PROCEEDINGS OF THE LAKE SUPERIOR MINING INSTITUTE

TWENTY-FIFTH ANNUAL MEETING
(Gogebic Range)

HELD AT

IRONWOOD, MICH.
AND
MILWAUKEE, WIS.

SEPTEMBER 8 AND 9, 1926

VOL. XXV

ISHPEMING, MICH.
PUBLISHED BY THE INSTITUTE.
AT THE OFFICE OF THE SECRETARY,
1926.

PRESSES OF IRON ORE,
ISHPEMING, MICH.

INDEX TO VOLUME XXV, 1926.

[Frontispiece, group picture of members, Milwaukee, Sept. 9th, 1926]

LAKE SUPERIOR MINING INSTITUTE AT ELKS CLUB, MILWAUKEE, WIS., SEPTEMBER 9TH, 1926.

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(Term expires 1926)

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TREASURER

J. E. NELSON ..... Negaunee, Mich.
(Term expires 1926)

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(Term expires 1926)

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(Term expires 1927)

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(Term expires 1927)

(The above officers constitute the council.)

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ROYCE, STEPHEN.....Box 787, Crystal Falls, Mich.
RUMSEY, SPENCER S.....717 Wolvin Bldg., Duluth, Minn.
RUTHERFORD, HAROLD McKNIGHT.....Hibbing, Minn.
RYAN, JOHN A.....Iron Mountain, Mich.

SALSICH, L. R.....Hibbing, Minn.
SAMPSON, JOHN .....Ashland, Wis.
SAVAGE, JOHN A.....Alworth Bldg., Duluth, Minn.
SCADDEN, FRANK .....Crystal Falls, Mich.
SCALLON, E. P.....Crosby, Minn.
SCHACHT, WILLIAM H.....Painesdale, Mich.
SCHAUS, OLIVER M.....Ironwood, Mich.
SCHUBERT, GEO. P.....127 Hubbell Ave., Houghton, Mich.
SCHWEDES, WALTER F.....714 Wolvin Bldg., Duluth, Minn.
SCOFIELD, LLOYD M.....742 East Ayer St., Ironwood, Mich.
SEAMAN, A. E.....Houghton, Mich.
SEBENIUS, JOHN UNO.....Wolvin Bldg., Duluth, Minn.
SEEBER, R. R.....319 Hancock St., Hancock, Mich.
SEELYE, R. W.....1003 Roanoke St., Seattle, Wash.
SELDEN, W. H.....Stambaugh, Mich.
SELDEN, WM. H., JR.....Iron River, Mich.
SELLS, MAX .....Florence, Wis.
SELLWOOD, R. M.....Duluth, Minn.
SHELDON, ALBERT F.....112 W. Arch St., Marquette, Mich.
SHELDON, C. G.....care Ingersoll Rand Co., Houghton, Mich.
SHELDON, HORACE W., DR.....Negaunee, Mich.
SHERWOOD, GEO. A.....Duluth, Minn.
SHERWOOD, M. J.....Marquette, Mich.
SHEVIAKOFF, LEO D.....Ekaterinoslaw, Russia
SHIELDS, IRVING, J.....Duluth, Minn.
SIMPSON, W. F.....Hibbing, Minn.
SKILLINGS, DAVID D.....319 Bradley Bldg., Duluth, Minn.
SLAUGHTER, W. F.....Riverton, Minn.
SMITH, F. J.....Crystal Falls, Mich.
SMITH, HARRIS G.....25 Messaba Bldg., Duluth, Minn.
SMYTH, H. L.....Rotch Bldg., Cambridge, Mass.
SOADY, HARRY.....4629 Lyndale Ave. S., Minneapolis, Minn.
SPERR, F. W.....Houghton, Mich.
STAKEL, CHARLES J.....North Lake Place, Ishpeming, Mich.
STANFORD, FRED C.....Ishpeming, Mich.
STIRNE, MAXIMILLIAN, M.....1819 Broadway, New York City
STRACHAN, WILLIAM H.....Duluth, Minn.
ST. CLAIR, REX.....Box 23, Mountain Iron, Minn.
SUMMERSBY, J. J., JR.....1017 Commerce Bldg., St. Paul, Minn.
SUTHERLAND, D. E.....Ironwood, Mich.
SWAIN, JOHN D.....1922 Peoples' Gas Bldg., Chicago, Ill.
SWART, WALTER G.....Babbitt, Minn.
SWEET, ANDREW T.....Michigan College of Mines, Houghton, Mich.
SWIFT, GEORGE D.....Duluth, Minn.

SWIFT, H. L.....Houghton, Mich.
SWIFT, PAUL D.....Houghton, Mich.

TAPPAN, WILLIAM M.....Box 816, Hibbing, Minn.
TARR, S. W.....715 Wolvin Bldg., Duluth, Minn.
TAYLOR, CARROLL C.....Ironwood, Mich.
TAYLOR, WILLIAM L.....Verona, Mich.
THIEMAN, EDWARD .....Florence, Wis.
THOMPSON, CARMI A.....Cleveland, O.
TINKER, WILLIS L.....1450 Union Trust Bldg., Cleveland, Ohio
TOLONEN, FRANK J.....Michigan College of Mines, Houghton, Mich.
TREBILCOCK, WILLIAM.....North Freedom, Wis.
TREZONA, CHARLES .....Ely, Minn.
TRIPP, CHESTER.....943 People's Gas Bldg., Chicago, Ill.
TRUETTNER, WALTER F.....Bessemer, Mich.
TWEED, PAUL H.....Nashwauk, Minn.

UHLER, FRED WALTER.....Crosby, Minn.
ULRICH, WILLIAM F.....Box 159 Coleraine, Minn.
UREN, RICHARD FORBES.....245 College Ave., Houghton, Mich.
UREN, W. J. JR.....Box 1024, Clarkdale, Ariz.

VAN DYKE, W. D.....210 Wisconsin St., Milwaukee, Wis.
VAN EVERA, JOHN R.....411 Felt Bldg., Salt Lake City, Utah
VAN EVERA, WILBUR .....Box N, Crosby, Minn.
VAN SLYKE, W. R.....Eveleth, Minn.
VAN VALKENBURGH, ROBT. R.....Wharton, N. J.
VICKERS, J. TODD .....Vulcan, Mich.
VIVIAN, HARRY .....Calumet, Mich.
VIVIAN, JAMES G.....706 Alworth Bldg., Duluth, Minn.
VOGEL, F. A.....501 1st Nat. Bank Bldg., San Antonio, Texas

WAGNER, JOHN M.....P. O. Drawer 30, Houghton, Mich.
WAHL, R. L.....Ironton, Minn.
WALKER, ELTON WILLARD.....350 Florence St,. Houghton, Mich.
WALLACE, GEORGE .....Marquette, Mich.
WARE, J. F.....Forest and Five Oaks Ave., Dayton, O.
WARE, W. F.....Negaunee, Mich.
WEARNE, WILLIAM.....2422 E. 3rd St., Duluth, Minn.
WEBB, FRANCIS J.....1405 Alworth Bldg., Duluth, Minn.
WEBB, WALTER M.....Gilbert, Minn.
WEIDENFELLER RAYMOND P.....Coleraine, Minn.
WESBROOK, D. M.....5th Ave. & 5th St., S., Minneapolis, Minn.
WHITEHEAD, R. G.....Alpha, Mich.
WHITTLE, CHARLES E.....304 W. Randolph St., Chicago, Ill.
WILCOX, LEE L.....Iron Belt, Wis.
WILLIAMS, P. S.....310 Glencoe Bldg., Duluth, Minn.
WINTER, JOSEPH H.....Negaunee, Mich.
WORTLEY, R. B.....Iron River, Mich.
WRIGHT, DUDLEY D.....507 5th St., Ishpeming, Mich.

YUNGBLUTH, A. J.....Ishpeming, Mich.

ZAPFFE, CARL.....4 Brainerd State Bank Bldg., Brainerd, Minn.
ZINN, R. P.....Ironwood, Mich.

LIST OF DECEASED MEMBERS SINCE MEETING AUGUST, 15, 1925.

FARRELL, AUSTIN, Marquette, Mich.....December 25th, 1925
FAY, JOSEPH, Marquette, Mich.....April 20th, 1926
FISHER, HENRY, Lake Linden, Mich.....December 24th, 1926
MANVILLE, T. F., New York City.....October 19th, 1925
UREN, W. J., Houghton, Mich.....November, 10th, 1925
WADE, JEPTHA H., Cleveland, O.....March 20th, 1926

OFFICERS OF THE INSTITUTE 1893 TO 1926, INCLUSIVE.

PRESIDENTS.

Nelson P. Hulst	1893	Murray M. Duncan	1908
J. Parke Channing	1894	D. E. Sutherland	1909
John Duncan	1895	William J. Richards	1910
William G. Mather	1896	F. W. Denton	1911
William Kelly	1898	Pentecost Mitchell	1912
Graham Pope	1900	W. H. Johnston	1913
W. J. Olcott	1901	L. M. Hardenburgh	1914
Walter Fitch	1902	C. E. Lawrence	1915
George H. Abeel	1903	Charles T. Fairbairn	1917
O. C. Davidson	1904	Francis J. Webb	1922
James MacNaughton	1905	James E. Jopling	1925
Thomas F. Cole	1906	E. W. Hopkins	1926

(No meetings were held in 1897, 1899, 1907, 1916, 1918, 1919, 1920, 1921 and 1924).

TREASURERS.

C. M. Boss	1893	A. J. Yungbluth	1898-1900
A. C. Lane	1894	George H. Abeel	1901-1902
George D. Swift	1895-1896	E. W. Hopkins	1903-1925
J. E. Nelson	1925		

SECRETARIES.

F. W. Denton	1893-1896	F. W. Sperr	1900
F. W. Denton and F. W. Sperr	1898	A. J. Yungbluth	1901-.....

P, President; V, Vice President; M, Manager; S, Secretary; T, Treasurer.

*Abeel, Geo. H., P, '03; V, '96-'98, '13; M, 1900; T, '01-'02.
Amberg, J. Ward, M, '08-'09.
Armstrong, F. H., M, '15-'16.
*Armstrong, J. F., V, '96.
*Ball, Edwin, V, '98; M, '95-'96, 1900.
Barber, G. S., V, '15-'17; M, '13-'14.
Batchelder, B. W., M, '17-'22.
Baxter, C. H., M, '13-'14.
Boss, C. M., M, '94-'95; T, '93.
Brewer, L. C., V, '14; M, '11-'12.
*Brigham, E. D., V, '11-'12.
Brown, E. F., V, '98; M, 1900.
*Burt, M. W., V, '93.
Bush, J. M., V, '10-'11.
Calverley, Wm. D., V, '17-'22.
*Carbis, Frank, M, '23-'26.
Channing, J. Parke, P, '94; V, '93.
Chinn, W. P., V, '12-'13.
*Clancey, James, M, '01-'02.
Cole, Thomas F., P, '06; V, 1900; M, '98, '02-'04.
*Cooper, James B., V, '98, '03-'05; M, 1900-'01, '11-'12.
Davidson, O. C., P, 1904; V, 1900; M, '94-'95, '98.
Denton, F. W., P, '11; V, 1900-'01, '06-'08; S, '93-'98.
*Duncan, John, P, '95; M, '93-'94.
Duncan, M. M., P, '08; V, 1900-'01, '05-'06; M, '98.
Edwards, A. D., V, '13-'14.
Ellard, H. F., V, '02-'04.
Elliott, S. R., M, '14.
Fitch, Walter, P, '02; V, '98; M, 1900, '93-'94.
Flannigan, T. A., V, '15.
*Gilchrist, J. D., M, '98.
Godfrey, M. H., M, '12-'13.
Greatsinger, J. L., M, '01-'02.
*Greenway, John C., M, '05-'08.
*Grierson, E. S., M, '17.
Haire, N. W., V, '08-'09.
Hardenburg, L. M., M, '09-'10; P, '14.
Harrison, G. E., M, '22.
Henderson, Enoch, M, '15.
Hoatson, Thomas, M, '17-'22.
Hodge, J. E., V, '22-'25.
Hopkins, E. W., T, '03-'25; P, '26.
*Hulst, N. P., V, '01; P, '93.
Hunner, E. E., V, '22-'25.
Jackson, G. R., V, '15, '22-'25.
Jobe, W. H., V, '12-'13.
Johnston, William H., V, '02-'03; P, '13; M, '13.

Jones, John T., V, '93-'94.
Jopling, J. E., P, '23-'25; M, '12-'13.
Keese, F. E., V, '15-'17; M, '09-'10.
Kelly, William, P, '98; V, 01-'02; M, '93-'96, '05-'06.
*Kruse, C. T., V, '14.
Lane, A. C., T, '94.
*Larsson, Per, V, '95-'96.
Lawrence, C. E., P, '15; V, '14; M, '10-'11.
*Longyear, J. M., V, '08.
Lutes, J. S., M, '14.
*Mills, F. P., V, '93-'94; M, '95-'96.
Mitchell, Pentecost, P, '12; M, '08-'09.
*Morgan, D. T., V, '08-'09.
Munger, C. H., V, '11-'12; M, '93-'96.
McDowell, John, M, '03-'05.
McLean, J. H., V, 1900-'01, '03-'05.
*McNair, F. W., V, '05-'06.
MacNaughton, James, P, '05; M, '93-'01.
McRandle, W. E., V, '23-'26.
Nelson, John E., M, '22-'25; T, 25.
Newett, George A., V, '95-'96.
Olcott, W. J., P, '01; V, '94-'95.
Parker, R. A., V, '94-'95.
Pascoe, Peter W., M, '11-'12.
*Pope, Graham, P, 1900; V, '93-'94; M, '96-'98, '02-'04.
Prescott, Fred M., V, '05-'06.
Richards, M. E., V, '17-'22; M, '15.
*Richards, W. J., P, '10; V, '09-'10; M, '04-'05.
Rough, J. H., V, '10-'11.
Rowe, Henry, M, '15.
Schacht, W. H., V, '23-'26.
*Shephard, Amos, M, '02-'04.
Siebenthal, W. A., M, '14.
Smith, Fred, V, '02-'04.
Sperr, F. W., V, '10-'11; S, '98-1900.
Stanton, F. McM., V, '95-'96.
*Sturtevant, H. B., M, '05-'06.
Swift, George D., T, '95-'96.
Sutherland, D. E., P, '09; V, '08-'09.
Tappan, W. H., M, '22-'25.
*Thompson, James R., M, '06-'08.
Trezona, Charles, V, '10.
*Uren, W. J., M, '09-'10.
Vogel, Felix A., M, '06-'08.
Wadsworth, M. E., M, '94-'95.
Van Evera, J. Wilbur, M, '25-'26.
Wearne, William, M, '15-'17.
Webb, F. J., P, '22; V, '14.
*West, W. J., M, '10-'11.
Woodworth, G. L., V, '15-'17.
Yungbluth, A. J., T, '98-1900; S, '01-

(*Deceased)

LIST OF MEETINGS OF THE INSTITUTE AND THEIR LOCALITIES FROM ITS ORGANIZATION.

No.	Place.	Date.	Volume.
1	Iron Mountain, Mich.	March 22,23, 1893	I
2	Houghton, Mich.	March 7-9, 1894	II
3	Mesabi and Vermilion Ranges	March 6-8, 1895	III
4	Ishpeming, Mich.	August 18-20, 1896	IV
5	Ironwood, Mich.	August 16-18, 1898	V
6	Iron Mountain, Mich.	February 6-8, 1900	VI
7	Houghton, Mich.	March 5-9, 1901	VII
8	Mesabi and Vermilion Ranges	August 19-21, 1902	VIII
9	Ishpeming, Munising and Sault Ste. Marie, Mich.	August 18-20, 1903	IX
10	Ironwood, Mich., and Milwaukee, Wis.	August 16-18, 1904	X
11	Iron Mountain and Escanaba, Mich.	October 17-19, 1905	XI
12	Houghton, Mich.	August 8-10, 1906	XII
13	Mesabi and Vermilion Ranges	June 24-27, 1908	XIII
14	Ishpeming and Munising, Mich.	August 25-27, 1909	XIV
15	Ironwood, Mich., and Gary, Ind.	August 24-26, 1910	XV
16	Crystal Falls, Mich.	August 22-24, 1911	XVI
17	Houghton, Mich.	August 28-30, 1912	XVII
18	Mesabi Range	August 26-30, 1913	XVIII
19	Marquette Range and Detroit, Mich.	Aug. 31 to Sept. 3,1914	XIX
20	Gogebic-Cuyuna Ranges	September 6-9, 1915	XX
21	Menominee, Mich.,-Birmingham, Ala.	March 3-15, 1917	XXI
22	Houghton, Mich.	August 28-30, 1922	XXII
23	Minnesota Ranges	August 28-29-30, 1923	XXIII
24	Marquette Range-Sault Ste. Marie, Mich., and Sault Ste. Marie, Ont.	August 13-14, 1925	XXIV
25	Gogebic Range and Milwaukee	September 8-9, 1926	XXV

NOTE—No meetings were held in 1897, 1899, 1907, 1916, 1918, 1919, 1920, 1921 and 1924.

LIST OF PAPERS PUBLISHED IN PRECEDING VOLUMES.

1893—Vol. I.

1894—Vol. II.

1895—Vol. III.

1896—Vol. IV.

1898—Vol. V.

1900—Vol. VI.

1901—Vol. VII.

1912—Vol. XVII.

1913—Vol. XVIII.

1914—Vol. XIX.

1915—Vol. XX.

1916-1917—Vol. XXI.

1922—Vol. XXII.

1923—Vol XXIII.

RULES OF THE INSTITUTE.

I.
OBJECTS.

The objects of the Lake Superior Mining Institute are to promote the arts and sciences connected with the economical production of the useful minerals and metals in the Lake Superior region, and the welfare of those employed in these industries, by means of meetings of social intercourse, by excursions, and by the reading and discussion of practical and professional papers, and to circulate, by means of publications among its members, the information thus obtained.

