GWINN DISTRICT MINES
ANNUAL REPORT
YEAR 1928

17. CONDITION OF PREMISES: (Cont.)

Princeton Location:

This location was cleaned by the Township. Over half of the Company houses in this location are vacant.

Gardner-Mackinaw Location:

Five families moved to this location last summer. The balance of employees live in Gwinn and surrounding locations. This year a bus service was started to the mine by a local garage, the fare being ten cents per trip. Heretofore the men have used their own cars or walked.

Due to houses being unoccupied for nearly nine years, there has been considerable deterioration. New roofs and other repairs will soon be required if these houses are to be kept in condition for possible sale.

19. GWINN ASSOCIATION, GWINN HOTEL, GWINN COUNTY PARK:

a. Gwinn Association:

It is gratifying to report that the Gwinn Association has had one of the most successful years since its organization. This has occurred in spite of the practical withdrawal of financial support by the Cleveland-Cliffs Iron Company, and was made possible by the united support of the community. The report of the activities of the association is included in full in the yearly report of Mr. W. H. Moulton, so is omitted from this report. This report is very interesting, as it gives a perfect cross-section of the social, musical, athletic, and recreational activities of the community. The people depend on the association for everything of this nature, and I question whether there is a community center in the whole United States that fulfills its purpose to the same extent.

The successful conduct of the association affairs is due to the ability and hard work of the Secretary, Mr. E. L. Miller.

b. Gwinn Hotel:

The Gwinn Hotel continued under the same management as in 1927, and had a fairly successful year. The manager has purchased considerable supplies at his own expense, and from this standpoint the hotel is in better shape than before. The Company donated the rent and electric service as in previous years, and the manager has made small wages for himself and paid all bills. The hotel is clean, has good meals, and is gaining in favor with the traveling public and summer tourists. More tourists are spending a week or more at Gwinn, fishing the lakes and streams, and stopping at the hotel.

c. Gwinn County Park:

Owing to the cold, wet summer, the swimming pool at this park was not used as much by Marquette County people as in previous years. Many tourists stopped for a day or two, and the knowledge of the park is thus being spread over an increasing territory. It is to be regretted that the County has not acquired more land along the East branch of the Escanaba River, in anticipation of future needs for expansion that will follow the opening of U.S.#41, the new concrete road, in 1931. The big trees in the woods along the river just above the present park are being cut for wood, and unless included in the park area will be gradually despoiled.

GWINN DISTRICT MINES
ANNUAL REPORT
YEAR 1928

19. GWINN ASSOCIATION,
GWINN HOTEL, ETC.

d. Future of Gwinn Townsite:

It is to be regretted that no progress was made in 1928 regarding the sale of the townsite. Conditions at present are satisfactory to the local residents, but will not continue for much more than another year, by which time the Archibald Mine will probably be abandoned. The decision to sink the Mackinaw shaft and open another level has added more than a year to the life of this property. Every effort should be made to interest prospective buyers so that sale can be made while conditions in the community are prosperous.

e. Company Houses:

The following table shows the number of houses in each location vacant and occupied during 1928 and 1927.

	1928			1927		
	Vacant	Occupied	Total	Vacant	Occupied	Total
Princeton Location	8	7	15	7	8	15
Austin Location	33	34	67*	30	38	68
Gwinn Townsite	20	100	120	28	92	120
Gardner-Mackinaw Location	46	5	51	51	0	51
Total	107	146	253	116	138	254

* One house partly burned in 1927. Sold and dismantled in 1928.

f. Gwinn District Crusher:

Summary of crusher operations for 1928 and 1927:

(10 Mos.)	1928		1927		INCREASE		DECREASE	
	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
General Expense	668.54	.003	1,389.04	.005			720.50	.002
Maintenance	4,326.81	.018	1,789.76	.006	2,537.05	.012		
Operating	4,777.98	.020	6,442.73	.023			1,664.75	.003
Total Optg. Cost	9,773.33	.041	9,621.53	.034	151.80	.007		
Switching	706.50	.003	2,053.50	.007			1,347.00	.004
Grand Total	10,479.83	.044	11,675.03	.041		.003	1,195.20	

The following table shows the grades and tons of ore crushed:

Grade	1928 Tons	1927 Tons	INCREASE	DECREASE
Stephenson	14,250	118,401		104,151
Austin	275	33,270		32,995
Gardner-Mackinaw	70,787	48,798	21,989	
Francis	-	11,822		11,822
Gwinn	-	7,053		7,053
Archibald	69,636	31,938	37,698	
Archibald, Jr.	7,865	-	7,865	
Foundry	72,280	-	72,280	
Roberts	39,728	-	39,728	
Total	274,821	284,288		9,467

	To. Nov. 1	Year
Average tons crushed per day,	1,796.47	1,883
No. days operated,	131	151
No. days idle,	53	95
Shifts and hours,	1-9 hour	1-9 hr.
Rated capacity per ten hour shift,	1,000	1,000

GWINN DISTRICT MINES
ANNUAL REPORT
YEAR 1928

19. GWINN HOTEL, ETC.

f. Gwinn District Crusher: (Cont.)

1. GENERAL:

The above gives only a rough comparison of costs for the two years, as cost figures are not available for November, when considerable ore was crushed, nor for December, when maintenance charges were $548.98 for dismantling the pan conveyor, changing sprockets, etc.

REPUBLIC MINE

ANNUAL REPORT

YEAR 1928.

1. GENERAL:

Conditions at the Republic Mine were most discouraging from the beginning of the year. We had a very small tonnage in sight and there was little chance of finding any additional ore as there was no exploratory or development work going on. Our mining operations were confined to three levels, the 1500', 1570' and 1710' levels and by the 8th of February all the ore had been cleaned out of the stope above the 1570' level, leaving only the two other levels to furnish the production. About the middle of March, all the broken ore from the main stope above the 1710' level had been hoisted and it was decided after a conference with Messrs. Rough and Stakel to start mining the floor pillars of the 1570' and 1500' levels, in order to keep up production as long as possible.

The hoist kept dropping off after January month and in order to keep the cost of production as los as possible we reduced the number of men from 115 in January to 67 in May. The mine was operated up to May 21st when it was necessary to close down on account of the small tonnage to work on. While there was some ore left in the floor pillar on the 1500' level, the risk was greater than the tonnage involved. The filling places on the 1710' level, to which the ore dropped, 200' below, were open as the ore had to be pulled as fast as it was broken and there was danger of the men loading the ore being hit by falling dirt.

The hoisting of ore was discontinued on May 21st and work of salvaging all supplies and equipment was immediately begun. The Republic Mine being a very old property, there was a great deal of pipe and rail that was only scrap and was left in place. All pipe, rail and equipment of value was removed from the mine by July 1st. The Central Power Plant was closed down on June 15th and pumping discontinued. During the balance of the year, a few men were employed on dismantling om surface and loading ore from time to time.

The Republic Mine was first opened in 1871, the initial shipment going forward in 1872. The total shipments to January 1, 1929 were 8,409,616 tons. From the time this mine was opened until it was abandoned on May 21st, 1928, it was only closed down for a period of six months during 1893. I believe it can be said the Republic ore has been shipped to more different points in the world than any other Lake Superior Iron Ore.

The closing of the Republic Mine, the only industry in the community, was a blow to the town of Republic. It will take several years for it to adjust itself to the situation. The greatest immediate problem is the school. With the valuation of the township so materially reduced by the closing of the mine and its effect on all other property, it is a question how long they will be able to maintain a high school. The township and school are both entirely free of any kind of indebtedness, and have been operating on a cash basis during the past two years, a very unusual but fortunate condition. The Cleveland-Cliffs Iron Company, in the closing of the Republic Mine and withdrawing from the District, have not left a financial burden for the remaining taxpayers.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

Basic Lump, - -	12,807 tons
Basic Crushed, -	9,325 "
Total Ore, - -	22,132 "
Rock, - - -	1,137 "

The product for the five months of the year 1928 was 22,132 tons compared with 63,850 tons for the twelve months of 1927. The average monthly production was 4,426 tons in 1928 compared with 5,321 tons in 1927. The decrease was due to the small tonnage available and limited working places. The production at the Republic Mine has always been dependent on the number of stopes that you could pull from at the same time. The shrinkage stope method of mining only allows you to hoist part of the tonnage broken, and in order to secure a paying average daily production, it was necessary to have at least eight to ten working places going at the same time. At no time during the five operating months of 1928 did we have more than five stopes to work and then the lens was small in several of them.

There was very little rock work undertaken during the year. A drift was driven in rock on the 1710' level in order to make a second filling place for the main stope that extended to above the 1500' level. The raise from this drift into the stope was also in rock.

b. Shipments:

Grade of Ore.	Pocket Tons.	Stockpile Tons.	Total Tons.	Total Last Year Tons.
Bessemer Lump,	270	277	547	440
Basic Lump,	1755	18938	20693	23105
Basic Crushed,	1960	23307	25267	23058
Pascoe Crushed,		659	659	160
Total,	3985	43181	47166	46763
Total last year,			46763	
Increase,			403	

The tonnage shipped during 1928 was not large and only exceeded the 1927 shipments by a few hundred tons. The Sales Department was handicapped as we were unable to estimate in advance the expected production on account of the small reserve tonnage as shown on December 31, 1927.

Shipments of Bessemer and Basic Lump ore were made intermittently throughout the year for all rail shipment. A total of 32 cars were loaded for ten different steel casting companies, 18 cars going to the American Steel Foundries Company for their plants at Granite City, Illinois, Indiana Harbor, Indiana, and East St. Louis, Illinois.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

PRODUCTION, SHIPMENTS & INVENTORIES:

b. Shipments (Continued):

The cars of Lump Ore for all rail shipment were loaded from pocket until the time the mine was closed in May and then by hand from the Lump Ore stockpile. We tried loading from stockpile with the steam shovel but found that we got too much fine material in the car and could not pick out the low grade material as carefully.

We started shipping our daily hoist of Basic Lump and Crushed Ore from pocket on May 1st and continued until the mine was shut down on May 21st. The first loading from stockpile was done on May 8th and 9th in the crushed pile. During the balance of the season the shovel was operated 20 days loading Basic Crushed Ore,- cleaning up this grade by the middle of October. We show an overrun of this grade of 5,404 tons. Part of this tonnage was secured by cleaning up the sollar of the old Crushed Ore stocking ground along the River,- amounting to 1,344 tons. The overrun on the ore stocked from the end of the 1927 shipping season to May 1st was 4,060 tons, or 34%.

We have carried a small tonnage of Pascoe Run-Of-Mine ore in stock for a long time as it is difficult to dispose of this grade of ore. As our Basic Crushed pile was running about two points above the guarantee in iron content, we decided to load fifteen cars of this ore and have it crushed at the Maas Mine crusher, miking it in mining quantities with each Basic Crushed cargo. In this way, we loaded out all but 646 tons.

The shovel was moved into the Basic Lump pile for the first loading on May 10th and operated here four days in May, two days in June, one day in July, four days in August and four days in October. Besides the shovel loading, 25 gondola cars were loaded by hand for all rail shipment. This pile was not cleaned up this year.

We started loading by hand the Basic Run-Of-Mine pile, the ore taken from a pit near surface, East of the Pascoe, known as the "Bice Pit", on June 16th and continued until the 8th of July, sorting the Lump from the fine ore and dumping it in different railroad cars. On account of the low contract price for loading this ore, the men were only making about $3.00 per day and it was difficult keeping a full crew at work. The men asked to be allowed to load this pile by hand rather than with steam shovel and put it in through the screening plant. The contract price per ton was placed 2½¢ higher than our estimated cost of making repairs to the screening plant and shovel loading. Hand loading was stopped on July 7th and arrangements made for steam shovel loading and putting through the screening plant. The shovel was operated in this pile on July 18th, 19th, 30th and 31st, and ten days in August, cleaning up the entire tonnage by August 25th. The loading was very slow as the pile was small and track conditions very poor. However, there was a saving over hand loading.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

PRODUCTION, SHIPMENTS & INVENTORIES:

c. Stockpile Inventories:

The following is the tonnage of various grades in stock on December 31, 1928:

Grade.	Tons.	Last year Tons.
Basic Lump, - -	9605	13,360
Basic Crushed, -		4,523
Basic Run-Of-Mine,		8,627
Pascoe Run-Of-Mine,	646	3,371
Total tonnage in stock,	10251	29,881

There is a decrease of 19,630 tons over the balance carried in stock on December 31, 1927. As our shipments for the two years were about the same, the decrease is due to the mine being closed down on May 21st. The Engineer's estimate of ore in stock as of November 1, 1928 shows an overrun of 9,009 tons in the Basic Lump ore pile and 139 tons in the Pascoe Run-Of-Mine pile.

d. Division of Product by Levels:

The tonnage trammed from the various levels during 1928 is as follows:

Level.	Tonnage.	Percentage of Product.
1500	4,780	21.6%
1570	4,913	22.2%
1710	12,439	56.2%
Total,	22,132	100.0%

The 1928 production was secured from only three different levels, as was that for the last three months of 1927. The difficulty in maintaining a uniform hoist is readily understood, when the number of filling places are so restricted. We secured over 56% of our year's product from the 1710' level stope, which was practically exhausted during the month of March. Mining of the 1510' floor pillar was started and tramming then limited to the 1500' and 1710' level. When the mining of the 1500' level floor pillar was begun, the entire product was pulled from the 1710' level.

e. Production by Months:

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

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

PRODUCTION, SHIPMENTS & INVENTORIES:

e. Production by Months (Continued):

Month.	Tons Rock.	Tons Ore.	Days Operated.	Average Daily Product.	Tons Per Man Per Day.
January,	363	5698	25	228	1.93
February,	256	4247	25	170	1.59
March,	203	4054	27	150	1.50
April,	201	4374	23	190	1.99
May,	114	3759	17	221	2.16
Total,	1137	22132	117	189	1.96
Stockpile Overrun,		5404			
Grand total,	1137	27536	117	235	2.45

January was the only month in which we secured a fair tonnage and was due to the opening up of the stope on the sill floor at the Southeast end of the 1500' level, which permitted breaking a large tonnage when taking down the back before building the stull. Further, with mining stopped in the stope above the 1570' level, we were able to pull heavily from this place. After January, it kept us scratching to keep our monthly product above 4000 tons. In February, three quarters of our tonnage came from the main stope above the 1710' level, which was cleaned out by the middle of March. At this time it was decided to start mining the floor pillars on the 1570' and 1500' levels, respectively. These floor pillars were the only available ore left in the mine that could be taken profitably. Work on these floor pillars was continued until May 21st when all mining operations were stopped and the mine closed down. There was some ore left in 1500' level floor pillar but there was too much risk for the tonnage involved. The filling holes on the 1710' level were open and there was danger of the men filling the ore being hit by dirt dropping from the 1500' level over 200' above.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

PRODUCTION, SHIPMENTS & INVENTORIES:

f. Ore Statement:

	Run-Of-Mine. Basic.	Run-Of-Mine. Pascoe.	Basic Lump.	Bessemer Lump.	Basic Crushed.	Pascoe Crushed.	Total.	Total Last Year.
On hand January 1, 1928,	8627	3371	13360		4523		29,881	11,666
Output for year,			12807		9325		22,132	63,850
Stockpile overrun,					5404		5,404	1,128
Transferred to			4678	547	6015	659		
from,	8627	2725	547					
Total,	0	646	30298	547	25267	659	57,417	76,644
Shipments,			20693	547	25267	659	47,166	46,763
Balance on hand,		646	9605				10,251	29,881
Decrease in output,	7540		19962		14216		41,718	
Decrease in ore on hand,	8627	2725	3755		4523		19,630	

1927 -- 2-8 hr. shifts, 6 days per week, January 1st to December 31, 1927.
1928 -- 2-8 hr. shifts, 6 days per week, January 1st to May 21, 1928.
Mine closed May 21, 1928.

g. Delays:

Production was interrupted several times during the year on account of non-electrical delays and only one of these was of a serious nature.

Date.	Duration.	Delays. Cause.	Tonnage Lost.
Jan. 3,	4 hours	Fine ore stocking car run over end of trestle, - - - - - -	50
May 14,	12 hours	Over winding skip, - - - - - -	180

The first mechanical delay of the year occurred January 4th. At the end of the day shift on January 3rd the fine ore stocking car was run off the end of the trestle, wrecking the car and breaking off the legs of the last bent. It took until 11:00 A. M. on January 4th to put things in shape so hoisting could be resumed. As we were not hoisting on the night shift, the delay was only for a period of four hours, causing a loss of 50 tons in the day's production. The accident was due to carelessness on the part of the top tram engineer, as he was running the car too fast when dumping close to the end of the trestle and was given a five day lay-off.

