

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING:  
(Continued)

b. Detailed Cost Comparison:

(7) Detail of Accounts: (Cont.)

In studying the detail of accounts for 1932 and 1931, it is immediately evident that the cash expenditures for the two years are very much different. The reasons briefly stated are that the 1932 figures represents 7 months operating, while 1931 represents 12 months, that wages were reduced 10% on Oct. 1st, 1931 and 15% on May 16th, 1932, that salaries were reduced about 16% on June 16th, 1931 and again on Feb. 1st and June 1st, 1932 to make a total reduction of about 45% in the period, June 16th, 1931 to June 1st, 1932. The only comparison of value is in the cost per ton which is discussed in the following paragraphs.

1. Exploring in Mine:

Ishpeming Office charge for Geologist's time on mine geological work.

2. Development in Rock:

There was no rock development in 1932.

4. Development in Ore:

Large decrease in cost per ton due to less work required in 1932 to complete development of the seventh level. Most of this work was done in 1931.

5. Stoping:

Decrease in cost per ton due to less labor and supply cost for breaking ore.

6. Timbering:

Less expense for repairing timber throughout the mine and less expense for timbering on the seventh level.

7. Tramming:

Increase due to less expense loading ore at chutes. All ore in both years handled twice (In the auxiliary and main shafts).

9. Pumping:

The comparison covers 7 months pumping in 1932 as compared with 12 in 1931. The cost per ton is higher due to more idle time in 1932, causing extra expense for pumpman's helper, also some expense for pumping from eighth level in 1932 and none in 1931, and more expense for power by fifth and sixth level centrifugal pumps.

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
Gallons per Minute	225	327		102
Cost for Power per Ton	.165	.127	.038	
Labor Cost per Ton	.080	.070	.010	

10. Compressors and Air Pipes:

Decrease in cost per ton due to more stoping and less development in 1932.

11. Back Filling:

No expense for filling in 1932.

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING:  
(Continued)

b. Detailed Cost Comparison:

(7) Detail of Accounts: (Cont.)

16. Electric Tram Equipment:  
Less expense in 1932 for extension of tracks on seventh level and repair of cars and locomotives.
17. Pumping Machinery:  
Normal expense in 1932, in previous year extraordinary account of installing additional pumping equipment on the fourth, sixth and seventh levels.
18. Hoisting:  
Small increase in cost per ton due to handling all product twice in 1932. Most of product came from seventh level, 120 feet more depth, and power cost higher per ton.
19. Stocking Ore:  
Less expense for erecting trestles.
21. Dry House:  
Dry used for only five months in 1932, Jan. to June 1st. Cost per ton for this period higher than average cost for twelve months 1931.
22. General Surface Expense:  
Less surface work required in 1932.
23. Maintenance: Hoisting Equipment:  
A new hoisting rope charged out each year. Less expense per ton in 1932 for repairs to skip roads and skips.
24. Maintenance: Shaft:  
More expense per ton in 1932 for repair of runners in cage road.
25. Maintenance: Top Tram Equipment:  
Cost per ton higher on account of proportional expense for repairs to cars and tracks greater in 1932.
26. Maintenance: Docks, Trestles and Pockets:  
Less expense in 1932 for repairs to permanent trestles and pockets in shaft house. No ore shipped in 1932. No new portable trestles erected in 1932, while in 1931 some new stocking ground was prepared and trestle erected.
27. Mine Buildings:  
Less repairs required in 1932.
31. Analysis and Grading:  
Cost per ton higher due to increase in cost per determination in 1932, on account of reduced working schedule at all mines.
32. Personal Injury:  
Lower payroll in November and December, two of the seven operating months of 1932, reduced the 2% reserve and casualty insurance.

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING:  
(Continued)

b. Detailed Cost Comparison:  
(7) Detail of Accounts: (Cont.)

33. Safety Department:  
Decrease in cost per ton due to less expense for salaries of committees and no awards for safety records in 1932.
36. Special Expense, Pensions and Allowances:  
Large increase in cost per ton due to expense of gardens and wood furnished by the company included in December charges. No similar expense in 1931.
40. Taxes:  
Taxes increased in 1932 on account of more ore in stock.

The following statement gives the supply balances and supplies used in 1932 and 1931.

Comparison Supply Balance Jan. 1st, 1933 with Balance Jan. 1st, 1932:

	<u>Jan. 1st, 1933</u>	<u>Jan. 1st, 1932</u>	<u>Increase</u>	<u>Decrease</u>
1. General Supplies	1823.78	2042.27		218.49
2. Iron & Steel	193.89	261.58		67.69
3. Oil & Grease	190.12	225.07		34.95
4. Machinery Supplies	3234.45	3692.13		457.68
5. Explosives	104.62	51.55	53.07x	
6. Lumber & Timber	1828.36	1362.55	465.81xx	
7. Fuel	659.70	1659.68		999.98
9. Sundries	23.47	35.76		12.29
<b>TOTAL</b>	<b>8058.39</b>	<b>9330.59</b>		<b>1272.20</b>

x Powder stored underground and not charged out yet.

xx Timber from D.S.S. & A. Ry. Co. a/c E & A. #566 - Sinking Mackinaw Shaft.

Comparison Supplies Used & Cost per Ton, 7 Opt. Mos. 1932 with 12 Mos. in 1931:

	<u>7 MOS. 1932</u>		<u>12 MOS. 1931</u>		<u>INCREASE</u>		<u>DECREASE</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
1. General Supplies	604.34	.024	4735.89	.059			4131.55	.035
2. Iron & Steel	202.81	.008	801.53	.011			598.72	.003
3. Oil & Grease	287.59	.012	1309.66	.016			1022.07	.004
4. Machinery Supplies	600.92	.024	4252.85	.054			3651.93	.030
5. Explosives	2265.48	.092	15598.97	.196			13333.49	.104
6. Lumber & Timber	365.39	.016	2217.62	.028			1852.23	.012
7. Fuel	497.17	.020	995.33	.013		.007	498.16	
8. Electric Power	10208.96	.412	31999.61	.403		.009	21790.85	
9. Sundries	550.90	.022	2779.78	.035			2228.88	.013
Other Mines, Etc.	685.30	.028	1817.18	.023		.005	1131.88	
<b>TOTAL</b>	<b>14898.26</b>	<b>.602</b>	<b>62874.26</b>	<b>.792</b>			<b>47976.00</b>	<b>.190</b>

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

9. EXPLORATIONS  
AND FUTURE  
EXPLORATIONS:

There was no diamond drilling in 1932.

10. TAXES:

<u>Description</u>	<u>1 9 3 2</u>		<u>1 9 3 1</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Gardner Mine, C. & N.W. Lease:				
SE $\frac{1}{4}$ of SE $\frac{1}{4}$ Sec. 35-45-25	5,000	160.35	5,000	188.02
NW $\frac{1}{4}$ of NE $\frac{1}{4}$ Sec. 2-44-25	80	2.57	200	7.51
Personal Property - Both Mines	170,000	5451.84	155,000	5828.62
Total	175,080	5614.76	160,200	6024.15
Collection Fee		56.15		60.24
Total Taxes		5670.91		6084.39
Mackinaw Mine, D.M. & M. Lease:				
N $\frac{1}{2}$ of SE $\frac{1}{4}$ & SW $\frac{1}{4}$ of SE $\frac{1}{4}$ Sec. 35-45-25	10,000	320.70	15,000	564.06
Collection Fee		3.21		5.64
Total Taxes		323.91		569.70
Gardner-Mackinaw Dwellings:	5,000	160.35	6,500	244.43
Collection Fee		1.60		2.44
Total Taxes		161.95		246.87
Total Taxes - Gardner-Mackinaw Mine & Location		6156.77		6900.96
Decrease - 1932		744.19		
Tax Rate per \$ 100		3.2390		3.7604

Taxes decreased in 1932 due to a lower rate.

11. ACCIDENTS  
AND  
PERSONAL  
INJURY:

No accidents occurred in either 1932 or 1931. The record was 951 days or nearly three years without a lost time accident at the end of 1932. The surface record is now four years and two months without an accident.

12. NEW  
CONSTRUCTION  
AND  
PROPOSED NEW  
CONSTRUCTION:

E & A. 566 - Sinking Mackinaw Shaft:

Work under this E & A. was in progress during the seven operating months of 1932. It was mainly in connection with work preliminary to raising the shaft and covered sinking of winze from seventh to eighth level, drifting 220 feet on the eighth level to the shaft, raising the shaft 165 feet on the incline and stripping and timbering the shaft. Although the work was not completed, the E & A. was considered finished in 1932 and a new E & A. will be prepared in 1933.

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

12. NEW  
CONSTRUCTION  
AND  
PROPOSED NEW  
CONSTRUCTION:  
(Continued)

<u>E &amp; A. 566 - Sinking Mackinaw Shaft:</u>		
Original Estimate		\$ 82,280.00
Expended to Jan. 1st, 1932	\$ 47,757.61	
Expended in 1932	<u>8,417.91</u>	
Total Expended	\$ 56,175.52	<u>56,175.52</u>
Unexpended Balance Dec. 31st, 1932		\$ 26,104.48
 <u>Detail of Expenditures 1932:</u>		
<u>Sinking Shaft:</u>		
Original Estimate		\$ 35,000.00
Expended to Jan. 1st, 1932	\$ 25,982.00	
Expended in 1932	<u>3,195.52</u>	
Total Expended	\$ 29,177.52	<u>29,177.52</u>
Unexpended Balance Dec. 31st, 1932		\$ 5,822.48
 <u>Plat and Pocket:</u>		
Original Estimate		\$ 4,000.00
Expended to Jan. 1st, 1932	\$ 4,162.27	
Expended in 1932	<u>181.20</u>	
Total Expended	\$ 4,343.47	<u>4,343.47</u>
Unexpended Balance Dec. 31st, 1932		\$ 343.47
 <u>Drifting:</u>		
Expended to Jan. 1st, 1932	\$ 7,028.83	\$ 19,800.00
Expended in 1932	<u>3,366.32</u>	
Total Expended	\$ 10,395.15	<u>10,395.15</u>
Unexpended Balance Dec. 31st, 1932		\$ 9,404.85
 <u>Contingencies:</u>		
Original Estimate		\$ 7,480.00
Expended to Jan. 1st, 1932	\$ 7,503.71	
Expended in 1932	<u>1,674.87</u>	
Total Expended	\$ 9,178.58	<u>9,178.58</u>
Unexpended Balance Dec. 31st, 1932		\$ 1,698.58
 <u>Summary of Work in 1932:</u>		
Sinking	\$ 3,195.52	
Plat and Pocket	181.20	
Drifting	3,366.32	
Contingencies	<u>1,674.87</u>	
Total Expended 1932	\$ 8,417.91	
Unexpended Balance Jan. 1st, 1932		\$ 26,104.48
Unexpended Balance Dec. 31st, 1932		\$ 17,686.57

The work in 1932, involving an expenditure of \$ 8,417.91, covered sinking and timbering a winze 60 feet, cutting plat and pocket for winze, drifting 220 feet on the eighth level, raising 165 feet in line of auxiliary shaft, and sinking and timbering 72 feet of the shaft. All of the ore broken in connection with this work had to be handled three times, in the winze, the auxiliary shaft and the main shaft. The cost per foot for the total of 517 feet of combined sinking, drifting and raising was \$ 16.00.

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

13. EQUIPMENT  
AND  
PROPOSED  
EQUIPMENT:

a. Steam Shovels:

No repairs were made to steam shovels during the winter of 1931-1932. The shovels were not used this year as no ore was shipped.

b. Stockpile Trestles:

No trestles were erected in 1932.

c. Scraper Hoists:

The equipment at this mine is as follows:

	On Hand <u>1/1/1932</u>	Purchased <u>in 1932</u>
Ingersoll-Rand Air	6	--
Sullivan Air	3	--
Sullivan 10 H.P. Electric	1	--
Sullivan 20 H.P. Electric	<u>1</u>	--
Total	<u>11</u>	--

The Sullivan air hoists are ready to be scrapped so that if the necessity ever arises for much scraper equipment, additional electric units will have to be purchased.

d. Pumping Equipment:

With the opening of additional levels it will soon be necessary to obtain another centrifugal pump to handle the water from the bottom level to the fifth level. Very little water comes in on the seventh and even less is anticipated on the eighth and lower levels, so the pump required will be of small capacity. A pump capable of handling 50 gallons per minute against a head of 600 feet will fill the requirements for the eighth and ninth levels. This pump should have an automatic starting and stopping device to reduce labor expense. The question of another pump for this mine has already been submitted to the Mechanical Department and they are endeavoring to find one in the idle equipment.

14. MAINTENANCE  
AND REPAIRS:

There was no extraordinary maintenance or repair expense in 1932.

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

15. POWER:

Electric power was furnished by the Cliffs Power & Light Co., a subsidiary of the Cleveland-Cliffs Iron Co. The charge of  $1\frac{1}{2}$  cents per kilowatt hour was the same as in previous years.

The following statement gives a detail of the power used in 1932 and 1931:

	<u>K.W.H. Used</u>		<u>Increase</u>	<u>Decrease</u>	<u>Remarks</u>
	<u>1932</u>	<u>1931</u>			
Gardner Hoist		22,950		22,950	Mine idle 1932
Mackinaw Hoist	80,010	215,340		135,330	Less product
Compressors	287,730	1,089,640		801,910	Operating part time
Safety Department	13,488	12,918	570		More lighting on levels
Electric Haulage	40,036	76,046		36,010	Operating part time
E & A. 566 - Winze Hoist	35,416	14,334	21,082		Sinking winze, etc.
Shops	1,274	2,954		1,680	Operating part time
Top Tram	440	1,258		818	" " "
U.G. Auxiliary Hoist	18,550	27,760		9,210	" " "
Pumping	469,230	659,494		190,264	Less water pumped
Lights - 4th L. Pumphouse	3,562	2,875	687		More expense for lights
Crusher - Samples	28	65		37	Operating part time
Drier - Samples	5,486	13,282		7,796	" " "
Flood Lights - Stocking	22	1,214		1,192	" " "
Barn	0	38		38	Not used in 1932
Heating Plant	610	2,234		1,624	Operating part time
Dry House	2,604	4,854		2,250	" " "
Office	206	739		533	" " "
Engine House - Lights	1,940	4,224		2,284	" " "
Timber Tunnel	702	1,440		738	" " "
Total	961,334	2,153,659		1,192,325	
In Cash	\$ 14420.01	\$ 32304.89		\$ 17884.88	

17. CONDITION  
OF  
PREMISES:

No improvements were made in 1932. The premises were kept clean and in neat condition.

GARDNER-MACKINAW MINE  
ANNUAL REPORT  
YEAR 1932

18. NATIONALITY  
OF  
EMPLOYEES:

This report compares month of December 1932 with same month, 1931. It has been prepared under two statements. The first shows the nationality of the employees as to parentage. The second statement separates the nationalities into "Foreign born" and "American born."

<u>As to Parentage</u>	<u>1932</u>	<u>%</u>	<u>1931</u>	<u>%</u>
English	5	7.2	10	7.9
Finnish	15	21.8	46	36.2
Italian	10	14.5	32	25.2
Swedish	18	26.1	17	13.4
French Canadians	13	18.8	16	12.5
Germans	2	2.9	2	1.6
Norwegians	4	5.9	2	1.6
Irish	0	0	1	.8
Hungarian	1	1.4	0	0
Scotch	0	0	1	.8
Total	69	100.0	127	100.0

<u>As to Birth</u>	<u>Total</u>		<u>American Born</u>		<u>Foreign Born</u>	
	<u>1932</u>	<u>1931</u>	<u>1932</u>	<u>1931</u>	<u>1932</u>	<u>1931</u>
English	5	10	4	6	1	4
Finnish	15	46	6	17	9	29
Italian	10	32	2	7	8	25
Swedish	18	17	11	10	7	7
French Canadians	13	16	9	11	4	5
Germans	2	2	2	2	0	0
Norwegians	4	2	2	1	2	1
Irish	1	1	1	1	0	0
Scotch	0	1	0	1	0	0
Hungarian	1	0	0	0	1	0
Total	69	127	37	56	32	71
Percentage			54%	44%	46%	56%



FRANCIS MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL:

The only structure left at this abandoned mine is the head frame, all other buildings were sold and removed several years ago.

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:b. Shipments:

None in 1932.

c. Stockpile Inventories:

	<u>1932</u>	<u>1931</u>
Franport	197,676	197,676

8. COST OF  
OPERATING:

	<u>1932</u>	<u>1931</u>	<u>Decrease</u>
General Mine Expenses		53.39	53.39
Loading and Shipping		412.67	412.67
Taxes	<u>5,687.58</u>	<u>7,067.41</u>	<u>1,379.83</u>
Total Cost at Mine	<u>5,687.58</u>	<u>7,533.47</u>	<u>1,845.89</u>

General Mine Expenses and Loading and Shipping, no charges in 1932 account of no ore shipped.

Taxes lower on account of lower tax rate and decrease in assessed valuation.

10. TAXES:

	<u>1 9 3 2</u>		<u>1 9 3 1</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
SW $\frac{1}{4}$ of NW $\frac{1}{4}$ , Sec. 27-45-25 - 40 Acres	C & N W	3.04	C & N W	3.12
SW $\frac{1}{4}$ (Except R of W) " 153.56 Acres	500	16.03	500	18.81
Personal Property	175,000	<u>5612.20</u>	185,500	<u>6975.54</u>
Total		<u>5631.27</u>		<u>6997.47</u>
Collection Fees		<u>56.31</u>		<u>69.94</u>
Total Taxes		<u>5687.58</u>		<u>7067.41</u>
Tax Rate per \$ 100.00		3.205		3.7604

Taxes decreased on account of decrease in valuation and lower tax rate.

REPUBLIC MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL

Very little transpired at this property during 1932. There has been no watchman at the Mine since February 1, 1931. We have sold several of the mine buildings and dwellings during the year and moved most of the equipment stored in the drill sharpening shop near No. 9 shaft to Ishpeming.

2. SURFACE

a. Buildings

1. Mine Buildings.

The old warehouse building was sold to Bert W. Cook for \$150.00. He completed payments in full during December. He is using the building as a wood working shop and is making articles out of white birch, such as souvenirs for summer resorts.

The drill sharpening shop has been leased to Charlie Maki of Republic for use as a storage garage and repair shop at a monthly rental of \$15.00 per month. The lease includes an option to purchase within six months. The purchase price has been set at \$500.00 and any rental paid is to be credited on said \$500.00.

2. Location Houses.

Two more of the location houses were sold during 1932 as follows:

<u>House No.</u>	<u>Purchaser</u>	<u>Sale Price</u>
No. 45	John A. Waananen	\$ 200.00
No. 16	Bert W. Cook	200.00

Both sales were for cash. House No. 45 was dismantled and used to build a house on Waananen's farm south of Republic. Mr. Cook will use the dwelling he purchased as his residence and will be given a lot lease on the ground.

There were little or no repairs made to the house during the year. The Company still owns eighteen houses, 12 single and 6 double ones of which 10 single houses and 8 halves of the double houses were occupied on December 31, 1932. While we are not able to collect rent on most of these houses, still we feel it is better to have them occupied than remain vacant at an isolated location where there is no watchman.

REPUBLIC MINE  
ANNUAL REPORT  
YEAR 1932

10. TAXES

<u>Description</u> <u>Republic Township</u>	<u>1932</u>		<u>1931</u>	
	<u>VALUATION</u>	<u>TAXES</u>	<u>VALUATION</u>	<u>TAXES</u>
Realty as described on tax receipt	\$ 10,000	\$ 455.80	\$ 10,000	\$ 592.90
Personal property .....	10,000	455.80	10,000	592.90
Lots 71,72,86,108 and 126.....	95	4.51	95	4.51
Total.....	20,095	916.11	20,095	1,191.55
Collection Fee.....		9.16		11.92
Total Operating Republic Mine.....		925.27		1,203.47
Republic Mine Dwellings, Inc. Fees..	6,950	320.31	6,950	416.53
Total Republic Township (Inc. Fees)	27,045	1,245.58	27,045	1,620.00
Rate.....		4.588		5.929

There has been no change in the valuation of the Realty or Personal property but due to a decrease in school expenditures, the rate is lower.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL

The Spies Virgil Mine operated four months and was idle eight months during 1932. The mine operated four single shifts per week, giving each man at least eight days work per month, from January 1st until February 29th. All work was stopped on this date with the exception of pumping, the mine remaining idle until November 1st. Operations were resumed solely to relieve the unemployment situation.

The Republic Steel Corporation discontinued all work on the Sherwood at the same time that the Spies Virgil closed down in February but did not resume again November 1st. We have been able to reemploy all of our old crew that were able and wished to return.

During the idle period from March 1st to November 1st we only employed pump men and watchmen. The pumping was done on one shift, by providing additional storage capacity by building dams on the Third and Eighth Levels. The same pumping schedule is being maintained with the mine operating by changing the dam from the Eighth to the Fourth Level.

The development work was confined to the top subs above the Eighth Level at the West end of the ore body. Mining was carried on in the stopes above the Sixth and Eighth Levels.

2. PRODUCTION  
SHIPMENTS &  
INVENTORIES

a. Production by Grades

<u>Grade</u>	<u>Tons</u>
Virgil Crushed	13,601
Virgil High Sulphur	-
Total Virgil	13,601
Rock	
Sherwood Ore	
Rock	738

The production of 13,601 tons for 1932 compares with 93,580 tons in 1931, a decrease of 79,976 tons. This large reduction is due to the mine being idle eight months and on a very reduced operation the other four.

	<u>Virgil Ore</u> <u>Tons</u>	<u>Virgil Hi-Sulphur</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>
Production to Jan. 1, 1932	812,093	8,879	820,972
Production for 1932	13,601		13,601
Total Produced from			
Mine to Jan. 1, 1933	825,694	8,879	834,573

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

2. PRODUCTION  
SHIPMENTS &  
INVENTORIES

b. Shipments

<u>Grade of Ore</u>	<u>Pocket</u> <u>Tons</u>	<u>Stockpile</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>	<u>Last Year</u> <u>Tons</u>
Virgil Crushed		4,551	4,551	79,497
Sherwood				1,027
Total		4,551	4,551	80,524
Total Last Year	31,248	49,276	80,524	
Decrease	31,248	44,725	75,973	

Total shipments to January 1, 1932	492,457 tons
Shipments during 1932	<u>4,551 tons</u>
Total shipments from Mine to January 1, 1933	497,008 tons

The shipment of Virgil ore for 1932 was 9,050 tons less than the production. The ore was all shipped from stockpile and loaded out of the North pile in order to secure a high phosphorus grade.

The No. 4 Shovel, which had been at the Spies Virgil Mine for a number of years, was in very poor condition and was shipped to the General Shops at Ishpeming for a complete overhauling last fall. It was found however, that the repairs necessary would be too expensive, so the No. 30 Shovel was shipped from Ishpeming to Iron River early in June. This shovel was cut into the North pile on July 16th and loaded 2,175 tons on July 18th and 19th and 2,376 tons on August 15th and 16th, making four days loading for the season.

c. Stockpile Inventories

<u>Grade</u>	<u>Tons in Stock</u>
Virgil Crushed	328,684
Virgil Crushed (High Sulphur)	8,879
Total	<u>337,563</u>

d. Division of Product by Levels

<u>Level</u>	<u>Tons</u>	<u>Per Cent</u> <u>of Product</u>
Sixth	6,213	45.68
Eighth	<u>7,388</u>	<u>54.32</u>
Total	13,601	100.00

e. Production by Months

The product by months, days operated, average daily product, and tons per man per day are shown in the table below:

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

2. PRODUCTION  
SHIPMENTS &  
INVENTORIES  
(Continued)

e. Production by Months (Cont.)