II.
MEMBERSHIP.

Any person interested in the objects of the Institute is eligible for membership.

Honorary members not exceeding ten in number, may be admitted to all the privileges of regular members except to vote. They must be persons eminent in mining or sciences relating thereto.

III.
ELECTION OF MEMBERS.

Each person desirous of becoming a member shall be proposed by at least three members, approved by the Council, and elected by ballot at a regular meeting (or by ballot at any time conducted through the mail, as the Council may prescribe), upon receiving three-fourths of the votes cast. Application must be accompanied by fee and dues as provided by Section V.

Each person proposed as an honorary member shall be recommended by at least ten members, approved by the Council, and elected by ballot at a regular meeting, (or by ballot at any time conducted through the mail, as the Council may prescribe), on receiving nine-tenths of the votes cast.

IV.
WITHDRAWAL FROM MEMBERSHIP.

Upon the recommendation of the Council, any member may be stricken from the list and denied the privilege of membership, by the vote of three-fourths of the members present at any regular meeting, due notice having been mailed in writing by the Secretary to him.

V.
DUES.

The membership fee shall be five dollars and the annual dues five dollars, and applications for membership must be accompanied by a remittance of ten dollars; five dollars for such membership fee and five dollars for dues for the first year. Honorary members shall not be liable to dues. Any member not in arrears may become a life member by the payment of fifty dollars at one time, and shall not be liable thereafter to annual dues. Any member in arrears may, at the discretion of the Council, be deprived of the receipt of publications or be stricken from the list of members when in arrears six months; Provided, That he may be restored to membership by the Council on the payment of all arrears, or by re-election after an interval of three years.

VI.
OFFICERS.

There shall be a President, five Vice Presidents, five Managers, a Secretary and a Treasurer, and these Officers shall constitute the Council.

VII.
TERM OF OFFICE.

The President, Secretary and Treasurer shall be elected for one year, and the Vice Presidents and Managers for two years, except that at the first election two Vice Presidents and three Managers shall be elected for only one year. No President, Vice President, or Manager shall be eligible for immediate re-election to the same office at the expiration of the term for which he was elected. The term of office shall continue until the adjournment of the meeting at which their successors are elected.

Vacancies in the Council, whether by death, resignation, or the failure for one year to attend the Council meetings, or to perform the duties of the office, shall be filled by the appointment of the Council, and any person so appointed shall hold office for the remainder of the term for which his predecessor was elected or appointed; Provided, That such appointment shall not render him ineligible at the next election.

VIII.
DUTIES OF OFFICERS.

All the affairs of the Institute shall be managed by the Council except the selection of the place of holding regular meetings.

The duties of all Officers shall be such as usually pertain to their offices, or may be delegated to them by the Council.

The Council may, in its discretion, require bonds to be given by the Treasurer, and may allow the Secretary such compensation for his services as they deem proper.

At each annual meeting the Council shall make a report of proceedings to the Institute, together with a financial statement

Five members of the Council shall constitute a quorum; but the Council may appoint an executive committee, business may be transacted at a regularly called meeting of the Council, at which less than a quorum is present, subject to the approval of a majority of the Council, subsequently given in writing to the Secretary and recorded by him with the minutes.

There shall be a meeting of the Council at every regular meeting of the Institute and at such other times as they determine.

IX.
ELECTION OF OFFICERS.

Any five members not in arrears, may nominate and present to the Secretary over their signatures, at least thirty days before the annual meeting, the names of such candidates as they may select for offices falling under the rules. The Council, or a committee thereof duly authorized for the purpose, may also make similar nominations. The assent of the nominees shall have been secured in all cases.

No less than two weeks prior to the annual meeting, the Secretary shall mail to all members not in arrears a list of all nominations made and the number of officers to be voted for in the form of a letter ballot. Each member may vote either by striking from or adding to the names upon the list, leaving names not exceeding in number the officers to be elected, or by preparing a new list, signing the ballot with his name, and either mailing it to the Secretary, or presenting it in person at the annual meeting.

In case nominations are not made thirty days prior to the date of the annual meeting for all the offices becoming vacant under the rules, nominations for such offices may be made at the said meeting by five members not in arrears, and an election held by a written or printed ballot.

The ballots in either case shall be received and examined by three tellers appointed at the annual meeting by the presiding officer; and the persons who shall have received the greatest number of votes for the several offices shall be declared elected. The ballot shall be destroyed, and a list of the elected officers, certified by the tellers, shall be preserved by the Secretary.

X.
MEETINGS.

The annual meeting of the Institute shall be held at such time as may be designated by the Council. The Institute may at a regular meeting select the place for holding the next regular meeting. If no place is selected by the Institute it shall be done by the Council.

Special meetings may be called whenever the Council may see fit; and the Secretary shall call a special meeting at the written request of twenty or more members. No other business shall be transacted at a special meeting than that for which it was called.

Notices of all meetings shall be mailed to all members at least thirty days in advance, with a statement of the business to be transacted, papers to be read, topics for discussion and excursions proposed.

No vote shall be taken at any meeting on any question not pertaining to the business of conducting the Institute.

Every question that shall properly come before any meeting of the Institute, shall be decided, unless otherwise provided for in these rules, by the votes of a majority of the members then present.

Any member may introduce a stranger to any regular meeting; but the latter shall not take part in the proceedings without the consent of the meeting.

XI.
PAPERS AND PUBLICATIONS.

Any member may read a paper at any regular meeting of the Institute, provided the same shall have been submitted to and approved by the Council, or a committee duly authorized by it for that purpose prior to such meeting. All papers shall become the property of the Institute on their acceptance, and with the discussion thereon, shall subsequently be published for distribution. The number, form and distribution of all publications shall be under the control of the Council.

The Institute is not, as a body, responsible for the statements of facts or opinion advanced in papers or discussions at its meetings, and it is understood, that papers and discussions should not include personalities, or matters relating to politics, or purely to trade.

XII.
SPECIAL COMMITTEES.

The Council is authorized to appoint from time to time special committees to consider and report upon, to the Institute through the Council, such subjects as changes in mining laws, safety devices, the securing and editing of papers on mining methods, definition of mining terms, affiliations with other societies, and such other subjects as the Council shall deem it desirable to inquire into, such reports not to be binding on the Institute except action is taken by the Institute in accordance with the rules, and the Council is authorized to expend not exceeding six hundred dollars in any one year to carry out the purpose of this section.

XIII.
AMENDMENTS.

These rules may be amended by a two-thirds vote taken by letter ballot in the same manner as is provided for the election of officers by letter ballot; Provided, That written notice of the proposed amendment shall have been given at a previous meeting.

PROCEEDINGS OF THE TWENTY-FIFTH ANNUAL MEETING.

Arrangements.

R. P. ZINN, Chairman
E. L. COCHRAN
A. J. CAYIA
D. E. SUTHERLAND
WALTER WEBB
O. M. SCHAUS

Finance.

F. J. JEPPESEN, Chairman
R. A. DOUGLAS
W. F. TRUETTNER
R. A. ANGST
H. B. HOOPER
ABE MATHEWS

Papers.

O. M. SCHAUS, Chairman
W. A. KNOLL
W. C. GILLIES
C. C. TAYLOR

Entertainment.

JULIAN RITCHIE, Chairman
J. M. PRICE
W. C. JANSEN
LEON CONE
F. LESSELYONG
B. C. HAYES
J. F. BERTELING
DR. G. F. COONS

Reception.

A. D. CHISHOLM, Chairman
ARTHUR GILBERT
W. H. BOEHME
FELIX CANNON
H. B. HOOPER
JOHN BERTELING
R. A. ANGST
R. A. DOUGLAS
D. E. SUTHERLAND
F. LESSELYONG
PAT O'DONNELL
W. F. TRUETTNER
BERT HAYES
O. M. SCHAUS

Automobiles.

HENRY ROWE, Chairman
W. C. JANSEN
HARRY BYRNE
W. L. TAYLOR
R. A. BOWEN

ITINERARY

Ironwood, Michigan, Wednesday, September 8th.

	Time
	A. M.
Registration at Elks' Club	8:00
Automobile trip to West end of Range	9:30
Buffet Lunch at Gogebic Country Club	12:00
	P. M.
Blind Bogey Golf Match at Gogebic Country Club ($10.00 prize) or Automobile trip to East end of Range	1:30
General Entertainment at Country Club	4:30
Banquet at Ironwood Memorial building	6:30

Evening Program—Ironwood.

Dinner will be served at the Memorial building at 6:30 (Central Time), Belmont Waples, toastmaster.

Following dinner, there will be short addresses by members and guests who may be called upon by the toastmaster.

A business session will follow immediately after the entertainment and the committees on nomination, and auditing will report during the meeting.

A band will furnish music during the evening session.

Train for Milwaukee will leave from the Chicago & Northwestern station at Ironwood at 10:00 P. M.

Special train, Ironwood to Milwaukee and return, September 8th, 9th 10th, 1923, Central Standard Time.

South bound, leaves 10:00 P. M. September 8th.

Arrives Milwaukee 7:00 A. M. September 9th.

Leaves Milwaukee 11:25 P. M. September 9th.

Arrives Ironwood 10:00 A. M. September 10th,

With optional route via Menominee, Marquette, Powers, Iron Mountain, Crystal Falls, Iron River and Ironwood.

Tickets good for returning on either route including Sunday night, September 12th.

Milwaukee, Wisconsin, Thursday, September 9th.

	Time
	A. M.
Special train arrive Milwaukee	7:00
Breakfast at Elks' Club	7:30
Busses will leave from Elks' Club for tour of the city promptly at	8:30
	P. M.
Halt will be made at Chenequa Country Club where a luncheon has been arranged for	12:30
A golf match has been arranged for the afternoon for such members of the party as would like to play golf.	
Busses will be furnished for such members of the party as would prefer to take a sight-seeing trip through the resort district.	
Busses taking care of both golfers and sight-seers will meet at the Milwaukee Athletic Club not later than	6:00
An evening meeting has been planned by the entertainment committee of the Milwaukee manufacturers at which time the regular business meeting of the Institute will be held, after which special trains will leave for Ironwood over either route promptly at	11:30

IRONWOOD, WEDNESDAY, SEPTEMBER 8TH.

The party assembled at the Elks' Club for registration. There were 150 members and guests in attendance. At 9:30 automobiles left for a trip to the west end of the range, stopping at the Montreal mine where nearly the entire forenoon was spent in visiting the new surface plant, some of the party making the trip underground. This property is operated by the Oglebay, Norton Company, of which E. W. Hopkins is general manager, and is one of the largest producers on the range. The mining methods and the surface plant are fully described in papers published in this volume.

Luncheon was served at the Gogebic Country Club after which a brief business meeting was held and committees appointed to report at the evening session. A golf match was arranged and would have proven a very interesting feature if the rain had not interrupted. Showers continued during the afternoon so that the players who ventured out received a thorough drenching and the golf scores were not officially announced. A number of the members went by automobiles to the east end of the range and visited mines at Bessemer and Wakefield. The remainder of the afternoon was spent at the club with a concert by the Ironwood City band, and several vocal selections by members.

Following is list of special committees appointed:

Committee on Nominations—S. R. Elliott, Marquette Range; George J. Eisele, Menominee Range; Francis J. Webb, Mesabi Range; H. I. Pearl, Cuyuna Range; O. M. Schaus, Gogebic Range.

Committee on Resolutions—W. O. Hotchkiss, Copper Range; W. H. Schacht, Copper Range; R. A. Angst, Gogebic Range; D. H. Campbell, Menominee Range; R. S. Archibald, Marquette Range.

Auditing: Committee—Lucien Eaton, Marquette Range; Abe Mathews, Gogebic Range; Benjamin C. Neely, Menominee Range.

EVENING SESSION.

The banquet was held at the new Memorial building at 6:3o, covers being laid for 225 guests. Musical numbers were rendered by the Red Jacket Orchestra and vocal selections by the Kiwanis Quartette. Mr. Swedeborg rendered a Swedish dialect story of his experience with Nels Flodin at a Minneapolis hall game.

President E. W. Hopkins presided at the business session and Belmont Waples, of Ironwood, acted as toastmaster. Following the dinner Mr. Hopkins opened the meeting with an address to the Institute members and guests.

PRESIDENTIAL ADDRESS.

Members of the Lake Superior Mining Institute and Guests:—We are again assembled on the Gogebic range for our annual meeting and the Gogebic range is proud to welcome you as their guests.

Thirty-four years ago, a small group of mining men from the Lake Superior district met at Ironwood and organized what is known as the Lake Superior Mining Institute. Since that time, five meetings have been held on this range, the last meeting previous to this one being eleven years ago.

I realized fully before this Institute was brought to this range that we had very little if anything new to show you. In the first place, due to the greatly improved methods of transportation, the members get about on the different ranges very frequently and, therefore, any new developments are known to nearly all of you as the work progresses. Although our mines have

shown vast improvements in the past eleven years, both on surface and underground, have realize that these advancements or improvements are only comparable with the mines of other ranges. Therefore, in view of the fact of our not being able to show you anything new, we will have to ask you to take the will for the deed and permit us to rely on our ability to entertain you rather than to interest you in any new mining operations.

Our meeting this evening will necessarily be rather short and snappy due to the fact that we have accepted an invitation from the citizens of Milwaukee, Wisconsin, to visit them, and they have arranged to give us a full day of sight-seeing and entertainment. In order to arrive in Milwaukee in sufficient time to give them an opportunity to work out their program, our train has been scheduled to leave here promptly at ten o'clock which will necessitate our closing this meeting not later than 9:15 which will give us 45 minutes to get our baggage together and get aboard the train.

I am indeed very glad to see so many in attendance at this time as I appreciate that the people from outside of the Gogebic range are probably as busy as we are and, therefore, it requires quite a considerable sacrifice of time to pick up and go to these meetings at this time of the year. In addition to that we have had such very bad weather for the past week that it has been somewhat difficult to count on weather which would make driving from one range to another a pleasure. Due to our lack of time, I will now turn this meeting over to Mr. Belmont Waples, our toastmaster.

TOASTMASTER: I join with your President in the welcome to our city and am sorry that the weather has interfered with your comfort in visiting our mines and looking over our splendid city. It gives me great pleasure to introduce to you our Mayor, J. B. Patrick, who will welcome you m behalf of the citizens of Ironwood.

MAYOR PATRICK: Members of the Lake Superior Mining Institute—It affords me unusual pleasure on behalf of the City Commission of Ironwood and the citizens of this community to bid you a hearty welcome and to extend to you our very best wishes.

We feel honored that you have selected Ironwood, the metropolis of the Upper Peninsula, as the city in which to hold your 25th annual meeting. We citizens of Ironwood are proud of our city. We regret that our welcome has been so wet,—so very wet that we cannot show you our city to its best advantage.

We have confidence in our future. In the twenty-four years of my residence here, Ironwood has enjoyed a consistent, year in and year out, prosperity. Mining a high grade ore that is always in demand, our mines, employing a high class of efficient labor, have worked steadily without interruption, all of which has contributed to the substantial development of our city. Quite a furor was created a year or so ago when a visiting expert expressed his belief that the life of the local mines was extremely brief, which carried with it the idea that the end was in sight and that we might as well begin to close up shop and get out. This naturally tended to throw a scare into a few, but generally speaking, our citizens have refused to become excited. To corroborate the faith which local people have manifested in the community by spending their money in good buildings and improvements, two events of importance have occurred. First, the Kresge company has signed a 50-year lease on a local business block and will open a store here as soon as possession can be obtained. Here is a nationally known chain-store organization which is satisfied that Ironwood's future warrants the signing of a lease for half a century, a lease which gives the company permission to erect a new building on the site. This is score one for the business conditions here. Secondly, one week ago announcement was made that iron ore of high quality had been found at a depth of 3,100 feet at the Davis mine of the Oliver Iron Mining Company. The finding of the ore was not so important perhaps as was the fact that it was found at a depth heretofore unexplored on this range, which marks a new epoch in mining in this locality and will renew the faith that mining will be continued here for many years to come.

Again I extend to you the courtesies of the city and trust that you will visit us whenever the occasion offers.

Our welcome is genuine and our hospitality is sincere.

William Kelly, of Iron Mountain, a charter member, and past-President of this Institute and of the American Institute of Mining & Metallurgical Engineers, responded to Mayor Patrick.

MR. KELLY: Mr. Toastmaster, Mr. Mayor, Mr. President and Gentlemen of the Lake Superior Mining Institute:

I feel that it is a great honor to be asked to respond to the speech of welcome. My only regret is that it may prevent us from hearing from some two hundred others who would a great deal rather speak than I and who can undoubtedly express our sentiments better than I can. However, as a candidate for the position of the oldest living graduate of the Institute I feel that it is my duty to respond.

We have had an enjoyable day and it recalls to me many other days that we as an Institute have had here in Ironwood. I do not wish to dwell on ancient history. However, I cannot but recall one of our meetings here when we had a notable trial. Perhaps there are not many here who were present on that occasion when our dear friend Fred Prescott was charged with a terrible crime and the judge on that occasion was dear old Graham Pope. Then there was the most delightful trip on Chequamagon Bay on one occasion, and on another we came here from the different parts of the Lake Superior country by rail, and some of us were compelled to come from the Menominee range on that wonderful and noted train known as "The Cordwood Limited." As I thought at that time and as I now recall it, it took a week to come from that range to Ironwood. From here we went down to Milwaukee, as most of you gentlemen are going to do tonight, and I have no doubt you will enjoy that as much as we did. Then there was another occasion when we gathered here and went down to Gary, Indiana, inspected a lot of steel works and mills of one kind or another, and ended up in the evening in Chicago where we saw the pictures of a notable fight for which presentation some of those who were sponsors with difficulty escaped jail.

We have today been enjoying the occasion. We have had some water from the skies, but in certain places that has been diluted. At other times the sun has shone. So we will carry away with us again the recollection of more recent pleasures together with pleasant memories of the past with the feeling; that Ironwood is a most delightful place to visit.