On Sunday, the 13th, at about 2:00 P. M., the hoisting engineer at No.9 Power House pulled the skip too high into the dump, breaking the bale of the skip loose from the skip. The skip dropped back into the dump and caught, while the guides and cross-head part of the bale went over the shaft house and landed on the ground just clear of the base of the shaft house.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

PRODUCTION, SHIPMENTS & INVENTORIES:

g. Delays (Continued):

The cage rope had been turned end for end on Sunday, April 29th, and when the rope was attached to the cage, allowance was made for several feet of stretch in that portion that had been on the drum which was new. The skip-pit was being cleaned on Sunday, May 13th, and in order to lower the cage to the bottom of the shaft so the car could be run on, the skip had to be hoisted a little higher than the automatic safety device was set for. The engineer blocked up the weight to allow the cage to get down to the required depth but failed to remove the block when he lowered the skip to hoist the dirt to surface, so the automatic trip could not work and cut off the current. The engineer admits he was hoisting at full speed when the accident happened. He claims the warning bell had been ringing all day but at the particular time it did not ring and upon investigation it was found that the nut on one of the terminals came off, breaking the contact. It is our opinion that this accident was due to negligence on the part of the engineer.

There was not a great deal of damage done, or any one hurt. The repairs were made on Monday, the 14th, and operations resumed on Tuesday morning, May 15th. There was one day's loss in product, estimated at 180 tons.

The dismantling work was delayed for one week from July 18th to 25th, waiting for a decision from the Ford Motor Company, whether or not they would lease the Republic Mine in order to drill their property to the West from its underground workings. An answer was received on the 24th, turning down the proposition, and work again started on the 25th.

h. Delays From Lack Of Current:

The following are the delays account of no current:

Date.	Duration.	Cause.	Tonnage Lost.
Apr. 14,	4 hours	Lightning striking transmission line,	50
Jul. 26,	1 day	Trouble on transmission line electrical storm, - - - - - - -	None
Aug. 8,	1½ days	Trouble on transmission line account electrical storm, - - - -	None

There were only three delays during the year on account of lack of current and all were due to the same cause, lightning striking the transmission line. The last two occurred after the mine was closed down and we were engaged in dismantling the underground equipment; therefore the delay was not serious and the time of making repairs longer than would have been had we been operating.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

3. ANALYSIS:

a. Average Mine Analysis On Output:

Grade.	Iron.	Phos.	Silica.
Basic Lump,	66.20	.070	3.33
Basic Crushed,	62.73	.067	6.93

b. Average Analysis On Straight Cargoes:

Grade.	M I N E.			Lake Erie.	
	Iron.	Phos.	Sil.	Iron.	Moist.
Basic Lump,	65.79	.063	4.39	64.66	.30
Basic Crushed,	62.58	.067	7.19	62.88	2.59

d. Complete Analysis Of Season's Shipments:

Lake Erie Chemist.

	Basic Lump.	Basic Crushed.
Iron, - - -	64.50	63.25
Phosphorus, - -	.064	.063
Silica, - - -	5.84	6.70
Manganese, - -	.07	.07
Alumina, - -	.62	.75
Lime, - - -	.51	.80
Magnesia, - -	.45	.51
Sulphur, - -	.007	.005
Loss, - - -	.05	.80
Moisture, - -	.30	2.59.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

None, except 291,000 tons tied up in shaft pillars and not available.

b. Prospective Ore:

None.

The mine was closed down on May 21st on account of no available ore that could be mined at a profit.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

5. LABOR AND WAGES:

a. Comments:

1. Labor:

Our greatest labor problem at the Republic Mine during the past year has been to take care of our old employees. On February 8th, after pulling all the ore from the stull above the 1570' level, we were forced to reduce our tramming and filling crews by about fifteen men. In order not to make it too much of a hardship on any one at that season of the year, we laid off a different lot of fifteen men each week. A further reduction in the number of men employed underground was made in March and April as the working places were exhausted. As our underground operations were curtailed, we also reduced the men on surface. When the mine was closed down on May 21st, we were only employing a total of 80 men.

Some of the younger men have found employment elsewhere themselves and we have taken care of a number at the Spies-Virgil, Morris-Lloyd, Cliffs Shaft, Maas and Negaunee Mines. Labor has been very plentiful in both the Ishpeming and Negaunee Districts and it has been difficult to place any of the men 55 years of age and older.

We have a number of men that have had many years of service at the Republic Mine but who are below the pension age of 65 years, that should be given assistance either in continued employment at some other of the Company's properties or by a pension.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

5. LABOR & WAGES (CONTINUED):

b. Comparative Statement of Wages & Product:

	1928.	1927.	Increase.	Decrease.
PRODUCT:	22,132	63,850		41,718
No. shifts and hours,	2 - 8	2 - 8		
AVER.NO.MEN WORKING:				
Surface,	19	30		11
Underground,	60	85		25
Total,	79	115		36
AVER. WAGES PER DAY:				
Surface,	4.54	4.58		.04
Underground,	4.73	4.73		
Total,	4.66	4.66		
WAGES PER MONTH OF 25 DAYS:				
Surface,	113.50	114.50		1.00
Underground,	118.25	118.25		
Total,	116.50	117.25		.75
PRODUCT PER MAN PER DAY:				
Surface,	4.40	6.45		2.05
Underground,	2.62	2.55	.07	
Total,	1.64	1.89		.25
LABOR COST PER TON:				
Surface,	1.033	.710	.323	
Underground,	1.805	1.779	.026	
Total,	2.838	2.489	.349	
AVER.PRODUCT BR'K & TRM'G:	7.34	6.94	.40	
" WAGES CONTRACT MINERS,	4.68	4.61	.07	
" " " TRAMMERS,	7.23	6.66	.57	
" " " LABOR,	5.04	5.07		.03
TOTAL NO. OF DAYS:				
Surface,	5.031½	9.900		4.868½
Underground,	8.439¾	24.005¼		15.565½
Total,	13.471¼	33.905¼		20.434
AMOUNT FOR LABOR:				
Surface,	22858.35	45356.10		22497.75
Underground,	39957.50	113575.90		73618.40
Total,	62815.85	158932.00		96116.15

PROPORTION SURFACE TO UNDERGROUND MEN:

1928 - 1 to 3.15
1927 - 1 to 2.83
1926 - 1 to 2.34
1925 - 1 to 2.47
1924 - 1 to 2.80

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

6. SURFACE:

a. Buildings:

1 Mine Buildings:

The barn on the Republic Mine Farm was burned to the ground on Thursday, June 28th, at 9:30 P. M. While the Fire Department responded promptly, the building had no doubt been burning for some time before it was discovered by the night watchman at the mine who turned in the alarm, as it was completely enveloped in flames on their arrival. They used their chemical apparatus and saved a few pieces of farm machinery standing outside the building.

In order to get water on the fire, it would have been necessary to start up the compressor at the Water Power Plant to operate a pump in the building and then stretch a hose some 800'. As there was no operator at hand, this would have taken considerable time and been too late to do any good.

This building was evidently set afire as no one had been around it and was some distance from any mine location houses. We estimate it would cost $2050.00 to replace this barn.

The following items of farm equipment were a total loss:

1 Binder,
1 Mowing machine,
1 Seeder,
1 Hay Fork.

Besides the above equipment, there was about ten tons of hay in the barn belonging to Axel Carlson, farmer, to whom we rented the farm last year. He carried no insurance.

The insurance carried on the building is $1600.00 and contents $1,000.00.

About 11:00 the same night, another fire was started under the floor of an old abandoned warehouse, just Southwest of the Pascoe Shaft. This fire, on account of where it started, was slow burning and the Fire Department, after working until nearly 3:30 A. M., were able to completely extinguish it. Again at 5:00 A. M., the Watchman discovered the entire roof in flames and while he turned in an alarm, the building was burned to the ground before the Fire Department arrived.

Mr. Donaldson, Chief of the Republic Fire Department, feels positive the first fire in this building was entirely out when they left at 3:30 A. M. He said that after they had the fire out, he sent to town for some coffee and sandwiches and they sat around for over a half hour and made a final inspection before they left.

Our Night Watchman was up at this building at 4:30 A. M. and says there was no sign of smoke from any smoldering timber. He left to make his final round and when he reached the No.9 dry on the hill, he happened to look back and saw this building afire again and turned in an alarm.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

SURFACE:

a. Buildings:

1. Mine Buildings (Continued):

As this building had been used as a Cornish pump house and also a place to make "Sunshine" for the miners lamps, it is quite possible that the fire started this second time as a result of the first. The Fireman and Watchman feel that it was set again, as this time it was in the roof.

This building is listed on our insurance sheet under "Group No.4 South", as warehouse. The building is insured at $500.00 and there were no contents. We estimate it would cost $1100.00 to replace this building.

The windows of all the mine buildings have been boarded up to protect them from breakage and theft of material and machinery stored in them. The oil house, carpenter shop and a number of small sheds were sold and have been dismantled and removed from the property.

2. Location Houses:

Practically no repairs were made to the houses during the past several years on account of the uncertain conditions at the mine. As the mine closed on May 21st, we did not give the tenants any kalsomine or paint for the usual spring cleaning. We are anxious to sell these houses. As we do not know how long the present occupants will continue to live in them, it was decided to reduce the rent from one to one dollar and a half a month, the tenant to do all inside kalsomining and painting.

We have sold a number of the location houses and joined with the Republic Mine Accident and Sick Benefit Club in donating the Republic Mine Hospital to the Republic Improvement Association. The Hospital building was jointly owned by the Company and the Club and had to be disposed of before the funds could be distributed. It was impossible to sell it, except for a very small amount, the only bid being for $100.00, so it was decided to give it to the Republic Improvement Association for the use of the town.

Four single houses and three double ones have been sold as follows:

House No.	Purchaser.	Sale Price.
17	P. W. Pascoe, Jr.	$700.00
22	Bert Martell,	350.00
32	Bert Anderson,	1500.00
21, E½,	Gust Windahl,	150.00
21, W½,	Richard Fowler,	150.00
23, E½,	Annie Peterson,	200.00
23, W½,	John R. Peterson,	200.00
53, Entire,	Clifford Gjiers,	250.00

b. Stockpiles:

On January 3rd, the Crushed Ore stockpile car ran off the end of the trestle and broke the legs of the last bent. This bent was repaired and one more added. Then two more bents were added to the Lump Ore trestle, which gave sufficient room for the balance of the season for this grade. While we had the men, we built another trestle for the Crushed Ore. It was erected to the East of the pile close to the bank. This work was all completed by February 7th and two of the carpenter crew laid off.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

SURFACE:

b. Stockpiles (Continued):

When shovel loading was started, the trestles were dismantled and in July a carload of fir timber and trestle legs was shipped to the Spies-Virgil Mine for a new trestle to be constructed there. There were a number of old trestles, including the rock trestle that ran out into the Bay, that were given away for fire wood for the dismantling. These trestles were in a dangerous condition and would have had to be taken down by the Company.

d. Farm:

The Company Farm, located near the Water Power Plant, was offered for sale in 1927 and the one bid of $1500.00 was not accepted. We were unable to rent it as it needs extensive cultivation and no one would rent it for a short period.

e. Scrap:

Several men who worked on the steam shovel when loading ore, spent the time when not so occupied during August and September, together with the team gathering up scrap iron from around the property and piling it on the dock East of the Shops building to have it ready to load when sold. We loaded and shipped out during October two cars of mixed scrap, sold to the West End Scrap Iron & Metal Company, of Duluth. In the bottom of one of these cars, we placed a barrel containing 455 lbs. of scrap copper. One car of cast scrap was also loaded and shipped to the Lake Shore Engine Works at Marquette.

In order to make room for the new electrical generator at the Water Power Plant, the air compressor had to be dismantled and removed from the building. This work was started by the operators and finished by our shovel crew during November. This material was hauled and piled near a loading track at the mine where it will be loaded as scrap.

About 1200 pounds of scrap brass salvaged from these compressors was shipped to the Lake Shore Engine Works at Marquette.

It was decided to scrap all of our steam equipment at the Central Plant and miscellaneous material that could not be used at other Company mines, or be sold. We had several scrap iron dealers look over the equipment, offered as scrap. The highest bid of $6.50 per gross ton, as is, received from the Michigan Scrap Iron Company, of Ironwood, Michigan, was accepted. The equipment included in this sale is as follows:

Water power compressors,
Old electric light machine and boilers at No.5, engine house.
Picking belt and screen at No.9 shaft,
Screen and hoist at crushing plant,
All underground cars, skips and cages,
Hoist and compressor at Central Plant and Boiler Plant,
except electric and small steam feed pumps.
Miscellaneous scrap now in the scrap pile East of the shops building and scattered throughout the property.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

SURFACE:

f. Sale of Equipment & Supplies:

The following equipment was sold to various Company properties:

General Storehouse, Ishpeming.

All supplies carried in warehouse,
All iron and steel,
All oils and grease.

Cliffs Shaft Mine, Ishpeming.

2 Storage battery locomotives,
1 Motor generator set for charging batteries,
1000' 4" pipe,
Repair parts for No.248 drill machines.

Holmes Mine, Ishpeming.

62 Boxes 50% geletin powder,
2 Small pumps.

Morris-Lloys Mine, Ishpeming.

2 Wall phones,
1 Mine-a phone,
1 1/8" round drill steel - new,
Repair parts for No.248 drill machines,
1 Plainer,
1 26" Lathe and accessories.

Maas Mine, Negaunee.

1 Steam hammer.

Gardner-Mackinaw Mine, Gwinn.

2 Sullivan double drum turbin air hoists.

Spies-Virgil Mine, Iron River.

2100' used 1¼" hoisting rope,
1005' new electric signal cable,
43 Pieces 12" x 16" x 30' used fir trestle stringers,
12 35' used, cypress trestle legs,
1 Circular saw,
1 Wood plainer,
1 18" Lathe traded for smaller one at Spies-Virgil,
1 Shaper,
1 Bolt cutter,
1 Air driven emery wheel,
1 Power driven emery wheel,
1 Mine-a-phone,
1 Wall phone,
5 Fire extinguishers,
1 6" Bench vise,
1 18" Jack screw,
1 Lot old pipe,
1 Lot used bar iron,
1 Lot railroad ties and ladders made for the Spies-Virgil Mine and on hand.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

SURFACE:

f. Sale of Equipment and Supplies(Continued):

Holman-Cliffs Iron Company, Taconite, Minnesota.

700' 12" pipe.

Iron County Road Commission, Crystal Falls:

1800' 6" pipe.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking done in 1928.

b. Development:

The development drifting and raising done during the past year was limited to the work necessary for mining known ore.

1500' Level:

A drift was driven ahead from the South end of the hanging wall stope following a small seam of ore. While it was mixed with banded material, we were in hopes of the good ore opening up to a mineable width. After advancing 50', we broke through on the West side into the stope which came up from the 1710' level without finding any additional ore. We were glad for this information, however, as we always had the idea that there was ore left in the back of this stope which had been lost due to pulling the dirt from under the miners feet. This stope had been stopped on account of lean material in the back.

1710' Level:

Toward the end of 1927, it appeared that unless we made a second filling place into the main stope above the 1710' level, we would not be able to clean out all the broken ore and further, when mining the floor pillars of the 1500' and 1570' levels, all the ore would have to be loaded from this level. In November, 1927, a gang was started drifting Southeast, parallel to the main stope, about 20' East. They drifted 48', then turned about 90° to the right and extended the drift under the stope, where a raise was put up. All this work was in rock.

c. Stoping:

1. General:

The ore hoisted the past year was secured from three different levels. The 1710' level produced 56% and the 1570' and 1500' each approximately 22%. The operations on these three levels were of a scram nature as we had to take the ore as cheaply and rapidly as possible and in a number of instances were forced to leave ore that was slow and costly to mine.