<u>Month</u>	<u>Hi-Sul.</u>		<u>Virgil</u>	<u>Total</u>	<u>No.</u>	<u>Average</u>	<u>Tons</u>
	<u>Rock</u>	<u>Ore</u>	<u>Ore</u>	<u>Ore</u>	<u>Days</u>	<u>Daily</u>	<u>Per Man</u>
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Opt.</u>	<u>Product</u>	<u>Per Day</u>
January			3,240	3,240	16	202	4.78
February			3,509	3,509	17	206	5.28
March							
April							
May							
June							
July							
August							
September							
October							
November			3,199	3,199	18	178	4.35
December			3,653	3,653	17	215	5.17
YEAR			13,601	13,601	68	200	4.87

The mine was idle from February 29, 1932 until November 1st, 1932.

f. Ore Statement

	<u>Virgil</u>	<u>Virgil</u>	<u>Total</u>	<u>Total</u>
	<u>Low Sul.</u>	<u>Hi-Sul.</u>		<u>Last Year</u>
On hand Jan. 1, 1932	319,634	8,879	328,513	314,430
Output for year 1932	13,601		13,601	93,580
TOTAL	333,235	8,879	342,114	408,010
Shipments	4,551		4,551	79,497
Balance on hand				
12-31-32	328,684	8,879	337,563	328,513
Increase in Output	77,853		77,853	49,247
Increase in Ore on hand	9,050		9,050	14,083

1932 1-8 Hr. Shift 4 days per week, Jan. 1 to March 1.  
 1932 Idle except pumping from March 1 to November 1.  
 1932 1-8 Hr. Shift, 4 days per week Nov. 1, to Dec. 31st.

1931 2-8 Hr. Shifts 5 days per week to May 1st.  
 1931 2-8 Hr. Shifts 4 days per week May 1st to May 25th.  
 1931 1-8 Hr. Shift 6 days per week May 25th to Nov. 16th.  
 1931 1-8 Hr. Shift 4 days per week Nov. 16 to Dec. 31st.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

2. PRODUCTION  
SHIPMENTS &  
INVENTORIES  
(Continued)

a. Developed Ore

g. Delays

Assumptions: 12 cu. ft. equals one ton.

There were no mechanical or electrical delays during the entire year.

h. Delays from Lack of Current

There were no delays during the entire year due to lack of current.

3. ANALYSIS

a. Average Mine Analysis on Output

Grade Levels	Tons	Iron	Phos.	Sil.	Sulp.	Total Tons
Virgil Crushed	13,601	59.96	.418	4.07	.075	3,709

b. Average Analysis on Straight Cargoes

Grade	Tons	Mine				Lake Erie		
		Iron	Phos.	Sil.	Sul.	Iron	Moist.	Iron Natl.
Virgil Crushed	2,175	58.53	.507	4.88	.110	58.58	8.90	53.37
Total Revised	2,376	58.87	.469	4.77	.091	58.74	7.15	54.54
1932 Production	4,551	58.70	.488	4.82	.100	58.66	7.99	53.98

c. High Sulphur Ore

No high sulphur ore was mined or encountered in development during 1932.

d. Average Analysis on Total Shipments

Grade	Tons	Iron	Phos.	Sil.	Sul.
Virgil Crushed	4,551	58.70	.488	4.82	.100

e. Average Analysis of Ore in Stockpile

Grade	Tons	Iron	Phos.	Sil.	Mn.	Al.	Lime	Mag.	Sul.	Loss	Moist.
Virgil Crushed											
Dried 212° F.	328,624	57.68	.401	7.12	.19	1.84	.60	.21	.078	6.50	
Natural		53.35	.371	6.59	.18	1.70	.55	.19	.072	6.01	7.50
Virgil Hi-Sulphur											
Dried 212° F.	8,879	57.41	.424	4.09					.369		
Natural		53.10	.392	3.78					.341		7.50

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

4. ESTIMATE  
OF ORE  
RESERVES

a. Developed Ore

Assumption:- 12 cu. ft. equals one ton.  
10% deduction for rock.  
10% for loss in mining.

The only development during 1932 was on the sub-levels above the 8th Level. A new estimate of this area was made, and deductions made for production in other areas, as there was little change, the mine operating only four months on a curtailed basis.

	Available Tons	Un- Available Tons	Total Tons
Nov. 30, 1931 Est. of Ore 6th Level & Above	104,520	457,472	561,992
Nov. 30, 1931 Est. of Ore Bet. 6th & 8th Levels	170,498	95,712	266,210
Nov. 30, 1931 Total Developed Ore	275,018	553,184	828,202
Dec. 1931 Production	3,709		3,709
Reserves as of Dec. 31, 1931	271,309	553,184	824,493
Deduct Developed ore bet. 6th & 8th Level Balance	170,498	95,712	266,210
Revised Est. Developed Ore	100,811	457,472	558,283
Between 6th & 8th Level Dec. 31, 1932	174,715	95,712	270,427
Total Revised Developed Tons	275,526	553,184	828,710
1932 Production	13,601		13,601
Total Developed Ore, Dec. 31, 1932	261,925	553,184	815,109

b. Prospective Ore

	Available Tons	Unavailable Tons	Total Tons
Between 6th & 8th Level	409,151	278,755	687,906
Total all ore Dec. 31, 1932	671,076	831,939	1,503,015
Ton developed during 1932			
All above 8th Level			4,217

We estimate we will recover about one third the ore above the Sixth Level tied up in pillars and shown unavailable, in our last mining operations.

c. Estimated Reserve Analysis

	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Dried	57.50	.425	7.00	.16	1.64	.60	.30	.119	7.35	
Natural	51.75	.382	6.30	.15	1.48	.55	.26	.107	6.60	10.00



SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

4. ESTIMATE  
OF ORE  
RESERVES  
(Continued)

d. Estimated Production

The following is the estimated tonnage and expected analysis of the 1933 production from the Virgil Mine. This estimate is based on 4 single shifts per week from January 1st to May 1st, and from November 1st to December 31st, 1933, the mine being idle the intervening six months:

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>	<u>Iron Natl.</u>
Virgil Crushed	20,200	57.50	.432	7.00	.078	7.50	53.19

5. LABOR  
AND  
WAGES

a. Comments

We operated the four months of 1932 with four less men than last year. One man died, one left to go back on the farm and two did not return for unknown reasons. During the idle period, we employed a crew of 12 men, including the Captain and Clerk, on a staggered schedule.

The men realize fully that the mine is being operated to give them employment and appreciate what the Company is doing for them.

Wages were reduced 15% on May 16, 1932, making common labor \$2.90 and Company account miners \$3.55 per day.

b. Comparative Statement of Wages and Product

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
<u>PRODUCT</u>	13,601	93,580		79,979
<u>NO. SHIFTS &amp; HOURS</u>	1-8	2-8 First 5 mos. 1-8 Last 7 "		
<u>AVG. NO. OF MEN WORKING</u>				
Surface	18	19		1
Undg.	48	51		3
Total	66	70		4
<u>AVG. WAGES PER DAY</u>				
Surface	3.71	4.40		.69
Undg.	4.33	5.30		.97
Total	4.14	5.03		.89
<u>WAGES PER MONTH OF 25 DAYS</u>				
Surface		110.00		
Undg.		132.50		
Total		125.75		
<u>WAGES PER MONTH OF 20 DAYS</u>				
Surface		88.00		
Undg.		106.00		
Total		100.60		

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

5. LABOR  
AND  
WAGES  
(Continued)

b. Comparative Statement of Wages and Product (Cont.)

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
<u>WAGES PER MONTH OF 16 DAYS</u>				
Surface		70.40		
Undg.		84.80		
Total		80.48		
<u>WAGES PER MONTH OF 12 DAYS</u>				
Surface		52.80		
Undg.		63.60		
Total		60.36		
<u>WAGES PER MONTH OF 8 DAYS</u>				
Surface	29.68	35.20		5.52
Undg.	34.64	42.40		7.76
Total	33.12	40.24		7.12
<u>PRODUCTION PER MAN PER DAY</u>				
Surface	15.77	20.80		5.03
Undg.	7.06	9.11		2.05
Total	4.88	6.33		1.45
<u>PRODUCTION PER MAN PER DAY 20 DAYS</u>				
Surface		21.14		
Undg.		8.86		
Total		6.24		
<u>PRODUCTION PER MAN PER DAY 16 DAYS</u>				
Surface		21.33		
Undg.		9.04		
Total		6.35		
<u>PRODUCTION PER MAN PER DAY 12 DAYS</u>				
Surface		21.60		
Undg.		9.69		
Total		6.69		
<u>PRODUCTION PER MAN PER DAY 8 DAYS</u>				
Surface	15.77	16.74		.97
Undg.	7.06	8.28		1.22
Total	4.88	5.54		.66
<u>LABOR COST PER TON</u>				
Surface	.2355	.2116	.0239	
Undg.	.6129	.5820	.0309	
Total	.8484	.7936	.0548	

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

5. LABOR  
AND  
WAGES  
(Cont.)

b. Comparative Statement of Wages and Product (Cont.)

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
<u>LABOR COST PER TON 20 DAYS</u>				
Surface		.2112		
Undg.		.6056		
Total		.8168		
<u>LABOR COST PER TON 16 DAYS</u>				
Surface		.2111		
Undg.		.5805		
Total		.7916		
<u>LABOR COST PER TON 12 DAYS</u>				
Surface		.2029		
Undg.		.5509		
Total		.7538		
<u>LABOR COST PER TON 8 DAYS</u>				
Surface	.2355	.2480		.0125
Undg.	.6129	.5955	.0174	
Total	.8484	.8435	.0049	
AVG. PRODUCT BR'K & TRAM'G.	35.46	36.48		1.02
AVG. PRODUCT BR'K & TRAM'G. 20 DA.		30.18		
A VG. PRODUCT BR'K. & TRAM'G. 16 DA.		35.19		
AVG. PRODUCT BR'K & TRAM'G. 12 DA.		45.90		
AVG. PRODUCT BR'K & TRAM'G. 8 DA.	35.46	45.67		10.21
AVG. WAGE CONTRACT MINERS	4.845	5.78		.935
<u>TOTAL NO. OF DAYS</u>				
Surface	862 $\frac{1}{2}$	4499 $\frac{3}{4}$		3637 $\frac{1}{4}$
Undg.	1927	10274 $\frac{3}{4}$		8347 $\frac{3}{4}$
Total	2789 $\frac{1}{2}$	14774 $\frac{3}{4}$		11985
<u>AMOUNT FOR LABOR</u>				
Surface	3,203.07	19,803.07		16,600.00
Undg.	8,336.34	54,459.15		46,122.81
Total	11,539.41	74,262.22		62,722.81
<u>PROPORTION SURFACE TO UNDG. MEN</u>				
1932	1	to	2.23	
1931	1	to	2.28	
1930	1	to	2.43	
1929	1	to	2.74	
1928	1	to	2.64	

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

6. SURFACE

a. Building Repairs

1. Buildings, Mine

The roof on the Engine House and Office and Warehouse were given a coat of tar during the summer. Practically no other repairs were made this year.

2. Buildings, Location

What repairs were made to the location houses were done by the tenants, any supplies necessary being furnished by the Mine. The usual kalsomining and painting which is done by the tenants, with material furnished, was reduced to a minimum.

b. Stockpiles

The ore stockpiled during the winter of 1931-1932 and up to December 31, 1932, was all placed on the main pile northeast of the shaft. There is sufficient room to take care of our years production on the present basis of operation.

7. UNDERGROUND

b. Development

Fourth Level

There was no new development on the Fourth Level during 1932. A dam 30" high was built near the fire door on this level to increase the storage capacity for water so as to be able to pump on one shift. An elevated walk was constructed from the top of the dam in several hundred feet so as to maintain this drift as a traveling way. Water between the Third and Fourth Level is stored here.

Sixth Level

There was no new development on the Virgil side of the Sixth Level.

The Sherwood drift was extended to the Southwest 68 feet and the cross-cut to the south along the 200 foot coordinate 55 feet, a total of 123 feet. The Republic Company gave notice to discontinue work on February 29th and nothing has been done since. The main drift is now 462 feet from the Virgil-Sherwood line and was in ferruginous ores and cherty slate. The cross-cut is being driven to reach the ore in the vicinity of Diamond Drill Hole No. 9, which shows over 100 feet of ore above this elevation. It is estimated that this cross-cut will have to be driven at least 200 feet in rock before striking the ore.

As instructed by the Republic Company, we took up all rail and pipe from their drift and stored it on the Virgil side in a dry place. The Sherwood drift is driven down grade from the Virgil line and will fill with water. The ventilating fan and motor from the underground locomotive were taken to surface and stored in one of the buildings

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

7. UNDERGROUND  
(Continued)

b. Development

Subs Above Sixth Level

There was no actual development of any additional ore on these sub-levels.

Eighth Level

There was no new development on the Eighth Level.

Subs Above Eighth Level

The development on the upper sub-levels above the Eighth Level, namely, the -50 foot, -25 foot, 000 foot and +25 foot, which were extended to the northwest, proved up approximately 4,200 tons over that mined during the year. Both tonnages are small as the mine was on a curtailed basis and only operated four months during the year. The cross-cuts to the Southwest from these upper subs are being extended into the main ore body below the Sixth Level. There is a lean area between the two ore bodies.

The highest elevation reached at the West end of this ore body is +25 foot. The formation has flattened out on these upper sub-levels and from the limited development done thus far it looks like the +25 foot is the top of the ore.

c. Stoping

Sixth Level

The ore hoisted the past year from the Sixth Level has all been secured from stoping operations. One gang has been engaged in stoping during the four operating months on the 185 and 230 foot sub-levels, in the area east of the main pillar. This ore breaks in large chunks and the miners spend considerable time blasting on the lower subs and chutes.

Eighth Level

The larger part of the 1932 tonnage was secured from the West stope above the Eighth Level. No mining was done in the East Stope.

Mining had just started in this stope the previous year. Two gangs have been employed breaking ore in this stope during 1932. West of the 200 foot coordinate where the grizzly elevation is one sub lower, stoping began on the -130 foot elevation and was extended upward to the -25 foot sub-level. The ore in this stope runs higher in iron and lower in silica than the average of the mine. The phosphorus and sulphur are both lower. The ore is of a good structure but hard to break.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

7. UNDERGROUND  
(Continued)

d. Timbering

The timbering during the past year has all been in the nature of repairs to main level drifts. It was necessary to put in lining sets on the Fourth and Sixth Levels before the mine was shut down in February. The timber showed considerable deterioration during the idle period even though the air in the mine was fresh. The fungus growth was very heavy on the timber, especially on the Sixth Level. Some work was done to retimber part of the main Sixth Level drift during September. Since the mine reopened the timbermen have replaced many sets. The stretch where the Sixth Level drift branches to the North-west to the first cross-cut West has all been replaced. There is no weight but the ground is slabby and needs timber. As a larger percentage of the product came from the Eighth Level, there was not as much repairs necessary to the chutes on the Sixth Level. The timbering cost at the Virgil Mine is never very high and there is little difference between 1932 and 1931, as 1932 costs were mostly to cover repairs due to dry rot.

Statement of Timber Used

<u>KIND</u>	<u>LINEAL FEET</u>	<u>AVG. PRICE PER FOOT</u>	<u>AMOUNT 1932</u>	<u>AMOUNT 1931</u>
6" to 8"	1,028	.04444	45.69	217.22
8" to 10"	48	.06708	3.22	57.38
10" to 12"	366	.0903	33.05	219.22
12" to 14"				73.88
Total Timber 1932	1,442	.05684	81.96	
Total Timber 1931	8,968	.0633		567.70
		Per 100 Ft.		
6' Lagging	2,144	.6492	13.92	40.47
7' Lagging				202.70
Total Lagging	2,144	.6492	13.92	243.17
Poles	84	1.381	1.16	477.14
Total Lagging and Poles 1932	2,228	.6768	15.08	
Total Lagging & Poles 1931	68,809	1.047		720.31

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

7. UNDERGROUND  
(Continued)

d. Timbering (Continued)

Statement of Timber Used (Cont.)

	<u>Amount</u> <u>1932</u>	<u>Amount</u> <u>1931</u>
Product	13,601	93,580
Feet of Timber per Ton of Ore	.1060	.0958
Feet of Lagging Per Ton of Ore	.1576	.3861
Feet of Lagging per Foot of Timber	1.4868	4.029
Cost per Ton for Timber	.00603	.00606
Cost per Ton for Lagging	.00102	.00260
Cost per Ton for Poles	.00008	.00510
Cost per Ton for Timber, Lagging & Poles	.00713	.01376
Equivalent of Stull Timber to Board Measure	2,141	16,004
Feet of Board Measure per Ton of Ore	.1574	.1710
Cost of Timber, Lagging & Poles 1932	\$ 97.04	\$1,288.01

e. Drifting and Raising

The following is a Comparison of the drifting and raising done in the years 1932 and 1931:

<u>Year</u>	<u>Drifting</u>		<u>Raising</u>	
	<u>Ore</u>	<u>Rock</u>	<u>Ore</u>	<u>Rock</u>
1932	1,054	34	24	11
1931	4,521	578	1,132	231

We employed less contracts on development work during 1932 than the previous year and worked 68 shifts compared with 271 in 1931, which explains the decrease in feet drifted and raised.

f. Explosives, Drilling and Blasting

The following statement of explosives used shows an increase in powder used per ton of ore and cost per ton for powder. The larger part of the year's production was secured from the west stope above the Eighth Level. This stope had just been started the latter part of 1931 and the tonnage broken per hole was smaller than during the previous year when the bulk of the ore was mined from the stope above the Sixth Level, where there was big face to break to. Further, the ore in the area above the Eighth Level is very tight and requires more powder to break it.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

7. UNDERGROUND  
(Continued)

e. Explosives, Drilling and Blasting (Cont.)

Statement of Explosives Used

<u>Ore Development and</u>	<u>Quantity</u>	<u>Average</u> <u>Price</u>	<u>Amount</u> <u>1932</u>	<u>Amount</u> <u>1931</u>
<u>Stopping</u>				
40% Gelatin Powder	3,400	.1134	385.63	2,440.61
50% Gelatine Powder				31.25
#2 Gelamite Powder	6,549	.1257	823.46	5,412.28
Total Powder Lbs.	9,949	.1215	1,209.09	7,884.14
Fuse	37,600	6.018	226.27	1,323.76
#6 Caps	5,900	11.586	68.36	355.55
Fuse & Cap Seal	2 Pts.	.60	1.20	4.80
Cap Crimpers	2	.96	1.92	.42
Powder Bags	2	1.345	2.69	33.26
Tamping Bags	3,800	2.474	9.40	32.90
Safety Fuse Lighters	550	8.109	4.46	23.20
Total Fuse, Caps, Etc.			314.30	1,773.89
TOTAL ALL EXPLOSIVES			1,523.39	9,658.03
Production			13,601	93,580
Pounds Powder Per Ton of Ore			.73149	.68305
Cost Per Ton for Powder			.08890	.08425
Cost per Ton for All Explosives			.1120	.1032
<u>Sinking, Rock Development,</u>				
<u>Etc.</u>				
40% Gelatine Powder				36.11
#2 Gelamite Powder				27.54
Total Power, Pounds				63.65
Fuse				9.82
Caps				5.79
Total Fuse, Caps, etc.				15.61
TOTAL ALL EXPLOSIVES				79.26
TOTAL EXPLOSIVES USED IN MINE			1,523.39	9,737.29
AVG. PRICE PER POUND FOR POWDER			.1215	.1233



SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

7. UNDERGROUND  
(Continued)

h. Ventilation

When the mine was closed February 29th, it was decided to disconnect the hoist and other machines to reduce the connected load and power minimum. The operation of the cage and skip in the shaft produced sufficient circulation of air to keep the pump houses and mine ventilated. After the hoist was stopped the air became poor and a small fan was purchased.

A No. 2 $\frac{1}{2}$ -B Anaconda Type Ventilating Fan with a 5 horsepower A.C. motor was purchased from the Morgan Gerrish Company, Minneapolis. This fan was set up on surface at the collar of the shaft and connected into the 6 inch air line. This fan was run continuously and kept the air throughout the mine fresh. Before the fan was started the air a few hundred feet in from the shaft on various levels was so poor that you could not keep a light burning. Within 48 hours after it was started, the entire mine was clear and fresh. Monthly inspections during the idle period proved the mine to be well ventilated.

i. Pumping

The Spies Virgil Mine was closed on February 29th except for pumping. Up to this time pumping had been done on two shifts. The third level pump was operated several hours on each shift to pump out the small sump on that level and the Eighth Level pumps were run about four hours on each shift. Arrangements were made with the Wisconsin-Michigan Power Company to waive the minimum stated in our contract to the connected load, which they agreed to do; hence, the hoist, compressor, motor generator set, crusher and shop motors were disconnected. The minimum of the connected load of the pumps and lights was then under the actual consumption of current, in other words, we only paid for what current we used.

By reducing the pumping operation to one shift, which doubled the load factor, we secured a lower rate per K.W.H. making our power bill average about \$450.00 per month. In order to provide additional storage capacity so as to pump on one shift, a dam was built on the Third Level to hold all the water from above this elevation for 16 hours. Another dam was built on the Eighth Level which gave storage in addition to the main sump. This arrangement worked very satisfactorily.

When operations were resumed it was necessary to exercise every economy to reduce costs. We have continued to pump on the day shift only, by leaving the dam on the Third Level and building one on the Fourth Level to replace the one on the Eighth Level, which had to be taken out on account of tramming. With this arrangement we are able to keep our power bills slightly below the minimum of \$1186.80 paying the minimum, however, compared with our previous arrangements of pumping two shifts with an average power bill of about \$1440.00, a saving of over \$200.00.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING

a. Comparative Mining Costs

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
<u>PRODUCTION</u>				
Ore Produced	13,601	93,580		79,979
Average Daily Product	200	345		145
Tons per Man per Day	4.87	6.33		1.46
Number Days Operating	68	271		203
Number Shifts & Hours	4 months 5 " 7 "	2-8 1-8		
Budget Estimated Production	50,000	100,000		50,000
Budget Estimated Cost at Mine	\$ 2.519	\$ 1.916	.603	
<u>COSTS</u>				
Underground Costs	\$ 1.187	\$ 1.003	.184	
Surface Costs	.348	.217	.131	
General Mine Accounts	.449	.319	.130	
Cost of Production	1.984	1.539	.445	
Cost of Loading & Shipping	.033	.027	.006	
Cost at Mine per Cost Sheet	2.017	1.566	.451	
<u>DEPRECIATION</u>				
Plant and Equipment	.038	.038		
Development	.219	.219		
Movable Equipment		.001		.001
Taxes	.288	.227	.061	
Supply Inventory				
Total Cost at Mine	2.562	2.051	.511	
Idle Expense for 8 months	1.983		1.983	
Total Cost at Mine including Idle Expense	\$ 4.545	\$ 2.051	\$2.494	

The production is average for the shifts worked. The daily product is less than for 1931 as the mine was worked 2 shifts for five months compared with a single shift for the four months of 1932. The tons per man per day considering the number of idle shifts per week, was satisfactory. The actual operating days show an increased efficiency.

b. Detailed Cost Comparison

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING  
(Continued)

b. Detailed Cost Comparison (Cont.)

