America or Europe for coking coals as well as for industrial machinery and equipment.

With this brief sketch, we propose to examine the iron ore supply and requirements of the Atlantic Basin nations from the broad scope of the entire area instead of from any one nation's point of view.

Iron Ore Supplies of the Atlantic Basin Nations

Because domestic ores are and will remain the principal source

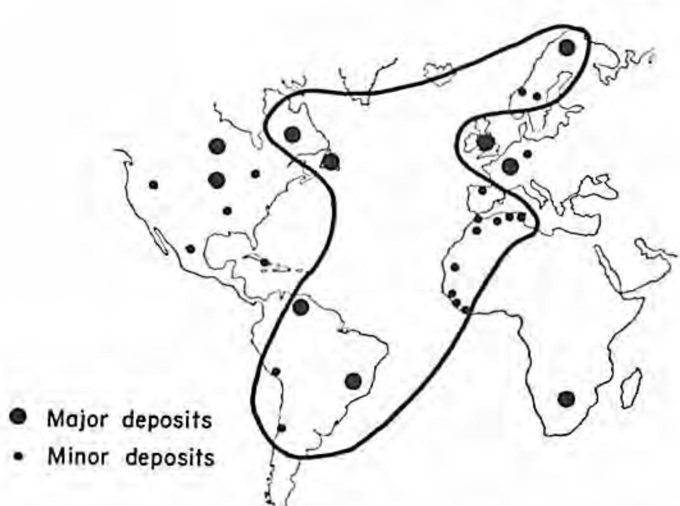

Fig. 1 — Iron ores in the Atlantic Basin entering international trade

TABLE 1

RESERVES OF IRON, AS METAL,[1] IN PRINCIPAL SUPPLYING DISTRICTS

Region or district		Millions of tons
Labrador-Quebec, Newfoundland		2,200
Sweden	1,513	2,115
Spain	511	
Norway	91	
North Africa		212
Brazil	7,500	9,045
Venezuela	1,430	
Chile	115	
West Africa, estimated		600

[1] Source: United Nations Survey of World Iron Ore Resources, Chap. 2, pp. 19-39, 1955.

of iron for the North Atlantic industrial nations, even though supplemented by imported ores, it is convenient to differentiate three groups of ores: 1) ores dominantly for North American industry; 2) ores dominantly for West European industry; 3) ores available for the North Atlantic international market. In figure 1 this third group of ores is shown within the enclosed line.

Within the area of ores that supply the international market, are the subgroups: 1) the Canadian deposits of Labrador-Quebec and the Wabana deposits in Newfoundland supply ore to both western Europe and the United States; 2) the deposits in Sweden, Norway, and Spain supply the European Coal and Steel Community countries and the United Kingdom, in addition to which Sweden also supplies the United States; 3) the third group includes the African and South American ores which export a high proportion of their output both to western Europe and North America.

The estimated reserves of iron in these groups of deposits, expressed in terms of the metal, are summarized in table 1.

The iron supply of the United States, as of 1955, is given in table 2. In that year nearly 21 percent of our total metal was received from foreign sources. We depended principally for imported ore on Canada and Venezuela which together supplied about three-fourths of the imported metal. Imports from other sources were in part based upon special grades of ore or corporate connection on the part of steel mills.

The source of Europe's new iron supply is given in table 3. The United Kingdom and the European Coal and Steel Community nations (Belgium, France, Western Germany, Italy, Luxembourg, and the Netherlands) together obtain about two-thirds of their iron supply from domestic sources. The principal outside source is Sweden. Contributions from several African sources are 10 percent and shipments from Brazil are negligible.

The United Kingdom is dependent upon imported iron to a greater degree than either the United States or the nations of the European Coal and Steel Community. In fact, more than half of United Kingdom new iron supplies come from abroad. This is shown in table 4, "Source of Iron for the United Kingdom, 1954."

Two sources of imported ore, Sweden and French North Africa, contribute 70 percent of foreign imports.

Summary of Post World War Ore Movements

The importance of ores by industrial nations is assuming significant proportions and will apparently continue in the future. The largest imports are of high grade ore. Fifty-four percent of ore imported by the United States is 60 percent grade or higher. Likewise, 77 percent of ECSC's iron ore imports are of 60 percent grade or better and 66 percent of the United Kingdom's imports. In the important intercontinental movements of ores, only the rich ores can bear the heavy cost of long distance transport.

TABLE 2
IRON SUPPLY OF THE UNITED STATES IN 1955, IN GROSS TONS

	Ores (thousands)	Percent iron content	Approx. content iron
Domestic iron ore shipments	107,388	49.5	53,157,060
Canada	10,072	54.5	5,489,289
Venezuela	7,120	64.0	4,556,941
Peru	1,554	56.0	870,296
Sweden	1,221	60.0	732,800
Chile	1,058	63.5	672,400
Brazil	1,010	68.0	686,887
Liberia	927	68.0	631,031
Mexico	176	68.0	119,879
British W. Africa	137	60.0	82,619
Dominican Republic	101	65.0	66,257
Cuba	40	40.0	16,078
Algeria	20	52.0	10,532
United Kingdom	2	30.0	623
Total			67,092,692
Percent imported			20.8%

TABLE 3
EUROPE'S SOURCE OF IRON, 1951[1]
(thousands of metric tons)

	Ore production	Percent iron in ore	Produced or imported as iron	Per-cent
ECSC				
United Kingdom	15,014	30.0	4,504	
Belgium	79	27.9	22	
France	35,201	33.5	11,792	
West Germany	12,923	27.0	3,489	
Luxembourg	5,625	27.9	1,569	
Netherlands, Saar		33.5		
Total			21,376	65.0
Iron shipped in				
Sweden	12,404	60.0	7,442	22.6
Spain	1,489	44.5	663	
Yugoslavia	281	50.0	141	
Total			8,246	25.0
Brazil	132	68.0	90	0.2
Algeria	2,387	52.0	1,241	
French Morocco	545	45.0	245	
Sierra Leone	1,169	60.0	701	
Spanish Morocco	959	66.5	638	
Tunisia	771	53.5	413	
Total			3,238	9.8
Grand Total			32,950	

[1] Bureau of Mines, Mineral Yearbook, 1953, reprint on "Iron Ore," p. 22.