1500' Level:

Early in January, a drift was driven from the end of the Southeast heading to the Northeast holing into a raise put up from the stope below. A stope was then opened up on the sill floor 18" x 30'. After the timber stull was completed, a crew of four men were employed until March 19th breaking ore from above the level. The foot and hanging walls of this lens were flat and the ore area was getting smaller as the stope advanced upward. The number of men was reduced as the area became smaller, until it was finally stopped on April 10th. We had reached a point where a sufficient tonnage could not be broken to even fill on one shift. As we had to secure more ore to keep up our production to a paying operation, mining had to be stopped here and the broken ore loaded as fast as possible. About one half

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

UNDERGROUND:

c. Stoping:

1. General:

1500' Level(Continued):

of our April output was loaded from this place. When all the broken ore was cleaned out, mining of the floor pillar was started and continued until May 21st when we reached a point where the risk of mining the remaining ore was too great for the tonnage involved. This being the last of the available ore, the mine had to be closed down.

1570' Level:

During December of 1927, we completed the mining of all the ore above the 1570' level and started loading it as fast as possible and had it all cleaned up by February 8th.

The hanging wall stope on the 1500' level above was of quite a size and there was every reason to believe there was ore in the bottom. A drift had been started from a bench under the level but showed rock for a distance of 18' and was stopped. As we were up against it for ore, it was decided to put up an incline raise from the end of this drift to determine what was above. This raise was in rock to within a few feet of the 1500' level, when it cut ore on the hanging side. This ore was broken and scraped to the footwall stope where it dropped to the 1570' level. A total of about 2000 tons was realized from the ore in the floor of the 1500' level, hanging wall floor pillar. This ore was exhausted by April 27th, when the miners were laid off.

1710' Level:

When this stope was opened, there was no connection to the level above and we had to pull enough each day to keep a travelling way open for the men. As the hanging was steeper than the run of the broken ore, some ore was left on the hanging. In order to mine this after a connection was made to the level above, the ore was allowed to accumulate to height where the ore in the back could be drilled. Filling from this stope was discontinued in December, 1927, and all the available ore was mined from the hanging rock by February 1st. Work was then started on the foot side and as it was very flat, we had to install a scraper and pull the broken ore to a point where it would roll down the stope.

After the 1570' level stope was cleaned out on February 8th, this stope had to furnish the larger part of the daily hoist and as a result, it was pretty well cleaned out by the middle of March. In order to secure ore quickly, we had to leave a triangular piece on the foot and start mining the floor pillar of the 1570' level. This pillar was all mined by May 1st and the miners laid off.

When driving the drift for making a second filling place for the main stope, a seam of ore was cut. While it was small, we were in such shape that we had to follow every lead, regardless of size. This piece of ore opened up a stope 12' x 20' on the sill floor and pinched together gradually as we raised on it. Mining was continued here until the 16th of March as it was doubtful whether it was paying or not. The men were laidmoff and the ore loaded as fast as possible. It was exhausted by the end of March.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

UNDERGROUND:

d. Timbering:

We realized from the beginning of the year that the life of the mine was short and with this in mind, made only those repairs to the No.9 and Pascoe Shafts that were necessary for a safe operation. Heretofore, our shaft repairs had been the main part of our timbering and a large item of expense. The timber crew was cut down and their work was mainly repairs to stulls and salvaging material from abandoned levels.

e. Drifting and Raising:

The only drifting and raising done during 1928 was in connection with the second filling place of the main stope on the 1710' level and the mining of the floor pillar under the hanging wall stope on the 1500' level.

The following is a comparative statement of the drifting and raising for the past two years:

YEAR.	DRIFTING.		RAISING.	
	Ore.	Rock.	Ore.	Rock.
1927	332	145	334	
1928	30	20	75	47

f. Explosives, Drilling & Blasting:

The cost of explosives per ton of ore in 1928 was $0.1916 compared with $0.2101 for 1927, a decrease of $0.0185. The decrease is due to the smaller amount of drifting and raising done in 1928.

Statement of Explosives Used:

	Quantity.	Average Price.	Amount 1928.	Amount 1927.
50% L. F. Gelatine, -	26,840	.1433	3848.62	12,254.42
Total powder, - -	26,840	.1433	3848.62	12,254.42
Fuse, - - - -	51,550	5.7160	294.66	969.69
Caps, - - - -	9,045	1.0652	96.35	182.80
Tamping bags, - -				4.71
Cap crimpers, - -	1	1.0000	1.00	4.02
Ignitors, - - -				
Electric exploders,				
Connecting wire,				
Leading wire,				
Total fuse, etc,			392.01	1,161.22
Total explosives,			4240.63	13,416.64
Product, - - - -			22,132	63,850
Pounds powder per ton of ore,			1.212	1.357
Cost per ton for powder,			.1739	.1919
Cost per ton for fuse, caps, etc,			.0177	.0182
Cost per ton all explosives,			.1916	.2101
Average price per pound for powder,			.1433	.1414

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1928.	1927.	Increase.	Decrease.
Production:				
Ore produced, - -	22,132	63,850		41,718
Average daily product,	189	225		36
Tons per man per day,	1.96,	1.92	.04	
No. days operating,	117	284		167
No. shifts & hours,	2 - 8	2 - 8		
Cost:				
Underground costs, -	2.462	2.270	.192	
Surface, - - -	1.007	.804	.203	
General mine accounts,	.573	.281	.292	
Cost of production,	4.042	3.355	.687	
Cost of loading and shipping, - -	.230	.041	.189	
Cost at mine per cost sheet,	4.272	3.396	.876	
Depreciation - movable equipment. - -		.001		.001
Taxes, - - -	.443	.162	.281	
Central office, -	.255	.184	.071	
Welfare, safety, hospital, etc, - -	.278	.184	.094	
Cost adjustment, -		.028		.028
Totalcost at mine, -	5.248	3.955	1.293	
Expense Beyond Mine:				
Rail freight, - -	.700	.700		
Lake freight, - -	.760	.760		
Cargo, insurance & analysis,	.010	.010		
Shrinkage, - -	.059	.047		
Total cost lower lake ports, - -	6.777	5.472		

b. Detail Cost Comparison:

1. Days and Shifts:

The mine operated two eight-hour shifts per day six days per week from January 1, 1928 to May 21st, when the mine was closed down, compared with five days per week from January 1, 1927 to June 16th and six days per week from June 16th to December 31, 1927. The mine being closed on May 21, 1928 explains the large difference in days operated.

2. Production:

The decrease in production is due to the mine closing on May 21st and the smaller average daily output on account of the limited tonnage available. The 1928 operation was in the nature of a scram which was confined to three levels. The tons per man per day are about the same for each year, even though there was a smaller daily production in 1928. This is explained by our laying off every available man on surface and underground.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detail Cost Comparison(Continued);

3. Cost of Production:

The increase in cost of production and total cost at the mine is explained by the mine closing so early in the year and having certain charges added without any additional tonnage. Comparing the costs for the first five months of each year, the increase for 1928 is $0.292 and $0.270 for cost of production and total cost at the mine, respectively. The loading cost during 1928 was exceedingly high on account of the large amount of hand loading done.

4. Underground Costs:
5. Surface Costs:
6. General Mine Accounts:

It is impossible to analyze each item under the above headings as our 1928 operation only covered a period of five months compared with a full year in 1927, and further, our operations were more or less of a scram and hardly comparable to conditions during 1927.

10. TAXES:

DESCRIPTION.	1928. VALUATION.	1928. TAXES.	1927. VALUATION.	1927. TAXES.
Realty as described on Tax Receipt,	25,000	1324.01	100,000	5,274.20
Personal property, - - - -	160,000	8473.50	99,500	5,248.25
Lots 71, 72, 86, 108 and 126, -	95	5.07	95	5.06
Total opt. Republic Mine,	185,095	9802.58	199,595	10,527.51
Various persons - accts. rec., -		154.40		
Republic Mine dwellings, - - -	20,750	904.51	20,750	1,095.00
Dr. H. H. Loveland, hospital, -		40.00	2,500	132.00
Total Republic Township (inc. fees),	205,845	10901.49	222,845	11,754.51
Rate,		5.243		5.22

11. ACCIDENTS AND PERSONAL INJURY:

a. Accidents:

We had a total of five accidents during 1928 compared with twelve in 1927 and thirty three in 1926. Of the five accidents, two occurred underground before May 21st, the date the mine closed down, and three on surface after that time.

Only one of the five accidents during 1928 was of a serious nature. On October 19th at 11:30 A. M., Henry Kangas, who was employed with another man loading ore from the lump stockpile into gondola cars for all rail shipment, had his right leg broken. These men were working on a platform, built from the top of the gondola car to the stockpile. They had loaded all of the loose chunks and Kangas was going to run the pile and in the act of doing this a large piece of ore came from the top of the pile. He saw it coming, but being rather old and slow in his movement, was unable to get out of the way and was struck on the right leg, breaking the bone just above the ankle. Kangas will be laid up for some time and on account of the mine being closed, it will be difficult to find work for him at our other properties. It is unfortunate that an accident of this nature should have happened after the mine was closed.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

15. POWER:

We operated the water driven compressors until March 8th, by running at low pressure and then boosting it with the electric booster compressor at the Central Plant. Even though we used considerable current to run the booster compressor, there is a saving over the operation of the steam machine.

On account of low water, we were forced to shut down the water plant for three days, March 8th, 9th and 10th, and run the steam compressor at the Central Plant. Although the water did not raise but a few inches during these three days, in anticipation of our spring break-up, as the snow was beginning to melt, we again operated the water power compressors in connection with the electric booster. By the first of April, the water had raised to a point where we could make sufficient air for the few gangs of miners employed, by running only one machine. The other wheel was connected to the electric generator and we made current. We were able to operate all our pumps and other electrical equipment, excepting the No.9 hoist, on our own power, effecting a great saving to the Republic Mine.

The Cliffs Power & Light Company took over the operation of the Water Power Plant on June 1st. The plant was only operated on the day shift to help take care of the peak loads until after the fires on June 28th, when it was run both day and night in order to have some one around all the time. The plant was operated this way until the middle of October, when we started to dismantle the compresors in order to make room for an additional generator to be connected with the second wheel. The compressors were removed from the building and sold for scrap. Alterations were started during December and part of the new machinery had arrived. The changes should be completed early in 1929.

17. CONDITION OF PREMISES:

We cleaned up around the surface and mine buildings and repaired fences about the pits and old shafts during April and May. As the mine was shut down, the usual repairs to the buildings were not made. During the latter part of July and first of August, three men were employed for about ten days cutting thistles from the Republic Mine property, which covers an area about one mile square.

18. NATIONALITY OF EMPLOYES:

	DECEMBER 31, 1928.		DECEMBER 31, 1927.	
	NO. MEN.	PERCENT.	NO. MEN.	PERCENT.
Finnish,	43	40.1	53	46.2
Scandinavians,	20	18.7	21	18.3
English,	14	13.2	12	10.5
French,	12	11.2	12	10.5
Irish,	11	10.3	11	9.5
Belgian,	5	4.7	3	2.6
German,	-	-	1	.8
Italian,	1	.9	1	.8
Welsh,	1	.9	1	.8
Total,	107	100.0	115	100.0

The figures used in the above table for 1928 as a matter of comparison were taken from our May 15th time books as the mine was closed down on May 21, 1928.

REPUBLIC MINE
ANNUAL REPORT
YEAR 1928.

19. DISMANTLING:

a. Underground:

Immediately upon discontinuing mining operations, we started to dismantle all equipment with a salvage value. All the drill machines, tools, cars and other movable equipment was removed first, then the pipe and rails that were in a useable condition. The pumps in No.9 shaft were stopped on June 15th,- by this time the cross-over pump, discharge pipe, and electric cable in the Pascoe Shaft, had been taken out and hoisted to surface. The Central Power Plant was also closed on June 15th.

The hoist on the 2050' level Pascoe Shaft and pumps in No.9 Shaft were dismantled and hoisted to surface by July 1st, when a crew of seven men were employed taking out the discharge and air lines. The last thing taken out was the pump and signal cables. The pump cable was in three pieces and the signal cable in one. The removing of the pump cable was a slow, tedious job as it was on the inside of some of the shaft sets and the clamps holding it to the hoisting rope would get caught, retarding the work to a great extent.

After everything of value was removed from underground, the two shafts were bulk-headed with concrete. The No.9 Shaft was covered with a slab of reinforced concrete, while the Pascoe Shaft, which is incline and open for a distance from surface, we had to go down about 150' where the rock was solid in the back. Here a bulk-head of reinforced concrete was built. The collar of the shaft was covered with plank and guarded with a fence.

b. Surface:

The equipment brought from underground was stored on surface. The electric motors were housed in the drill sharpening shop near No.9 Shaft and the pumps in the tunnel back of the dry buildings. The surface crew handling this equipment also were engaged dismantling the trestles and pipe lines on surface. After July 1st, all surface work was done from time to time by the steam shovel,crew when it was not in operation. As the shovel was only run several days a week, and never started loading before nine or ten o'clock, we were able to accomplish quite a lot of work.

The machine and carpenter shop equipment was dismantled, a large portion of which was shipped to various mines or stored in the machine shop. The 16" and 12" air line from the Water Power Plant to the Central Power Plant and No.9 Shaft was taken apart. There is about 4700' of the 16" riveted pipe and 1500' of the 12" iron pipe. We shipped 700' of the 12" pipe to the Holman-Cliffs Iron Company at Taconite, Minnesota, for use in connection with the drainage of the pit. The 16" pipe is now being hauled and piled where it will be convenient for loading. On account of so little snow and the rough character of the country through which the pipe had to be hauled, it could not be handled until after the first of the year.

The water driven compressors were dismantled during November and December and preparations made for the new installations at the Water Power Plant, which has been taken over by the Cliffs Power & Light Company.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

1. GENERAL:

The operation at the Spies-Virgil Mine during 1928 was very steady, the production varying very little from month to month. Toward the end of the year our development work was not keeping up with our mining due to the irregularity of the ore body at the East end of the North finger. The lens in this vicinity is very narrow and is cut by seams of rock, or rather zones of lack of concentration. The ore grades very abruptly into these lean zones. A great deal of development drifting and raising is required for the ore developed. Unless we can develop a fair tonnage above the 280' sub-level, we will have to start work to develop the ore below the 6th level. A study will have to be made as to whether it will be cheaper to mine this ore from the 8th level or from an intermediate one.

2. PRODUCTION SHIPMENTS & INVENTORIES:

a. Production by Grades:

Virgil Crushed, - - - -	180,403 tons
Virgil High Sulphur, - - -	0
Total Ore,	180,403 tons
Rock,	3,848 tons.

We show no high sulphur ore produced during 1928. However, we did mine some 6,000 tons from the 4th level and sub-levels above and mix it with our Virgil Crushed grade. As this ore could be left in the mine, mining was discontinued in this territory when it was decided not to raise the sulphur content any higher than necessary.

The rock work during the past year was limited to the East cross-cut on the main 6th level and subs above this drift. This lens is very small and considerable drifting and raising has been necessary to follow the ore which is cut by seams of rock.

b. Shipments:

Grade of Ore.	Pocket Tons.	Stockpile Tons.	Total Tons.	Total Last Year Tons.
Virgil Crushed,	7,397	14,937	22,334	12,904
Virgil High Sul.,				0
Spies Crushed,				3,264
Total,	7,397	14,937	22,334	16,168
Total last year,	8,662	7,506	16,168	
Increase,	1,265	7,431	6,166	

The total shipments for 1928 were small even though they exceeded the previous year by about 6,000 tons. They only amounted to 12.3% of our year's production.

We did not expect to make any shipments for the season, when word was received from Cleveland on October 29th to prepare a cargo of 5,800 tons of Virgil ore. Pocket shipments were started on the night shift of October 29th and stockpile loading Wednesday, the 31st. The desired tonnage for this cargo was secured by the night of November 1st.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

2. PRODUCTION SHIPMENTS & INVENTORIES:

b. Shipments (Continued);

An additional order was received on November 7th and loading again started from both pocket and stockpile on the 8th and continued to the 15th, inclusive.

One cargo of 5,901 tons was shipped as straight Virgil ore, while the balance of the tonnage was mixed with either Athens or Stephenson ore and shipped as Virdale or Yorkshire grades.

We kept an accurate count of the number of underground cars dumped into the railroad cars, and the small tonnage loaded from pocket of 6,314 tons showed an overrun of 17%.

c. Stockpile Inventories:

Grade.	Tons In Stock.
Virgil Crushed (low sulphur),	316,449
Virgil Crushed (high sulphur),	2,923
Total,	319,372

On December 31, 1928, the ore in stock amounted to 319,372 tons, an increase of 158,069 tons over December 31, 1927, or approximately twice the tonnage. We do not consider the high sulphur grade as merchantable ore.

