

HILL-TRUMBULL MINE  
ANNUAL REPORT  
YEAR 1926.

18. NATIONALITY  
OF  
EMPLOYEES:

<u>NATIONALITY:</u>	<u>NO. OF MEN</u>	
	<u>1926</u>	<u>1925</u>
Jugo-Slav.-----	15	14
Swede-----	13	18
English-----	12	12
Irish-----	7	7
Finish-----	5	8
German-----	4	6
Croatian-----	4	13
French-----	3	6
Dutch-----	3	1
Norwegian-----	3	-
Scotch-----	2	1
Italian-----	2	2
Polish-----	2	1
Bulgarian-----	1	1
Welch-----	1	1
TOTAL-----	77	91

19. WASHING PLANT  
OPERATIONS:

The concentrating plant was started on May 7th and operations were very satisfactory throughout the season. There was very little trouble with frost chunks during the forepart of the washing season, whereas in the past we have had considerable difficulty early in the year from this source.

Operations at the mill were quite slow at times, due to a very low grade of ore and preponderance of rock.

A new picking belt was put in service the latter part of the season. We had hoped to get through with the old belt, but it broke several times and it was deemed inadvisable to run it any longer.

Very little trouble was occasioned by the dyke during 1926 and most of the time one man patrolling the dyke was ample to take care of any leaks. The tailings were carried to the extreme north end of the basin by means of a pipe line and only the first section of the basin was utilized. It was not necessary to do any work on the dyke last fall, but we contemplate putting the dragline out there in the spring and build up the dyke where necessary for the accommodation of tailings during 1927.

In 1926, 577,827 tons of wash ore were treated and in 1925, 648,270 tons were put through the mill. The production of concentrates in 1926 amounted to 378,405 Tons, which compares with 406,094 tons for the previous year.

The gross tonnage recovery for 1926 amounted to 65.49% as against 62.64% for 1925. The fact that the character of the wash ore treated was about the same during the two years, the 1926 results were gratifying.

The iron unit recovery in 1926 was 89.14% and compares with 88.23% in 1925. In view of the fact that a considerable quantity of very lean ore was treated during 1926, the iron unit recovery obtained was quite satisfactory.

HILL-TRUMBULL MINE  
ANNUAL REPORT  
YEAR 1926.

19. WASHING PLANT  
OPERATIONS:  
(Continued)

The analysis of the product from the several machines for the years 1926 and 1925 was as follows:

	-----1926-----			-----1925-----		
	Iron	Phos	Sil.	Iron	Phos	Sil.
Screen-----	58.09	.082	9.54	57.92	.053	8.80
Logs-----	59.73	.070	7.53	58.41	.053	8.35
Turbos-----	54.68	.064	15.34	51.79	.046	18.54
Tailings---	19.59	-	--	11.36	-	--

While the average analysis of the crude ore treated in 1926 showed a higher iron content, the character of the material from the south part of the Trumbull pit was not alone low grade, but it was difficult to wash and the comparatively high iron content of the tailings (8.23% higher in 1926 than in 1925) was due to our inability to secure a desirable product from the area without considerable sorting and rejection of some partly decomposed taconite. The rejects from the ore treated from the south side of the Trumbull pit were considerably higher in iron than the tailings resulting from our washing operations in 1925.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926.

1. GENERAL:

The Boeing Mine was operated actively during the past year, underground work being carried on steadily and open pit ore loading was conducted from May 14th until November 11th. On account of the inability of some of our partners to take forward Boeing ore until the middle of June, the open pit work started rather late and operations were not pushed during the early part of the season. Pocket shipments were started on April 13th and were continued until November 6th.

The ice conditions at the head of the lakes were such that the ore season was later than usual in starting.

General labor conditions were satisfactory at the Boeing Mine during 1926 and there were no serious interruptions to mining operations due to accidents of any nature. On the whole, weather conditions were favorable for open pit work, there being only the usual expected delays occasioned by heavy rains washing surface material onto the approach tracks.

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:

a. Production by Grades:

Boeing Pocket Ore-----	218,678 Tons.
Boeing Open Pit Ore-----	294,938 Tons.
TOTAL BOEING ORE-----	513,616 Tons.

The underground product for 1926 was 11,265 tons more than for the previous year, due largely to the use of scrapers in the majority of the working places. The output from the open pit for 1926 was 3,878 tons in excess of that for 1925 and was due to the ore schedule being increased. The underground workings were operated to capacity and the balance of the requirements were obtained from the open pit. The Boeing Mine could have produced at least 50,000 tons additional open pit ore during the season, had the demand required it.

b. Shipments:

<u>Grade of Ore</u>	<u>Pocket</u> <u>Tons.</u>	<u>Stockpile</u> <u>Tons.</u>	<u>Open Pit</u> <u>Tons.</u>	<u>Total</u> <u>Tons.</u>
Boeing-----	131,270	95,710	294,938	521,918

There was an increase of 17,966 tons in the 1926 shipments over those for 1925. This was the result of increased sales made during the latter part of the 1926 season and raised the original schedule over that for the previous year.

c. Stockpile Inventories:

Boeing Underground Ore-----	23,311 Tons.
Boeing Lean Open Pit Ore-----	33,417 Tons.
TOTAL-----	56,728 Tons.

The Boeing lean ore pile was accumulated during open pit operations in 1922 and under the terms of a special agreement with the fee owners, we are obliged to ship, or pay royalty, on this ore during the life of the lease.

The Boeing ore stocked from underground operations on January 1st, 1927, is 8,302 tons less than it was on January 1st, 1926, due to a somewhat reduced production the latter part of 1926 and the fact that pocket shipments were carried on 10 days later in the fall of 1926.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926.

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:  
(Continued)

d. Division of Product by Levels:

The ore hoisted from the various levels was as follows:-

First Level-----	216,101 Tons.
Second Level-----	2,577 Tons.
Open Pit Ore-----	294,938 Tons. (Above First-Level Elevation).
TOTAL-----	513,616 Tons.

e. Production by Months:

<u>MONTH</u>	<u>UNDERGROUND</u>	<u>OPEN PIT</u>	<u>TOTAL</u>
January-----	16,547	----	16,547
February-----	17,210	----	17,210
March-----	18,396	----	18,396
April-----	17,470	----	17,470
May-----	18,200	21,822	40,022
June-----	19,278	51,267	70,545
July-----	20,961	45,853	66,814
August-----	21,918	47,934	69,852
September-----	18,188	52,214	70,402
October-----	17,941	49,135	67,076
November-----	13,769	26,713	40,482
December-----	12,929	----	12,929
Stockpile			
Overrun-----	5,871	----	5,871
TOTAL-----	218,678	294,938	513,616

The average monthly underground production during 1926 was 18,223 tons and compares with 17,284 tons for the previous year. The open pit output was regulated quite largely during 1926 by the requirements of the Shipping Department and the loading facilities offered by the Great Northern Railway as a result thereof. During 1925 the open pit operations were dependent to a greater extent on the loading conditions in the pit, which at times slowed down progress appreciably.

f. Ore Statement:

	<u>UNDERGROUND</u>	<u>OPEN PIT</u>	<u>OPEN PIT</u>	<u>TOTAL</u>	<u>TOTAL</u>
			<u>LEAN ORE</u>		<u>LAST YEAR</u>
On Hand Jan.1,1926-----	31,613	----	33,417	65,030	70,509
Output for Year-----	218,678	294,938	----	513,616	498,473
TOTAL-----	250,291	294,938	33,417	578,646	568,982
Shipments-----	226,980	294,938	----	521,918	503,952
Balance on Hand-----	23,311	----	33,417	56,728	65,030
Increase in Output-----				15,143	
Decrease in Ore on Hand--				8,302	

The underground operations were conducted on two 8-hour shifts during 1925 and 1926 and the open pit on one 10-hour shift during the shipping season of each year. There were five night shifts worked in the open pit during September, 1926.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:  
(Continued)

g. Delays:

Underground:

With the exception of the two shifts lost on January 15th and November 24th, the following underground delays did not affect the product to any material extent. The tramping and hoisting facilities are adequate to take care of a larger production than we are handling, and delays of an hour or less would not reduce the shaft's output.

January 15th,	10 hours,	Top tram cable broken.
February 22nd,	3 "	Broken axle on north skip.
May 1st.,	1½ "	Top tram car dumping mechanism out of order.
August 25th,	3 "	First level drift caved down, shutting off west deposit product.
October 30th,	4 "	A cave in the first level tramway cut off west deposit product.
November 19th,	2 "	Car off track at rotary dump.
November 22nd,	1 "	Car off track at rotary dump.
November 30th,	5 "	Air lines leading to east deposit broken.
December 14th,	4 "	Top tram transformer burned out.
November 24th,	8 "	Air lines leading to east deposit broken.
December 15th,	2 "	Ore frozen in top tram car.

Open Pit:

The most serious delays that occurred in the open pit operations during 1926 was the shortage of Great Northern railway cars, inadequate boat surface and clean-up operations caused by heavy rains washing surface material onto the ore and tracks. These delays occur each year and are more or less general in open pit operations on the Mesaba Range. There was one serious delay occasioned by a broken boom pinion on the 350-ton shovel. Following is a list of the open pit delays occurring during the shipping season of 1926:

May 31st,	1½ Hours,	Broken crank shaft on swinging engine.
July 2nd,	10 "	Cleaning sand from top of ore, washed by heavy rain.
July 9th,	2 "	Cleaning sand from top of ore, washed by heavy rain.
July 16th,	10 "	Casting ballast for tracks, softened by heavy rains.
July 17th,	10 "	Casting ballast for tracks, softened by heavy rains.
July 19th,	4 "	Casting ballast for tracks, softened by heavy rains.
September 7th,	1½ "	Heavy rain stopped work.
September 8th,	10 "	Pit flooded account heavy rains.
September 9th,	10 "	Cleaning mud out of deep shovel pit.
September 10th,	7 "	Cleaning mud out of deep shovel pit.
September 11th,	5 "	Cleaning mud out of deep shovel pit.
September 15th,	7½ "	Broken hoisting gear on shovel.
September 27th,	5 "	Broken shipper shaft pinion on shovel.
October 5th,	10 "	Shovel cut flooded account heavy rains.
October 6th,	10 "	Cleaning mud out of deep shovel pit.
October 7th,	8 "	Cleaning mud out of deep shovel pit.
November 2nd,	1 "	Broken shipper shaft pinion on shovel.
November 3rd.,	6 "	Broken shipper shaft pinion on shovel.
Total,	208¾	No Great Northern empties furnished.
Total,	80	Inadequate boat service, dock plugged.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:  
(Continued)

h. Delays from Lack of Current:

There were no serious electrical delays at the Boeing Mine during the year 1926, the few minor interruptions being listed below:

April 2nd,	1 Hour,	No power.
June 22nd,	1 $\frac{1}{2}$ "	No power.
September 3rd,	$\frac{1}{2}$ "	No power.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	Tons	Iron	Phos	Sil.	Mn.	Alu.	Mois.	Fe.Nat.
Underground--	218,678	55.61	.081	9.26	1.00	4.60	12.68	48.56
Open Pit-----	294,938	54.25	.084	13.84	.70	3.38	14.29	46.50
TOTAL 1926---	513,616	54.83	.083	11.89	.83	3.90	13.60	47.37
TOTAL 1925---	498,473	55.18	.077	10.69	.90	4.08	14.42	47.22

Average Mine Analysis of Shipments:

	Tons	Iron	Phos	Sil.	Mn.	Alu.	Mois.	Fe.Nat.
Underground--	131,270	55.56	.081	9.11	1.10	4.52	12.61	48.60
Stockpile----	95,710	55.55	.082	10.10	.97	4.09	12.78	48.45
Open Pit-----	294,938	54.25	.084	13.84	.70	3.38	14.29	46.50
TOTAL 1926---	521,918	54.82	.083	11.96	.85	3.80	13.59	47.37
TOTAL 1925---	503,952	55.16	.078	10.67	.89	4.02	14.41	47.21

b. Average Analysis on Straight Cargoes:

Mine Analysis:	Iron	Mois.	Fe.Nat.	Lower Lake:	Iron	Mois.	Fe.Nat.
Boeing-----	55.18	13.10	47.95	Boeing-----	55.62	12.98	48.40
Boeing Special--	55.48	13.66	47.90	Boeing Special--	55.62	13.36	48.19

The Boeing grade contained 29,426 tons of Hill Direct ore and the Boeing Special was made up of a mixture of Boeing, Wade and Helmer ores.

d. Composite Analysis by Lerch Bros. of the Season's Shipments:

Iron	Phos	Mn.	Sil.	Alu.	Lime	Mag.	Sul.	Loss
54.84	.083	.84	11.93	3.79	.29	.24	.012	4.12

e. Analysis of Ore in Stockpile January 1st., 1927:

	Tons	Iron	Phos	Sil.	Mn.	Alu.
Boeing Underground-----	23,311	55.07	.074	9.06	.75	6.28
Boeing Open Pit Lean Ore--	33,417	50.84	.101	17.74	--	5.91

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

4. ESTIMATE OF  
ORE RESERVES:

a. Ore Developed for Mining:

Assumption: 14 cu. ft. equals one ton.  
10% deduction for rock.  
10% deduction for loss in underground mining.  
Percentage of Bessemer equals 0.

Underground Ore:

Above First Level:

West Deposit-----	10,000 Tons.
East Deposit-----	100,000 Tons.
TOTAL UNDERGROUND ORE-----	110,000 Tons.
Open Pit Steam Shovel Ore-----	413,000 Tons.
TOTAL DEVELOPED ORE-----	523,000 Tons.

b. Ore Proven but not Developed for Mining:

Underground Ore:

Above First Level:

South Bank-----	252,000 Tons.
North Bank-----	63,000 Tons.

Between First & Second Levels:

West Channel-----	200,000 Tons.
Main Channel-----	286,500 Tons.
North Bank-----	64,000 Tons.
TOTAL UNDERGROUND ORE-----	865,500 Tons.
Milling Ore-----	169,000 Tons.
TOTAL UNDEVELOPED ORE-----	1,034,500 Tons.

GRAND TOTAL ALL ORE-----1,557,500 Tons.

The estimate of ore in sight January 1st., 1927, is as above noted, 1,557,500 tons, being made up of 975,500 tons of underground ore, 413,000 tons of open pit steam shovel ore and 169,000 tons of open pit milling ore. Considering the estimates of January 1st., 1926, and deducting the tonnage produced during 1926 shows that the estimate of January 1st. increases the underground ore by 375,178 tons, decreases the open pit steam shovel ore 131,562 tons and a decrease in the milling ore of 169,000 tons, or a net increase of all deposits of 74,616 tons. The decrease in the open pit steam shovel ore is due to two facts; first, the occurrence of a very low grade ore in the proximity of the rock, which we had previously considered of shipping grade, and; second, the location of the southerly extension of the west channel, which development work during the past season shows to occur under the stripping bank at the west end of the pit. From the drill records, we assumed that the southerly extension of the west channel was out under the open pit to a greater extent than has now been proven.

From second level development work, we find that the main ore channel below the first level lies somewhat further north and near the toe of the stripping than we had anticipated. This means that the deeper part of the milling ore along the north side of the channel will be very dangerous to mine by that method and in order to be conservative in our estimate, one-half of the milling ore, or 169,000 tons, is now considered as underground tram-to-shaft and the estimate of milling ore has been reduced by that amount.

The increase in the underground ore is the result of adding 169,000 tons of milling ore, the transferring of a part of the southerly extension

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

4. ESTIMATE OF  
ORE RESERVES:  
(Continued)

of the west channel from open pit steam shovel to underground and the development of additional underground ore in the east deposit during the past year.

The south bank ore will not be available for mining until the steam shovel deposit has been exhausted and the open pit equipment removed. The caving which would result from mining the south bank ore would endanger our approach tracks into the pit.

The so-called north bank ore, amounting to 127,000 tons, will have to be left as a shaft support as long as that opening is in use.

The second-level development work will make available for mining the 169,000 tons of milling ore and will increase the developed underground ore by 865,500 tons.

c. Estimated Analysis:

<u>DRIED 212<sup>9</sup></u>	<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Mois.</u>
Underground---	975,500	56.70	.080	9.06	.97	<del>3.26</del>	13.46
Milling-----	169,000	56.56	.068	9.76	1.29	2.43	15.00
Open Pit-----	<u>413,000</u>	<u>55.76</u>	<u>.078</u>	<u>9.74</u>	<u>1.60</u>	<u>2.60</u>	<u>14.05</u>
TOTAL-----	1,557,500	56.44	.078	9.32	1.17	3.00	13.78
<u>NATURAL:</u>							
Underground---	975,500	49.07	.069	7.84	.84	2.82	---
Milling-----	169,000	48.08	.058	8.30	1.10	2.07	---
Open Pit-----	<u>413,000</u>	<u>47.93</u>	<u>.067</u>	<u>8.37</u>	<u>1.38</u>	<u>2.23</u>	---
TOTAL-----	1,557,500	48.66	.067	8.03	1.01	2.58	---

5. LABOR & WAGES:

a. Comments:

(1) Labor:

The labor conditions were more satisfactory in 1926 than was the case in 1925. There was no shortage in open pit labor and the underground men were of a somewhat better standard and worked more steadily.



BOEING MINE  
ANNUAL REPORT  
YEAR 1926

5. LABOR & WAGES:  
(Continued)

b. Comparative Statement of Wages & Product:

	1926	1925	Increase	Decrease
PRODUCT-----	218,678	207,413	11,004	
No. Shifts & Hours-----	2-8	2-8		
<u>AVG. NO. MEN WORKING:</u>				
Surface-----	26	26		
Underground-----	102	89	13	
Total-----	128	115	13	
<u>AVG. WAGES PER DAY:</u>				
Surface-----	4.97	4.94	.03	
Underground-----	5.19	5.73		.54
Total-----	5.14	5.55		.31
<u>WAGES PER MO. OF 25 DAYS:</u>				
Surface-----	124.25	123.50	.75	
Underground-----	129.75	143.25	--	13.50
Total-----	128.50	138.75	--	10.25
<u>PRODUCT PER MAN PER DAY:</u>				
Surface-----	26.83	25.73	1.10	--
Underground-----	6.90	7.63		.73
Total-----	5.48	5.88		.40
<u>LABOR COST PER TON:</u>				
Surface-----	.185	.192		.007
Underground-----	.752	.751	.001	
Total-----	.937	.943		.006
<u>AVG. PRODUCT BREAKING ORE:</u>				
Tons Per Miner Per Day--	9.830	11.150		1.320
<u>AVG. WAGES CONTRACT MINER--</u>				
	5.540	6.180		.640
<u>TOTAL NO. OF DAYS:</u>				
Surface-----	8150 $\frac{1}{2}$	8062 $\frac{1}{2}$	88	
Underground-----	31689 $\frac{3}{4}$	27188 $\frac{3}{4}$	4501	
Total-----	39840 $\frac{1}{2}$	35251 $\frac{1}{2}$	4589	
<u>AMOUNT FOR LABOR:</u>				
Surface-----	40546.86	39876.31	670.55	
Underground-----	164551.99	155806.27	8745.72	
Total-----	205098.85	195682.58	9416.27	
<u>PROPORTION SURFACE TO UNDERGROUND MEN:</u>				
1923 - 1 to 4.43				
1924 - 1 to 3.68				
1925 - 1 to 3.42				
1926 - 1 to 3.92				

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

**6. SURFACE:**

**a. Buildings, Repairs:**

Only very minor repairs were made to the Boeing Mine buildings during the year 1926. The superintendent's house was painted and some interior decorating was done in the location dwellings.

**b. Stockpiles:**

The stockpile was loaded out by October 16th and between this date and November 8th, the new stocking trestle was erected. The new trestle is a duplication of that used for stocking operations the previous year.

The Model "60" Marion steam shovel, which is used in loading out the stockpile, was taken into the pit for clean-up work on May 9th, and as this job was not completed when it was necessary to start stockpile loading, a Model "75" Marion shovel was rented from the Winston-Dear Co. from May 31st. to June 11th. The Model "60" machine loaded out the balance of the ore from stockpile.

**c. Tracks, Roads, Transmission Lines:**

The main line tracks were shifted over to the south near the mouth of the pit, as a measure of safety. The stripping bank to the north of the track had sloughed to some extent and the crest of the bank was so close to the edge of the ties that it was not considered safe to run locomotives and trains. The track from the point of depression down the approach to the pit was straightened and retied where necessary. These jobs were done between the 12th and 30th of April. The tail track at the west end of the pit had been affected by the caving of underground working places and it was necessary to dump dirt to bring up the grade, ballast and relay the tail track, the work being done between the 22nd and 30th of April. A considerable amount of rock from the Susquehanna Mine screening plant was dumped along the north side of the approach tracks to the pit in order to prevent excessive sloughing. This work was done with the consent of the fee owners.

Some repair work was done on the tracks leading to the waste dump and on one of the bridges. We used this track very little during the past year and the necessary repairs were comparatively light.

**Roads:**

Further than dumping some cinders along the road leading into the mine from the Brooklyn location, it was not necessary to do any work on the mine roads during 1926. The caving of the extreme easterly workings has not extended to the highway leading into the mine and now that the underground operations have drawn back considerably and there has been no further movement in the vicinity of the road for some considerable time, we feel that there is no danger of the highway being disturbed.

**Transmission Lines:**

It has not been necessary to do any work on the mine transmission lines during 1926, nor do we anticipate having to do any further work on these lines during the life of the present Boeing lease.

**7. UNDERGROUND  
& OPEN PIT:**

**a. Shaft Sinking & Stripping:**

**(1) Shaft Sinking:**

No shaft sinking was attempted at the Boeing Mine during 1926, or in fact has any been done since the mine was put on an operating basis. We now contemplate sinking the main shaft from the first to the second level during 1927.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

7. UNDERGROUND  
& OPEN PIT:  
(Continued)

a. Shaft Sinking & Stripping - Continued:

(2) Stripping:

The Model "60" Marion shovel was engaged from May 10th to June 8th in cleaning up the toe of the stripping bank along the south side of the pit. Aside from a few shifts cleaning up surface material that had washed onto the ore from time to time, this was the only stripping operation attempted during 1926.

b. Development:

A test-pit was put down from the main level in the center of the west channel to a depth of 73' and crosscuts were extended to the west and east in order to determine the width of the channel at depth. The east crosscut was pushed out 50' before rock was encountered and that to the west 38'. Water prevented sinking this test-pit to a greater depth, but a drill hole was pushed down 12' from the bottom and as near as could be determined, the ore was of the same good character as that developed in the winze and crosscuts. The ore developed by the winze and crosscuts showed an average of approximately 56.90% iron.

Early in June a winze was started in the open pit, to the west of the shaft and located approximately in the center of the main ore channel. This winze was sunk for 138', where a sump was cut, the opening being extended to the north rock wall of the channel some 60' distant. Hoisting equipment was installed in the pit and a headframe erected for handling the material from the winze. The headframe is located over one of the first level crosscuts and the material from the winze is dumped into a chute and drawn off through this crosscut to the main shaft. The second level development workings were started 12' above the sump level and by the end of the year they had been pushed out 70' to the southeast and 15' to the northwest. The southeasterly workings will be turned toward the shaft and it is now contemplated to drive through 350' of rock to make the necessary connection between the channel workings and the main shaft. When the sump work is completed, the other gang employed on the second level will push the development work along the main channel to the northwest. All operations on the second level to-date have been for the purpose of draining the steam shovel and milling ore in the main channel. The development work on the second level in connection with the underground deposits has not yet been decided upon. The temporary second level pumphouse is now completed, as well as the safety bulkhead and discharge raise to the first level. The complete installation of the electric pumps will be consummated early in January.

On August 25th, a blast in the second level pump sump, 10' in from the winze, tapped a flow of water that was greater than the steam pumps could handle. The winze filled with water to within 40' of the first level and it was necessary to utilize a steam sinking pump in reclaiming the winze. The winze was dewatered and development work resumed on September 6th. On November 30th a quantity of ore sloughed off from the back and side of the drift near the pumphouse and the suction pipes were blocked. The winze was drowned out and it was necessary to again use a steam sinker. The winze was dewatered and operations resumed on December 7th. It is hoped with the installation of the electric pumps and the safeguarding from exceptional flows of water, that we will not have any further delays of this nature in our second level development work.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

7. UNDERGROUND  
& OPEN PIT:  
(Continued)

c. Stoping (Underground):

West Deposit:

On January 1st., 9 contracts were employed in this territory, working on the 1358', 1346' and 1335' sub-levels. This force was gradually reduced as the subs were worked out and at the end of the year but two gangs were employed slicing and scrambling out pillars on the main level. The average output per contract in the west deposit was 1,660 tons per month during 1926. Most of the work was done with scrapers under favorable conditions.

1358' Sub-Level:

Three contracts were employed here until March, when the ore at this elevation was exhausted.

1346' Sub-Level:

A force of 5 gangs was engaged on this sub until May, when the final pillars were exhausted.

1335' Sub-Level:

Three contracts were employed at this elevation until the forepart of December, when the ore was exhausted.

First Level:

Two contracts spent the last several months of the year, and are still engaged, one in the west channel ore and the other in the main channel. There is sufficient ore here to furnish employment to these two gangs for about five months.

East Deposit:

On January 1st., 9 contracts were engaged in this deposit on the 1356' sub-level. During the year the force was increased from time to time as the west deposit working places were exhausted and on December 31st., 16 contracts were employed. The average output per gang per month has amounted to 720 tons from the east deposit. As compared with the west deposit, this showing is very unsatisfactory and is due to the hardness of the ore, the low mining height in some of the working places and the excessive water dripping from the back. It has been impossible to use scrapers to advantage to any great extent in the east deposit on account of the wetness of the ore and this has slowed up progress materially, as compared with the west deposit. The hard cretaceous ore is now practically all mined and development work on the first level is being pushed in an endeavor to tap the water around the limits of the deposit and dry up the sub-level workings.

1356' Sub-Level:

Operations at this elevation have been conducted throughout the year, the number of gangs being increased during the first six months of 1926 and then decreased as the ore was drawn back to the raises. A force of seven contracts was employed at this elevation at the end of the year. The north shore line was found to extend somewhat further than we had anticipated and the tonnage of ore mined on the 1356' sub has been larger than expected.