Ocean distances in nautical miles from principal sources to principal consumers are about as follows:

To the United States from
- Brazil 4,900
- Chile 4,600
- North/West Africa 4,000
- Sweden 4,000
- Venezuela 2,180

To Europe from
- Brazil 6,270
- Newfoundland 2,500
- North Africa 1,990
- Scandinavia 1,250
- Sierra Leone 3,420
- Spain 930
- Venezuela 3,650

With distances ranging from 2,000 to more than 6,000 miles, transportation costs become critical. To effect economies in transportation, barge ore carriers of 31,000 tons DWT are being built for trans-Atlantic and coastal service. In 1956, a combined ore and oil carrier was put in service with a capacity of more than 50,000 tons of either iron ore or petroleum. In the matter of transportation costs, it is obvious that ore deposits on or near tidewater have a distinct advantage over deposits in interior locations.

Although 14 countries and 19 mining districts in the Atlantic Basin contribute to the ore needs of the industrial nations in North America and western Europe, five major ore bodies, because of the large size of the deposits and high grade of ore, are of significance in future long-time ore calculations. These are: 1) the Swedish deposits at Kiruna and Gallivare; 2) Labrador-Quebec; 3) Wabana; 4) El Pao and Cerro Bolivar in Venezuela; and 5) the Minas Geraes region in Brazil. Peru may probably be entered in this list if major ore discoveries justify it.

Among other producers and exporters of ore, principally those districts in northern and western Africa, the reserves are so limited that we cannot expect production to be expanded and productive life will also be short. Only Algeria appears to have a reserve that gives promise of a sustained output at current levels.

Ore consumers on both sides of the Atlantic are now drawing from common sources in Labrador, Venezuela, Sweden, Algeria, Sierra Leone and Tunisia. As between the two groups of consumers on opposite sides of the ocean, the Euro-

TABLE 4
SOURCE OF IRON FOR THE UNITED KINGDOM, 1954
(thousand long tons)

	Ore production	Percent iron in ore	Iron content
United Kingdom	15,337.9	30.0	4,601.4
Newfoundland	997.0	51.0	508.5
Sweden	3,541.8	60.0	2,125.1
France	712.8	33.5	238.8
Spain	513.9	44.5	228.7
Spanish Morocco	245.6	66.5	163.3
French N. Africa	2,702.8	52.0	1,405.5
Sierra Leone	675.1	60.0	405.1
Total			5,075.0
Grand Total			9,676.4
Percent imported			52.4%

TABLE 5
STEEL PRODUCTION IN WESTERN EUROPE IN 1952
(Coheur and Kosmider)

	Total steel production*	Basic bessemer	Percent basic bessemer
Luxembourg	3.302	3.238	98.0
Belgium	5.608	4.631	82.6
Saar	3.105	2.319	74.7
France	11.594	7.265	61.2
West Germany	17.387	7.630	43.8

* Thousands of tons per annum.

peans have the more serious physical and financial problems. Consumers in the United States have a financial interest in the Labrador-Quebec and also the Venezuelan ores, and these source areas are favored by short transportation routes.

In ECSC countries and the United Kingdom, iron ore output has been more or less stationary since 1910, rarely exceeding 100 million tons. With the exhaustion of the richer ores, never very abundant, these countries now draw heavily on foreign ores in order to obtain suitable blendings. These imported ores come chiefly from Sweden, Spain, and North Africa. Recently, imports have come also from west Africa and America.

The present pattern (table 4) shows that the United Kingdom and ECSC countries of continental Europe obtain two-thirds of their new iron locally from low-grade ores present in these countries. France ships its surplus iron ore to Belgium, Luxembourg, West Germany, and the Saar. Shipments from Sweden and other European nations bring the total inter-European receipts of new iron up to 90 percent. Africa contributes practically all the remainder. Brazil and Venezuela are making token shipments.

In this pattern of European ore supply, the position of Sweden is unique. The typical properties of high iron content, high density, and low gangue reduce the space required for shipping. Even more important than the physical properties of Swedish ore is the high phosphorus content of much of the Swedish ore.

"Because phosphorus can not be removed from pig iron which is refined into steel in the acid or silica lined converter, the amount in the finished steel must be controlled by the selection of low phosphorus raw materials, particularly the iron ore. All of the phosphorus in the charge enters the pig iron. On the contrary, phosphorus can be slagged off in basic lined Thomas converters. In fact, Thomas pig iron normally contains from 1.5 to 2.0

percent phosphorus to supply heat during the latter stages of refining. This requires ore ranging from 0.75 to 1.0 percent of phosphorus depending upon the iron content of the burden and in turn the number of tons of ore per ton of pig. Under current European practice, ore containing in excess of 1.0 percent of phosphorus is desirable because it can be used as a "Sweetener" thus making it possible to use medium or low phosphorus ore in the production of Thomas pig iron. The marked extent to which Europe utilizes the Thomas process is shown in table 5. In brief, the high phosphorus content of certain grades of Swedish iron ore is a distinct advantage in marketing such ore in Europe." (Joseph, 1954.)

The high phosphorus Swedish ore is blended with domestic ore and other imported ores. Germany, for example, currently obtains about one-third percent of its iron from Sweden, another third from domestic ores, and the remainder, in varying quantities, from 16 other countries in Europe and Africa. Germany nevertheless is one of the large consumers of Swedish ore because the total output of steel is relatively large and about 44 percent of the steel produced is made by the basic Bessemer process. Although less steel is produced in Belgium, Luxembourg, and the Saar than in Germany, the former countries produce a larger portion of their steel by the basic Bessemer process. As a result, almost 90 percent of the ores imported from Sweden are high phosphorus ores.