TOASTMASTER: I am greatly pleased to next call upon a gentleman who is well known to you all by his many years of association with you on the various ranges, but who has only recently taken up his residence in the Lake Superior country, Dr. W. O. Hotchkiss, President of the Michigan College of Mines.

MR. HOTCHKISS: Mr. Toastmaster—I thought by reading the resolutions which the resolution committee prepared I had done my duty in speaking to you tonight, but I have discovered in my short time up at Houghton that all kinds of bodies delight in picking on a college president, and this Institute I see is no different from the rest. I was taken completely by surprise and am at a loss for something to say. I think I will tell you a story which I know a few of you have heard, but it is perhaps appropriate to this occasion.

A college president one time was called upon to make a speech and he got up and said that he had heard a story recently defining a gentleman. He said that a gentleman under that definition was a man who could play the cornet and refrained from doing so. He stated that he was going to change that definition a little and that his definition of a gentleman was a college president who had an opportunity to make a speech and refrained from doing so. So I am not going to make a speech.

Before I take my seat however, I want to say a few words on the importance of keeping the annual volume of this Institute a complete record of the developments of the mining industry in the Lake Superior region.

In an old district like this we are using ideas and methods developed by long experience and are profiting by them. Some of these ideas were brought from Cornwall, others from South Africa and other districts. We owe it to the industry to return to it the new ideas and practices which we develop. The young men in the industry particularly owe it to themselves and their profession to present papers embodying the results of their work. Yet the tendency of young men is to leave the preparation of such papers to the older men to whom they look as guides and directors of their work. The older men are frequently too busy with administrative affairs to do this. So I want to urge on the younger members the need of giving serious consideration to presenting papers.

TOASTMASTER: We have not heard from the Minnesota Ranges and as we have with us a past-President from that district I am pleased to call on Francis J. Webb, of Duluth.

MR. WEBB: Mr. Toastmaster and Gentlemen—We are here and it is good to be here. It is good to meet again with the members of the Institute and to see our friend Brother Kelly and other charter members. I have no speech to make to you, but I just want to do one thing, I want to propose a toast to one of the greatest mining men, one of the finest gentlemen and one of the most loyal friends that any of us has ever known—M. M. Duncan.

All rose in honor of this toast.

REPORT OF THE COUNCIL.

SECRETARY: On behalf of the Institute I wish to thank the members of the Gogebic range and the several committees for their efforts in providing the interesting program planned for this meeting. I find the committees include some of your citizens who are not members and we extend our thanks to them all for their fine spirit of cooperation.

We are celebrating the 34th anniversary of our organization which was founded in the City of Ironwood on February 2nd, 1893, and formally organized at Iron Mountain on March 22nd, 1893. We are happy in still having in our membership many of those who attended the first meeting and note with deep sorrow those who have ended their labor and gone to their reward in the great beyond.

We have lost many members since the meeting- of 1917—since which time we have not held our meetings as regularly as before, due mainly to the time being taken up in war work, with the Red Cross, Liberty Loans and other endeavors as was required and to which all responded so nobly. During the past four years we have again increased our number and in another year or two we expect it will be back to that of the former membership. To this end we wish to give our best efforts. There are new men coming into our district as mine superintendents, engineers, mechanics, electricians, etc., and all of them should become affiliated with our organization. It is up to the members to see that they are extended a cordial invitation to join the Institute and to share in its activities.

We have a great many interesting papers prepared for this meeting and much credit is due the committee having these in charge. We wish to extend the thanks of the members to the authors for the great care in the preparation and selection of subjects. We notice from time to time that articles are published in mining magazines on subjects pertaining to this district. This is very commendable and we would ask that such material be furnished to the Institute for publication in our Proceedings where it will be available and in convenient form for future reference. You will be interested to know that a complete set of proceedings was recently purchased for the Mining Institute of Soviet Russia and that Dr. Sheviakoff, professor of mining engineering, has become a member. There are other instances quite as interesting. In this connection, I will say that the Council has authorized a reduction in the price of some of the back volumes and members desiring to complete their sets will be able to do so at the reduced prices.

You will find by examining your financial report that the present dues of $5.00 per year are not quite adequate to meet the expenditures for publication, office expenses, etc. However, the interest on our investments and the contributions have more than made up the deficit. It has not been the custom to charge dues in years when no meetings are held. We see no good reason for changing this practice more especially as we have resumed our annual meetings and show an increase in membership. In closing, I wish personally to thank the officers and members for their hearty cooperation and with their continued help we know the Institute will merit the approval of the men responsible for its organization here in Ironwood, 34 years ago.

LIST OF PROPOSALS FOR MEMBERSHIP.

The following proposals were acted upon by the Council and recommended for election to membership:

Angst, R. A., General Superintendent, The Montreal Mining Company, Montreal, Wis.

Atkins, Samuel E., President, S. E. Atkins Co., 710 Alworth Bldg., Duluth, Minn.

Boehme, W. F., Proprietor, New St. James Hotel, Ironwood, Mich.

Carey, Eugene, Superintendent, Bates Iron Co. (M. A. Hanna Co.), Iron River, Mich.

Carney, Thomas A., General Agent, Chicago & Northwestern Railway Co., Escanaba, Mich.

Cone, Leon J., Salesman, Sullivan Machinery Co., 120 Pewabic St., Ironwood, Mich.

Crane, W. R., Mining Engineer, U. S. Bureau of Mines, College of Mines, Houghton, Mich.

Edwards, Guy B., Civil Engineer, Oglebay-Norton & Co., Ironwood, Mich.

Gillies, Donald B., Vice President, The McKinney Steel Co., 3100 East 45th St., Cleveland, Ohio.

Gillis, W. C, Mining Engineer, McKinney Steel Company, Bessemer, Mich.

Goelser, George W., Field Inspector, Northwest Engineering Co., 1320 Elue St., Green Bay, Wis.

Grigg, John, Mining Captain, Newport Mining Co., Ironwood, Mich.

Hooper, H, B., Manager, J. C. Penney Co., Ironwood, Mich.

Hyde. Joseph L., Mine Timber Department, Cleveland-Cliffs Iron Co., Ishpeming, Mich.

Johnson, Carl F., Mining Engineer, Pickands Mather Co., Bessemer, Mich.

Kauper, William P., District Manager, Northwest Engineering Co., 845 69th Ave., West Allis, Wis.

Kerr, Ralph C., Division Freight and Passenger Agent, Chicago & Northwestern Railway Co., Green Bay, Wis.

King, Robert, Mining Superintendent, Hayes Mining Co., Ironwood, Mich.

Lesselyong, Frank H., President, Lesselyong Hardware Co., 228 West Ayer St., Ironwood, Mich.

Lizee, Albert J., Assistant General Superintendent, A. Guthrie & Co., Inc., Calumet, Minn.

Kern, Fred T., 650 Lawton Place, Milwaukee, Wis.

Mahon, R. C., Superintendent, Buffalo Iron Mining Co., Iron River, Mich.

Manderfield, Nicholas H., Assistant Professor, Metallurgy & Ore Dressing, Michigan College of Mines, Houghton, Mich.

Marks, John Edwin, Mining Geologist, Hennepin Mining Co., Ltd., 213 Park St., Port Arthur, Ontario, Can.

Massie, E. W., Attorney, Ironwood, Mich.

Moore, H. C., District Sales Manager, Swedish Charcoal Steels, Inc., 1140 West Washington Blvd., Chicago, Ill.

Nickel, Peter J., General Contractor & Builder, P. J. Nickel Co., Ironwood, Mich.

O'Connor, Edward S., Superintendent, Youngstown Sheet & Tube Co., Mayville, Wis.

O'Neill, J. B., Utility, Lake Superior District Power Co., Ironwood, Mich.

Perry, Frederick C, Electrical Engineer, Westinghouse Electric & Manufacturing Co., 408 Bradley Bldg., Duluth, Minn.

Price John M., Superintendent, The Castile Mining Co., Ramsay, Mich.

Quirt, Howard A., Editor, Ironwood Daily Globe, Globe Publishing Co., Ironwood, Mich.

Rohn, Alvin W., General Manager, Donner Mining Co., Box 1372, Hibbing, Minn.

Sampson, John, Ore Dock Agent, Chicago & Northwestern Railway Co., Ashland, Wis.

Schaus, Oliver M., Assistant Range Manager, Oglebay, Norton & Co., Ironwood, Mich.

Scofield, Lloyd M., Mining Engineer, Pickands, Mather Co., 742 East Ayer St., Ironwood, Mich.

Sherwood, Geo. A., Assistant General Freight Agent, Soo Line, Duluth, Minn.

Skillings, David N., Skillings' Mining Review, 319 Bradley Bldg., Duluth, Minn.

Stirne, Maximillian M., Chemist, The Sterling Materials Co., 1819 Broadway, New York City.

Sweet, Andrew T., Metallurgist, Michigan College of Mines, Houghton, Mich.

Taylor, Carroll C., Fee Owners Representative, Keweenaw Land Association, Ironwood, Mich.

Tolonen, Frank J., Research Engineer Iron Investigation, Michigan College of Mines, Houghton, Mich.

Vivian, Harry, Chief Engineer, Calumet & Hecla Consolidated, Calumet, Mich.

Zinn, R. P., Superintendent, Newport & Gary Mines, Pickands, Mather Co., Ironwood, Mich.

The report was on motion adopted and the Secretary instructed to cast the ballot for the election of the applicants to membership.

Secretary's Report of Receipts and Disbursements from August 15th, 1925 to September 1st, 1926.

Receipts—			
Cash on hand August 14th, 1925			$ 9,811.88
Entrance fees, 1925-1926	$ 120.00		
Annual dues, 1925-1926	1,320.00		
Entrance fees, 1923-1924	5.00		
Dues, 1924-1925	95.00		
Dues, 1922-1923	5.00		
Advance entrance fees, 1926-1927	25.00		
Advance dues, 1926-1927	45.00		
Advance dues, 1927-1928	5.00		
Sales of Proceedings	159.40		
Sale of badges	7.00		
From Marquette range committee	523.33		
Total secretary's receipts		$2,309.73	
Interest on bonds and deposits		893.79	
Total receipts			3,203.52
Total on hand and receipts			$13,015.40
Disbursements—			
Stationery and printing	$ 155.70		
Postage	108.68		
Freight and express	7.58		
Telephone and telegraph	12.11		
Secretary's salary and expenses	569.00		
Total office expenses		$ 853.07	
Photos, maps, cuts, etc.	$ 110.97		
Publishing bulletins, papers, etc.	345.00		
Publishing proceedings	1,546.25		
Badges	68.45		
Publications	3.00		
Total publishing		2,073.67	
Total disbursements (vouchers No. 1 to 28 inclusive)			2,926.74
Balance on hand			$10,088.66
Grand total			$13,015.40

Treasurer's Report as of September 2nd, 1926.

Balance on hand, August 14th, 1925		$ 9,811.88
Remittance from secretary	$2,309.73	
Interest on bonds and deposits	893.79	
Total receipts		3,203.52
Total balance and receipts		$13,015.40
Disbursements for secretary's vouchers		2,926.74
Treasurer's balance		$10,088.66
Bank balance, September 2nd, 1926	$ 531.88	
Less drafts outstanding	82.72	
Treasurer's cash balance		449.16
Pennsylvania Railway bonds (par $3,000.00)		3,369.67
Youngstown Sheet & Tube Co. bonds (par $5,000.00)		4,883.33
Certificate of Deposit, No. 77		1,386.50
Total balance cash and bonds, September 2nd, 1926		$10,088.66

List of Bonds Held by Treasurer.

Bond	Amount	Rate	Number	Interest Payable	Maturity
The Pennsylvania Railroad Co.	$1,000.00	6½%	M 2400	Feb. & Aug.	Feb. 1, 1936
The Pennsylvania Railroad Co.	$1,000.00	6½%	M 2401	Feb. & Aug.	Feb. 1, 1936
The Pennsylvania Railroad Co.	$1,000.00	6½%	M 2402	Feb. & Aug.	Feb. 1, 1936
Youngstown Sheet & Tube Co.	$1,000.00	6 %	M25746	Jan. & July	July 1, 1943
Youngstown Sheet & Tube Co.	$1,000.00	6 %	M25747	Jan. & July	July 1, 1943
Youngstown Sheet & Tube Co.	$1,000.00	6 %	M25748	Jan. & July	July 1, 1943
Youngstown Sheet & Tube Co.	$1,000.00	6 %	M25749	Jan. & July	July 1, 1943
Youngstown Sheet & Tube Co.	$1,000.00	6 %	M25750	Jan. & July	July 1, 1943
Total bonds	$8,000.00				
Certificate of Deposit	$1,386.50	3 %	77		
Grand total	$9,886.50				

I hereby certify that I have audited the books of the Secretary of The Lake Superior Mining Institute for the fiscal year from August 15th, 1925 to September 1st, 1926, and found the same correct in accordance with report attached, and the following; summary:

Cash receipts	$3,203.52
Cash disbursements	2,926.74
Net cash receipts	$ 276.78
Remitted to treasurer	$3,203.52

Have also checked the postings of cash received with the membership book.

E. E. REIDINGER.

The Council took no action on the time and place for the next annual meeting, and this will be decided at a later date.

The Council appropriated the sum of $750.00 for salaries and expenses of the Secretary's office for the ensuing year. The report of the Council was on motion adopted.

REPORT OF AUDITING COMMITTEE.

Your committee have examined the report of the Secretary showing receipts and disbursements from August 15th, 1925 to September 1st, 1926, as certified by the auditor. Also the report of the Treasurer for the same period and recommend the adoption of the reports as presented by the Secretary.

L. EATON, Chairman,
BENJ. C. NEELY,
ABE MATTHEWS,
Committee.

REPORT OF COMMITTEE ON NOMINATION.

Ironwood, Mich., September 8th, 1926.

Your Committee on Nomination beg leave to submit the folowing officers of the Institute for terms specified:

For President (one year)—
CHARLES H. BAXTER ..... Loretto, Mich.
For Vice Presidents (two years)—
GEORGE J. EISELE ..... Iron Mountain, Mich.
HARRY VIVIAN ..... Calumet, Mich.
For Managers (two years)—
FRANK J. SMITH ..... Crystal Falls, Mich.
HOLMAN I. PEARL ..... Crosby, Minn.
FRANK H. COHOE ..... Hibbing, Minn.
For Treasurer (one year)—
JOHN E. NELSON ..... Negaunee, Mich.
For Secretary (one year)—
A. J. YUNGBLUTH ..... Ishpeming, Mich.

S. R. ELLIOTT, Chairman,
GEORGE J. EISELE,
F. J. WEBB,
H. I. PEARL,
O. M. SCHAUS,
Committee.

The report of the nominating committee was on motion accepted and the secretary instructed to cast the ballot for their election. Motion carried and officers declared duly elected.

REPORT OF COMMITTEE ON RESOLUTIONS.

The Committee on Resolutions presented the following report:

1—Resolved that we extend to the President and members of the Council our thanks for their interest and their untiring efforts in behalf of this organization during the past year, and to A. J. Yungbluth, Secretary, who has completed twenty-five years of attentive and faithful service to the Institute, our deep appreciation for his untiring efforts and interest in again placing this organization on a strong and financial basis.

2—Resolved that we express to the local committees our sincere thanks for the arrangements made by them for our comfort and pleasure while at Ironwood and in its vicinity and that we also express our appreciation to the Gogebic Range mining companies who entertained us and extended to us their courtesy, and to the Mayor and Citizens of Ironwood, the Elks' Club, the Gogebic Country Club and also to Henry Rowe and his committee on transportation for the excellent facilities furnished in automobile service while in Ironwood.

3—Resolved that we record our thanks for the courtesies extended to us by the Mayor and Citizens of Milwaukee, to the Manufacturers who arranged for our entertainment and to the Elks' Club, the Milwaukee Athletic Club and the Chenequa Country Club for the facilities extended to us while in their city.

4—Resolved that we also express our gratitude to the Railroad Companies and their employes for their attention and courteous handling of the Institute and its guests.

5—Be it further resolved that we note with profound sorrow the loss of those members who have passed beyond and commend their achievements and their memory as an inspiration in our future efforts.,

W. O. HOTCHKISS, Chairman,
W. H. SCHACHT,
R. A. ANGST,
D. H. CAMPBELL,
R. S. ARCHIBALD,
Committee.

Mr. Baxter, the newly elected President, received the congratulations of the members, to which he responded in part as follows:

MR. BAXTER: Mr. President and Members of the Institute—I deeply appreciate the honor that you have conferred upon me in electing me your president for the coming year, and I realize the responsibility. I hope that next year you will all come to the Menominee Range and help us put on a successful meeting. My friends of the Menominee Range will give you a cordial welcome.

This Institute has for over thirty years been a vital factor in the development of the Lake Superior mining' district, in welding this great region including three States and extending from the Cuyuna Range on the west to the Marquette Range on the east, and from the Vermilion and Copper Ranges on the north to the Menominee Range on the South, with its great variety of mining problems, into one great unit. Our meetings bring together the operators and the representatives of manufacturers serving the district, foster friendships, and broaden our outlook. Our proceedings are a record of the development of the district and are most valuable to the industry, not only within the district, but to the mining industry at large.

Dr. Hotchkiss has spoken of the importance of our proceedings and emphasised the value of contributions from the younger members. I also want to urge the young men in the profession to become members of the Institute and present the results of their work for our publications, and to urge our members to present the importance of this to the younger members. The future of the industry is in their hands; it will be what they make it; the part they take in it is up to them, and the publishing of the results of their work will be beneficial both to them and to the industry.

Many new practices are of slow development, no one individual is wholly responsible, and without our realizing it the entire method of performing a certain operation changes. These changes should be made a matter of record and this can best be done by one who has had an intimate part in it, even though that part may have been small.