	<u>1932</u>		<u>1931</u>		<u>Increase</u>		<u>Decrease</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
1. Exploring in Mine	117.51	.008	658.12	.007		.001	540.61	
3. Development in Rock			873.08	.009			873.08	.009
4. Development in Ore	3,403.47	.250	23,223.28	.248		.002	19,819.81	
5. Stoping	2,796.05	.206	19,190.60	.205		.001	16,394.55	
6. Timbering	948.18	.070	7,028.58	.075			6,080.40	.005
7. Tramming	1,355.01	.100	10,677.44	.114			9,322.43	.014
8. Ventilation	20.20	.001	120.84	.001			100.64	
9. Pumping	2,824.19	.208	8,593.43	.092		.116	5,769.24	
10. Compressors and Air Pipes	2,163.53	.159	11,145.19	.119		.040	8,981.66	
12. Underground Superintendence	958.74	.071	4,915.52	.053		.018	3,956.78	
14. Compressors & Power Drills	110.65	.008	1,052.24	.011			941.59	.003
16. Electric Tram Equipment	1,131.12	.083	5,093.64	.055		.028	3,962.52	
17. Pumping Machinery	317.85	.023	1,276.98	.014		.009	959.13	
Total Under-ground Costs	16,146.50	1.187	93,848.94	1.003		.184	77,702.44	
18. Hoisting	1,285.48	.096	6,298.15	.067		.029	5,012.67	
19. Stocking Ore	535.69	.039	2,783.46	.030		.009	2,247.77	
20. Screening-Crushing at Mine	345.91	.025	2,055.91	.022		.003	1,710.00	
20. Dry House	860.56	.064	2,672.03	.028		.036	1,811.47	
22. General Surface Expense	647.46	.047	2,694.63	.029		.018	2,047.19	

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING  
(Continued)

b. Detailed Cost Comparison (Cont.)

	<u>1932</u>		<u>1931</u>		<u>Increase</u>		<u>Decrease</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
23. Hoisting Equipment	786.63	.058	1,948.72	.021		.037	1,162.09	
24. Shaft	6.38	.000	93.78	.001			87.40	.001
25. Top/Tram Equipment	72.83	.005	1,012.10	.011			939.27	.006
26. Docks, Trestles and Pockets	192.76	.014	683.89	.007		.007	491.13	
27 Mine Buildings	4.46	.000	96.42	.001			91.96	.001
Total Surface Costs	4,738.16	.348	20,339.09	.217		.131	15,600.95	
28. Insurance	51.27	.004	191.46	.002		.002	140.19	
29. Mining Engineering	221.02	.016	2,274.11	.024			2,503.09	.008
30. Mechanical and Elect. Engr.	118.23	.009	286.00	.003		.006	167.77	
31. Analysis and Grading	383.78	.028	2,482.44	.026		.002	2,096.66	
32. Personal Injury	389.90	.029	3,030.38	.032			2,640.48	.003
33. Safety Depart- ment	97.56	.007	567.36	.006		.001	469.80	
34. Telephones & Safety Devices	153.35	.011	831.28	.009		.002	677.93	
35. Local and General Welfare	388.55	.029	1,546.75	.017		.012	1,158.20	
36. Special Exp. Pensions & allowances	1,061.84	.078	4,347.40	.046		.032	3,285.56	

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING  
(Continued)

b. Detailed Cost Comparison (Cont.)

	<u>1932</u>		<u>1931</u>		<u>Increase</u>		<u>Decrease</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
37. Ishpeming Office	1,652.43	.122	4,942.58	.053		.069	3,285.56	
39. Mine Office	1,524.94	.116	9,450.64	.101		.015	7,875.70	
Total General Mine Expenses	6,092.87	.449	29,950.40	.319		.130	23,857.53	
COST OF PRODUCTION	26,977.53	1.984	144,138.43	1.539		.445	117,160.90	
40. Taxes	3,921.49	.288	21,225.75	.227		.061	17,485.68	
TOTAL COST	30,899.02	2.272	165,364.18	1.766		.506	134,465.16	
IDLE EXPENSE	26,974.86	1.983			26,974.86	1.983		

Operating Schedule

<u>1932</u>	<u>1931</u>
Jan. 1 - Feb. 29, 4 single shifts per week	Jan. 1 - April 30, 5 double shifts per week.
March 1 - Oct. 31, Mine idle except for pumping.	May 1 - May 25, 4 double shifts per week
Nov. 1 - Dec. 31, 4 single shifts per week	May 26 - Nov. 16, 6 single shifts per week
	Nov. 16 - Dec. 31, 4 " " " "

General

The total amount shows a decrease in every item due to the large difference in number of operating shifts; further, wages were reduced 10% November 16, 1931 and 15% May 16, 1932, a total of 23.5%.

1. Exploring in Mine.

Both the 1932 and 1931 charge is a proportion of the Geological Department expense charged to the Spies Virgil Mine. No exploration work was undertaken in either year.

3. Development in Rock

There was no rock development during 1932.

<u>Year</u>	<u>Rock Drifting</u>	<u>Rock Raising</u>
1932	None	None
1931	578'	231'

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING  
(Continued)

b. Detailed Cost Comparison (Cont.)

4. Development in Ore

The actual cost per foot for ore development in 1932 was less due to lower wages, but the cost per ton shows a slight increase on account of small product.

5. Stopping

The cost per ton considering the reduction in wages was higher than in 1931 due to working up to a normal production after the 8 month idle period. The cost each year was low, however.

6. Timbering

This account shows a decrease due to a larger proportion of the year's product secured from the 8th Level. Less blasting in the chutes on the 6th Level reduced the repairs required. Above the 8th level there is a grizzly sub where the chunks are broken.

7. Tramming

The cost of tramming is usually proportional to the tonnage handled. The reduced tonnage was offset by the reduction in wages.

9. Pumping

This shows the largest increase of any item on the cost sheet due to extra labor (helpers) on the idle days and the very small production for the year. The pumping cost for the 8 month's idle period is charged to Idle Expense.

10. Compressor & Air Pipes

The increased cost per ton is explained by the smaller output, repairs to air lines when mine was reopened in November after being idle 8 months. Also during 1931 about 14% of this expense was charged to the Sherwood drift from August 1st. Work on the Sherwood was not resumed when operations started again in November.

12. Underground Superintendence

The small output explains the increased cost per ton although the Captain's salary and shift bosses wages were reduced 23.5% during the year.

14. Compressor and Power Drills

The exciter burnt out and had to be rewound during 1932, otherwise repairs were light.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING  
(Continued)

b. Detailed Cost Comparison (Cont.)

16. Electric Tram Equipment

A new armature for the underground locomotives was charged out in 1932 amounting to \$527.38. This one item together with the low output is responsible for the increased cost per ton.

17. Pumping Machinery

During 1932, \$142.50 was paid the City of Iron River for making a change in the drainage ditch thru the Burns Addition, also the motors cleaned and painted and new oiling system installed on one of the 8th Level Pumps. In 1931 Rezistal cased pump poles were installed in both 8th Level pumps. The increased cost per ton is due to tons produced.

18. Hoisting

19. Stocking Ore

20. Screening & Crushing

A smaller tonnage was handled during 1932 besides a proportion of this expense was charged to Sherwood developments beginning August 1931, explaining the increased cost per ton.

21. Dry House

This increased cost per ton is due to operating the dry on the idle days on account of heating plant and small product.

22. General Surface Expense

General surface work was reduced to a minimum in 1932 but curtailed production explains the increased cost per ton.

23. Hoisting Equipment

A new skip rope was put on prior to resumption of operation November 1st.

24. Shaft

25. Top Tram Equipment

26. Docks, Trestles & Pockets

27. Mine Buildings

Maintenance was reduced to a minimum as the expenditures show for a four months operation.

28. Insurance

This is charged on a monthly basis and 8 months has been charged to Idle Expense.

29. Mining Engineering

The decrease is due to reduced engineering force and salaries.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

8. COST OF  
OPERATING  
(Continued)

b. Detailed Cost Comparison (Cont.)

30. Mechanical & Electrical Engineering  
More supervision by this Department.

32. Personal Injury  
Reduction due to charge being on 2% of payroll which was less account of lower wages and curtailed operation.

31. Analysis & Grading

33. Safety Department

35. Local & General Welfare

36. Special Expense, Pensions & Allowances

37. Ishpeming Office

All these captions show an increase cost per ton due to high charge and smaller production. These General Expense charges are proportioned on a tonnage basis, which has been small at all the Company's properties.

39. Mine Office

In spite of salary cuts this caption shows an increase cost per ton on account of the small tonnage.

40. Taxes

The amount for taxes for 1932 is not the total, as a proportion was charged to Idle Expense. The total is as follows:

	<u>1932</u>		<u>1931</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
Charged to Operating	\$ 3,921.49			
Charged to Idle Expense	12,700.00			
Total	\$ 16,621.49	\$1.232	\$21,225.75	\$ .227

Idle Expense

The Idle Expense, exclusive of taxes, was \$14,094.86 or an average monthly charge of \$1,761.86. The idle expense at the mine was almost entirely labor and supplies for pumping and watchmen labor.

9. EXPLORATIONS  
AND FUTURE  
EXPLORATIONS

No exploration work of any kind was done during the past year.



SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

10. TAXES

The following tabulation is a comparative statement of taxes paid in Iron County for the years 1932 and 1931.

<u>Description</u> <u>Iron County</u>	<u>1932</u>		<u>1931</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
<u>Iron River Township</u>				
NE $\frac{1}{4}$ of NW $\frac{1}{4}$ , Sec. 24-43-35, 40 acres				
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ , " 24-43-35, 40 acres				
Spies Dwellings.....	4,500	126.04	5,000	178.57
Collection Fees.....				-
Total Dwellings.....				178.57
<u>Spies-Virgil (a)</u>				
NE $\frac{1}{2}$ of NW $\frac{1}{4}$ , Sec.24-43-35, Spies...)	30,000		215,000	7,678.36
SW $\frac{1}{4}$ of NW $\frac{1}{4}$ , " 24-43-35, Virgil..)	90,000	2,520.80		
Stockpile, Supplies & Equipment....	485,000	13,584.27	370,000	13,213.92
Total.....	575,000	16,105.07	585,000	20,892.28
Collection Fees.....				
Total Spies Virgil Mine.....				20,892.28
(a) Total Iron River Township.....	579,500	16,231.11	590,000	21,070.85
Rate.....		2.8008		3.57133
<u>Village of Mineral Hills (b)</u>				
<u>Spies Lease</u>				
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ , Sec. 24-43-35.....)				
NE $\frac{1}{4}$ of NW $\frac{1}{4}$ , " 24-43-35.....)				See Note (a)
Dwellings.....	4,500	4.04	5,000	2.85
<u>Virgil Mine Lease</u>				
(a) SW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec.24-43-35.....	90,000	80.83	215,000	122.56
Stockpile, Supplies and Equipment....	485,000	435.59	370,000	210.91
Total Opt. Spies Virgil.....	575,000	516.42	585,000	333.47
Total Mineral Hills.....	579,500	520.46	590,000	336.32
Rate.....		.0898		.0570

(a) The mineral valuation is not divided between the Spies and Virgil. The valuation of 90,000 includes both the Spies and Virgil descriptions noted above for the year 1932. Not divided by tax appraiser and any division would be arbitrary.

Fees not required in Iron River Township according with a ruling of the Auditor General, Dec. 21, 1931 and advice by Iron County Tax Payers Assn. Dec. 23, 1931

(b) The Village of Mineral Hills is in Iron River Township. The valuation as shown here are the valuations (either all or in part) as the valuations of the respective townships. Above taxes paid in August, 1932.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

10. TAXES  
(Continued)

<u>Description</u> <u>Iron County</u>	<u>1932</u>		<u>1931</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
<u>Bates Township</u>				
Erickson Lease, SW $\frac{1}{4}$ of Sec.21-43-34	193,000	6,657.54	226,000	9,681.85
Collection Fees.....		66.58		96.82
Total Bates Township.....		6,724.12		9,778.67
Rate.....		3.446		4.283

11. ACCIDENTS  
AND  
PERSONAL  
INJURY

a. Accidents

There were no lost time accidents at the Spies Virgil Mine during 1932 and only one causing no lost time. This record compares with two lost time accidents in 1931, three in 1930 and four in 1929.

b. Safety Work

More attention was paid to safety in connection with the operations in order to reduce the expense of accidents. Training in Rescue and First Aid was discontinued on account of the curtailed operation.

12. NEW CONSTRUCTION  
AND PROPOSED  
NEW CONSTRUCTION

During January one man was employed laying sollar plank on the Sherwood stocking ground. This trestle is ready for dumping of ore.

14. MAINTENANCE  
AND REPAIRS

a. Shafts

1. Spies Shaft

A thorough examination was made several times during the operating months and also during the idle period. The pipes carrying the water from the upper levels to the sumps below had to be renewed and a number of hangers replaced.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

14. MAINTENANCE  
AND REPAIRS

a. Shafts (Cont.)

2. Virgil Shaft

A monthly inspection was made of the Virgil Shaft, the second outlet, during the operating months and several during the eight months the mine was idle. The water in the old stopes has been raising again after dropping a total of about 12 feet during 1931. The shaft and connecting drifts are in good shape and as soon as we started the small fan on surface during May a circulation was created that kept the air fresh.

b. Hoisting Equipment

The hoist which was repaired during November 1931, shows signs of some strain at times when picking up a load. During January and December the bearing on the motor was scraped, and adjustments made to the shims. The skip was changed on February 3rd and a new skip rope put on when operations were renewed in November. The rope taken off was Plow Steel and had been in service 28 months and handled a total of 268,000 tons of ore and rock, besides making many idle trips without load due to the cage and skip being in balance. The previous skip rope was the same make and grade and was only in service 10 months, handling 150,000 tons. Our explanation for the better service is regular greasing and use of hard wood idler sheaves and steel lined head sheaves.

c. Pumps

Our pumps gave very little trouble the past year. During November and December the motors on the 8th Level pumps were cleaned and painted to protect them from the oil vapor. The oiling system was changed on one of the pumps and will probably show a saving in oil used on these machines.

17. CONDITION  
OF  
PREMISES

When the mine was closed on February 29, all equipment was stored in building and the supplies outside were left in a neat condition. Arrangements were made with the Village to clean up the alley at the location at regular intervals. All the men had nice gardens and a number living outside the location were provided with lots for planting of potatoes.

SPIES VIRGIL MINE  
ANNUAL REPORT  
YEAR 1932

18. NATIONALITY  
OF  
EMPLOYEES

<u>Parentage</u>	<u>American Born</u>	<u>Foreign Born</u>	<u>Total and Percent</u>	
American	4		4	6%
English	8	14	22	33.5%
Croatian		1	1	1.5%
Swedish	2	2	4	6%
German	1	2	3	4.5%
Finnish	7	8	15	23%
Polish	3	3	6	9%
Italian		2	2	3%
Danish	2		2	3%
French-Canadian	5		5	7.5%
Irish	2		2	3%
TOTAL	34	32	66	100.%

WADE MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL:

During the months of January, February, March and April, three pumpmen and two watchmen were employed at the Wade Mine.

Orders were received to discontinue pumping in April. The pumps were removed from the mine, together with all other salvageable equipment before the first of May and the mine was allowed to flood. From May 1st to the end of the year only Captain Wivell and Clerk McKercher were employed as watchmen, other than the crew engaged in stockpile loading.

Notice of surrender of the Wade Mine lease was served on the Great Northern Company and the surrender of this property became effective as of August 27th, 1932.

The following statement shows the equipment and supplies shipped to the General Storehouse at Ishpeming from the Wade Mine during the month of December, 1932:

Equipment:

- 1 - Drill Press
- 1 - High Speed Hack Saw
- 1 - 10 H.P. Motor
- 1 - Bolt and Pipe Threading Machine
- 1 - Cutting and Welding Outfit
- 4 - Tugger Hoists
- 3 - Underground Locomotives
- 22 - Drilling Machines
- 20 - Sullivan Electric Hoists
- 1 - Wood Boring Machine
- 1 - 15 H. P. Caterpillar Tractor
- Miscellaneous Tools
- 1 - Monroe Calculating Machine
- 1 - Burroughs Adding Machine
- 1 - 14" Underwood Typewriter

Supplies

- Miscellaneous General Supplies, Tools, etc.
- 11,000 - Ft. Steel Wire Rope
- Repairs for Sullivan Electric Hoists
- "      "   Drill Machines
- "      "   Underground Electric Locomotives
- 16,000 - Lbs. Iron and Steel
- Misc. Bolts, Screws and Nuts
- "      Pipe Fittings

WADE MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL:  
(Continued)

Stockpile Shipments:

On July 22nd, we received instructions to prepare a sample cargo of Wade ore for the Corrigan, McKinney Steel Company. This cargo apparently was satisfactory and we received instructions on August 8th to forward 100,000 tons. This tonnage of ore was loaded out October 2nd. It was then necessary for the Sales Department to make further arrangements for the Corrigan, McKinney Company to take the balance of the stockpile. This arrangement was not made until October 22nd. Between October 22nd and November 8th, the Wade stockpile was cleaned up.

The cost of loading the stockpile was as follows:

Loading by steam shovel, .....	\$ 3,266.27
Mechanical Engineering, .....	167.23
Analysis and Grading, .....	968.52
Spotting Expense, .....	<u>1,858.61</u>

Total Loading Expense, ..... \$ 6,260.63

Credit for engine service from Great Northern  
Railway Company @ \$6.50 per hour, ..... 4,566.25

Net Loading Cost, ..... 1,694.38

Cost per ton (124,244 tons) ..... \$ .0136

Ore in stock, as per Ore Ledger, ..... 111,930 tons  
Railroad weights on shipments, ..... 124,244 "

Stockpile Overrun,..... 12,314 "

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Moist.</u>
Analysis of ore in stock,	111,930	56.31	.070	7.58	1.43	12.30
Analysis of Shipments,	124,244	56.48	.072	7.72	1.50	13.34 Mine 12.40 L.E.

4. ESTIMATE OF  
ORE RESERVES:

a. Developed Ore:

Assumption:

13 Cubic Feet equals one ton.  
10% Deduction for rock.  
10% Deduction for Mining Loss.

WADE MINE  
ANNUAL REPORT  
YEAR 1932

4. ESTIMATE OF  
ORE RESERVES:

a. Developed Ore: (Continued)

West Deposit, ----- 462,803 tons.

b. Undeveloped Ore:

East Deposit, ----- 1,118,790 "

Total, ----- 1,581,593 "

Deacon Bessemer, ----- 80,000 "

Deacon Non-Bessemer, ----- 95,000 "

Grand Total, ----- 1,756,593 "

10. TAXES:

Tax Statement:

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
Ad Valorem,	\$ 23,553.53	24,883.98		1,330.45
Personal Property,	<u>15,826.25</u>	<u>17,472.65</u>	-----	<u>1,646.40</u>
Total,	39,379.78	42,356.63		2,976.85
Average Tax Rate,	1.253	1.259		.006

THE CLEVELAND-CLIFFS IRON COMPANY-AGENTS  
ALEXANDRIA MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL:

During the months of January and February the force employed at the Alexandria Mine consisted of watchmen and pumpmen. During March, orders were received to pull the pumps and allow the underground workings to flood. All underground equipment was removed and the pumps taken to surface for storage prior to the end of March.

Beginning April 1st, and from then until the end of the year, only the policing of the mine premises was undertaken. Captain Cain was retained as day watchmen and the night shift work was divided between two former employees.

During the months of April, May, June, October, November and December, some timber was removed from the Alexandria Mine. The following tabulation shows the amount of timber supplies removed and the price charged for same:

Oliver Iron Mining Co.	79,871 ft. Boards	\$ 399.36	
	10,175 ft. Timber	370.98	
	864 ft. Poles,	6.48	\$ 776.82
Mesaba Tie & Timber Co.	1,278 ft. Timber		76.68
International Harvester Co.	108 ft. Timber		6.48
Republic Steel Corporation,	4,472 ft. Poles		44.00
Crete Mining Company,	Lumber & Wedges,		17.36
Wisconsin Steel Company,	1,989 ft. Timber		99.45
	<b>Total,</b>		<b>\$ 1,020.79</b>

The timber supplies were sold F.O.B. the mine and the Companies taking same did the loading and transporting to their properties.

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES

No ore was produced or shipped from the Alexandria Mine during the year 1932.

f. Ore Statement:

The Alexandria Mine stockpile contains 128,052 tons of ore as per skip and car tally. The average analyses of this ore is as follows:

<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>
56.70	.093	5.60	1.46	1.63

The Oliver Iron Mining Company's property to the East of the Alexandria Mine is being developed from the Godfrey shaft. The Alexandria stockpile is situated on land leased from the Oliver Iron Mining Company



THE CLEVELAND-CLIFFS IRON COMPANY-AGENTS  
ALEXANDRIA MINE  
ANNUAL REPORT  
YEAR 1932

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:  
(Continued)

and the development from the Godfrey shaft of that company has extended under the land leased from them. It is the intention of the Oliver Company to develop the ore to the North and it will probably be two years before caving operations are extended far enough to the South to interfere with the Alexandria stockpile ground. The loading out and shipping of the present Alexandria Mine stockpile should be completed by the end of the ore season of 1934, unless some arrangement is made with the Oliver Company whereby an extension of the lease on the ground can be secured. If the ore extends to the Eastward under the stockpile ground, with the same thickness as shown along the West boundary line of the Alexandria Mine, approximately 137,000 tons of Oliver ore is tied up by this stockpile ground lease.

4. ESTIMATE OF  
ORE RESERVES:

a. Developed Ore:

Displacement factor based on Oliver Curve.

15.72 Cubic Foot = 1 Ton.

No deduction for rock. (Included in factor used above).

East Forty, -----	242,124 tons.
West Forty, -----	148,271 "
South Forty, -----	<u>833,334</u> "
Total Alexandria, -----	1,223,729 "

b. Undeveloped Ore:

St. Anthony #2 Reserve, ----- 800,317 "

c. Estimated Analyses:

	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Moist.</u>	<u>Fe.Nat.</u>
Alexandria, -----	56.41	.106	5.74	1.44	1.41	13.00	49.08
St. Anthony #2 Reserve	55.43	.088	6.34	1.43	3.78	-	-

The estimated analyses of the ore remaining in the mine is based on exploration drill hole records and the sampling of drifts and raises. The analyses shown should be realized in the mining of the remainder of the ore body. There might be some slight decrease in the average iron content, with a corresponding increase in the Manganese content. This is especially true, as indicated by our operations to date in the South Forty ore body.

THE CLEVELAND-CLIFFS IRON COMPANY-AGENTS  
ALEXANDRIA MINE  
ANNUAL REPORT  
YEAR 1932

5. LABOR & WAGES:a. Comments:

Since pumping was discontinued in March, the only men employed at the Alexandria Mine have been watchmen. Captain Cain has been retained at a salary of \$166.00 per month and the night shift watching is staggered between three men, their total wages per month amounting to approximately \$115.00.

6. SURFACE:

No repairs or work of any nature was done on the buildings, stockpile or tracks and roads during the year 1932.

7. UNDERGROUND:

Other than pumping during the first two months of the year and the removing of underground equipment during the month of March, no underground activities have been attempted during 1932.

10. TAXES:a. Tax Statement:

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
Alexandria Mine,	\$ 9,952.26	9,628.81	323.45	
St. Anthony #2 Reserve,	1,852.29	1,952.96	-	100.67
Village Lot,	149.59	161.21	-	11.62
Total,	11,954.14	11,742.98	211.16	-
Personal Property,	7,533.29	13,621.15	-	6,087.86
GRAND TOTAL,	\$19,487.43	25,364.13	-	5,876.70
	<u>TAX RATE</u>	<u>TAX RATE</u>		
Town of Stuntz,	.489	.527		.038
Town of Balkan,	.467	.488		.021
Village of Hibbing,	.552	.582		.030

11. ACCIDENTS  
AND  
PERSONAL  
INJURY:

No accidents occurred at the Alexandria Mine during the past year.