In addition to supplying phosphorus for the basic Bessemer ovens, Swedish ore is very desirable because of its high iron content which reduces slag volume and coke consumption.

The growing output of Swedish iron ore, especially since 1950, reflects the increasing drafts upon this ore by both the United Kingdom and ECSC nations. The practical limit to the tonnage of Swedish ore available is the capacity of the docks at Narvik, Norway, which is about 15 million tons annually.

The quest for additional high grade ores, at possibly lower cost, extends also to west Africa and the Americas. In the case of the African ores, the difficulty common to practically all the ore districts is the limitation of the size of the reserve. This factor precludes the economic feasibility of capital expenditures in enlarging port and rail transportation facilities in order to expand shipments. Exceptions to this are the relatively large known deposits in Algeria and the less well explored deposits in West Africa in the vicinity of Conakry.

From current sources, then, the limits of available ore for western Europe are set by the capacity of the Swedish mines and the port facilities of Narvik and the capacities of port facilities in north and west Africa.

Should demand for high grade ores expand beyond the capacity of the Swedish and African sources, the potential alternatives are Venezuela, Wabana, Labrador-Quebec, and Brazil. Each of these districts may be considered as having major size ore deposits.

An examination of each of these potential sources discloses their differential economic availability.

The Wabana ores are well situated for cheap ocean transport.

This ore has a high silica content which prevents its wide use in the United States. The United Kingdom is the major overseas consumer although small amounts were shipped to Germany. This high phosphorus ore competes with like ores from Sweden to supply the basic Bessemer furnace and is not likely to expand in output against Swedish competition.

Labrador-Quebec, Venezuela, and Brazil, not restricted by chemical composition of ore, compete on a price basis, in which mining costs and transportation to European markets both figure. The average price in 1955 is reported as follows:

Source	Price per gross tons	Percent of iron	Price per 100 pounds of iron	Distance to Europe nautical miles
Brazil	$11.11	68.0	$0.73	6,270
Venezuela	6.37	54.0	0.44	3,650
Canada	7.85	51.5	0.64	2,600

The Special Problem of Brazil

The ore deposits of Brazil, in the State of Minas Geraes, rank among the largest in the world. Production is currently about 3.6 million metric tons of which about one and a half million tons is used in the domestic iron industry and the remainder is exported mainly to the United States, but also to Europe in small amounts.

The Brazilians are anxious to establish a domestic iron and steel industry and have succeeded to the extent of producing annually more than one million metric tons of pig iron and an equivalent tonnage of steel. This is the equivalent of 40 pounds per person per year. The principal steel plant is located at Volta Redonda on the railway connecting Rio de Janeiro with Sao Paulo.

Expansion of an iron and steel industry in Brazil is attended by two difficulties—high transportation costs of ore and inadequate coal supplies of poor quality.

The principal producing area, the Itabira district, is about 325 miles from the seaport of Victoria by way of the Victoria-Mines railroad. This railroad is of meter gauge and was laid out to avoid heavy earthwork and expensive bridges. The result is a very winding road with some steep grades.

Iron ores in the San Francisco Valley is served by the Central & Brazil Railroad which is 1.6 meters gauge from Rio de Janeiro to Belo Horizonte, with feeder lines of 1 meter. The distance is 300 miles. The Volta Redonda steel plant is on the broad gauge line of the Central railroad making connection at Entre Rios.

The proved coal reserves of Brazil are all in the southern provinces. Brazilian coal presents a very difficult problem being high in both ash and sulfur. It is generally found in many seams and small partings. The inclusion of these partings in the coal as mined presents a washing problem which, it is stated, is the most difficult known throughout the world (Price, 1953). With an allowable ash of 13 to 16 percent in the washed coal, it is possible to recover only 30 percent of washed coal, and the cost is therefore excessive.

This explains the economy of importing coal.* Unexplored coal fields are known to exist in the northern part of Brazil between the Xunger and Parnarba rivers but are presently inaccessible.

Santa Catarina coal, delivered to Volta Redonda, costs twice the price of imported coal, irrespective of quality, and as the latter contains only 5 percent ash, the real difference is greater. At Volta Redonda where 70 to 75 percent of pig iron is used in making of steel and where iron scrap is scarce and costly, the cost of pig iron determines the cost of the finished product. Coke represents 65 percent of the cost of pig iron, while the cost of coal, which accounts for 75 percent of the coke, represents 50 percent of the cost of pig iron. It is obvious, therefore, that a blast furnace could not be economically and efficiently operated in normal times with 100 percent coal (Colliery Guardian, Aug. 5, 1954).

Brazil will have to import more coal in the future to meet the growing needs of the National Steel Works at Volta Redonda. Brazil's opportunity to obtain coal from abroad is conditioned to some extent upon her ability to deliver iron ore to consumers abroad, thereby providing both a means of foreign exchange and also return cargo for coal carrying vessels.

Expanding iron ore exports is, in turn, conditioned upon transportation facilities which, in effect, are the key to the Brazilian iron ore industry. Were Brazil's iron deposits on the seaboard, millions of tons a year would be exported. They are, however, located several hundred miles inland, behind formidable mountain barriers. The Victoria-Mines railroad has been improved and its capacity stepped up to handle six trains of 20 cars of 50 tons each daily. On the basis of a 5-day week, it handles approximately 1,500,000 tons annually (Vandenburg, 1952). The port of Victoria, the ocean terminus of the Victoria-Mines railroad, cannot handle ships of more than 10,000 tons and is, therefore, unsuitable as a large-scale loading point, which would demand ships of 20,000 tons or more. An adequate port site is available at Ara Cruz which would give a shorter railroad haul.