I hope that we may during the coming year add to our membership a large percentage of those in the industry who are not now members, and that our Proceedings will be so full of the new developments in the district that we can feel that we have gone a long way toward filling up the gaps and making them a complete record of the development of the mining industry of the Lake Superior region. I will do everything I can to bring this about and ask you to co-operate with me.

The following list of papers was presented:

"The Gogebic Iron Ore Range"—By C. C. Taylor.

"Standard Maps Used by Pickands, Mather & Co. on Gogebic Range"—By H. W. Johnson.

"Further Data on the Correlation of the Cuyuna Iron-Bearing Member"—By Carl Zapffe.

"Drifting at Odgers and Tobin Mines"—By E. J. Oswald.

"New Installations at Ironton Mine"—By M. L. Dezendorf.

"Mine Ventilation With Flexible Tubing"—By F. W. Hotchkiss.

"The Montreal Mining Company's No. 5 Shaft Surface Layout"—By L E. Dick.

"Transportation of Lake Superior Iron Ores from Mines to Furnaces" —By John Sampson.

"The New Employee"—By Lee Wilcox.

"The New Cascade Tunnel for the Great Northern Railway"—By J. C. Baxter.

"Notes on Mining the North Palms Orebody"—By J. F. Berteling.

"Shaft Sinking at the Eureka Mine"—By A. L. Foss and J. M. Flanagan.

"Mining Method of the Montreal Mining Company"—By R. A. Bowen.

"The Gogebic Range Mines of the Oliver Iron Mining Company"—By Byron G. Best.

"Mining Methods of the Castile Mining Company"—By C. H. Funkey.

"Reducing Secondary Shooting by the Primary Blast"—By C. D. Peacock.

"The Mining of Fluorspar and Its Uses"—By C. M. Fellman.

"Research Work at Michigan College of Mines"—By Dr. W. O. Hotchkiss.

"Montreal Mining Company Grading Ore at Soo Dock, Ashland"—By W. H. McDonell.

"Minnesota Sintering Company—Ironton Plant"—By Clyde M. Pearce.

Other papers are being prepared for which titles have not been selected.

MILWAUKEE, WISCONSIN, THURSDAY, SEPTEMBER 8TH.

COMMITTEE.

W. F. Kinsella, Chairman—Worden-Allen Company.
H. W. Dow—Nordberg Manufacturing Company.
Harry Balding—Allis-Chalmers Manufacturing Company.
C. R. Messinger—Chain Belt Company.
C. S. Smith—Smith Engineering Company.
John Miller—Bucyrus Company.
J. U. Heuser—Cutler-Hammer Manufacturing Company.

The "Institute Special" arrived at the Northwestern Station at 7:15 a. m. The committee of the Manufacturers' Association and a delegation of friends joined the party and escorted them to the Elks' Club, where a substantial breakfast had been prepared. Dr. H, Foster Bain, secretary of the American Institute of Mining and Metallurgical Engineers spent the day with the Institute party. Dr. Bain was en route to the meeting of the Colorado Section of the A. I. M. M. E. at the Western States Convention held at Denver, September 22nd. Several of the Milwaukee and Chicago members who could not attend the meeting at Ironwood joined us at the Club. After breakfast the party proceeded by automobiles for a drive through the city.

The first stop was at the plant of the A. O. Smith Corporation, where considerable time was spent. This company builds automobile frames for many of the large

manufacturers. The operation is automatic and continuous from the time the strips of steel enter the first press until the frames are completed. This visit was an addition to the regular itinerary and arranged through the courtesy of L. R. Smith, president of the corporation.

Luncheon was served at the Chenequa Country Club at one o'clock, after which some of the members enjoyed a game of golf with their Milwaukee friends and several spirited matches were played. Others of the party continued the tour of inspection, visiting the plants of Allis-Chalmers, Worden-Allen, Nordberg, Cutler-Hammer, Bucyrus, Chain Belt, and the Smith Engineering Works, which took up the entire afternoon. The weather was perfect and the trip most enjoyable. A .brief description of the city and the plants visited is given elsewhere.

Promptly at 6:30 the party gathered at the Milwaukee Athletic Club, where dinner was served. There were over two hundred present, including the members of the Manufacturers' Association who were the hosts for the occasion and were ably represented by Mr. Kinsella, chairman. The menu was carefully planned, the committee being mindful of the strenuous work they had laid out for the members in their tour over the city.

Following the dinner, the chairman, Mr. Kinsella, after a brief address on behalf of his committee, introduced Harry J. Bell, Executive Secretary of the Milwaukee Association of Commerce, who extended to the Institute a most cordial welcome. Mr. Bell spoke in part as follows:

MR. BELL: The request made of me was that I deliver an address of welcome before your dinner meeting. Some times such addresses are empty, hollow expressions, but here is an instance where we should like to have you feel the genuine sincerity and the warmth of the welcome that Milwaukee extends to you on this occasion. This welcome is extended not only on behalf of the Association of Commerce but in the name of the City and particularly as to the seven Milwaukee manufacturers which are your hosts on this occasion and the many other companies which would be glad of an opportunity likewise to express cordiality.

It is a particularly happy arrangement that the Lake Superior Mining Institute has come here following its business sessions in Ironwood because you have had opportunity to see certain of our industries and to appreciate better the beautiful city that we have and to realize its importance as the metropolis of Wisconsin. You must understand, too, that we appreciate to the full the tremendous natural resources of the Lake Superior mining region and their overwhelming importance to the United States and, for that matter, to the world.

"We believe that you and we have many interests in common. You produce, as raw material the iron and copper which Milwaukee industries use in large volume, while Milwaukee leads the country in the manufacture of steam shovels, air compressors, hoisting machinery and other products which you in turn use extensively. Milwaukee has a greater diversity of manufacture than any city in the world; Milwaukee rock and ore crushers are the most widely distributed in the world and its electrical apparatus is used in a larger number of plants than is the case with any other city.

LAKE SUPERIOR
MINING INSTITUTE
TWENTY-FIFTH ANNUAL
CONVENTION DINNER

MILWAUKEE ATHLETIC CLUB
Thursday, September 9th, 1926
6:30 P. M.
Milwaukee, Wisconsin

This dinner is tendered to the Lake Superior Mining Institute by the following Milwaukee manufacturers:

Allis-Chalmers Mfg. Co.
Bucyrus Company
Chain Belt Company
Cutler-Hammer Mfg. Co.
Nordberg Mfg. Co.
Smith Engineering Works
Worden-Allen Co.

MENU

Shrimp Cocktail
Celery Salted Nuts Olives

Consomme, Brunoise

Filet Mignon, Mushrooms
Special Baked Potato
New Peas in Cream

Panama Salad

Cantaloupe a la Mode

Coffee

Milwaukee leads the nation in the manufacture of silk hosiery, has the largest producer of toilet soaps in the United States and is ahead of all other cities in the manufacture of work shoes.

Wisconsin is the greatest dairy state in the union and is the summer recreation center of the nation. In short, the city and the state are in the forefront in so many respects that you might accuse us of boasting if we attempted to outline all of the virtues of this great commonwealth and its metropolis city.

You men in the mining industry have occasion to be proud of your profession because the world needs steel and copper and you have an important part in their production; and just so we are proud of Milwaukee and its Association of Commerce which, with its nearly two thousand members and six hundred committee men serving in voluntary capacity, constitutes the business clearing house of this remarkable industrial district.

The Association of Commerce, through its Transportation, Better Business, Convention, Retail and other departments, stands ready and willing to serve you in every consistent manner. You will be interested especially in the fact that our Safety Division through its Foremen's Safety School. First Aid School and Fire Prevention School, reaches every year approximately nine thousand foremen and other supervisors; and that its ramifications are such as to interest and instruct directly or indirectly fully seventy-five per cent of the industrially employed population of Milwaukee County in accident prevention and related problems.

The important thing is that you and we recognize the mutuality of interest that we have in the promotion of your business and your success and ours. Thus we will be able together to provide the greatest possible service. And after all there is nothing better or finer than service—unless it be cooperation; and if you question the value of cooperation, then think for a moment of what happens to a wagon if one wheel comes off!

E. W. Hopkins, Ironwood, Mich., President of the Institute, responded on 'behalf of the members.

MR. HOPKINS: I wish to voice the vote of thanks of the members of the Lake Superior Mining Institute to the members of the Chamber pf Commerce of Milwaukee and Mr. William Kinsella and his committees for the very wonderful entertainment which you have given us during our stay in Milwaukee.

A number of the older members remember a meeting which we had in Milwaukee in 1904, at which time the banquet was held at the old Plankington House and I am sure we all had a wonderful reception at that time and, therefore, we have all had a warm spot in our hearts for Milwaukee. I am sure that we will all benefit from these meetings as they bring us closer in touch with each other who are in a large measure employed in industries which have interests in common. Therefore, I again wish to thank you very sincerely for all of the good things which have been furnished us during our stay in Milwaukee.

Many other speakers responded, as called upon by the chairman, during the evening. A splendid musical program was rendered by the orchestra and also a number of vocal selections by local artists.

There is a wide circle of acquaintances among the manufacturers of Milwaukee and the Institute members and many warm personal friendships have developed. The products of Milwaukee factories may be found in nearly every mine and mill in the Lake Superior district. The party remained at the Club until the time of departure of the trains for the north country.

The visit to Milwaukee was very enjoyable and will long be remembered.

MILWAUKEE, WISCONSIN.

Many generations ago, before the fathers of this country anticipated the establishment of an independent sovereign, there existed in the New World on the west bank of a mighty lake near the mouths of three rivers, a thriving Indian village with inhabitants from several great tribes.

The spot was famed far and wide for its scenic beauty and fertile soil. Because of this fact Marquette, Joilet, de la Salle, Nicolet—those dauntless explorers of the unknown territory about this mighty lake, came to that spot to rest from their arduous labors. These fearless men found happy groups of natives living in well-made tepees and huts surrounded by corn and other products of the soil. They learned that the Indians had named the spot "Mahn-awau-kie." The explorers learned that this name meant "good lands."

With the passage of years and the advent of the white men, the location retained its attractiveness. The Indian name of the place—Mahn-awau-kie—-gradually became known as Milwaukee. With the close of the Black Hawk War in 1832, there was a steady influx of white settlers. Milwaukee was incorporated as a village, January 16, 1838, and eight years later a city charter was granted. Solomon Juneau was the first mayor.

The pioneers early capitalized the wonderful natural advantages of its situation for development of industry and commerce. Before 1842 there were two tanneries, two breweries and an iron foundry located in the city. Industry, commerce, social life and population kept pace with the progress of time. The population at that time of Milwaukee's incorporation was 500.

From that small beginning, less than 80 years ago, Milwaukee steadily has grown in commerce, industry and population. Today it boasts of a population of nearly 600,000 inhabitants and stands as one of the leading industrial cities of the country.

Milwaukee has about thirty-five diversified industries and some of them are the largest in the world; while in other classes Milwaukee ranks second and third. The following table is, of course, of considerable interest:

Industries—	Value of Product
Metal trades	$325,985,094
Food	132,915,170
Textile	69,841,431
Leather	65,270,946
Chemical	60,289,786
Wood products	52,371,133
Building trades	34,314,592
Various industries	46,436,859
Total manufacturing	$787,425,011
Jobbing and wholesale business	182,456,871
Grand total	$969,881,882

While Milwaukee has taken a commanding position as an industrial community, it has not neglected the beautiful and spiritual sides of existence. Unlike many industrial cities of the country, Milwaukee is likewise noted for its beautiful parks, boulevards and homes. With Lake Michigan at its feet, few American cities surpass Milwaukee in beautiful scenery and healthful climate. The Milwaukee bay has been called frequently the American Bay of Naples.

ALLIS-CHALMERS MANUFACTURING COMPANY.

The Allis-Chalmers Manufacturing Company is one of the largest builders of heavy machinery. From the two plants of this company, one at Milwaukee, Wisconsin, where the various lines of heavy power, electrical and industrial machinery are built, and the other at Norwood, Ohio (a suburb of Cincinnati), manufacturing motors and smaller electrical apparatus, shipments are made to practically every country in the world.

The West Allis Works at Milwaukee, which is one of the plants to be visited during the trip of the Institute to that city, is notable as being the largest industrial plant in Wisconsin and one of the largest heavy machinery plants in the world. Occupying 153 acres, the plant has a floor area considerably in excess of two and a half million square feet.

The company and its predecessors, covering a period of nearly eighty years, have been pioneers and recognized leaders in the manufacture of many important lines of equipment.

Among the outstanding equipment now under construction at the West Allis Works are two 260-in. Superior McCully Gyratory Crushers for the Chile Exploration Plant of Anaconda. These crushers have 60-in. by 150-in. openings, are built almost entirely of steel and weigh almost a million pounds each. In addition to their unusual size and heavy construction they are sectionalized for transportation over a narrow gauge, railroad.

Large hoisting equipment for the Mountain Consolidation Shaft of the Anaconda Company are nearing completion. The double-drum hoist, which will be driven by a 2,000-hp. motor is the largest double-drum unit ever constructed by one manufacturer.

A 7,000-hp., 50-120 r.p.m. Reversing Blooming Mill Motor with flywheel motor-generator set is being set up for test.

Parts for a 50,000 kw. Steam Turbine and Alternator Unit are now going through in the machine shop.

BUCYRUS COMPANY, SOUTH MILWAUKEE PLANT.

The Bucyrus Company, the largest builder of excavating machinery in the world and that which has been continuously building excavating machinery longer than any other manufacturer, operates two plants—a plant devoted exclusively to the manufacture of small revolving shovels and draglines, located at Evansville, Indiana, and the main plant at South Milwaukee, Wisconsin.

At South Milwaukee the company builds large revolving shovels and draglines for mining and stripping, heavy duty revolving shovels for mining, quarrying and heavy excavation, railroad-type shovels, dipper, hydraulic, elevator and placer dredges, railway cranes, unloading plows and spreader plows.

The plant at South Milwaukee occupies 24 acres, 9½ acres of which are covered with buildings. The number of men employed is approximately 1,600.

The shops include Pattern, Carpenter, Brass, Iron and Steel Foundries; Blacksmith, Structural, Machine and Erecting, as well as Power House, Store Rooms, Paint Shops, Offices, etc.

One interesting feature of this company is the Bucyrus Club, operated by the employes and containing dining room, recreation rooms, bowling alleys, gymnasium, tennis courts, etc.

CHAIN BELT COMPANY.

The Chain Belt Company is one of the largest manufacturers in the country of chain, conveyors and concrete mixers. Its products are widely known under the trade name REX and the company does an international business.

Two plants employing 1,200 men are operated, one located just off 16th street viaduct in Milwaukee and the other at West Milwaukee where 58 acres of land have been acquired for future expansion. The company is also closely affiliated with the Sivyer Steel Casting Co., and Interstate Drop Forge Co., of Milwaukee, Federal Malleable Co., of West, Allis, Wisconsin, and Nugent Steel Castings Co., Chicago, Ill.

Organized in 1891 by C. W. Levalley, the Chain Belt Company has enjoyed a steady and consistent growth in all of its lines. Its original products were chain and sprockets for agricultural machinery. The complete Rex line now includes chains, power transmission machinery and conveyors for practically all purposes, and concrete mixers from the small tilting type to large road building pavers which are playing an important, part in the country's highway development.

THE CUTLER-HAMMER MANUFACTURING COMPANY.

The Cutler-Hammer Manufacturing Company make control apparatus of all kinds and many of its products find application in the mining industry. One of the first automatic mine hoists ever manufactured is that which was made by the Nordberg Company and supplied with Cutler-Hammer control and which for several years has been in operation at the St. Louis Smelting & Refining Company of St. Francis, Missouri. Also, this company manufacture many automatic sub-station-controllers which find application in mine-sub-stations.

A visit to this plant will include the Test Department where something new in the way of electrical control apparatus is generally on test. A large quantity of the new inductive time limit self-starters which have created such a sensation in the control field are generally on test.

In addition to control apparatus and wiring devices this company also manufactures lifting magnets and magnetic clutches, which however, are made at the Orchard Street Plant. It is the general plan that the inspection trip to the Cutler-Hammer Plant will include only the main plant which is located at 12th and St. Paul. If any visitors however desire to visit the magnet and clutch departments located at the Orchard Street Plant, special arrangements can be made.

THE NORDBERG PLANT.

The growth of the Nordberg Manufacturing Company is closely linked with the rapid development and expansion of the copper and iron mines of the Lake Superior district. The mines in that locality were an important factor to this company's growth, which today is ranked among the prominent companies engaged in the building of large mining equipment.

The Nordberg plant is located on the South City Limits, adjacent to the main line of the C. M. & St. P. Railway. It comprises a tract of about forty acres, eighteen of which are utilized for manufacturing space. The plant is complete in very detail and consists of pattern shop, pattern storage, foundry, machine, forge and erecting shops. Each shop or department is provided with such machinery and facilities as are required for building large, high grade machinery.

On the erecting floor can be seen under construction one of two of the largest capacity double-drum hoists so far built in this country. These hoists will have steel drums of 12-ft. diameter and will require 2,400-hp. motors to drive them. Here will also be seen in operation the last of three 3,750-hp. Diesel engines being furnished to the Government for service at the Panama Canal. This engine will be complete and connected to its flywheel type generator, the first to be used of this type on large Diesel engines in this country. These engines are by far the largest stationary Diesels ever attempted in America. They will comprise the largest installation in the Western Hemisphere and rank among the largest in the world. There is also in the process of manufacture for a prominent mining company three Diesel engines which will comprise a 6,750 horsepower plant. This is the one outstanding Diesel order so far placed this year, which is of particular interest owing to the fact that these engines are going into mining service.

SMITH ENGINEERING WORKS.

This company was originally founded as a partnership, Smith & Post, consisting of Mr. Thomas L. Smith, now deceased and Mr. Paul W. Post. The original purpose was to manufacture a metal cut-off saw, designed by Mr. Post; but soon after the formation of the partnership, Mr. Smith became interested in certain patents covering gyratory crushers, issued to E. B. Symonsj of Fort Wayne, Ind. In 1906, the partnership took over these patents and the first pillar shaft crusher was built in the winter of 1906-1907.