An engineer's estimate of the tonnage in stock on November 1st shows an overrun of 62,126 tons, or 20%. This compares with our pocket overrun of the small tonnage shipped this season of 17%.

d. Division of Product by Levels:

The ore hoisted from the various levels was as follows:

Level.	Property.	Tons.	% of Product.
4th level,	Virgil	6,314	3.5%
6th level,	Virgil	174,089	96.5
Total,	Virgil	180,403	100.0

The product from the 4th level was the high sulphur ore mined and mixed during the months of February, March and April. Rather than continue to mine from this level and stock the ore on the high sulphur pile, operations were stopped. The main operation for the past year was in the Northwest stope above the 6th level, which furnished practically our entire output.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

2. PRODUCTION SHIPMENTS & INVENTORIES:

e. Production by Months:

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

Month.	Tons Rock.	Tons Ore.	No.Days Operated.	Average Daily Product.	Tons Per Man Per Day.
Jan.	732	11,922	25	477	4.70
Feb.	350	14,744	25	590	6.32
Mar.	86	15,922	27	590	6.36
Apr.	344	14,778	24	614	6.53
May	586	15,094	26	581	6.59
June	512	14,536	26	559	6.17
July	194	16,140	25	646	7.30
Aug.	374	18,364	27	680	7.85
Sept.	188	14,066	24	586	6.82
Oct.	168	16,475	27	610	6.92
Nov.	100	15,148	24	631	7.39
Dec.	214	13,264	24	553	6.40
Total	3848	180,403	304	593	6.57
Stockpile Overrun					
Grand Total,	3848	180,403	304	593	6.57

The production from the Virgil property was just our estimate of 180,000 tons.for the year. January was our smallest production for the year. After that we maintained a rather uniform output for the balance of the year. August was the best month with 18,364 tons, the entire tonnage coming from the ore stope above the 6th level. We feel that if we had more than one stope to pull from we could secure 18,000 tons, or better, each month.

f. Ore Statement:

	Virgil Low Sul.	Virgil High Sul.	Total.	Total Last Year.
On hand January 1, 1928,	158,380,	2,923	161,303	21,468
Output for year, - -	180,403		180,403	153,079
Stockpile overrun, - -				2,925
Total,	338,783	2,923	341,706	177,472
Shipments, - - -	22,334		22,334	16,169
Balance on hand, - -	316,449	2,923	319,372	161,303
Increase in output, -	30,249	2,923	27,324	78,034
Increase in ore on hand,	158,069		158,069	139,835

1927 - 2-8 hour shifts, 6 days per week, Jan.1st to Dec.31, 1927.
1928 - 2-8 hour shipfts,6 days per week, Jan.1st to Dec.31, 1928.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

2. PRODUCTION SHIPMENTS & INVENTORIES:

g. Delays:

Production was interrupted several times during the year as follows:

DELAYS.

Date.	Duration.	Cause.	Tonnage Lost.
Apr.14th,	2 hours	Larry car off track,	88
Apr.15th,	2 hours	Larry car off track and air cylinder at pocker frozen,	50
May 4th,	3½ hours	Larry car off track,	120
Jun.14th,	2 hours	Larry car off track,	50
Jun.23rd,	2½ hours	Larry car over end of dump,	75
Aug. 9th,	6 hours	Changing skip sheave at top of shaft house,	200
Oct. 9th,	1½ hours	Larry car motor burned out,	50
Oct.10th,	6 hours	Product stocked by hand tramming account repairs to Larry cars,	200
Oct.11th,	2 hours	Product stocked by hand,	50
Oct.24th,	2½ hours	Trolley pole jumping wire,	50
Nov. 9th,	3½ hours	Skip catching in shaft timber,	60
Dec. 1st,	4 hours	Larry car over end of stock-pile,	110

Out of the twelve non-electrical delays which occurred during the past year, ten were in connection with the operation of the Larry stockpile car; none of which were serious, however. The Larry car system of stocking ore operates with very little trouble when dumping from a trestle, where the track and trolley line are rigid. We were handicapped for stocking room during the winter and spring of 1928 and were compelled to build up on top of an old pile side dumping. As this meant frequent shifting of tracks, we were not able to keep them in shape, especially during thawing weather or heavy rains. You will note that the car was off the track five times between April 19th and June 23rd, the period of the spring break-up and heavy rains.

A new stocking ground was made and trestle erected, which was put into use on July 15th. During the time from July 15th to September 15th, when we were dumping from a trestle, we operated without any trouble from our stocking system. About the middle of September, we started to side dump again and swing tracks, when our troubles began. The unevenness of the track throws a strain on the car and on the night shift of October 9th one of the coils in the motor was burned out. As the spare car had been partly dismantled waiting for a new set of wheels, it was necessary to transfer the motor from one car to the other, which was done the next day, October 10th. The car was only in operation a short time when the second motor burned out and it was necessary to resort to hand tramming until the night shift of October 11th. In order to have the motors repaired, they had to be taken to the general shops at Ishpeming.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

2. PRODUCTION SHIPMENTS & INVENTORIES:

g. Delays (Continued):

There was a delay on the day shift of August 9th of six hours due to changing the skip head sheave in the shaft house. This sheave had worn very thin and several spokes were broken. An inspection was made daily with the hope it would last until the following Sunday. The inspection made on August 9th showed the sheave in an unsafe condition. The men were already underground but brought to surface immediately and the sheave changed.

On the morning of November 9th, it was reported that the skip was not hanging plumb and was rubbing the shaft timbers. In order to avoid having the skip catch in the shaft timbers and cause an accident that would mean a long delay, after the men were taken underground the skip was changed. It was 11:30 A. M. before hoisting was resumed, causing a delay of 3½ hours and a loss in production of 60 tons.

h. Delays From Lack Of Current:

There were only two delays during 1928 due to lack of current, neither of which were serious, as follows:

DELAYS.

Date.	Duration.	Cause.	Tonnage Lost.
Apr.18th,	2 hours	Snow storm,	40
May 2nd,	3½ hours	Lightning struck underground cable,	50

The first delay, on account of lack of current, occurred on the night of April 18th when during a severe snow storm the electrical power was off for two hours. During the night of May 2nd there was an electrical storm and lightning struck the underground cable and caused a short circuit in the pot head in the 8th level pump house. It took several hours to make repairs, which tied up the underground haulage system for a period of 3½ hours, with a loss of production of 50 tons.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

3. ANALYSIS:

a. Average Mine Analysis on Output:

Grade.	Iron.	Phos.	Sil.	Alum.	Mang.	Lime.	Mag.	Sul.	Loss.	Moist.
Virgil crushed,	57.40	.442	6.35	1.69	.22	.48	.21	.073	7.55	8.00

b. Average Analysis on Straight Cargoes:

		Mine.				Lake Erie.	
Grade.	Tons.	Iron.	Phos.	Sil.	Sul.	Iron.	Moist.
Virgil crushed,	5901	58.14	.382	6.87	.054	57.76	7.46

c. High Sulphur Ore;

The development of the sub-levels above the 4th level proved up all high sulphur ore averaging between .175 and .225. The ore secured from the 6th level stope was averaging under .060 in sulphur, so one gang was employed stoping above the 4th level and the ore mixed so as to keep the sulphur content of the product below our guarantee .090. Daily sulphur samples were run and a limited number of cars hoisted and mixed each shift, depending on the sulphur content. During February, March and April between 10% and 13% of our production was hoisted from the 4th level, increasing the sulphur content of the output between .010 and .013. This helped out our production and decreased the cost per ton. We felt that if we expected to secure any returns from the development of this level, we should mine and mix a limited tonnage when the sulphur content in the ore being mined from the stope above the 6th level would stand for mixing it.

As the high sulphur ore being mined from above the 4th level could be left in the mine, it was decided to discontinue mining here in May and make a grade as low in sulphur as possible. As we were cramped for stocking room, we could not handle and stock this high sulphur ore separately without going to quite some expense.

The sulphur content of the ore mined from the stope above the 6th level has been most satisfactory, averaging .057%. As we mine upward and get closer to the 4th level, the sulphur will no doubt increase.

d. Average Analysis on Total Shipments:

Grade.	Tons.	Iron.	Phos.	Sil.	Alum.	Mang.	Lime.	Mag.	Sul.	Igni.	Moist.
Virgil,	22334	56.75	.450	7.80	1.65	.180	.30	.15	.080	7.70	8.14

e. Average Analysis of Ore in Stockpile:

Grade.	Tons.	Iron.	Phos.	Sil.	Mang.	Alum.	Lime.	Mag.	Sul.	Igni.	Moist.
Virgil,	316449	57.27	.433	6.89	.21	1.69	.47	.21	.096	7.85	8.00
Virgil Hi-Sul,	2923	58.32	.334	5.00	.20	1.71	.47	.21	.342	8.45	8.00

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 12 cu. ft. equals one ton
10% deduction for rock
10% deduction for loss in mining.
Percentage of Bessemer equals 0.

	Available Tons.	Unavailable Tons.	Total Tons.
6th level and above,	723,140	83,666	806,806

b. Prospective Ore:

Below 6th level,	709,834	68,042	777,876
Total all ore December 31, 1928,	1,432,974	151,708	1,584,682

Estimated reserves December 31, 1927, - 1,824,267 tons
Estimated reserves December 31, 1928, - 1,584,682 tons.
Decrease over 1927, 239,585

Production 1928, 180,403 tons.
Prospective ore estimated above 4th level in 1927 not considered in 1928 estimate account of high sulphur, 27,219 tons

Total decrease, production and hi-sulphur ore, 207,622

Tons mined during 1928 in excess of tons of ore developed, 31,963

The estimate of prospective ore above the 4th level has not been considered in our 1928 estimate of ore reserves as we proved in the development of the sub-levels above this level that it was all too high in sulphur to be merchantable.

The development of the ore above the 6th level on the upper sub-levels showed that ore areaabove the 255' sub-level contracted very much within 25' in height, reducing our reserve tonnage over a year ago.

The unavailable tonnage is the ore tied up in supporting pillars in the stope above the 6th level and below. In all probability these pillars will be mined entirely or in part at the end of operation at the Virgil Mine.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

4. ESTIMATE OF ORE RESERVES:

c. Estimated Analysis:

	Iron.	Phos.	Sil.	Alum.	Mang.	Lime.	Mag.	Sul.	Igni.	Moist.
Dried 212°	57.50	.425	7.00	1.64	.16	.60	.30	.119	7.35	
Natural	51.75	.382	6.30	1.48	.15	.55	.26	.107	6.60	10.00

d. Estimate of Production:

The following is the estimated tonnage and expected analysis of the 1929 production from the Spies-Virgil Mine:

Grade.	Tons.	Iron.	Phos.	Sil.	Sul.	Moist.	Iron Nat.
Virgil,	180,000	57.50	.400	7.00	.065	8.00	52.90

5. LABOR & WAGES:

a. Comments:

(1). Labor:

The labor conditions at the mine were most satisfactory; at no time was there a shortage of men. The Baltic and Fogarty Mines of the Pickands, Mather Company were closed about the middle of April and the Ford Motor Company laid off some 700 men at their Iron Mountain plant during the same month. They we closed the Republic Mine on May 21st and since that time whenever in the need of a man have taken on one of these old employes. We have built up a very steady crew of underground and surface men and have a very small turn-over. We are at present employing 9 men who formerly worked at the Republic Mine.

(2). New Construction:

The old dry house, a frame structure, was destroyed by fire on July 15th and was replaced by a new brick modern building. A contract on a cost plus basis was let to A. H. Proksch of Iron River. He maintained a steady crew on the job and had no trouble with labor during the entire time.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

5. LABOR & WAGES:

b. Comparative Statement of Wages and Product:

	1928.	1927.	Increase.	Decrease.
PRODUCT, - - -	180,403	153,079	27,324	
No. shifts and hours,	2-8	2-8		
AVER.NO.MEN WORKING:				
Surface, - - -	25	27		2
Underground, - -	66	83		17
Total,	91	110		19
AVER.WAGES PER DAY:				
Surface, - - -	4.28	4.20	.08	
Underground, - -	5.20	5.11	.09	
Total,	4.93	4.88	.05	
WAGES PER MO. OF 25 DAYS:				
Surface, - - -	107.00	105.00	2.00	
Underground, - -	130.00	127.75	2.25	
Total,	123.25	122.00	1.25	
PRODUCT PER MAN PER DAY:				
Surface, - - -	22.89	17.76	5.13	
Underground, - -	9.19	6.03	3.16	
Total,	6.56	4.50	2.06	
LABOR COST PER TON:				
Surface, - - -	.1868	.2362		.0494
Underground, - -	.5651	.8483		.2832
Total,	.7519	1.0845		.3326
Aver. Product Br'k & Trm'g, - -	22.21	17.08	5.13	
Aver. Wages Contract Miners, - -	5.84	5.64	.20	
TOTAL NO. DAYS:				
Surface, - - -	7,880¾	8.619		738¼
Underground, - -	19,623½	25,406½		5,783
Total,	27,504¼	34,025½		6,521¼
AMOUNT FOR LABOR:				
Surface, - - -	33,702.69	36,163.97		2,461.28
Undergrcund, - -	101,950.87	129,863.53		27,912.66
Total,	135,653.56	166,027.50		30,373.94

PROPORTION SURFACE TO UNDERGROUND MEN:

1928	1 to 2.64	1924	1 to 1.82
1927	1 to 3.08	1923	1 to 3
1926	1 to 3.00	1922	1 to 2.8
1925	1 to 2.3		

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

6. SURFACE:

a. Buildings, Repairs:

(1). Buildings Mine:

Sunday, July 15th, just at noon, the Spies-Virgil Mine dry was destroyed by fire. That portion housing the heating boiler was saved. The fire was started in the locker belonging to Norman Vasser. Norman Vasser and Andrew Isaacson, pipe-men, were repairing the 6" air line at the collar of the shaft. They had taken out the top 20' length and also the valve that shuts off the air from underground. In taking out this pipe, the water line that supplies the mine from the Village water system broke and they closed the supply valve at the storage tank in the location. After closing this valve, they started to take their dinner while the water line was draining. This was about twenty minutes to twelve. Vasser claims that he did not enter the dry with a burning lamp, but it is his opinion that the clothes in his locker were ignited from matches in his pocket. He said he had gone fishing the evening before and had put quite a bunch of matches in his pocket and that when he closed the door of his locker after taking out his lunch pail, that the matches must have ignited in some manner and started the fire.

The fire was first noticed about 12:00 o'clock when men working on the stockpile saw smoke issuing from the ventilator in the dry. Leslie Lehmann, Electrician and Surface Foreman, who was working on the stockpile at the time, immediately shut off the power, as the electric power lines cross the dry.

Two streams of water were put on the fire, but there was little pressure, as the only source of water supply was from the small tank in back of the dry building. Unfortunately, the Village supply line had been shut off and on account of the necessity of cutting off the current underground, we could not secure water from our underground discharge line. Although we have a triplex air pump located in the engine house for fire fighting, on account of the valve being taken off on the air line to underground, we could not build up sufficient pressure to operate this pump.

The Village of Mineral Hills now owns a fire truck, which is located at the Town Hall near the Davidson Mine. No alarm system has been installed and in order to secure their help, it was necessary to send a man over by automobile. This truck has a pump attached and after their arrival at about 12:30, we were able to do more effective work and the fire was under control in about fifteen minutes' time and the portion housing the heating boiler was saved.

The insurance carried on the building was $2200.00 and on the contents $1000.00.

Immediate steps were taken to provide a temporary changing place in our engine house by petitioning off a space 16' square and building clothes racks, benches and installing a wash trough salvaged from the old dry. A small shower shed was built outside over the creek, so those who desired could take a bath.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

6. SURFACE:

a. Buildings, Repairs:

(1). Buildings Mine (Continued):

Although we were short a few men on Monday, July 16yh, we were able to operate the mine and there was no loss of product.

The men who lost their clothing in the fire were each given a check for $10.00 to partly reimburse them for their loss.

The old dry building was a frame structure, stucco on the outside. A contract, on a cost plus basis, was immediately given A. H. Proksch of Iron River for a modern brick change house.

The steel work of the shaft house was covered with a heavy scale of rust due to the sulphur fumes from the burning rock pile and acid water. These agents have a deteriorating effect on it. Two men were employed during September and part of October scraping and painting the shaft house with "Valdura", an acid resisting paint.

The Grizzly rails in the shaft house just below the dump were changed in April and again in October.