1342' Sub-Level:

Development work at this elevation was started in May and several contracts were employed working along the edge of the pit face during the summer months. The ore has practically been exhausted along the north pit face and the four contracts still working at this elevation are slicing and caving back from the east open pit face. The number of contracts on this sub will be increased during the next several months, as the pillars on the sub above are exhausted and the development work on the main level for drainage purposes is pushed forward.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

7. UNDERGROUND  
& OPEN PIT:  
(Continued)

c. Stoping (Underground) - Continued:

East Deposit:

First Level:

During the latter part of 1926, four crosscuts were driven to the south boundary from the main haulageway and drifts extended along the boundary line. It is the intention to put up raises at intervals along this boundary drift and endeavor to tap the water and bring it down into the crosscuts and thus do away with the excessive drip in the back of the sub workings. Five contracts were employed at this elevation at the end of the year. As the raises are completed the gangs will be moved up to the 1342' sub-level.

d. Timbering:

During the year 1926 there was considerably less timber used than during the previous year and the average cost per foot of the timber was less. In 1925 it was necessary to do considerable repair work on the main level and on the main tramways of the west deposit subs and due to the excessive weight the best grade of tamarack and norway was necessary. The bulk of the operations during 1926 were in the east deposit, where a smaller, less expense, timber could be used, and further than this, there was not as much repair work necessary on the main level.

As regards the lagging, poles and covering boards, the quantity used in 1926 was larger than for the previous year, due to the fact that the floors of the top sub in the east deposit were all covered down with lagging, poles and covering boards. The reason for this extra-ordinary precaution was to prevent as far as possible sand runs on the second sub, the flow of water in the top sub being quite excessive.

Comparative Timber Statement for the years 1925 and 1926:

	<u>LINEAL</u> <u>FEET</u>	<u>AVG. PRICE</u> <u>PER FOOT</u>	<u>AMOUNT</u> <u>1926</u>	<u>AMOUNT</u> <u>1925</u>
7" to 9" Timber----	76442'	.0717	5480.89	16011.44
9" to 12" " ----	146312'	.1266	18523.12	27181.38
Total Timber 1926-	222754'	.1073	23904.01	43192.82
Total Timber 1925-	301715'	.1431	23904.01	43192.82
	<u>1926</u>	<u>1925</u>	<u>Per 100'</u>	
6' Cedar Lagging----	747840'	382800'	.691	5168.00
Poles-----	344000'	271448'	1.250	4300.00
Covering Boards----	544093'	430499'	13.67M'	7442.60
Total 1926-----	1635933'	1084747'		16910.60
				12822.80
<u>PRODUCTION-</u>			218678	207413
Feet of Timber Per Ton of Ore-----			1.018	1.455
Feet of Lagging Per Ton of Ore-----			3.419	1.845
Feet of Boards Per Ton of Ore-----			2.488	2.075
Feet of Poles Per Ton of Ore-----			1.573	1.308
Feet of Lagging Per Foot of Timber-----			3.213	1.268
Cost Per Ton for Timber-----			.109	.208
Cost Per Ton for Lagging-----			.024	.016
Cost Per Ton for Boards-----			.034	.029
Cost Per Ton for Poles-----			.019	.017
Cost Per Ton for All Timber-----			.186	.270
Equivalent of Stull Timber to Board Measure-			651236	678881
Feet Board Measure Per Ton of Ore-----			2.978	3.273

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

**7. UNDERGROUND  
& OPEN PIT:**  
(Continued)

**f. Explosives, Drilling and Blasting:**

On account of the extreme hardness of the ore mined on the upper sub of the east deposit, it was necessary to use a stronger explosive and the amount consumed during 1926 was considerably in excess of that for the previous year. The amount of fuse and caps was also increased considerably in 1926. The larger part of the hard cretaceous ore has now been mined and the quantity of explosives, which will be used in 1927, should show a decided decrease from 1926

Comparative Statement of Explosives used in Underground Operations  
For Years 1925 and 1926.

	<u>QUANTITY</u>	<u>AVERAGE PRICE</u>	<u>AMOUNT</u> <u>1926</u>	<u>AMOUNT</u> <u>1925</u>
30% 1-1/4" R.C.-----	2900#	12.75	369.75	8788.46
40% 1-1/4" R.C.-----	9500#	13.50	1282.50	----
35% 1-1/8" Spec.Gel.-----	76150#	12.79	9746.62	----
40% 1-1/8" Spec.Gel.-----	5700#	13.22	754.00	----
TOTAL-----	94250#	12.89	12152.87	8788.46
Fuse, Crescent-----	228500'	.692	1581.22	1083.90
Caps, #6, E.B.-----	57100	1.065	920.46	434.45
Total-----			2501.68	1518.35
TOTAL ALL EXPLOSIVES-----			14654.55	10306.81
Production-----			218678	207413
Pounds of Powder Per Ton of Ore-----			.431	.323
Cost Per Ton for Powder-----			.055	.042
Cost Per Ton for Fuse, Caps, Etc.-----			.011	.007
Cost Per Ton for All Explosives-----			.067	.049
Average Price per Pound for Powder-----			.1289	.1311

The only explosives used in the open pit operations during 1926 were in the test-pits, whereas in 1925 it was necessary to blockhole and blast the hard cretaceous material, which occurred on top of the ore deposit at the east end of the pit.

**g. Open Pit Mining & Loading:**

Open pit ore loading operations were begun on May 13th and completed on November 11th.

The 350-ton shovel was moved down an incline along the ore bank, loading ore cars on the first switchback track and reached the bottom of the pit on May 24th. The first cut along the south side of the pit was completed on June 12th, the shovel at this time being at the west end of the pit. The machine was turned around and dug easterly on the second cut until August 24th, when it was again turned around and from August 25th until October 14th a third cut was taken, the shovel following the rock until the west channel was reached, when it dug down to the loading limits

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

7. UNDERGROUND  
& OPEN PIT:  
(Continued)

g. Open Pit Mining & Loading - Continued:

in this channel. Operations in the third cut were slowed down to quite an extent on account of encountering lean material, which had to be cast, and the unevenness of the bottom of the cut, due to the irregularity of the rock. While the shovel was operating in the west channel there was quite a little delay occasioned, due to heavy rains flooding this part of the pit and washing surface material into it. It was necessary to suspend operations for five days on one occasion, from September 7th to 11th, and on another from October 4th to the 7th. At the extreme west end of the pit, the underground workings had caved along the open pit face and it was necessary to exercise considerable care in taking the open pit ore up to these old caves, as there is always the likelihood of a slide occurring when the support is removed. One bad crack developed along the main approach tail track, but the shovel was moved back and the slide which occurred did no appreciable damage, except covering a small quantity of ore that we had hoped to recover.

When operations in the west channel had been completed, the shovel dug up on top of rock and moved eastward in the fourth cut until the end of the season. The machine was south of the shaft when operations were suspended. It is the intention to complete this cut along the south bank the forepart of the 1927 season and finish the open pit operations that year in the main channel.

In order to do the winter repairing to the best advantage, the 350-ton shovel was moved westward onto higher ground.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

8. COST OF  
OPERATING:

a. Comparative Mining Costs:

<u>PRODUCT:</u>	<u>1926</u>	<u>1925</u>	<u>INCREASE</u>	<u>DECREASE</u>
Open Pit-----	294,938	291,060	3,878	
Underground-----	218,678	207,413	11,265	
Total Product-----	513,616	498,473	15,143	
<u>OPEN PIT COSTS:</u>				
Operating Accounts-----	.288	.285	.003	
General Mine Accounts---	.041	.037	.004	
Winter Expense-----	.068	.102		.034
Stripping Amortization--	1.150	1.150		
Equipment Depreciation--	.050	.050		
Total Open Pit Costs--	1.597	1.624		.027
<u>SHAFT COSTS:</u>				
Underground Costs-----	1.236	1.232	.004	
Surface Costs-----	.098	.123		.025
General Mine Accounts---	.162	.134	.028	
Loading & Shipping-----	.042	.040	.002	
Total Shaft Costs-----	1.538	1.529	.009	
Depreciation-----	.400	.400		
Occupation Taxes-----	.015	.028		.043
Taxes-----	.040	.061		.021
Central Office-----	.010	.010		
Cost Adjustments-----	.004	.007		.003
Misc. Debits & Credits--	.004	.006	.002	
Total Cost on Cars----	2.013	2.096		.083
<u>OPEN PIT:</u>				
No. Days Operating-----	150	138	12	
No. Shifts & Hours-----	1-10	1-10		
Avg. Daily Product-----	1966	2109		143
<u>SHAFT:</u>				
No. Days Operating-----	308	306	2	
No. Shifts & Hours-----	2-8	2-8		
Avg. Daily Product-----	710	678	32	

b. Detailed Cost Comparison:

(1) Product:

Due to the fact that we were able to increase our underground production during 1926, as compared with 1925, by 11,265 tons, our open pit tonnage would have been decreased by a like amount, but the sales of Boeing ore the latter part of the season raised the year's requirements and there was an increase of 3,878 tons in the open pit production in 1926, as compared to 1925.

(2) Open Pit Costs:

The open pit "Operating Accounts" showed an increase of \$.003 per ton in 1926, as compared with the previous year. Under this caption the cost of Drilling & Blasting, Operating Locos. & Cars and General Open Pit Expense showed decreases in the charges per ton of \$.032, \$.017 and \$.014 respectively, but offsetting this, there was an increase of \$.059 per ton for Pumping & Drainage and \$.015 for Waste



337

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

8. COST OF  
OPERATING:  
(Continued)

b. Detailed Cost Comparison - Continued:

(2) Open Pit Costs - Continued:

File Expense, the charges under the other headings being about the same for the two years considered. Very little drilling and blasting was required in the Boeing pit in 1926, whereas in 1925 it was necessary to blockhole and blast a large amount of the certaceous ore mined in the east end of the pit. Less equipment was used during 1926 and as a result, the General Open Pit Expense was somewhat less for that year. The large increase of \$.059 per ton in the 1926 charges to Pumping & Drainage, as compared to the previous year, was due to the work undertaken for pit drainage in the open pit winze. The tracks leading to the dumps had to be repaired during 1926 and the increase in the cost per ton for Waste Pile Expense was the result of this work and the charges for renting dump cars to handle material from the pit to the dump.

The open pit "General Mine Accounts" showed an increase of \$.004 per ton for 1926, as compared with 1925. While the charges for Analysis and Mine Office were each \$.002 per ton lower in 1926 than in 1925, due to the fact that less sampling was necessary in the pit and less traveling expenses charged to mine office, the increases of \$.004 in Personal Injury Expense and \$.004 in District Office more than offset this. More compensation was paid in 1926 than in 1925 and the District Office charges to the Boeing Mine were higher, as the result of decreased activity in our other Mesaba Range operations during 1926.

There was a decrease of \$.034 per ton in the "Winter Expense" for 1926. This decrease is due to the fact that some stripping and clean-up operations were carried forward during 1925, whereas in 1926, the only work of this nature that was attempted was during the ore operating period and the amount of material handled was comparatively small. Under this caption the item for Pumping & Drainage shows a 1926 expense almost double that of the previous year, due to the cost in connection with the open pit winze, but this was much more than offset by the stripping expense noted above.

(3) Underground Costs:

Under this caption, there were a number of items that showed practically the same costs for the two years considered and comments will only be made on those where there was a material increase or decrease in the charge per ton, which resulted in showing a net increase of \$.004 in the cost per ton for underground operations. Development in Ore shows a decrease of \$.018 per ton in 1926. This was the result of the extensive development work undertaken in connection with the east deposit in 1925. Under Stopping there was an increase of \$.064 per ton in 1926, as the result of the bulk of our operations during that year being conducted in the east deposit, where the ore was harder, the average mining height was less favorable and the water conditions were bad. There was a decrease of \$.033 per ton for Timbering in 1926, due to the fact that less timbering for the same product was required in the east deposit and the fact that the average price paid for the timber used in 1926 was less than that for the previous year. The cost per ton for tramming showed an increase of \$.014 for 1926, due to the fact that the subs were worked down closer to the tramming level and it required a larger force to handle the product. Further than this, during 1925, the bulk

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

8. COST OF  
OPERATING:  
(Continued)

b. Detailed Cost Comparison - Continued:

(3) Underground Costs - Continued:

of the product came from the west deposit, whereas in 1926 it was split between the east and west deposits and the average footage trammed per ton of ore was greater. There was an increase of \$.012 in the cost per ton for Electric Tram Equipment in 1926, which was occasioned by the considerable replacement of motor car wheels during that year and the charging off of two new motor cars. The decrease of \$.028 in the 1926 cost per ton for Pumping Machinery is explained by the fact that the drainage ditches had to be changed in 1925 and the charges for that year against this item were exceptionally heavy, while the 1926 charges were nominal.

The 1926 "Surface Costs" were \$.025 per ton less than those for 1925 and the reduction is explained by a decrease of \$.016 per ton for Stocking Ore and \$.003 for General Surface and \$.003 for Hoisting Equipment. During 1925 a quantity of new trestle timber was charged out, whereas in 1926, old material was used for the most part. Further than this, a larger proportion of the product was shipped direct from the pocket in 1926 than was the case in 1925. We were able to reduce the force engaged on general surface work during 1926, explaining the decreased cost that year to this account. During 1925 two new hoisting cables were charged out, whereas in 1926 the costs to this account were nominal.

"General Mine Accounts" for 1926 showed an increase of \$.028 per ton, which is explained by the fact that considerably more analytical work was necessary the past year, there were a greater number of accidents requiring compensation payments and the charge of the District Office was higher, due to decreased activities at our other Mesaba Range operations.

The cost of "Loading & Shipping" was \$.002 per ton higher in 1926 than it was in 1925, due to the fact that pocket loading was conducted on two shifts in 1926, whereas during the previous year we had sufficient storage capacity underground so that during a part of the year pocket loading was done day shifts only.

(4) Depletion & Depreciation:

"Occupational Taxes" are estimated a year ahead and those charged during 1925 were altogether too high, which resulted in a credit of \$.015 per ton for the 1926 account. The Minnesota State Tax Commission allowed us to put in more cost and depreciation charges against the ore than was anticipated when we made the estimate for Occupational Taxes to be paid in 1926. The Occupational Tax decrease for 1926 amounted to \$.043 per ton, as compared with that for 1925.

There was a decrease of \$.021 per ton in the 1926 "Ad Valorem Taxes" as compared with 1925. This was due to a reduced tonnage on account of shipments and also a decided reduction in the rate of valuation for underground ore and a slight reduction on the open pit ore.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

8. COST OF  
OPERATING:  
(Continued)

b. Detailed Cost Comparison:- Continued:

(5) Days and Shifts:

Open pit ore operations were carried on 12 days more in 1926 than in 1925 and while the total open pit tonnage was greater in 1926 than the previous year, there was a decrease of 143 tons per shift secured. This was due to the fact that a considerable quantity of very lean material was encountered along the south bank of the pit during 1926 and it was necessary to cast this ore behind the shovel and pick it up later when the grade was such that it could be absorbed. The Great Northern car supply affected the production both years, the shortage of cars being a somewhat more serious item in 1926 than it was in 1925. The fact is that our dock capacity was exceeded in 1926 more than it was in 1925.

The Boeing Mine was operated underground two shifts more in 1926 than was the case in 1925 and the average daily product for the year showed an increase of 32 tons. The increase in the tons per shift was due to a larger force being employed underground.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

9. EXPLORATIONS  
AND  
FUTURE  
EXPLORATIONS:

No exploratory work was undertaken at the Boeing Mine during 1926, other than some shallow tests in the pit to determine the character of the ore to be taken as a bottom in the shovel cuts. Besides the development work, which we contemplate doing between the first and second levels, no exploratory work at the Boeing Mine is contemplated for the future.

10. TAXES:

Tax Statement:

	<u>1926</u>	<u>1925</u>	<u>Increase</u>	<u>Decrease</u>
Boeing Mine-----	\$20,933.42	\$30,312.56	-----	\$9,379.14

The decrease in the 1926 taxes at the Boeing Mine, as shown above, is the result of our shipments from May 1st., 1925 to May 1st., 1926 and the fact that the rate for valuing the reserve ore has been reduced by the Minnesota State Tax Commission, in the case of the open pit ore from .231 to .220 and underground from .16 to .12. On account of the low grade of the Boeing ore, we are in hopes of securing a still further reduction of the rate on the reserve tonnage and toward this end expect to present a petition to the St. Louis County Board of Commissioners.

11. ACCIDENTS  
AND  
PERSONAL  
INJURY:

The following statement shows the number of accidents and total time lost during the years 1925 and 1926:

	-----1926-----		-----1925-----	
	<u>Accidents</u>	<u>Time Lost</u>	<u>Accidents</u>	<u>Time Lost</u>
Boeing Mine----	42	821½ Days	25	582½ Days

There were no fatal accidents during 1926 and only two accidents in the open pit where compensation was paid. The increase in the accident rate at the Boeing Mine is very regrettable, especially in the face of a campaign against accidents, which has been carried on. An earnest endeavor is being made to reduce the number of accidents and it is hoped that the year 1927 will show a decided improvement over 1926.

12. NEW CON.  
AND  
PROPOSED  
NEW CON.:

Further than the headframe, erected over the open pit winze, no new construction work was undertaken during 1926. No new construction work is contemplated for the future at the Boeing Mine.

13. EQUIPMENT  
AND  
PROPOSED  
EQUIPMENT:

d. Tugger Hoists & Scrapers:

The mine is now supplied with nine tugger hoists and scrapers, eight being double drum electric and one air operated.

BOEING MINE  
ANNUAL REPORT  
YEAR 1926

14. MAINTENANCE  
& REPAIRS:

The only repair work undertaken during the year 1926 consisted in the usual overhauling of the open pit and underground equipment.

17. CONDITION OF  
PREMISES:

The usual cleaning was done about the mine premises during the past year. The mine location houses were painted in 1924 and are in good condition. The mine buildings would look much better if they had the woodwork painted, but it is not advisable to do anything until we have determined whether or not we will continue operating the Boeing Mine after the expiration of the present lease October 1st., 1928.

18. NATIONALITY  
OF  
EMPLOYEES:

<u>NATIONALITY:</u>	<u>NO. OF MEN</u> <u>1926</u>	<u>NO. OF MEN</u> <u>1925</u>
American-----	38	32
Finnish-----	32	26
Austrian-----	30	23
Slavish-----	15	6
Italian-----	15	11
Swede-----	8	8
Montenegrin-----	7	5
Croatian-----	6	13
Bulgarian-----	4	2
Swiss-----	2	1
Polish-----	2	3
English-----	1	2
German-----	1	2
Russian-----	1	-
Canadian-----	1	3
TOTAL-----	163	137

Ishpeming, Michigan,

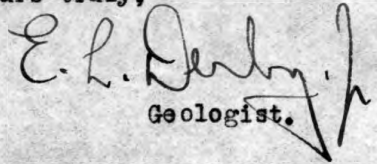
February 9, 1927.

ANNUAL REPORT - GEOLOGICAL DEPARTMENT.

I beg to submit herewith my report for the year ending December 31, 1926, covering the work of the Geological Department, the geological surveys and the drilling explorations conducted during that time.

The detailed report of drilling at the Spies and Tilden explorations and in the Cliffs Shaft, Republic and Virgil Mines will be found in the annual report book labeled, "The Cleveland-Cliffs Iron Company - Ishpeming, Republic and Iron River Districts, December 31, 1926"; the drilling at the Clark Mine exploration will be found in the book labeled, "The Cleveland-Cliffs Iron Company - Mesabi District, December 31, 1926". These books are submitted as a part of the annual reports of the Engineering and Geological Departments.

Yours truly,

  
Geologist.

ELD:LTD.

22. REPORT OF THE GEOLOGIST FOR THE YEAR ENDING DECEMBER 31, 1926.A. STAFF.

The staff of the Geological Department in 1926 is shown in Table I below. The personnel has remained the same throughout the year:

TABLE I.

<u>NAME.</u>	<u>OCCUPATION.</u>	<u>DURATION OF EM- PLOYMENT IN 1926.</u>	<u>DAYS LOST. SICKNESS.</u>	<u>VACATION.</u>	<u>% OF WORKING DAYS WORKED.</u>
E. L. Derby, Jr.	Chief Geologist,	Entire year	0	3	98.9
M. C. Drake,	Assistant Geologist,	" "	2½	14	94.0
E. A. Allen,	Assistant, testing diamond drill holes, collecting & label- ing samples, etc,	" "	0	5½	98.0
Gustav Afuhs,	Draftsman,	" "	4½	3	97.3

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

TABLE II.

Total days of eight hours worked,	- - -	274 days.
Sundays,	- - - - -	52 "
Days resulting from Saturday afternoons,	-	26 "
Holidays,	- - - - -	13 "
<b>Total,</b>		<b>365 days.</b>

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

TABLE III.

<u>YEAR.</u>	<u>AVERAGE NUMBER OF MEN.</u>
1922	3.00
1923	3.00
1924	3.58
1925	4.00
1926	4.00

B. DIVISION OF WORK AMONG THE MEMBERS OF THE DEPARTMENT.

H. L. Smyth. The work of the Geological Department continued throughout the year under the direction of Mr. H. L. Smyth as Consulting Geologist.

E. L. Derby, Jr. I continued to have charge of the Department as Chief Geologist. The major part of my time, as in the past, was taken up with the general oversight and supervision of the work of the Department. This has included, besides the usual routine office work, surface drilling explorations in the Tilden District on the Marquette Range, the Iron River District on the Menominee Range and the Crosby-Ironton District on the Cuyuna Range; underground drilling in the Cliffs Shaft, Republic and Virgil Mines; and the geological surveys in the Athens, Austin, Barnes-Hecker, Cliffs Shaft, Holmes, Morris-Lloyd, Negaunee, Republic, Spies-Virgil and Stephenson Mines. I, personally, made frequent underground geological surveys of the new development work in the mines, especially in the Virgil Mine.

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

I spent the last three days of January and the first three days of February at Hibbing, re-classifying the drill samples and revising the Tax Commission estimates of the Boeing, Bingham and Trumbull Mines. Mr. Barber and I consulted with Pickands, Mather & Company officials in Duluth relative to the plausibility of our supplying the latter with ore from our Holman-Brown properties in lieu of their deferred opening of the Orwell property.

In March, I prepared another estimate of ore on our Bingham property for the Minnesota Tax Commission. I also went over our Tax Commission estimate of the Spies-Virgil Mine with Mr. L. P. Barrett, State Appraiser of Mines.

In May, I joined Mr. Barber at Hibbing in a conference with Inland Steel Company officials relative to their anticipated interest in the Holman-Brown properties. We made a field examination of the Holman-Brown pits at that time. Later in the month, Messrs. S. L. Mather, H. A. Raymond, Barber and I met Messrs. Block, Thompson and Randall of the Inland Steel Company at their office in Chicago in conference on the same subject. I also spent part of the month going over the work of the Department with Mr. Smyth during his stay in Ishpeming.

In July, I went to Hibbing and made an estimate of the annual production we might expect to obtain from the Holman, Brown, Bingham and North Star operation, and examined reports and estimates of several Cuyuna Range manganese properties which were offered to us. I made a joint estimate with Messrs. Baxter and Matthews of the ore developed by the Ford Motor Company in their drilling on the NW $\frac{1}{4}$  of Section 3, 47-28, West of the old Chase Mine. We acted as an arbitrary committee between the Ford Motor Company and the Palms Book Land Company.

I went to Hibbing in August and reestimated the ore in the Wade Mine for our Minnesota Tax Commission report and went over all our recent tax estimates in Minneapolis with Professor Lambert, Engineer for the Tax Commission. Mr. Barber was with me part of the time in Minneapolis. I also examined the drill cores and records of the exploring done by Messrs. Odgers, McPherson and Monroe on the so-called Spies-Barnett option lying North and Northeast of the Virgil Mine.

We started drilling on the Clark option on the Cuyuna Range late in September and subsequent to this I went to Crosby and examined the old drill samples and other records of the exploring done there. I also went to Hibbing at that time to consult with Mr. Barber about our proposed drilling campaign at this property.



Mr. Smyth visited Ishpeming in October and I went over the work of the Department with him. We made a field examination of the siliceous ore outcrops in the NW $\frac{1}{4}$  of the NW $\frac{1}{4}$  of Section 26, 47-27 in the Tilden District. I also made two trips to the Clark exploration.

I made one trip to the Clark exploration in November and one in December, going to Hibbing both times for conference with Mr. Barber.

In December, I also spent three days at the Geological Conference held at the State University at Madison, Wisconsin, by the Geological Society of America and the Society of Economic Geologists. A symposium on Pre-Cambrian geology and particularly that part relating to the Lake Superior District was the principal feature of this Conference. About 250 geologists were present from all over the United States and Canada and some from foreign countries.

M. C. Drake. Mr. Drake continued as Assistant Geologist throughout the year. He made regular underground geological surveys in the Barnes-Hecker, Cliffs Shaft, Holmes, Morris-Lloyd and Republic Mines and posted these surveys on the geological maps and cross-sections. He also posted, periodically, the geological maps and cross-sections of the Athens, Austin, Maas, Negaunee and Stephenson Mines from data supplied us by the engineers at these properties. During the summer and early fall, he spent most of his time in the field as geologist with a party of engineers who located contours and rock outcrops in the SE $\frac{1}{4}$  of Section 22, and S $\frac{1}{2}$  of the N $\frac{1}{2}$  of Section 26, 47-27 in the Foster-Finden District. He made a geological longitudinal projection through the Southeast Deposit of the Cliffs Shaft Mine from the 4th to the 10th levels, inclusive, for Mr. Eaton and a North-South geological cross-section through the Virgil Mine workings and extending North to include the recent drilling of Odgers, McPherson and Monroe. He made a composite geological tracing of the Cliffs Shaft Mine workings in Section 3, which is leased from the Oliver Company. The rest of his time was taken up with office routine work.

E. A. Allen. Mr. Allen continued as an assistant in the Department during the year. At times, however, he also assisted several of the engineers with their surveys and drove the Dodge truck. The major part of his time was spent in collecting, sampling and filing diamond drill samples from the current explorations. He made Maas Compass surveys of all the holes drilled on the Carlson forty, South of the Spies Mine, otherwise known as the Spies option, and also in hole No. 44 underground in the Virgil Mine. He took Mr. Drake's place as field geologist on the surveys in Sections 22 and 26, 47-27 whenever the latter was needed on other work. He also made regular monthly carbon reports and the annual inventory of diamond drill equipment.