13. EQUIPMENT AND  
PROPOSED  
EQUIPMENT:

No new equipment was purchased during the year and none is contemplated for 1933.

HILL-TRUMBULL MINE  
ANNUAL REPORT  
YEAR 1932.

1. GENERAL:

General repair work at the Hill-Trumbull Mine was discontinued January 8th, the repair crews having been engaged in overhauling locomotives and washing plant machinery.

The force at this property was reduced to four men on January 8th, an engineer, washing plant watchman and a day and night general mine watchman. These men were carried until April 1st, when the engineer was transferred to the washing plant as a night shift watchman, on account of the necessity of maintaining a constant inspection of the tailings basin so as to be prepared to start the spraying system in case of wind storms. Sudden winds were apt to start fine dust from the basin and blow it into the Village of Calumet. This crew of four men were carried as watchmen during the balance of the year.

An extra force of men were employed from time to time during the spring and summer months in operating the sprinkling device and during the month of April several changes were made in the system. The pipe line running along the West side of the basin was moved some 200 feet Eastward and the North line was placed 150 feet to the South. Further than this a diagonal cross line was installed, thus providing three lines of sprinklers.

To augment the system and to some extent at least replacing it, the tailings in the basin were disked and sweet clover planted. This work was undertaken during April and May. The sweet clover grows largely to roots during the first season, but the growth had attained a height of several inches by the end of July and aided considerably in holding the tailings. It is expected that the development of the sweet clover and the several rows of willows, which were planted during the summer, will take care of the dust problems in 1933 and it will not be necessary to operate the sprinkling system to any great extent. However, the sprinkling system will have to be maintained in case of emergency.

The coal, which was stocked at the Hill-Trumbull Mine in the fall of 1931, was transferred to the Canisteo Mine during August. This job involved the handling of 508 tons of coal.

Pumping operations at the Hill-Trumbull pits were discontinued the latter part of 1931 and while there was a normal amount of rainfall during 1932, there was no accumulation of water in the pits at any time. The water level in both the Hill and Trumbull pits had been lowered to such an extent by previous pumping operations that the ground did not become saturated to the bottom of the pits during 1932, such rain as fell in the pits, or flowed into them from the small water shed, seeping into the ground within a few hours.

HILL-TRUMBULL MINE  
ANNUAL REPORT  
YEAR 1932

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:

No mining operations were undertaken at the Hill-Trumbull Mine during the year 1932.

3. ANALYSIS:

No ore was produced from the Hill-Trumbull Mine during 1932.

4. ESTIMATE OF  
ORE RESERVES:

a. Developed Ore:

Assumption: 13 cu. ft. per ton for Direct Ore.

17 cu. ft. per ton for Wash Ore.

A rock deduction of 10 per cent was made in the case of the Direct Shipping and Wash Ore and 35 per cent for the Rocky Wash. Concentrates are figured on 65 per cent gross recovery.

Hill Bessemer Direct Shipping, -----	632,449 tons.
Hill Non-Bessemer Direct Shipping, -----	1,132,200 "
Hill Bessemer Concentrates, -----	291,226 "
Hill Non-Bessemer Concentrates, -----	389,323 "
TOTAL HILL ORE, -----	2,445,198 "
Trumbull Bessemer Direct Shipping, -----	85,000 "
Trumbull Non-Bessemer Direct Shipping, -----	200,560 "
Trumbull Bessemer Concentrates, -----	2,255,539 "
Trumbull Non-Bessemer Concentrates, -----	645,992 "
TOTAL TRUMBULL ORE, -----	3,187,091 "
GRAND TOTAL HILL AND TRUMBULL ORE, -----	5,632,289 "

The ore estimate of January 1st, 1933 is the same as that reported a year ago, as no drilling or test-pitting was done during 1932 and there is no reason to make any changes in the tonnage or the grade.

b. Prospective Ore:

The drilling of the land to the North of the Hill pit in the vicinity of the taconite island, will no doubt show up an additional tonnage of concentrating ore. Test-pits put down along the ore limits of the pit in 1925 indicated that the ore makes back beyond the stripping banks and a few old scattered drill holes confirm this. From the standpoint of taxes it has not been advisable to conduct any drilling in this locality, but when ore conditions become normal and the mine resumes operations, it would be advisable to investigate this matter and decide on what drilling should be done. According to our lease we are required to re-estimate, with the Great Northern engineers, the tonnage of ore in sight in the Hill-Trumbull Mines as of December 31st, 1933, so as to fix the minimum tonnage requirements during the last fifteen years of the lease. In connection with this estimate the lease provides that the Great Northern engineers will furnish us plans, showing what exploring they consider it would

HILL-TRUMBULL MINE  
ANNUAL REPORT  
YEAR 1932

4. ESTIMATE OF  
ORE RESERVES:  
(Continued)

b. Prospective Ore: (Continued)

be necessary to do to determine the existence of ore bodies other than those upon which our estimates have been based during the first fifteen years of the lease.

Owing to the depression existing in the steel business and the curtailment of all mining operations at this property, the Great Northern have delayed furnishing us exploratory plans and no doubt the question of conducting such exploratory campaign will be delayed until conditions in the ore trade improves.

c. Estimated Analysis:

<u>Hill Mine:</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Fe.Nat.</u>
Bessemer Direct Shipping,	632,449	58.00	.045	13.00	53.36
Non-Bess.Direct Shipping,	1,132,200	58.00	.055	13.00	53.36
Bessemer Concentrates,	291,226	59.50	.045	8.50	55.04
Non-Bessemer Concentrates,	389,323	60.00	.059	7.50	55.50
<b>TOTAL HILL ORE, -----</b>	<b>2,445,198</b>	<b>58.57</b>	<b>.052</b>	<b>11.38</b>	<b>54.87</b>
 <u>Trumbull Mine:</u>					
Bessemer Direct Shipping,	85,000	56.40	.040	12.79	51.32
Non-Bess. Direct Shipping,	200,560	58.04	.060	9.85	52.82
Bessemer Concentrates,	2,255,539	59.00	.043	9.00	54.57
Non-Bessemer Concentrates,	645,992	59.00	.080	9.00	54.57
<b>TOTAL TRUMBULL ORE, -----</b>	<b>3,187,091</b>	<b>58.88</b>	<b>.054</b>	<b>9.14</b>	<b>54.38</b>
<b>GRAND TOTAL HILL-TRUMBULL,</b>	<b>5,632,289</b>	<b>58.74</b>	<b>.053</b>	<b>10.11</b>	<b>54.59</b>

5. LABOR & WAGES:

a. Comments:

(1) Labor:

Common labor was on the basis of \$3.75 per day, until May 16th, when it was reduced to \$3.15. All other classes of employees were reduced in a like amount.

Although very few men were employed at the Hill-Trumbull Mine during the year, the old hands were given part-time work while stripping operations were carried on at the Canisteo Mine from early in June to the end of October.

(2) New Construction:

No new construction work was undertaken at the Hill-Trumbull Mine during 1932.

HILL-TRUMBULL MINE  
ANNUAL REPORT  
YEAR 1932

6. SURFACE:

No repairs or construction work was undertaken on buildings, tracks, roads or transmission lines during the past year.

7. OPEN PIT:

There was no activity in the Hill and Trumbull open pits during the year 1932.

9. EXPLORATIONS  
AND  
FUTURE  
EXPLORATIONS:

No exploratory work was undertaken during 1932 and the question of future explorations will be delayed until the ore market improves decidedly. No exploratory work is contemplated for 1933.

10. TAXES:

The following statement shows the taxes and average rate at the Hill-Trumbull Mine for the years 1931 and 1932:

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
Hill Mine, -----	34,343.37	37,993.30		3,649.93
Trumbull Mine, -----	42,921.94	46,525.04		3,603.10
Hill-Trumbull Shops, -----	905.63	1,006.44		100.81
Hill-Trumbull W.P.Lands, -	2,936.80	3,301.97		365.17
Personal Property, -----	<u>2,092.73</u>	<u>2,554.72</u>		461.99
 TOTAL, -----	 \$ 83,200.47	 91,381.47		 8,181.00
 Village Lots, -----	 <u>540.48</u>	 <u>571.46</u>		 <u>30.98</u>
 GRAND TOTAL, -----	 \$ 83,740.95	 91,952.93		 8,211.98
 Average Rate, -----	 .729	 .771		 .042

HILL-TRUMBULL MINE  
ANNUAL REPORT  
YEAR 1932

11. ACCIDENTS  
AND  
PERSONAL  
INJURY:

There were no accidents of any nature to the few employees engaged at the Hill-Trumbull Mine during the year 1932.

12. NEW CONSTRUCTION  
AND PROPOSED  
NEW CONSTRUCTION:

13. EQUIPMENT AND  
PROPOSED  
EQUIPMENT:

There was no new construction undertaken or equipment purchased during 1932 and no construction work contemplated or equipment to be purchased during the year 1933.

14. MAINTENANCE  
& REPAIRS:

The small amount of work undertaken at the Hill-Trumbull Mine under this caption has been covered by the general remarks at the beginning of this report.

19. WASHING PLANT  
OPERATIONS:

Other than the few days repair work at the beginning of the year and the work done in connection with the tailings basin, (explained under "General Remarks" at the beginning of this report) no operations were undertaken at the Hill-Trumbull washing plant during 1932.

HOLMAN-CLIFFS MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL:

General repair work at this property was discontinued January 8th, the crew having been engaged in overhauling open pit locomotives and washing plant machinery.

The force at the Holman-Cliffs Mine was reduced to nine men on January 9th and a further curtailment made to six men on February 1st, when all research work was discontinued.

Orders were received the fore part of March to shut down the pit pumps, as a decision had been reached to suspend operations at the Holman-Cliffs Mine for an indefinite period. All of the equipment was removed from the pit, the pumps disconnected and the pit allowed to flood. The crew engaged on this work was furnished from the force employed at the Canisteo Mine shops.

The Minnesota Power & Light Company's contracts for the Holman-Cliffs pit and washing plant were cancelled during the month of March.

The United Verde Copper Company secured an option to purchase the two 120-B electric shovels owned by and operated at the Holman-Cliffs Mine. The shovels were inspected and the United Verde Company exercised their option to purchase one of the machines. This shovel was taken down, loaded on cars and shipped to Arizona, a small crew of men being engaged on the work from May 28th to June 7th.

From June 7th to the end of the year a force of three men was employed at the Holman-Cliffs Mine, two watchmen, policing the mine premises and one watchman at the washing plant.

The water in the Holman pit had risen above the approach tracks by the end of the year. The elevation of the water was, however, some distance below that attained when pumping operations were started by The Holman-Cliffs Company in 1929.

4. ESTIMATE OF  
ORE RESERVES:

a. Developed Ore:

Assumption: 16 cubic feet per ton for Wash Ore.

A rock deduction of 10% was made generally and in estimating a part of the deposit the deduction was increased to 20%, due to the exceptionally rocky condition of this ore.

The tonnage listed below is on a concentrated basis and is figured on a 60% gross recovery:



HOLMAN-CLIFFS MINE  
ANNUAL REPORT  
YEAR 1932

4. ESTIMATE OF  
ORE RESERVES:  
(continued)

a. Developed Ore: (Continued)

<u>Brown No. 1:</u>		
Non-Bess. Concentrates, -----		1,126,196 tons.
<u>Holman:</u>		
Non-Bess. Concentrates, -----		2,798,873 "
<u>Brown #2:</u>		
Non-Bess. Concentrates, -----		<u>1,891,533</u> "
TOTAL HOLMAN-BROWN, -----		5,816,602 "
<u>North Star:</u>		
Non-Bess. Direct, -----		80,103 "
Bess. Concentrates, -----		538,083 "
Non-Bess. Concentrates, -----		<u>101,891</u> "
TOTAL NORTH STAR, -----		720,077 "
<u>Bingham:</u>		
Bessemer Direct, -----		269,664 "
Non-Bess. Direct, -----		329,590 "
Bessemer Concentrates, -----		1,198,361 "
Non-Bess. Concentrates, -----		<u>590,238</u> "
TOTAL BINGHAM, -----		2,387,853 "
TOTAL BINGHAM-NORTH STAR, -----		3,107,930 "
GRAND TOTAL HOLMAN-CLIFFS MINE, -----		8,924,532 "

10. TAXES:

The following statement shows the taxes and average rate for the Holman-Brown, Bingham and North Star Mines, together with the Holman-Cliffs auxiliary lands, Bingham-North Star washing plant lands, Holman-Brown lands, Holman-Cliffs shops and Holman-Cliffs personal property for the years 1931 and 1932:

HOLMAN-CLIFFS MINE  
ANNUAL REPORT  
YEAR 1932

10. TAXES:  
(Continued)

Statement of Taxes:

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
Holman-Brown Mine,	49,711.50	57,160.45		7,448.95
Bingham Mine,	13,150.97	7,061.99	6,088.98	
North Star Mine,	10,248.47	12,828.10		2,579.63
Holman-Cliffs Aux.Lands	2,626.50	2,867.13		240.63
Bingham-North Star W.P.Lands,	41.36	44.64		3.28
Holman-Brown Lands,	19.24	20.80		1.56
Holman-Cliffs Shops,	279.87	301.76		21.89
Holman-Cliffs Personal, Property,	3,396.06	4,193.06		797.00
	<hr/>	<hr/>	<hr/>	<hr/>
TOTAL,	\$ 79,473.97	84,477.93		5,003.96
Rented Buildings,	<u>1,392.69</u>	<u>1,504.94</u>		<u>112.25</u>
GRAND TOTAL,	\$ 80,866.66	85,982.87		5,116.21
Average Tax Rate,	.728	.786		.058

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL:

Due to the fact that no ore was required from this property during the season of 1932, it was decided not to put the finishing touches on the washing plant. Other than policing the plant layout and obtaining data on the elevation of the water in the storage basin from time to time, no work was undertaken at the plant during the year.

There was a rise of several feet in the elevation of the water in the tailings basin lake during the past year. This was due to the damming of the stream draining the basin and providing drainage pipes through the dykes to the North. This stopped all flow from the basin and allowed the water draining Southward to enter the basin. While it appears that pumping facilities will have to be provided to furnish an ample supply for washing operations, it will not be necessary to provide the amount of water originally anticipated and arrangements can now be made to secure the supply from O'Reilly Lake, approximately three-quarters of a mile to the Northeast of the basin, rather than to pump it from the Canisteo pit, approximately two miles distant. This will affect a substantial saving, as compared with the original plan.

Pumping operations were conducted throughout 1932 in such manner as to confine the water to the bottom of the pit. The 7000-gallon pump had a capacity of approximately three times that necessary to handle the inflow and the operation of this pump on a one-third time basis affected our load factor adversely. It was necessary to shift our pumping operations in the pit to the Westward, to further lower the water and make possible the conducting of stripping operations in the lower part of the pit. When this changed position of the pumping layout was decided upon, the 7000 G.P.M. pump was replaced by one of 2,000-gallon capacity. This work was accomplished during the month of November and pumping is now being done continuously at a reduced cost.

In order to provide some work for our employees at the Canisteo, Hill-Trumbull and Holman-Cliffs Mines, it was decided to conduct stripping operations and handle approximately 400,000 cubic yards during a six-months period in 1932. The men were employed on a part-time basis, the operation going forward five day shifts per week and the average employment being on the basis of about twelve shifts per man per month. This part-time employment effected 170 men.

Stripping operations were started early in June on the Hemmens land at the East end of the pit. Work continued here until suitable grading to the bottom of the pit was completed and a track laid for the handling of stripping paint-rock from the Snyder island. The bulk of the stripping done from June 1st to November 8th was on the Snyder

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

1. GENERAL:  
(Continued)

island, as this furnished the most favorable ratio of yards of stripping to tons of ore, as well as making available a good grade of wash ore.

Some shallow structure drilling was done in connection with the stripping operations on the Snyder island. This was for the purpose of determining the depth of the paint-rock and the quality of the underlying ore.

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:

No ore was produced from the Canisteo Mine during the year 1932.

g. Delays:

The following list of delays were reported in connection with the Canisteo stripping work during 1932:

<u>Date</u>	<u>Time Lost</u>	<u>Cause:</u>
June 7th,	7 Hours	Mine shut down 10:00 A.M. heavy rains.
June 16th,	3 "	Shovel cut out 9:00 A.M. - cut in again 12:00 Noon.
June 21st,	1/2 "	Shovel cut out 5:00 P.M.
June 22nd,	3 "	Shovel moved back and cut in again 10:00 A.M.
June 24th,	1/2 "	Power off.
July 11th,	5 "	Rock encountered. Necessary to send crews home and blast before loading could be resumed.
July 29th,	1-1/2 "	Shovel cut out. Commenced moving shovel to Snyder island.
August 1st,	10 "	Changing power lines and moving shovel to Snyder island.
August 15th,	2-1/4 "	Putting shovel on mats.
August 16th,	1 "	Changing hoisting cable.
August 24th,	3 "	Slow operation account of heavy rains. Tracks and dumps very soft; also washouts on tracks and slough over tracks.
September 8th,	1 "	Shovel cut out and moved back.
September 13th,	1/2 "	Exciter on electric shovel out of order.
November 3rd,	2 "	Shovel moved back after cutting out.
Total,	40-1/4 "	

3. ANALYSIS:

No ore was produced during 1932.

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

4. ESTIMATE OF  
ORE RESERVES:

a. Developed Ore:

Assumption:

14 cu. ft. per ton for Direct Ore.

16 cu. ft. per ton for Wash Ore.

A rock deduction of 10% was applied in this estimate.

The ratio of concentrates was figured at 60%.

		WASH	LOW GRADE WASH	LEAN WASH	MERCH.
Snyder, SE $\frac{1}{4}$ -SE $\frac{1}{4}$ Sec.30, --		2,091,075	187,000	285,000	
" SW $\frac{1}{4}$ -SE $\frac{1}{4}$ " ---		1,000,000	129,000	78,000	
" SE $\frac{1}{4}$ -SW $\frac{1}{4}$ " ---		485,000	-	-	
Total, -----		3,576,075	316,000	363,000	
No. Bovey NW $\frac{1}{4}$ -SE $\frac{1}{4}$ Sec.30, --		302,800	35,900	13,500	
" NE $\frac{1}{4}$ -SE $\frac{1}{4}$ " ---		597,500	-	-	229,400
Total, -----		900,300	35,900	13,500	229,400
So. Bovey NE $\frac{1}{4}$ -NE $\frac{1}{4}$ Sec.31, --		742,700	78,400	60,900	-
Hemmens SW $\frac{1}{4}$ -SW $\frac{1}{4}$ Sec. 29, --		1,356,500	178,800	148,000	-
Total Wash Concentrates, -		6,575,575	609,100	585,400	229,400
Total Low Grade Wash " -		609,100			
Total Lean Wash,		585,400			
Total Merch.		229,400			
GRAND TOTAL ORE, -----		7,999,475			

No exploratory work was undertaken during 1932, other than the putting down of shallow structure drill holes on the Snyder island to determine the thickness of the paint-rock and the character of the ore immediately thereunder. There has been no occasion to make any change in the estimate, as of January 1st, 1932.

c. Estimated Analyses:

	Fe.	Phos.	Sil.	Moist.	Fe.Nat.
Bessemer,	58.00	.045	10.00	9.00	52.78
Non-Bessemer,	58.00	.095	10.00	9.00	52.78

The exploratory work at the Canisteco Mine indicates that approximately one-half of the ore will be of Bessemer grade, based on a Phosphorus of .045. To be conservative it might be advisable to assume the Bessemer ore at 40%.

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

5. LABOR & WAGES:

a. Comments:

(1) Labor:

All classes of labor was abundant during the year 1932. A very satisfactory crew for the stripping operation was secured from old employees at the Hill-Trumbull, Holman-Cliffs and Canisteco Mines. The scale of wages in effect at the beginning of 1932 was based on common labor at \$3.75 for ten hours. The common labor basis was reduced in May to \$3.15 per day of ten hours and all other classes of labor correspondingly.

b. Statement of Wages & Product:

<u>PRODUCTION:</u> (Stripping)	349,547 Cu. Yds.
Number of Shifts Operated:	
Single 10-hour shifts,	112
Cubic Yards per shift operated,	3,121
Average number of men working,	95
Average wage per day,	\$ 3.879
Amount paid for labor,	\$ 47,945.61

6. SURFACE:

a. Buildings, Repairs:

There were no repairs made to the buildings at the Canisteco Mine during the year 1932.

c. Tracks, Roads, Transmission Lines:

(1) Tracks:

The track grade, leading to the bottom of the Snyder pit from the Hemmens land was undertaken during the months of June and July. This job included the laying of tracks to the Snyder island. The gasoline shovel was engaged on the work, while stripping was in progress on the Hemmens land.

The pit approach tracks and drainage ditches were cleared of all material washed in.

It was not necessary to do any repair work on the roads or transmission lines during the year. In order to effect a substantial saving in current during operating periods and secure a more favorable load factor, it was decided advisable to make arrangements to take all current through one meter, instead of having the pit and washing plant separately metered. In order to accomplish this a force of from six to eight men were employed from November 21st to the end of the year, brushing out a right-of-way and erecting a pole line (the poles being obtained from the Holman Mine) - from the mine to the washing plant. The transmission line will be completed during February, 1933 and we will be able to take all of our current through one meter during our 1933 operations. The saving per year is estimated to equal the cost of making these changes.

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

7. OPEN PIT:

a. Stripping:

A force of thirty men were employed on the tracks June 1st to put the several lines in shape for stripping operations, which started June 6th. The pit tracks were cleaned, raised and blocked and the main lines repaired. From June 6th to the conclusion of the year's stripping job, November 8th, the track crew were engaged in throwing over loading tracks in the pit and on the dumps, laying lean ore tracks for stockpiling and in maintaining all lines used in connection with this operation.

Stripping operations were started June 6th. The 120-B electric shovel first completed an old cut on the Hemmens land, which had been started during the previous season. This cut was finished June 16th and the machine was moved across the old Oliver approach to the West and took a top slice off the Snyder bank. This work was done to provide a bench for future operations. It was found that the Hemmens bank could not be handled in one lift to advantage and the Snyder stripping was to provide tail track facilities. The Snyder cut was completed June 21st and the shovel was moved Eastward and started a sinking cut along the approach bench. This and subsequent cuts in the Hemmens area will be worked down to the permanent approach. When the sinking cut had been completed, a connection was made with the permanent approach track from the North Bovey bay. A second approach cut was taken, starting near the Walker Mine boundary and progressing Westward to connect with a cast grade, leading to the bottom of the pit.

Some Walker ore was encountered in this cut and the material was dumped into the Walker pit of the Oliver Iron Mining Company, in accordance with arrangements made with that Company.

All track connections were made and switch-backs provided by August 1st and the approach tracks on the Bovey and Hemmens land were carried down into the bottom of the Canisteco pit. The gasoline shovel had been engaged in casting grades across the Bovey and Snyder areas to the Snyder rock island and tracks laid thereon during the months of June and July.

The most favorable stripping to provide the maximum tonnage of desirable grade ore for the first year's operations, could be secured from the East Snyder forty, by removing the paint-rock capping from the so-called Snyder island area. Stripping operations were therefore made to this end and from the First of August to the end of the season - November 8th, operations were conducted here. It was not possible to attack the Snyder paint-rock, until suitable grades and switch-backs had been provided by the work done during June and July.