The North end of the carpenter and electrician's shop, which has been used as a store room, was cleaned out in November and the floor lowered to the same level as the other part of the building. A large sliding door was made between the two rooms and the circular saw and planer purchased from the Republic Mine were set in the new portion of this building. This new equipment will be a time saver and permit us to do better work. During the operation of the Republic Mine, a great deal of carpenter shop work was done there, such as making ladders and ties.

The circular saw had been set up temporarily outside and ties for the new trestle made. The ties were cut from 6" to 8" x 5'4" cribbing timber. We had this material on hand and were not using it and could not dispose of it to Sawyer-Stoll at the time we sold them some of our other surplus mine timber.

(2). Buildings Location:

The mine carpenters spent most of the month of August repairing the location houses. The repairs consisted of rebuilding the floor and steps of the front porches, replacing windows and doors, renewing sills under several of the houses and other minor repairs. It was our intention to let the sheds go until next summer but we had to do some work on two of them in November.

A new cess-pool was dug at the East end of the location, near the original one made at the time the location houses were built and sewer drains installed in 1916. The new cess-pool was dug 12' deep; the last 2' was sand and then the bottom hardpan. It is very difficult to get good drainage as the soil is a heavy clay. A connection from the sewer drain was made into the new cess-pool and the old one filled in with the dirt taken out of the new one.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

6. SURFACE:

b. Stockpiles:

We continued to stock with the Gravity system during January. The stockpile had reached the coal dock approach track and was being fanned to the West, as fast as the timber was loaded out or moved. By January 30th the Larry car with remote control system of stocking was installed and ready for use. A trestle was erected on top of the ore pile East of the pocket tracks. As the pile ran down grade and the trestle had a one half percent up grade, we gained 12' at the end of the pile, to which we added five more bents, which averaged 35' in height. While we were filling this new trestle, one was built on top of the West pile. It was completed early in March and was ready by the time the East side was filled. When the trestle was filled, we built up one side of the Larry car and started side dumping, swinging the track every afternoon. The cars are of a saddle back type, 100 cu. ft. capacity, and will hold three of our underground cars of ore in each skip. There is sufficient room to hold a skip of ore after building up one side.

In May, an estimate of available stocking room was made and showed that at our rate of production it would be entirely filled by the middle of July. Arrangements were made to prepare a new stocking ground North of the shaft across the coal dock approach track. This ground was fairly level and covered with only a small amount of large timber and lent itself to being cleared and graded at a low cost for the capacity provided. We cleared an area sufficient to stock between 180,000 and 200,000 tons of ore. Part of this stocking ground was covered with 1" hemlock boards for a sollar. This work was done during October and November.

A trestle was built during the first part of July and was ready by the 15th. The first ore was dumped on this new ground on July 16th. The trestle was filled by September 15th and side dumping started again. We found that when dumping from a trestle that the Larry car system could be operated by one man,- the engineer. He loads the car at the shaft house, takes the sample and operates the car. As soon as we begin side dumping, an extra man had to be employed out on the dump and then additional labor for shifting tracks several times a week. On account of this extra labor when side dumping, a trestle more than pays for itself and avoids trouble and delays. A second trestle was built, branching off the first North of the coal dock track, and to the right. We continued to side dump until the middle of December and then changed to the trestle which will last at least three months and carry us through the worst of the winter weather.

During August, the permanent trestle that spans the pocket tracks was repaired. The sills had rotted and the trestle settled. The old rock trestle to the South of the shaft house was in poor condition and as it is no longer used, was dismantled.

d. Drainage Ditches:

The heavy rains during the summer and the water from the hillside East of the shaft, caused the Northwest corner to settle, throwing weight on the air line and breaking it. In order to help this situation, ditches were dug on the hill side and run into catch basins at four different points. The ditches were lined with rock and covered with cement mortar and the catch basins made of concrete. The water from the catch basins was carried across the tracks in 12" pipe.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

6. SURFACE:

e. Timber Yard:

The slope along the coal dock approach was used as a timber yard. On account of being cramped for stocking room, arrangements were made toward the end of 1927 to move the larger sizes to a place near the shaft and sell our surplus of small sizes through Sawyer-Stoll Lumber Company, the concern from whom it was purchased. The last three cars were loaded in January and all but several tiers was moved to the hill side Southeast of the shaft. In May, we needed the additional room taken by these few tiers left and it was moved also.

While it cost more than estimated to cut and load this timber, making the loss greater, still if it had not been disposed of, it would have had to be moved to make more stocking room, and then within another year, it would have been worthless.

7. UNDERGROUND:

a. Shaft Sinking:

There has been no shaft sinking during the past year.

b. Development:

Fourth level:

There was no development work done on the 4th level other than the drilling of five drill holes.

450'- 475' & 500' Sub-Levels:

Contract No.14 continued to develop the ore immediately above the South end of the 4th level crosscut. They raised and drifted from the two Southerly raises, striking rock just above the 500' sub in most Southerly raise, while in the other they had ore to a point above the 450' sub-level., Connecting drifts were also driven to the raises to the North, which were put up to the 450' elevation. These drifts were all in high sulphur ore, but on account of the small tonnage secured by only one gang in their development work, it was hoisted and mixed with the Virgil grade. After January month, the development on these sub-levels was confined to keeping a travelling way into the stope started at the South end of the ore body.

Sixth Level:

The development on this level during the past year was very small compared to 1927, only two crosscuts being driven, one to the Southwest and one to the East. The crosscut to the Southwest was started early in January and driven so as to cut the pillar between No.1 crosscut and the next drift North. Where they branched off the main heading the ground was slabby and treacherous and progress was slow. They struck ore 32' from point of starting and were in ore the entire distance of 205'. As the drift was timbered as it was advanced and raises started at regular intervals of 15', it was not completed until April.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

7. UNDERGROUND:

b. Development (Continued);
Sixth Level (Continued);

The development of the 165' sub-level showed the ore extending Easterly toward diamond drill hole No.14. In order to mine this ore, a crosscut was driven on the main level under this area. This drift was mostly in rock, cutting several narrow seams of ore and lean material. The ground at the start was soft and slabby but after it had advanced a short distance, it changed and was very hard. Four raises were put up from this drift and by the end of the year all but the first raise had been put up to the 280' sub-level. The first raise, which is back in the slate foot, was stopped at the 145' elevation and is being used as a travelling way.

Northwest Side;
90' & 120' Sub-Levels;

The development work on these two sub-levels was blocking out the ore body into pillars, preparatory to mining operations as the stope was worked to the South and East.

145' Sub-Level;

The North finger which was developed during 1927 almost pinched together 200' East of the Sherwood-Virgil line. Development from No.630 raise and one put up just North of ~~the~~ No.52 diamond drill hole proved that it was not a pinching together of the rock walls but flattening and a roll in the hanging. The ore body to the East and South of the rock was blocked out into pillars during the year, keeping well in advance of stoping operations. After the raises from the East crosscut reached this elevation, a drift connecting them was driven and showed a narrow lens extending Eastward in the vicinity of diamond drill hole No.14. As yet we have not proven any connection on this elevation between this ore and that developed West of No.52 drill hole. The foot rock evidently is very flat at the Northeast end of the main ore body near No.52.drill hole and rolls back to the East, as we did not strike it on the /65' elevation.

165'- 185'- 230'- 255'- 280' & 305' Sub Levels:

The development on these sub-levels has all been in the territory between diamond drill holes No.52 and No.14. As we worked East, we found the ore body pinching together and the rock walls were irregular. Further, the ground in this area was very hard and progress slow. We did considerable rock drifting and raising for the ore developed. It should be noted how the ore area between the 255' sub-level and the 280' sub only 25', has contracted.

Unless our future development proves that the ore widens out again at a higher elevation, we are going to have a very limited tonnage to work on during the coming year and will have to make plans for developing the ore below the 6th level.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

7. UNDERGROUND:

c. Stoping:

The ore hoisted the past year has practically all been secured from stoping operations and amounted to 155,000 tons; the balance of 25,403 tons coming from development drifting and raising. Four gangs were engaged in stoping until May, when we discontinued work above the 4th level when they were reduced to three. At times when there was an accumulation of ore in the stope, a gang was put on drifting or raising in connection with their stoping operation for a day or two.

Fourth Level:

Stoping was started in February from the subs at the South end of the 4th level crosscut. Contract No.4 worked here until the end of April when on account of the high sulphur content of the ore, further mining was stopped in this territory. We secured 5,230 tons from this stope over a period of three months. While we were aware of the fact that the sulphur was running high, we only hoisted a certain number of cars each shift so it would be well mixed and not raise the average sulphur in the total product. As the tonnage from the 6th level stope was running low in sulphur, we felt that if we intended to mine any of this ore, it should be done in small amounts. The tonnage hoisted was only a little over 10% of the total production and raised the sulphur from .010% to .013%. On account of the difficulty of selling high phosphorus ores, it is necessary to make the other elements in the ore attractive rather than a handicap for its sale.

Sixth Level - Northwest Stope:

Three gangs of miners were employed breaking ore in this stope the entire year. The stope was worked back to the East as far as No.52 diamond drill hole and to the South over No.1 main crosscut. A uniform production was hoisted each month, the conditions in the stope varying very little. We found that we had more trouble from chunks in the chutes when breaking ore on the lower sub-levels. The ore on the upper subs was harder and more friable and dropping a greater distance broke into smaller pieces. As our work was confined to one stope, with the miners working at times almost over one another, only further back in the upper sub-levels, the output was drawn from two or three chutes. Therefore, when any of them became blocked, there was a delay, which could not be made up, there being no other stope to pull from.

We found in the course of our operations that the North-South dimension of the ore body above the 6th level was too great to stope in the entire. A study was made from the cross-sections and pillars planned at the most advantageous points. The hanging rock came down below the 145' elevation and separated the ore body into separate fingers above. A pillar was left under this rock, supporting it and dividing the stope. A second pidlar is being left South of No.1 crosscut. This pillar is entirely in ore up to the 145' sub-level, where the rock comes in and the ore tonnage tied up is small. The total tonnage tied up in supporting pillars above the 6th level is 83,500 tons.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

7. UNDERGROUND:

d. Timbering:

There is a decided decrease in the amount of timber, lagging and poles used during 1928 compared with 1927. We only use timber in the main level drifts and for building chutes. As the amount of main level development was very small in 1928 compared with the previous year, the timber used was proportionally less. The method of mining, sub-level stoping, does away with the use of timber except on main levels.

We did not buy any stull timber during the winter of 1927-1928; in fact, had a surplus on hand which was disposed of through the Sawyer-Stoll Lumber Company, the concern through whom it was purchased.

The increase in cost per foot for stull timber and per 100' for lagging and poles is due to the fact that we used a larger percentage of big timber and more poles. The cost per ton for all timber is only about one third what it was in 1927.

Statement Of Timber Used:

	Lineal Feet.	Aver.Price Per Foot.	Amount 1928.	Amount 1927.
6" to 8" timber,	1,772	.045	79.74	792.90
8" to 10" "	1,648	.095	156.56	491.38
10" to 12" "	480	.149	71.52	792.65
12" to 14" "	992	.149	147.81	431.49
14" to 16" "				30.99
Total timber 1928,	4,892	.0931	455.63	
Total timber 1927,	34,294	.0737		2539.41
		Per 100'.		
6' lagging,	95,000	.73	693.50	1265.20
7' "	10,000	.65	65.00	349.07
Total lagging,	105,000	.722	758.50	1614.27
Poles,	33,000	1.471	485.43	259.34
1928Total lagging and poles,	138,000	.901	1243.93	
1927 Total lagging and poles,	247,213	.758		1873.61
Product,			180,403	153,079
Feet of timber per ton of ore,			.0271	.224
Feet of lagging per ton of ore,			.5820	1.4815
Feet of lagging per foot of timber,			.2146	.6613
Cost per ton for timber,			.00252	.0166
Cost per ton for lagging,			.00421	.0105
Cost per ton for poles,			.00269	.0017
Cost per ton for timber, lagging and poles,			.00942	.0288
Equivalent of stull timber to board measure,			5,936	62,916
Feet of board measure per ton of ore,			.0329	.411

Cost of timber, lagging and poles 1928, $1,699.56
Cost of timber, lagging and poles 1927, 4,413.02

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

7. UNDERGROUND:

e. Drifting and Raising:

Very little rock drifting was done except in the development of the ore body above the East end of the 6th level. The sub-level drifting was, with a few exceptions, all in ore.

The following is a comparison of drifting and raising done in the years 1927 and 1928:

	Drifting.		Raising.	
Year.	Ore.	Rock.	Ore.	Rock.
1927	8213	1397	2849	562
1928	6758	604	2720	699

The decrease in ore and rock drifting is entirely due to the small amount of main level development done the past year. We did more sub-level drifting, blocking out the ore with small dog drifts, preparatory to stoping. The development of the area between No.52 and No.14 diamond drill holes disclosed that the ore is cut by rock or lean seams which we had to drift through in blocking out the ore.

There is very little difference between the total footage ore and rock raising done each year. The total footage raised, ore and rock, in 1927 was 3401' compared with 3419' for 1928, an increase of 18'. The increase in rock footage is in the development of the area above the 280' sub-level, where we have put up a number of raises to try and locate the upward extension of the ore body.

f. Explosives, Drilling and Blasting:

The powder costs were less for 1928 with an increased production, which is explained by the fact that a greater percentage of the hoist came from the stope where a larger tonnage is broken per hole. During 1927, we did a large amount of main level drifting which takes considerable powder, especially in rock work. We show a decrease in the amount of 50% and 60% powder used.

An underground powder house and a cap room were established during the summer. Having the fuses cut by one man, allowed the buying of it in large 3000' coils, effecting a saving by less waste on each small coil. Further, the establishment of an underground powder house and a fuse and cap room reduces the hazard of handling explosives in that one man is making up the fuses with a safe crimping machine, instead of many miners throughout the mine doing the same work. It is also a time saver for the miners.

The powder costs for rock development in 1928 was less than half that for 1927, due to a smaller footage of rock drifting. However, per foot of drifting and raising, it was slightly more. This is explained by the high explosive cost for driving the small sub-level drifts, the footage being more in 1928 than for 1927.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

7. UNDERGROUND:

f. Explosives, Drilling and Blasting (Continued):

Statement of Explosives Used:

Ore Development & Stoping.	Quantity.	Average Price.	Amount 1928.	Amount 1927.
40% powder, - - - -	158,650	.12905	20474.40	20829.08
50% " - - - -	2,000	.1316	263.13	837.75
60% " - - - -	7,750	.1500	1162.50	1321.00
Total powder, lbs.	168,400	.13005	21900.03	22987.83
Fuse, - - - - -	389,900	5.803	2256.68	2378.53
Caps, - - - - -	58,600	11.195	656.05	694.34
Cap crimpers, - - - -	28	.50	14.00	18.30
Powder bags, - - - -	10	1.25	12.50	22.50
Tamping, " - - - -	30,000	2.35	70.37	36.41
Total fuse, etc,			3009.60	3150.08
Total all explosives,			24909.63	26137.91
Production, - - - -			180,403	153,079
Pounds powder per ton of ore,			.9335	1.1292
Cost per ton for powder, -			.1214	.1502
Cost per ton for all explosives,			.1381	.1707
Sinking, Rock Development, Etc.				
40% powder, - - - -	8,800	.12787	1124.25	2584.47
50% "				
60% "				
Total powder,	8,800	.12787	1124.25	2584.47
Fuse, - - - - -	29,400	5.828	171.36	377.56
Caps, - - - - -	4,470	11.114	49.68	92.65
Cap crimpers, - - - -	2	.50	1.00	1.00
Tamping, " - - - -	500	2.35	1.18	3.10
Total fuse, etc,			223.22	474.31
Total all explosives,			1347.47	3058.78
Total explosives used in mine,			26257.10	29196.69
Average price per pound for powder,			.1299	.13227

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1928.	1927.	Increase.	Decrease.
Production:				
Ore produced, - - - - - -	180,403	153,079	27,324	
Average daily product, - - -	594	500	94	
Tons per man per day, - - -	6.56	4.50	2.06	
No. days operating, - - - -	304	306		2
No. shifts & hours, - - - -	2 - 8	2 - 8		
Costs:				
Underground costs, - - - - -	.966	1.431		.465
Surface costs, - - - - - -	.225	.241		.016
General mine accounts, - - -	.088	.141		.053
Cost of production,	1.279	1.813		.534
Cost of loading & shipping,	.004	.007		.003
Cost at mine per cost sheet,	1.283	1.820		.537
Depreciation:				
Plant and equipment, - - -	.219	.200	.019	
Movable equipment, - - -	.007	.008		.001
Taxes, - - - - - -	.096	.121		.025
Central office, - - - -	.083	.103		.020
Welfare, safety, hospital, etc, -	.013	.024		.011
Cost adjustment, - - -	.000	.021		.021
Supply inventory, - - -	.001	.000	.001	
Total cost at mine,	1.702	2.298		.596
Expenses Beyond Mine:				
Royalty, - - - - - - -	.407	.407		
Rail freight, - - - - -	.820	.820		
Lake freight, - - - - -	.655	.655		
Cargo, insurance and analysis, -	.010	.010		
Shrinkage, - - - - - -	.029	.035		.006
Total cost lower lake ports,	3.623	4.225		.602

b. Detailed Cost Comparison:

(1). Days and Shifts:

The mine operated on the same schedule: 2 - 8 hour shifts, six days per week, both in 1928 and 1927. We operated two less days in 1928 which was due to an extra Sunday and a holiday in November at the time of National Election.