Gustav Afuhs. Mr. Afuhs continued as draftsman throughout the year. His work, as heretofore, has, in part, consisted in preparing cross-sections of all current drilling. He made two sets of large scale cross-sections through the Clark Mine exploration, one set for Mr. Barber's office, and has kept our set posted daily as the work progressed. He prepared a set of cross-sections of the drilling on the Bingham Mine which I used in my estimates for the Tax Minnesota Tax Commission. He made a set of North-South geological cross-sections of the Virgil Mine to be used exclusively for photographic records and more particularly for the annual reports to the State Tax Commission. He also made a working set of geological cross-sections East and West through the Virgil Mine. He made a tracing of the Ogden pit and the lean ore area adjoining it in Section 14 owned by Jones & Laughlin for a report prepared by Mr. Eaton. He painted the geology on photographic plates of the various Republic Mine levels which were used in making a model of this mine. He made a tracing for Mr. Barber of the so-called Jennings forty, South of the Helmer Mine at Kinney, Minnesota. He colored in the annual and Tax Commission report sheets of this Company's drilling for the year and the legend sheets to accompany them. He also made

copies of drill results, for our outside exploration files, of all the important land offers that were received during the year and spent the rest of his time on the routine work of the office.

### C. SURFACE GEOLOGICAL SURVEYS.

Surface geological surveys were made during the past summer and early fall covering the SE $\frac{1}{4}$  of Section 22 and the S $\frac{1}{2}$  of the S $\frac{1}{2}$  of the N $\frac{1}{8}$  of Section 26, both in 47-27. Work was also started in the NW $\frac{1}{4}$  of Section 25, 47-27 when winter weather set in. It is anticipated that this work will be continued next spring. The field notes will be plotted during the present winter and tracings made. The work consists of contouring, as well as locating and geologizing all rock outcrops.

### D. UNDERGROUND GEOLOGICAL SURVEYS.

#### D-1. ATHENS MINE.

The geological surveys at the Athens Mine were made periodically by Mr. Nicolson, Engineer, and during his three months absence in Alaska, by Mr. Allen, also of the Engineering Department. We have kept this information posted on both the geological maps and cross-sections. The workings above the 4th level developed an area of hard jasper mixed with paintrock along the South footwall near the Lucky Star line where good ore had been anticipated. Developments in other parts of the mine, however, were in accord with expectations as based on previous surveys.

#### D-2. AUSTIN MINE.

The Austin Mine was reopened about May 1st and it produced ore the remainder of the year from the shaft pillar. Mr. Tillson, Engineer at the property, collected the little geological data that was available and we have posted both the geological maps and cross-sections to date.

#### D-3. BARNES HECKER MINE.

We made periodic surveys in this mine until the catastrophe of November 3rd. Both geological maps and cross-sections have been posted to that time. Development work on the 630' sub-level above the 3rd level and in raises from *this* level had increased considerably the developed ore area in the vicinity of the 3rd level. The grade of ore was also improving in continuity as stoping progressed to lower levels.

#### D-4. CLIFFS SHAFT MINE.

Extensive geological surveys were made by us in the Cliffs Shaft Mine each time the engineer made his surveys. We have found this co-operation to be by far the most satisfactory way of collecting information since it is very difficult to map geological features accurately without the aid of a transit. Both the geological maps and cross-sections have been posted regularly.

The extension of the No. 3 Mine is being explored by drifting and raising on the 3rd level and the extension of the Incline ore by a raise from the 9th level. The main Southeast Deposit is opening up very satisfactorily in stopes on the 4th, 5th, 6th, 7th and 8th levels. The extension of ore from the Cliffs Shaft on to the Oliver lease in Section 3 is being developed on the 1st, 6th and 7th levels "A" Shaft. The 7th level is particularly promising and already indicates a larger tonnage than could be anticipated from the old drilling.

The development in ore at the West end of the 15th Level "B" Shaft was disappointing but this is largely off-set by an increased amount of ore found in the South limb of the main vein on the 13th Level "B" Shaft.

D-5. HOLMES MINE.

We have made geological surveys at this mine only occasionally during the year as the work here was principally stoping the areas already developed and geologized. The geological maps and cross-sections, however, have been kept posted regularly.

D-6. MAAS MINE.

The work at the Maas consisted almost entirely of stoping areas already developed and no notable changes were found in the anticipated conditions. Geological data was collected regularly by Mr. Moulton, Engineer at the property, and we have posted this information on both the geological maps and cross-sections.

D-7. MORRIS LLOYD MINE.

We made geological surveys periodically at this property and have posted the geological maps and cross-sections regularly. Development work during the year has increased the developed ore in No. 33 Deposit considerably. This deposit was first opened up on the 7th level and it is now estimated to extend at least 50' above the 6th level.

No. 8 Deposit in Section 6 proved disappointing and in developing it between the 1290' sub-level and the 3rd main sub, it is only a small stringer about the size of a raise.

Following the Barnes-Hecker disaster, new safety mining limits were adopted in the Morris Mine which have cut down the available ~~xxxxxx~~ developed ore. The East Deposit from the 4th to the 5th levels and the No. 21 Deposit from the 430' to the 610' sub-levels, are eliminated thereby, as is also the ore remaining in the large ~~xxxx~~ sub-level called the West Deposit.

D-8. NEGAUNEE MINE.

Mr. Moulton, Engineer at the Negaunee Mine, has collected the essential geological data at this property regularly and we have kept the geological maps and cross-sections posted to date. Development work on the 12th level has proved the footwall to be farther Southeast than we anticipated, thus increasing the area of developed ore in this vicinity. No other notable changes have occurred.

D-9. OGDEN MINE.

Geological data was collected in the Ogden Pit as work progressed during the past shipping season by Mr. Allen, Engineer at the property. The main greenstone contact was found to have an average dip of about 80°. As stripping progressed, the course of this contact resulted in a decrease of the available ore area to the Southeast but this was offset by the swinging back of this contact, resulting in an increase of available ore area to the Northwest.

D-10. REPUBLIC MINE.

We have made regular and frequent geological surveys at the Republic and have posted the geological maps to date. New ore is being developed in a shallow incline from surface near the collar of the Pascoe Shaft. In all probability this represents an irregular fringe of the large ore body close by that was mined in an open pit many years ago.

The Pascoe Shaft was bottomed 15' below the 2910' level. The ore area on this level has developed fully as large as that on the 2870' level, which was opened early in the year, but drilling below indicates that this main ore lens pinches out not far down the pitch of the trough.

New ore is being developed above the 1710' level and is being explored from the 1570' and 1335' levels. We believe it will prove to be a continuous ore body throughout this distance.

#### D-11. SPIES-VIRGIL MINE.

An intensive geological study of this property was made during the year, including no less than 24 geological surveys. The geological maps and cross-sections were posted following each survey. Work on the Spies property consisted in removing a floor pillar in the North lens and stoping a small extension of ore above the 3rd level on the Southwest side of the mine. Some of this ore extended across the Virgil line.

Practically all the work was done in the Virgil property and consisted chiefly of extending the 6th level development, putting up raises and opening development sub-levels above the 6th level. The ore area South and above the first main drift on the 6th level was prepared for mining by the sub-level stoping method and considerable ore was mined. The Northwest side of the mine above the 6th level is being prepared for a similar operation.

The results of raising and drilling have shown the main Virgil ore body to be quite separate from the Spies and above the 6th level it assumes a very steep attitude. The top of the ore has not been reached as yet but it has been pretty well outlined in the vicinity of the 6th level. A complicated system of folding, however, changes the shape of this outline considerably in going up the pitch.

#### D-12. STEPHENSON MINE.

Geological data was collected in the Stephenson Mine at regular intervals by Mr. Sterling, Engineer at the property, and we have posted this information on the geological maps and cross-sections. The work of developing the 7th and 8th levels has progressed steadily but no notable changes have occurred in the ore areas anticipated.

#### E. OPTIONS AND LEASES.

Two options for exploring and lease were taken and one given during the year as follows:

An option, No. 111, was taken from the Spies Mineral Land Company on January 23, 1926, for one year, covering the entire fee of the NW $\frac{1}{4}$  of the SE $\frac{1}{4}$  and the minerals in the NE $\frac{1}{4}$  of the SW $\frac{1}{4}$  and the SW $\frac{1}{4}$  of the SE $\frac{1}{4}$  and 7/8 of the minerals in the SW $\frac{1}{4}$  of the NE $\frac{1}{4}$ , all in Section 24, 43-35 at Iron River.

An option was taken from Mr. B. Magoffin, Jr. of Deerwood, Minnesota, on August 10, 1926, for six months, covering the fee of the NW $\frac{1}{4}$  of the NE $\frac{1}{4}$ , the N $\frac{1}{2}$  of the NW $\frac{1}{4}$  and the SE $\frac{1}{4}$  of the NW $\frac{1}{4}$ , all in Section 34, 47-29, near Crosby, Minnesota.

An option, No. 112, was given to the Ford Motor Company on January 1, 1926, for one year, since extended to April 31, 1927, covering the N $\frac{1}{2}$  of the NE $\frac{1}{4}$  and the NE $\frac{1}{4}$  of the NW $\frac{1}{4}$  of Section 12, 42-33, near Alpha, Michigan. This is the Neely property on which we have a lease.

The Holman-Cliffs Mining Company, in which I understand the Cleveland-Cliffs Iron Company has a fourth interest, leased the Holman-Brown properties on the West end of the Mesabi Range from the Canisteo Mining Company from July 1, 1926 to December 1954. These properties are described as follows:

Brown No.1,	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ of	Section 21,	56-24,	Minnesota,
Holman,	SE $\frac{1}{4}$ of NE $\frac{1}{4}$ of	"	21,	" "
Brown No.2,	S $\frac{1}{2}$ of NW $\frac{1}{4}$ of	"	22,	" "
	NE $\frac{1}{4}$ of SW $\frac{1}{4}$ of	"	22,	" "
	NW $\frac{1}{4}$ of SE $\frac{1}{4}$ of	"	22,	" "

#### F. EXPLORATIONS.

Drilling explorations were carried on during 1926 in the following districts and mines:

##### FROM SURFACE.

<u>DISTRICT.</u>	<u>RANGE.</u>
Crosby-Ironton,	Cuyuna.
Iron River,	Menominee.
Tilden,	Marquette.

##### FROM UNDERGROUND.

<u>MINE.</u>	<u>DISTRICT.</u>
Cliffs Shaft,	Ishpeming.
Republic,	Republic.
Virgil,	Iron River.

Table IV, which follows, gives the footage drilled, the ore encountered, and the cost per foot of drilling for both the surface and underground explorations. It will be noted that the average cost of surface drilling was \$3.23, excluding certain items which are not actual drilling expense but which are charged to the explorations. By including these items, the average cost was \$3.85. The average cost of underground drilling in the same way was \$2.66 per foot and \$2.87 per foot, respectively.

The cost of the Tilden drilling is out of all proportion to what it will be when the work is completed. Drilling did not commence until December and the relatively small footage had to carry the large expense of moving the two drill equipments on to the property and all other incidental expenses which are met in beginning a new exploration.

The costs at the Virgil Mine include one diamond drill hole of 614' which was done on contract and cost \$3.58 per foot. Eliminating this and considering only the work done with the Waugh deep hole reciprocating machine, which was used exclusively for the drilling done in 1925, we would have a cost of \$1.49 per foot. Even this is considerably more than this drilling cost us in 1925, due principally to breakage of drill rods and expensive repairs to the drilling machine itself. As a whole, the cost of drilling in 1926 was almost exactly the same as that in 1925.

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

TABLE IV.

SUMMARY OF DRILLING FOR 1926.

EXPLORATION.	DESCRIPTION. SEC. T. R.	STAND- PIPING FT.	CHURN DRILLING FT.	DIAMOND DRILLING FT.	TOTAL FT.	FIRST CLASS ORE FT.	SECOND CLASS ORE FT.	LEAN ORE FT.	TOTAL COST "A".	COST PER FOOT "A".	TOTAL COST "B".	COST PER FT. "B".
<u>SURFACE DRILLING.</u>												
Clark,	34, 47 -29, Minn.	1068	176	2841	4085	748	370		\$15995.67	\$3.89	\$12100.10	\$2.96
Spies,	24, 45 -35, Mich.	667		1883	2550	80	60	108	8693.61	3.41	8409.57	3.30
Tilden,	26, 47 -27, "	4	2	154	160			35	1571.06	9.82	1444.46	9.03
Total Surface Drilling,		1739	178	4978	6795	828	430	143	\$26160.34	\$3.85	\$21954.13	\$3.23
<u>UNDERGROUND DRILLING.</u>												
Cliffs Shaft Mine,	9 & 10, 47-27,			2297	2297	322	92	84	8364.39	3.64	7659.95	3.33
Republic Mine,	7, 46-29,			6929	6929	703	160	398	20360.79	2.94	19377.56	2.80
Virgil Mine,	24, 43-35,		2664	614	3278	1476	83	139	7146.36	2.18	6175.21	1.68
Total Underground Drilling,			2664	9840	12504	2501	335	621	\$35871.54	\$2.87	\$33212.72	\$2.66
Grand Total Drilling,		1739	2842	14718	19299	3329	765	764	\$62031.88	\$3.21	\$55166.85	\$2.86

NOTE: COST "A" includes office expense, engineering, analysis, legal, personal injury, etc.

COST "B" excludes " " " " " " " " " " (To compare with contract price).

The drilling on both the CLARK and the SPIES explorations was done under contract by the S. E. Atkins Company, of Duluth.  
The diamond drilling in the VIRGIL MINE was done under contract by Ira Odgers of Crystal Falls.

TABLE V.

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

YEAR.	TOTAL FEET DRILLED.	COST PER FOOT "A".	COST PER FOOT "B".
1922	7634	\$3.79	\$3.44
1923	9091	3.65	3.38
1924	11007	4.10	3.54
1925	11708	3.22	2.84
1926	19299	3.21	2.86

G. SURFACE EXPLORATIONS.

G-1. CUYUNA RANGE, CROSBY-IRONTON DISTRICT.

SECTION 34, 47-29, MINNESOTA, CLARK OPTION.

An option of the Clark Mine was acquired on August 10, 1926 and drilling was started the last of September with four drills operated under contract by the S. E. Atkins Company of Duluth. Twenty nine holes had been drilled on this property previous to and during the World War and a shaft was sunk 13' into ledge for a total depth of 78'. A body of manganiferous ore was discovered but the Armistice was signed and the property abandoned before it was opened up.

Most of the old drilling was done on seven cross-sections at right angles to the lines of maximum magnetic attraction, Sections A to G, inclusive, and spaced at intervals of from 110' to 140'. Our plan of drilling has been to check the more important of the old holes, to drill deeper on the old sections and to drill at least two holes on three additional sections to the West spaced at 110' intervals. The formation is very steep so that the holes are all inclined from 60° to 70° either North or South, but most of ours are dipping to the South.

We have completed eleven holes, Nos. 301 to 307, inclusive, and 310 to 312, inclusive, and are now drilling holes Nos. 308, 313, 314 and 315. Reports by two engineers averred that there were several parallel lenses of manganiferous ore indicated by the old drilling. Our results, taken in connection with the former drilling, indicate, instead, a single main lens somewhat wider than any of those in the earlier correlations with here and there local enrichments more or less parallel to the main one.

The ore is a hard black oxide of manganese and iron running on the average about 37.25% iron, .070% phosphorus, 15.25% manganese and 16.75% silica, all dried analysis. It occurs in a hard cherty wall rock resembling the taconite of the Mesabi Range and should lend itself to a cheap method of mining without timber. It outcrops at ledge, which is covered with an average of 65' to 70' of water-bearing sand and some clay, and extends to varying depths up to 400' or more. It is quite irregular in shape, though uniformly steep. Thus far the drilling has developed about 450,000 tons but there still remain two sections to be drilled before reaching the West boundary of the property.

G-2. MENOMINEE RANGE, IRON RIVER DISTRICT.

SECTION 24, 43-35, SPIES OPTION.

An option on Spies land South and Southeast of the Spies Mine was acquired on January 23, 1926, following a reported find a while ago of rich ore of the Spies type at the bottom of a well on the Carlson farm, which occupies the surface of one of the four forties covered by this option. This forty lies immediately South of the Spies Mine.

The bottom of the well had caved somewhat and our first work was to clean it out and sink it to ledge. The latter proved to be a steeply dipping black slate with small interbedded seams of ferruginous slate. Several pieces of lean ore float were found in the hardpan on top of the ledge and undoubtedly it was this material that gave rise to the reported discovery of ore.

A part of this option, particularly the Carlson forty, appeared to be pretty well located in relation to the known geological structure of the district so we started drilling near the South boundary of the Carlson forty the latter part of March. We used one drill operated under contract by the S. E. Atkins Company of Duluth.

We put down six holes, Nos. 55 to 60, inclusive, and bottomed all of them in the footwall slate. We found a fairly thick and rich iron formation typical of the district and folded into a promising trough apparently pitching Westerly. In hole No. 56, the second one drilled, we cut 55' of good ore in one run, 10' in another and 5' in a third run. We also found the formation enriched in several other holes. We finished drilling on this option the middle of August.

Apparently we have discovered another fold in the iron formation not unlike the Spies trough. The formation is rich and of promising thickness and farther down the pitch to the West it may contain an ore body of commercial importance. To prove this it would be necessary to acquire the forties to the West and Southwest.

### G-3. MARQUETTE RANGE, TILDEN DISTRICT.

#### SECTION 26, 47-27, TILDEN EXPLORATION.

Drilling was commenced December 20th to sample the large hard siliceous ore outcrop in the NW $\frac{1}{4}$  of the NW $\frac{1}{4}$  of Section 26, and South of the old Tilden Mine. Two Company drills are employed and it is planned to test this locality for siliceous ore with eleven holes arranged on five cross-sections running about S. 15° E., or at right angles to the strike of the formation. All holes will be drilled with a dip of 60° S. 15° E. and varying in depth from 110' to 240', depending on the contour of the surface.

It is hoped we will develop a large tonnage of open pit siliceous ore of the grade we are now producing at the Ogden to take its place when the latter is exhausted.

Hole No. 1, which started in diorite, had just cut into the iron formation at the end of the year.

deep

Hole No. 2 was 73' the last of the year and, except for a 5' dike, was all in siliceous ore averaging about 42% iron, .037% phosphorus and 36% silica.

### H. UNDERGROUND EXPLORATIONS.

#### H-1. CLIFFS SHAFT MINE.

One diamond drill was operated continuously throughout the year in the Cliffs Shaft Mine. Twelve holes were completed and another started and all but one were drilled horizontally. The exception was a hole drilled vertically from the end of the 15th level "B" Shaft.

Hole No. 362 was being drilled due South from the Southwest end of the 12th level "B" Shaft at the beginning of the year to explore the fault vein territory as far as the dike footwall in hopes of developing an extension of the ore encountered in No. 361, 200' to the East. Enrichment was encountered in the fault vein but the ore was considerably mixed with jasper and it appears that the good ore does not extend quite this far West on this elevation. No. 363 was drilled due North from the same location to explore for the main vein between this drift and the hanging wall and with the exception of two narrow dikes encountered 27' of ore at the beginning of the hole.

The fault vein was explored again on the 13th level "B" Shaft by No. 364. It found no ore in contact with the fault dike but encountered 54' of good ore before reaching this point which may prove to be a branch from the main fault vein. Still another hole was drilled into the fault vein from the 14th level "B" Shaft. En-



richment was encountered but no commercial ore.

Following this, four holes, Nos.366 to 369, inclusive, were drilled from the West end of the 15th level "B" Shaft. The results were very disappointing as no good ore was encountered in any of the holes. The drill was now moved to the North side of the 1st level "A" Shaft to start a campaign of drilling on the various levels to explore the ground in Section 3 on the Oliver lease, immediately North of the Cliffs Shaft boundary.

The first hole to be drilled on the Oliver lease at this time, No.370, encountered good ore to a depth of 80' with the exception of a few narrow seams of dike and jasper. A series of three holes were next drilled from the 2nd level "A" Shaft into the same territory. The first hole did not cut ore but the second and third, Nos.372 and 373, were very encouraging. No.373 in particular had almost continuous ore from 15' to 97'. No.374 is now being drilled into this territory from the 3rd level "A" Shaft. With the exception of a 7' seam of jasper, it encountered ore from the beginning of the hole to a depth of 70'. Here it passed into hanging slate. This slate is either faulted or folded because the drill again encountered ore at a depth of 141' and was still in it at a depth of 161' on the last of the year.

H-2. REPUBLIC MINE.

Two drills operated continuously in the Republic Mine until the drilling campaign outlined late in 1925 was completed the last of August. One machine continued working until the last of October, when all drilling was stopped. Hole No.576, which was drilling at the beginning of the year, was finished and 47 new holes, Nos.578 to 624, inclusive, were drilled during this time. Two old holes, Nos.471 and 539, were also deepened.

A total of 6929' of drilling was done as follows:

<u>LEVEL.</u>	<u>NO. OF HOLES.</u>	<u>FOOTAGE.</u>	<u>FIRST CLASS ORE.</u>
Pascoe scam,	11	685'	242'
1335'	5	716	54
1570'	5	1208	48
1710'	1	124	0
1780'	6	508	107
1850'	4	566	85
1950'	6	423	119
2070'	2	231	5
2170'	1	281	6
2840'	9	2187	38
Total,	50	6929'	704'.

All the holes, except those in the Pascoe Scram and a few others, were drilled in the vicinity of old stopes having floor pillars where the downward extension of these lenses had not been encountered on the lower levels, and to explore for the upward continuation of several lenses being mined at this time so that drifts might be planned to open them up at the high elevations and speed up production.

Drilling from the Pascoe Scram was for the purpose of outlining the ore body that apparently is an irregular fringe which was left when the large ore lens just Northeast of the Pascoe Shaft was mined in an open cut many years ago. This ore is being developed during the shipping season in an incline and one level leading from it about 30' below the collar.

Six holes were drilled from a drill station in the hanging wall on the 2840' level, about 200' from the jasper contact and practically on the axis of the main Republic trough in which the bulk of the ore at this mine has been found. Two of the holes were drilled horizontally to the sides of the fold and the other four were drilled down into it. A continuation of ore was found but it becomes smaller rapidly not far below the 2910' level. One of these holes was drilled in the direction of the pitch and at a small angle with it. It encountered practically no ore at or near the hanging wall contact, which has been the locus of practically all the important ore lenses in the mine.

The past year's drilling has proven beyond much doubt that very little ore remains in the upper 3000' of the Republic trough, except in those lenses now being mined and developed. The condition of both the Paxcoe and No.9 shafts is such that should ore be found at great depth it would not be an economical operation to mine it. The drilling also indicates that the main soaprock, which is the footwall of most of the large ore lenses in the lower part of the mine, is approaching the hanging contact as depth is gained along the pitch of the trough and might be expected to cut out this ore horizon entirely within a few hundred feet below the 2910', or bottom level.

### H-3. VIRGIL MINE.

Drilling in the Virgil Mine was continuous throughout the year. Thirty two holes, Nos.41 to 72, inclusive, were drilled with a total of 3278' as follows:

<u>LEVEL.</u>	<u>NO. OF HOLES.</u>	<u>FOOTAGE.</u>	<u>FIRST CLASS ORE.</u>
3rd,	4	936'	12'
4th,	7	914	746
5th,	18	1314	693
165' sub,	2	32	10
6th,	1	82	15
Total,	32	3278'	1476'.

All but one hole, No.44, were drilled with the Denver deep hole reciprocating air drill. No.44 was drilled with diamonds by Mr. Odgers of Crystal Falls under contract. It was drilled in rock due West from the North-South drift on the Spies-Virgil boundary on the 3rd level to explore for the upward extension of the main Virgil ore body, but did not encounter it. The other three holes on this level were shallow ones drilled to explore for the continuation of the Southwest limb of the Spies ore body.

The 4th level holes were drilled from this elevation at the top of a raise put ~~down~~ up from the 330' sub-level. Four of them outlined the main ore body in the vicinity of the raise at the 4th level elevation. The other three were drilled upward on steep inclinations to follow the ore up along its pitch and dip.

The holes on the 5th level outlined the ore body quite completely, except for its Northwest limb. The two holes on the 165' sub-level were unimportant. One of them was stopped at a depth of 1' to use the drill where the information was more urgently needed.

The only 6th level hole was drilled into the hanging rock from the breast of the first Southwest drift North of the main drift to test the ground as far as the Sherwood boundary.

## I. EXPLORATIONS BY OTHER COMPANIES.

For a number of years past we have not attempted to keep close watch of the explorations conducted on the iron ranges by other companies as we used to do when Mr. Allen made periodical trips to visit them. Several, however, have come to our attention on the Marquette and Menominee Ranges the past year as follows:

The Ford Motor Company drilled all last winter and up to the middle of the summer on the NW $\frac{1}{4}$  of Section 3, 47-28, West of the old Chase Mine. They developed about one million tons of hematite ore and have taken a lease and are sinking a shaft to open it up. This property has been named the Blueberry Mine. They also did a small amount of drilling in Section 21, 47-28, on land which they own, but found nothing.

The Ford Company took an option on our Neely lease at Alpha and completely check drilled it and at the same time optioned to buy back the lease which the Oliver Company has on the land lying immediately South of the Neely. The Ford Company owns the fee of this land and they have check drilled it. The results on both descriptions are said by them to be encouraging. They are now exploring the McKenna lands on the N $\frac{1}{2}$  of Section 2, 39-30 at Quinnisec, Michigan, on the old Menominee Range.

Messrs. Odgers and McPherson continued drilling on the Spies and Barnett lands, North of the Virgil Mine at Iron River until the middle of the summer, first on their own account and later financed under option by Pickands, Mather & Company. Nothing of importance was found.

The M. A. Hanna Company drilled near the old Wickwire Mine, Southwest of Iron River and I understand they have taken a lease. A syndicate composed of D. H. Campbell and Charles E. Lawrence of Iron River and O. C. Davidson of Iron Mountain is exploring in the SE $\frac{1}{4}$  of Section 33, 43-35, about two miles West of the Hiawatha Mine. This is the old Gleason exploration and the work is being done under contract by the S. E. Atkins Company of Duluth. They have drilled two holes so far and I understand they encountered rich and relatively thick iron formation.