Three long cuts were taken across the paint-rock island and several short clean-up cuts were necessary. The yardage and costs realized were quite satisfactory, considering the fact that the material was quite hard, necessitating drilling and blasting, and the top of the ore was somewhat uneven.

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

7. OPEN PIT:  
(Continued)

a. Stripping: (Continued)

The gasoline shovel was utilized in connection with the island stripping, cleaning out pot-holes, corners and casting some wash ore which over-lay the paint-rock at the Westerly and along the Southerly parts of the area.

Some of the paint-rock was sufficiently enriched to necessitate its being separated and placed on a lean ore stockpile. In order to ascertain the Iron content of the paint-rock, so as to determine whether it could be wasted or required stockpiling, it was necessary to sample and analyze the material daily.

The material stripped at the Canisteeo Mine during 1932 amounted to 349,547 cubic yards and was divided as follows:

		<u>BOVEY</u>	<u>SNYDER</u>	<u>HEMENS</u>	<u>WALKER</u>	<u>TOTAL</u>
Surface,	(Yds.)	6,660	10,971	85,754	4,548	107,933
Rock	"	-	220,318	9,390	6,124	235,832
Ore,	"	-	-	-	5,782	5,782
Total,	"	6,660	231,289	95,144	16,454	349,547

d. Timbering:

Statement of Ties Used:

<u>Amount</u>	<u>Kind</u>	<u>Price</u>	<u>Cost</u>
5,964	Standard 8"x8"-8'	.88 Each	\$ 4,649.92

f. Explosives, Drilling & Blasting:

Statement of Explosives Used:

<u>KIND</u>	<u>QUANTITY</u>	<u>PRICE</u>	<u>AMOUNT</u>
25% 5 x 16 L.F. Gel.	21,650 Lb.	10.3175	\$ 2,233.75
35% 1-1/8 x 8 L.F. Am. Gel.	300	11.15	33.45
40% 1-1/4 x 8 L.F. Am. Gel.	750	11.333	85.00
40% 1-1/4 x 8 L.F. Extra	1,400	11.16	156.24
60% 7/8 x 8 L.F. Extra	700	12.537	87.76
60% 1-1/8 x 8 L.F. Extra	250	13.25	33.13
60% 1-1/8 x 8 L.F. Am. Gel.	250	13.75	34.38
Hercomite Bag #2	450	12.00	54.00
Hercomite Bag #4	24,200	12.188	2,949.50
Crescent Fuse	1,900 Ft.	.624	11.85
8' #6 E.W. Electric Blasting Caps	550	.671	36.91
18' #6 " " " "	175	.970	16.99
24' #6 " " " "	400	.1151	46.04
30' #6 " " " "	1,050	..1284	134.82
#6 E.B. Caps	3,200	.116	37.12
#20 Connecting Wire,	92 Lbs.	.322	29.68
Dup. Lead Wire	250 Ft.	.972	2.43
Grand Total,			\$ 5,983.05



CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

7. OPEN PIT:  
(Continued)

g. Open Pit Mining & Loading:

No ore mining operations were conducted at this property during 1932.

8. COST OF OPERATION:

Canistee Mine - Stripping Cost Sheet - Season 1932:

<u>Stripping:</u>	<u>Amount</u>	<u>Per Yard</u>
Drilling and Blasting, -----	4,580.51	.013
Steam Shovels Operating, -----	6,246.56	.018
Steam Shovels Maintenance, -----	1,378.72	.004
Locomotives & Cars Operating, -----	26,157.63	.075
Locomotives & Cars Maintenance, -----	5,359.95	.015
Track Expense, e-----	20,130.12	.058
Total, -----	63,853.49	.183
 <u>General Pit Expense:</u>		
Pumping & Drainage, -----	10,132.60	.029
Water Supply, -----	319.23	.001
General Open Pit Expense, -----	2,775.77	.008
Open Pit Superintendent, -----	1,756.33	.005
Waste Pile Expense, -----	9,994.90	.028
Testpitting, -----	763.32	.002
Structure Drilling, etc., -----	730.88	.002
Total, -----	26,473.03	.075
Total Pit Operating, -----	90,326.52	.258
 <u>General Mine Expenses:</u>		
Mining Engineering, -----	1,584.97	.005
Mechanical & Electrical Engineering, -----	987.39	.003
Analysis and Grading, -----	1,352.85	.004
Personal Injury, -----	1,090.90	.003
Geological, -----	125.98	.000
Ishpeming Office, -----	1,003.25	.003
District Office, -----	3,482.79	.010
Mine Office, -----	4,100.48	.012
Total, -----	13,728.61	.040
COST OF PRODUCTION, -----	\$ 104,055.13	\$ .298

The cost of \$.298 per yard realized on the stripping job, as compared with an estimate of \$.327, is quite satisfactory, considering the fact that a larger proportion of rock was removed than had been anticipated when the estimate was prepared and the track work was considerably more extensive, than had been planned originally.

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

9. EXPLORATIONS  
AND  
FUTURE  
EXPLORATIONS:

No exploratory work was undertaken during 1932, other than the shallow structure holes to determine the depth of the paint-rock on the Snyder island and the character of the underlying ore.

Future explorations will consist largely in structure drilling the bottom of the Snyder pit and in test-pitting around the edge of the Bovey and Hemmens stripping limits to determine the character of that ore.

10. TAXES:

The following statement shows the taxes and average rate for the years 1931 and 1932:

	<u>1932</u>	<u>1931</u>	<u>Increase</u>	<u>Decrease</u>
Canisteco Mine,	\$ 40,871.74	39,570.45	1,301.29	
Washing Plant Lands,	2,549.81	338.10	2,211.71	
Personal Property,	<u>2,850.71</u>	<u>3,475.71</u>	-	625.00
Total,	46,272.26	43,384.26	2,888.00	-
Village Lots,	<u>187.78</u>	<u>199.87</u>	-	12.09
GRAND TOTAL,	\$ 46,460.04	43,584.13	2,875.91	-
Average Tax Rate,	.747	.795		.048

The increase in the Canisteco valuation and taxes is due to the inclusion of 3,945,500 tons of underground wash ore by the Tax Commission's engineers, as of May 1st, 1932. Further than this the 1932 tax list includes the washing plant and mine buildings, which had not been considered in the previous year's statement, as they had not been completed.

11. ACCIDENTS  
AND  
PERSONAL  
INJURY:

There were no lost-time accidents at the Canisteco Mine during 1932. It is of interest to note that the last lost-time accident at this property occurred March 18th, 1931.

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

12. NEW CONSTRUCTION  
AND PROPOSED  
NEW CONSTRUCTION:

The only new construction undertaken during 1932 was the work in connection with the erection of a transmission line, connecting the mine and washing plant. This new transmission line will make it possible to take all current through one meter and thus secure a more favorable load factor.

New construction work contemplated for 1933 will be in the nature of putting finishing touches on the washing plant and providing an adequate water supply for concentrating operations. This work will consist in the installing of vibrating screens, providing rock disposal tracks and trestles, connecting up the pipes and machinery and providing a pumping plant at O'Reilly Lake and laying the necessary pipe line to the storage basin.

13. EQUIPMENT AND  
PROPOSED  
EQUIPMENT:

No new equipment was purchased for the Canisteco Mine for 1932 and none will be necessary for the operations contemplated in 1933, other than the vibrating screens for the washing plant.

14. MAINTENANCE  
& REPAIRS:

An average force of twenty men was employed in the Canisteco shops on pit equipment repair work during the months of January, February and March. The locomotives and dump cars were overhauled and put in service for the summers stripping job. The employees were rotated in such manner as to receive from ten to twelve shifts each per month and the old hands from the Hill-Trumbull, and Holman-Cliffs Mines were taken care of, as well as the key men from the Canisteco.

No repair work was undertaken at the conclusion of the 1932 stripping operations.

CANISTEO MINE  
ANNUAL REPORT  
YEAR 1932

18. NATIONALITY  
OF  
EMPLOYEES:

<u>NATIONALITY:</u>	<u>NO. OF MEN</u> <u>1932</u>	<u>NO. OF MEN</u> <u>1931</u>
American, -----	88	27
Swedish, -----	16	5
Norwegian, -----	13	4
Croatian, -----	6	2
Slavish, -----	6	2
Austrian, -----	12	2
Scotch, -----	1	1
Italian, -----	11	1
Canadian, -----	3	1
Dane, -----	1	1
Serbian, -----	4	1
German, -----	-	-
Finnish, -----	12	-
Bulgarian, -----	2	-
Total, -----	175	47

22. REPORT OF THE GEOLOGIST FOR THE YEAR ENDING DECEMBER 31, 1932

A. STAFF

The staff of the Geological Department for the year 1932 is shown in Table I below. The drastic curtailment in the personnel of the Mining Department, which went into effect on February 1st, made it necessary to lay off Mr. Afuhs at that time. A further curtailment that took effect on June 1st, required the laying off of Mr. Tillson.

TABLE I

NAME	OCCUPATION	DURATION OF EMPLOYMENT IN 1932	DAYS LOST		% OF WORKING DAYS WORKED
			SICKNESS	VACATION	
E.L.Derby, Jr.,	Chief Geologist	Entire Year	0	0	102.8 #
A.H.Tillson,	Asst.Geologist	5 months	51	0	54.3
Gustav Afuhs,	Draftsman,	1 month	0	0	100.0

# Represents 60 hours net overtime after cancelling 1 1/4 days vacation and 1 1/2 days illness.

The year was divided into the factors shown in Table II below:

TABLE II

Total days of eight hours worked, ( <u>2172</u> / 8 ) - - - -	271 1/2 days
Sundays - - - - -	52 "
Full days resulting from Saturday afternoons -	24 "
Full Saturdays not worked - - - - -	5 "
Holidays - - - - -	<u>13 1/2</u> "
	366 "

Table III, below, shows the average number of men regularly employed on the staff of the Geological Department during the last five years.

TABLE III

YEAR	AVERAGE NUMBER OF MEN
1928	4.0
1929	4.0
1930	4.0
1931	3.7
1932	1.5

B. DIVISION OF WORK AMONG THE MEMBERS OF THE DEPARTMENT

A division of the time actually consumed by the members of the Department is shown in Table IV, below:

TABLE IV

ITEMS	HOURS WORKED			TOTAL HOURS
	DERBY	TILLSON	AFUHS	
<u>MINES:</u>				
Armour-Ironton - - - - -	117	0	0	117
Athens - - - - -	12	4	0	16
Bingham-North Star - - - - -	373	2	25	400
Canisteo - - - - -	65	0	0	65
Cliffs Shaft - - - - -	34	122	0	156
Corrigan, McKinney Mines - - - - -	3	0	0	3
Dean-Itasca - - - - -	79	0	0	79
Erickson-Ravena Leases - - - - -	27	0	0	27
Gardner Mackinaw - - - - -	5	19	0	24
Gold property - - - - -	17	0	21	38
Hartford-Cambria-Jackson - - - - -	26	0	0	26
Hill Trumbull - - - - -	10	0	0	10
Holman-Brown - - - - -	30	0	0	30
Lloyd - - - - -	85	48	13	146
Maas - - - - -	12	56	0	68
Morris - - - - -	73	49	13	135
Negaunee - - - - -	30	38	0	68
Sherwood - - - - -	15	0	0	15
Tilden - - - - -	4	0	0	4
Virgil - - - - -	24	20	0	44
Wade - - - - -	10	0	0	10
<u>MISCELLANEOUS ITEMS:-</u>				
Annual Report - - - - -	34	0	0	34
Assisting Engineer Department - -	17	0	0	17
Beneficiation of Iron Ores - - - -	69	0	0	69
Federal Taxes - - - - -	118	0	0	118
General Departmental - - - - -	585	88	10	683
Investigating Mineral Land Offers-	16	32	0	48
Investigating Outside Explorations	40	0	0	40
Limestone Lands, (For Land Dept.)-	55	0	0	55
Michigan Mineral Land Company - -	236	6	78	320
Minnesota Research Company - - - -	5	0	0	5
Quartzite Lands, (for Cleveland Off.)	6	0	0	6
TOTAL HOURS WORKED	2,232	484	160	2,876

E. L. Derby, Jr. Approximately twenty-five percent of my time, during the year, was taken up with office routine, and numerous duties peculiar to the Geological Department. The time so spent was greater than in former years because I was without assistance during a greater part of the year. As stated above, Mr. Afuhs left February 1st and Mr. Tillson June 1st, but the latter was very ill and out of the office from the middle of March until a few days before he was laid off. I supervised the completion of the drilling campaign on the Bingham lease the first part of January, and the geological surveys that were made during the limited operating period of our several mines.

My time, not taken up with these duties, was spent chiefly as follows:

In January, I spent five days on the Mesaba Range during which time I completed the classification of the drill samples from the Bingham drilling just finished, and checked over Mr. E. G. Sterling's estimate of the Bingham ore reserves based on this drilling. I also estimated the expected analyses of the various grades of ore included in the estimate. I went over the affairs of the Research Department with Mr. Morris.

On my way to the Mesaba Range, I attended the Annual Meeting of the Minnesota Research Company and was re-elected a Director and Vice President. I also had conferences with Mr. Butcher, Chief Engineer of the Republic Steel Corporation, and with Messrs. Diehl and Cronk of the Oliver Iron Mining Company on matters pertaining to our Minnesota operations.

At Ishpeming, I made a joint report, with Mr. R. S. Archibald, on the tax situation of the Michigan Mineral Land Company, recommending the non-payment of taxes, for the year 1931, on a number of parcels of fee lands which, in accordance with very recent information, do not appear to be of sufficient mineral or surface value to warrant this continual expense. I also prepared a revised estimate of the Negaunee Mine ore reserves, compiled from the engineer's most recent figures, as a part of the Annual statement sent to the Bethlehem Steel Corporation.

In February, I assisted Messrs. Jackson and Meyers with geologic data and estimated ore extensions, in the preparation of their joint report on the operation of the Corrigan-McKinney properties. I also started to work up data for a set of cross-sections of the Bingham lease as the basis for a reserve ore estimate to be submitted to the engineers of the Minnesota State Tax Commission.

In March, I spent considerable time completing a joint report with Mr. Archibald on the classification of the entire mineral estate of the Michigan Mineral Land Company and preparing my recommendations for the purchase of certain tax titles, at the May tax sale, on lands where both the Michigan Mineral Land Company and the Cleveland-Cliffs Iron Company own the mineral rights. I also put in a little time on the Bingham cross-sections commenced in February.

In April, I continued to spend considerable time on various tax matters pertaining to property of both this Company and the Michigan Mineral Land Company in preparation for the sale of delinquent taxes held on May 3rd. In connection with Michigan Mineral Land Company mineral property, I attended a Directors meeting of this company held at the Congress Hotel in Chicago on Sunday, April 24. I nearly completed the preparation of data for the reserve ore estimate on the Bingham lease to be submitted to the Minnesota State Tax Commission. I made an

underground examination of the Hartford-Cambria Mine workings, especially the recent developments nearest the Jackson boundary line, and prepared a report on the subject. I also visited the Dolomite district of Fairbanks Township, in Delta County, from the vicinity of Fayette, Southwesterly to Burnt Bluff. Mr. Brotherton of the Land Department accompanied me on this examination. We examined the Burnt Bluff area in connection with an offer received by the Company to acquire its mineral interest in this property. The surface is owned by other parties.

In May, I went to Iron River and conferred with Messrs. Cannon and Fish of the Hanna Company, in connection with the proposed transfer to us of the Ravenna-Prickett leases held by that company, in exchange for our lease on the Erickson property. These men came to Ishpeming later in the month for another conference on the subject with Messrs. Elliott, Jackson and me. I made a superficial field examination of the Company's property in the immediate vicinity of the old Michigan Gold Mine. The question of leasing these lands to outside parties seeking them comes up every little while and I had Ernest Allen, formerly of the Geological Department, but at that time a helper in the Engineering Department, make a compass and pacing geological survey and map of this area.

I spent three days at our Hibbing office going over the data I had worked up for the cross-sections of the Bingham lease with Mr. E. G. Sterling. Mr. Sterling then made up these sections and later in the month, at Ishpeming, I prepared for the Tax Commission an estimate of the reserve ore, together with the stripping necessary to mine this ore from an open pit. Also, while in Hibbing, I went over with Mr. Sterling the cross-sections he was working up of the Canisteo property in connection with a complete estimate of the various ore areas for operating purposes, and the most recent and revised estimate of the Dean Mine ore reserves to accompany a report by Mr. Barber.

At Ishpeming, I started to work up data for my report on the examination, in April, of the Dolomite lands in Fairbanks Township, Delta County. I also started a review of the problem of revaluing the Morris Lloyd Mine for depletion purposes in preparation for such a revaluation to be made in June with Mr. Gordon, Engineer in the Internal Revenue Department at Washington.

In June, I completed the detailed report on my examination of Burnt Bluff in Fairbanks Township, Delta County, which I had visited with Mr. Brotherton the latter part of April. Mr. Gordon came to Ishpeming and spent three and a half days with me making a complete study of the Morris Lloyd estimates that I had made for the revaluation and compiling other data necessary for his own estimates later on. It is to be noted that a revaluation of this property for depletion purposes was allowed by the Government and that precisely our own data was accepted and used in the final set-up, which will result in a large financial saving to the Company in Federal taxes.

I spent a week at our Hibbing office. During that time, I went into the possibilities of the so-called "Jig Ore" at the Canisteo for a report Mr. Barber was preparing. I went over the production and cost figures on the Wade



Mine for the years 1930 and 1931 in an attempt to get some relief in our Federal taxes as a result of surrendering this lease. I spent one day at the Coleraine office of the Oliver Iron Mining Company searching their records for the sampling of the underground workings on the North Star property, under the Mt. Griffen area, which were opened during the Oliver's operation of the Holman-Brown property. This data was finally brought to light and the original records loaned to me for copying. This information was of the utmost importance in preparing my formal protest to Prof. Lambert, engineer for the Tax Commission, of his estimate of 377,486 tons of underground direct shipping ore in the Mt. Griffen area of the North Star property, which I claimed was not there.

Later in the month, Mr. Barber and I had a conference with Prof. Lambert at his office at the University of Minnesota in Minneapolis, and presented to him our revised estimate of reserve ore in the Bingham lease as the result of our recent campaign of structure drilling. I spent one day at the Coleraine sample house of the Oliver Iron Mining Company, classifying fifty old drill holes located on the Canisteo property but which, until recently, we had not needed. These results will be incorporated by Mr. E. G. Sterling in a new operating reserve ore estimate that he had started to work up. Mr. Bolthouse assisted me in this classification.

In July, I started to compile data and prepare maps for my protest to Prof. Lambert, on the 377,486 tons of underground direct shipping ore included in his estimate of North Star reserve ore. I spent one day at Sidnaw examining a property on which hard specular ore was claimed to have been found in place. The foliage and underbrush were so thick that my guide was unable to take me to the spot. He promised to find it after the leaves were off the trees in the Fall. Because of high magnetic dips, an iron formation in this district has been suspected for many years, which accounts for the retention, until the recent financial crisis, of the Michigan Mineral Land Company's mineral interest in the district. I went over the most recent edition of the history of the Negaunee Mine, prepared periodically by the Bethlehem Steel Corporation, for their records, and made several corrections which I enumerated in a special report. I also spent a day sampling the Quartzite bluff on the Company's property in the N $\frac{1}{2}$  of Section 32, 48-26, North of the Maas Mine. Mr. D. T. Croxton of our Cleveland office, asked for a source of comparatively pure silica to market to the producers of Ferro-Silicon. Two typical average samples analyzed 98.20% and 97.20% respectively, in free silica. I also suggested, as a source of this mineral, the silica sand on the Company's property along the lake shore near Munising.

In August, I completed the assembling of data and preparation of maps to sustain my protest to Prof. Lambert against the underground direct shipping ore in his North Star reserve ore estimate. About 25% of my time was spent preparing data in connection with the negotiations pending at that time with the Inland Steel Company relative to their leasing the Morris Mine. I prepared a map of the development work done on the Sherwood property during the years 1931 and 1932 in the extension of the 6th Level Virgil Mine on to this property, and assisted Messrs. Brewer and Chenneour in the preparation of maps showing stockpile areas at the

Morris Lloyd Mine to be leased to the Jones & Laughlin Ore Company in connection with their ore contracts. I also visited the surface layout of the Greenwood Mine of the Inland Steel Company and was shown around the property by the Superintendent, Mr. Satterley. I prepared a special report on this visit.

In September, I worked up some data with Mr. Archibald on the grades of ore that might be expected in the future at the Morris Mine. This was in connection with the Inland negotiations. I went to Minneapolis and had a conference with Prof. Lambert and his assistant, Mr. Heilig, going over in detail the data supporting my protest on the underground direct shipping ore at the North Star property. In this connection, I also conferred with Messrs. MacCraw and McAdams in the State Tax Commission's office at the Capitol in St. Paul. It appeared that the detailed working maps of the underground areas mined years ago by the Oliver Iron Mining Company were desired to aid in completing this case, and I left at once for the Coleraine office of the Oliver Iron Mining Company, got the maps that afternoon, and brought them back to Ishpeming for printing. As soon as possible prints, including, also, some additional data, were dispatched to Prof. Lambert. I am pleased to record that this protest was finally upheld and the 377,486 tons of underground direct shipping ore in Prof. Lambert's estimate of the North Star reserve ore was eliminated, resulting in a saving in taxes of approximately \$1500 annually, and a much larger amount as time goes on since the rate at which it was assessed, five cents, undoubtedly would be increased when the property as a whole became an active one. It is, in fact, more than likely that the rate would be increased to at least seventeen cents per ton, or more than three times the former rate, hence the importance of this decision.

I spent a week, here at Ishpeming, with Messrs. Schaus, Smith, Johnston and Eidemiller of the Oglebay Norton Company, who came here to make a detailed study of the Morris Lloyd property in connection with possible negotiations for supplying their company with ore from one of these two mines. Messrs. Johnston, Eidemiller and I made a new joint conservative operating estimate of the reserve ore in each property. At the conclusion of this work, I went underground at both mines with the four men, going through the principal main level workings, accompanied by Mr. Stakel and Capt. Thomas.

Mr. Meyers and I went to Crosby, Minnesota, on the Cuyuna Range, where we spent two days examining the Armour No. 2 and Iron-ton Mines of the Inland Steel Company. The leases on these properties were involved with Inland's negotiations for a lease on the Morris Mine. While there, we also visited the Evergreen Mining Company's sintering plant as a preliminary to a review of the possibility of sintering the Dean Mine ore.

In October, Mr. Meyers and I completed our joint detailed report on the examination of the Armour No. 2 and Iron-ton Mines. We also revised Mr. Barber's report of August 5th on the possibility and cost of sintering and sinter-drying Dean Mine ore from data obtained by us while on the Cuyuna Range. We wrote a short report on the Wearne Mine located on the Cuyuna Range. The Inland Steel Company were about to surrender the lease and we examined the maps, cross-sections and miscellaneous operating data while at the Armour No. 2 office in September. Messrs. Webb, Nelson and Butcher of the Republic Steel Corporation conferred with me on a proposed lease to the Republic Company of a strip of our Jackson property adjacent and just south of the Hartford-Cambria Mine. I studied over the Oglebay

Norton Company's proposal to substitute their Greenway Mine operation on the Mesaba Range for their Eureka-Asteroid production and then compared that picture with one in which we might supply them the required tonnage from the Lloyd Mine.