The Central Brazil railroad is already overloaded and its carrying capacity can be increased only by heavy expenditures for enlarged port facilities, additional trackage, and rolling stock.

"It will be necessary to improve rail and port facilities in order to ensure regular supplies of coal to Volta Redonda. With this object, and also to raise mineral export capacity from the Minas Geraes iron mines, it is proposed to build a port at Itacurussa, on the Rio

* Coal imports from the United States in recent years, in net tons were: 1947, 1,468,312; 1948, 959,323; 1949, 681,838; 1950, 1,054,305; 1951, 1,026,952; 1952, 875,507; 1953, 812,804.

de Janeiro coast, and connect it by rail to the Central of Brazil Railway at Japeri. This would cut out the overloaded railway section between Japeri and the Federal Capital, which cannot be conveniently amplified. The projects will probably be carried out in two stages. The first will provide for exports of 1 million tons of ore; the mineral ships bringing coal on the return trip. Export capacity would be raised later to 5 million tons or more.

An alternative project has been submitted to the government to build a special ore railroad from the iron mines of Minas Geraes to Augusto Pestana, on the crest of the mountain. A double conveyor belt would be constructed from the point in two parts. The first section, 30 miles long, would drop 2,600 feet to the National Steel works at Volta Redonda. The second section, of 112 miles, would rise 700 feet to clear the coastal range, then drop 1,950 feet to the port of Angra dos Reis, on the coast of Rio de Janeiro. According to calculations, one side of a 36-inch wide double conveyor belt would transport 2,400 tons of ore per hour down the mountain. The other side would haul 800 tons of coal hourly from the port at Angra dos Reis. (Colliery Guardian, Dec. 17, 1953.)

Fuel Supply

The American coal industry is now assuming a strategic role in sustaining a vigorous iron and steel industry in western Europe and in expanding the industry in Latin America.

European nations have been importing coal from the United States in varying tonnages since World War II. The year 1956 may prove to be the year of largest exports to date. On the basis of reports to the Secretariat of the Economic Commission for Europe by individual governments, the full development of iron and steel production in Europe is being impeded by a coke shortage. There appears to be no immediate prospect of overcoming this shortage except for continued imports from the United States. This is already causing difficulties in the balance of payments position of some countries. The economic position can only be made secure if the mounting imports of coal and oil also are used to provide additional exports. This should not be difficult where fuel purchases are made in non-industrialized countries, but coal, at present, is available only in North America.

Coal to Latin America

The United States has long exported relatively small amounts of coal to Latin American nations; Brazil has been the principal importer. Two of the South American nations, as previously indicated, have extensive deposits of high-grade iron ore. The Brazilian problem has been stated previously; the key questions are transportation, adequate means of obtaining foreign exchange, and a supply of coking coal, which, under present conditions must necessarily come from the United States. Venezuela is also initiating a local iron and steel industry based on the extensive iron deposits of Cerro Bolivar. Coal will be obtained from domestic deposits located at Naricual. A plant of 165,000 ton output is being plan-ned. This is equivalent to about 60 pounds of steel per person. In terms of consumption in the United States this is very small. Future enlargements will depend upon a continued growth of the national income and an adequacy of coking coal supply. Little is known about Venezuelan coal deposits. Limited surveys have been made and although it is thought that several hundred million tons may be found, only some ten million tons have been actually proved. Samples taken have indicated the coal to be of high-volatile bituminous type, but not suitable by itself for producing a metallurgical coke of good quality (Price, 1953). Future economic growth of Venezuela will eventually require far more steel than is contemplated in the output of the proposed plant. This may involve new plant construction, more imports of raw steel, or both. As in the case of Brazil, the United States may be called upon to furnish coking coal to supplement domestic supplies. Financial aid may also be necessary. This brings up the controversial question of foreign aid.

Foreign aid, if it is to be useful, effective and in the interest of the United States, must seek out the conditions under which a highly productive society can be built and, if these exist, it can aid in marshalling the forces that can bring a productive society to the functioning stage.

Any program which increases the iron and steel output of a Latin American nation will also increase her productivity, her purchasing power, and her economic ability to increase trade with maturely industrialized nations—the United States and western Europe.

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CONSTITUTION AND BY-LAWS

Adopted June 24, 1913
Amended Nov. 12, 1926
Amended Nov. 8, 1929
Amended Nov. 8, 1935
Amended Oct. 21, 1938

ARTICLE I.

Name and Purpose.

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

ARTICLE II.

Membership.

Section 1. Any person directly engaged or interested in any branch of mining, mining supplies, mining appliances, or mining machinery may become an active member of the Institute. Any person desiring to become a member of the Institute shall fill out a blank for that purpose, giving his name, residence, age, and occupation. This application shall be accompanied by one year's dues of $3.00. Each application for membership shall be submitted to the Executive Board, who shall make an investigation as to the qualifications of the applicant, and shall be authorized to elect to membership and issue a certificate of membership to such applicant subject to the ratification of the next regular meeting of the Institute.

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

Section 3. The annual dues for active members shall be $3.00 and any person in arrears on August 1, of the current year, after having been sent two notifications of dues, shall be dropped from membership. Members in arrears for dues will not receive the printed proceedings of the Institute.

Section 4. Any active member may become a life member by the payment of $50.00 and shall be exempt from further payment of dues during his lifetime.

ARTICLE III.

Officers.

Section 1. The officers shall consist of a President, 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 Presiident at least thirty days before the annual November meeting, provided that anyone can be nominated on the floor of the meeting for any office for which an election is being held.

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

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

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

Section 4. In case of death, resignation, or expulsion of any officer, the executive board may fill the vacancy by appointment until the next regular meeting, when the vacancy shall be filled by regular election. In case of a vacancy in the office of president, the duties shall devolve upon the vice-president.

Section 5. The executive board shall consist of the officers and twelve other board members.

ARTICLE IV.

Duties of Officers.