## J. EXAMINATION OF MINERAL LAND OFFERS.

Five mineral land offers were examined during the year and covered by special reports as follows:

No. 1610 is the Clark Mine, two miles Northwest of Crosby, Minnesota, on the Cuyuna Range. It comprises the NW $\frac{1}{4}$  of the NE $\frac{1}{4}$ , the N $\frac{1}{2}$  of the NW $\frac{1}{4}$  and the SE $\frac{1}{4}$  of the NW $\frac{1}{4}$  of Section 34, 47-29, Minnesota. We took a six months option for lease or purchase of this property on August 10, 1926 and have been diamond drilling on the SE $\frac{1}{4}$  of the NW $\frac{1}{4}$  since September 25th.

No. 1613 comprises the Spies land North of the Virgil Mine, the NW $\frac{1}{4}$  of the NW $\frac{1}{4}$  of Section 24, 43-35 and the Barnett land to the North of the Spies, on the SW $\frac{1}{4}$  of Section 13, 43-35. A considerable amount of drilling has been done here but apparently only the Eastern fringe of the iron formation was encountered and no ore of importance.

No. 1618 covers the SE $\frac{1}{4}$  of Section 30, 47-29, Minnesota. This lies about five miles Northwest of Crosby on the Cuyuna Range. No exploring has been done on this description but some drilling was done to the Northeast and to the West which discovered a small amount of manganese ore.

No.1627 comprises the NW $\frac{1}{4}$  of the SW $\frac{1}{4}$  of Section 24, 43-35, which lies immediately South of the Virgil Mine at Iron River. This property may contain an ore body in the Westerly extension of the iron formation which we developed by our drilling on the Carlson forty of the Spies option just to the East.

No.1628 covers the 32 forties in Sections 14, 23, 24, 25 and 26, 58-24, Minnesota, lying about twelve miles North of Taconite, which is on the Western Mesabi Range. No exploring has ever been done anywhere near this locality. There are several occurrences of 40% bog iron leaching out along the banks of two streams. This may or may not indicate the presence of an oxidized iron formation but we are negotiating at the present time with Mr. Charles A. Parks of Chisholm, Minnesota, for an option.

K. EXPENSE STATEMENTS.

Tables VI and VII, 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 VI.

DETAILED STATEMENT OF CHARGES TO GEOLOGICAL EXPENSE FOR YEAR 1926.

Salaries, - - -	\$18982.40
Travel, - - -	329.57
(1).Operating automobile,	833.58
(2).Supplies, - - -	878.79
Office expense, - -	<u>3.42</u>
Total,	\$21027.76.

EXPENSES OF H. L. SMYTH.

Travel, - - -	\$268.30
Supplies, - - -	16.33
Miscellaneous, -	<u>90.00</u>
Total,	\$374.63.

SUMMARY.

Expenses of Geological Department,	\$21027.76
Expenses of H. L. Smyth, - -	<u>374.63</u>
Grand total,	\$21402.39.

(1). DETAIL OF COST OF OPERATING AUTOMOBILES.

<u>ITEMS.</u>	<u>STUDEBAKER.</u>	<u>1/2 PROP. DODGE TRUCK.</u>
Gasoline, oil & grease,	\$137.90	\$61.47
Tires and chains,	125.93	10.97
Tools, - - -	None	None
Repairs, - - -	161.27	37.97
Miscellaneous, -	None	11.96
Insurance, - - -	23.64	?
License, - - -	35.20	5.60
Depreciation, -	None	111.56
Winter enclosure,	80.00	None
Battery, - - -	30.11	None
<b>Total,</b>	<b>\$594.05</b>	<b>\$239.53</b>

(2). THE MORE IMPORTANT CHARGES TO SUPPLIES.

Blue print paper, (1/3 proportion,)	\$116.65
Tracing cloth, " "	128.78
Drawing paper, " "	86.80
Level rods, bobs & scales " "	17.24
Gelatine cases, - - - - -	23.66
Maas Compass rental, - - - - -	50.00

TABLE VII.COMPARATIVE STATEMENT OF CHARGES TO GEOLOGICAL DEPARTMENT FOR LAST THREE YEARS.

	<u>1926.</u>	<u>1925.</u>	<u>1924.</u>
Salaries, - - -	\$18,982.40	\$18,509.26	\$17,832.99
Travel, - - - -	329.57	102.52	656.90
Operating automobiles,	833.58	918.93	867.82
Supplies, - - -	878.79	927.03	1,200.39
Office expenses, -	3.42	13.24	309.15
<b>Total,</b>	<b>\$21,027.76</b>	<b>\$20,470.98</b>	<b>\$20,867.25</b>
Expenses of H. L. Smyth, i.e., travel, supplies and miscellaneous,	374.63	234.30	717.06
<b>Grand total,</b>	<b>\$21,402.39</b>	<b>\$20,705.28</b>	<b>\$21,584.31</b>

SAFETY DEPARTMENTANNUAL REPORTYEAR 192611. ACCIDENTS  
AND  
PERSONAL  
INJURYa. Fatal Accidents:

The past year was the sixteenth of the Safety Department and in the future probably will be referred to as the year of the Barnes-Hecker disaster, which caused the heaviest loss of life at a mine in the history of the Lake Superior mining district. If the loss of life that was caused by this accident had been sustained throughout the past sixteen years instead of by one accident, in addition to our other fatalities, our fatality record from 1911 to 1926, inclusive, would have compared favorably with the records of other operators, but unfortunately the stigma that follows in the wake of such a disaster cannot be forgotten by a past record or a possible future record regardless how favorably it may compare with records of other companies. While this disaster thrust a heavy burden upon the Company, it would be felt more severely if it had been subjected to criticism. Opinion is unanimous in holding the belief that there had been no negligence in the operation of the Barnes-Hecker mine and that the accident was unavoidable.

The value of the Company's policy of promoting the safety and welfare of its employees has been much in evidence since the accident. The Company is held in high regard and has won the confidence of its employees, all of whom have shown by deed and word that their loyalty is beyond approach. A like attitude has been shown by our associates in the mining industry, and also by the people living in the various communities of Marquette County.

Accidents at our mines in the year 1926 resulted in fifty-five deaths. There were single fatalities at the Cliffs Shaft, Republic and Spies mines and one at the Princeton electric sub station. Fifty-one lives were lost in the flooding of the Barnes Hecker mine. The year's fatality rate, excluding this accident, was 1.62 per 1000 men employed, and otherwise would have been the fourth lowest annual rate in the history of the Company. An average annual fatality rate of 2.14 per 1000 men employed from 1911 to 1926 has been raised to an average annual rate of 3.34 by the Barnes Hecker accident. It will take years of strenuous effort in accident prevention work to absorb the heavy loss incurred this year.

The average annual fatality rate for all the Lake Superior mines from 1911 to 1924 was 3.18 per 1000 men employed. The average rate for the U.S. metal mines for the same period was 3.66 and for the U. S. coal mines from 1911 to 1923, 4.35 per 1000 men employed.

The fatal accidents occurred as follows:

Accident No. 1.

Isaac Setala, a miner, was instantly killed by a fall of ground at the Cliffs Shaft Mine, 9:50 a. m., May 21st, 1926.

Setala and his partner, Sam Siltanen, were employed in No. 45 Contract, 8th level, "A" Shaft and had started to raise from the main level. About one-half hour previous to the accident, Captain John Olds visited the contract and went up the pile of ore, which was about 15 feet above the floor level, where Setala was barring. Setala told the Captain that on quitting the night before they had blasted in the breast of the raise and that they had shot a pop in the back, where there was some loose ground which they could not bar down. The Captain noticed a vertical crack near the place where they had blasted the pop and warned Setala about the back in that particular place.

SAFETY DEPARTMENTANNUAL REPORTYEAR 192611. ACCIDENTS  
AND  
PERSONAL  
INJURY

At 9:45, Shift Boss Edward Mandley came into the working place and started to climb the pile where Setala was working. At this time Setala had his back to the foot of the raise and faced the shift boss while he was talking to him, doing no barring at the time. After Mandley started to climb the ore pile, on the foot side, Setala asked him to go around the pile and approach from the opposite side, as the back did not look safe on that side. Mandley did as Setala suggested and had gone about one-half way up the pile when he heard a crash and without looking to see what caused it, jumped from the pile into the drift. Immediately there was a fall of ground and on calling to Setala and getting no response, he came back and found him lying on top of the pile. His skull was crushed and his body badly mangled.

An inspection of the place where the accident occurred revealed a slip from which the slab had fallen. This slip was exposed six feet or more in length, three or four feet in width and carried a slight seepage of water.

Setala was a Finn, aged 40 years, and is survived by a widow and one child. The accident was classified a trade risk.

Accident No. 2.

John Extrum, a miner, was instantly killed by falling in a stope at the Republic Mine, 10:15 a. m., June 18th, 1926.

Extrum and his partner, Henry Maki, were removing a part of a floor pillar on the 1,710-foot level. They were working on a bench 22 feet below the level. They were near the edge of the pillar and on this day were drilling a row of holes near the edge of the bench. The stope extended to the 1,850-foot level. A ladder-road extended from the 1,710 foot level down to the bench, 22 feet below. The bottom of the ladder was near the edge of the bench, where the men were working. A rope, for lowering tools, hung from the top of the ladder to the bench.

Shortly after 10:00 o'clock, Extrum finished drilling a hole and told Maki that he would take the dull drill up to the level and bring down a sharp one. He went to the level, and Maki says that he heard a noise from which he knew that Extrum was measuring the drills. The next thing Maki heard was the noise of the drill falling down the ladder-road. This was followed by his partner's hat and lamp, which landed on the bench. Extrum fell down the ladder-road into the stope. Trammers, who were loading ore into the stope, heard the fall and immediately summoned Superintendent Meyers and Captain Pascoe, who were on this level at that time, and the body was removed to surface.

It was evident from the testimony of Maki that Extrum slipped in some manner in getting on the ladder with a drill in his hand. The accident probably would have been avoided if he had used the rope in lowering the drill.

Extrum was a Finn, aged 54 years, and is survived by a widow and six children. The accident was classified preventable.

Accident No. 3.

Gust Foress, an engineer employed at the Central Power Plant, Princeton, was electrocuted at 4:00 o'clock, a. m., August 4th, 1926.

The accident occurred when Foress was throwing a switch under a tower near the Princeton electric sub-station. There had been trouble on the transmission line and Foress had been instructed to throw the switch by Oscar Anderson, who is one of the electricians employed in the Gwinn district. When Foress lifted the switch handle and started to throw it, Anderson noticed an electric arc shoot across the top of the switch and

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

the horn. He called to Foress to throw the switch back in but Foress started to sink to the ground, at the same time Anderson felt a current through his feet and realized that Foress had received an electric shock. He ran to the sub-station and got a dry pole to pull Foress away from the switch. This took but a few seconds but when he returned he found Foress had released his hold on the switch and was lying on the ground. Artificial respiration was used in an attempt to revive him but failed.

The ground wire had been installed directly over one of the horns and when the arc formed, it jumped across to the ground wire, which broke off and fell to the tower. The ground wire had been erected too close to the horn gaps, and for this reason the accident was regarded as a failure to provide a safe working place, and was classified accordingly.

Foress was a Swede, aged 35 years, and is survived by a wife and three children.

Accident No. 4.

At 11:20 o'clock a. m., November 3rd, 1926, without the slightest warning, a cave occurred at the Barnes Hecker mine and in about fifteen minutes the workings of the entire mine were filled with sand and water. There were fifty-two men in the mine at the time and only one succeeded in escaping. Three others were saved by having gone to surface in the cage shortly before the accident occurred.

The ore in this mine is soft and the only mining method that could be adopted was the top slicing and caving system. The cave occurred over a small ore body about 60 feet by 225 feet, which had an overburden of 200 feet of sand, gravel and water. Two hundred and fifty feet of ground was left to provide safety, in the expectation that it would prevent a sudden inrush of surface material, such as filled the mine on the day of the accident. Twelve sub-levels, each having a vertical height of 11 feet, were mined, the first two of which were completely filled with timber. The rock associated with the ore, both on the foot and the hanging walls, was soft and it was not necessary to blast material to fill a sub-level after it had been mined. Due to excessive crushing, the first sub-level collapsed before the ore was mined and it was necessary to reopen it. There was no inkling whatever of the possibility of an opening being formed above the workings of this territory.

Any conclusion that is reached relative to what happened when this accident occurred is merely a conjecture that is largely based on personal opinion. The surviving witness was of the opinion that the material that flooded the mine came through the 2nd level before it reached the first level. There is the possibility that a large vug may have been encountered, which permitted an inflow of sand and water from ledge. When the mine was developed a large vug was struck on the second level, which was full of water. The interlocking gob of timber that must have been made by the caving of twelve well-timbered sub-levels, together with an intermingling of ore and rock from the hanging and foot walls, strengthens this explanation.

Since 1911 we have had caves of sand, gravel and water at the Stephenson, Negaunee, Maas and Morris Lloyd mines with the loss of but one life, which occurred at the Maas mine. Past experiences were kept in mind with the development of the Barnes-Hecker mine and every precaution that was thought necessary for the safety of the miners and the mine were taken.

It was apparent immediately after the accident that there was no possibility of saving life and that the task of recovering the bodies of the men within the mine would be tremendous. Within a few hours a rescue crew pene-



SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

trated the drift, which connected the Barnes Hecker with the Morris Shaft, and recovered seven bodies, which were found almost completely submerged in sand and water. After a few days spent repairing the Barnes Hecker shaft, three bodies were found in the ladderway about 450 feet from surface. Additional recovery work has been impossible.

The names, nationalities, number of widows and orphans, etc. of those who were killed by this accident, are given in the Annual Report of the Pension Department and it is not necessary to repeat such information here. The loss included men who followed every occupation to be found underground at an iron ore mine. The accident was classified a trade risk by the Central Safety Committee.

Accident No. 5.

Thomas Mitchell, a miner, was killed by a fall of ground at the Spies-Virgil mine, December 18th, 1926. This fatality occurred on the fourth level drift, 1000 feet from the shaft. The drift was being driven in black slate and had been advanced fifty feet without timber, as the rock was hard. However, the sides of the drift broke away and it was decided to put in timber. Six sets had been put in before the accident occurred and nine pops were blasted ahead of the last set of timber to make room for another set. After blasting, Mitchell's partners trimmed the back from ten minutes to one o'clock until ten minutes past two, when they decided it was secure. Mitchell, in the meantime, repairing the scraper puffer, which was being used to load the haulage cars. It was found necessary to scrape the rock which had been blasted down by the pops before the set of timber could be erected. Three cars were loaded, Mitchell running the puffer during this time. The cars were then sent to the shaft. While one of the miners was engaged picking the rock loose for the scraper, Mitchell walked around the puffer and approached to see the condition of the ground for scraping. He reached a point directly underneath where the pops had been blasted and was looking at the rock in the bottom of the drift, when, without warning, a chunk weighing about two tons, fell from the back, killing him instantly.

Shift boss Roberts had visited the place where the miners were trimming a short time before this accident and he reported that he thought the place was safe. Every precaution apparently had been taken to prevent an accident by a fall of ground.

Mitchell was a single man, 31 years old, but supported his mother. He and the men who worked with him were experienced miners. The accident was classified a trade risk.

TABLE I.

Percentage of nationalities employed and fatalities  
1898 - 1927, inclusive

<u>Nationalities</u>	<u>% Employed*</u>	<u>% Killed**</u>
Pinn	26.5	33
English	17.6	16
Scandinavian	17.0	12
Italian	11.9	12
American	8.4	7
French	8.3	7
Irish	5.3	4
Miscellaneous	5.0	9
	100.	100

\*Approximate

\*\*Percentage of total men killed.

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

TABLE II  
Classification of Fatal Accidents 1911 to 1926, inclusive  
BY the Central Safety Committee

I. Trade Risk			102	
II. Negligence of Company:				
Violation of Rules.....	4			
Failure to Provide Safety Devices....	4			
Improper Method of Doing Work.....	3			
Failure to Instruct Men.....	1			
Failure to Provide Tools or Safe				
Place to Work.....	2	14		
III. Negligence of Workmen:				
A. Injured Men:				
Improper Method of Work.....	7			
Carelessness.....	6			
Violation of Rules.....	6			
Failure to Use Tools or Appliances..	3			
Failure to Use Safety Devices.....	1	23		
B. Other Workmen:				
Improper Method of Work.....	9			
Violation of Rules.....	3			
Carelessness.....	2	14	153.	

TABLE III

Showing number of fatalities and rates per 1000 employees for thirteen years prior to safety work and for sixteen years of Safety Work.

<u>Year</u>	<u>Fatalities</u>	<u>Rate</u>	<u>Year</u>	<u>Fatalities</u>	<u>Rate</u>
1898	6	5.63	1911	5	1.89
1899	4	3.41	1912	4	1.71
1900	4	2.80	1913	11	4.12
1901	9	6.83	1914	10	4.10
1902	8	5.38	1915	5	2.15
1903	8	5.15	1916	8	2.61
1904	4	2.97	1917	6	1.73
1905	12	6.54	1918	13	3.45
1906	10	4.13	1919	11	2.79
1907	17	5.97	1920	5	1.21
1908	6	2.52	1921	6	2.60
1909	13	5.15	1922	1	.45
1910	20	6.88	1923	6	2.19
			1924	5	1.88
			1925	2	.81
			1926	55	22.30
Total	121	Avg. 4.95	Total	153	Avg. 3.34
Tons of ore					
mined per fatality	176,000			296,000	

423

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY

(Continued) b. Serious and Slight Accidents:

The number and causes of the slight and serious accidents at the mines in 1926 show no improvement over the records of recent years. Their average severity rate, measured by the number of days lost and based on the number of days of labor performed, is slightly higher than the rate for 1925. Similiar causes account for about the same number of accidents year by year and when they are investigated it appears very frequently that the margin between a slight and serious accident is a matter of good luck or misfortune. Falls of ground, tools and timber, loading and transporting ore account for the major number of accidents, and it is apparent by investigation that experience and skill are qualifications that do not always keep a miner free of accident.

It is the contention of many writers upon accident prevention work that the elimination of accidents depends largely upon the foremen who supervise the labor of those liable to injury and that their active cooperation is essential if progress is desirable. Our foremen have always shown an active interest in every policy of the Company, but as an incentive for more strenuous effort in preventing accidents, a Conference was called by the General Superintendent, which was held at the Central Office, October 9th, with an attendance of 107, consisting of superintendents, mining captains, electricians, surface and underground foremen, mine mechanics, etc. Accident frequency costs were illustrated by graphs and their various causes enumerated. A discussion of the subject was held and all present were given an opportunity to speak, after which the General Superintendent charged every man with a personal responsibility to assist in trying to eliminate needless accidents. The Barnes-Hecker accident followed shortly after the Conference and its disastrous effect has not entirely worn off, but it is hoped that the year 1927 will show improvement.

In Table III, which follows, injury rates at metal mines, as reported by the U. S. Bureau of Mines for Minnesota, Michigan and all states, are given, together with our rates. The mines in Minnesota report rapid progress in reducing injuries, if their figures are to be credited. It is no secret that competitive campaigns for favorable accident records between mines have led to a practice of covering up accidents, largely by keeping injured men on a payroll when not qualified to work. This procedure is in vogue both in Michigan and Minnesota but is carried on more extensively in the latter state. The rates for all the metal states show a gradual rise and probably is explained by a more accurate reporting of injuries in the other states.

TABLE IV.  
Injuries per 1000 workers.

	<u>1916</u> <u>to 1920</u>	<u>1921</u>	<u>1922</u>	<u>1923</u>	<u>1924</u>	<u>1925</u>	<u>1926</u>
C. C. I. Co.	175	170	168	166	152	152	155
Mich. Metal Mines	235	251	225	191	208		
Minn. Metal Mines	209	180	134	116	123		
All U. S. Metal Mines	241	249	268	275	278		

42

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY

(Continued) The most severe accidents are herewith tabulated by mines.

Athens Mine

32 accidents were reported by this mine and they represent a slight increase in frequency and severity rates as compared with the record of 1925. The hazard of injury by falls of ground apply at this mine. There are many places where the ground is known as "treacherous", due to a tendency to break away suddenly in large pieces. This is especially true when ground is exposed to the air. Miners are advised and warned by the foremen to be careful to avoid injury by this cause. Poles are kept convenient so that head protection may be provided when advancing beyond the last set of timber. The serious accidents are as follows:

<u>Name</u>	<u>Cause of Injury</u>	<u>Time of Injury</u>	<u>Time Lost</u>
Kalle Rintala	Fall of ground.	Jan. 13th.	51 Days
Frank Markala	Fall of ground.	Mar. 17th.	39 days
William Ghischia	Fall of ground.	Apr. 16th.	Refuses to return to work
Andrew Tellam	Fell 12' in ladderway.	May 10th.	114 days
George Chapman	Fall of ground.	July 8th.	Unable to work Dec. 31st.
Frank Guizzetti	Finger squeezed between car and timber.	Aug. 12th.	38 days
Arthur Paulon	Finger cut off by chunk of ore.	Sept. 1st.	81 days
Tony Guizzetti	Fall of ground.	Nov. 19th	18 days

Austin Mine

This mine had two slight accidents both, caused by falling ground.

Boeing Mine

42 accidents were sustained at the Boeing as compared with 24 for the previous year, and the total days lost are much higher. There has been considerable labor turnover at the mine, which is offered as an explanation for the increase in the number of accidents. Thirteen of the last fifteen were classified preventable. Serious accidents were:

Paul Davich	Fall of ground.	Feb. 1st.	51 days
John Koski	Blasted	Apr. 10th.	30 "
John Magnusson	Struck pick in detonators that were mislaid	Apr. 26th	Unable to work Dec. 31st.
Martin Hayduk	Fall of ground.	Apr. 26th	125 days
Joseph Andrews	Scraper hoist turned over on his foot.	June 11th	31 "
Tauno Peterson	Fall of ground.	Sept. 19th	37 "
John Rajanen	Caught between motor cars.	Oct. 17th	Probably a total disability
Joe Skalski	Knocked off railway car.	Oct. 20th	22 days
Larie Lehto	Pushed by a motor train.	Oct. 23rd	31 "
Domenic Santi	Caught between motor cars.	Oct. 23rd	60 "
Steve Kosovich	Rail fell on foot.	Nov. 16th	42 "

425

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY

Cliffs Shaft Mine

Serious and slight accidents at this mine number 60, 11 less than the number for 1925. The severity rate is also slightly less. The severest accident is that of John Tynismaa, who oiled a drill machine and when he turned on the air the oil blew out through the exhaust, striking him in the eyes. 32 accidents, one-half of the total, were due to handling or loading heavy chunks of ore and were generally classified trade risks. 17 of the 59 accidents were classified preventable. Serious accidents were:

Victor Kampinen	Struck by piece of ground while barring.	Jan. 8th	26 days
Lawrence Nelson	Squeezed finger between chunks.	Feb. 7th.	33 "
Felix Knuttila	Slipped on a sharp chunk.	Feb. 9th.	35 "
Ernest Francine	Squeezed finger between chunks.	Feb. 20th.	37 "
Fred Lessard	Chunk of coal fell on fingers.	Mar. 24th.	39 "
Elvin Nelson	Chunk rolled on foot.	May 21st.	44 "
Ernest Francine	Chunk rolled on ankle.	May 26th.	23 "
Fred Nicholls	Squeezed hand between drill & shaft runner.	June 1st.	35 "
John Hakala	Chunk rolled on ankle.	June 17th.	27 "
Victor Olliakinen	Hernia, due to lifting chunks.	June 25th.	42 "
John Tynismaa	Oil Blew in eyes.	July 15th.	76 "
Wilfred Argall	Fingers squeezed between chunk and chute stopper.	July 28th.	28 "
Fred Paju	Struck by pipe.	Aug. 20th.	49 "
Gust Carlson	Fell while carrying tripod.	Sept. 24th.	20 "

Hill-Trumbull Mine

Three slight injuries occurred at this property but one caused a loss of 60 days. Nick Skorich had a sliver run into his hand in May and a month later he was not able to work due to the slight injury having festered.

Holmes Mine

There were 26 accidents at this mine, the same number as in 1925, but the severity rate is less. Working in hard ore caused a larger proportion of severe accidents than any other cause. Nine of the total were classified preventable. Serious accidents were:

Frank Niemi	Piece of hard ore fell on thumb.	Feb. 4th.	51 days
Richard Champion	Ore fell on hip.	Feb. 19th.	52 "
James Ravello	Squeezed fingers between chunk and car.	Mar. 25th.	26 "
Arsene Tousignant, Sr.	Rock rolled on foot.	May 27th.	44 "
Herman Aho	Fell off stage.	June 15th.	28 "
John Johnson	Rope block fell on his side.	July 9th.	38 "
John Threthewey	Squeezed between drift & motor.	Sept. 2nd.	24 "
Adolph Almquist	Squeezed fingers while barring.	Oct. 15th.	37 "
Harry Brewer	Thrown by puffer rope.	Nov. 9th.	24 "

426

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

Maas Mine

This mine reported 26 accidents, 5 more than last year. The severity rate was the highest of the mines. Severe accidents were due to several causes, but this fact should not be given as an excuse for those which were classified preventable, of which there were a large proportion. This fact was called to the attention of the mining captain and the foremen of the Maas mine at the Special Safety Conference, and assurance was given that a better record would be the aim of the foremen of the mine. Serious accidents were:

Domenic Francisco	Fell off trestle.	Jan. 9th.	Not working	Dec.31.
Thomas Allen	Squeezed between car & shaft.	Jan. 14th.	44 days	
Edward Thomas	Squeezed finger between timber.	Feb. 23rd.	24 "	
Uno Kohelum	Squeezed finger between timber and truck.	Apr. 22nd.	26 "	
Adolph Laitenen	Fall of ground.	Apr. 26th.	127 "	
Nick Aho	Fall of ground.	Apr. 29th.	40 "	
Charles Pulkinen	Fall of ground.	May 14th.	Not working	Dec.31.
Joseph Holman	Fell 30 feet in ladderway.	June 7th.	72 days	
John Chiri	Fell 45 feet in raise.	June 19th.	103 "	
James Langdon	Timber rolled on foot.	June 21st.	23 "	
Fred Carlson	Fall of ground.	Aug. 17th.	53 "	
Gust Lampi	Overcome by gas.	Sept. 16th.	21 "	
Richard Oats	Caught between car & chute.	Oct. 29th.	27 "	
Sam Tripp	Caught by pole pushed by motor train.	Nov. 13th.	Not working	Dec. 31.