(2). Production:

We show an increase in production of 27,324 tons for 1928, which is explained by the fact that the mine was in a well developed stage at the beginning of the year and we were able to secure a larger tonnage from our stoping operation. The development work was confined principally to the sub-levels, blocking out the ore, preparatory to mining, while during 1927 we did extensive drifting on the main levels.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detailed Cost Comparison (Continued):

(3). Cost of Production:

The large decrease in cost of production and total cost at the mine is due to the increased output and the fact that very little main level development work was done during 1928. Further, we were able to reduce the number of men employed on surface and underground, increasing our tons per man and decreasing the cost.

(4). Underground Costs:

Exploring in Mine:

Year 1927,	-	$3,264.67
1928,	-	1,801.65
Decrease for 1928,		$1,463.02.

During 1928, we only operated our deep hole machine and diamond drill until the 14th of April, the footage being 638' compared with 1361' for 1927, which explains the large decrease in charges against this account. The average cost per foot for the drilling done in 1928, however, was $2.82 compared with $2.40 for 1927. This increase in cost is due to the harder character of the ground drilled.

Development in Rock:

Year 1927,	-	$18,705.55
1928,	-	7,363.14
Decrease for 1928,		$11,342.41.

This large decrease in cost of rock development for 1928 is explained by the difference in footage. The rock drifting in 1928 was 604' compared with 1397' in 1927. Very little rock drifting was done on the main levels during the past year, while in 1927 we were still developing the 6th level and drove the 4th level from the shaft to the ore. There is very little difference in the rock raising each year.

Development in Ore:

Year 1927,	-	$46,851.49
1928,	-	21,440.86
Decrease in 1928,		$25,410.63.

The ore development during the past year was confined principally to the sub-levels, blocking out the ore into pillars, preparatory to stoping, while during 1927 we were still doing considerable main level drifting which requires timber and costs are higher than for sub-level work where the drifts are small and are not timbered. Further, the cost of some of the drifting for several months was charged to stoping, in error, reducing this item and increasing the stoping account.

Stoping:

Year 1927,	-	$56,344.46
1928,	-	67,550.98
Increase in 1928,		$11,206.52.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detailed Cost Comparison (Continued):

(4). Underground Costs (Continued):

Stoping (Continued):

More men were employed stoping during the past year, securing a larger product, which also increased the supplies, principally explosives. The cost per ton for stoping was $0.374 in 1928 compared with $0.368 in 1927. With as large an increase in production in 1928, our stoping cost per ton should have shown a decrease rather than an increase. This is explained by the fact that for several months costs chargeable to development in ore were made to this caption in error.

Timbering:

Year 1927,	-	$18,837.14
1928,	-	12,047.72
Decrease in 1928,		$6,789.92.

As most of our main level development was completed by the end of June, we were able to reduce our timber crew who built the chutes along the main haulage drifts. Fewer number of chutes were built in 1928 than in 1927, explaining the decrease against this account.

Tramming:

Year 1927,	-	$21,435.19
1928,	-	18,699.30
Decrease in 1928,		$ 2,735.89.

The decrease is due to the larger tonnage trammed with the same labor and equipment from the 6th level where we secured 96½% of the total output. Further, during 1927, while developing the 4th level, a motorman was employed on each shift, while during the past year, what tramming was done from this level was done by the miners themselves.

Pumping:

Year 1927,	-	$10,536.42
1928,	-	9,256.18
Decrease in 1928,		$ 1,280.24.

The decrease in cost of pumping for 1928 is entirely in the current charge. Our maximum demand meter was watched very closely towards the end of the month and at times we operated our compressor, even when not necessary, in order to consume more current and benefit by a lower rate per K.W.H.

Compressors and Air Pipes:

Year 1927,	-	$22,770.00
1928,	-	21,214.08
Decrease in 1928,		$ 1,555.92.

Conditions affecting the cost relative to this account were about the same x each year except that our current charge was less in 1928 due to our watching the maximum demand meter and whenever possible securing a lower rate per K.W.H.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detailed Cost Comparison (Continued):

(4). Underground Costs (Continued):

Underground Superintendence:

Year 1927,	-	$6,310.78
1928,	-	6,284.34
Decrease in 1928,		$ 26.44

This small decrease is due ot less overtime by the bosses.

Maintenance Accounts:

Compressors & Power Drills:

Year 1927,	-	$ 546.97
1928,	-	20.73
Decrease in 1928,		$526.24.

The charges for 1928 are for minor repairs made to the compressor.

Electric Tram Equipment:

Year 1927,	-	$11,638.53
1928,	-	7,227.45
Decrease in 1928,		$ 4,411.08

The repairs made to underground cars and locomotives was about the same for each year. The decrease for 1928 is explained by a smaller amount of main level drifting, requiring less extensions to tracks and trolley lines.

Pumping Machinery:

Year 1927,	-	$1,815.73
1928,	-	1,313.19
Decrease in 1928,		$ 502.54

We had continual trouble with the Prescott pumps located in the 8th level pump house during 1927 on account of crank shafts breaking. Only one was broken during the past year and the expense of dismantling and replacing same was small. During the past year we covered the discharge line with rubberoid roofing to protect it from the action of the acid water.

(5). Surface Costs:

Hoisting:

Year 1927,	-	$8,673.90
1928,	-	8,837.25
Increase in 1928,		$ 163.35

This increase is small considering the increase in production of over 27,000 tons in 1928.

Stocking Ore:

Year 1927,	-	$9,187.32
1928,	-	7,776.54
Decrease in 1928,		$1,410.78

A new stocking system was installed about the first of February and we were able to operate with less labor, which explains this decrease.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detailed Cost Comparison (Continued):

(5). Surface Costs:

Crushing and Screening at Mine:

Year 1927,	-	$3,127.08
1928,	-	2,945.68
Decrease in 1928,		$ 181.40

One man's time is charged to crushing and screening, regardless of tonnage handled. The decrease is entirely in current consumed.

Dry House:

Year 1927,	-	$3,137.96
1928,	-	2,998.79
Decrease in 1928,		$ 139.17

This decrease is explained by extensive repairs made to the heating boiler in the summer of 1927.

General Surface:

Year 1927,	-	$2,546.34
1928,	-	2,503.77
Decrease in 1928,		$ 42.57

We employed very little surface labor. The charges to this account include the night watchman and labor employed during the summer months, cleaning the premises from time to time - small difference.

Maintenance Accounts:

Hoisting Equipment:

Year 1927,	-	$2,367.85
1928,	-	3,799.93
Increase in 1928,		$1,432.08

Two new 8' head sheaves were installed in the shaft house in August and the cage was practically rebuilt, as well as a new box for one of the skips, which explains this large increase against hoisting equipment for 1928.

Shaft:

Year 1927,	-	$6,624.37
1928,	-	1,371.82
Decrease in 1928,		$5,252.55

The 1928 charges are for minor repairs made during the year and the recasing between the skip and cage compartments with 2" plank from the 4th level to the bottom of the shaft, while in 1927 we opened the old Virgil shaft from surface to the 1st level of the old workings, a distance of 173', and retimbered the Spies shaft from surface to ledge, a distance of 67', explaining the large decrease against this account.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detailed Cost Comparison (Continued):

(5). Surface Costs (Continued):

Maintenance Accounts:

Top Tram Equipment:

Year 1927,	-	$ 260.97
1928,	-	2,577.13
Increase in 1928,		$2,316.16

This large increase is for repairs to the Larry cars which were installed early in the year. The wheels wore flat in a very short time and had to be replaced by crome-nickel wheels. In October, due to the unevenness of the track, considerable strain was thrown on the motor and it was burned out. The spare car was put into operation. For some unknown reason, the motor on this car also burned out. It was necessary to send the motors to the General Shops at Ishpeming for repairs. In addition, a large amount of the trolley equipment and labor for installation has been charged to this account.

Docks, Trestles & Pockets:

Year 1927,	-	$ 829.72
1928,	-	6,629.97
Increase in 1928,		$5,800.25

This large 1928 expenditure is for thepreparing of the new stocking ground North of the coal dock approach, trestles and sollar plank.

Mine Buildings:

Year 1927,	-	$ 149.36
1928,	-	1,096.98
Increase in 1928,		$ 947.62

The increase against this account is the ~~labor~~ cost of labor and supplies for painting the steel work of the shaft house.

(6). General Mine Accounts:

Insurance:

Year 1927,	-	$1,019.07
1928,	-	153.91
Decrease in 1928,		$ 865.16

This large decrease is explained by the adjustment made in July 1927 account of fire and boiler insurance policies.

Engineering:

Year 1927,	-	$2,488.86
1928,	-	2,298.35
Decrease in 1928,		$ 190.51

Due to less main level drifting, less time was required of the engineers giving lines and making surveys.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detailed Cost Comparison (Continued):

(6). General Mine Accounts:

Analysis:

Year 1927,	-	$2,030.09
1928,	-	897.54
Decrease in 1928,		$1,132.55

During 1927, on account of the sulphur situation, we took many samples in the course of development drifting, which explains the large decrease for this year when we only ran samples of our daily product and an occasional extra sample.

Personal Injury Expense:

Year 1927,	-	$7,472.13
1928,	-	2,845.23
Decrease in 1928,		$4,626.90

Although we only paid $14.50 compensation during 1928, the charge to this account is on a pay roll basis of 2% of the total labor. The large charge for 1927 is due to the settlement made with Renaldo Feroni in June 1927 on account of a permanent disability.

Safety Department Expense:

Year 1927,	-	$156.48
1928,	-	158.04
Increase in 1928,		$ 1.56

The expense in connection with the safety work was practically the same each year.

Telephones & Safety Devices:

Year 1927,	-	$1,109.01
1928,	-	1,095.80
Decrease in 1928,		$ 13.21

Small difference.

Local General Welfare:

Year 1927,	-	$221.57
1928,	-	273.97
Increase in 1928,		$ 52.40

This charge is for the Spies-Virgil proportion of Visiting Nurse and Iron River District ambulance, which is made on a pay roll basis of the different mines interested.

Special Expense:

Year 1927,	-	$378.39
1928,	-	585.40
Increase in 1928,		$207.01

The special expense for 1927 represents the Cleveland-Cliffs Iron Company's proportion of the Iron County Taxpayers Association, while that for 1928 also covers the charge by the Village of Mineral Hills for fire protection amounting to $420.00 a year.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

8. COST OF OPERATING:

b. Detailed Cost Comparison (Continued):

(6). General Mine Accounts;

Mine Office:

Year 1927,	-	$6,852.62
1928,	-	7,597.90
Increase in 1928,		$ 745.28

This increase is due to a larger proportion of the Superintendent's salary charged to the Spies-Virgil Mine after the Republic Mine was closed down in May, 1928.

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

b. Underground Explorations:

Underground explorations were carried on with the deep hole drill until March 10th, when it was decided to abandon further work with this machine and put in a diamond drill. The ground on the 4th level was so hard that progress was slow and in several holes we were not able to reach the desired depth. Holes Nos.100 and 101 were drilled and further drilling stopped on April 14th.

The following table shows the location, depth and footage of ore of the holes drilled in 1928:

Hole No.	Location.	DEPTH OF HOLE.	FOOTAGE OF ORE.	REMARKS.
94	4th level,	95'	None	
96	145' sub-level,	41	15'	
97	4th level,	106	None	
98	4th level,	71	None	
99	4th level,	71	None	First 5' ran 53.00% iron and .255% sulphur.
100	4th level,	159	None	D.D.H. cut 10' ore, 53.70% iron and 1.043 sul.
101	6th level,	95	None	
	Total 7 holes,	638'	15'	

There were seven holes drilled, having a total depth of 638'; five were drilled with the deep hole machine, having a depth of 384', and two with the diamond drill, with a depth of 254'. Hole No.96, which was started in ore, was the only one showing merchantable ore, being 2.3% of the footage drilled.

The total cost of the drilling was $1,801.65, or a cost of $2.824 per foot. The cost per foot with the deep hole machine was approximately $2.66 and the diamond drill $3.07.

Hole No.95 was drilled during December 1927 from the extreme Northeast workings of the 145' sub-level. The foot rock was very flat and the development of the 165' sub showed the ore extending further to the East. This made us even more apprehensive that the rock on the ~~other side~~ 145' sub-level was not the foot but only a seam with ore on the other side. Holes Nos.95 and 96 proved, however, that there was no additional ore to the East at this elevation.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

b. Underground Explorations (Continued):

The development of the 165' and 185' sub-levels showed the ore extending to the East toward hole No.14. We felt positive that this ore reached the 4th level and were anxious to locate it, as another low sulphur stope would help out our operation materially. We did not know whether the foot flattened out and the ore would extend to the East, where holes Nos.98 and 99 were located, or steepen and be found in the area explored by diamond drill hole No.100., None of these holes struck ore. We are now of the opinion that this ore does not reach this elevation, or that the small seam cut in the main drift 175' East of the breast of the main drift is the top.

The ore developed on the subs above the 6th level had extended to the East to a point where in order to mine same a crosscut and raises from the 6th level had to be started. We felt that the ore above must have some connection with the level and if so, it would be quite an advantage to plan the drift so as to have as much of it and the raises in ore. Holes Nos.17 and 93 had already been drilled into this area and No.101 was planned and drilled to explore the territory between. It cut alternate seams of rich iron formation and cherty slate.

As we wished to reduce our cost wherever possible, all drilling was stopped on April 14th and the drill equipment stored at the mine, so if we wish to put down a diamond drill hole at any time, it will only be necessary to send down a runner from the Ishpeming District.

10. TAXES:

The following tabulation is a comparative statement of taxes paid in Iron County for the years 1928 and 1927:

Description.	1928. Valuation.	1928. Taxes.	1927. Valuation.	1927. Taxes.
Iron River Township.				
NE¼ of NW¼ Sec.24,43-35,40 a.				
SE¼ of NW¼ " 24, " 40 a.		(See note)		
Spies dwellings, - -	5,000	134.48	5,000	135.72
Collection fees, -		1.35		1.35
Total dwellings,		135.83		137.08
Spies-Virgil (a)				
E½ of NW¼ Sec.24,43-35,)				
Spies,)	250,000	6724.57	455,000	12350.75
SW¼ of NW¼ " 24,43-35,)				
Virgil,)				
Stockpile,supplies and equipment, - -	320,000	8606.72	145,000	3935.95
Total,	570,000	15331.29	600,000	16286.70
Collection fees,		153.31		162.86
Total Spies-Virgil Mine,		15484.60		16449.56
(a)Total Iron River Township,	575,000	15620.43	605,000	16586.64
Rate,		2.6896		2.7144

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

10. TAXES(CONTINUED):

	1928. Valuation.	1928. Taxes.	1927. Valuation.	1927. Taxes.
Village of Mineral Hills.				
Spies Mine.				
SE¼ of NW¼ Sec.24, 43-35,)				
NE¼ of NW¼ " 24, ")		(See note (a)		
Dwellings, - - - -	5,000	15.75	5,000	17.14
Virgil Mine.				
(a)SW¼ of NW¼ Sec.24,43-35,	250,000	787.35	455,000	1559.37
Stockpile supplies, equipment,	320,000	1007.81	145,000	496.95
Total Opt. Spies-Virgil,	570,000	1795.16	600,000	2056.32
Total Mineral Hills,	575,000	1810.91	605,000	2073.46
Rate,		3.150		3.427

(a). The mineral valuation for 1927 and 1928 is not divided between the Spies and Virgil, and the surface and buildings of the Spies is included in the mineral assessment of the Virgil. Not divided by Tax Appraiser and any division would be arbitrary.