This concern was incorporated in 1907 under the name Smith & Post Co. In September, 1913, this name was changed to the Smith Engineering Works. In 1915, Charles F. Smith took general charge of the company and still, occupies that position. While in the early years, the company progressed slowly, since 1915 it has developed rapidly. In 1925, a new plant was constructed on Lake Boulevard at Holton Street; and in November of that year all operations were transferred to the new work.

WORDEN-ALLEN COMPANY.

The Worden-Allen Company operate a large steel fabricating plant in Milwaukee. They specialize in mine structures and manufacturing plants. Besides fabricating the steel work they offer their services as general contractors and engineers.

Since their inception, namely, 1902, they have designed and built most of the shaft houses on the iron ranges and practically all the rock houses in the copper country.

The plant occupies about fifteen acres in buildings and storage yards on the north side of the City of Milwaukee and was founded by Beverly L. Worden.

The present officers are E. W. Krueger, President; William F. Kinsella, Vice President, and Cecil Martin, Secretary and Treasurer.

From the November issue of "Mining and Metallurgy" we extract the following regarding our organization:

A DAY WITH THE LAKE SUPERIOR INSTITUTE.

Mining men of the Lake Superior region support a flourishing' Institute all their own which has the pleasant custom of holding a field meeting each year when the men from the various ranges get together to renew acquaintance and discuss technical matters. This year the quarter century was celebrated by a two-day meeting of which the first, September 8, was spent on the Gogebic Range, with headquarters at Ironwood, and the second at Milwaukee where the mining men went to see what becomes of some of the copper and iron they produce. Many A. I. M. M. E. men belong to the Lake Superior Institute and are active in its meetings, but at Ironwood Past-President William Kelly officially represented the National Society, and at Milwaukee Secretary Bain joined the party. President E. W. Hopkins and Secretary A. J. Yungbluth of the local Institute, extended generous hospitality to the delegates while the local committees at both Ironwood and Milwaukee did everything possible to make the hundred or more mining men attending enjoy their annual outing. It is apparently becoming more and more customary to emphasise the excursion features of the meeting and to read by title and print in the proceedings the papers offered. Within the limited time it is possible for a superintendent or engineer to get away from the ranges near the end of the shipping season, there is hardly time for both and, certainly, there is much to see and learn as well as to enjoy on the excursions.

Entirely aside from the value of its publications, which are generally accessible, the Lake Superior Mining Institute is serving a useful purpose in its own community through these excursions and, as in all professional societies, the members who take most advantage of the opportunities it offers get the most out of their membership.

PARTIAL LIST OF MEMBERS IN ATTENDANCE.

COPPER COUNTRY.

Cooper, C. H.	Houghton, Mich.	Richards, W. J.	Painesdale, Mich.
Crane, W. R.	Houghton, Mich.	Schacht, W. H.	Painesdale, Mich.
Hotchkiss, W. O.	Houghton, Mich.	Schubert, G. P.	Houghton, Mich.
Manderfield, N. H.	Houghton, Mich.	Sweet, A. T.	Houghton, Mich.
Mitchell, E. C.	Houghton, Mich.	Tolonen, F. J.	Houghton, Mich.
Richards, J. B.	Painesdale, Mich.	Vivian, Harry	Calumet, Mich.

GOGEBIC RANGE.

Angst, R. A.	Montreal, Wis.	Jeppeson, F. J.	Ironwood, Mich.
Berteling, J. F.	Bessemer, Mich.	Johnson, Carl F.	Bessemer, Mich.
Best, B. G.	Ironwood, Mich.	Johnson, H. W.	Ironwood, Mich.
Boehme, W. F.	Ironwood, Mich.	King, Robert	Ironwood, Mich.
Bowen, R. A.	Montreal, Wis.	Knoll, W. A.	Bessemer, Mich.
Bretting, Lyman	Ashland, Wis.	Lesselyong, Frank	Ironwood, Mich.
Bretting, R. C.	Ashland, Wis.	Massie, E. W.	Ironwood, Mich.
Byrne, Harry	Ironwood, Mich.	Matthews, Abe	Ironwood, Mich.
Cayia, A. J.	Wakefield, Mich.	Nickel, Peter J.	Ironwood, Mich.
Cannon, Felix	Ironwood, Mich.	Noland, George	Ironwood, Mich.
Chisholm, A. D.	Ironwood, Mich.	O'Donnell, Pat	Ironwood, Mich.
Cochran, E. L.	Ironwood, Mich.	O'Neil, J. B.	Ironwood, Mich.
Cole, W. A.	Ironwood, Mich.	Patrick, J. B.	Ironwood, Mich.
Cone, Leon J.	Ironwood, Mich.	Peacock, C. D.	Ironwood, Mich.
Coons, G. F.	Ironwood, Mich.	Price, J. M.	Ramsay, Mich.
Davis, Joseph	Ironwood, Mich.	Quirt, Howard A.	Ironwood, Mich.
Dick, L. E.	Montreal, Wis.	Ritchie, Julian	Ironwood, Mich.
Douglass, R. A.	Ironwood, Mich.	Rowe, Henry	Ironwood, Mich.
Edwards, G. B.	Ironwood, Mich.	Sampson, John	Ashland, Wis.
Gilbert, Arthur	Ironwood, Mich.	Schaus, O. M.	Ironwood, Mich.
Flanagan, J. M.	Ramsay, Mich.	Shove, B. W.	Ironwood, Mich.
Foss, A. L.	Ramsay, Mich.	Scofield, L. M.	Ironwood, Mich.
Funkey, C. H.	Ramsay, Mich.	Sutherland, D. E.	Ironwood, Mich.
Gillies, W. O.	Bessemer, Mich.	Taylor C. C.	Ironwood, Mich.
Grigg, John	Ironwood, Mich.	Truettner, W. F.	Bessemer, Mich.
Hardenburgh, L. M.	Hurley, Wis.	Webb, W. M.	Ironwood, Mich.
Hayes, B. C.	Ironwood, Mich.	Wilcox, Lee	Ironwood, Mich.
Hopkins, E. W.	Ironwood, Mich.	Waples, Belmont	Ironwood, Mich.
Hooper, H. B.	Ironwood, Mich.	Zinn, R. P.	Ironwood, Mich.
Janson, W. C.	Ironwood, Mich.		

MARQUETTE RANGE.

Archibald, R S.	Negaunee, Mich.	Elliott, S. R.	Ishpeming, Mich.
Begole, Charles	Marquette, Mich.	Graff, W. W.	Gwinn, Mich.
Chenneour, R. J.	Ishpeming, Mich.	Haines, S. W.	Negaunee, Mich.
Cowpland, C. C.	Ishpeming, Mich.	Hansen, A. C.	Negaunee, Mich.
Flodin, N. P.	Marquette, Mich.	Huhtala, John	Palmer, Mich.
Dagnais, Archie	Ishpeming, Mich.	Jackson, Geo. R.	Negaunee, Mich.
Drake, M. C.	Ishpeming, Mich.	Jopling, J. E.	Ishpeming, Mich.
Eaton, Lucien	Ishpeming, Mich.	Jory, William	Gwinn, Mich.
Lytle, C. E.	Marquette, Mich.	Peterson, H. S.	Ishpeming, Mich.
Moulton, H. O.	Ishpeming, Mich.	Rose, R. S.	Marquette, Mich.
Maitland, Alex	Negaunee, Mich.	Sheldon, H. W.	Negaunee, Mich.
McClure, O. D.	Ishpeming, Mich.	Syverson, A. O.	Marquette, Mich.
Nelson, J. E.	Negaunee, Mich.	Thomas, Joseph	Negaunee, Mich.
Newett, W. H.	Ishpeming, Mich.	Wright, D. D.	Ishpeming, Mich.
Keese, W. J.	Ishpeming, Mich.	Yungbluth, A. J.	Ishpeming, Mich.

MENOMINEE RANGE.

Baxter, C. H.	Loretta, Mich.	Lloyd, F. R.	Escanaba, Mich.
Brown, F. E.	Iron River, Mich.	Mahon, R. C.	Iron River, Mich.
Brown, W. F.	Iron Mountain, Mich.	Martin, Alfred	Crystal Falls, Mich.
Cannon, Geo. M.	Iron River, Mich.	Neely, B. C.	Crystal Falls, Mich.
Carey, Eugene	Iron River, Mich.	Newton, G. C.	Iron Mountain, Mich.
Carney, Thomas A.	Escanaba, Mich.	Odgers, Ira	Crystal Falls, Mich.
Eisele, Geo. J.	Iron Mountain, Mich.	Oswald, E. J.	Crystal Falls, Mich.
Erieson, Rudolph	Iron River, Mich.	Ryan, J. A.	Iron Mountain, Mich.
Kelly, William	Iron Mountain, Mich.	Royce, Stephen	Crystal Falls, Mich.
Laing, E. L.	Iron River, Mich	Smith, F. J.	Crystal Falls, Mich.
Laing, V. D.	Iron River, Mich.	Tayler, W. L.	Verona ,Mich.
Lawrence, C. E.	Caspian, Mich.	Wortley, R. B.	Iron River, Mich.

MINNESOTA RANGES.

Agthe, H. H.	Crosby, Minn.	Pearl, H. I.	Crosby,Minn.
Cash, F. H.	Kinney, Minn.	Perry, Frederick C.	Duluth, Minn.
Cohoe, F. H.	Hibbing, Minn.	Prisk, M.	Ely, Minn.
Hampton, H. C.	Duluth, Minn.	Richards, G. A.	Duluth, Minn.
Hunner, E. E.	Duluth, Minn.	Rowe, Wm. N.	Hibbing, Minn.
Johndrow, A. B.	Duluth, Minn.	Sherwood, Geo. A.	Duluth, Minn.
Kitts, T. J.	Duluth, Minn.	Shields, I. J.	Duluth, Minn.
Knight, William	Duluth, Minn.	Skillings, David N.	Duluth, Minn.
Kohlhaas, C. L.	Duluth, Minn.	Smith, H. G.	Duluth, Minn.
Lake, M. C.	Duluth, Minn.	Tresider, John	Chisholm, Minn.
Lizee, Albert J.	Calumet, Minn.	Webb, F. J.	Duluth, Minn.
McDonald, D. B.	Duluth, Minn.	Wedlake, F. R.	Eveleth, Minn.
Murphy, C. M.	Coleraine, Minn.	Williams, R. J.	Virginia, Minn.

MILWAUKEE, WISCONSIN.

Agthe, F. T.	Milwaukee, Wis.	Messinger, C. R.	Milwaukee, Wis.
Balding, Harry A.	Milwaukee, Wis.	Niven, John	Milwaukee, Wis.
Bell, Harry J.	Milwaufiee, Wis.	Perkins, W. J.	Milwaukee, Wis.
Bond, J. S.	Milwaukee, Wis.	Pfau, Ray H.	Milwaukee, Wis.
Brandt, W. H.	Milwaukee, Wis.	Shelbauer, R. A.	Milwaukee, Wis.
Coleman, W. W.	Milwaukee, Wis.	Smith, C. S.	Milwaukee, Wis.
Dow, H. W.	Milwaukee, Wis.	Smith, L. R.	Milwaukee, Wis.
Heuser, J. U.	Milwaukee, Wis.	Talboys, H. H.	Milwaukee, Wis.
Kern, Fred T.	Milwaukee, Wis.	Van Dyke, Geo. D.	Milwaukee, Wis.
Kinsella, Wm. F.	Milwaukee, Wis.	Van Dyke, Wm. D.	Milwaukee, Wis.
Miller, J. G.	Milwaukee, Wis.	Van Dyke, Wm. D., Jr.	Milwaukee, Wis.

MISCELLANEOUS.

Bain, H. Foster	New York City	Lyon, D. A.	Washington, D. C.
Barrett, L. P.	Lansing, Mich.	Miller, S. F.	Chicago, Ill.
Biyers, H. W.	Chicago, Ill.	Mitchell, W. A.	Chicago, Ill.
Buhlman, E. H.	Stevens Point, Wis.	Moore, H. C.	Chicago, Ill.
Comstock, E. H.	Minneapolis, Minn.	O'Connor, E. S.	Mayville, Wis.
Core, H. T.	St. Paul, Minn.	Sells, Max	Florence, Wis.
Goelzer, Geo. W.	Green Bay, Wis.	Soady, Harry	Minneapolis, Minn.
Harden, J. H.	Minneapolis, Minn.	Stirne, M. M.	New York City
Kauper, W. P.	Green Bay, Wis.	Wiedling, C. C.	Chicago, Ill.
Kerr, R. C.	Green Bay, Wis.	Whittle, C. E.	Chicago, Ill.
Leppla, John	Antigo, Wis.	Woodhull, M. J.	Chicago, Ill.
Lindsay, Geo. H.	Chicago, Ill.		

PAPERS

THE GOGEBIC IRON ORE RANGE.

BY CARROLL C. TAYLOR. IRONWOOD, MICH.*

Since its inception in 1893, the Gogebic Range has acted as host to the Lake Superior Mining Institute on four occasions, the present meeting being the fifth to be held here. There are undoubtedly many attending the present meeting who have been here on all of the previous trips to this range and others who visit the range frequently, but, for the benefit of those few who are making this their first visit and who are unfamiliar with the general conditions here, this article is written.

The iron-bearing formation which constitutes the producing member of the Gogebic Range extends from Mineral Lake, in Wisconsin, to Lake Gogebic, in Michigan, a distance of about 60 miles. That portion of the range which has produced commercial bodies of ore lies between Iron Belt on the Wisconsin end and the Morgan mine east of Wakefield, Mich. Several mining ventures have been attempted further to the east but none of them have been successful to date. At present a good deal of exploratory work is being done on the eastern extension of the range and the prospect of discovering merchantable orebodies seems very good.

The iron formation varies in width; in the heart of the range in the vicinity of Ironwood it is about 650 ft. wide, just west of Wakefield it is a little over a mile wide and about eight miles east of Wakefield it has a width of three miles. The strike of the formation is about 15 deg. north of east and the dip is almost uniform; in the neighborhood of 60 deg. to the northwest. The iron formation lies on a basal Archean granite and schist, overlying this occurs in succession a thin conglomerate series, the quartzite footwall of the iron series, the lower jaspers or cherts which contain the main footwall, or lower, bodies of ore, a slate formation, then the upper jaspers or cherts which contain the hanging-wall or upper orebodies, the Tyler slates, which constitute the hanging-wall of the range and finally the Keweenawan or "Copper Country" trap flows. The Tyler slates are missing in the eastern end of the range due to heavy erosion which also removed a portion of the iron formation.

*Fee-Owners' Representative, Keweenaw Land Association and Newport Land Co.

The main concentration of ore on the range can be divided roughly into the two classes, Primary and Secondary. The primary concentration is usually found close to the lower slate or quartzite in the form of a hard blue ore and generally quite narrow. Secondary concentration is responsible for the largest orebodies and it has been caused by impervious dioritic and diabasic dikes cutting across the footwall and slate members, forming troughs in which the ore occurs. These dikes generally pitch to the east and south and are the channels through which the Keweenawan formation flowed out.

East of the Black River at Ramsay the formation is badly broken up by cross faults and the geology is still more or less a matter of guess work although a great deal of progress has been made in recent years through study in the Eureka-Asteroid-Mikado district. On the eastern end of the range the main orebodies have been formed on the lower slates while the footwall quartzites have not formed good orebodies. West of Bessemer the main orebodies lie on the quartzite footwall with some very important ones lying on the upper slates.

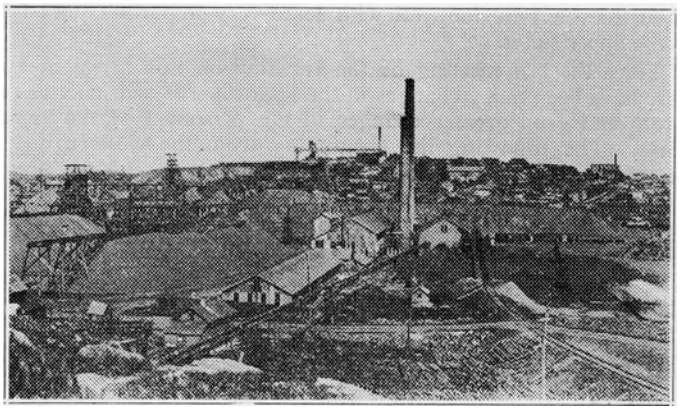
Since the last meeting of the Institute on this range in 1915 there have been many changes in the list of active and inactive producers and even greater changes in the personnel of the various mines. The following list (beginning from, the western end of the range), shows the mines that are now active and the present operators:

MINE—	OPERATOR—	STATUS—
Iron Belt		Inactive—1912
Atlantic		Inactive—1913
Plummer	Republic Iron & Steel Co.	Inactive—1924
Snyder		Inactive—1912
Pence		Inactive—1912
Montreal	Oglebay, Norton & Co.	Active
Ottowa	Oglebay, Norton & Co.	Active
Cary-Windsor	Pickands, Mather & Co.	Active
Germania		Inactive—1912
Ashland	Hanna Ore Mining Co.	Inactive—1925
Norrie	Oliver Iron Mining Co.	Active
Townsite	Republic Iron & Steel Co.	Active
East Norrie, Aurora, Vaughn and Pabst	Oliver Iron Mining Co.	Active
Newport-Bonnie	Pickands, Mather & Co.	Active
West Davis-Davis	Oliver Iron Mining Co.	Active
Geneva-Royal	Oliver Iron Mining Co.	Development
Puritan	Oliver Iron Mining Co.	Active
Ironton	Corrigan, McKinney Steel Co.	Active
Jackpot		Inactive—1904
Yale	Charcoal Iron Co. of America	Inactive—1923
Colby	Corrigan, McKinney Steel Co.	Inactive—1921
Tilden	Oliver Iron Mining Co.	Active
Palms-Anvil-Keweenaw-Houghton County	Pickands, Mather & Co.	Active
Eureka-Asteroid-Mikado	Oglebay, Norton & Co.	Active
Plymouth Pit	Pickands, Mather & Co.	Active
Wakefield Pit	Hanna Ore Mining Co.	Active
Crown Point		Inactive—1902
West Pike		Inactive—1910
East Pike		Inactive—1910
Brotherton		Inactive—1923
Sunday Lake	Pickands, Mather & Co.	Active
Castile	Oglebay, Norton & Co.	Inactive—1924
Meteor-Comet		Inactive—1904
Morgan	Thomas Furnace Co.	Inactive—1924

From the above it will be noted that since 1915 there have been seven mines removed from the active, list; namely, the Plummer, Ashland, Yale, Colby, Brotherton, Castile and Morgan mines; while there have been no new mines opened up in the same period. Through the effects of mergers the number of active operators has been reduced from 13 to seven since 1915.