Morris-Lloyd Mine

This mine had 39 accidents compared with 46 in 1925. The loss of time covering these accidents was about one-half the number of days for 1925. The severest accident occurred Nov. 22nd, when James Harvey was struck by scattering pieces of dirt from a blast. This accident was discussed at the Central Safety meeting and was classified a trade risk. Harvey was not able to return to work at the end of the year, but will have no physical disability.

John Sangalli	Foot squeezed between legs.	Feb. 12th	26 days
Gust Polomaki	Stepped on nail	Mar. 16th	23 "
Lawrence Siilo	Cut foot with axe	Apr. 23rd	49 "
Walter Jacobson	Foot caught by car.	May 6th	35 "
Wm. Billings, Jr.	Caught between car & chute stand.	May 25th	37 "
Alex Niemi	Rope block fell on his leg.	Aug. 6th	22 "
Oscar Maki	Struck by piece of ore	Aug. 9th	24 "
Vincenzo Elveti	Squeezed finger between timber.	Sept. 2nd	29 "
Jacob Wirtala	Fingers squeezed while coupling cars.	Nov. 16th	35 "
James Harvey	Struck by scattering pieces of dirt from blast.	Nov. 22nd	Not working
John Perala	Squeezed finger between chute and chute handle.	Nov. 23rd.	35 days

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

Negaunee Mine

27 accidents occurred at the Negaunee mine, ten less than 1925. Their severity, as measured in the number of days lost, is slightly higher than the average for the 1925 accidents. The record however for both years is very satisfactory. Serious accidents are as follows:

Constantino Basola	Fall of ground.	Jan. 21st.	44 days
Edward Peterson	" " "	Apr. 8th.	60 "
Frank Jarvi	" " "	May 5th	117 "
Isaac Seppala	Struck by timber.	June 10th	24 "
Simon Maki	Infected finger.	June 17th	24 "
Arthur Warmanen	Finger caught by ven-tilation door.	July 14th	43 "
Emil Dahl	Bumped elbow against car.	Aug. 12th	26 "
Matt Siik	Scraper fell on leg.	Sept. 28th.	Not working Dec. 31.
Henry Siik	Fell five feet off coal runway.	Sept. 28th.	" " " "
Albert Johnson	Fall of ground.	Oct. 28th.	25 days
Dolf Wheeler	Bumped his side on rail of passageway.	Oct. 28th.	27 "

Republic Mine

Republic mine sustained 34 injuries, 3 more than in 1925. Severity rates were about the same both years. The accident of March 1st, when Andrew Augustson was thrown from a skip, and suffered a fractured skull which incapacitated him the rest of the year, accounted for one-third of the number of days lost. This was the only very severe accident that occurred at the mine, excepting the fatality previously reported. Following is the list of serious accidents.

Andrew Augustson	Thrown out of skip.	March 11th.	Not working Dec. 31.
John Savolarnin	Foot squeezed between gate level and runner	May 17th	42 days
Chas. Lawrila	Slipped against side of drift.	Apr. 14th.	19 days

Stephenson Mine

23 accidents occurred at this mine and several of them were of a very serious nature although regarded trade risk accidents by the Central Safety Committee. This mine headed the list for 1925 and the past year was slightly above the average at all mines, both in the number of accidents and severity rate. Serious accidents were:

Gust Maki	Fell off top tram car.	Jan. 27th.	21 days
John Bakala	Fall of ground.	Feb. 24th.	22 "
John Meni	Timber fell on his leg.	Mar. 29th.	36 "
Battista Volpi	" " " " "	Mar. 30th.	91 "
Peter Minelli	Hand squeezed between roller and belt.	May 5th.	39 "
Erick Soyrintki	Chunk rolled on hand.	May 20th.	33 "
John Zanardi	Slipped and fell.	May 18th.	42 "
Fred Deshaine	Blasted	June 10th.	26 "
Alfred Besola	Infected knee.	May 28th.	30 "
John Battaglio	Piece of ore struck his eye.	July 14th.	34 "
Emil Vilimaki	Fall of ground	Aug. 18th.	Not working Dec. 31.
Ermon Nocenti	Struck by bar.	Sept. 2nd.	44 Days
Albert Larson	Infected hand.	Sept. 24th.	Not working Dec. 31.
Basilio Paris	Timber fell on him.	Oct. 5th.	" " " "

SAFETY DEPARTMENTANNUAL REPORTYEAR 192611. ACCIDENTS  
AND  
PERSONAL  
INJURYSpies Mine

Spies mine reported 16 accidents and many of them were of a serious nature. The time lost by injured men on the basis of the number of days worked makes the Spies record next to the Maas, at the bottom of the list. The serious accidents were:

Renaldo Ferone	Slipped between ladder rungs.	Feb. 1st. Not working	Dec. 31.
Warner Antilla	Dirt blew in his eye.	Apr. 24th.	67 days.
Sam Trevarton	Hand squeezed between bar & drift.	June 8th.	54 "
Henry Beale	Fell, injured an old wound.	June 2nd.	74 "
John Sudeski	Caught between motor cars.	Aug. 7th.	57 "
Alex Marinowski	Wrenched his side.	Aug. 17th.	47 "
Walter Carlson	Chunk fell on hand.	Sept. 20th.	35 "

General Storehouse

Napoleon Mayrand, a teamster was injured Jan. 9th by an iron falling on his foot. He lost 60 days.

TABLE No.V.

Table giving the number of accidents by  
mines and the number receiving compensation.

<u>Mine</u>	<u>Number of</u> <u>Accidents</u>	<u>Received</u> <u>Compensation</u>	<u>No</u> <u>Compensation</u>
Athens	31	17	14
Barnes-Hecker	75	65	10
Boeing	41	28	13
Cliffs-Shaft	61	39	22
Hill-Trumbull	3	1	2
Holmes	26	19	7
Maas	26	24	2
Morris-Lloyd	39	19	20
Negaunee	27	23	4
Republic	33	18	15
Spies	16	13	3
Stephenson	35	27	8
General Storehouse	3	3	0
Miscellaneous	9	6	3
Ogden	1	1	0
	<u>426</u>	<u>303</u>	<u>123</u>



SAFETY DEPARTMENTANNUAL REPORTYEAR - 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

TABLE VI.  
Number of Accidents, number classified  
Preventable and Percentage Preventable.  
1912 - - 1926.

Year	Number of Accidents	Preventable Accidents.	Percentage Preventable
1912	207	51	25
1913	316	77	24
1914	443	118	37
1915	427	97	23
1916	592	120	20
1917	639	149	23
1918	590	124	21
1919	670	159	22
1920	708	132	19
1921	351	63	18
1922	344	90	26
1923	453	104	23
1924	407	92	23
1925	363	101	27
1926	426	140	33

c. Safety Inspection

The local mines were inspected regularly each month by the Safety Inspector, with the exception of November when his time was spent at the Barnes-Hecker and Morris mines. Two inspections were made of the Spies-Virgil mine but the Minnesota mines were not visited.

A committee of three shift bosses, William Johns, Stephenson Mine, Thomas Sargent, Athens Mine, and Thomas Tippet, Morris-Lloyd mine, inspected the local mines in June. A committee on surface and mechanical equipment, consisting of Emanuel Stephens, mechanic, Cliffs Shaft mine, Ed. Youngs, electrician, Maas mine, and John Peel, surface foreman, Negaunee mine, were appointed to inspect the local mines but important work demanded Mr. Peel's time and Mr. Moulton volunteered to act in his place. 59 recommendations were submitted by this Committee.

Quarterly inspection reports of the underground electrical equipment at the mines are made by members of the Mechanical Department. In addition there are numerous other safety inspections, as is apparent by the number of reports which were received by the Safety Department during the year, as appearing in Table VI. A careful audit of these reports is kept and when a report fails to appear the mine superintendent is notified.

TABLE VII.  
List and number of all reports  
for the Prevention of Accidents.

Cage Rider	4,407
Hoisting Ropes	3,253
Cage Safety Catches	116
Ladderways	501

SAFETY DEPARTMENTANNUAL REPORTYEAR 192611. ACCIDENTS  
AND  
PERSONAL  
INJURY(Continued) c. Preventable AccidentsTABLE VII (Cont'd.)

Skip and Cage Roads	543
Fire Hose Equipment	53
Fire Extinguishers	35
Electrical Equipment	19
Safety Inspection	101
Mine Rescue and First Aid	<u>217</u>
Total -	9245

d. Special Safety Measures:

The Central Safety Committee met 12 times in 1926. Several mining captains and members of the Mine Safety Committees were present at two sessions and participated in the discussions, Mr. C. B. Randall, of the Inland Steel Co. and his safety engineer, Mr. Fritz Olson, attended the meeting that was held in January.

Each mine now has its Mine Safety Committee, for the purpose of investigating and reporting upon all slight and serious accidents. Since these committees have functioned ~~preventable accidents~~, ~~preven-~~ as classified by the Central Safety Committee, shows an increase of about 12%, exclusive of the Barnes-Hecker accidents.

The Committee on Fatal Accidents and the Safety Inspector investigated the fatalities that occurred at the Cliffs Shaft, Republic, Princeton and Spies properties. Many serious accidents were investigated by the Safety Inspector.

Wire mesh goggles were offered Cliffs Shaft mine trammers for the protection of eyes when sledging chunks, but only a slight degree of success was noted in the use of them. Goggles at shops were inspected frequently because of a tendency of employees to work at emery wheels without them, when they are not kept in good condition.

The use of safety belts for hazardous work in raises and shafts is increasing. Several costly accidents would have been avoided if this device had been used more frequently.

Fire doors were tested by the Safety Inspector, and it was decided that more frequent inspections should be made by mine employees. Larger and additional signs, designating the 2nd outlet, were posted in several of the mines.

The attention of surface and shop foremen was called frequently in the fall and spring to the hazard of ice falling off buildings.

Abandoned properties were inspected in May and a crew of men were employed several days repairing fences.

Photographs of several employees, who are crippled as a result of infected injuries, were posted at the mines, and an appeal was made soliciting for first aid treatment of injuries.

A chart, showing the accident records of all mines for 1925, was posted at each mine. The Stephenson mine was at the top of the list and each employee was given a cigar.

A description of preventable accidents is given monthly to captains and foremen and also posted in the bulletin boards. The material in the bulletin boards is changed weekly and magazines, articles, etc. which treat on safety subjects, are placed in the foremen's change rooms.

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR - 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY

(Continued)

e. Rules and Regulations:

Arrangements had been made to examine a limited number of men at each mine on their familiarity with the Company's rules and regulations but the members of the examining committee, Messrs. Rough, Moulton and Conibear, were busy at Barnes Hecker and it was thought also that our employees were thinking of safety at that time without taking this method of interesting them.

Several employees were penalized by being given a few days lay off for having disregarded safety rules or for being careless, but the number was comparatively few. Rarely is it found that an accident can be charged to a flagrant violation of a rule or to wilful negligence.

533 receipts for rule books were received by the Safety Department, just two less than the number received in 1925. 376 were English, 110 Finnish and 47 Italian, and the proportions by nationalities for both years are about equal.

f. First

f. First Aid Work

In accordance with the Company's policy of training additional men each year at all operating mines, when conditions permit, seven new first aid crews were organized at the Barnes-Hecker, Morris-Lloyd, Holmes, Cliffs Shaft, Athens, Negaunee and Maas mines. At the Republic and Stephenson mines training was confined to men who had had training in previous years and was in the nature of review work. Practice work was suspended during August and September due to special mine rescue work under direction of the Bureau of Mines and also during November when Mr. Williams assisted Mr. Moulton and the Safety Inspector.

80 first aid practices were held during the year in which 85 men took part.

During 1912 to 1926, 637 men received more or less First aid training, 509 men have completed the course and awarded Company First Aid Certificates, 17 are deceased, 5 are pensioned, 155 have left the Company, leaving a total of 332 employed men qualified to render first aid to the injured.

First aid supplies, amounting to \$344.68, were purchased in 1926 and are being distributed as needed. An ample supply is kept at all properties to take care of any emergency which may arise.

With the exception of a few very slight accidents all injured workmen were given first aid treatment and no criticism has been heard relative to this work.

TABLE NO. VIII.

Showing number of men trained in  
First aid Work. 1912 to 1926.

Number men receiving training 1912 to 1926.....	637
Number receiving certificates.....	509
Number deceased.....	17
Number pensioned.....	5
Number now in employ of Company.....	329

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

TABLE No. IX.  
First Aid Supplies for 1926.

125 Rolls Bandage, cut.....	\$ 116.25
9 Doz. First Aid Packets.....	38.88
4 Doz. Handy Fold Gauze - 6x36".....	28.80
2 Doz. Boxes Handy Fold Gauze 18x36"	12.60
2 Doz. Handy Fold Picric Gauze.....	11.70
8 Doz. Z. O. Tape.....	33.30
6 Lbs. Absorbent Cotton.....	4.50
5 Doz. Carbolated Vaseline.....	14.40
3 Doz. Aromatic Spirits of Ammonia....	11.52
9 Gross Leather Finger Cots.....	58.50
2 Gals. Iodine.....	13.40
Postage.....	.83
	<u>\$ 344.68</u>

f. Mine Rescue Work:

113 mine rescue practices were held during the year in which 77 men took part. From August 23rd to September 10th the U. S. Bureau of Mines Rescue Car, No. 8, was stationed at several of the Company's local mines and three or four men from each mine in this County were given one week's training under the direction of Mr. A. J. Martinson, the foreman in charge of the car. Each man was given a thorough physical examination by one of our physicians. Training consisted of lectures, apparatus inspection, wearing apparatus in a mine, building brattices and training in gas and smoke. At the conclusion of the training the men were awarded Bureau of Mines Mine Rescue Certificates for mine rescue work.

From 1912 to 1926, 390 men have received more or less mine rescue training; 16 are deceased; 7 of whom lost their lives in the Barnes Hecker disaster; 1 is pensioned; 84 disqualified on account of advanced age or other unfitness and 132 have left the service of the Company, leaving a total of 159 men qualified to wear mine rescue apparatus now in the employ of the Company. Supplies and repairs for the year amounted to \$325.22.

30 Edison electric safety mine lamps and a ten lamp charging panel were received by the Safety Department. They were purchased originally for use in the Barnes Hecker mine during recovery operations in the shaft, as it was thought imperative to have lights that would not be extinguished by sudden rushes of air or water. This lamp is used in many coal mines where open lights are not permissible. The lamps are assembled, lighted and locked on surface and will burn eight to twelve hours showing a good light. They will be distributed among our rescue stations.

SAFETY DEPARTMENTANNUAL REPORTYEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

TABLE No. X.

Showing number of Men trained in  
Mine Rescue Work - 1912 to 1926.

Number receiving training.....	390
Number deceased.....	16
Number pensioned.....	1
Number disqualified.....	84
Number left employ of Company.....	132
Number now in employ of Company qualified to wear Mine Rescue Appara- tus.	159

TABLE NO. XI.Mine Rescue Supplies and Repairs

300 Lbs. Cardoxide.....	\$105.00
25 Side straps for Mouth Breath- ing Attachment.....	75.00
11 Cylinders Oxygen.....	39.27
5 Refillable Regenerator Cans....	60.00
88 ft. Armord Cable.....	17.82
3 Gals. Glycerine.....	9.00
Miscellaneous Items.....	<u>19.13</u>
	\$325.22

g. Miscellaneous Statistics:

g. Misc.

TABLE No. XII.Comparison of Fatality Rates for Coal Mines, Metal Mines, etc.

Year	U. S.		Minn.	Mich.	C. C. I.
	Coal Mines	Metal Mines	Metal Mines	Metal Mines	Company
1911	4.97	4.45	5.46	4.28	1.89
1912	4.46	4.09	3.15	3.22	1.71
1913	4.70	3.72	3.16	3.12	4.19
1914	4.66	3.92	2.93	3.97	4.10
1915	4.44	3.89	2.71	3.74	2.16
1916	3.94	3.62	2.59	3.76	2.61
1917	4.25	4.44	3.04	3.40	1.76
1918	3.94	3.57	3.25	3.31	3.45
1919	4.27	3.43	3.09	2.99	2.79
1920	3.62	3.16	2.61	3.25	1.21
1921	4.11	3.09	2.51	3.63	2.60
1922	4.89	3.54	3.03	2.17	.43
1923	4.39	3.01	2.08	2.03	2.19
1924		3.51	5.61	2.30	1.88
1925					.81
1926					<u>22.30</u>
Average	4.35	3.66	3.23	3.22	3.34

SAFETY DEPARTMENTANNUAL REPORTYEAR 192611. ACCIDENTSAND  
PERSONAL  
INJURY

(Continued)

TABLE No. XIII.Classification of Causes of Fatal Accidents  
from Dec. 1st, 1898 to January 1st, 1927.

<u>A. Fall of ground or timber:</u>		
Back or side (drift, raise or stope).....	84	
Fall of chunk or ore from chute .....	2	
Stray chunk or stick down raise or stope....	2	
Run of mud or sand.....	60	
Run of ore in stope.....	1	149
<u>B. Shaft Accidents:</u>		
Falling down shaft.....	12	
Rock or timber falling down shaft.....	2	
Being struck or caught by cage, skip, bucket or tool.....	8	
Falling from cage, skip or bucket.....	11	
Falling from ladder in shaft.....	5	
Being carried or pushed into shaft by car...	3	
Attempting to jump on or off cage, skip or bucket.....	3	
Being struck by crosshead.....	5	49
<u>C. Use of Explosives:</u>		
Explosion of powder.....	14	
Premature blast.....	3	
Fall of ground or timber due to blast.....	4	
Being overcome by gas.....	3	
Erysipelas resulting from blast.....	1	25
<u>D. Mine and Railroad Cars:</u>		
Being caught by haulage cars.....	11	
Riding or attempting to ride cars.....	5	
Falling with car from trestle.....	4	
Being run over by railroad car.....	6	
By miscellaneous causes.....	1	27
<u>E. Miscellaneous Causes:</u>		
Falling in raise or pocket.....	7	
Falling from ladder, trestle or stage.....	4	
Falling with machine or tripod.....	2	
Being caught under pump rod.....	2	
Contact with electric wire .....	5	
Asphyxiation due to mine fires.....	3	
Being pulled into sheave.....	1	24
<u>T o t a l - 274</u>		

Average Percentage of Accidents by Causes

A. 54%    B. 18%    C. 9.5%    D. 10%    E. 8.5%

SAFETY DEPARTMENTANNUAL REPORTYEAR 192611. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)TABLE No. XIVCauses of Accidents1925 and 1926Exclusive Barnes-Hecker Accident of Nov. 3, 1926

	<u>1925</u>	<u>1926</u>
Fall of ground from back or side of drift, stope or raise.....	54	68
Fall of timber from back, stray chunk down raise, etc.	8	15
Shaft Accidents.....	2	2
Use of Explosives.....	3	9
Mine and Railroad Cars.....	30	34
Falls of Persons.....	12	12
Squeezing finger, hand or foot between timber, pieces of ore, etc.....	45	36
Strains and wrenches.....	19	18
Chunks of ore or rock rolling down piles, off cars, etc.	31	25
Struck by glancing tool, timber, dirt, etc.....	35	56
Struck by axe, pick, shovel, hammer, etc.....	25	21
Falling tools, material, etc.....	15	19
Stumbling or slipping causing a fall.....	27	22
Catching finger, hand or foot in moving machinery.....	29	16
Nails and splinters.....	8	7
Infection from various causes.....	8	6
Miscellaneous causes, underground.....	8	4
"          "          surface.....	6	5
	<u>363</u>	<u>375</u>





SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1926

11. ACCIDENTS  
AND  
PERSONAL  
INJURY  
(Continued)

TABLE No. XVI

Supplies

Office Equipment, printing, calendars, etc.	\$154.56	
Mine Rescue and First Aid	71.63	
		<u>\$226.19</u>

Travelling

Inspector	453.44	
Mine Rescue Foreman	235.93	
Messrs. Rough, Graff, et al	102.47	
Committees	156.55	
		<u>948.39</u>

S a l a r i e s 7440.00

Grand Total - \$ 8614.58

Respectfully submitted,

*Lutwain Corbett*  
Safety Inspector.

MECHANICAL   DEPARTMENT

ANNUAL   REPORT

YEAR   1926

HARD ORE & OTHER SHOPS:

Our shop conditions and methods of operating them are in a deplorable way. An attempt to remedy this has been made several times in the past, but has never succeeded. This effort will probably suffer a like fate, but it will at least serve as a record that the conditions exist and should be corrected, even if they are not.

The entire mining department is quite well satisfied with conditions as they now exist and the only one opposed to them is the Chief Mechanical Engineer.

Modern manufacturing methods have emphasized two things - mass production and the value of close supervision of shop methods and labor. In our shop these two things are absolutely ignored. To produce a certain amount of shop work we are operating eight shops instead of one. In Ishpeming, within a radius of one-half mile we are operating three shops. In Negaunee there are also three shops. There is not in the whole eight a competent foreman. Most of them have no foreman whatever. Very few of the men are trained mechanics, that is, men who have served a regular apprenticeship and are qualified to hold a job at this trade. With the work split so many ways no shop is big enough to furnish work so that apprentices can be trained. Vacancies are filled by "handy men", who have a smattering of the trade and no more. Work by such men is turned out and there is no check on its accuracy or quantity. These men are not capable of any speed on machine tools because they have never been trained, and it is inevitable that men working without supervision will slow down, and when slowed down will never get back up to speed of their own accord. When shop work is slack they will slow up and when there is a rush it is made up by overtime and Sunday work. The whole method is a relic of 40 years ago and seems impossible of destruction. There is some psychology in it. When a job is done at the General Shops a bill is rendered for time, labor, material and overhead, which is as it should be. This bill looks big to the mine and they conclude that the bill is unjust and they can do it cheaper, hence the individual mine shop, where no cost system is kept and they are blissfully ignorant of what the work does cost. If a poor job is done nobody hears about it. If it is spoiled and made over and over again they get by with it. Standardizing is absolutely impossible as every shop is on its own and would feel disgraced to use an appliance or method worked out by another, but delight in working out a different way. The men come to work late, take extra time at noon and wash early at night. The men are not to blame, it is the system that is at fault and the custom which has maintained since the beginning of the iron ore industry, and age old customs are hard to break up.

There are many other angles to this question and a book could be written on it if necessary. It is manifestly inadvisable to equip eight shops with modern tools. Some of these tools would not be used one-half of one percent of the time. At the same time with high price of labor it is a crime to use antiquated machinery. We have some machines in service which date to before the war, and the Civil War is meant by this designation.

Our General Shop is not run as it should be, for want of a competent foreman. There are so few men working there that we can not afford to have a bang-up-to-date man in charge, so we have to put up with a less competent one. A man such as we should have would be competent to lay out work, both machine and other work, and follow each job through and see that the costs are right. He should see that all machines are in shape to get out speedy and accurate work

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

HARD ORE & OTHER SHOPS: (Cont'd)

and that modern methods are used. We can not afford a man of this capacity in a shop with only three machinists working. The shop costs at present carry an abnormal charge for the central heating plant at the old Brownstone Boiler Room. For reasons already described the mines avoid the General Shop as much as possible, and this gradual reduction of work increases the percentage of this excess charge.

If it were possible the General Shop might be shut down, but this is not possible because there is a lot of work the mine shops can not do.

There is less reason now for so many shops than there ever was before because we have good roads and trucks, which facilitate delivery of work between mine and shop.

- - - - -

441

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

CLIFFS SHAFT MINE:

During July one of the #5 McCully crushers was dismantled and transferred to the Holmes Mine to replace a #6 McCully crusher which was later transferred to the Morris Mine.

A new herringbone gear and pinion was installed on the top tram plant to increase the rope speed and capacity of the plant.

There were no other changes or additions made to the mechanical equipment at this mine. All mechanical equipment operated in a satisfactory manner.

HOLMES MINE:

On January the 3rd the crankshaft on the Aldrich quintuplex pump broke. We had some trouble getting delivery on a new shaft. This finally arrived and the pump was put in operation again on April 21st. This breakdown did not cause any delay as the centrifugal pump handled the water without any trouble.

The #8 McCully crusher gave us some trouble in February. The main gear broke and sprung the pinion shaft. This gear was replaced by a new one which was in stock at the mine. The shaft was taken from the South Jackson crusher, also a bearing cap, and they were installed in the Holmes crusher. New parts have been received to replace those taken from the Jackson crusher.

One of the #6 McCully crushers was dismantled in August and transferred to the Morris Mine. This crusher was replaced by a #5 from the Cliffs Shaft Mine.

There were no other changes or additions to the mechanical equipment at this mine.

OGDEN MINE:

The new Bucyrus 80-B electric shovel was received on March the 23rd and started loading in May. We had some trouble with a bearing on the generator, which finally wore in and gave no more trouble.

A new set of tubes was put in the intercooler of the air compressor to replace the old tubes, which were leaking very badly.

The electric shovel was shut down on October 27th and laid up for the winter.

ATHENS MINE:

Some trouble developed in the low pressure cylinder of the Ingersoll-Rand air compressor. New piston rings were made at the Hard Ore Shops and the compressor again put in operation. This cylinder is worn very badly and it is necessary to rebores and fit a new piston in it. This work will be taken care of as soon as the new piston is received, this having been ordered some time ago.

On June 9th the brake arm bracket on the skip hoist broke. This bracket was patched and used until a new one was received and installed.

On August 4th the shaft in the north skip head sheave broke inside the hub, causing about six hours delay. A spare sheave, which was in stock at the

442

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

ATHENS MINE: (Cont'd)

mine, was used to replace the broken one. A new bearing support was put in the head frame so that the bearings can be set in close to the hub on the sheave. This girder should prevent any further trouble of this kind.

All other mechanical equipment operated satisfactorily.