Section 1. The president shall perform the duties commonly performed by the presiding officer and chairman. He shall, with the executive board, 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, sign all orders for money, and shall purchase necessary supplies.

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

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

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

Section 4. The president shall appoint an auditing committee annually to audit the accounts of the secretary-treasurer, and said audit shall be submitted to the November meeting of the Institute.

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

ARTICLE V.

Meetings.

Section 1. Regular meetings shall be held in June and November of each year and on such days and in such places as may be determined by the executive board of the Institute. Notice of all meetings shall be given at least thirty days in advance of such meetings.

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

ARTICLE VI.

Amendments.

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

ARTICLE VII.

Order of Business.

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

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

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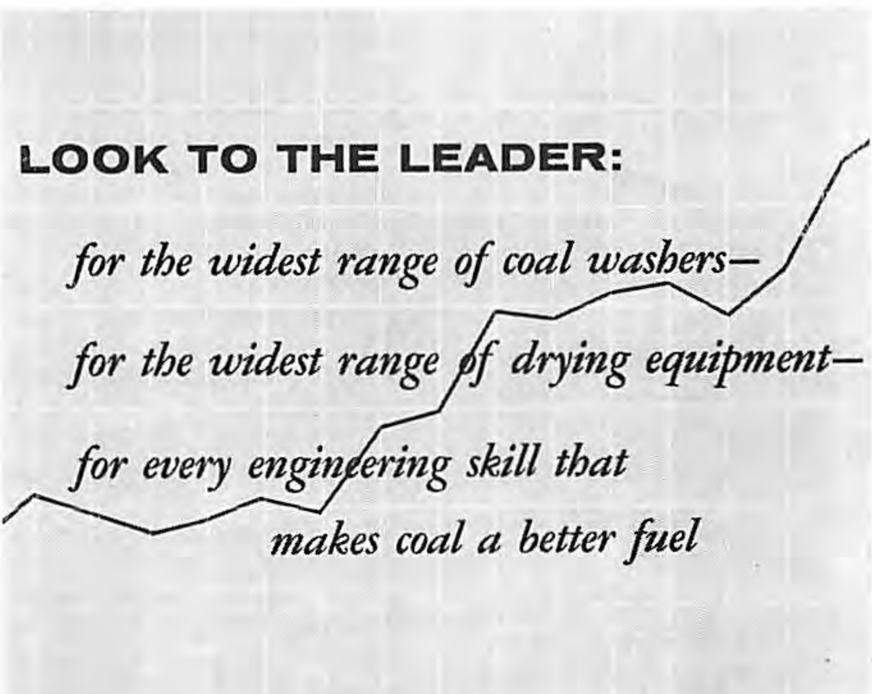

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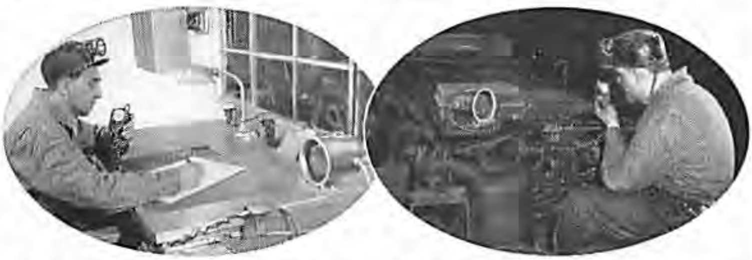

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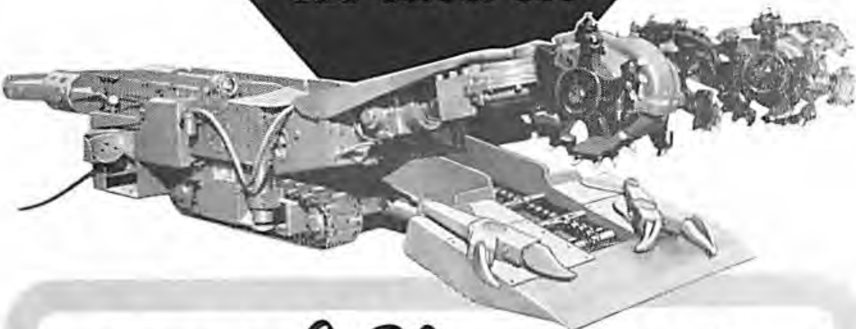

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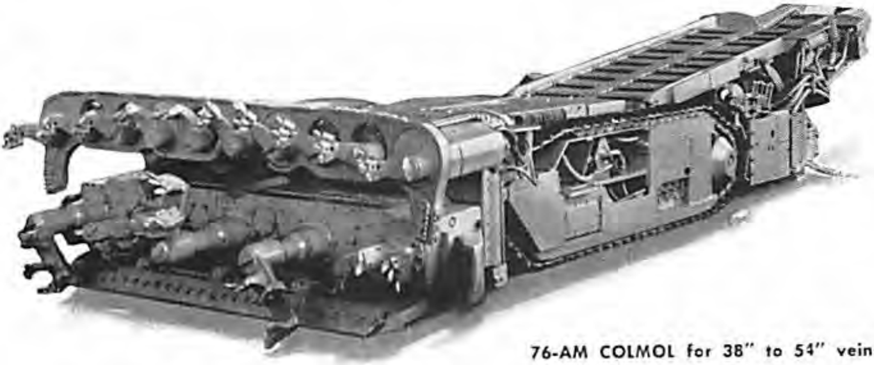