The transition from hand labor to an almost universal mechanical operation has been equally marked. Practically every mine on the range is now using slushers with either electric or air double-drum hoists for power where hand-tramming and shovels were the rule in 1915. While some of the properties were electrified completely at that time they were in the minority while now the range can be said to be completely electrified. The use of hydro-electric power is general throughout the range but several mines are generating their power by steam and converting to electric power.

So many papers are being prepared covering the mining operations in the various mines along the range that no attempt will be made to cover that phase of activity in this article. In order that visitors may get a general idea of the typical Gogebic Range surface installation several mines are taken as examples and, their equipment summarized briefly.



PABST MINE SURFACE—NEWPORT SHAFT IN BACKGROUND

The westernmost producing mine at this time is the Montreal, being operated by the Oglebay, Norton Company. A very complete description of this mine is being prepared for publication in the "Proceedings" so that little need be said here. This property is particularly interesting from the industrial relations viewpoint. Every effort is being made to make the Montreal location a desirable place to live and the labor turn-over at that property proves that the men employed there appreciate the efforts being made in their behalf. The Hamilton Club, owned and operated by the company, forms the center of social activity with well maintained pool and billiard tables, four splendid bowling alleys, card and reading rooms, ice cream parlor, ladies' club rooms, barber shop, and a splendid auditorium where dances, amateur theatricals and moving pictures are frequently held. The houses that are being provided for the men are not only practical but have been designed with an eye to beauty as well so that the entire location gives the impression, of being a well-kept suburban district to a large city, rather than a mere mining company location. The Ottowa mine really forms a part of the Montreal operation and need not be treated separately.

At the Cary-Windsor property the ore reserves have never warranted an expensive surface outlay and there is nothing of particular interest to be seen at the mine. The same can be said of the Townsite mine which is now operating in some of the old mined-out portions under very adverse conditions, but apparently doing well.

The Oliver Iron Mining Company's Norrie group is well known as the heaviest producer of iron ore on the range for many years. On only five occasions in the last 23 years has it failed to produce a million tons. Hoisting is now being done at five shafts which are all connected underground. At the Norrie shaft they are working on the 32nd level, 2,878 ft. below the collar on an incline of about 65 deg. The East Norrie shaft is down to the 19th level at an inclined depth of 1,405 ft. The Aurora shaft is cut out to the 20th level or 1,487 ft. on the incline while the Pabst G shaft is down to the 26th level at 2,163 ft- on the incline. The Pabst H. shaft is the only vertical shaft of the group and is directly connected with the Pabst G shaft on the 26th level.

The surface equipment at the Pabst power house is of particular interest as power is generated there for all of the Oliver mines on the range except the Tilden. The transmission of the electric power is through a concrete trench to the Norrie, East Norrie and Aurora mines and by a steel tower transmission line to the Davis, Geneva and Puritan properties. The G shaft power house is a land-mark along the range with its three stacks. The first to be constructed was a 9-ft. tile stack 150 ft. high. A little later a 9-ft. by 200-ft. re-enforced concrete stack was added and in 1924 the last of the group, a 10-ft concrete stack 275 ft, high, was built.

The power plant is modern in every respect with eight 72-in. by 18-ft. Kewanee return tubular boilers which are hand-fired, four 406-hp. Heine water tube boilers with mechanical stokers and one 600-hp. Babcock and Wilcox water tube boiler with mechanical stokers. Steam power is converted through a battery of steam turbines to electrical energy and transmitted at 2200 volts. The air compressor at the plant has a capacity of 5,280 cu. ft. of free air per minute at 75 lbs. which is raised by a two-stage booster compressor to 100 lbs. on the output air line.

The Newport mine shows many changes on the surface due to the fact that at the time of the last meeting hoisting was being done through the old D shaft which is now merely a memory and the Woodbury shaft was just being sunk. The Woodbury shaft was sunk in record time during 1915-16 and holed to the 19th level, a distance of 2,265 ft., in just one day under a year, in March of 1916. The present bottom level is the 21st at about 2,500 ft. vertically below the surface. The shaft is topped by a 120-ft. shaft house. The engine house equipment is largely the same as in 1915 due to the fact that the D shaft equipment was moved to its new location to serve the Woodbury shaft.

The power for the mine is generated in three Badenhousen 750-hp, boilers of Class O, 3 ½-in. tubes using 50 deg. of superheat to produce steam at 165 lbs, pressure. The boilers are served by Riley stokers with an overhead endless belt transmission bringing the coal from the coal dock which is about 250 ft. north of the boiler house. The coal is all crushed and elevated at the coal dock. The hoisting equipment at the Woodbury shaft consists of a Nordberg simple-twin 34 by 72-in. steam-driven hoist with two 12-ft. diameter, 66-in. face drums serving the skips and a 22 by 48-in. Allis-Chalmers hoist with two 6-ft. by 60-in. drums, one keyed to the shaft and the other operated by a clutch, on the cage service. The hoisting at the Bonnie or K shaft of the Newport mine is done by a Thompson-Greer simple-twin 24 by 48-in. hoist with two 8-ft. by 144-in. drums operated by clutches. The cage hoist at the Woodbury shaft is equipped with a Lilly control as a safety measure. The power for tramming and pumping underground and for lighting, shop and miscellaneous surface uses is generated by two reciprocating-engine units of 250-kw. and 150-kw. capacity and one mixed-pressure turbine unit of 500-kw. capacity. Air is

compressed in four compressors with a combined capacity of 9,000 cu. ft. of free air per minute to 90 lbs, pressure.

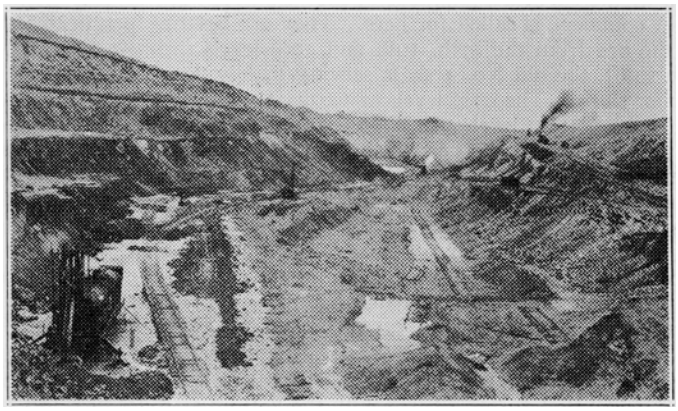
The most interesting feature of the Davis mine, an Oliver operation, is the pump house on the 26th level where they have three motor-driven pumps with a combined capacity of 1,200 gals. per minute on a single lift of 2,346 ft. Each of the three units consists of a Presscott 4⅞ by 24-in. horizontal-duplex, center-packed pump with a Westinghouse 12-pole, 300-hp,, 60-cycle, 2200-volt 3-phase induction motor at 580 r.p.m. In the construction of the pump house, which is situated about 50 ft. south of the footwall in the quartz-slates, they had a great deal of trouble with the back slabbing off and on one occasion a single block of about 3,600 tons; came down. This left a hole which was 37 ft. to the top and to fill it up nine large concrete pillars were built on which six cross girders of re-enforced concrete 2 by 6 ft. were placed and above them 2-ft. cross-walls were built up- to the back. Since placing these supports no further movement has been noticed.

The Geneva-Royal property is now merely in the development stage with a new vertical shaft being sunk in the granite. The first station to be cut out is the 30th level at a depth of 2,845 ft. At that point, due to the inclination of the footwall, it will be nearly 2,000 ft. south of the footwall. The collar of this shaft is about 25 ft. south of the slate-granite contact. An ultimate depth of over 4,000 ft. is anticipated. At present the bottom of this shaft is about 2,700 ft. below the surface.

The fronton mine, the only Corrigan, McKinney Steel Company operation on the range, is to be covered by a detailed description of the surface equipment in the "Proceedings" so that only a brief comment is called for here. They are hoisting practically all of the ore from the 17th, 19th and 20th levels through the Corrigan shaft, the old No. 4 shaft serving mainly as a ventilation and timber shaft. The 21st level, at 1,634 ft. vertically below the collar is the bottom level at present. The outstanding surface feature at this property is the permanent stocking trestle which utilizes to the best advantage a rather limited stocking area. A very elaborate and effective signalling system is in use in the Corrigan shaft that shows where all signals are sent from, whether or not the cage is in motion, when any gate is open at any level and further provides a means of signalling from the cage while it is in motion. The Ironton is enjoying the most productive year in its history and will produce in excess of 500,000 tons.

At the Palms-Anvil-Keweenaw-Houghton County group they have a modern surface layout. The main orebodies lie on a Hat dike or sill that forms a basin with the bottom at roughly 1,200 ft. and the mine is not to be classed therefore as a deep one. The Anvil shaft, which is an inclined shaft at about 65 deg., has a rather larger head frame than is necessary due to the fact that it was moved from the old D shaft at the Newport at the time that shaft went out of commission. It provides for four parallel skiproads with only two now in use. A travelling crane to handle the timber and tools at the surface is one of the features found most useful at this shaft. The Palms shaft, lying about a quarter of a mile west of the Anvil, is a vertical shaft and the two are connected on several levels so that mechanical means of ventilation are not necessary except in a few dead-ends.

The Oglebay, Norton Company have followed their general idea of surface and location improvement, as exemplified by their Montreal mine, at their Eureka-Asteroid-Mikado property at Ramsay. Numerous faults have made the location and mining of ore difficult at this property. At present there are three shafts in use but it is anticipated that only one will be maintained as a hoisting shaft as soon as the surface equipment is ready to handle the ore. The Eureka and Asteroid shafts will then serve only as air and service openings while the new No. 4 shaft will carry the main burden of the operation. Considerable difficulty was experienced in sinking the No. 4 shaft through the surface material, a large steel ring under pressure of hydraulic jacks being necessary until ledge rock was reached. Within the last two months this shaft has been put into operation so that it represents the last word in Gogebic Range shaft and shafthouse construction. The shafthouse, which is fully enclosed, is particularly high in order to provide for a crushing and screening plant and bins and to provide storage capacity for four grades of ore and two of rock. The new engine-house and warehouse are worthy of a complete inspection. The dry for the men is to be located at one end of the warehouse with an underground passage to the shaft to render unnecessary any exposure during the cold weather.



PLYMOUTH OPEN PIT

Working east along the range from Ramsay the formation widens very considerably making possible the open pit operation of the Plymouth and Wakefield mines. While these mines do not compare with some of the Mesabi Range open pits in size they are considerably deeper than most of those on the Mesabi and show a surface opening of over a mile and a half long by nearly a quarter of a mile wide. The present depth of both mines is in the neighborhood of 200 ft. below the original surface with an ultimate depth of open pit operation of nearly 300 ft.

The Plymouth pit, a Pickands, Mather operation, was not opened until 1916 but since that time has been one of the heaviest producers on the range. They reached their peak of production in 1921 when they shipped 821,000 tons. The pit is served by a mile and three-quarters approach track on which 105-lb. rail is used and about ten miles of 80-lb. rail in the pit. The shovel equipment consists of one 300-ton, 225-B Bucyrus of 6-yd. capacity, three 100-ton, 103-C Bucyrus 3½-yd. dipper, one 60-ton Marion 2½-yd. dipper and one 35-ton 35-B Bucyrus 1½-yd. dipper. In addition they have 29 dump-cars for stripping operations, two flat cars, one 15-ton Brownhoist locomotive crane, seven 6-wheel locomotives, one Clyde track-shifter, a Jordon spreader, one Keystone drill and one Clipper electric churn drill for drilling the ore ahead of the shovels. It is not absolutely necessary to drill and blast the ore but it has been found economical to do so as the shoveling operation is greatly accelerated by first breaking up the ore.

The Wakefield pit has been in operation since 1913 and has shipped nearly eight million tons to date. The largest production in a single year was in 1918 when 1,130,532 tons were sent to the docks. Up to date over eight million yards of overburden have been removed. Drainage is provided in the pit by a drift underlying the orebody and connected to low points in the pit by Keystone drill holes. The water is pumped out through a shaft from a depth of 400 ft. The total trackage in the pit and on the dumps is approximately 25 miles. Equipment in the pit consists of eight locomotives of the 65-ton switcher type and five steam shovels, one 85-C railroad type, one 193-C railroad type, one 85-C caterpillar, on 35-B on caterpillars and one 225-B operating on a double track. This latter shovel is full-revolving and is equipped with a 6-yd. bucket. A 15-ton locomotive crane and a spreader plow are additional equipment. The Wakefield is a M. A. Hanna operation.

The only property now in operation east of the Wakefield pit is the Sunday Lake mine, another Pickands, Mather property. Recent developments have insured a long and productive life and there have been numerous surface improvements in the last year or so. A new shafthouse has been erected and the shaft thoroughly repaired and sunk an additional 200 ft. One of the best ore-bodies on the range is being developed at the Sunday Lake mine.

No mining venture east of the Sunday Lake mine has been really successful so far, the Castile, Meteor and Morgan mines never having panned out very well. Surface exploration by test-pitting and ditching and diamond drilling have failed to prove up any merchantable ore so far but various companies continue to explore and perhaps the day is not far distant when we will see new mines and new towns on what is now waste land east of Wakefield.

COMPARATIVE STATEMENT SHOWING SHIPMENTS FROM MINES ON GOGEBIC RANGE.

	1924		1925	
	C. & N. W.	SOO LINE	C. & N. W.	SOO LINE
Anvil	9,929	4,078	6,322	26,252
Ashland	62,089	.....	.....	90,754
Asteroid	140,991	.....	142,089	.....
Aurora	298,259	8,231	346,319	6,853
Cary*	58,064	.....	80,138	.....
Davis	.....	.....	12,701	.....
Eureka	273,123	.....	301,752	.....
East Norrie	110,469	19,082	211,013	35,653
Ironton	130,191	197,226	181,242	254,643
Keweenaw	48,218	51,855	95,435	82,016
Montreal*	.....	559,282	.....	578,052
Morgan	.....	.....	27,763	.....
Newport	654,603	.....	790,744	.....
North Ashland	1,032	.....	.....	.....
North Aurora	9,745	.....	7,274	.....
North Norrie	230,157	11,522	258,199	22,845
North Pabst	16,072	.....	21,858	.....
Ottowa*	.....	170,660	.....	403,001
Pabst	405,567	10,778	633,868	38,338
Palms	65,558	70,201	137,170	42,679
Plymouth	504,502	.....	586,181	.....
Puritan	77,470	.....	290,387	.....
Sunday Lake	113,332	.....	106,953	.....
Tilden	.....	178,524	.....	155,229
Townsite	85,750	.....	91,389	8,084
Vaughn	.....	.....	4,543	.....
Wakefield	230,996	.....	573,692	.....
West Davis	.....	.....	13,095	.....
Total	3,526,117	1,281,448	4,920,127	1,744,374

SUMMARY—	1924	1925
Total C. & N. W.	3,526,117	4,920,127
Total Soo Line	1,281,448	1,744,374
All rail	209,865	287,625
Total Gogebic range	5,017,430	6,952,126

*Mines in Wisconsin.

SHAFT SINKING AT THE EUREKA MINE.

BY A. L. FOSS* AND J. M. FLANAGAN,† RAMSAY, MICH.

Flans for sinking a new shaft at the Eureka mine of the Castile Mining Company at Ramsay, Michigan, were made necessary by the condemnation of their No. 3 shaft, which had been the main hoisting shaft at this mine previous to 1926.

The old shaft was bottomed in severely faulted ground. Diamond drilling had revealed an orebody below and development showed considerable ore both on the north and east sides of the shaft. These orebodies could not be mined without caving the shaft. For this reason, and the fact that No. 3 shaft was located near the west end of the property, which necessitated long haulageways and expensive development, it was decided to sink the new shaft at a more central location.

Previous development and exploration had disclosed a sufficient tonnage to warrant the expense of a new shaft, and in addition to this the property, which extends one and one-half miles along the strike of the iron formation, contains large areas of very favorable ground for exploration. An ultimate depth of 4,500 ft. is anticipated for this shaft and the present workings are near the 2,000-ft elevation.

The vertical type shaft was selected in preference to the incline type. After balancing the advantages of each, it was found that the expense of the longer shaft crosscuts to the footwall, made necessary by the vertical shaft, was less than that necessary to operate an incline shaft during the life of the mine. The chief items of expense considered in the incline type were as follows: slow hoisting speed, rails and replacements, idler pulleys,

extra wear on rope, skip wheels and replacements, labor greasing skip wheels, wear and tear on shaft sets.

It was decided that the shaft should have six compartments, consisting of 2 skip roads, 2 cage roads, a, pipeway and a ladderway, (See Fig. I), the sets to be made of 6-in. H-section spaced 6 ft apart. The outside dimensions were to be 19-ft. 8-in x 12-ft 6-in. and the shaft was to be lined with reinforced concrete lath.

*Chief Engineer, †Engineer in charge of shaft sinking for the Castile Mining Co.