MAAS MINE:

On January 9th a bolt on the connecting rod of the Gould triplex pump on the fourth level broke, bending the connecting rod and breaking the cross-head guides. This pump was repaired with parts taken from a pump that was not in operation at the Morris Mine.

The steam turbine was operated from February 4th to 13th on account of a breakdown at the McClure Plant. The turbine was again put in operation from March 28th to April 1st on account of low water in the storage basins.

A set of chilled cast iron plungers was installed in the third level Prescott pump to replace a set that was worn out.

All other mechanical equipment operated satisfactorily. No changes or additions to this plant.

MAAS CRUSHING PLANT:

The steel work for the new crusher building was completed on January the 14th. The new crushers for remodelling this plant were received on March 13th and the balance of the equipment in April. The installation of this equipment was completed and the plant put in operation on May the 6th. Some trouble developed in a reduction gear box on the belt conveyer. This was finally taken care of and did not give us any more trouble.

The short toggle in the jaw crusher broke on July 21st, causing a delay of 48 hours until a new one was received by express from Milwaukee. The concaves were reversed in the 10" McCully crusher on August 23rd on account of being worn out. In September two sections of wearing plates in the revolving screen were changed from 2" dia. holes to 3" holes. This change improved conditions considerable as there is not as much fine material going into the 10" fine reduction crusher. A new breaking head was put in this crusher during September as the old one was worn out.

This plant completed crushing on November 13th.

A few men are still at work as there are several changes to be made to the plant before the crushing season opens.

NEGAUNEE MINE:

A little trouble developed in the steel stocking trestle, but did not cause any delay. This trestle has been repaired and is now in good condition.

In November a new spray cooling pond was built to replace a cooling tower which was in very poor condition.

There were no other changes or additions and all mechanical equipment operated in a satisfactory manner.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

443

SOUTH JACKSON CRUSHING PLANT:

This plant was operated from September 30th to October 19th. It was necessary to operate this plant because the Maas Crushing Plant could not handle all the ore there was to be crushed.

BARNES-HECKER MINE:

In February a fire in the top tram control house, which is located in the head frame, destroyed part of the control equipment. The cause of this fire is unknown. The control was repaired with spare parts from the General Storehouse.

The crankshaft on the Aldrich triplex pump on the third level broke on April 21st. This pump was operated with one plunger until the new crankshaft was received and put in on August 9th.

The drainage ditch was completed in July and the locomotive crane moved to the Hard Ore Yard for storage.

On November the 3rd a cave-in occurred at this mine which buried the three underground pumps, two 1,000 G.P.M., 1,000 ft. head, centrifugals and one Aldrich plunger, 1,000 G.P.M., 1,000 ft. head.

All other mechanical equipment operated satisfactorily.

LLOYD MINE:

There were no changes or additions made to the mechanical equipment at this mine. All mechanical equipment operated in a satisfactory manner.

MORRIS MINE:

The concrete foundation for the #6 Mc Cully crusher was completed in October and the crusher is assembled on the foundation. The steel men completed the changes necessary in the head frame to make room for a grizzly screen to the crusher.

The skip hoist has been rebuilt and changed from a double reduction drive to a single reduction drive. A new herringbone gear and pinion was used on this change to increase the rope speed about 500 feet per minute. A new 600 H.P. Westinghouse motor was also installed on this hoist. This was necessary on account of the increase in rope speed.

There were no other changes or additions to the mechanical equipment at this mine. All equipment operated satisfactorily.

SECTION 6 SHAFT:

No changes or additions to the mechanical equipment at this shaft. Operation was satisfactory throughout the year.

AUSTIN MINE:

Work at this shaft was resumed in March. The old Austin skip was repaired for use in the incline shaft. Eight new underground scrapers were made up.

In May the primary contact fingers on the skip hoist control burned,

AUSTIN MINE: (Cont'd)

causing a two hour delay.

On July 21st an old crack in the outer pinion bearing on the hoist motor opened up a little more and all the oil ran out of the bearing, causing a delay of  $1\frac{1}{4}$  hours.

GWINN MINE:

No work at this mine except pumping.

In April a bushing in the packing end of the high pressure water end of the 7th level centrifugal pump wore out and was replaced with a new one. The pump was idle three days while being repaired.

The ventilating fan motor on the 11th level was burned out during a storm on August 4th.

GWINN CRUSHING PLANT:

This plant operated from May 3rd to November 8th.

In October a bearing on the top pulley of the 36" rubber belt conveyor broke, causing a delay of about two hours.

GARDNER-MACKINAW MINE:

Idle the entire year.

PRINCETON MINE:

Idle with the exception of the underground pumps. These operated satisfactorily throughout the year.

PRINCETON CENTRAL POWER PLANT:

Early in the year the boilers and economizer were repaired and put in good shape.

The steam turbine was operated on April 12th and 13th.

No trouble with any of the mechanical equipment during the year.

PRINCETON PUMP STATION:

The steam pumps were idle the entire year. No trouble was experienced with the electric pump.

STEPHENSON MINE:

In January one pole on the Prescott 5th level pump was replaced with a new one.

In February the axle broke off in the auxiliary shaft head frame sheave on the 6th level. This was replaced with a new sheave made up at the Hard Ore Shops.

In November the Ingersoll-Rand air compressor from the South Jackson Mine was installed in the engine room. This machine is 16" & 10" x 14", capacity 600 cubic feet per minute and is driven by a 100 H.P. General Electric



STEPHENSON MINE: (Cont'd)

motor. This compressor is to be run on night shift only, enabling us to shut down the big compressor at the Central Power Plant nights.

BOEING MINE:

At the beginning of the year the shop crew was kept busy making up scrapers and equipment for underground slushing machines. After experiments with two, the number was increased until nine electricians and one air machine were in operation.

Some trouble was experienced with moisture in the compressed air. This was traced to intercooler tube leakage and a leak in low pressure cylinder water jacket casting. A new set of copper tubes was installed in December to replace the aluminum tubes that kept developing leaks, and the air is now dry again.

A new Master Mechanic, Thomas Slattery, was hired when Ed. Walline left March 1st to work for the Denver Rock Drill Co.

Some repairs were necessary on #28 shovel in the Spring. A new bottom was put in the water tank. A 1" x 6" x 6" angle added to the back of the dipper where cracks had developed due to thrust of dipper braces. The machine started work on April 26th and during the season broke a main hoisting gear and two shipper shaft pinions. As these repairs could be secured from the Oliver Iron Mining Co., only 24 hour delays were caused. The coal hoist on this machine was improved by using a boom engine from the scrapped #12 shovel to swing the crane instead of the hand crank supplied with the machine. One ballast compartment was cleaned out and on inspection found to be in first class shape, no excessive rust of steel members being observed. The pistons of oil operated equalizing jacks caused too much oil leakage, due to scoring. This was taken up with the factory and the Marion Shovel Co. is now fitting these jacks up with bronze bushings free of charge as fast as they can be returned to the factory. The shovel finished loading on November 11th. With the exception of removing part of the boiler flues and re-bushing the boom point sheaves, no repairs have been added.

While sinking the Pit shaft, started in June, some trouble was experienced with water. As the flowage increased with depth the 50 H.P. spare locomotive boiler was moved over from the Hill-Trumbull to supply steam when the air supply was inadequate. When the second level was reached the old Crosby Mine 1,000 G.P.M., 175 ft. head, electric pump was installed. Due to mud in sump this pump was drowned on November 30th and was not recovered until December 7th. A permanent pump house is being put in on the second level, in which will be located one 800 G.P.M., 350 ft. head, Allis-Chalmers centrifugal and the centrifugal now in use.

In June a small hoist, equipped with a 50 H.P. motor, was installed to handle the pit shaft sinking bucket. This was received from Ishpeming and is a second hand machine.

On May 20th the condemned #20 shovel was wrecked and shipped for scrap on July 14th.

No. 22 shovel started loading stockpile April 19th and was used here and in the pit on short stripping jobs all summer. A Model 75 Marion shovel was rented from Winston-Dear Co. from May 29th to June 11th, while #22 shovel was busy in the pit. In July a 35-ton Osgood shovel was overhauled at the shop and then used in the pit to cut track approach to lower bench.

446

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

BOEING MINE: (Cont'd)

In the first level pump house, the old Prescott centrifugal pump from the Lake Mine was scrapped and the 800 G.P.M., 350' head, Allis-Chalmers pump moved from the east end of the pit and used in its place. A new water end was purchased from Allis-Chalmers Co. to replace the Prescott centrifugal and will be used on second level with the 125 H.P. General Electric motor from the Prescott Centrifugal pump.

CROSBY MINE:

Due to the M. A. Hanna Co. moving the pump station from the Crosby Mine engine house to a location nearer the dam, about 3,000 ft. of 10" pipe was not needed, as well as the Prescott plunger pump in engine house. At the request of the M. A. Hanna Co. this material was moved to and stored at the Hill-Trumbull Mine during november. The switchboard was used in the engine house at the Boeing Mine for circuits to the pit, top tram and second level pump house.

A Cameron 1,000 G.P.M. electric driven centrifugal pump was added to the pump station and both pumps equipped and operated by remote control from the mill.

The three 75 K.V.A. transformers were returned to the LaRue sub-station from storage at the Hill-Trumbull and used to operate the washing plant.

HILL-TRUMBULL MINE:

After completion of repairs to locomotives, cars and shovels, operations in the Pit started May 1st on track cleaning.

The washing plant started May 5th, but had a 6 hour delay due to the 20" water line settling and breaking a 12" valve. One other delay of four hours occurred during the season, this being on August 25th, when the screen motor had bearing trouble. A split end bell was purchased for this motor and this will cut the delay by three hours if such trouble occurs again.

In the Spring 25 new conveyor rollers were purchased from the Stevens-Adamson Co. to replace part of the old rollers under conveyor belt. Considerable work was put on pan conveyor to straighten and reinforce the pan links, but by the end of the season these were again in bad shape, due to the head drive steel drum being badly worn. This is being repaired by building up the worn parts and straightening the links. The receiving pocket plate was badly worn and is being revamped to cause less wear on pan conveyor.

The tailings pond dyke caused very little trouble during the season, as most of the tailings were deposited in #1 basin, the dyke wall of which was built high during the fall of 1925. A second hand 1½ yard gas driven dragline, built by the Austin Machinery Co., Muskegon, Mich., was purchased in September for \$1,000.00 and will be used on the dyke during 1927. It will be put in good condition at the shops before starting on the dyke job.

In the Pit the #26 shovel had two short delays. The hoisting drum shaft broke on June 26th and was replaced with one on hand. On June 27th one jack arm broke and almost tipped the shovel over. This was replaced with one on hand. The jack arms on this machine are of poor design and should be rebuilt to make the machine safe. In September locomotive #101 broke the valve gear on the left side, while going up on rock dump at night by hitting a boulder which had rolled too close to the track.

447

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

HILL-TRUMBULL MINE: (Cont'd)

The washing plant was closed down on October 9th after washing 378,405 tons of concentrates for the season, working only day shift with an average of 2,805 tons per day. The tables ran only ten days during the season, and these were mostly test runs to prove that there was not sufficient fine ore to pay to operate them.

WADE MINE:

Pumping continued during the year. In April, due to a bad cave of ground from surface that filled the sump, the maximum horse power jumped from 78 to 164 and increased the yearly minimum by \$2,377.13. This was partly used during the remainder of the year when the Dohm Construction Co. used the electric hoist and sump pump at the Helmer incline to get out 10,000 tons of ore during August, September and October, and also the Wade Mine drifts and sump were cleaned during October and November. During the shipping season #23 shovel cleaned up the stockpile and was moved to the Boeing Mine on November 11th.

A 4" water line was laid along the Location streets and alleys and connected to the underground pumps for fire protection. With 400 feet of hose a stream of water can be played on any house in the Location.

REPUBLIC MINE:

There were no additions to or changes in the mechanical and electrical equipment at this mine during the year, and no accidents of any consequence.

SPIES MINE:

The two cast steel crankshafts on the Prescott underground pumps, which were broken in 1925, were replaced with forged steel shafts. One pump body was also replaced during the year. These three items were furnished by The Prescott Company without charge.

The old Chase Mine hoist, which was used on the stockpile, was shipped to the Barnes-Hecker Mine to be used in emergency. This hoist is now at the Morris Mine, where it will be used a short time, after which it can be returned to the Spies Mine if needed, or used elsewhere.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

448

ELECTRICAL DEPARTMENT:

The operation of our electric plants, now The Cliffs Power & Light Company, was very satisfactory during the past year. The steam plants were in service a total of only fifteen days, and we closed the year with the largest amount of stored water in the history of the plants. Very few interruptions occurred and service was extended to outside parties. A burned out bearing and a crack in water wheel at the McClure Plant was the only trouble of any consequence.

The final completion of the Dead River Storage Dam was made, with wave screens and booms to protect the back and additional toe fill and drainage for the front of the levee. The stabilized conditions are as expected and entirely satisfactory.

A new Substation to serve the Palmer District was installed. This consists of two 625 K.V.A., 30,000/2300 volt, General Electric transformers with oxide film lightning arresters and metering apparatus. Approximately one-half mile of high tension line was built and a two circuit transfer tower erected at the line junction. A 2300 volt feeder line was extended from this Substation to serve the Empire Mine.

One additional 500 K.V.A., 30,000/2300 volt, General Electric transformer was installed at the Cliffs Shaft-Holmes Substation, which makes six 500 K.V.A. transformers at this station now. This is to provide capacity for the Oliver Iron Mining Company service at Section 16 Mine. A #4/0 stranded, 3 phase, line was built to this mine and the service established in December. This extension was covered by E. & A. #496, which has been completed.

The transmission line to the Hoist Plant has been re-insulated for 30,000 volts and necessary junction switches installed. Three 667 K.V.A., 30,000/2300 volt, General Electric transformers have been set in place at the Hoist Plant. Circuit breaker and lightning arrester will be put in and the connection made for this apparatus next Spring. This work is covered by A. & A. #498, and its purpose is to give us additional peak load capacity.

The apparatus for small Substations to serve Champion and Chatham has been received, but the service has not yet been established. These are covered by Cliffs Power & Light Company E. & A's #4 and 5.

A 1500 K.V.A. synchronous condenser was ordered for installation at the Brownstone Substation to improve regulation and reduce losses. Due to a defect under factory test this has not been received, but should come through very soon. The four Westinghouse oil circuit breakers ordered for this Substation have not been received, but they should be in service early in 1927.

Conditions are very favorable for a profitable year in 1927 as there is ample water in storage to assure continuous service.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department: (Cont'd)Summary of Operating Conditions - 1926.

Month	-	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Precipitation	-	0.66	1.24	2.54	0.77	0.86	3.68	5.42	4.33	7.19	2.83	4.41	1.76
Total Precipitation at Ishpeming during 1926 - 35.69 inches.													
Average	"	"	"	Marquette			- 32.8	"					(46 year record)

CARP RIVER HYDRO-ELECTRIC PLANT

Drainage area above Intake Dam,	66.66 sq. miles.
Cubic feet Precipitation in 1926,	5,527,114,433
Kilowatt Hours generated in 1926,	11,086,600
Cubic feet water utilized (90 cu. ft. = 1 KWH.)	997,794,000
" " " in Carp Storage Basin Jan. 1, 1926,	88,099,600
" " " " " " " " Dec.31, "	398,216,400
" " " stored in 1926,	310,116,800
" " " wasted over Intake Dam in 1926,	481,364,000
Total run-off for the year 1926,	1,789,274,800 cu. ft.
Run-off per square mile of drainage area,	26,841,806 " "

	<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>
Total Precipitation,	30.11	26.53	38.4	36.83	25.46	31.05	29.50	27.40	30.38
Second ft. per sq.mile,	1.03	.67	.93	1.29	.70	.79	.83	.73	.68

	<u>1922</u>	<u>1923</u>	<u>1924</u>	<u>1925</u>	<u>1926</u>
Total Precipitation,	33.67	21.90	22.95	20.71	35.69
Second ft. per sq.mile,	1.06	.59	.50	.25	.85

McCLURE HYDRO-ELECTRIC PLANT

Drainage area above Intake Dam,	140.52 sq. miles.
Cu. ft. Precipitation in 1926, (Hoist Plant 43.85")	14,315,098,406
Kilowatt Hours generated at McClure Plant in 1926,	25,481,800
Cubic feet water utilized (125 cu. ft. = 1 KWH.)	3,185,225,000
" " " wasted over Intake Dam in 1926,	1,832,276,000
" " " in Hoist Storage Basin Jan. 1, 1926,	534,405,122
" " " " " " " " Dec.31, "	1,601,178,288
" " " stored in Hoist " in 1926,	1,066,773,166
" " " in Silver Lake Jan. 1, 1926,	0
" " " " " " " Dec.31, "	691,715,900
" " " stored in Silver Lake in 1926,	691,715,900
Total run-off for the year 1926,	6,775,890,066 cu. ft.
Run-off per square mile of drainage area,	48,220,823 " "

	<u>1920</u>	<u>1921</u>	<u>1922</u>	<u>1923</u>	<u>1924</u>	<u>1925</u>	<u>1926</u>
Second ft. per sq. mile,	1.22	1.02	1.54	0.85	0.92	0.52	1.52

ELECTRIC POWER SYSTEM

SUMMARY OF OPERATIONS - 1926.

	KILOWATT HOURS GENERATED						Purchased	TOTAL GENERATED & PURCHASED	Used by Auxilia- ries	Delivered to Line	KWH. Used & Sold	Transmission Losses		
	McClure	Carp	Hoist	Au Train	Maas	Princeton						TOTAL	K.W.H.	%
Jan. 1,	877,400	500,800	637,000	103,420	0	99,100	3,217,720	0	3,217,720	21,604	3,196,116	2,730,059	466,057	14.58
Feb. 1	911 800	501 400	609 000	73 900	115,500	0	3 211 600	72,591	3 284 191	20 650	3 263 541	2 771 082	492 459	15.08
Mar. 2	181 100	450 300	578 000	63 820	0	0	3 273 220	38 409	3 311 629	12 330	3 299 299	2 824 481	474 818	14.39
Apr. 1	658 900	919 900	376 000	277 050	57 600	40 500	3 329 950	0	3 329 950	20 230	3 309 720	2 853 043	456 677	13.79
May 1	619 600	1 446 800	411 000	474 700	0	0	3 952 100	2 300	3 954 400	10 020	3 944 380	3 389 214	555 166	14.07
June 2	309 500	779 000	749 000	324 250	0	0	4 161 750	0	4 161 750	9 010	4 152 740	3 593 570	559 170	13.46
July 2	514 400	743 700	806 000	298 780	0	0	4 362 880	0	4 362 880	9 660	4 353 220	3 737 956	615 264	14.13
Aug. 2	544 500	675 700	880 000	149 360	0	0	4 249 560	0	4 249 560	11 140	4 238 420	3 649 601	588 819	13.89
Sept. 2	043 400	1 458 300	605 000	288 280	0	0	4 394 980	0	4 394 980	9 540	4 385 440	3 806 478	578 962	13.20
Oct. 2	265 000	1 406 500	497 000	330 900	0	0	4 499 400	0	4 499 400	8 970	4 490 430	3 921 464	568 966	12.67
Nov. 2	283 800	1 281 100	493 000	260 330	0	0	4 318 230	0	4 318 230	8 760	4 309 470	3 779 175	530 295	12.30
Dec. 2	272 400	923 100	600 000	265 160	0	0	4 060 660	0	4 060 660	9 430	4 051 230	3 544 622	506 608	12.50
	25,481,800	11,086,600	7,241,000	2,909,950	173,100	139,600	47,032,050	113,300	47,145,350	151,344	46,994,006	40,600,745	6,393,261	13.60%

Entire System taken over by The Cliffs Power & Light Co. on May 6th.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

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

	INSTALLED		CONNECTED JAN. 1, 1927 TOTALS
	TO JAN. 1, 1926	INSTALLED TAKEN OUT IN 1926	
ANGELINE MINE			
Hoist	250 HP.		250 HP.
CLIFFS SHAFT MINE			
Shop	25		
No. 8 Crusher	125		
No. 5 Crushers - 2 - 25 HP. motors (Stored)	50	50	
Screens	15		
Lower Tram #1	35		
Top Tram	100		
Hoist for "A" Shaft	500		
Underground Plunger Pump #1	180		
" Centrifugal Pump	250		
Compressor - Allis-Chalmers	175		
Hoist for "B" Shaft	500		
Underground Plunger Pump #2	200		
Laboratory Crusher	5		
Coal Crushing Plant	15		
" " " Exhaust Fan	$\frac{1}{2}$		
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		
Conveyor Belts - New Crushing Plant, 2 motors	40		
Jaw Crusher - " " "	75		
Feeder Belt - " " "	5		
Magnetic Separator " " "	$1\frac{1}{2}$		
Underground Scrapers - 22 - 25 HP. motors	350	200	
" Scraper	30		
Battery Charging Set - 2nd Level, "A" Shaft	$7\frac{1}{2}$		
Underground Haulage Set #1		100	
			4,026 $\frac{1}{2}$
HARD ORE SHOPS			
Machine Shop	10		
Carpenter Shop	25		
Blacksmith Shop Punch	3		
Armature Banding Machine	2		
" " "	$\frac{1}{2}$		
" " "	$\frac{1}{8}$		
Lathe Grinder	1		
Portable Drill	$\frac{1}{4}$		
" " - Large	$\frac{1}{4}$		
Commutator Slotter	$\frac{1}{8}$		
Air Compressor	10 $\frac{1}{2}$		
Water Supply Pump	$7\frac{1}{2}$		
Blacksmith Shop Blower	$\frac{1}{4}$		
Hacksaw	$\frac{1}{2}$		
Small Grinder	$\frac{1}{4}$		
			61- $\frac{1}{4}$
fwd.	4,087 $\frac{3}{4}$ HP.	300 HP.	50
			4,337 $\frac{3}{4}$ HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	brt.	fwd.	INSTALLED TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	CONNECTED JAN. 1, 1927 TOTALS
			4,087 $\frac{3}{4}$ HP.	300 HP.	50 HP.	4,337 $\frac{3}{4}$ HP.
<b>BROWNSTONE SUBSTATION</b>						
Test Set			1/2			
Oil Filter Press			1/4			
Battery Charging Motor-Generator Set			3			
Commutator Grinder				<u>1</u>		4 $\frac{3}{4}$
<b>HOLMES MINE</b>						
Air Compressor			340			
" " Cooling Water Pump			3			
Skip Hoist			400			
Cage "			400			
Underground Haulage Converter			150			
Top Tram			25			
No. 8 Crusher (To South Jackson)			150		150	
No. 6 Crushers - 2 - 40 HP. motors			80			
Screens			20			
Laboratory Crusher			2			
Underground Plunger Pump			250			
" Centrifugal Pump			400			
Boiler Feed Pump			5			
Machine Shop			<u>25</u>			2,100
<b>SALISBURY MINE</b>						
Hoist			<u>400</u>			400
<b>OGDEN MINE</b>						
Compressor			150			
" Cooling Water Pump			2			
Water Supply Pump			20		20	
Electric Shovel Motor-Generator Set				110		
" " Air Compressor				4 $\frac{1}{2}$		
" " Oil Pump				1/4		
" " Trip Motor				2		
" " Exciter Motor				10		
Scrapers (2)				50		
Pump				<u>100</u>		428 $\frac{3}{4}$
<b>ISHPEMING HOSPITAL</b>						
Passenger Elevator			7 $\frac{1}{2}$			
Dumb Waiter			3			
Large Washer			2			
Small "			1			
Extractor			2			
Vacuum Cleaner			3			
" Pump			1			
Water Supply Pump			<u>2</u>			21 $\frac{1}{2}$
fwd.			6,935 HP.	577 $\frac{3}{4}$ HP.	220	7,292 $\frac{3}{4}$ HP.



MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	brt. fwd.	INSTALLED		CONNECTED	
		TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	JAN. 1, 1927 TOTALS
<b>ATHENS MINE</b>		6,935 HP.	577 $\frac{3}{4}$ HP.	220 HP.	7,292 $\frac{3}{4}$ HP.
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 Pump #1		400			
Ore Tram - 2 - 50 HP. motors		100			
Carpenter Shop		20			
Underground Plunger Pump #2		400			
Ore Crusher		25			
Battery Charging Motor-Generator Set			1/4		
Underground Ventilating Fan #2		40			
Ingersoll-Rand Compressor		450			
Rock Tram		50			
					3,301 $\frac{1}{4}$
<b>MAAS MINE</b>					
(Circulating Pump		40			
Turbine Auxiliaries (Injection " "		25			
(Exciter		33			
Underground Haulage Set		215			
Shop		10			
Underground Centrifugal Pump		350			
" Hoist		50			
" Plunger Pump #1		320			
Compressor Cooling Water Pump		5			
Ore Tram - 2 - 50 HP. motors		100			
Coal Crushing Plant		15			
Underground Plunger Pump #2		250			
Ingersoll-Rand Compressor #1		400			
" " " #2		400			
Rock Tram		50			
Skip Hoist		700			
Cage "		400			
Boiler Room Fan			1/2		
Skip Hoist Rheostat Pump		2			
Carpenter Shop Saw		15			
Auxiliary Compressor for Hoist Brakes		7 $\frac{1}{2}$			
4th Level Pump		50			
Cooling Water Pump		5			
Triplex Pump, 4th Level		50			
					3,493
<b>MAAS CRUSHING PLANT</b>					
Jaw Crusher		100			
Belt Conveyor		50			
Secondary Belt Conveyor		50			
Screen		50			
Pan Conveyor Motor-Generator Set		50			
Secondary Crusher		100			
					400
<b>fwd.</b>		14,129 $\frac{1}{4}$ HP.	577 $\frac{3}{4}$ HP.	220	14,467 HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	brt. fwd.	INSTALLED			CONNECTED
		TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	JAN. 1, 1927 TOTALS
		14,129 $\frac{1}{4}$ HP.	577 $\frac{3}{4}$ HP.	220 HP.	14,487 HP.
<b>NEGAUNEE MINE</b>					
Underground Haulage Set		215			
"Ilgner" Hoist Set		450			
Top Tram - 2 - 50 H.P. motors		100			
Laboratory Crusher		5			
Auxiliary Compressor for Hoist Brakes		3			
U.G. Plunger Pumps - 2 - 300 HP. motors		600			
" Centrifugal Pump		350			
" Suction Pumps - 2 - 15 HP. motors		30			
Compressor Cooling Water Pump		3			
Nordberg Air Compressor		325			
Shop		15			
Skip Pit Pump		5			
Ore Crusher		25			
Ingersoll-Rand Compressor		400			
Commutator Grinder (to Brownstone)		1		1	
13th Level Plunger Pump		15			
11th Level Plunger Pumps - 2 - 75 HP. motors		150			
Exciters for U.G. Pump Motors (2)		40			
Signal System Motor-Generator Set		1/2			
Timber Hoist - #2 Shaft		25			
Ventilating Fan - #2 Shaft		150			
Gravel Hoist		15			
Saw in Carpenter Shop			15		
					2,936 $\frac{1}{2}$
<b>SOUTH JACKSON CRUSHING PLANT</b>					
Hoist		75			
Air Compressor (to Stephenson Mine)		100		100	
Crusher (from Holmes Mine)			150		
					225
<b>BARNES-HECKER MINE</b>					
Cage Hoist		400			
Skip "		400			
Water Supply Pump		10			
Underground Haulage Converter		150			
" Centrifugal Pump - 2nd Level		400			
" " " - 3rd "		400			
" Plunger " - " "		350			
Top Tram		50			
Location Water Supply Pump		2			
Centrifugal Pump at Cave-in (from Salisbury)			30		
					2,192
<b>LLOYD MINE</b>					
Skip Hoist		400			
Cage "		400			
Top Tram - 2 - 40 HP. motors		80			
Ore Crusher		25			
Water Supply Pump installed underground		50			
					955
fwd.		20,343 $\frac{3}{4}$ HP.	772 $\frac{3}{4}$ HP.	321	20,795 $\frac{1}{2}$ HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	brt. fwd.	INSTALLED			CONNECTED
		TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	JAN. 1, 1927
		20,343 $\frac{3}{4}$ HP.	772 $\frac{3}{4}$ HP.	321 HP.	TOTALS 20,795 $\frac{1}{2}$ HP.
<b>MORRIS MINE</b>					
Skip Hoist (larger motor installed)		400	600	400	
Cage "		400			
Shop		25			
Ingersoll-Rand Compressor #1		250			
4th Level Plunger Pumps - 2 - 350 HP. motors		700			
7th " " Pump		100			
" " Centrifugal Pump		175			
Laboratory Crusher		5			
Carpenter Shop		25			
Nordberg Air Compressor		325			
Compressor Cooling Water Pump		5			
Top Tram - 2 - 50 HP. motors		100			
Underground Haulage Set		150			
Centrifugal Water Supply Pump		50			
Heating Plant Condensing Water Pump		2			
Centrifugal Pump unwatering North Lake		200		200	
Ingersoll-Rand Compressor #2		500			
Centrifugal Pump - Primer at North Lake		5		5	
Planer in Carpenter Shop		15			
					3,427
<b>SECTION 6 SHAFT</b>					
Hoist		200			
Water Supply Pump		3			
					203
<b>AUSTIN MINE</b>					
Laboratory Crusher		3			
Hoist		200			
Top Tram		50			
					253
<b>GWINN MINE</b>					
Skip Hoist		400			
Cage "		400			
Underground Centrifugal Pump		400			
" Plunger "		350			
Ore Tram		37			
Rock Tram		10			
Underground Haulage Set		150			
Shop		5			
11th Level Plunger Pump		50			
" " Centrifugal Pump		50			
" " Ventilating Fan		100			
					1,952
<b>GWINN CRUSHING PLANT</b>					
Crusher		85			
Fan Conveyor		50			
Belt "		40			
					175
<b>GARDNER MINE</b>					
Top Tram		25			
					25
<b>MACKINAW MINE</b>					
Hoist		400			
Compressor Cooling Water Pump		3			
Shop		7 $\frac{1}{2}$			
Water Supply Pump		7 $\frac{1}{2}$			
Top Tram		25		25	
Fire Pump		20			
					438
	fwd.	26,846 $\frac{3}{4}$ HP.	1,372 $\frac{3}{4}$	951	27,268 $\frac{1}{2}$ HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	brt. fwd.	INSTALLED TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	CONNECTED JAN. 1, 1927 TOTALS
PRINCETON MINE #2		26,846 $\frac{3}{4}$	1,372 $\frac{3}{4}$	951	27,268 $\frac{1}{2}$
Hoist		200			
Top Tram - 2 - 50 HP. motors		100			
Underground Plunger Pump		150			
" Centrifugal Pump		<u>125</u>			
					575
PRINCETON MINE #3					
Hoist		<u>75</u>			75
STEPHENSON MINE					
Skip Hoist		400			
Cage "		400			
Top Tram - Bessemer		50			
" " - C. & N. W.		50			
" " - #2 Bell		50			
Rock Tram		25			
Aldrich 5th Level Plunger Pump		250			
Prescott " " " "		250			
5th Level Centrifugal Pump		275			
6th " " "		50			
8th " Plunger Pump		50			
Underground Haulage Converter		150			
5th Level Centrifugal Pump		400			
6th " " "		125			
Underground Hoist		75			
6th Level Automatic Pumps- 2 - 30 HP. motors		60			
Air Compressor (From South Jackson)			100		
Ore Tram			<u>50</u>		
					2,810
PRINCETON CENTRAL POWER PLANT					
(Circulating Pump)		50			
Turbine Auxiliaries (Injection " )		40			
(Exciter)		33			
Underground Haulage Set		215			
Air Compressor		625			
Compressor Cooling Water Pump		7 $\frac{1}{2}$			
Boiler Room Fan		50			
Coal Handling Machinery		10			
" " "		<u>5</u>			
					1,035 $\frac{1}{2}$
PRINCETON CENTRAL SHOPS					
Shop Motor		25			
Grinder		<u>3</u>			
					28
PRINCETON CENTRAL PUMP STATION					
Centrifugal Pump		<u>100</u>			
					100
	fwd.	31,320 $\frac{1}{4}$	1,522 $\frac{3}{4}$	951	31,892

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	INSTALLED TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	CONNECTED JAN. 1, 1927. TOTALS
brt. fwd.	31,320 $\frac{1}{4}$ HP.	1,522 $\frac{3}{4}$ HP.	951 HP.	31,892 HP.
<b>REPUBLIC MINE</b>				
Screen at #9 Shaft	25			
Crusher	100			
Auxiliary Compressor for Hoist Brakes	5			
Pump in Engine House	7 $\frac{1}{2}$			
Centrifugal Pump in Engine House	20			
Coal Gram	7 $\frac{1}{2}$			
Pump, bottom level #9 Shaft	20			
Machine Shop	5			
Pump - 4th Level	15			
" - 3rd "	50			
Pascoe Shaft Underground Pump, cross-over	50			
#9 Shaft Rock Tram	15			
Portable Hoist	7 $\frac{1}{2}$			
Laboratory Crusher	3			
Picking Belt	5			
Screen at Crusher	10			
Carpenter Shop	20			
#9 Shaft Hoist - 2 - 500 HP. motors	1,000			
Motor-Generator Set for U.G. Haulage	30			
U.G. Hoist - 7th Level Pascoe Shaft	100			
" " - 8th " " "	50			
#9 Shaft Ore Tram - 2 - 50 HP. motors	100			
Pump - 11th Level Pascoe Shaft	10			
Drill Hoist - 7th Level Pascoe Shaft	7 $\frac{1}{2}$			
Booster Compressor	<u>200</u>			1,863
<b>CARP PLANT</b>				
Auxiliaries - 2 - 15 HP. pump motors	30			
Water Supply Pump	<u>1</u>			31
<b>HOIST PLANT</b>				
Exciter Motor-Generator Set	<u>20</u>			20
<b>McCLURE PLANT</b>				
Water Supply Pump	<u>2</u>			2
<b>DEAD RIVER STORAGE DAM</b>				
Air Compressor	<u>50</u>			50
<u>TOTAL MINING DEPARTMENT</u>	<u>33,286<math>\frac{1}{4}</math> HP.</u>	<u>1,522<math>\frac{3}{4}</math> HP.</u>	<u>951 HP.</u>	<u>33,858 HP.</u>

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	INSTALLED TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	CONNECTED JAN. 1, 1927. TOTALS
<u>TOTAL MINING DEPARTMENT</u>	33,286 $\frac{1}{4}$ HP.	1,522 $\frac{3}{4}$ HP.	951 HP.	33,858 HP.
PIONEER FURNACE Furnace & Sawmill	<u>1,195</u>			1,195
L. S. & I. RR. CO. Shops, Sawmill, Ore Dock & Pumps	<u>800</u>			800
LAND DEPARTMENT Sawmill at Munising - 2 motors Grand Island	<u>125</u> <u>10<math>\frac{1}{2}</math></u>			135 $\frac{1}{2}$
LUMBERING DEPARTMENT Dixon Location Water Supply Pump	<u>5</u>			5
MICHIGAN GAS & ELECTRIC CO., MUNISING City Pumping	<u>125</u>			125
REPUBLIC TOWNSHIP Water Supply Pump	<u>25</u>			25
OLIVER IRON MINING COMPANY Pumps at Angeline & Section 16 Mines Air Compressor at Section 16 Mine	525	<u>700</u>		1,225
CITY OF ISHPEMING Pump at Brownstone Substation	<u>15</u>			15
CITY OF NEGAUNEE	<u>435</u>			435
THE CLEFFS ELECTRIC COMPANY, PRINCETON	<u>100</u>			100
MICHIGAN GAS & ELECTRIC COMPANY Ishpeming Munising	2,170 <u>250</u>			2,420
PALMER MINING COMPANY Volunteer Mine, Palmer		<u>800</u>		800
EMPIRE-QUINN MINING COMPANY Empire Mine, Palmer		<u>135</u>		135
MUNISING WOODENWARE COMPANY	<u>695</u>			695
<u>TOTAL OUTSIDE LOAD</u>	<u>6,475<math>\frac{1}{2}</math> HP.</u>	<u>1,635 HP.</u>		<u>8,110<math>\frac{1}{2}</math> HP.</u>
<u>GRAND TOTAL CONNECTED LOAD</u>	39,761 $\frac{3}{4}$ HP.	3,157 $\frac{3}{4}$ HP.	951 HP.	41,968 $\frac{1}{2}$ HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

The following motors are not connected to our Power System:

	INSTALLED		CONNECTED	
	TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	JAN. 1, 1927. TOTALS
<b>SPIES MINE</b>				
Hoist Motor used on Scraper	200	HP.		
Underground Triplex Pump	50			
Crusher	50			
Air Compressor	403			
Grinder in Shop	3			
Compressor Cooling Water Pump	3			
Hoist	400			
Boiler Feed Pump	2			
Top Tram	25			
3rd Level Aldrich Pump	50			
Shop	5			
Compressor Cooling Water Pump	3			
Underground Haulage Set	150			
" Plunger Pump #1 - 8th Level	150			
" " #2 - " "	150			
" Centrifugal Pump	400			
				2,044 HP.
<b>MESABA RANGE</b>				
<b>BOEING MINE</b>				
Sinking Hoist	35			
Air Compressor	225			
Underground Plunger Pump - 1st Level	100			
" Centrifugal " - " "	125			
" Haulage Set	150			
Hoist	200			
Top Tram	50			
Compressor Cooling Water Pump	2			
Shop	10			
Underground Centrifugal Pump - 2nd Level	125			
" " " - 1st "	125			
Blacksmith Shop Fan	1/4			
Churn Drill	10			
Tool Post Grinder	1/4			
Winze Hoist		50		
Band Saw		3		
Centrifugal Pump - 2nd Level		85		
				1,295 1/2
<b>GROSBY MINE</b>				
Log Washer	40			
Screen	20			
Picking Belt	3			
Log Washer (Spare at Plant)	20		20	
Chip Screen	3			
Tables	20			
Feeder Motor (to Buffalo Mine)	20		20	
Stockpile	7 1/2			
Plunger Pump (Stored at Hill-Trumbull)	50		50	
Centrifugal Pump		85		
				178 1/2
<b>HELMER MINE</b>				
Hoist	200			
				200
fwd.	3,585 HP.	223 HP.	90 HP.	3,718 HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	brt. fwd.	INSTALLED		CONNECTED	
		TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	JAN. 1, 1927 TOTALS
HILL-TRUMBULL MINE		3,585 HP.	223 HP.	90 HP.	3,718 HP.
Log Washer		25			
" "		40			
Turbos - 4 - 5 HP. motors		20			
Chip Screens - 2 - 2 HP. motors		4			
Crusher		100			
Sand Pump		10			
Sample Crusher		10			
Prescott Flunger Pump		125			
Centrifugal Pump		125			
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			
Forge Fan		$\frac{1}{2}$			
Electric Drill		$\frac{1}{4}$			
Motor-Generator Set		65			
Blacksmith Shop Fan		$\frac{1}{4}$			
Drill		$\frac{1}{4}$			
Keystone Drill		15			
Tailings Pump		50			
Blacksmith Shop Fan		3			
Picking Belt		5			
Car Puller		$7\frac{1}{2}$			
					842 $\frac{3}{4}$
WADE MINE					
Hoist		125			
Air Compressor		150			
Compressor Cooling Water Pump		2			
Underground Haulage Set		150			
Machine Shop		10			
Underground Triplex Pump		50			
" Centrifugal Pump		100			
Sump Pump		5			
Top Tram		50			
Locomotive Water Pump		5			
Clear " "		15			
Blacksmith Shop Fan		3			
					665
<u>TOTAL</u>		5,090 $\frac{3}{4}$ HP.	225 HP.	90 HP.	5,225 $\frac{3}{4}$ HP.



MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

The following motors are on hand (Dec. 31, 1926), but are not installed:

<b>CLIFFS SHAFT MINE</b>		
Top Tram (stator only)	50	
Spare Top Tram	50	
Synchronous Motor from Mackinaw Mine compressor	325	
Top Tram	<u>50</u>	
		475 HP.
<b>GENERAL STOREHOUSE</b>		
Centrifugal Pump from D.R.Storage Dam	3	
Motor-Generator Set for Signals (From Cl.Shaft)	1/4	
Spare Motor-Generator Set	15	
" from Republic Concrete Mixer	5	
" General Electric pump	50	
" Westinghouse Motor-Generator Set	220	
" " " " (Angeline)	150	
" Pump from Lake Mine	75	
" from Stephenson Mine plunger pump	250	
" " Salisbury Mine air compressor	150	
" " Hard Ore #3 centrifugal pump	150	
" " " " plunger "	35	
" General Electric	7½	
" from Holmes crusher	100	
" Shop motor	10	
" Bag Cleaner from D. R. Storage Dam	½	
Stock for Underground Scrapper	<u>25</u>	
		1,246½
<b>LAKE MINE CHANGE HOUSE</b>		
Ventilating Fan - (from Salisbury Mine)	<u>7½</u>	
		7½
<b>MAAS MINE</b>		
Winze Pump	15	
Oil Pump	2	
Pump (from Morris Mine)	<u>50</u>	
		67
<b>NEGAUNEE MINE</b>		
Flywheel Hoist Set motor	<u>350</u>	
		350
<b>ATHENS MINE</b>		
Pump motor	<u>35</u>	
		35
<b>BARNES-HECKER MINE</b>		
Saw motor on Sand Pump	<u>10</u>	
		10
<b>MORRIS-LLOYD MINE</b>		
Underground Haulage Set motor	150	
Pump motor	40	
Centrifugal Pump motor (From McClure Plant)	<u>50</u>	
		240
<b>AUSTIN MINE</b>		
Top Tram	<u>25</u>	
		25
<b>GWINN MINE CHANGE HOUSE</b>		
Skip Hoist (from Francis Mine)	400	
Cage " " " "	400	
Pump	35	
"	<u>275</u>	
		1,110
fwd.		<u>3,565½</u> HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

	brt. fwd.	3,565 $\frac{3}{4}$ HP.
GWINN MINE CHANGE HOUSE (Cont'd)		
Top Tram (From Francis Mine)	37	
Underground Haulage Converter (From Francis Mine)	150	
" Plunger Pump " " "	<u>35</u>	
		222
MACKINAW MINE		
Quintuplex Pump	350	
Triplex "	<u>75</u>	
		425
STEPHENSON MINE		
Layne & Bowler Pump #2	<u>350</u>	
		350
REPUBLIC MINE		
Spare	15	
"	10	
"	<u>30</u>	
		55
ISHPEMING HOSPITAL		
Spare for Dumb Waiter	<u>3</u>	
		3
	<u>TOTAL</u>	<u>4,620<math>\frac{3}{4}</math> HP.</u>
Spare motors on Mesaba Range:		
BOEING MINE		
Sump Pump	<u>7<math>\frac{1}{2}</math></u>	
		7 $\frac{1}{2}$
HILL-THUMBULL MINE		
Log Washer	25	
Conveyor	50	
Screen	20	
Pump	3	
Shop	5	
Sump Pump	5	
Spare	3	
Plunger Pump	<u>50</u>	
		161
WADE MINE		
Pump	5	
"	5	
"	20	
Ventilating Fan	<u>15</u>	
		45
	<u>TOTAL</u>	<u>213<math>\frac{1}{2}</math> HP.</u>
Total C.C.I.Co. load connected to Power System -		33,858 HP.
" Outside " " " " " "		<u>8,110<math>\frac{1}{2}</math> "</u>
	<u>TOTAL CONNECTED LOAD</u>	<u>41,968<math>\frac{1}{2}</math> H.P.</u>
Total connected load at Spies Mine -		2,044 H.P.
" " " " Minnesota Mines -		5,225 $\frac{3}{4}$ "
Total spare motors on hand 12/31/26 - Ishpeming District -		4,620 $\frac{3}{4}$ "
" " " " " " " - Minnesota Mines -		213 $\frac{1}{2}$ "

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

463

Electrical Department (Cont'd)

The following direct current generators and exciters are installed and operating as needed:

	INSTALLED			JAN. 1, 1927 TOTALS
	TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	
<b>AU TRAIN WATER POWER PLANT</b>				
Exciters (2)	<u>34</u>			34 KW.
<b>CARP RIVER WATER POWER PLANT</b>				
Exciters (2)	<u>150</u>			150
<b>HOIST PLANT</b>				
Exciter	<u>17½</u>			
"	<u>37</u>			54½
<b>McCLURE PLANT</b>				
Exciters (2)	<u>110</u>			110
<b>MAAS PLANT</b>				
Motor Driven Exciter	<u>22½</u>			
Turbo " "	<u>22½</u>			
Compressor Motor Exciters (2)	<u>20</u>			65
<b>PRINCETON CENTRAL POWER PLANT</b>				
Motor Driven Exciter	<u>22½</u>			
Turbo " "	<u>22½</u>			
Compressor Motor Exciter	<u>12</u>			57
<b>REPUBLIC MINE</b>				
Exciter in #5 Engine House	<u>7½</u>			
" " Water Power Plant	<u>17</u>			24½
<b>CLIFFS SHAFT MINE</b>				
Compressor Motor Exciters (2)	20			
" " Exciter		<u>10</u>		30
<b>BROWNSTONE SUBSTATION</b>				
Battery Charging Set	2			
Line Testing Set	<u>½</u>			2½
<b>HOLMES MINE</b>				
Compressor Motor Exciter	<u>10</u>			10
<b>ATHENS MINE</b>				
Nordberg Compressor Motor Exciter	10			
Flywheel Set Exciter	15			
Skip Hoist Generator	700			
Battery Charging Motor-Generator Set	½			
Ingersoll-Rand Compressor Motor Exciter	<u>10</u>			735½
<b>NEGAUNEE MINE</b>				
Skip Hoist Generator	400			
Cage " "	150			
Flywheel Set Exciter	25			
Exciters for Underground Pump Motors (2)	28			
Ingersoll-Rand Compressor Motor Exciter	10			
Nordberg " " "	10			
Bell Signal Set	<u>½</u>			
fwd.	<u>1,886½</u>	<u>10</u>	<u>0</u>	<u>623½</u> 1,896½ KW.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

		* INSTALLED TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926		JAN. 1, 1927 TOTALS
brt. fwd.		1,886 $\frac{1}{2}$ KW.	10 KW.	0		1,896 $\frac{1}{2}$ KW.
MAAS CRUSHING PLANT						
Pan Conveyor Generator			35			
" " " Exciter			<u>1<math>\frac{3}{4}</math></u>			36 $\frac{3}{4}$
MORRIS MINE						
Ingersoll-Rand Compressor Motor Exciter	12					
Nordberg " " "	10					
Ingersoll-Rand " " "	<u>10</u>					32
MACKINAW MINE						
Compressor Motor Exciter (to Cl. Shaft)	10			<u>10</u>		0
OGDEN MINE						
Thrust Generator on Electric Shovel			15			
Hoist " " " "			75			
Swing " " " "			15			
Exciter " " " "			<u>5<math>\frac{1}{2}</math></u>			110 $\frac{1}{2}$
<u>TOTAL</u>		<u>1,928<math>\frac{1}{2}</math> KW.</u>	<u>157<math>\frac{1}{4}</math> KW.</u>	<u>10 KW.</u>		<u>2,075<math>\frac{3}{4}</math> KW.</u>

Underground Haulage Generators:

CLIFFS SHAFT MINE						
Motor-Generator Set #1	100 KW.					
" " " #2	100					
Motor-Generator Charging Set			<u>5</u>			205 KW.
HOLMES MINE						
Rotary Converter	<u>100</u>					100
ATHENS MINE						
Rotary Converter	<u>100</u>					100
MAAS MINE						
Motor-Generator Set	<u>100</u>					100
NEGAUNEE MINE						
Motor-Generator Set	<u>100</u>					100
BARNES-HECKER MINE						
Rotary Converter	<u>100</u>					100
MORRIS-LLOYD MINE						
Motor-Generator Set	<u>100</u>					100
GWINN MINE						
Motor-Generator Set	<u>100</u>					100
PRINCETON CENTRAL POWER PLANT						
Motor-Generator Set	<u>100</u>					100
STEPHENSON MINE						
Rotary Converter	<u>100</u>					100
REPUBLIC MINE						
Battery Charging Set for Storage Battery						
Locomotives	<u>20</u>					20
<u>TOTAL</u>		<u>1,120 KW.</u>	<u>5 KW.</u>	<u>0</u>		<u>1,125 KW.</u>

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

455

<u>Electrical Department</u> (Cont'd)	INSTALLED			JAN. 1, 1927
	TO JAN. 1, 1926	INSTALLED IN 1926	TAKEN OUT IN 1926	TOTALS
D.C. Motors:				
AU TRAIN WATER POWER PLANT				
Governor Control Motors (2)		<u>1/2</u> HP.		1/2 HP.
CARP RIVER WATER POWER PLANT				
Rheostat Control (2)		1/2		
Governor " (2)		<u>1/2</u>		1
McCLURE PLANT				
Valve Control (2)		2		
Rheostat Control (2)		<u>1/2</u>		2 1/2
CLIFFS SHAFT MINE				
Portable Hoist		10		
Re-crushing Plant Conveyors (1 burned out)		4		
Sturtevant Fan (to Holmes)		1 1/2	2	
Car Puller			<u>6 1/2</u>	16 1/2
HOLMES MINE				
Sturtevant Fans (3)		3	<u>1 1/2</u>	4 1/2
OGDEN MINE				
Hoist Motor on Electric Shovel		100		
Swing " " " "		20		
Thrust " " " "		<u>20</u>		140
ATHENS MINE				
Skip Hoist		900		
Ventilating Fans (1 stored)		30	15	
" " (1 " ) (3)		<u>20</u>	5	930
MAAS MINE				
Timber Hoist - 2nd level		10		
" " - 4th "		10		
Bilge Pump		<u>5</u>		25
MAAS CRUSHING PLANT				
Pan Conveyor			<u>40</u>	40
NEGAUNEE MINE				
Skip Hoist		500		
Cage "		200		
Timber Hoist - Tunnel		10		
" " - 10th level		10		
Ventilating Fan		15		
" " (from Athens)			5	
Denver Electric Hoists (6) 7 1/2 HP.			45	
Sullivan Hoists 2 - 6 1/2 "			<u>13</u>	798
MORRIS MINE				
Ventilating Fan - 6th level		15		
Sullivan Scraper Hoists - 5 - 6 1/2 HP.			32 1/2	
Denver Rock Drill Scraper			<u>7 1/2</u>	55
GWINN MINE				
Hoist - 9th Level		15		
Ventilating Fan		15		
" "		<u>15</u>		
PRINCETON MINE				
Bilge Pump		5		45
<u>TOTAL</u>		<u>1,796 3/4</u>	<u>289 1/2</u>	<u>2,061 1/4</u> HP.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department (Cont'd)

Spare generators and exciters on hand December 31st, 1926:

GENERAL STOREHOUSE		
Signal Set		1/2 KW.
Old Hoist Exciter		22
Motor-Generator Set used for battery charging in Hard Ore Shop	10	
		32 1/2 KW.
NEGAUNEE MINE		
Skip Hoist (armature only)	500	HP.
HOIST PLANT		
Spare exciter	18	
	<u>TOTAL</u>	50 1/2 KW.

Spare underground haulage generators on hand Dec. 31, 1926:

GENERAL STOREHOUSE		
Motor-Generator Set		150
" " " (from Angeline)	100	
		250 KW.
MORRIS-LLOYD MINE		
Motor-Generator Set		100
GWINN MINE		
Rotary Converter (from Francis Mine)	100	
	<u>TOTAL</u>	450 KW.

Spare direct current motors on hand Dec. 31, 1926:

ATHENS MINE		
Fan Motor		15 HP.
MORRIS-LLOYD MINE		
Crane Motor		10
Scraper Motor	7 1/2	
		17 1/2
GWINN MINE		
Pump Motor		20
NEGAUNEE MINE		
Fan Motor		7 1/2
HOLMES MINE		
Fan Motors - 2 - 1 1/2 HP.	3	
	<u>TOTAL</u>	63 HP.

Electrical Department (Cont'd)

MESABA RANGE

Exciters and Generators installed up to December 31, 1926:

BOEING MINE  
 Compressor Motor Exciter 6 KW.

Underground haulage generators installed up to Dec. 31, 1926:

BOEING MINE  
 Motor-Generator Set 115 K.W.