I went to Hibbing and went over the Greenway picture with Mr. Barber and he wrote a report on the subject. I then went more thoroughly into sinter-drying Dean Mine ore. Messrs. Barber, McMorris and I went to Crosby and got more complete cost and metallurgical data from Mr. Perry Harrison, Superintendent of the Evergreen Mining Company. I then made up an entirely new picture on the proposed Dean operation for Mr. Barber's report of October 21st. I went to St. Paul from Hibbing and spent the last week of the month preparing data for and attending the hearings before the Minnesota State Tax Commission relative to a request by the mining companies for a 20% horizontal reduction in assessment rates on all unmined iron ore in the state; also a relief in the assessments on all stockpiles. Messrs. S. L. Mather and Barber were also there the first two days and Mr. Donovan most of the week.

In November, I prepared some additional figures on the sinter-drying of Dean Mine ore for Mr. S. L. Mather. I spent a day at Duluth going over with Messrs. Webb and Butcher of the Republic Steel Corporation, our complete study of the Armour No. 2-Ironton property with maps and all other data. At this time I also discussed with them additional points in connection with their proposed lease of the ore on the Jackson property just south of the Hartford-Cambria Mine. I conferred with Mr. Neely at Crystal Falls and with Mr. Harlow Clark at Marquette relative to a proposed revaluation of the Carpenter-Neely property for depletion purposes, at the request of our Cleveland office, and persuaded them to drop the petitions for such revaluation as being detrimental to all parties concerned, including this Company.

I assisted Messrs. Meyers and Stakel on the figures of reserve tonnages to be incorporated in their "Mine Studies" of the Cliffs Shaft, Morris-Lloyd and Tilden properties. I joined with Mr. Archibald in the annual review of our mineral classification of the Michigan Mineral Land Company's entire mineral estate to bring it up to date as a guide to the payment of taxes the first of the year. I also examined, with Mr. McClure, the surface prospecting being done at the old Ropes Gold Mine by the present lessees and sampled several trenches and open cuts. The lessees have applied to Mr. McClure for a power line to the property.

In December, I spent a day underground at the Negaunee Mine, assisting Mr. Moulton with some engineering work and an half day helping Mr. Brewer line in the guiding bottom timbers in the raise being put up from the sixth level Lloyd Mine on the line of the shaft. I attended, on December 12, the Annual Meeting of the Minnesota Section of the American Institute of Mining and Metallurgical Engineers held at the Mining School of the University of Minnesota in Minneapolis. I spent the following two days at the University Experiment Station, where Mr. McMorris had just started a series of concentrating tests on jig size (maximum 1/2 inch) Canisteo banded taconite, or so-called "Jig Ore", using a commercial size diagonal deck overstrom concentrating table. This table, designed and manufactured by the Deister Concentrator Company of Fort Wayne, Indiana, is a new departure. It has been used successfully for cleaning the coarser sizes of coal but never before for concentrating the relatively coarse sizes of iron ore. These tests are being watched with great deal of interest and may revolutionize the field now occupied by jigs. I covered my observations by a detailed report. I also started to prepare estimates of the reserve ore in each of our Michigan mines for our Annual report to the Michigan State Tax Commission.

A. H. Tillson. Mr. Tillson continued as Assistant Geologist until he was laid off June 1st when the mines closed down. He has not been re-employed in this Department. He was taken seriously ill with pneumonia on March 21st and did not return to work until just a week before he was laid off. Before this, however, he made underground geological surveys at the Cliffs Shaft, Maas, Mackinaw and Morris Lloyd Mines and posted this information on the geological maps and cross-sections. He also posted the current extensions of mining and development work on the geological maps and cross-sections of the Athens, Negaunee and Virgil mines. The new sub-levels opened up in a number of these properties required him to make new geological tracings to cover this development work. He posted all current information on the two general surface geological tracings of the Marquette Range, - one taking in the Ishpeming and Negaunee Districts, and the other the North Lake district and territory to the west. These maps were partially made up several years ago and then laid aside due to the greater urgency of other work. He checked over the drill sections of the Bingham exploration which Mr. Afuhs completed just before being laid off February 1st. He also posted exploration data for our outside exploration files that had been received in several land offers. The rest of his time was spent in a variety of office routine duties.

Gustav Afuhs. Mr. Afuhs continued as our Draftsman until he was laid off February 1st, at which time the personnel of the entire office was considerably curtailed. He has not been re-employed. During the month of January he finished making up several white prints of a new geological map of Iron County, showing the lands and mineral interests owned by the Michigan Mineral Land Company. He completed the plotting of all the analytical results, including classification of material, of the Bingham drilling on our regular drill section tracings. He started to post the 1931 extensions on the annual report set of geological tracings of the Morris Lloyd Mine. He also commenced work on a tracing map of the gold mine area Northwest of Ishpeming, taking in the territory from a point West of the old Michigan Gold Mine to a point East of the Ropes Gold Mine. He spent the rest of the month on the routine work of the office.

## C. SURFACE GEOLOGICAL SURVEYS

### C-1. GOLD MINE AREA

Mr. E. A. Allen, formerly an assistant in the Geological Department but recently an assistant in the Engineering Department, spent several days during the month of May making a rough geological survey of a part of the old Michigan Gold Mine property and the Company land immediately west. He mapped all outcrops, shafts, testpits, trenches, open cuts, waste dumps, etc., using a sun-dial compass and pacing. He covered pretty thoroughly the NW $\frac{1}{4}$  of the NE $\frac{1}{4}$  of Section 35, 48-28 on which is located the old Michigan Gold Mine shaft and surface equipment; also the SW $\frac{1}{4}$  of the NE $\frac{1}{4}$  and the E $\frac{1}{2}$  of the NW $\frac{1}{4}$ . These latter descriptions are owned by the Company. He had started work on the Company's lands to the west when he was laid off June 1st and the survey abandoned.

## D. UNDERGROUND GEOLOGICAL SURVEYS

### D-1. ATHENS MINE

The Athens Mine worked four days per week, single shift, and with half a crew alternate weeks from January 1st to June 1st and after November 1st. It was idle but kept unwatered the rest of the time. Geological data was collected periodically by Mr. C. W. Allen, engineer at the property, until the mine closed June 1st.

The product came entirely from between the 4th and 8th levels. The bulk of it came from the mining of pillars between the 6th and 8th levels. Development from the 6th level raises South of the fault dike and on the hanging side put up in 1930 and 1931, continued to open up this area on the -415', -430', -440' and -485' sub-levels. The only other development was in raise 609 starting on the 6th Level. It was put up 108' during the year and will be carried through to the 4th level, principally for ventilation purposes. It is in ore with a cut-out on the -550' sub-level and a change in pitch (a knuckle) at that point.

### D-2. CLIFFS SHAFT MINE

At the Cliffs Shaft Mine the day shift men worked two days per week (Mondays and Wednesdays) mining, tramping and hoisting ore from January 1st to June 1st and after November 1st. During the same time the old night shift men worked two days per week, day shift, (Tuesdays and Thursdays) tramping and dumping rock into old stopes. The mine was idle from June 1st to November 1st but kept unwatered. Mr. Tillson made geological surveys each month, coincident with the contract surveys made by the engineer, until he was taken ill the latter part of March,

In "A" Shaft, the development drift north on drill hole 421, coordinate 1800 East, on the 10th Level, was continued North in the ore encountered by the drill hole for about 105'. This is located on the Bancroft lease, Lot 2, Section 3. The East end of this level, on the Bancroft lease, was extended East for about 90'. A development drift at the East end of the 11th Level was extended East about 85'. At the East end of the 12th Level, a development drift was extended Southeasterly 135' during the year. A drift being driven North on the 15th Level, Bancroft lease, to develop the downward extension of the Main Bancroft vein was extended 200'. This drift followed the line of drill hole 422. Most of the ore production from this shaft continued to come from the Bancroft vein, from the 1st to 5th Levels, inclusive, and from the 7th, 8th, and 10th Levels. Mining of ore also continued in the ground between the Cliffs Shaft and the old Incline and No. 3 mines from the 6th, 7th, 8th and 10th Levels. A little ore came from the Southeast deposit on the 5th and 6th Levels and the remainder from stopes and pillars in the Main deposit.

In "B" Shaft, the drift going Westerly from the Northwest end of the 6th Level to follow the North limb of the main fold, was discontinued after being advanced about 100', early in the year. The drift from the Southwest end of the 10th Level being driven Westerly to explore and develop the ore en-

countered many years ago in the old drilling from surface in the  $W\frac{1}{2}$  of Section 9, was extended about 210'. The drift running Northeasterly on the 15th Level toward the Section 3 soft ore body was carried ahead about 250'. The ore production came entirely from floors, raises and stopes in ore deposits already developed on the various levels.

#### D-3. GARDNER MACKINAW MINE.

The Gardner Mackinaw Mine worked a full crew on the day shift two days per week from January 1st to June 1st. It was idle on a pumping basis from June 1st November 1st and then operated six day shifts per week with a third of the crew each day the rest of the year. Mr. Tillson kept the geology posted on the geological maps and cross-sections until he was taken ill.

Development work was confined principally to the advancement of the 7th Level Northwesterly for about 300' and the opening up of the new 8th level. The 7th Level development was all in ore with the breast still in it but the sulphur content is so high that the ore cannot be mined at present. Later on, if enough lower sulphur ore is developed at a lower elevation, some of this 7th Level ore may be mined and mixed with it. In opening the 8th, which is 148' vertically below the 7th, a small incline winze was sunk. About 250' of drifting was done on the 8th and a small incline raise put up to the 7th Level on the line of the main incline shaft. This will be stripped to the full size of the shaft. Drifting on the 8th Level was all in good ore with the sulphur content well within the mineable limit. All of the regular ore production came from the stopes between the 6th and 7th Levels.

#### D-4. MAAS MINE

The Maas Mine worked four days per week, single shift, and with half a crew alternate weeks from January 1st to June 1st and after November 1st. It was idle but on a pumping basis from June 1st to November 1st. Geological data was mapped periodically by Mr. Tillson and Mr. Pellow, engineer at the property, until it closed June 1st.

The principal development work was confined to the 3rd, 4th and 5th Levels but was relatively small in amount. On the 3rd Level, the footwall drift under the new riser of ore, first encountered on the footwall side of the Race Course property at the 4th Level elevation, was extended 125' Easterly. On the 4th Level, a cross-cut was started southeasterly from the main rock drift from the shaft to hole into No. 3 cross-cut East. About 50' was drifted. Also on this level, the Southwest drift parallel with the American Mining Co. strip and south of the Race Course was extended 100', - the first 20' in dike and the balance in ore. One raise was put up near the end of the drift. On the 5th Level, no work was done until after November 1st and then No. 2 Cross-cut, on the Race Course, was extended about 35' to and into the dike South of which the ore body occurs.

The principal ore production came from three localities: Above the 3rd Level in the new riser of ore from the 4th Level on the Race Course; between the 2nd and 3rd Levels on the footwall side of the deposit; and above the 4th Level under the hanging and mainly just South of the Race Course.

D-5. MORRIS LLOYD MINE

The Morris Lloyd Mine worked single shift two days per week until June 1st and was idle on a pumping basis from June 1st to November 1st. After November 1st the Lloyd Mine worked three shifts per day, six days per week, staggering the men so that each man worked at least eight shifts per month. The Morris remained on an idle, pumping basis and was leased to the Inland Steel Company December 9, 1932. Mr. Trosvig, engineer, mapped the geology periodically.

At the Morris Mine new sub-levels were developed on the 150', 130', 110', 70' and -40' elevations, all on Chase Lease No. 9. No main level development work was done. All of the ore production also came from Lease No. 9, from both above the 7th and 8th Levels.

At the Lloyd Mine two cross-cuts were driven into the main Lloyd-East ore body on the 6th Level, a total of nearly 300'. Also beginning November 1st, a footwall drift was driven about 800' due North on the 6th Level, to a point under the main hoisting shaft which is bottomed about 80' below the 4th Level. A raise will be put up and the shaft stripped down for a 6th Level connection. A small amount of ore came from above the 3rd Level but most of the production came from the subs above the 4th Level. No ore was produced after June 1st.

D-6. NEGAUNEE MINE

The Negaunee Mine worked four days per week, single shift, and with half a crew alternate weeks, from January 1st to May 1st and after November 1st. Geological data was mapped periodically by Messrs. Fellow and Moulton, engineers.

Under the heading of new development, one raise was put up from the 12th to the 11th Levels on the Northwest side and near the American Mining Company strip. The 12th Level drift along this strip was extended Northeasterly about 20'. Work was started to open up a new transfer drift on the 350' elevation to replace the one on the 385' sub-level. The 13th Level shaft plat was completed and tail drift started.

The principal ore production continued to come from between the first sub-below the 10th Level and the first sub above the 11th Level.

D-7. TILDEN MINE

The Tilden Mine shipped 19,957 tons of standard silicious ore, all from the West pit, and worked seven days in July, three days in August and two days in October. The ore had all been broken during 1931 and there is an estimated balance of broken ore in this pit of approximately 10,000 tons. No geological mapping was necessary.

D-8. VIRGIL MINE

The Virgil Mine worked four days per week, single shift, and with half a crew alternate weeks from January 1st to March 1st and after November 1st. It was idle on a pumping basis from March 1st to November 1st. I have kept the geology mapped periodically and the geological maps and cross-sections posted.

A small amount of ore was produced from stoping in the main ore body above the 6th Level but most of the production came from the continued development of the 8th Level ore body between the 6th and 8th Levels. This work was carried ahead on the 000', -25', -50' and -75' sub-levels. Stoping was started on the -100' and -130' sub-levels.

The drift at the 6th Level elevation, Southwesterly on the Sherwood property, was carried ahead 110' and a North-South cross-cut started on the 200' West coordinate line. The curve was nearly completed (about 75'). This work was all done prior to March 1st and not resumed since.

#### E. OPTIONS AND LEASES

No new options to explore, nor leases, were taken during the year.

The lease on the Wade Mine was surrendered to the Great Northern on September 1, 1932.

The Morris Mine was leased to the Inland Steel Company on December 9, 1932. This includes a lease on fee lands and a sub-lease covering Moore and Chase leases 9,24,25,26,27 and 28.

Notice, dated December 5, 1932, was given of our intention to surrender the lease on the Dean-Itasca Mine to become effective 60 days thereafter or on February 3, 1933.

#### F. EXPLORATIONS AND COSTS

Drilling explorations were carried on during 1932 only at the Bingham Mine as follows:

##### F-1. FROM SURFACE

<u>DISTRICT</u>	<u>RANGE</u>
Taconite	Mesaba

Table V, which follows, gives the footage drilled, the ore encountered and the cost per foot of drilling. It will be noted that the cost of this drilling was \$3.75 per foot, excluding certain items which are not actual drilling expense but which are charged to explorations. By including these items, the cost was \$11.44 per foot. In the present case this cost is all out of line, from the fact that this drilling was just a small footage at the tail end of the Bingham drilling campaign of over 5300' and the items of cost in cleaning up the work should, in all justice, be spread over the entire footage drilled. The total cost over the total footage was \$3.94 per foot. Excluding the items of overhead it was \$3.34.

Table VI, also shown below, gives a comparative cost per foot of total drilling for the past five years.

The year 1932 is the only year shown in the table that doesn't contain underground drilling, as none was done. The higher cost, in comparison with the other years, is consequently noticeable since the lower cost of underground drilling in years previous to 1932 yielded a lower average cost of total drilling.



538

TABLE V  
SUMMARY OF DRILLING FOR 1932

EXPLORATION	DESCRIPTION			STAND- PIPING FT.	CHURN DRILLING FT.	DIAMOND DRILLING FT.	TOTAL DRILLING FT.	FIRST CLASS ORE FT.	SECOND CLASS ORE FT.	LEAN ORE FT.	TOTAL COST "A"	COST PER FT. "A"	TOTAL COST "B"	COST PER FT. "B"
	SEC.	T.	R.											
<u>SURFACE DRILLING</u>														
Bingham Lease	21	56	24, Minn.	8	37	18	63	0	0	0	\$720.51	\$11.44	\$236.25	\$3.75
TOTAL SURFACE DRILLING				8	37	18	63	0	0	0	\$720.51	\$11.44	\$236.25	\$3.75

Note:- Cost "A" includes office expense, engineering, analysis, legal, personal injury, etc.  
 " "B" excludes " " " " " " " " (to compare with contract prices).

The drilling on the Bingham Lease was done under contract by J. S. Schultze of Grand Rapids, Minn.

TABLE VI  
SUMMARY OF FOOTAGE DRILLED AND COST PER FOOT OF DRILLING FOR PAST FIVE YEARS

YEAR	TOTAL FEET DRILLED	COST PER FOOT	
		"A"	"B"
1928	4,770	\$3.00	\$2.63
1929	13,190	3.75	3.36
1930	14,656	4.15	3.61
1931	8,031	3.59	3.05
1932	63	11.44	3.75

F-3. DIAMOND DRILL CARBON

Since no diamond drill carbon was consumed in 1932, we had on hand, December 31, 1932, the same amount as on December 31, 1931, namely a total of 380.90 karats which inventoried at \$46,556.06.

F-4. DRILL SECTIONS

Cross-sections showing a detailed report of the drilling done during 1932 on the Bingham lease, Mesaba Range, will be found in the Annual Report Book which is submitted as a part of the Annual Report of the Engineering and Geological Departments.

G. SURFACE EXPLORATIONSG-1. BINGHAM MINE LEASE, NW $\frac{1}{4}$  OF SE $\frac{1}{4}$  OF SECTION 21, 56-24, MINNESOTA

A campaign of check drilling the Bingham lease with large diameter structure drill holes was commenced in April 1931, and carried on throughout the rest of that year. Twenty four holes were completed and the last hole, No. 25, started during that time. This last hole was stand piping in surface material at a depth of 60' on January 1st, 1932. It encountered decomposed taconite ledge at 68'6". The hole was finally bottomed in hard taconite at 123' on January 13th without encountering either wash ore or direct shipping ore, although the taconite was decomposed to a depth of 105'.

This completed the Bingham check drilling. As a result, we increased the estimated ore reserves approximately one million tons, or from 1,400,000 to 2,400,000 tons, in round numbers. Of this tonnage, approximately 600,000 tons is direct shipping ore and the balance is good wash ore concentrate, - all open pit ore. To mine it, will require the stripping of approximately 3,800,000 cubic yards of surface material and 400,000 cubic yards of paint-rock and lean ore.

H. UNDERGROUND EXPLORATIONS

No underground drilling was done during the year 1932.

I. EXPLORATIONS AND NEW DEVELOPMENTS BY OTHER COMPANIES.

Generally speaking, very little exploring and drilling were done by the various iron ore companies in the Lake Superior district during 1932 because of the economic stress. Exceptions to this that came to my attention are as follows:

I-1. MARQUETTE RANGE

The Inland Steel Company, at its Greenwood Mine exploration, continued development work on a curtailed basis throughout the year. A cross-cut south on the 1100' Level, which had been started in December, 1931, was completed to the ore body. This ore, which is a hard ore somewhat resembling the Cliffs Shaft ore, lies along the quartzite hanging contact and a drift was driven both East and West from the shaft cross-cut to follow the ore.

Raises were also put up at intervals along this drift. Furthermore, a diamond drill was rented from us and the formation drilled at intervals as drifting and raising progressed.

Thus far, the ore has been very spotty in occurrence, being in the form of narrow and irregular stringers and bunches with barren areas between. Perhaps 10,000 to 15,000 tons have been mined and shipped to the Inland furnaces at Indiana Harbor. The property is distinctly a prospect even after the considerable development work that has been done.

#### I-2. MENOMINEE RANGE

All drilling and exploring which were being carried on at various points on the Menominee Range in 1931 and years just previous, were discontinued during 1932.

#### I-3. GOGEBIC RANGE

Starting some time late in 1931, Mr. B. C. Neely of Crystal Falls, and associates, had some drilling done on contract by Ira Odgers, also of Crystal Falls, on the Western extension of the Gogebic Range in Wisconsin. Twelve holes with a total of 6373' were drilled along the strike of the iron formation on a stretch of about two miles Northeast and Southwest and located to the South and Southwest, of Upsan, Wisconsin. This work was discontinued during the past summer or early fall. No merchantable ore bodies were found but enough oxidation, with here and there some concentration, was found to encourage the promoters and the work was stopped only because of the general economic conditions.

#### J. EXAMINATION OF MINERAL LAND OFFERS

Six mineral land offers were received and reported on during the past year as follows:

<u>NUMBER</u>	<u>DESCRIPTION</u>	<u>REMARKS</u>
1872	At Allegheny in heart of Mother Lode district, Calif.	Declined
1873	Various in 46-25;45-29 and 46-29, Marquette County	"
1876	3 Claims in Saskatchewan, Canada	"
1877	Armour No. 2 & Ironton Mines, Cuyuna Range, Minnesota	"
1878	Wearne Mine, Cuyuna Range, Minnesota	"
1879	Greenway Mine, Mesaba Range, Minnesota	Pending

#### K. EXPENSE STATEMENTS

Tables VII and VIII, which follow, show a detailed statement of charges to Geological expense for the year and a comparative statement of these charges for the last three years. They are self-explanatory:

TABLE VIISTATEMENT OF CHARGES TO GEOLOGICAL EXPENSE FOR YEAR 1932

Salaries	\$5,469.83
Travel and Entertainment	633.34
Operating Automobiles	560.37
Supplies and Office Expense	188.73
Unclassified	67.67
Total	<u>\$ 6,919.94</u>

TABLE VIIICOMPARATIVE STATEMENT OF CHARGES TO GEOLOGICAL DEPARTMENT FOR LAST THREE YEARS

	<u>1932</u>	<u>1931</u>	<u>1930</u>
Salaries	\$5,469.83	\$12,994.58	\$ 15,495.00
Travel & Entertainment	633.34#	2,244.77#	100.33
Operating Automobiles	560.37	451.81	852.90
Supplies & Office Expense	188.73	1,094.39	1,537.74
Unclassified	67.67	119.86	295.00
	<u>\$6,919.94</u>	<u>\$16,905.41</u>	<u>\$ 18,280.97</u>

# Previous to 1931 all Travel and Entertainment expense charged against any particular mining operation was not included in this statement.

L. RESEARCH DEPARTMENT

Our Research Department on the Mesaba Range was discontinued Feb. 1st, 1932 but Mr. McMorris was employed until March 1st completing his report on the jig tests that he had made at the University Experiment Station in Minneapolis.

Mr. McMorris was re-employed on special research work from June 1st until July 15th and again from August 1st till the end of the year. During this time he was sent on an inspection trip which included the milling plants in the Tri-State lead, zinc field, and the coal fields of Pennsylvania. He also visited miscellaneous steel plants in Cleveland, Youngstown and Chicago districts.

Starting in September, Mr. McMorris spent the balance of his employment with us making comparative jig tests and concentrating table tests, both on the so-called jig material taken from our wash ore properties. With the exception of a short preliminary table test on coarse jig material at the Deister Concentrator Company's laboratory in Fort Wayne, Ind., these tests were made at the University Experiment Station in Minneapolis. The tests were far from completed when we had to lay him off January 1st, but Mr. E. C. Congdon, of Duluth, of the Canisteo Mining Company, arranged to have Mr. McMorris continue the tests at the Canisteo Mining Company's expense, with the understanding that his report on all the tests would be submitted jointly to this Company and the Canisteo Company. It is anticipated both the tests and the

detailed report will be completed some time during the coming summer.