In selecting the shaft site, there were four major considerations, viz.: 1—The shaft should be centrally located; 2—It should be sunk in the footwall; 3—The location should be such that a surface plant could be erected conveniently near it; 4—The geological structure should be favorable. The site chosen is about midway between Eureka No. 2 shaft and Asteroid No. 5 shaft and approximately one-half mile from the west end of the property. The location is well in the center of underground operations. Because of danger from subsidence, the shaft was sunk in the footwall. All excellent site for a surface plant was obtained with easy accessibility for railroad spurs. (See Fig. II). The geological structure was a very important consideration for the reason that there is constant movement along certain faults. This movement is no doubt due to subsidence from the mining of adjacent and sometimes distant orebodies. One shaft on the Gogebic Range was lost for this reason. Considerable diamond and churn-drilling was done on the proposed site to prove that the structure was favorable and that no large ore bodies existed in this vicinity. This drilling on the shaft site proved the depth of overburden and structure of the rock formation below as shown in Fig. III. It seemed safer to sink through the overburden, soft slate and soft dike, by means of a concrete drop-shaft, so this method was adopted.

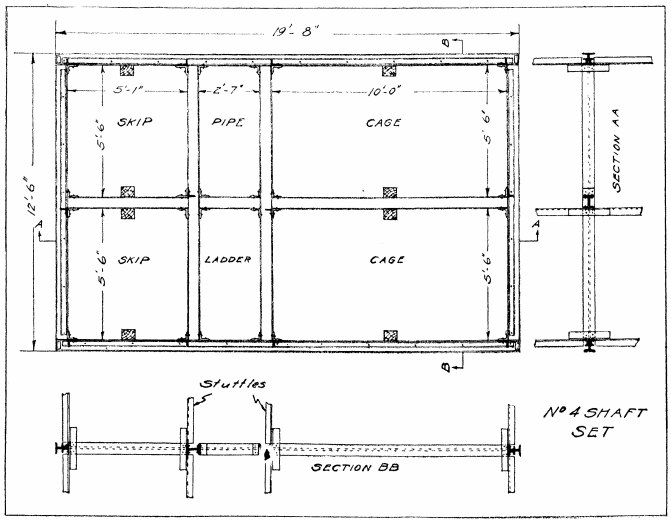


FIG. I—NO. 4 SHAFT, EUREKA MINE

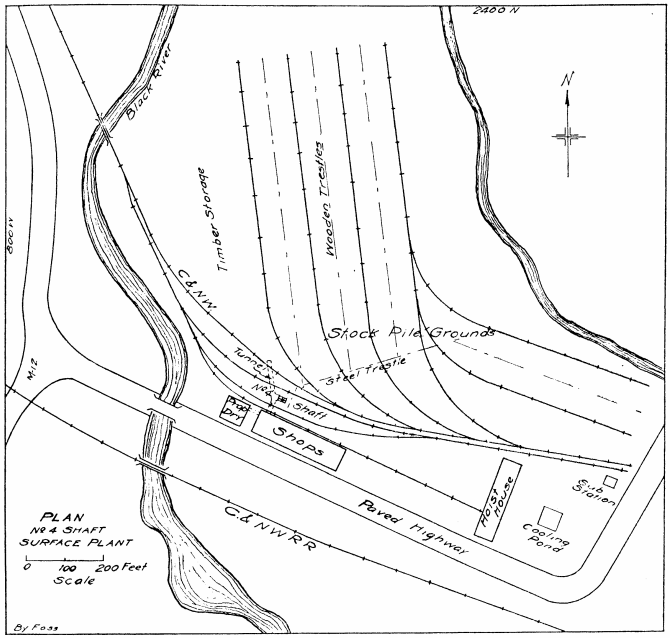


FIG. II—SITE FOR SURFACE PLANT, EUREKA MINE

At this time there was quite a shortage of men on the Gogebic Range. Due to this fact and other reasons, it was decided to let the shaft sinking on contract with the stipulation that laborers would be imported. The contract was based on an estimated "cost of work" with a basic fee, the latter to be increased or decreased by 50 per cent of the difference between actual and estimated costs. The Foundation Company was awarded this contract and commenced operations on August 28th, 1923.

The drop-shaft* was a circular structure 29 ft. in outside diameter. It consisted of a steel cutting edge, at the base of a 3-ft. wall which was battered on the inside. The lower 18-ft. section of the caisson had a 3-ft. wall and the balance had a wall 2 ft. thick. The material through which the drop-shaft was sunk consisted of 45 ft. of overburden, composed of sand, gravel, clay and boulders, and 36 ft. of a heterogeneous mixture of soft dike, iron ore, jasper and soft slates. The occurrence of water did not seriously hamper sinking operations. Toward the bottom, the drop-shaft was making about 60 gal. of water per minute. Hard iron-formation rock was encountered below the dike and the drop-shaft was anchored and sealed at this point, 81 ft. below the surface, with the expectation that the shaft would be dry below this point. This was not the case, however, for considerable water came in through the bedding planes of the formation and in order to retard the flow, it became necessary to line the shaft with concrete from the base of the drop-shaft seal to a depth of 215 ft., where more impervious rack was encountered. Equipment used in sinking the drop-shaft consisted of a stiff-leg derrick with a 72-ft. boom, a steam hoist, boiler and clamshell buckets. Water was handled with a steam syphon to a depth of 35 ft. when a No. 7 Cameron pump was installed.

*A description of the drop-shaft published in Skillings' Mining Review, Vol. XIV, No. 6, June 20, 1925, page 1, is published herewith, following this paper. (By courtesy of the publishers.)

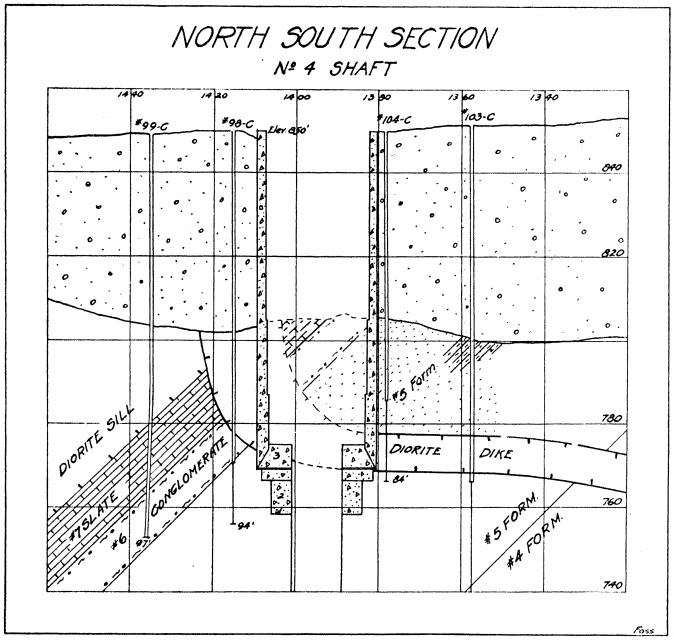


FIG. III—DRILL SHOWINGS, EUREKA MINE

In conjunction with the shaft sinking, development was in progress on the 22nd level in preparation for hoisting through the new shaft. A winze had been sunk from the 21st level to the 22nd, a distance of 150 ft. The winze was about 1,000 ft. northwest of the new shaft. Three headings were driven from the winze, one west, beneath the main orebody, and from which development raises were put into the ore, one drift northeast to explore for ore on the footwall, and a crosscut southeast for a haulageway to the new shaft. All of this work was completed when the shaft holed through. All that remained to be completed before hoisting was the pocket construction and spill-shaft. It was found cheaper to sink the pockets along with the shaft than to put them in afterwards.

After the shaft had reached a depth of 228 ft., in June 1924, the labor shortage, which had prevailed throughout the previous winter, improved considerably. For this and various other reasons, the Castile Mining Company decided to take over the shaft sinking. An excellent crew of shaft miners was recruited from the ranks of the underground crew. Several of these had been engaged in sinking the winze mentioned above. Others had done shaft work elsewhere and some who had worked for the Foundation Company preferred to stay rather than move. Captain Jacob Kettula, who had been in charge of the Asteroid mine and of sinking the Asteroid No. 5 shaft, was transferred to the new shaft and J. M. Flanagan of the Engineering Department was put in charge of shaft sinking.

The question of more rapid advance in sinking was now becoming of paramount importance. Further delay in the shaft reaching the 22nd level meant considerably increased mining costs. The attention of the management became concentrated on the new shaft. The best men were picked for this work and liberal wages were paid them. The crew was organized as follows:

Engineer in charge	
Captain	
1 shift boss	3 shifts 8 hours each
7 miners	
1 lander	
1 motorman	
1 hoisting engineer	
1 pumpman	
1 man on dump 10 hours	
1 drill sharpener	
1 drill sharpener helper	
Total 41 men	

The miners were given a minimum wage of 75 cents per hour with an additional 5 cents per hour for each 5 ft. advance per month in excess of 60 ft. The miners were separated into shifts of three nationalities, Croatians, Finns and Swede Finns, in order to incite competition. This arrangement encouraged the miners and they worked with remarkable enthusiasm which is evidenced by the first month's advance, shown in Fig. IV, for the month of July, 1924,

Sinking equipment used at No. 4 shaft consisted of one 150-h.p. double-drum electric hoist, drums having 4-ft. diameter and 3-ft. face; one 150-h.p. single-drum electric hoist with 4-ft. diameter and 3-ft. face; a light steel headframe, 56 ft. in height; three 1-yd. sinking buckets; fifteen Ingersoll-Rand jackhamers, Model DCR-23; one Worthington Triplex electric-driven 3½-in. x 8-in. 50-gal. pump, three No. 7 Cameron air-driven 50-gal. pumps; and one No. 2½ Sirocco electric fan, 7½-h.p. Motors used for the hoists were Westinghouse, 440-volt, 3-phase, 60-cycle with wound rotors. The hoists were manufactured by the Lake Shore Engine Works. The sinking headframe was made by the Worden-Allen Company.

From the bottom of the drop-shaft to a depth of 400 ft., the shaft was sunk in iron formation, most of which was an extremely hard, flinty chert. From 400 ft. to 1,600 ft. the rock was quartzite, the upper portion massive and the lower portion thin bedded. From 1,600 ft. to 2,200 ft. the rock was a clean unaltered granite. The greatest difficulty was experienced in sinking through the flinty iron formation. This rock was exceedingly hard on drill steel. The average cut in this material was about 3½ ft., while in the quartzite and granite the cuts averaged 7 ft.

The progress of the shaft during the last half of 1924 was considerably retarded by water, which, though at no time greater than 50 gal. per minute, was very hard on the morale of the men, who developed boils, rash and sickness as a result. Most of this water was coming from the area between the depths of 125 ft. to 400 ft. The section of the shaft which had been concreted did not prove impervious. It was decided in October to line the inside of the shaft with corrugated sheet iron in an endeavor to stop the water. The sheeting arrived in December and was promptly put in place. The water carried behind the sheet iron was caught in a water ring

at the 400-ft. elevation, where an electric pump was installed. This work proved about 90 per cent effective in stopping the water and increased the advance by about 30 per cent.

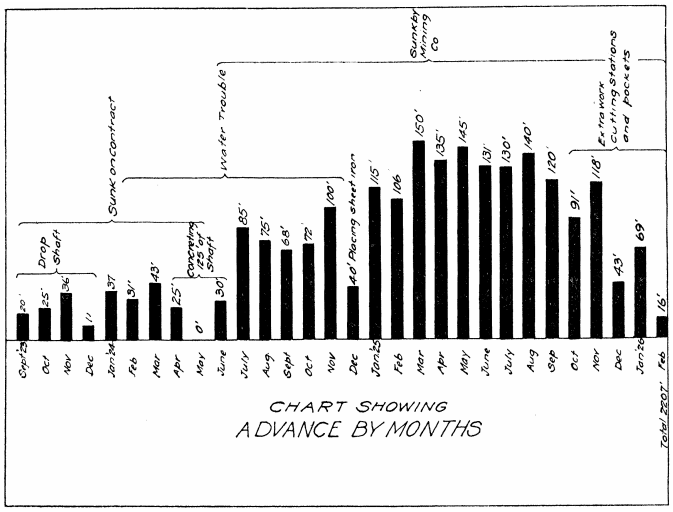


FIG. IV—EUREKA MINE.

In January the management declared a change in the contract price of the shaft miners. This was occasioned by the fact that the water troubles were over and the shaft had entered ground which permitted obtaining cuts of 7½ feet compared with a maximum of 6 ft. previously. The new arrangement cut out the three pumpmen and added one miner on each shift who attended the pumps in addition to his duties as miner. The minimum monthly advance was raised from 60 to 100 ft. The new scale paid 75 cents per hour for 100 ft. or less and 5 cents per hour additional for each 5 ft. of advance in excess of 100 ft. per month. This adjustment had no serious effect upon the men as they could see they had a better chance to make money than before.

The month of March, 1925, although the record month, is considered typical, and interesting data for that period are given below:

		Miners only	
Drilling	926¼	man-hours	14.5%
Mucking	3,259¾	" "	50.8%
Blasting	275	" "	4.3%
Lunch	380¼	" "	5.9%
Placing sets	1,235	" "	19.3%
Ventilating	243¼	" "	3.8%
Delays	92½	" "	1.4%
Total	6,412	" "	100.0%

Size of opening—14 ft. x 21 ft.
Rock—thin-bedded quartz slates.
Solid rock broken—44,100 cu. ft.
Loose rock hoisted—81,621 cu. ft.
Powder used—4,345 lbs.
Solid rock broken per lb. powder—10.15 cu. ft.
Electric igniters used—1,196.
Powder and igniter, cost per foot of shaft—$6.70.
Labor, miners only, cost per foot of shaft—$52.92.
Number of cuts—21.
Average depth of cut—7.3 ft.
Loose rock mucked per man-hour—25 cu. ft.
Feet drilled per man-hour—9.4.
Depth of sinking per 24 hours—4.85 ft.
Depth sunk per man-shift—2.24 in.
Cubic feet displacement per man-shift—55 cu. ft.
Number of bore holes—1,092.
Feet of drilling—8,690.
Average depth of borehole—8.0 ft.
Average number sticks of powder per hole—12.3,
Average cubic feet burden per hole—40.5.
Powder used per yard solid rock—2.66 lbs.
Number of drills used—3,304.
Lineal feet drilled—8,690.
Steel placed—26 sets.
Guides placed—62 pieces.
Ladders placed—9.
Sollars placed—9.

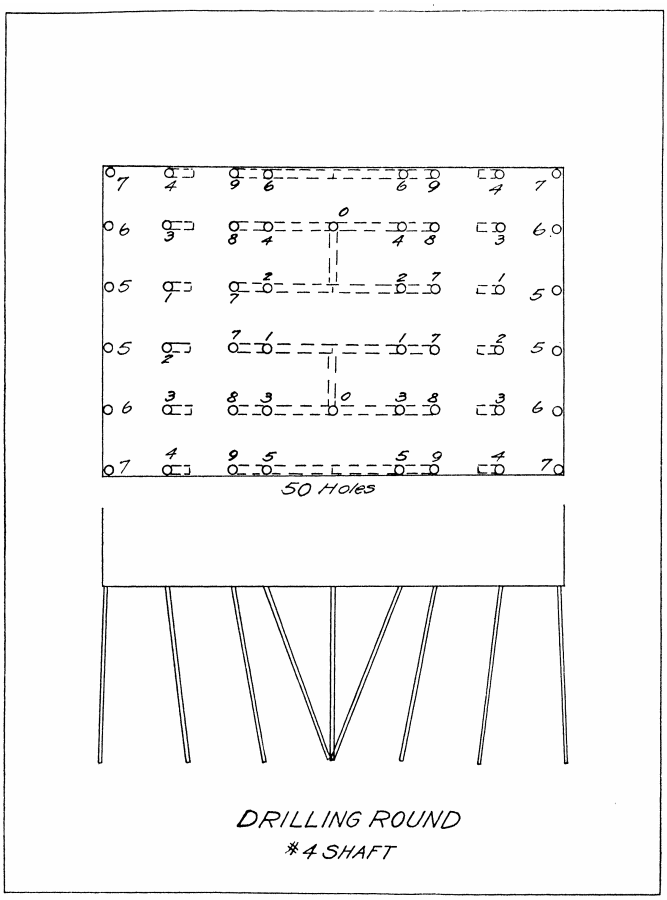


FIG. V—EUREKA MINE

Fig. V shows the round of holes used in sinking No. 4 shaft. The cut was shot first and the broken material mucked out. Following this the remainder of the holes were blasted squaring up the bottom. By cleaning out the cut first the explosives consumption was reduced and the face squared up in better shape by not having any material to block the rock broken by the second blasts. By doing this, deeper rounds were pulled cleanly, the bottom left in better shape for efficient drilling of the next round, and a lower strength explosive was used in the holes of the second blast.

The numbers by the holes in the figure show the order in which the blasts were fired. To avoid injury to the steel sets not more than two holes were shot simultaneously.

Two buster holes were placed in the middle of the cut and were shot first. This eased the work required by the cut holes and kept the bottom in the center free from being higher than the rest.