Bates Township.				
Erickson Lease,SW¼ Sec.21,				
43-34, - - - -	226,000	7697.56	226,000	7399.24
Collection fees,		76.98		73.99
Total Bates Township,		7774.54		7473.23
Rate,		3.406		3.288
Mastodon Township.				
Neely Lease.				
NW¼ of NE¼ Sec.12,42-33				
40 acres,				
NE¼ of NE¼ " 12,42-33				
40 acres,	137,000	4870.35	137,000	4469.21
NE¼ of NW¼ " 12,42-33,				
40 acres,	1,400	57.17	1,400	52.64
Total,	138.400	4927.52	138,400	4521.85
Collection fees,		49.27		45.22
Total Mastodon Township,		4976.79		4567.07
Rate,		3.555		3.262
Village of Alpha.				
Neely Lease.				
NE¼ of NE¼ Sec.12,42-33,	137,000	2642.04	137,000	2870.01
Collection fees,		26.42		28.70
Total Village of Alpha,		2668.46		2898.81
Rate,		1.928		2.845
Total Township and Village,		7645.25		7465.78

NOTES:

The Village of Alpha is situated in Mastodon Township, Mineral Hills is in Iron River Township. The valuations as shown here are the same valuations (either all or in part) as the valuations of the respective townships.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

11. ACCIDENTS & PERSONAL INJURY:

a. Accidents:

There were four accidents at the Spies-Virgil Mine during the past year compared with twelve in 1927 and sixteen in 1926. All four accidents were of a minor nature, there being a total loss of time of only 26 days. One man of the four injured received compensation amounting to $14.50 for the year. We are proud of our record and are making every effort to do better during 1929.

b. Safety Work:

Regular training was given through the summer to the First Aid and Helmet Crews. The men take quite an interest in this work and are making good progress.

12. NEW CON.AND PROPOSED NEW CON.:

A contract was immediately given to A. H. Proksch of Iron River for the construction of a new dry building, when the old one was destroyed on July 15, 1928. The contract was on a cost plus basis as we salvaged nearly all of the wood work and equipment from the Stephenson Mine dry. The new dry is a modern brick structure and in many ways an improvement over some of the other Company dry's. We have done away with the clothes rack for the underground clothes. Each man has his own clothes hanger, which is hoisted to the ceiling where they are out of the way and dry quickly. This gives more floor space and makes a clearer building. Another improvement is the wash troughs, which are white porcelain and equipped with individual shower heads.

Statement of Expenditures E & A 528:
Spies-Virgil Dry Building:

	Estimate.	Expended to 12/31/28.	Unexpended Balance.
1. Brick building, - -	5000.00	5263.42	263.42
2. Lockers and seats, -	300.00	570.34	270.34
3. Wiring, - - - -	100.00	152.59	52.59
4. Plumbing: a. Toilet,etc,	250.00	195.73	54.27
b. Lavatories,	500.00	699.11	199.11
c. Showers,	100.00	56.99	43.01
5. Heating,radiotors, etc,	250.00	292.05	42.05
Total,	6500.00	7230.23	730.23
Contingencies 10%,	650.00		650.00
Total,	7150.00		80.23

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

13. EQUIPMENT & PROPOSED EQUIPMENT:

e. Larry Stocking Cars:

The Larry car, with remote control, system of stocking ore was installed on January 30th and has proven most satisfactory and realized the expected results. With our old system of gravity tram, with a car too small to hold one skip of ore, and slow in operation, there were many delays in hoisting, which also delayed the underground motor trains at the shaft. These delays have been practically eliminated as the new cars are of sufficient capacity to hold a skip of ore when built up for side dumping. We haveproven that when dumping from a trestle we can operate with one man, the engineer, which has reduced the labor costs for stocking. The cost for stocking ore in 1928 was $.043 compared with $0.061. It must be remembered that stocking conditions up until July 16th were not the best as we were stocking on top of the old pile and had to shift the tracks at least once every day, which took considerable labor.

We have had some trouble with the cars due to poor construction. This has been corrected and in the future delays from this cause should be reduced.

Statement of Expenditures E & A 511:
Larry Car System for Stocking Ore:

	Estimate.	Expended to 12/31/28.	Unexpended Balance.
1. 2 cars complete, - -	4000.00	4000.00	
2. Control equipment, - -	200.00	159.20	40.80
3. Trolley Wire Installation,	300.00	419.74	**119.74**
4. Moving Motor Generator Set from 8th level Pump Room to Engine House, - -	900.00	788.34	111.66
5. Freight & unloading, -		164.81	**164.81**
Total,	5400.00	5532.09	**132.09**
Contingencies 10%,	540.00		540.00
Total,	5940.00	5532.09	407.91

14. MAINTENANCE & REPAIRS:

a. Shafts:

(1). Spies Shaft:

The shaft between the skip and cage compartments was recased with 2" plank from the 4th to the 8th level. We have had a great deal of trouble with the nails being eaten away by the acid water and the casing plank becoming loose in the shaft. We bought twenty five pounds of Monel metal nails to try. These are made of a nickel compound and are claimed to be acid resisting. We are also trying Monel metal lag screws in the shaft runners and bolts in the pipe hangers.

The air and discharge pipes in the shaft have been covered with rubberoid roofing paper to protect them from the water. Frequent inspections are made of the pipes and hangers in the shaft and renewals made often as the metal is eaten away.

SPIES-VIRGIL MINE
. ANNUAL REPORT
YEAR 1928.

14. MAINTENANCE & REPAIRS:

a. Shafts (Continued):

(2). Virgil Shaft:

Monthly inspections are made of the Second Outlet through the Virgil Shaft. In May, it was found that the iron rounds of the ladders in the raise from the 3rd level Spies to the 1st Level Virgil (old workings) were eaten away. A new ladder road with wooden rounds was installed. It was discovered during the summer inspections that the water was raising in the stope below the 1st Level. This was to be expected with the large amount of rain for several months. In November, the water began to drop in elevation. Diamond drill hole No.10, which was struck on the 6th level, had not been draining freely and was opened up during the latter part of October. The water pumped during November showed an increase of about 25 gallons per minute. This hole no doubt has some connection with the old Virgil workings as when it was first encountered, the water in the old shaft immediately began to subside.

b. Hoisting Equipment:

The skip rope was turned end for end on January 8th and taken off and a new spliced rope put on March 18th after 8½ months of service. The spliced rope was made up of 1000' of new rope and 1000' of rope used during sinking the Spies Shaft for the Virgil level and only partly worn. This rope was replaced on December 30, 1928, after 9½ months of service, by a Roebling plow steel rope. We had been using Crucible cast steel ropes but on account of poor service they have given, we are trying out out one of plow steel.

The cage rope was turned end for end in April, after eleven months of service, and is still in use.

The skip has been changed several times during the year and a new box made for one of the skips. The old cage from the Lake Mine was put into shape for use and put on April 29th, while we repaired our cage, which was in very bad condition. A number of members were broken and others eaten by the water. It was necessary to rebuild the bottom and top and repair the door. Heavier members were used in repairing it.

Both the skip and cage head sheaves in the shaft house were changed in August. The cage sheave was replaced by a special steel lined one and the skip with an old cast iron one.

c. Pumps:

The Prescott pumps in the 8th level pump room gave very little trouble during the year. The crank shaft on pump No.209, which broken on December 18, 1927, was replaced by a forged one of special steel and put into operation on March 22nd. While this pump was idle, it was completely overhauled, turning down the pump poles and rebabbiting the cross-head shoes.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1928.

14. MAINTENANCE & REPAIRS:

c. Pumps (Continued):

The crank shaft on the Dean pump on the 3rd level broke February 20th. It had been cracked for some time. We had an Aldrich pump in this pump house, which has been kept as a spare on account of our continual pump trouble. This pump was connected up and operated until the new crank shaft was installed during the summer.

17. CONDITION OF PREMISES:

The mine and location premises were cleaned up of the winter's accumulation of rubbish in May. At the mine, all material was piled neatly, and the grass plots around the building put into shape and kept clean the balance of the summer. The mine team cleaned up the alley behind the location houses several times during the summer.

18. NATIONALITY OF EMPLOYES:

	1928. No.Men.	%	1927. No.Men.	%
American, -	7	.077	6	.055
English, -	26	.286	27	.245
Croation, -	1	.011	1	.009
Dane, -	1	.011	1	.009
French, -	8	.088	12	.109
Swede, -	7	.077	12	.109
German, -	4	.044	2	.018
Finn, -	22	.241	25	.227
Polish, -	8	.088	16	.146
Italian, -	4	.044	6	.055
Irish, -	3	.033	2	.018
Total,	91	100%	110	100%

WADE MINE

ANNUAL REPORT

YEAR - 1928

1. GENERAL:

No underground operations were conducted at the Wade Mine during the past year, in fact, other than repair work, no underground activities have been attempted at this property since it was closed on May 28th, 1921.

Regular trips of inspection were made through the underground workings, which were open. Several caves occurred during 1927 and as it was not deemed advisable to make repairs, it has been impossible to get into the sub-level workings during the past year. Cleaning operations in the sump and in the main drainage drift were considerably lighter than during 1927. It was necessary to make some minor repairs in the shaft, which included work on the lathing, ladder roads and sollars.

Pumping conditions were normal throughout the past year and only the usual shut-down occurred for cleaning and minor repairs to the pumps. The old steam pump was removed from the underground pumphouse and as a matter of safety a 1000-gallon centrifugal pump from the Boeing Mine was installed in it's place. We have had no steam equipment in service at the Wade Mine for a number of years.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

Wade Stockpile Overrun (The Cleveland-Cliffs Iron Co.)	75	tons
Wade Open Pit, (Cleveland-Cliffs Iron Co.).....	298,137	"
Wade Open Pit, (Oliver Iron Mining Co.).....	1,948	"
Wade Open Pit, (To satisfy Oliver Trespass).....	6,851	"
Total, ...	307,011	"

b. Shipments:

All ore produced during the year was shipped, with the exception of the very lean material, which was placed on the taconite dump.

c. Stockpile Inventories:

The small tonnage of Wade stockpile ore was cleaned up during the past year, and showed an overrun of 75 tons from the book figures.

d, Division of Product by Levels:

Open pit ore above 1st Level, ... 298,137 tons.

WADE MINE
ANNUAL REPORT
YEAR 1928

2. PRODUCTION, SHIPMENTS & INVENTORIES:

e. Production by Months:

MONTH	CLEVELAND-CLIFFS IRON COMPANY	WADE-OLIVER TRESPASS	OLIVER IRON MINING COMPANY.	TOTAL
May. ----------	34,140			34,140
June, ----------	60,916		1,948	62,864
July, ----------	59,616			59,616
August, ---------	50,556			50,556
September, ------	64,267			64,267
October, --------	28,717	6,851		35,568
Total, ----------	298,212	6,851	1,948	307,011

f. Ore Statement:

	1928	1927
On hand Jan. 1, 1928-------	219	219
Output for Year, ----------	307,011	152,016
Total, -------------------	307,230	152,235
Shipments, ----------------	307,230	152,016
Balance on Hand, ---------	-	219

Of the above tonnage, 298,212 tons were shipped by The Cleveland-Cliffs Iron Company as Wade ore and 6,851 tons turned over to the Oliver Iron Mining Company in payment of a trespass.

g. Delays:

The Great Northern car service was quite satisfactory during the past year and the contractor has not reported any serious delays, as was the case in 1927. There were several derailments and the contractor's shovel was broken down several times for short periods.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	Tons	Iron	Phos.	Sil.	Mn.	Alu.	Moist.	Fe.Nat.
Wade (C.C.I.Co.) -----	298,212	56.94	.060	8.41	1.12	2.12	13.76	49.11
Wade (O.I.M.Co.) ---	1,948							
Wade (Wade-Oliver Trespass)----	6,851	59.72	.057	8.34	.54	--	15.51	49.61
Helmer, ----------	35,368	59.15	.070	7.72	1.37	2.01	11.81	50.40

b. Average Analysis on Cargoes:

	Mine Analysis			Lake Erie Analysis		
	Iron	Moist.	Fe.Nat.	Iron	Moist.	Fe.Nat.
Duluth Wadena------	57.61	15.68	48.58	57.51	14.69	49.06
Superior Wadena----	57.89	13.58	50.03	57.72	14.16	49.55
Corporation Wadena-	57.89	15.34	49.01	57.70	14.86	49.12
Wade Special, G.N.-	58.55	10.94	52.14	58.29	10.74	52.03
" " D.M.& N.Ry.	57.50	15.88	48.37	57.34	15.60	48.40

4. ESTIMATE OF ORE RESERVES:

WADE MINE
ANNUAL REPORT
YEAR 1928

2. ANALYSIS:
(Continued)

The following table shows the tonnage of outside ores going into mixtures with Wade ore during the season of 1928:

	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Moist.
Helmer Open Pit, Dohm Building Company, ----	35,368	57.15	.070	7.72	1.37	2.01	11.81
Wacootah Open Pit, ----	323,214	58.50	.057	6.00	.52	4.38	17.12
Wilpen Ore from Shenango Furnace Co.	43,321	58.30	.065	7.48	.95	2.39	13.91
Larue Concts. M. A. Hanna Co. ----------	30,367	59.13	.042	9.67	.34	-	7.64
Group Three Ore - Oliver Iron Mng.Co.--	23,498	59.83	.064	5.60	.76	-	13.25

The following table shows the tonnage of Wade and other ores going into mixed cargoes during the past season:

	WADE SPECIAL	WADENA	CORPORATION WADENA
Wade Stkpile Adjustment, ---		294	
Wade Pit, ----------	43,607	131,000	123,530
Wacootah, ----------	10,988	193,354	118,872
Wilpen, ----------		43,321	
Helmer, ----------		21,303	14,065
LaRue, ----------	25,365		
Trumbull N.B.Concts. -------	5,003		
Group Three (Oliver)--------		4,111	
Total, ----------	84,963	393,383	256,467

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

	Iron	Phos.	Mn.	Sil.	Alu.	Lime	Mag.	Sul.	Loss
Wade,	56.98	.059	1.16	8.52	2.06	.62	.41	.015	5.06
Helmer,	57.20	.071	1.40	7.60	1.97	.51	.45	.014	5.30

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 13 cu. ft. equals one ton
10% deduction for rock
10% deduction for loss in underground mining.

Open Pit Ore, ----------	178,000 tons
Underground Ore - West Deposit, ----------	804,000 "
Total Developed Ore, ----------	982,000 "

WADE MINE
ANNUAL REPORT
YEAR 1928

4. ESTIMATE OF ORE RESERVES:

b. Undeveloped Ore:

East Deposit - Underground Ore, ----------	1,515,000	tons
Deacon Bessemer - Underground Ore, ----------	80,000	"
Deacon Non-Bess.- Underground Ore, ----------	95,000	"
Total Undeveloped Ore, ----------	1,690,000	"
GRAND TOTAL ALL ORE, ----------	2,672,000	"

The above tabulation shows an increase of 57,000 tons in the open pit ore, taking into account the tonnage of this grade estimated as of January 1st, 1929 and deducting shipments from the tonnage shown the previous year.

No exploratory or development work was undertaken at the Wade Mine, other than some test-pits and churn drill holes in the pit to determine the grade of material to be mined in 1929. There was no work done to warrant changing the underground ore estimates.

c. Estimated Analysis:

Dried 212°:	Tons	Iron	Phos.	Mn.	Sil.	Moist.
Open Pit - #1, ----------	99,945	57.21	.060	1.03	8.74	12.50
" " - #2, ----------	78,606	52.47	.070	1.47	13.35	14.00
Underground - West Deposit	804,000	57.50	.074	1.45	7.49	12.50
" - East Deposit	1,515,000	56.91	.075	1.83	7.44	13.50
" - Deacon Bess.	80,000	56.65	.045	1.16	8.04	12.50
" - " Non-Bess.	95,000	55.77	.053	.42	8.43	12.50
Total, ----------	2,672,551	56.92	.072	1.60	7.73	13.11

5. LABOR & WAGES:

a. Comments:

The A. Guthrie Company had no difficulty in securing ample labor for their 1928 operations. The contractor's scale of wages was based on 35¢ per hour for common labor. This wage schedule compares with 42¢ per hour for common labor paid by the several mining companies operating on the Mesaba Range.