Respectfully submitted,

*E. L. Derby, Jr.*  
Geologist.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

CLIFFS SHAFT MINE:

The skip dump at "A" Shaft was entirely rebuilt, as it was in very poor condition. The ore pocket at this Shaft was also in very poor condition and it was repaired in November. Some of the timbers in the frame were replaced and new plank lining on sides and bottom. 70 lb. rialroad steel was used on the bottom for wearing strips, and the sides were lined with 3/4 x 6" manganese strips. The stopper fingers were replaced with a new design made of steel and cast iron. This dump and pocket is now in good condition and should last for several years.

All mechanical equipment at this mine is in good condition and operated satisfactorily during the year. No changes or additions were made to the mechanical equipment.

This mine was idle from May 28th to November 1st.

TILDEN MINE:

Some repairs were made to the equipment at this mine in May month. A little work was done on the shovels, locomotives and crushing plant. Some loading was done in July and August. All equipment is in good condition and operation was satisfactory during the year.

ATHENS MINE:

New copper cooling coils were installed in the oil tank on the hoist flywheel set to replace iron pipe coils which were in poor condition.

The flow of water in the mine increased from 326 to 597 G.P.M. in July due to a cave. There has been a decrease each month since that time; August being 542 G.P.M., September 486, October 431, November 402 and December 391. The water condition at the present time is almost back to normal.

In November the cage hoist drum was lengthened 3 inches to allow the cage to go to the bottom of the shaft and still have three complete turns of rope on the drum. Additional counterweight has been added to take care of the extra load when cleaning the skip pit.

Some repairs and changes were made on the Ingersoll-Rand air compressor. The intercooler tubes were leaking very bad and the intercooler was replaced with a spare. The low pressure cylinder was badly worn. A new bushing was put in and the old piston turned to fit. A new intake was also installed as the old one was leaking and considerable water and sand was getting into the machine.

All mechanical equipment at this mine is in good condition and operated satisfactorily during the year.

This mine was closed from May 28th to November 1st.

MAAS MINE:

A new water cylinder was installed on the Aldrich quintuplex pump to replace a cylinder that was cracked.

A new pump station was cut on the 5th level. The old 6" x 18" Lake

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

MAAS MINE: (Cont'd)

Mine Prescott pump has been repaired and changed to an 8" x 18" and installed on this level. It is operating very satisfactorily. The Aldrich triplex from the 4th level is now being moved to this pump station. When this change is completed it will give us a total capacity of about 1,500 G.P.M. from this station. The 4th level pump station will be abandoned as soon as the pump installation on the 5th level is completed.

All mechanical equipment at this mine is in good condition and operated satisfactorily during the year.

This mine was idle from May 28th to November 1st.

NEGAUNEE MINE:

On February the 11th the air receiver caught fire. This fire did not cause any damage to the receiver, but broke one elbow on the pipe line. Repairs were made at once without any delay to mining operations.

All mechanical equipment is in good condition and operated satisfactorily during the year.

This mine was idle from Apr. 30th to November 1st.

LLOYD MINE:

No changes or additions to this plant during the year. All mechanical equipment operated satisfactorily.

This mine was closed from May 28th to November 1st.

MORRIS MINE:

All mechanical equipment is in good condition and operated satisfactorily during the year.

SECTION 6 SHAFT:

All mechanical equipment is in good condition and operated satisfactorily during the year. No changes or additions. This mine was closed on May 28th.

GARDNER-MACKINAW MINE:

All mechanical equipment at this mine operated satisfactorily during the year. No changes or additions.

Mine closed May 28th and re-opened November 1st.

SPIES-VIRGIL MINE:

No changes or additions to the equipment at this mine. Operation satisfactory.

Mine was idle from February 1st to November 1st.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

ALEXANDRIA MINE:

No mining was carried on during the year.

Underground pumping continued until March, when motors were removed and mine allowed to fill. The pumps were well greased and left in place. The motors and starters are stored on surface. After the water reached above the bottom level it drained to adjacent mines, and is getting no higher.

The mine buildings were boarded up in April and only a watchman employed the rest of the year.

CANISTEO MINE:

In January mining plans were formulated that made necessary lowering the pit water an additional 30 ft. This meant a change of impellers in the 7,000 G.P.M. pump and it was decided to make the change while pit sump was frozen over. The change to high head impeller increased the pump horsepower from 386 to 682 - giving a high peak and low load factor. When it was decided in Cleveland, in February, that the pit water need not be lowered this season, the old impeller was put back in service and used until October, when stripping in bottom of pit made it necessary to lower the water five feet. This was beyond the range of low head impeller so the medium head was installed and raised the horsepower peak from 386 to 515 H.P. As the incoming water had decreased to approximately 1800 G.P.M., as soon as stripping stopped in November a 2,000 G.P.M. pump from washing plant was substituted for the big pump, causing a saving of over \$600.00 per month in cost of current, raising the load factor to 79% and reducing the peak to 168 H.P., as shown by the December bill. This pump will be used until pit operations start next May.

In November permission was secured from Cleveland to install a 22,000 volt transmission line between washing plant and pit and move the 1,000 K.W. Substation from south to north side of pit, back of shop buildings. With exception of pole top switches and moving Substation, this work is now complete. This change allows all power for both pit and washing plant to be purchased on one contract.

Stripping operations started June 6th on a single shift, five days a week schedule, and continued until November 8th - moving 349,547 yards from upper and lower banks of pit. Few repairs were needed on the 120-B electric shovel, which did most of the stripping. It was necessary to build up the lugs on caterpillar pads, but this was done during the summer by removing 24 pads from the Hill-Trumbull shovel and using them for replacement, while the 24 old ones were fixed up and changed back during the idle period on Saturday. Coal weighing on the several locomotives used in the pit showed a saving of close to \$150.00 per month by using the spool instead of slide valve engines. This meant storing the old Oliver locomotives and using the later type from the Hill-Trumbull and Holman Mines for stripping work.

Only minor breakdowns occurred during the summer. An axle broke on track shifter, some wheels had to be replaced on 30-yard cars and a few parts on the Northwest shovel had to be renewed.



MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

CROSBY MINE:

In March the watchman was removed and all motors and electric equipment at the washing plant moved to and stored in machine shop at Hill-Trumbull Mine. During this month the M. A. Hanna Company also removed their electric motors from Symons crusher and bowl classifier. In April the M. A. Hanna Company removed storage conveyor equipment from this plant. In December the 3400 feet of 10" water discharge line was loaded on railroad cars and shipped to Canisteco Mine to be used for tailings pond make up water. The only machinery now left in this plant is revolving screen, 25 ft. log and bowl classifier.

HILL-TRUMBULL MINE:

The shops were closed down on January the 8th and the best men shifted to the Canisteco shops on a part-time basis. The only summer activity was pumping at intervals at washing plant to keep the tailings sand from blowing into Calumet. The tailings basin was planted in sweet clover to hold sand, but a poor stand was secured near spray lines. Willow sprouts were planted on these bare areas, but failed to root. Changes were made in the spray lines during the summer to cover the area better without needing additional water. It is hoped by next Spring that the clover can hold the sand with no pumping required.

In August approximately 500 tons of coal, which had been in storage, was shipped to the Canisteco Mine, cleaning up all coal supplies at this mine.

HOLMAN-CLIFFS MINE:

Repair work in shops was stopped on January the 8th and a few of the men were transferred to the Canisteco shops on a part-time basis. Pumping was continued in pit until March 31st, when pumps were removed to high ground and pit allowed to fill. The contract for power was cancelled, effective May 1st, but lights were secured for office from Village of Taconite.

In May the United Verde Copper Company purchased one 120-B electric shovel, Shop No. 10542, and it was loaded and shipped to Jerome, Arizona. Representatives of other companies were here inspecting the second shovel, but it was not sold.

In July, due to extensive churn drilling, it was decided to move the Armstrong drill sharpener and set it up in Canisteco blacksmith shop. The sharpener will be used there until the Holman starts again.

WADE MINE:

Mine pumping continued during the first three months, but on April 1st orders were received to remove the electric locomotives from underground, and the latter part of April additional orders included removal of underground pumps. These were taken out, as well as all new rail and trolley wire on first level, by April 29th.

In June a gas driven plunger pump was connected to Location water system for fire protection. The 24" lathe in shop was moved to the Canisteco shops.

271

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

WADE MINE: (Cont'd)

Good use was secured from the Model 36 Marion shovel and Lima Shea locomotive when an 8,000 ton cargo was shipped from stockpile in July. This equipment also worked during August, September and October until all ore was loaded from stockpile. An average of forty-five 50-ton cars could be loaded in a 10-hour shift. The railroad allowed us \$65.00 per day for use of the Lima locomotive to spot cars for them.

In November orders were received to ship part of mine equipment and supplies to Ishpeming storehouse. Included in the shipment were:

- 3 - 6-ton Type LM-2-T-6 Electric locomotives.
- 17 - 15 H.P. Double drum hoists and slushers.
- 8 - tons Bar steel - all sizes.
- Power hacksaw from shop.
- Bolt and pipe threading machine from shop.
- 10 H.P. Motor and pulleys from shop.
- Emery wheel.
- Drill press.
- Angur drill steel, pipe fittings and small supplies from warehouse.

ALL MINES:

Mr. Lowe of Stone & Webster Company met with representatives of nine independent mining companies on May 17th to secure information covering our power needs. He also went through the Range, gathering facts pertaining to a power survey and a study proving if it will pay for these companies to install a power system of their own. In his report of July 15th to Mr. Randall of the Inland Steel Company he shows that to give us the necessary power service a total investment of approximately \$3,500,000.00 is necessary, with a maximum saving of 3% on the investment in our best year of 1929, while the power requirements of 1930 would cost to generate approximately \$730,000.00, compared with \$600,000.00 paid the present power company. From these conclusions it seems the mining companies will continue to purchase power from the Minnesota Power & Light Company.

ARMOUR #2 MINE:

During December orders were received to remove underground equipment at the Armour No. 2 Mine on the Cuyuna Range. Work was started on December 27th and power was shut off the underground pumps on January 1st and pumps removed. All power cables were removed from shaft and mine equipment, such as drill machines and hoses, stored on the levels. Orders on December 31st were to ship nothing from the mine, so all equipment is now stored in shops and on surface.

272

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

ELECTRICAL DEPARTMENT:

General conditions of operation of The Cliffs Power & Light Co. power plants are substantially unchanged and the output was approximately 50% of normal capacity.

The only new customer connected was the City of Marquette Municipal Plant, this connection having been completed at the close of 1931. They used a little more than 1,700,000 kilowatt hours during the year, amounting to nearly \$13,000.00. This is a dump power service and we figure it is clear profit, because they paid for the connection.

The Munising Paper Company, due to an accident in their plant and the various partially idle periods in their operations, used 1,131,000 kilowatt hours, amounting to \$12,177.00.

The Inland Lime & Stone Co. were able to use less than their contract minimum.

The Furnace Department in the latter part of the year somewhat increased their use.

The only expenditures made during the year, outside of routine operating and maintenance, were for certain necessary repairs which could not well be made when the plants were operating at normal capacity. These are as follows:

Rebuilt approximately 900 feet of Carp Plant wood pipe line with material on hand for this purpose; also repaired about 300 feet by placing a reinforced concrete shell around the old pipe. This had previously been developed and seems to be a new and very satisfactory method.

The tail race at the Hoist Plant was excavated to the proper level and cleaned out, retaining walls being built on each side. Similar work was done at the McClure Plant and the excavation carried down the tail race to give the maximum tail head as designed for the original installation. We estimate that the tail race work increases the capacity of the two plants about 1%.

Certain repairs were made on the water wheel governors which could not easily be made except when the units were not in service. This has resulted in a marked improvement in the system regulation and materially improved our service. A man from the Woodward Governor Company was secured for this work. This could not be done at the time plants were built because governor developments at that time were not available. Our regulation is reported by customers to be perfect.

The periodical replacement of insulators on high voltage lines was continued and apparently most of the "old process" porcelain has now been replaced.

Some interruptions occurred during the year due to storms and also on account of wood cutting operations.

The Substation at Munising on the 30,000 volt line, which was out of service the first of the year, was repaired and again put in service.

273

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

ELECTRICAL DEPARTMENT: (Cont'd)

Sectionalizing switches of the older type were rebuilt and apparently are all now in satisfactory operating condition.

The most serious breakdown during the year was stripping of the blades on #2 water wheel at the Hoist Plant. This seems to have been due to shrinkage cracks in the cast iron runner. A new bronze runner was purchased and installed and is apparently now better than the original wheel.

Changes in service connections at North Lake were made due to transfer of the Morris Mine to the Inland Steel Co. This separates the service to the Lloyd and each mine is now separated for metering and service. This was effective at the close of the calendar year.

Because of the demand of the Furnace Department for more power and better regulation, we have changed this circuit to operate at 11,000 volts instead of 6,600 volts as in the past. This is ready to cut over and only awaits the convenience of the Furnace Department. This change necessitated some equipment at the L. S. & I. RR. and some changes in their service. We carried this in our accounts because it is in no way considered as a betterment for the Railroad Department. They agreed to pay half the cost of necessary new motors on the basis of replacing practically obsolete equipment.

A considerable amount of consulting work has been done with the Furnace Department, the Piqua Handle & Mfg. Co. and particularly with the Coal Department at Green Bay. The Coal Dock was changed from the obsolete 25 cycle operation to 60 cycle service. This work is now completed and is apparently satisfactory and we think is a good job everything considered. The only charge that has been made for these services are the expenses in connection with the work, with no charge for engineering.

The service and revenue of The Cliffs Electric Co. has continued stable with practically no loss. We find collections better than anticipated and very few disconnects for non-payment.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

Summary of Operating Conditions - 1932.

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Precipitation	2.34	1.66	1.45	2.13	3.39	1.65	4.81	4.81	1.87	2.92	2.11	2.06	
Total Precipitation at Ishpeming during 1932	- 31.20"												
Average	"	"	Marquette										- 32.8" (46 year record)

CARP RIVER PLANT:

Drainage area above Intake Dam,	66.66 sq. miles
Cubic feet Precipitation in 1932,	4,831,772,700
Kilowatt Hours generated in 1932,	9,664,700
Cubic feet water utilized (90 cu. ft. = 1 KWH.)	869,823,000
" " " in Carp Storage Basin Jan. 1, 1932	416,495,300
" " " " " " " Dec. 31, "	266,608,300
" " " used from Storage	149,887,000
" " " wasted over Intake Dam in 1932,	1,655,592,000
Total run-off for the year 1932,	2,375,528,000 cu. ft.
Run-off per square mile of drainage area,	35,636,480 " "

	<u>1913</u>	<u>1914</u>	<u>1915</u>	<u>1916</u>	<u>1917</u>	<u>1918</u>	<u>1919</u>	<u>1920</u>	<u>1921</u>	<u>1922</u>
Total Precipitation,	30.11	26.53	38.40	36.83	25.46	31.05	29.50	27.40	30.38	33.67
Sec.ft.per sq.mi. run-off,	1.03	.67	.93	1.29	.70	.79	.83	.73	.68	1.06
	<u>1923</u>	<u>1924</u>	<u>1925</u>	<u>1926</u>	<u>1927</u>	<u>1928</u>	<u>1929</u>	<u>1930</u>	<u>1931</u>	<u>1932</u>
Total Precipitation,	21.90	22.95	20.71	35.69	29.86	36.06	32.28	23.14	36.70	31.20
Sec.ft.per sq.mi. run-off,	.59	.50	.25	.85	.98	1.11	.67	1.10	.83	1.13

McCLURE PLANT:

Drainage area above Intake Dam,	140.52 sq. miles
Cu. ft. Precipitation in 1932, (Hoist Plant - 32.54")	10,616,351,200
Kilowatt Hours generated at McClure Plant in 1932,	17,404,200
Cubic feet water utilized, (125 cu. ft. = 1 KWH.)	2,175,525,000
" " " wasted over Intake Dam in 1932,	3,574,368,000
" " " in Hoist Storage Basin Jan. 1, 1932,	1,901,359,200
" " " " " " " Dec.31, "	1,711,294,700
" " " used from " " in 1932,	190,064,500
" " " in Silver Lake on Jan. 1, 1932,	746,194,000
" " " " " " " Dec. 31, "	666,284,000
" " " used from Silver Lake in 1932,	79,910,000
Total run-off for the year 1932,	5,479,918,500
Run-off per square mile of drainage area,	38,997,400

	<u>1920</u>	<u>1921</u>	<u>1922</u>	<u>1923</u>	<u>1924</u>	<u>1925</u>	<u>1926</u>	<u>1927</u>	<u>1928</u>	<u>1929</u>	<u>1930</u>	<u>1931</u>
Sec. ft. per 1.22 sq. mi. run-off	1.02	1.54	0.85	0.92	0.52	1.52	1.80	2.22	1.36	1.45	1.10	

1932  
Sec. ft. per 1.23 sq.mi. run-off

1.29

THE CLIFFS POWER & LIGHT CO.

SUMMARY OF OPERATIONS - 1932..

	<u>KILOWATT HOURS GENERATED &amp; PURCHASED</u>							<u>Used by Auxilia- ries</u>	<u>Delivered to Line</u>	<u>KWH. Sold</u>	<u>Transmission Losses</u>		
	<u>McClure</u>	<u>Carp</u>	<u>Hoist</u>	<u>An Train</u>	<u>Republic</u>	<u>Esconaba</u>	<u>Purchased</u>				<u>TOTAL</u>	<u>K.W.H.</u>	<u>%</u>
Jan.	1,430,600	652,200	459,000	62,540	205,000	256,000	476,000	3,541,340	11,763	3,529,577	2,940,492	589,085	16.68
Feb.	1 463 400	776 200	444 000	63 610	176 700	251 000	432 000	3 606 910	11 978	3 594 932	3 017 117	577 815	16.07
March	1 708 500	731 400	469 000	67 290	166 400	252 000	0	3 394 590	11 380	3 383 210	2 785 143	598 067	17.67
April	1 576 900	703 800	438 000	59 040	183 800	234 000	0	3 195 540	10 886	3 184 654	2 627 091	557 563	17.50
May	1 694 300	869 900	219 000	56 290	111 700	242 000	0	3 193 190	8 955	3 184 235	2 612 711	571 524	17.94
June	1 885 100	688 400	0	45 880	100 100	226 000	0	2 945 480	8 397	2 937 083	2 412 240	524 843	17.86
July	1 219 300	713 300	156 000	35 820	98 600	204 000	545 000	2 972 020	9 831	2 962 189	2 440 265	521 924	17.61
Aug.	41 600	1 221 600	881 000	102 410	95 300	279 000	166 000	2 786 910	11 613	2 775 297	2 301 856	473 441	17.05
Sept.	1 439 900	462 200	659 000	116 750	107 000	233 000	0	3 017 850	9 464	3 008 386	2 498 358	510 028	16.95
Oct.	1 519 900	655 900	698 000	139 250	81 900	201 000	0	3 295 950	13 092	3 282 858	2 698 626	584 232	17.79
Nov.	1 709 900	1 378 000	420 000	148 740	94 800	241 000	0	3 992 440	10 194	3 982 246	3 410 299	571 947	14.36
Dec.	1 714 800	811 800	330 000	127 280	94 100	250 000	0	3 327 980	8 923	3 319 057	2 823 502	495 555	14.93
<b>TOTAL</b>	<b>17,404,200</b>	<b>9,664,700</b>	<b>5,173,000</b>	<b>1,024,900</b>	<b>1,515,400</b>	<b>2,869,000</b>	<b>1,619,000</b>	<b>39,270,200</b>	<b>126,476</b>	<b>39,143,724</b>	<b>32,567,700</b>	<b>6,576,024</b>	<b>16.79</b>

Hoist Plant shut down May 9th to July 13th - working on tail race.

McClure " " " July 18th " Aug. 22nd - " " " " , transformers and generators.

Carp " " " Sept. 6th " Sep. 17th - re-building about 900 ft. of wood stave pipe.

Agreement made with Manising Paper Co. not to take any current after Aug. 1st in order to secure reduction of minimum charge.

*Handwritten initials/signature*

*Handwritten mark*

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

The following alternating current motors are installed and operating as needed:

	INSTALLED TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932	CONNECTED JAN. 1, 1933 TOTALS
<b>ANGELINE MINE:</b>				
Hoist	<u>250</u>			250 HP.
<b>CLIFFS SHAFT MINE:</b>				
Shop	25			
No. 8 Crusher	125			
Screens	15			
Top Tram	100			
Hoist for "A" Shaft	750			
Underground Plunger Pump #1	180			
"    Centrifugal Pump	250			
Allis-Chalmers Compressor	175			
Hoist for "B" Shaft	750			
Underground Plunger Pump #2	200			
Laboratory Crusher	5			
Coal Crushing Plant Exhaust Fan	1/2			
Cooling Water Pump for Compressors	10			
Ingersoll-Rand Compressor #1	400			
"    "    "    "    #2	400			
Lower Tram #2	50			
Heating Plant Condensing Water Pump	2			
Underground Haulage Set #2	215			
Small Hoist in Crusher Building	15			
Jaw Crusher - New Crushing Plant	75			
Magnetic Separator - "    "	1 1/2			
Underground Scrapers - 50 - 25 HP. motors	1,250			
Lower Tram #3	30			
Battery Charging Set, 2nd level "A" Shaft	7 1/2			
Grinder in Drill Sharpening Shop	7 1/2			
Rotary Screen	10			
Boiler Feed Pump at Central Office	3/4			
Undg. Haulage Set #1 (from Gen. Storehouse)	150			
Carpenter Shop	25			
Return Water Pump at Central Office	<u>1</u>			5,225 3/4
<b>BROWNSTONE SUBSTATION:</b>				
Test Set	1/2			
Oil Filter Press	1/4			
Battery Charging Motor-Generator Set	3			
Commutator Grinder	1			
Synchronous Condenser	80			
M.G. Set on Voltage Regulator Control	1/4			
Large Oil Filter Press	2			
Drill	<u>1</u>			88
	<hr/>	<hr/>	<hr/>	<hr/>
fwd.	5,563 3/4 HP.	0	0	5,563 3/4 HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	INSTALLED			CONNECTED
	TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932	JAN. 1, 1933 TOTALS
brt. fwd.	5,563 $\frac{3}{4}$ HP.	0	0	5,563 $\frac{3}{4}$ HP.
<b>HARD ORE SHOPS:</b>				
Machine Shop	10			
Carpenter Shop	25			
Blacksmith Shop Punch	3			
Armature Banding Machine	2			
" " "	1/2			
" " "	1/8			
Lathe Grinder	1			
Portable Drill - small (Stanley)	1/4			
" " - large	1/4			
Commutator Slotter	1/8			
Air Compressor	10 $\frac{1}{2}$			
Water Supply Pump	7 $\frac{1}{2}$			
Blacksmith Shop Blower	1/4			
Hacksaw	1/2			
Small Grinder	1/4			
Portable Drill (Stanley)	1			
Carpenter Shop Saw	25			
				87 $\frac{1}{4}$
<b>ISHPEMING HOSPITAL:</b>				
Passenger Elevator	7 $\frac{1}{2}$			
Dumb Waiter	3			
Large Washer	2			
Small Washer	1			
Extractor	2			
Vacuum Cleaner	3			
Water Supply Pump	1			
Kray Machine	1/4			
Hot Water Circulating Pump	1/2			
" " Return - high pressure	5			
" " " - low "	1 $\frac{1}{2}$			
Vacuum Pump	3			
				29 $\frac{3}{4}$
fwd.	5,680 $\frac{3}{4}$ HP.	0	0	5,680 $\frac{3}{4}$ HP.



MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	brt. fwd.	INSTALLED TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932	CONNECTED JAN. 1, 1933 TOTALS
		5,680 $\frac{3}{4}$ HP.	0	0	5,680 $\frac{3}{4}$ HP.
<b>TILDEN MINE:</b>					
Compressor		150			
Centrifugal Pump		275			
Scraper on Coal Dock		15			
#29 Shovel - Motor-Generator Set		110			
"    - Air Compressor		4 $\frac{1}{2}$			
"    - Oil Pump		1/4			
"    - Trip Motor		2			
"    - Exciter Motor		10			
Cyclone Drill		10			
"    Drills - 4 - 15 HP.		60			
Car Dumper		30			
Large Crusher		250			
Car Puller		10			
Sample Crusher		3			
Belt Conveyor		50			
Secondary Crushers - 2 - 100 HP.		200			
Small Hoist over Crusher		3			
#31 Shovel - Motor-Generator Set		110			
"    - Exciter Motor		7 $\frac{1}{2}$			
"    - Trip		1 $\frac{1}{2}$			
"    - Air Compressor		5 $\frac{3}{4}$			
Drill Sharpener		15			
Pump for Drills		15			
Synchronous Condenser from P.C.P. Plant		625			
Shop Motor		5			
"    "    #2		3			
Scraper		50			
Armstrong Drill		15			
Blower Fan		1/2			
					2,035 $\frac{3}{4}$
<b>ATHENS MINE:</b>					
Cage Hoist		400			
Compressor - Nordberg		325			
Compressor Cooling Water Pump		3			
Auxiliary Compressor for Hoist Brakes		5			
Underground Ventilating Fan #1		15			
Sinking Pump - 2400' station		50			
Skip Hoist Set		850			
"    "    "    Oil Pump		1			
Shop		10			
Underground Haulage Converter		150			
Skip Pit Pump		2			
Laboratory Crusher		5			
Underground Plunger Pumps - 2 - 400 HP.		800			
Ore Tram 2 - 50 HP.		100			
Carpenter Shop		20			
Ore Crusher		25			
Battery Charging Motor-Generator Set		1/4			
Underground Ventilating Fan #2		50			
Ingersoll-Rand Compressor		450			
Rock Tram		50			
Underground Haulage Converter #2		150			
Nordberg Compressor Oil Pump		1/4			
					3,451 $\frac{1}{2}$
	fwd.	11,178 HP.	0	0	11,178 HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

		INSTALLED TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932	CONNECTED JAN. 1, 1933 TOTALS
brt. fwd.		11,178 HP.	0	0	11,178 HP.
<b>MAAS MINE:</b>					
	(Circulating Pump	40			
Turbine Auxiliaries	(Injection " "	25			
	(Exciter	33			
Underground Haulage Set		215			
Shop		10			
Underground Centrifugal Pump		350			
"	Plunger Pump #1	325			
Compressor Cooling Water Pump		5			
Ore Tram	2 - 50 HP. motors	100			
Coal Crushing Plant		15			
Underground Plunger Pump #2		250			
Ingersoll-Rand Compressors -	2 - 400 HP.	800			
Skip Hoist		700			
Cage "		400			
Boiler Room Fan		1/2			
Skip Hoist Rheostat Pump		3			
Carpenter Shop Saw		15			
Auxiliary Compressor for Hoist Brakes		7 1/2			
4th Level Pump		50			
Cooling Water Pump		5			
Triplex Pump, 4th Level		50			
Centrifugal Pump, 4th Level		40			
Saw Gunning Outfit in Carpenter Shop		2			
Underground Haulage Set #2 (from Neg. Mine)		215			
Return Water Pump in Heating Plant		2			
Aldrich Pump, 4th Level (from Boeing Mine)		100			
Centrifugal Pump, 3rd Level (from Francis Mine)		400			
" " " " - primer		50			
					4,208
<b>NEGAUNEE MINE:</b>					
Underground Haulage Set #1		300			
"Ilgner" Hoist Set		450			
Ore Tram	2 - 50 HP.	100			
Laboratory Crusher		5			
Auxiliary Compressor for Hoist Brakes		3			
Udg. Plunger Pumps -	3 - 300 H.P.	600			
" Centrifugal Pump		350			
" Suction Pumps	2 - 15 HP.	30			
Compressor Cooling Water Pump		3			
Nordberg Air Compressor		325			
Shop		15			
Ore Crusher		25			
Ingersoll-Rand Compressor		400			
13th Level Plunger Pump		15			
11th " " Pumps	2 - 75 HP.	150			
Exciters for 10th level Pump Motors (2)		40			
Signal System Motor-Generator Set		1/2			
Timber Hoist - #2 Shaft		25			
Ventilating Fan - " "		150			
Gravel Hoist		15			
Saw in Carpenter Shop		15			
Skip Pit Pump		3			
Underground Haulage Set #2		220			
fwd.		15,386 HP.	0	0	15,386 HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	brt. fwd.	INSTALLED TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932		CONNECTED JAN. 1, 1933 TOTALS
		15,386 HP.	0	0		15,386 HP.
<b>NEGAUNEE MINE:</b>	brt. fwd.	3,239½				
New Flywheel Set for Hoists		800				
Oil Pump on #2 Flywheel Set		1				
" " " " " "		1				
" " " Nordberg Compressor		1				
Hot Well Pump		<u>2</u>				
						4,044½
<b>MAAS CRUSHING PLANT:</b>						
Jaw Crusher		100				
Belt Conveyor		50				
Fan Conveyor Motor-Generator Set		<u>50</u>				
						200
<b>SOUTH JACKSON CRUSHING PLANT:</b>						
Hoist		75				
Crusher		<u>150</u>				
						225
<b>BARNES-HECKER MINE:</b>						
Skip Hoist		<u>400</u>				
						400
<b>LLOYD MINE:</b>						
Skip Hoist		400				
Cage "		400				
Top Tram		40				
Ore Crusher		25				
Water Supply Pump installed underground		50				
Concrete Mixer		5				
Top Tram		<u>50</u>				
						970
<b>MORRIS MINE:</b>						
Skip Hoist		600			600	
Cage "		400			400	
Shop		25			25	
Ingersoll-Rand Compressor #1		250			250	
4th Level Plunger Pumps - 2 - 350 HP.		700			700	
7th " " Pump		100			100	
" " Centrifugal Pump		175			175	
Laboratory Crusher		5			5	
Carpenter Shop		25			25	
Nordberg Air Compressor		325			325	
Carpenter Shop Boring Machine		5			5	
Ore Tram 2 - 50 HP.		100			100	
Underground Haulage Set #1		150			150	
Centrifugal Water Supply Pump		50			50	
Heating Plant Condensing Water Pump		2			2	
Ingersoll-Rand Compressor #2		500				
Planer in Carpenter Shop		15			15	
Crusher		25			25	
Underground Haulage Set #2		215				
Aldrich Triplex Pump		50			50	
8th level Pump		100			100	
Compressor Cooling Water Pump		3			3	
Fan at Morris Shaft			<u>40</u>		40	
						715
	fwd.	<u>25,045½ HP.</u>	40	<u>3,145</u>		<u>21,940½ HP.</u>

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	brt. fwd.	INSTALLED TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932		CONNECTED JAN. 1, 1933 TOTALS
		25,045½ HP.	40	3,145		21,940½ HP.
<b>SECTION 6 SHAFT:</b>						
Hoist		<u>200</u>				200
<b>GWINN CRUSHING PLANT:</b>						
Crusher		85				
Fan Conveyor		50				
Belt Conveyor		40				
Compressor		15				
" Cooling Water Pump		<u>3</u>				193
<b>FRANCIS MINE STOCKPILE:</b>						
Triplex Pump		<u>7½</u>				7½
<b>GARDNER MINE:</b>						
Hoist		400				
Top Tram		50				
Laboratory Crusher		<u>3</u>				453
<b>MACKINAW MINE:</b>						
Hoist		400				
Shop		7½				
Ore Tram		50				
Underground Haulage Set		150				
Air Compressor		325				
Compressor Cooling Water Pump		7½				
Underground Quintuplex Pump		350				
" Triplex "		75				
5th level Pump (Automatic) from Stephenson		30				
Winze Hoist " Morris		200				
Centrifugal Pump				400		
" " "				20		
Underground Hoist				<u>50</u>		2,065
<b>PRINCETON MINE #2:</b>						
Hoist		200				
Top Tram		50				
Stockpile Loader		<u>25</u>				275
<b>PRINCETON MINE #3:</b>						
Hoist		<u>75</u>				75
<b>STEPHENSON MINE:</b>						
Skip Hoist (Stored in Central Shops)		400		<u>400</u>		0
<b>PRINCETON CENTRAL POWER PLANT:</b>						
(Circulating Pump)		50				
Turbine Auxiliaries (Injection " (Exciter)		40				
" " " "		33				
Boiler Room Fan		50				
Coal Handling Machinery		10				
" " " "		<u>5</u>				188
<b>PRINCETON CENTRAL SHOPS:</b>						
Shop Motor		<u>25</u>				25
fwd.		<u>28,457 HP.</u>	<u>510</u>	<u>3,545</u>		<u>25,422 HP.</u>

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	brt. fwd.	INSTALLED		TAKEN OUT IN 1932	CONNECTED
		TO JAN. 1, 1932	IN 1932		JAN. 1, 1933 TOTALS
<b>PRINCETON CENTRAL PUMP STATION:</b>					
Centrifugal Pump		100			
Automatic Pump		<u>30</u>			130
<b>REPUBLIC MINE:</b>					
Aux. Compressor for Hoist Brakes (to Spies)		5		5	
#9 Shaft Hoist Motors	2 - 500 HP.	1,000			
" " Ore Tram	2 - 50 HP.	<u>100</u>			1,100
<b>CARP PLANT:</b>					
Auxiliaries	2 - 15 HP. pump motors	30			
Water Supply Pump		1			
Air Compressor		<u>5</u>			36
<b>HOIST PLANT:</b>					
Exciter Motor-Generator Set		20			
Oil Pump		3			
Air Compressor		5			
Small Supply Hoist Motor		<u>3</u>			31
<b>McCLURE PLANT:</b>					
Water Supply Pump		2			
Exciter Motor-Generator Set		17½			
Air Compressor		<u>5</u>			24½
<b>ESCANABA PLANT:</b>					
Air Compressor		5			
Oil Pump		5			
Valve Operating Motor		<u>1</u>			11
<b>TOTAL MINING DEPARTMENT</b>					
and					
<b>CLIFFS POWER &amp; LIGHT CO.</b>		29,794½ HP.	510	3,550	26,754½ HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	INSTALLED			CONNECTED
	TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932	JAN. 1, 1933 TOTALS
TOTAL MINING DEPARTMENT and CLIFFS POWER & LIGHT CO.				
PIONEER FURNACE: Furnace & Sawmill	29,794½ HP.	510	3,550	26,754½ HP.
L. S. & I. RR. CO. Shops, Sawmill, Ore Dock & Pumps	<u>1,195</u>			1,195
LAND DEPARTMENT: Grand Island 3 motors	<u>800</u>			800
LUMBERING DEPARTMENT: (Dixon) Location Water Supply Pump	<u>15½</u>			15½
Tie Mill Saw	5			
" " Conveyors	75			
" " Shop	<u>37</u>			
				127
MICHIGAN GAS & ELECTRIC CO. Ishpeming	2,170			
Munising	250			
Munising City Pumping	<u>125</u>			2,545
REPUBLIC TOWNSHIP: Water Supply Pump	<u>25</u>			25
OLIVER IRON MINING COMPANY: Pumps at Angeline & Sec. 16 Mines	525			
Holmes Mine	<u>2,552½</u>			3,077½
CITY OF ISHPERING: Booster Pump at Brownstone	<u>15</u>			15
CITY OF NEGAUNEE: <u>435</u>				435
THE CLIFFS ELECTRIC CO. <u>100</u> Est.				100
PALMER MINING COMPANY: Volunteer Mine, Palmer	<u>800</u>			800
MUNISING WOODENWARE CO. <u>695</u>				695
FORD MOTOR COMPANY: Blueberry Mine	<u>1,165</u>			1,165
INLAND STEEL CO. Greenwood Mine	450			
Morris "	<u>3,145</u>			3,595
INLAND LIME & STONE CO. Quarry & Dock	<u>4,000</u>			4,000
<u>TOTAL OUTSIDE LOAD</u>	<u>18,590</u> HP.	<u>0</u>	<u>0</u>	<u>18,590</u> HP.
<u>GRAND TOTAL CONNECTED LOAD</u>	<u>48,384½</u> HP.	<u>510</u>	<u>3,550</u>	<u>45,344½</u> HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

The following motors are not connected to our Power System:

	INSTALLED			CONNECTED
	TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932	JAN. 1, 1933 TOTALS
<u>MESABA RANGE:</u>				
<u>CANISTEO MINE:</u>				
Centrifugal Pump		600 HP.		
Priming Pump		3		
Shop		10		
Washing Plant Compressor	5	50		
Belt Conveyors	4 - 12 HP. motors	20		
Jaw Crusher		100		
Centrifugal Pumps	2 125 " "	250		
Symons Crushers	2 100 " "	200		
Belt Conveyor		75		
Dorr Washers	2 - 75 " "	150		
" "	2 - 30 " "	60		
Armstrong Drills	2 - 15 " "	30		
Centrifugal Pumps	2 - 25 " "	50		
Portable Drill		1/2		
Hacksaw		1/2		
Wood Planer		3		
Band Saw		5		
Circular Saw		5		
Shaper		3		
Dorr Classifiers	D.C.	10		10
Clear Water Pumps	2 - 3 " "	6		
Motor-Generator Set on Shovel		250		
Exciter Set	" "	20		
Dipper Trip	" "	2		
Fan		3		
Heater Motors	6 - 1/2 " "	3		
" "	8 - 1/8 " "	1		
Bolt & Pipe Machine		5		
Machine Shop Planer		10		
Boring Machine		15		
Pressure Pump in Boiler House		30		
Shop Air Compressor		50		
Portable Grinder		1		
Bench Grinders	2 - 1 " "	2		
Washing Plant Feed Water Pump (to Wade)		100		100
Blacksmith Shop Forge		1/4		
Electric Welder		15		
Punch & Shear Machine			5	
Small Pump			3	
Portable Saw			7 1/2	
Priming Pump			2	
Blacksmith Shop			10	
Roll Motor in Laboratory			5	
Pulverizer " "			1	
Fan " "			1/8	
Laboratory Heater (from Holman-Cliffs)			1/8	
	fwd.	2,138 1/4 HP.	33 3/4	110
				2,062 HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	brt.	fwd.	INSTALLED			CONNECTED
			TO JAN. 1, 1932	INSTALLED IN 1932	TAKEN OUT IN 1932	JAN. 1, 1933
			2,138 $\frac{1}{4}$ HP.	33 $\frac{3}{4}$	110	TOTALS 2,062 HP.
<b>HOLMAN-CLIFFS MINE:</b>						
Layne & Bowler Pump			350			
Bench Grinder				1/4		
Portable Drill				1/4		
Belt Conveyor			75			
Symons Crushers	2 -	100 HP, motors	200			
Jaw Crusher			100			
Dorr Classifiers	2 -	10 " "	20			
Air Compressor			50			
Screen			25			
Centrifugal Pumps	2 -	125 " "	250			
Picking Belts	2 -	5 " "	10			
Centrifugal Pump			85			
Machine Shop			30			
Priming Pump (Tox Canisteo)			2		2	
Exhaust Fan				1/2		
Centrifugal Pump			275			
Blacksmith Forge Fan				1/2		
Motor-Generator Set			225			
Blacksmith Shop (To Canisteo)			10		10	
Underground Haulage Set			150			
Locomotive Water Tank Pump			20			
Clear Water Pump, Washing Plant			3			
Armstrong Drills	2 -	15 HP. motors	30			
Hummer Screen			5			
Bench Grinder				1/4		
Portable Grinder			1			
Shop Heaters	2 -	1/2 " "	1			
" "	10 -	1/8 " "	1 $\frac{1}{2}$			
Roll Motor in Main Laboratory			3			
Pulverizer " " "			1			
Fan " " "				1/8		
Ro-Tap " " "				1/2		
Air Compressor " "			1 $\frac{1}{2}$			
Roll Motor in Washing Plant Lab. (to Canisteo)			5		5	
Pulverizer " " " " " "			1		1	
Fan " " "				1/8		1/8
Motor-Generator Sets on Shovel	2 -	250 HP.	500	(1 sold to	250	
Exciter Set	" "	2 - 20 "	40	U.V. Copper	20	
Dipper Trip	" "	2 - 2 "	4	Co.)	2	
Fans	" "	2 3 "	6		3	
Laboratory Heater (to Canisteo)				1/8		1/8
Portable Drill - should be		1/8		1/4		1/8
Flotation Machine	8 -	1/4 "	2			
Hydrotator			15			
"			20			
Centrifugal Pump at Pit			125			
Sump Pump			5			
Sample Crusher				10		
	fwd.		4,787 HP.	43 $\frac{3}{4}$	403 $\frac{1}{4}$	2,365 $\frac{1}{2}$ 4,427 $\frac{1}{2}$ HP.



MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

	brt. fwd.	INSTALLED		TAKEN OUT IN 1932	CONNECTED
		TO JAN. 1 1932	IN 1932		JAN. 1, 1933 TOTALS
HILL-TRUMBULL MINE:		4,787 HP.	43 $\frac{3}{4}$	403 $\frac{1}{4}$	4,427 $\frac{1}{2}$ HP.
Log Washer		50			
" "		40			
Belt Conveyors	4 - 5 HP. motors	20			
Crusher		100			
Sample Crusher (to Holman)		10		10	
Prescott Plunger Pump		125			
Centrifugal Pump		150			
Tables		20			
Shops		30			
Punch & Shear Machine in Shop		5			
Band Saw in Carpenter Shop		5			
Compressor in Shop		50			
Screen		20			
Conveyor		100			
Planer in Shop		2			
Variety Saw in Shop		5			
Electric Drill		1/4			
Motor-Generator Set		65			
Blacksmith Shop Fan		1/4			
Drill		1/4			
Washing Plant Laboratory Rolls		3			
Picking Belt		5			
Car Puller		7 $\frac{1}{2}$			
Portable Grinder		1			
North Pit Pump		30			
Air Compressor at Washing Plant		25			
Churn Drill		10			
Boiler Feed Pump		5			
Chip Screens	2 - 2 HP. motors	4			
Layne & Bowler Pump		125			
Tool Post Grinder		1/4			
Electric Welder		15			
Armstrong Drill		15			
Rack Drives on Classifiers	2 - 10 HP. motors	20			
Hummer Screen		2			
Pulverizer in Laboratory		1			
Fan " "		1/8			
Symons Crushers	2 - 100 HP. motors	200			
Bench Grinder		1/2			
Motor-Generator Set on Shovel		250			
Exciter " "		20			
Dipper Trip " "		2			
Fan		3			
Fan for Blacksmith Shop		5			
Clear Water Pump		3			
Flue Machine		5			
					1,545
	fwd.	6,342 HP.	43 $\frac{3}{4}$	413 $\frac{1}{4}$	5,972 $\frac{1}{2}$ HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1932

Electrical Department: (Cont'd)

		INSTALLED TO JAN. 1, <u>1932</u>	INSTALLED <u>IN 1932</u>	TAKEN OUT <u>IN 1932</u>	CONNECTED JAN. 1, 1933 <u>TOTALS</u>
	brt. fwd.	6,542 HP.	43 $\frac{3}{4}$	413 $\frac{1}{4}$	5,972 $\frac{1}{2}$ HP.
<b>BOEING MINE:</b>					
Air Compressor		225			
Blacksmith Shop Fan		<u>1/4</u>		1/4	225
<b>CROSBY MINE:</b>					
Log Washer	(to Hill-Trumbull shops)	40		40	
Screen	" " "	20		20	
Picking Belt	" " "	3		3	
Chip Screen	" " "	3		3	
Tables	" " "	20		20	
Stockpile	(to Canisteo)	7 $\frac{1}{2}$		7 $\frac{1}{2}$	
Centrifugal Pump	(to Hill-Trumbull shops)	85		85	
#2 Turbo	" " "	20		20	
Feeder	" " "	20		<u>20</u>	0
<b>WADE MINE:</b>					
Hoist		125			
Air Compressor		150			
Compressor Cooling Water Pump		2			
Underground Haulage Set		150			
Machine Shop	(to General Storehouse)	10		10	
Underground Triplex Pump		50			
Top Tram		50			
Clear Water Pump		15			
Blacksmith Shop Fan		3			
Sump Pump		7 $\frac{1}{2}$			
Sinking Hoist		35			
Underground Centrifugal Pump		125			
" Fan		<u>15</u>			727 $\frac{1}{2}$
<b><u>TOTAL MESABA RANGE MINES</u></b>		7,523 $\frac{1}{4}$ HP.	43 $\frac{3}{4}$	642	6,925 HP.

SPIES-VIRGIL MINE:

Underground Triplex Pump		50			
Crusher		50			
Air Compressor		403			
Compressor Cooling Water Pump		3			
Hoist		400			
Boiler Feed Pump		2			
Circular Saw in Carpenter Shop		25			
Shop		5			
Compressor Cooling Water Pump		3			
8th level Prescott Plunger Pumps	2 - 150 HP.	300			
Underground Haulage Converter		150			
Sump Pump		2			
Auxiliary Air Compressor for Hoist Brakes			<u>5</u>		
			<u>5</u>	<u>TOTAL</u>	1,398 HP.

Electrical Department: (Cont'd)

The following A.C. motors are on hand, (Dec. 31, 1932) but are not installed:

**CLIFFS SHAFT MINE:**

Top Tram (stator only)	50	HP.
Spare Top Tram	50	
Small Conveyor Motor	2	
Scraper Motors 8 - 25 HP.	200	
Crusher	25	
Battery Charger from Republic	30	
		357 HP.

**GENERAL STOREHOUSE & BARN:**

Spare from Republic concrete mixer	5	
" General Electric pump	50	
" " " Motor-Generator Set (Morris-Lloyd)	150	
" from Hard Ore #3 plunger pump	35	
Bag Cleaner from D.R. Storage Dam	1/2	
Spare for Centrifugal Pump used at North Lake	200	
" Motor	40	
Portable Hoist from Republic Mine	7½	
Pump Motor " " "	10	
2 - 500 HP. Hoist Motors from Cliffs Shaft Mine	1,000	
Hoist Stator only " " " "	500	
Feeder Belt " " " "	5	
Conveyor Belt " " " " 2 motors	40	
Motor-Generator Set from Tilden Mine	15	
South Jackson Compressor	100	
Pump from Au Train	125	
Concrete Mixer from Au Train	7½	
Picking Belt	5	
Leach Concrete Mixer	10	
Air Compressor from Republic Mine	200	
Pump from 11th level " "	7½	
Carpenter Shop from " "	20	
Undg. Hoist " " "	50	
" " " Maas "	50	
Air Compressor " Crosby "	50	
Concrete Hoist " Au Train Dam	50	
Centrifugal Pump " " " "	20	
" " " "	2	
" " " Republic Mine	20	
Cyclone Drill " Tilden "	10	
Pump " Au Train Dam	100	
" " Republic Mine	50	
" " " "	7½	
Spare " " "	30	
Screen #9 Shaft " " "	25	
Crusher " " "	100	
Coal Tram " " "	7½	
Pump from bottom level #9 Shaft - Republic Mine	20	
" " 3rd level " "	50	
Screen from Crusher " "	10	
Underground Hoist " "	100	
Pump " "	35	
Top Tram Motor from Athens Mine	50	
		3,570

**LAKE MINE CHANGE HOUSE:**

Ventilating Fan from Salisbury Mine	7½	
	7½	
		3,734½ HP.

fwd.