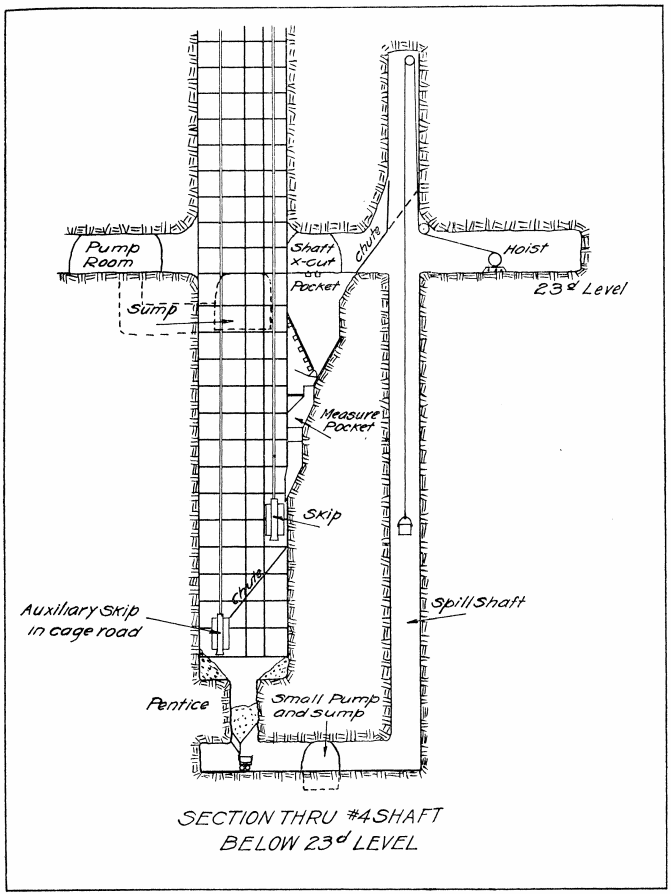


FIG. VI—EUREKA MINE

The explosive used was DuPont 80 per cent Red Cross and 60 per cent Gelatin, 1-in. x 8-in. The rounds pulled were from 7 to 8 ft. As it was too difficult and would slow down the drilling very greatly to finish the holes 1⅞ in. in diameter, it was best here to use the small diameter cartridges. The 60 per cent was used in the two back rows on each side.

As the holes were filled with water and there was necessarily considerable delay between loading and blasting, the blasting caps on the delay igniters were given an additional protection by drawing a piece of rubber tubing over the junction between the caps and fuse. Then the regular waterproofing dope was applied.

The new shaft reached the elevation of the 22nd level, a distance of 1,916 ft., on October 9th, 1925, two years and six weeks from the date the shaft was started. A three-compartment storage pocket was sunk along with the shaft for a distance of 50 ft. below the 22nd level. A station was also cut at this time. Following this work the shaft was continued to the 23rd level, 200 ft. below the 22nd level, where a station and pocket were also cut out. The shaft was bottomed 91 ft. below the floor of the 23rd level and 2,207 ft. below the collar. In the bottom of the shaft a 6-ft. x 6-ft. opening was sunk for a depth of 20 ft. (See Fig. VI), and a crosscut driven east a distance of 40 ft. At the end of the crosscut a two-compartment vertical raise was driven to the floor of the 23rd level. This arrangement was to serve two purposes, viz.: a rock pentice and auxiliary shaft were provided for future shaft sinking and the raise was also to be used for hoisting dirt spilled into the shaft from loading operations on the levels above.

It is a source of satisfaction to the management that during the entire operation of sinking this shaft, no fatal or serious accidents were reported. A total of 331 shifts were lost due to minor injuries out of a total of 15,347 shifts worked, miners only included. The most serious accident was due to a stage collapsing while the miners were placing steel sets. As a result of this accident 161 shifts were lost from minor injuries. A total of seventeen lost-time accidents are reported for the entire operation.

SINKING DROP-SHAFT AT THE EUREKA MINE.

BY A. L. FOSS.

(Supplementary to paper on “Shaft Sinking at the Eureka Mine.” By courtesy Skillings’ Mining Review.)

The beginning of the excavation was marked by a 35-ft. diameter circle laid out on the ground, its center coincident with the center of the proposed shaft. Excavation was carried down on the slope to a depth of 11 ft., the diameter at this depth being 29 ft. A center stake was set in the bottom, the ground leveled off smoothly, and the steel cutting edge (see Fig. 1) of the drop-shaft set in place.

Forms were built upon the cutting shoe for the first 18-ft. section of the drop-shaft. This section was built heavier than any of the following ones, having a wall 3 ft. thick, the lower 5 ft. of which was battered down to the shoe on the inside. One-inch reinforcing rods were spaced at 12-in. centers both horizontally and vertically.

Provisions for the rectangular steel shaft sets which were to be later set inside the circular drop-shaft, were made by leaving a one-foot set-in at each of the four points in the concrete, where the corners of the steel shaft sets would come. This added space was allowed so that the shaft sets could be placed in a vertical position if the drop shaft should be out of plumb when it landed at the point of seal.

In sinking through the overburden, the encountering of boulders under the cutting edge was the chief source of trouble. Boulders that were centered directly under the cutting edge had to be broken with hammers, but most of the rounded boulders which were not centered directly beneath the shoe, were pushed aside by the weight of the concrete upon the cutting edge.

It was originally planned to sink the drop-shaft through the overburden only and seal in the diorite which was immediately below.

At ledge the cutting shoe was in diorite dike on the north side, and formation and ore on the south side. The diorite dike was found to be in a highly kaolinized state, due to the action of surface waters that had leached much of the silica from the rock. Irregular and angular fragments of hard, cherty, broken-

up iron formation caused considerable trouble but It was found, as the earlier drilling had shown, that most of the iron formation above the dike had been altered to ore, therefore the drop-shaft could be continued. The cutting edge sunk rapidly through this material, some days as much as 4 ft. in two shifts.

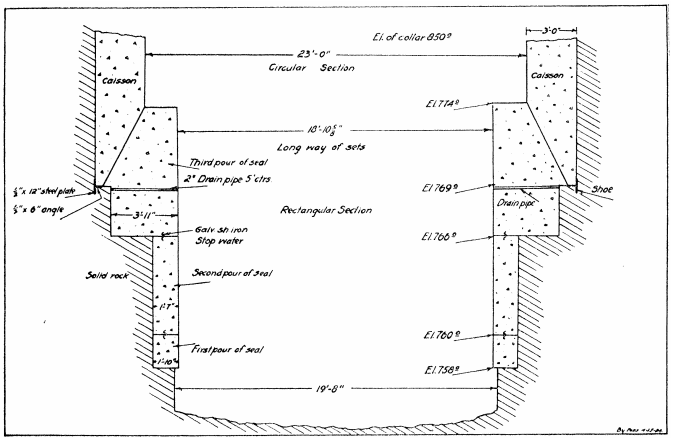


FIG. 1. LONGITUDINAL PROJECTION OF CONCRETE SEAL SHOWING STEEL CUTTING SHOE AT BOTTOM OF CAISSON.

Very little drilling and blasting was necessary as the dike rock was easily broken with picks and shoveled into convenient piles where it was picked up with the clam-shell bucket. The entire bottom was in dike at a depth of 73 ft. below the collar.

Occasionally, when heavy inrushes of water occurred for short periods it was found expedient to bail with a 30 cu. ft. bucket. The most serious inrush of sand, boulders and water occurred at a depth of 62 ft. A hole was opened outside the caisson the entire distance to the surface. The material was promptly mucked out, however, and no further trouble of that kind occurred.

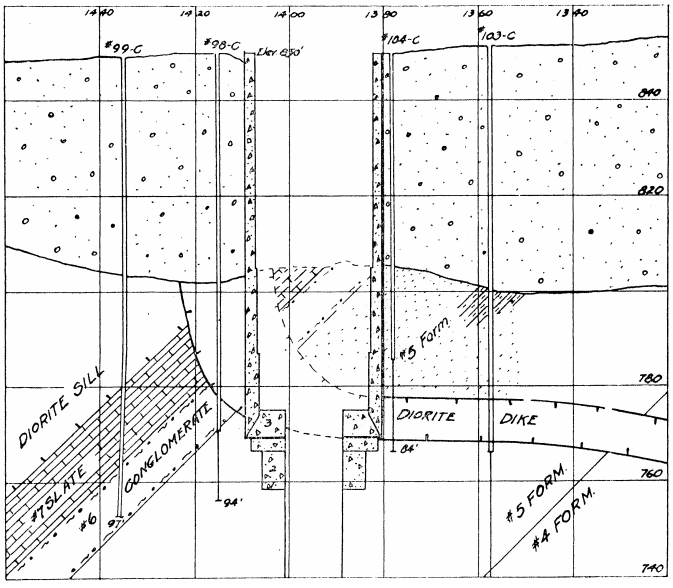
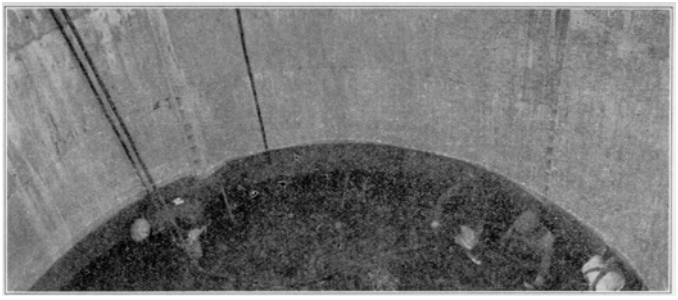


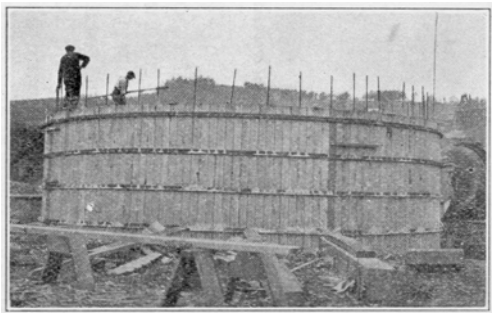
FIG. 2. VERTICAL SECTION THROUGH DROP-SHAFT SHOWING FORMATION ENCOUNTERED IN SINKING.

At a depth of 77½ ft. in the drop-shaft, the cutting edge on its north side pierced through the diorite dike and encountered very hard, thin bedded iron formation. From this point the sinking progressed much more slowly than heretofore, because this rock required considerable drilling and blasting.

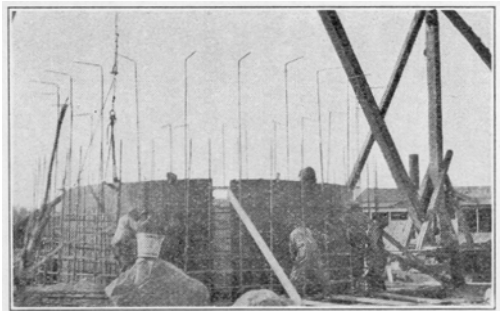
The lower contact of the diorite dike proved to be nearly horizontal and at a depth of 81 ft. the cutting edge was practically through the dike except a foot or two on the south side. It was decided to stop the sinking of the drop-shaft at this depth and proceed to anchor it and seal off the flow of water which was now coming in at the rate of about 60 gal. per minute.



VIEW DOWN SHAFT. NOTE MEN PICKING BOULDERS UNDER CUTTING EDGE.



POURING CONCRETE INTO FINISHED FORM OF FIRST SECTION OF DROP-SHAFT. NO. 3 SHAFT IN BACKGROUND



BUILDING FORM FOR SECOND SECTION OF DROP-SHAFT.

Sealing the drop-shaft so as to permit no water to enter the shaft from around the outside of the caisson was effected by the method shown in Fig. 1. The rock was cut out as shown in the illustration and the first ring of concrete, 2 ft. in height was poured. After the concrete had set, the second ring, 6 ft. in height, was poured. A 2-ft. ring of galvanized sheet iron was placed vertically at each of the joints of the successive rings, while the concrete was soft, to assure no leakage at these places. The third and final ring of the seal 8 ft. high was the most important and actually effected the seal, the others forming its foundations and stopping such water as reached that depth. Upon this ring 2-in. drain pipes were laid horizontally on 5-ft. centers. The pipes served to carry off the water while the concrete was setting, after which they were tightly closed by grouting. Fig. 1 shows dimensions in the long

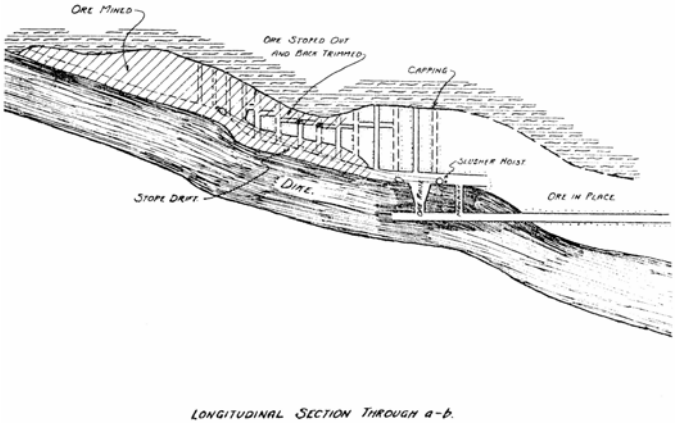
section. The rings were 3 ft. 7 in. thicker at the aides of the shaft.

NOTES ON MINING THE NORTH PALMS OREBODY.

BY JOHN E. BERTELING, BESSEMER, MICH.*

The North Palms orebody of the Palms-Anvil-Keweenaw group is so-called because it lies about 600 ft. north of the quartzite foot-wall of the Gogebic Range, and is on the Palms property.

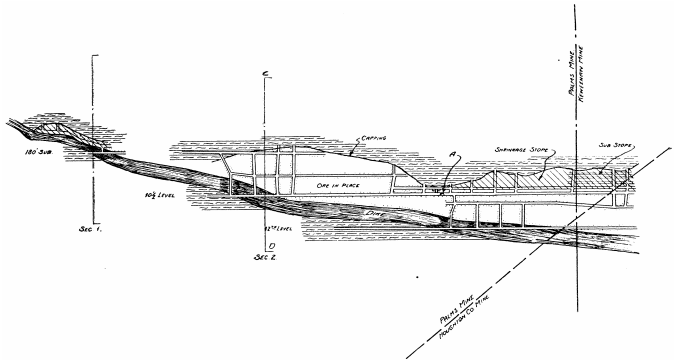
This deposit is the western extension of the Keweenaw orebody. The Anvil slates act as the foot wall and the ore rests on the same dike that carries the main footwall orebody in this property as well as its eastward extension into the Eureka mine. North Palms, Keweenaw and the extension eastward into the Eureka make a continuous orebody of over a mile in length.



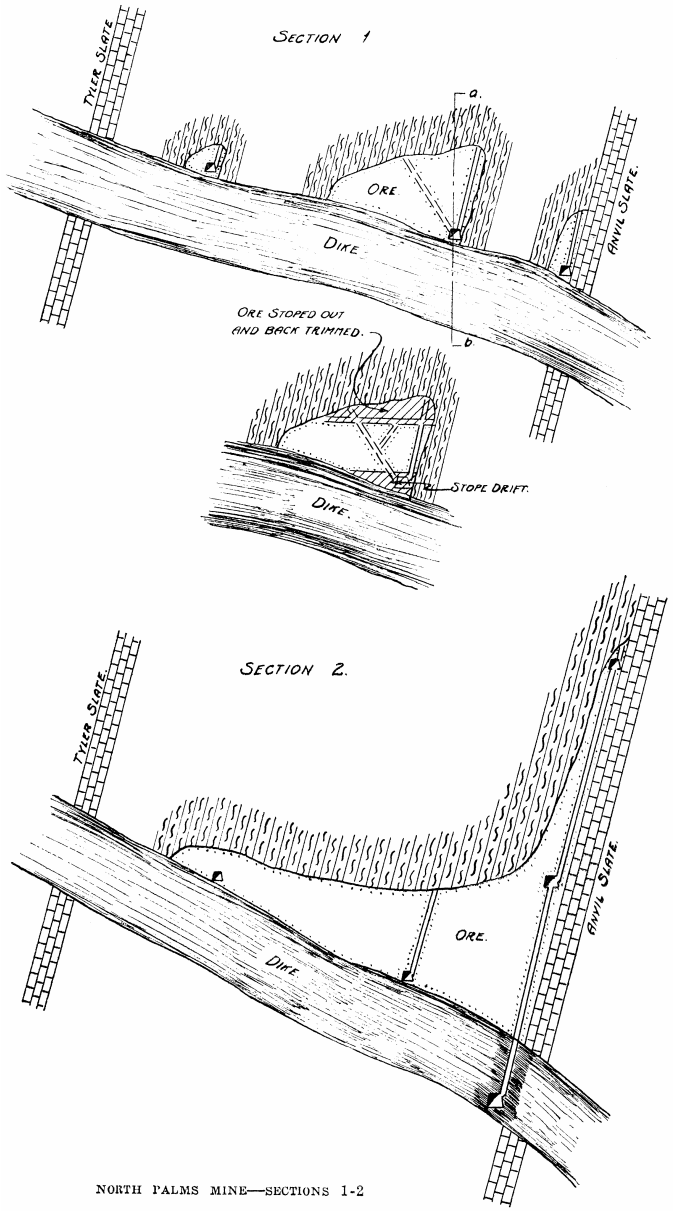
NORTH PALMS MINE

On the Palms property the ore body was first encountered at "A" (see longitudinal section, Sketch 1.) by a crosscut from the footwall orebody on the 10½ level elevation. The portion to the east of the crosscut and above the level was mined by the shrinkage stope method and later by sub-stoping.

*Superintendent, Anvil, Palms and Keweenaw Mines of the Youngstown Sheet & Tube Co.



SKETCH I—NORTH PALMS MINE



NORTH PALMS MINE—SECTIONS 1-2

The operations described in this paper relate to the development and mining west of "A" and above the 10½ level. From the longitudinal projection it will be noted that the dike on which the ore rests rises up to the west at an angle of about 15 degrees. Typical cross-sections are shown in Sec. 1, through the western end of the orebody and Sec. 2 through C. D. The dike rises to the north from the slate footwall at varying angles but in most instances is not steep enough for broken ore to run. In Sec. 1 lingers of capping rock come down to the dike making three distinct ore bodies while in Sec. 2 the ore is continuous along the dike from the slate north to the hanging wall. Along the slate footwall the ore runs up in a narrow seam to a much greater height than the average of the cross-sections. The conditions then are an ore body resting on a dike which rises to the west at an angle of 15 degrees, to the north at an average angle of 30 degrees, the average width of 180 feet, except