HILL-TRUMBULL MINE  
 Motor-Generator Set 55

WADE MINE  
 Rotary Converter 100

TOTAL 270 KW.

Direct current motors installed up to December 31, 1926:

HILL-TRUMBULL MINE  
 Feeder Motor 60 H.P.

Total Exciter and Generators installed to December 31, 1926 - 6 K.W.

" Underground Haulage Generators " " " " " - 270 K.W.

" Direct Current Motors " " " " " - 60 H.P.

SPIES MINE

Exciters installed up to December 31, 1926:

Compressor Motor Exciter 10 K.W.

Underground haulage generators installed up to Dec. 31, 1926: - 150 K.W.

ISHPEMING DISTRICT

Total D.C. Generators and Exciters installed to Dec. 31, 1926 - 2,075 $\frac{3}{4}$  K.W.

" Underground Haulage Generators " " " " " - 1,125 K.W.

" Direct Current Motors " " " " " - 2,061 $\frac{1}{4}$  H.P.

Total Spare D.C. Generators and Exciters on hand " " " " - 50 $\frac{1}{2}$  K.W.

" " Underground Haulage Generators " " " " " - 450 K.W.

" " Direct Current Motors " " " " " - 63 H.P.

Spare Direct Current Motor Armature " " " " " - 500 H.P.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

468

Electrical Department (Cont'd)

Substation Transformers installed up to December 31, 1926:

<u>33000/2300 Volts</u>	<u>PHASE</u>	<u>NO.</u>	<u>K.V.A.</u>	<u>TOTAL K.V.A.</u>
Brownstone Substation	1	3	400	1,200
Cliffs Shaft-Holmes Substation	1	6	500	3,000
Morris-Lloyd Substation	1	3	590	1,770
Barnes-Hecker "	1	3	250	750
Republic "	1	3	400	1,200
Maas "	1	6	590	3,540
Princeton "	1	3	590	1,770
Gwim "	1	3	625	1,875
Munising "	1	3	200	600
McClure Plant	3	2	5,000	10,000
Carp "	1	3	1,900	5,700
Au Train "	3	1	1,250	1,250
Ogden Mine Substation	1	3	75	225
Palmer "	1	2	625	1,250
			<u>TOTAL</u>	34,130 K.V.A.
<u>13000/2300 Volts</u>				
Maas Substation	3	1	1,250	1,250
Hoist Plant	3	1	1,250	1,250
			<u>TOTAL</u>	2,500 K.V.A.
<u>6600/2300 Volts</u>				
Carp Plant	1	6	185	1,110
Gwinn Substation	1	3	350	1,050
Mackinaw "	1	1	350	350
Marquette - Jas. Pickands & Co.	1	2	350	700
			<u>TOTAL</u>	3,210 K.V.A.

Transformers used for Underground Haulage installed to 12/31/26:

Athens Mine converter	1	3	35	105
Holmes " "	3	1	100	100
Barnes-Hecker "	3	1	110	110
Stephenson "	1	3	35	105
			<u>TOTAL</u>	420 K.V.A.



MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

469

Electrical Department (Cont'd)

Distribution Transformers installed up to December 31, 1926:

<u>2300/220/110 Volts</u>	<u>PHASE</u>	<u>NO.</u>	<u>K. V. A.</u>	<u>TOTAL K.V.A.</u>
<b>ANGELINE MINE</b>				
Hoist Control	1	1	<u>7½</u>	7½
<b>CLIFFS SHAFT MINE</b>				
Office Lights	1	1	10	
" "	1	1	15	
Laboratory	1	1	5	
"A" Shaft Hoist	1	1	7½	
"B" " "	1	1	10	
Coal Crusher	1	2 (7½)	15	
Pump House Lights	1	1	1	
Crusher House Lights	1	2 (1)	2	
Crushers	1	3 (10)	30	
Underground Scrapers	1	2 (15)	30	
" "	1	3 (75)	<u>225</u>	350½
<b>HARD ORE &amp; BROWNSTONE</b>				
Light & Power	1	1	15	
Light	1	1	<u>¾</u>	
Light & Power	1	1	7½	
Shop	1	1	<u>30</u>	53¼
<b>HOLMES MINE</b>				
Shop Power	1	3 (10)	30	
Engine House Lights & Power	1	1	5	
Skip Hoist Control	1	1	10	
Cage " "	1	1	10	
4th Level Pump House Lights	1	1,	2	
Cage Bell Circuit	1	1	<u>¾</u>	
Skip " "	1	1	<u>¾</u>	
Shaft House Lights	1	1	<u>¾</u>	
Pump " "	1	1	<u>¾</u>	
Change " "	1	1	<u>¾</u>	
Shaft " "	1	1	<u>¾</u>	
Engine " "	1	1	<u>7½</u>	66½
<b>LAKE MINE</b>				
Engine House Lights	1	1	5	
Shaft Lights	1	1	<u>¾</u>	5¾
<b>SALISBURY MINE</b>				
Eng.Ho. Lights & Circulating Pump	1	1	5	
" " " " " "	1	1	2	
Hoist Control	1	1	7½	
Lights	1	1	<u>¾</u>	15
				fwd. 500½

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

470

Electrical Department (Cont 'd)

Distribution Transformers: (Cont'd)

brt. fwd.	PHASE	NO.	K. V. A.	TOTAL K.V.A.
				500 $\frac{1}{2}$
<b>ATHENS MINE</b>				
Machine Shop	1	2 (10)	20	
Surface Lights & Lab. Hot Plates	1	3 (10)	30	
Pump House Lights	1	1	5	
" " "	1	1	2	
100 G.P.M. Pump	3	1	40	
Signal System	1	1	1	
Engine House Lights	1	1	5	
" " "	1	1	4	
Rock Tram	1	1.	2	
Top Tram Control	1	1	<u>1</u>	110
<b>MAAS MINE</b>				
Lights & Injection Pump	1	3 (10)	30	
Coal Crusher & Shop	1	2 (10)	20	
Signal System	1	1	$\frac{1}{2}$	
3rd Level Pump House	1	2 (5)	10	
Bell Signal at 55 Winze	1	1	1	
Cage Hoist Control	1	1	10	
Skip " "	1	1	2	
" " "	1	1	3	
Rock Tram "	1	1	1	
Heaters in Engine House	1	1	7 $\frac{1}{2}$	
Top Tram	1	1	<u>2</u>	87
<b>MAAS CRUSHING PLANT</b>				
Lights	1	1	7 $\frac{1}{2}$	
Screen	1	3 (10)	<u>30</u>	37 $\frac{1}{2}$
<b>NEGAUNEE MINE</b>				
Shop Light & Power	1	1	7 $\frac{1}{2}$	
" " " "	1	2 (10)	20	
Engine House Lights & Power	1	2 (10)	20	
" " " " "	1	1	5	
Signal System	1	1	$\frac{1}{2}$	
Pump House Lights, etc.	1	3 (7 $\frac{1}{2}$ )	22 $\frac{1}{2}$	
12th Level Pump	1	3 (5)	15	
Barn	1	1	5	
Gravel Pit	1	1	7 $\frac{1}{2}$	
Hoist & Lights - #2 Shaft	1	3 (10)	<u>30</u>	133
<b>SOUTH JACKSON CRUSHING PLANT</b>				
Hoist Brake	1	1	5	
Lights	1	1	<u>2</u>	7
<b>BARNES-HECKER MINE</b>				
Lights	1	1	5	
"	1	1	7 $\frac{1}{2}$	
Top Tram Control	1	1	1	
Skip Hoist Control	1	1	10	
Cage " "	1	1	10	
Pump House Lights	1	1	1	
Water Supply Pump	1	1	2 $\frac{1}{2}$	
Location Lights	1	1	<u>10</u>	47
				<u>922</u>
fwd.				

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department

Distribution Transformers:		PHASE	NO.	K. V. A.	TOTAL K.V.A.
brt. fwd.					922
<b>LLOYD MINE</b>					
Cage Hoist Control		1	1	$7\frac{1}{2}$	
Skip " "		1	1	$7\frac{1}{2}$	
Water Supply Pump House Lights		1	1	2	
Eng. House Lights & Bell Signal		1	1	5	
Shaft House Lights		1	1	<u>5</u>	
					27
<b>MORRIS MINE</b>					
Skip Hoist Control & Lights		1	1	10	
Cage " " " "		1	1	$7\frac{1}{2}$	
Signal System Lights		1	1	$\frac{1}{2}$	
Shop & Lights		1	3	(10) 30	
7th level Pump House Lights		1	1	2	
Location Lights		1	1	10	
Club House Lights		1	1	<u>5</u>	
					65
<b>SECTION 6 SHAFT</b>					
Hoist Control		1	1	$7\frac{1}{2}$	
Lights		1	2	(2) <u>4</u>	
					11 $\frac{1}{2}$
<b>AUSTIN MINE</b>					
Lights		1	1	10	
Top Tram		1	2	(10) 20	
Shop		1	1	<u>10</u>	
					40
<b>GWINN MINE</b>					
Substation Lighting		1	1	1	
Cage Hoist Control		1	2	(5) 10	
Skip " "		1	1	$7\frac{1}{2}$	
Engine House Lights		1	1	10	
Shaft " "		1	1	$1\frac{1}{2}$	
7th Level Pump House Lights		1	1	4	
11th " " " "		1	1	1	
9th " Pump		1	3	(15) <u>45</u>	
					80
<b>GARDNER MINE</b>					
Top Tram		1	3	(10) <u>30</u>	
					30
<b>MACKINAW MINE</b>					
Machine Shop		1	2	(5) 10	
Hoist Control		1	1	$7\frac{1}{2}$	
Signal System		1	1	1	
Top Tram		1	3	(10) <u>30</u>	
					48 $\frac{1}{2}$
<b>PRINCETON MINE</b>					
Top Tram Lights		1	1	3	
Pump House Lights		1	1	<u>2<math>\frac{1}{2}</math></u>	
					5 $\frac{1}{2}$
<b>PRINCETON CENTRAL POWER PLANT</b>					
Coal Crusher		1	3	(7 $\frac{1}{2}$ ) 22 $\frac{1}{2}$	
Power Plant Lights		1	1	10	
Injection Pump		1	2	(15) 30	
Boiler Room Fan		1	2	(10) <u>20</u>	
					<u>82<math>\frac{1}{2}</math></u>
				fwd.	1,312

472  
MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department

Distribution Transformers:		PHASE	NO.	K. V. A.	TOTAL K.V.A.
brt. fwd.					1,312
<b>PRINCETON CENTRAL SHOPS</b>					
Power & Light	1	2	(10)	<u>20</u>	20
<b>PRINCETON DISTRICT LABORATORY</b>					
Hot Plates	1	3	(10)	<u>30</u>	30
<b>STEPHENSON MINE</b>					
Rock Tram	1	3	(10)	30	
Skip Hoist Control	1	1		10	
Cage " "	1	1		<u>10</u>	50
<b>REPUBLIC MINE</b>					
G. E. Tram	1	2	(15)	30	
Lighting	1	3	( 2)	6	
" & Pump	1	1		10	
" " "	1	1		10	
Engine House Lights	1	1		7½	
Hoist Control	1	1		25	
Top Tram Controls	1	2	( 1)	2	
Office Lights	1	1		3	
Motor-Generator Set & Pumps	1	3	(7½)	22½	
Pascoe Shaft Hoist Control	1	1		7½	
#9 Shaft - 3rd and 4th Levels	1	3	(20)	60	
Power & Lights on Surface	1	3	(10)	30	
Water Power Plant Lights	1	1		1½	
Screen Motor & Lights	1	3	( 3)	9	
Portable Hoist	1	1		<u>10</u>	234
<b>AU TRAIN WATER POWER PLANT</b>					
Power Plant Lights	1	1		1	
Operator's Dwelling Lights	1	1		2	
Control	1	1		2	
Power & Lights, Dixon Location	1	2	( 5)	10	
" " " Grand Island	1	2	( 5)	<u>10</u>	25
<b>CARP RIVER WATER POWER PLANT</b>					
Power & Light	1	1	(10)	10	
" " "	1	1		20	
Pump	1	2	( 1)	<u>2</u>	32
<b>HOIST PLANT</b>					
Power & Light	1	1		7½	
" " "	1	2	( 5)	<u>10</u>	17½
<b>McCLURE PLANT</b>					
Power & Lights	1	2	(10)	<u>20</u>	20
<u>GRAND TOTAL</u>					1,740½ K.V.A.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

Electrical Department:

Spare Transformers on hand December 31, 1926:

	<u>PHASE</u>	<u>NO.</u>	<u>K. V. A.</u>	<u>TOTAL K.V.A.</u>
<b>GENERAL STOREHOUSE</b>				
General Electric	1	1	15	
Fort Wayne	1	1	5	
Allis-Chalmers (from Lake Mine)	1	1	7½	
General Electric	1	2	(5) 10	
General Electric	1	5	(15) 75	
General Electric	1	1	<u>3</u>	
				115½
<b>ANGELINE MINE</b>				
General Electric	1	1	<u>1</u>	1
<b>ATHENS MINE</b>				
Spare	1	1	3	
Spare	1	1	3	
Spare	1	1	<u>7½</u>	13½
<b>GWINN MINE</b>				
General Electric (Sump Pump)	1	1	<u>3</u>	3
<b>REPUBLIC MINE</b>				
General Electric	1	3	(10) 30	
" "	1	1	<u>4</u>	<u>34</u>
				<u>34</u>
<u>GRAND TOTAL</u>				167 K.V.A.

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

COMPARATIVE TABLES:

<u>YEAR</u>	<u>TONS COAL BURNED</u>	<u>TONS ORE &amp; ROCK HOISTED</u>	<u>CU.FT. AIR USED</u>	<u>CUBIC FT. AIR PER TON HOISTED</u>	<u>GALLONS OF WATER PUMPED</u>
<u>CLIFFS SHAFT MINE:</u>					
1915	5 181	347 955	889 280 382	2 555	283 489 900
1916	5 226	388 090	878 041 710	2 262	398 818 855
1917	4 500	377 177	885 993 944	2 349	345 847 725
1918	5 135	382 804	861 374 720	2 276	315 252 828
1919	3 494	277 901	907 895 024	2 402	298 889 689
1920	3 854	334 347	872 225 408	2 638	262 308 003
1921	2 094	67 454	273 648 228	4 057	274 901 402
1922	891	138 702	419 382 000	3 023	399 874 439
1923	2 359	305 727	734 645 710	2 403	377 383 675
1924	2 224	309 996	784 461 617	2 530	388 257 675
1925	2 900	322 928	824 005 547	2 551	327 655 585
1926	1 470	350 604	801 351 000	2 285	379 727 700

HOLMES MINE:

1916	729	32 951	--- --- ---	--- --- ---	--- --- ---
1917	739	90 225	425 227 500	4 712	--- --- ---
1918	700	130 295	368 456 686	2 840	--- --- ---
1919	947	173 178	521 145 000	3 009	*25 471 515
1920	682	260 118	448 965 000	1 726	26 099 690
1921	832	191 147	275 057 000	1 439	38 456 053
1922	911	231 306	346 466 000	1 497	73 009 389
1923	704	289 984	431 820 000	1 489	82 640 803
1924	879	170 228	296 460 000	1 741	75 235 295
1925	679	172 507	253 125 000	1 446	56 962 287
1926	768	178 296	267 795 000	1 502	83 223 451

\* (8 Months)

HARD ORE #3 HEATING PLANT:

1916	922
1917	1 038
1918	955
1919	970
1920	801
1921	1 014
1922	1 182
1923	1 033
1924	1 271
1925	1 098
1926	1 099

ATHENS MINE:

1916	419	26 930	222 840 000	--- --- ---	--- --- ---
1917	277	23 988	211 612 500	--- --- ---	--- --- ---
1918	609	101 394	498 600 000	--- --- ---	--- --- ---
1919	740	155 643	414 045 000	2 660	85 503 850
1920	593	214 601	505 035 000	2 353	82 794 824
1921	515	177 065	359 055 000	2 027	73 114 028
1922	683	193 711	456 615 000	2 357	86 235 708
1923	971	246 704	635 535 000	2 576	103 329 157
1924	685	246 352	581 130 000	2 359	116 161 813
1925	789	214 510	468 900 000	2 186	131 715 395
1926	869	226 229	547 650 000	2 421	140 788 044

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

475

COMPARATIVE TABLES:

<u>YEAR</u>	<u>TONS COAL BURNED</u>	<u>TONS ORE &amp; ROCK HOISTED</u>	<u>CU.FT. AIR USED</u>	<u>CUBIC FT. AIR PER TON HOISTED</u>	<u>GALLONS OF WATER PUMPED</u>
<u>MAAS MINE:</u>					
1916	8 062	272 802	763 134 066	2 797	363 273 050
1917	8 656	333 290	879 808 672	2 639	337 467 390
1918	9 351	312 634	935 128 335	2 991	510 265 180
1919	9 639	343 810	644 597 449	1 874	573 373 848
1920	5 097	351 521	571 224 659	1 625	513 176 403
1921	735	211 616	373 275 000	1 764	517 238 661
1922	628	219 676	458 010 000	2 083	516 431 109
1923	548	228 528	472 220 000	2 066	509 330 141
1924	682	224 291	470 880 000	2 099	522 683 088
1925	670	144 408	372 735 000	2 581	480 918 511
1926	829	245 992	420 930 000	1 711	508 242 996

NEGAUNEE MINE:

1916	1 223	526 337	474 099 050	900	---
1917	1 414	548 083	455 525 250	831	780 000 000
1918	1 293	524 869	443 996 750	845	828 575 874
1919	1 320	525 894	591 104 600	1 185	603 198 543
1920	1 095	569 895	729 139 000	1 279	610 132 854
1921	838	258 967	306 315 000	1 183	597 401 853
1922	1 075	300 041	414 765 000	1 382	613 603 672
1923	996	383 914	655 695 000	1 708	582 912 109
1924	1 156	322 705	558 980 000	1 732	502 525 354
1925	1 100	342 824	660 600 000	1 927	436 422 253
1926	1 229	374 004	602 010 000	1 609	440 271 619

SOUTH JACKSON MINE:

1917	0	46 994	---	---	---
1918	0	15 879	13 203 000	931	---
1919	0	56 840	---	---	---
1920	162	69 222	30 001 500	434	---
1921	48	5 051	1 935 000	383	---
1922	88	16 101	4 590 000	---	---
1923	-	12 812	5 850 000	---	---
1924	119	33 262	13 680 000	411	---
1925	0	---	---	---	---
1926	0	---	---	---	---

OGDEN MINE:

1925		61 514	---	---	---
1926		146 501	---	---	---

BARNES-HECKER MINE:

			(From Morris-Lloyd)		
1919	603	29 731	---	---	*5 481 940
1920	410	62 426	272 817 000	4 370	137 026 242
1921	120	3 712	38 406 000	1 034	585 904 565
1922	302	32 068	156 250 000	4 872	546 633 174
1923	467	38 536	153 900 000	3 993	391 860 539
1924	465	77 868	247 500 000	3 178	324 482 326
1925	390	133 602	315 253 080	2 359	374 628 327
1926	382	133 752	400 000 000	2 990	294 482 946

## ANNUAL REPORT

YEAR 1926

## COMPARATIVE TABLES:

YEAR	TONS COAL BURNED	TONS ORE & ROCK HOISTED	CU. FT. AIR USED	CUBIC FT. AIR PER TON HOISTED	GALLONS OF WATER PUMPED
<u>MORRIS-LLOYD MINE:</u>					
1916	1 004	304 849	---	---	320 074 400
1917	886	296 589	667 908 000	2 370	319 198 700
1918	859	299 360	681 964 000	2 378	315 454 220
1919	1 132	313 887	936 264 700	2 982	340 883 130
1920	971	283 400	802 952 000	2 832	311 061 125
1921	848	234 809	681 918 000	3 067	321 064 176
1922	931	241 065	596 225 500	2 473	276 149 791
1923	1 031	273 124	826 038 000	2 460	267 210 477
1924	894	229 868	381 573.000	1 659	221 874 604
1925	919	258 062	611 836 920	2 371	172 168 518
1926	1 190	291 852	469 265 000	1 608	203 411 761

AUSTIN MINE:

1916	---	23 697	---	---	---
1917	---	54 167	---	---	---
1918	---	759	(Mine Flooded in January)	---	---
1919	---	19 212	---	---	---
1920	---	---	(Mine Idle Entire Year)	---	---
1921	---	---	(Mine idle Entire Year)	---	---
1922	---	56 429	126 617 590	2 243	---
1923	14	93 238	---	---	---
1924	---	52	---	---	---
1925	---	---	(Mine Idle Entire Year)	---	---
1926	---	53 493	---	---	---

GWINN MINE:

1917	976	191 080	---	---	148 022 900
1918	844	177 051	---	---	168 172 800
1919	1 132	154 002	---	---	199 404 200
1920	921	115 497	(Air supplied by Francis Mine)	---	165 004 020
1921	386	48 216	---	---	111 928 220
1922	15	42	18 629 865	---	102 326 460
1923	5	194	(Mine idle entire year)	---	94 461 920
1924	0	205	(Mine idle entire year)	---	89 602 860
1925	11	---	(Mine idle entire year)	---	85 920 880
1926	12	---	(Mine idle entire year)	---	83 178 200

PRINCETON MINE:

1917	101	734	---	---	109 949 035
1918	334	182 760	---	---	112 926 605
1919	468	219 230	---	---	131 496 940
1920	476	184 912	---	---	129 512 469
1921	275	105 674	---	---	111 468 005
1922	0	108	*18 629 865	---	116 542 468
1923	6	0	(Mine Idle Entire Year)	---	92 190 881
1924	6	---	(Mine Idle Entire Year)	---	81 134 449
1925	8	---	(Mine Idle Entire Year)	---	68 045 175
1926	13	---	(Mine Idle Entire Year)	---	103 341 260



MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

COMPARATIVE TABLES:

<u>YEAR</u>	<u>TONS COAL BURNED</u>	<u>TONS ORE &amp; ROCK HOISTED</u>	<u>CU.FT. AIR USED</u>	<u>CUBIC FT. AIR PER TON HOISTED</u>	<u>GALLONS OF WATER PUMPED</u>
-------------	-------------------------	------------------------------------	------------------------	--------------------------------------	--------------------------------

PRINCETON CENTRAL POWER PLANT:

1916	5 322		1 375 169 052
1917	2 121		1 051 739 302
1918	6 279		971 385 234
1919	3 614		1 236 341 627
1920	2 598		1 264 657 500
1921	3 754		839 610 000
1922	1 630		620 995 500
1923	7 405		623 700 000
1924	3 149		513 445 500
1925	7 800		534 155 500
1926	160		525 271 500

PRINCETON PUMPING STATION:

1916	814			224 152 095
1917	986			275 717 100
1918	917			262 232 600
1919	920			237 147 315
1920	890			233 913 900
1921	259			309 992 940
1922	71			313 859 370
1923	71			315 072 000
1924	75			316 224 000
1925	481			301 892 325
1926	68			313 061 745

STEPHENSON MINE:

1916	1 658	327 395	---	---	---	*785 501 510
1917	3 073	256 756	---	---	---	*961 713 000
1918	1 560	---	(Mine flooded in December 1917)			---
1919	724	1 662				
1920	2 064	205 366				1 381 633 440
1921	2 163	219 145				1 215 685 840
1922	1 876	221 559	413 913 500	1 868		1 258 504 848
1923	868	266 211				1 234 675 108
1924	1 363	257 389				1 131 055 767
1925	1 372	267 092				1 146 774 100
1926	1 271	251 415				1 078 616 922
						* 11 Months

CROSBY MINE:

1915	250	---	---	---	---	---
1916	2 069	127 373	---	---	---	---
1917	2 504	300 142	---	---	---	---
1918	3 097	255 787	---	---	---	---
1919	2 578	208 449	---	---	---	---
1920	1 280	263 478	---	---	---	---
1921	72	89 754	---	---	---	---
1922	362	---	---	---	---	---
1923	---	---	---	---	---	---
1924	---	---	---	---	---	---
1925	---	---	---	---	---	---
1926	---	---	---	---	---	---

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1926

COMPARATIVE TABLES:

<u>YEAR</u>	<u>TONS COAL BURNED</u>	<u>TONS ORE &amp; ROCK HOISTED</u>	<u>CU.FT. AIR USED</u>	<u>CUBIC FT. AIR PER TON HOISTED</u>	<u>GALLONS OF WATER PUMPED</u>
<u>WADE-HEDMER MINE:</u>					
1921	855	70 578	---	---	---
1922	5	---	---	---	---
1923	6	---	---	---	---
1924	320	21 469	---	---	---
1925	---	---	---	---	---
1926	---	---	---	---	---
<u>BOEING MINE:</u>					
1920	491	34 428	---	---	---
1921	212	26 190	---	---	---
1922	132	266 862	---	---	---
1923	4 676	501 895	---	---	---
1924	3 870	521 792	---	---	---
1925	3 726	486 175	---	---	---
1926		478 981	---	---	---
<u>HILL-TRUMBULL MINE:</u>					
1922	3 447	352 651	---	---	---
1923	4 096	311 012	---	---	---
1924	3 049	322 823	---	---	---
1925	3 364	521 382	---	---	---
1926		522 017	---	---	---
<u>REPUBLIC MINE:</u>					
1919	5 709	185 383	1 228 202 000	6 625	34 770 380
1920	3 972	181 058	1 347 129 000	7 440	35 559 650
1921	1 436	79 761	954 242 000	11 964	35 132 398
1922	1 302	113 108	1 112 788 000	9 838	41 620 635
1923	1 816	137 181	1 279 058 000	9 329	37 204 860
1924	2 668	87 668	1 158 600 000	13 215	33 955 020
1925	2 275	90 773	871 386 000	9 599	27 210 960
1926	2 218	76 867	1 053 268 000	13 702	31 117 828
<u>SPIES &amp; VIRGIL MINES:</u>					
1919	962	71 000	---	---	---
1920	377	93 519	---	---	---
1921	350	46 878	87 360 300	---	---
1922	192	5 432	---	---	---
1923	495	19 732	---	---	---
1924	272	55 953	---	---	---
1925	313	72 542	---	---	---
1926	392	92 407	---	---	---