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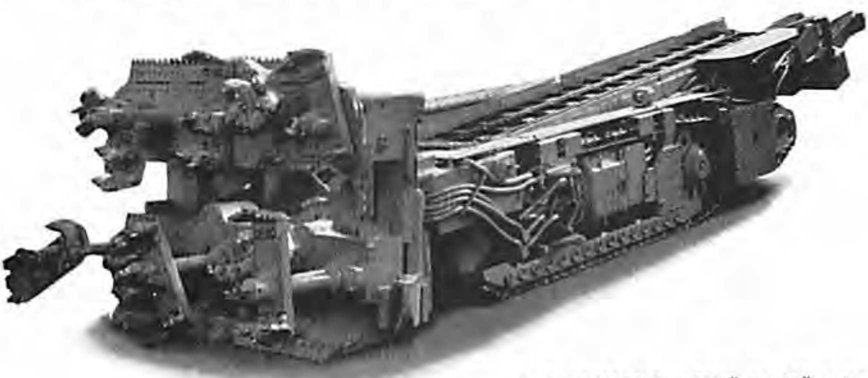

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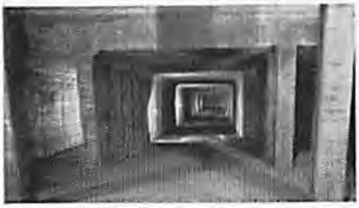

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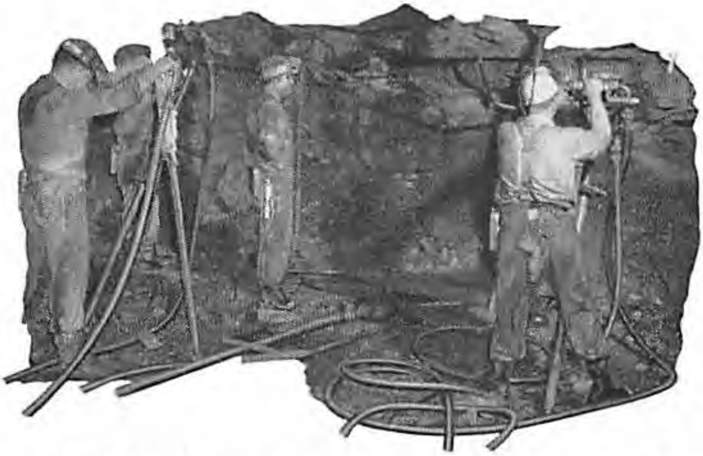

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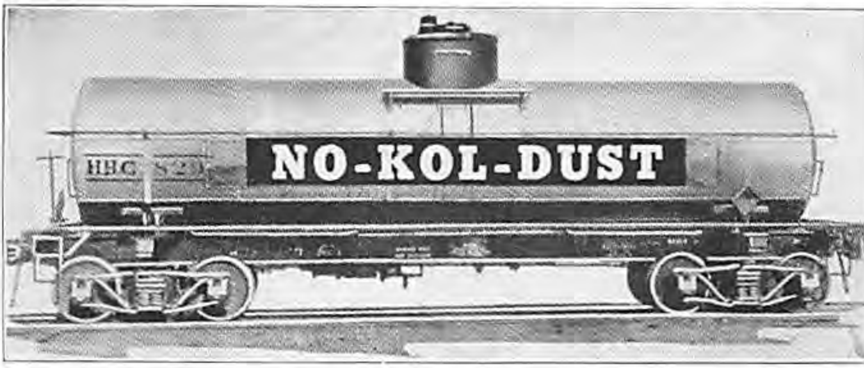

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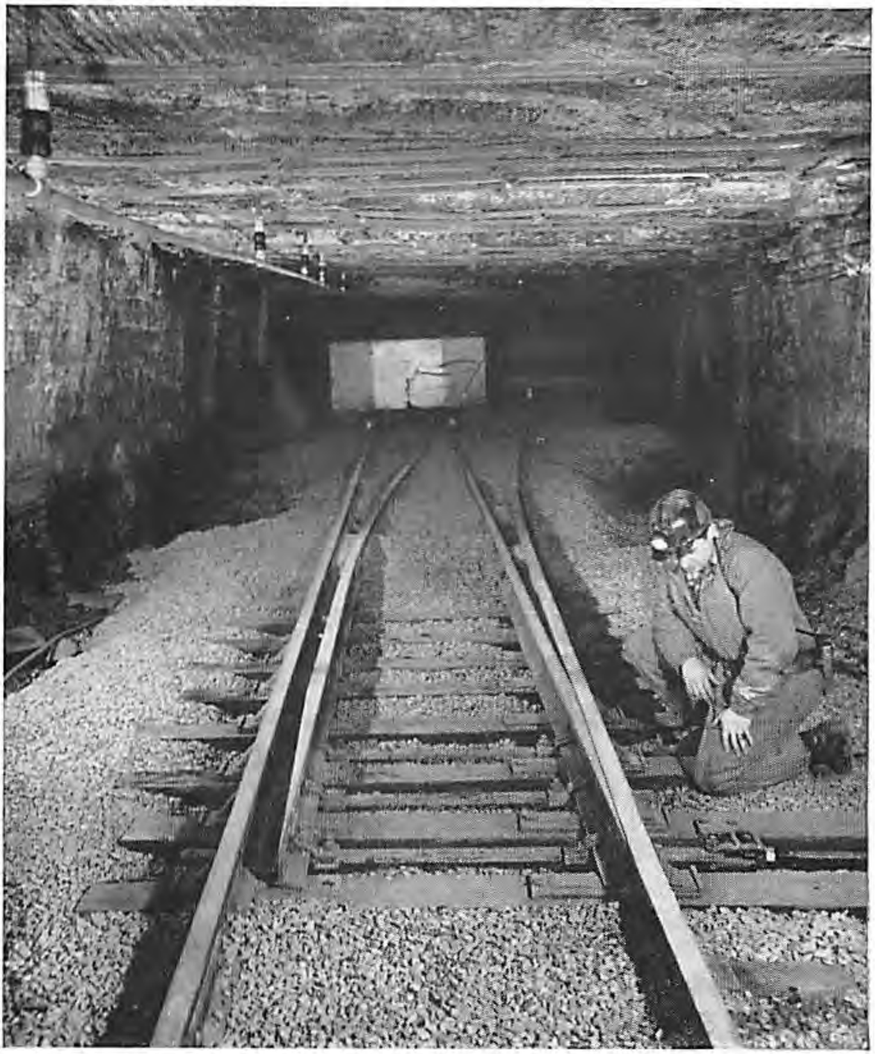

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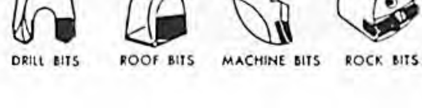

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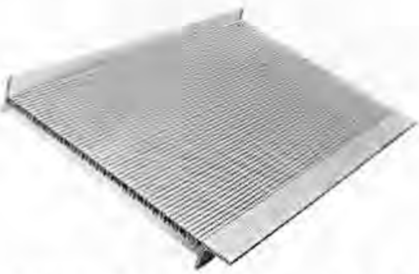

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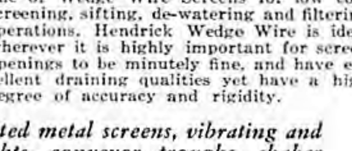

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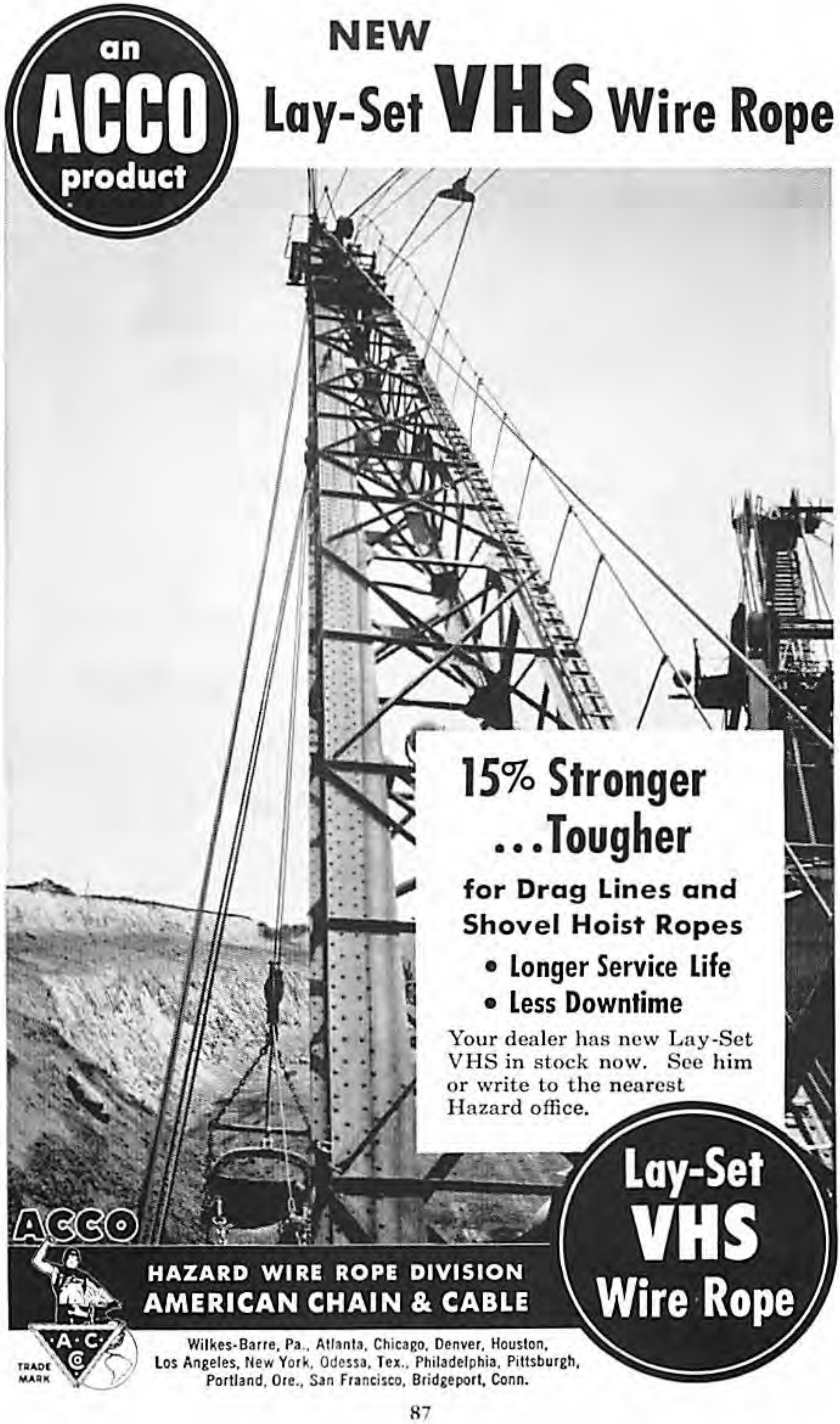
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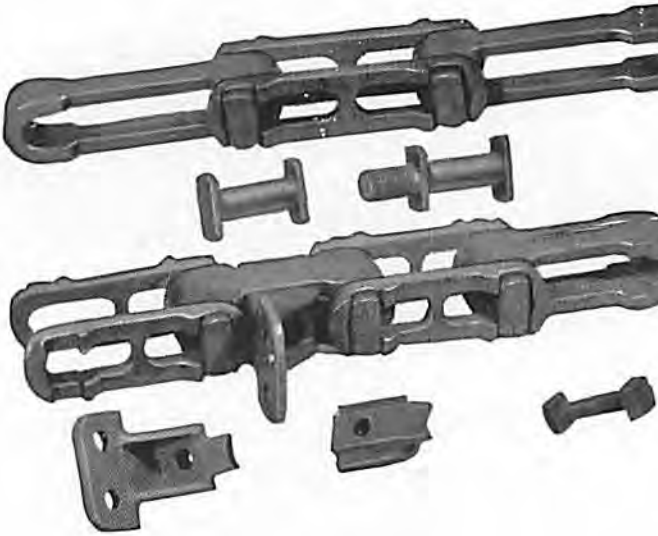

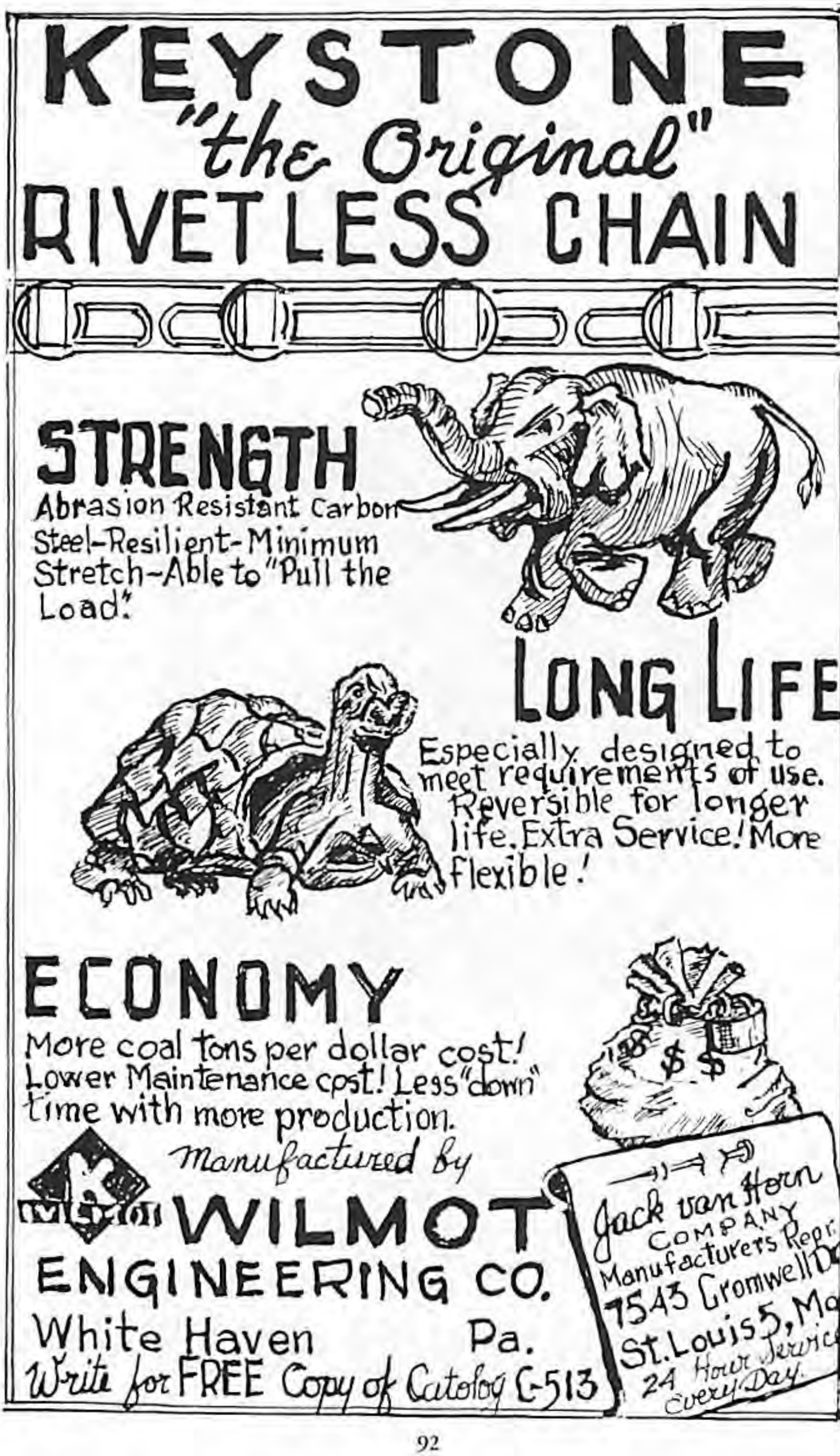

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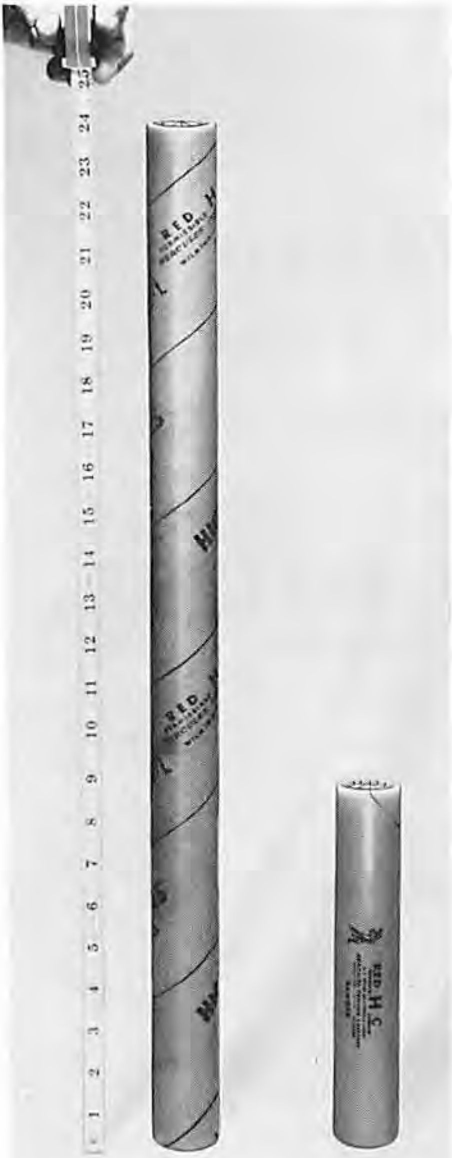

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