WADE MINE
ANNUAL REPORT
YEAR 1928

5. LABOR & WAGES:
(Continued)

b. Comparative Statement of Wages & Product:

	1928	1927	Increase	Decrease
PRODUCT:	298,137 (Loaded by Contract)	140,155	157,982	
AVG. NO. MEN WORKING:				
Surface,	4	3	1	
Underground,	4	6		2
Total,	8	9		1
AVG. WAGES PER DAY:				
Surface,	5.49	5.72		.23
Underground,	5.13	5.13	-	-
Total,	5.29	5.35		.06
WAGES PER MO. OF 25 DAYS:				
Surface,	137.25	143.00		5.75
Underground,	128.25	128.25	-	-
Total,	132.25	133.75		1.50
TOTAL NO. OF DAYS WORKED:				
Surface,	770¼	973		203¼
Underground,	921½	1653½		732
Total,	1691¾	2626½		935¼
AMOUNT FOR LABOR:				
Surface,	4,233.38	5,570.40		1,337.02
Underground,	4,729.04	8,485.65		3,756.61
	8,962.42	14,056.05		5,093.63

6. SURFACE:

a. Buildings, Repairs:

Practically no repair work was done on the location buildings during the past year. Some of the clapboarding was nailed down. The location houses were badly in need of paint and bids were secured for doing the work, but on account of the uncertainty as to our future operations at the Wade property, it was decided not to have the work done. Two of the boarding houses and two dwellings were occupied by employees of the A. Guthrie Company.

b. Stockpiles:

No ore was stocked during the year, but the 294 tons in stock was shipped. This work was done by the A. Guthrie Company on the same price per ton as the pit ore, viz: 44¢. It was necessary to lay a track into the stockpile and the ore was scraped up over the old bottom, making a slow and rather expensive job.

c. Tracks, Roads, Transmission Lines, etc:

No work was done by the Cleveland-Cliffs Iron Company on the tracks, roads or transmission lines during the past year.

WADE MINE
ANNUAL REPORT
YEAR 1928

7. OPEN PIT:

a. Stripping:

The A. Guthrie Company completed the stripping operations, with the exception of some clean-up work along the track bench, by the first of May, when ore operations were started. The total surface material handled by the contractor during 1928 amounted to 70,829 cubic yards.

The stripping banks stoodx very well and there was comparatively little wash on to the ore, notwithstanding the fact that there was an exceptionally heavy precipitation.

In connection with mining operations in the pit, the contractor loaded and placed in stockpile 17,330 tons of taconite running 38.12% Iron and 24.59% Silica - and 1,500 tons of very lean taconite was placed on the waste dump.

It is not anticipated that there will be any surface stripping to speak of in completing operations in the Wade pit in 1929 and the amount of taconite to be handled per ton of ore will be decidedly less than that for 1928.

b. Development:

No development operations were undertaken at the Wade Mine during the past year.

d. Timbering:

The only timbering work undertaken at the Wade Mine during 1928 was some propping of the main level caps and the renewal of some of the lathing in the shaft.

f. Explosives:

The only explosives used by The Cleveland-Cliffs Iron Company at the Wade Mine during 1928 was in connection with the test-pitting and churn drilling in the pit to determine the grade of ore to be mined in 1929.

g. Open Pit Mining and Loading:

All of the open pit ore loaded out during 1928 was done under our contract with the A. Guthrie Company. Shipments from the pit were started May 11th and continued until October 24th.

The Wade open pit face had been worked back from the Helmer line without encountering very much taconite and the underground workings, bounding the East side of the open pit limits, showed comparatively little taconite. Between these workings, however, a horse of taconite was encountered during 1928 operations. This slowed down ore loading and increased the amount of taconite to be handled very decidedly. In order to make sure of our 1929 operations, a number of test-pits and churn drill holes were put down to the bottom of the ore and our estimates are based on more accurate information than was the case on January 1st, 1928.

WADE MINE
ANNUAL REPORT
YEAR 1928

7. OPEN PIT:
(Continued)

g. Open Pit Mining & Loading: (Continued)

In digging down the approach grade along the Oliver line, some of their ore had to be loaded out. The amount of this ore was estimated by a joint survey of the Oliver, Great Northern and Cleveland-Cliffs engineers and the trespass was settled by later turning over Wade ore to the Oliver Company, the tonnage involved being based on the natural iron units.

The contractor worked under difficulties in the Wade pit during 1928 and it was necessary to change the shovel cuts on several occasions, due to the encountering of very low grade ore and taconite where it was unlooked for.

The contractor had loaded out the ore down to the lean ore bench along the Oliver line and the deep channel running in an East-Westerly direction across the center part of the pit. It will be necessary to load out the balance of the deep channel ore when operations are resumed next spring. This ore will be loaded into cars on the lean ore berm. It will then be necessary to load out the lean ore area and move the shovel to the North of the deep channel where there is a thin layer of ore in places. This layer of ore will be cast over against the approach track bench and the shovel will start removing this bench. The final operation to load out the ore in the Southeast corner of the pit will require the use of a dragline, digging out the ore as it is cast by the 300 shovel and loading it into cars spotted on the track on the Oliver Iron Mining Company's side of the boundary.

It will be necessary for the Dohm Company to mine and remove all of the Helmer ore from the pit previous to the middle of July, when the A. Guthrie Company will start attacking the approach bench.

8. COST OF OPERATION:

a. Comparative Mining Costs:

The production from the Wade Mine in 1928 was 156,579 tons greater than for the previous year. The tonnages in both years were mined by the A. Guthrie Company under contract.

The contract price for mining the ore was the same each year, the increase of $.097 in the total cost at the mine for 1928, as compared with the previous year was due largely to the high charge against taconite in 1928. The contractor encountered a horse of taconite in the center part of the Wade pit and it was necessary to load out the taconite in order to mine the ore. Previous open pit operations, as well as those from underground, did not indicate that there would be any such amount of taconite in the center of the pit as was encountered in the past season's work.

WADE MINE
ANNUAL REPORT
YEAR 1928

8. COST OF OPERATION: (Continued)

a. Comparative Mining Costs: (Continued)

The charges to District Office were much higher in 1928 than for the previous year. This was the result of pro-rating the District Office expense on a payroll basis in 1928 and considering the contractor's payroll in the same light as our own at other properties.

The only other item showing any material increase in the 1928 costs was "Analysis". During our operations in 1928 the grade of ore ran off and it was necessary to do a considerable amount of bank sampling, as well as test-pitting in an endeavor to improve the grade of ore and as a guide in taking the shovel cuts.

The Engineering and Mine Office accounts were lower in 1928 than for the previous year. In the case of Engineering, less work was required and in Mine Office - adjustments in the charges between the two years explains the decrease.

The Depreciation of Plant and Equipment was increased from $.054 per ton in 1927 to $.357 per ton in 1928. This was made necessary on account of charging off the balance of this account against a smaller tonnage than had previously been considered.

Due to the fact that a reduction in the Wade Mine taxes were secured and the tonnage handled during 1928 was so much greater than that for the previous year, the charge for Taxes per ton was $.113 per ton lower in 1928.

Previous to 1928 Winter Expense was charged as "Idle Expense". In the 1928 costs there was a charge of $.051 to this account.

The amortization charge for stripping was $.633 per ton lower in 1928 than for the previous year. This was due to a decision reached by the Cleveland office as to the proper rate to charge against a ton of ore.

The estimated cost at the Mine, prepared in connection with the year's budget, would have been about realized if we had not encountered the large amount of taconite in the pit and the depreciation of plant and equipment had not been increased to such an extent. The cost for handling taconite was $.081 per ton higher than was estimated at the time of preparing the budget.

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

No explorations were undertaken during 1928, nor do we contemplate any for the future.

WADE MINE
ANNUAL REPORT
YEAR 1928

10. TAXES:

Tax Statement:	1928	1927	Increase	Decrease
Wade Mine, ------	36,741.41	39,755.96		3,014.55
Personal Property,	936.56	1,049.95		113.39
Total, --------	37,677.97	40,805.91		3,127.94

18. NATIONALITY OF EMPLOYES:

NATIONALITY:	NO.OF MEN 1928	NO.OF MEN 1927
Americans, ---------	3	3
Austrians, ---------	3	3
TOTAL, ----------	6	6

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

1. GENERAL:

Ore operations were begun on May 7th and completed on September 26th. This was a later start than has been made in several years and the season's ore was secured at an earlier date. In 1927, the Washing Plant was started April 25th and closed down on October 12th.

On the whole the season's operations were quite satisfactory, the average mining conditions being fair and the Great Northern car service better than has been the case heretofore. The large amount of rocky material from the Hill pit slowed up operations both in the pit and at the Washing Plant. No frost was encountered in the early part of the season, as has been the case during the previous several years; this partly offset the rocky pit conditions.

2. PRODUCTION SHIPMENTS & INVENTORIES:

a. Production by Grades:

Hill Crude Ore----------	94,158	tons.
Trumbull Crude Ore----------	583,361	"
Total Crude Ore----------	677,519	"
Hill Bessemer Direct Shipping Ore--------	5,252	"
Hill Non-Bessemer Direct Shipping Ore----	6,605	"
Hill Bessemer Concentrates----------	42,649	"
Hill Non-Bessemer Concentrates----------	17,789	"
Trumbull Non-Bessemer Direct Shipping Ore	27,694	"
Trumbull Bessemer Concentrates----------	52,353	"
Trumbull Non-Bessemer Concentrates-------	336,555	"
TOTAL SHIPPING GRADE----------	488,897	"

The total output for the year 1928 was 27,488 tons less than for 1927. This was due to the fact that there was an over-shipment of Hill-Trumbull ore in 1927 from the 500,000-ton schedule. This over-shipment was taken into consideration in our 1928 output and the schedule reduced by the amount of such over-shipment the previous year. The amount of Direct Ore shipped in 1928 amounted to 39,551 tons and compares with 73,385 tons in 1927. The amount of Concentrates shipped in 1928 was 449,346 tons, or 6,346 tons more than in the previous year.

b. Shipments:

The shipments from the Hill-Trumbull Mine during 1928 was the same as the production figures, as all ore mined was forwarded to Lake Erie ports.

c. Stockpile Inventories:

No merchantable ore, either Concentrates or Direct, was stocked at the property during 1928, but the following lean non-wash material was placed in stock:

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

2. PRODUCTION, SHIPMENTS & INVENTORIES:

c. Stockpile Inventories: (Continued)

Concentrating Material Above 25%:

	Tons	Fe.	Phos.	Sil.
Trumbull---------	85,285	27.31	-	-
Hill----------	10,088	27.18	.035	50.48

Non-Concentrating Material Between 30% and 40%:

	Tons	Fe.	Phos.	Sil.
Hill----------	282	41.81	.033	35.63
Hill----------	7,245	32.90	.028	42.65

The lean material has been placed in stockpile in accordance with the terms of our lease with the Great Northern Ore Company. It is not at all probable that any of this ore can be treated and shipped advantageously during the life of our lease.

e. Production by Months:

(1) Crude Ore:

MONTH	HILL	TRUMBULL	TOTAL
May, ----------	9,500	100,790	110,290
June, ----------	18,920	147,290	166,210
July, ----------	28,495	124,691	153,186
August, ----------	16,237	123,059	139,296
September, ----------	21,006	87,531	108,537
TOTAL - 1928, ----------	94,158	583,361	677,519
TOTAL - 1927, ----------	165,100	549,290	714,390

(2) Concentrates and Direct Ore:

MONTH	HILL DIRECT	TRUMBULL DIRECT	HILL CONCTS.	TRUMBULL CONCTS.	GRAND TOTAL
May, ----------	2,149	--	6,374	69,935	78,458
June, ----------	002	--	12,995	101,214	114,211
July, ----------	9,611	5,141	19,061	81,896	115,709
August, -------	095	14,523	10,016	77,521	102,155
September, ----	-	8,030	11,873	58,309	78,212
October, ------	-	-	119	033	152
TOTAL - 1928---	11,857	27,694	60,438	388,908	488,897
TOTAL - 1927---	57,961	15,424	106,909	336,091	516,385

f. Ore Statement:

All material considered as ore that was mined during 1928 was shipped from the property.

g. Delays:

There were no serious delays effecting the operations to any considerable extent during the year 1928. The following delays were reported:

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

2. PRODUCTION, SHIPMENTS & INVENTORIES:

g. Delays: (Continued)

Pit Delays:

DATE	HOURS LOST	CAUSE:
June 13th,	2 - Hrs. 40 Min.	A broken hoisting chain on Shovel #27 whipped back and broke the eccentric strap.
June 22nd,	1 - Hr. 25 Min.	A broken swinging cable on the #27 shovel.

Washing Plant Delays:

June 7th,	40 Min.	A plate buckled on the 8-ft. pan conveyor.
August 10th,	1 - Hr.	Break in the trolley line to the rock dump necessitated suspension of tramming operations.
September 5th,	5 - Hrs.	The Washing Plant was idle on account of the shovels loading Direct Ore in the pit. This really might not be considered a delay as the Washing Plant crew were engaged on repair work.
September 6th,	5 - Hrs.	This delay was from the same cause as that above, viz: the pit shovels loading Direct Ore.

Delays Account no Cars:
Washing Plant Delays:

Season -	7 - Hrs. 30 Min.	No Great Northern cars furnished.

The time lost on account of not being furnished with Great Northern cars in 1927 amounted to 18 hours - 24 minutes.

Delays from Lack of Current:

Season -	2 - Hrs. 6 Min.

Delays to Stripping:

November 15th,	10 - Hrs. -	Softened condition of the dumps due to heavy rains, resulting in suspension of operations.
November 10th,	6 - Hrs. -	Broken bail on the 350-ton shovel.
December 1st,	4 - Hrs. 15 Min.	Broken swinging pinion on the 350-ton shovel.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

3. ANALYSIS:

a. Mine Analysis of Production & Shipments:

Grade:	Tons	Iron	Phos.	Sil.	Moist.	Fe.Nat.
Hill Bessemer Direct----	5,252	60.67	.040	9.39	7.17	56.32
Hill Non-Bess. Direct---	6,605	60.42	.044	10.42	7.12	56.12
Hill Bess.Concentrates--	42,649	61.45	.036	9.03	8.21	56.40
Hil Non-Bess. Concts.---	17,789	60.00	.040	9.78	8.00	55.20
Trumbull Non-Bess.Direct	27,694	56.11	.054	12.22	7.14	52.10
Trumbull Bess. Concts.--	52,353	59.64	.044	7.29	8.04	54.84
Trumbull Non-Bess.Concts.	336,555	59.42	.054	7.12	7.58	54.92
TOTAL - 1928----------	488,897	59.48	.051	7.76	7.66	54.92
TOTAL - 1927----------	516,385	59.23	.052	8.29	8.02	54.48

b. Average Analysis on Straight Cargoes:

	---Mine Analysis----				-Lake Erie Analysis-		
Grade:	Iron	Moist.	Fe.Nat.	Grade:	Iron	Moist.	Fe.Nat.
McCook-----	59.24	7.66	54.70	McCook-----	59.20	6.94	55.09
Hill Bess.-	60.45	8.09	55.56	Hill Bess.-	60.22	7.39	55.77

d. Average Analysis of Crude Ore Production:

	Tons	Iron	Phos.	Sil.
Hill Crude----------	94,158	47.22	.031	28.06
Trumbull Crude-------	583,361	44.73	.041	29.56
TOTAL - 1928---------	677,519	45.08	.040	29.35
TOTAL - 1927---------	714,390	39.33	.039	38.02

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

Grade:	Iron	Phos.	Sil.	Mn.	Alu.	Lime	Mag.	Sul.	Loss
Hill Bess.Direct	60.40	.040	10.00	.10	.65	.23	.09	.013	2.39
Hill N.B.Direct-	60.39	.043	10.52	.12	.51	.29	.09	.011	2.20
Hill Bess.Concts.	61.50	.034	8.84	.12	.46	.34	.14	.014	2.22
Hill N.B.Concts.-	59.90	.041	9.69	.12	.48	.28	.07	.012	3.50
Trumbull Direct--	56.04	.054	12.23	.08	.93	.34	.12	.014	6.14
" Bess.Concts.--	59.30	.044	7.49	.10	.54	.33	.11	.014	6.65
" N.B.Concts.---	59.34	.052	7.12	.10	.48	.30	.11	.018	7.05

The analysis of the ore shipped during 1928 was somewhat higher than anticipated. The hand-wash tests on the ore sampled from the Trumbull test-pits averaged almost two points lower in Iron than the results obtained at the Washing Plant in treating this ore.

The analysis of the Lower Lake Erie chemists checked closer with the mine sampling than has been the case in the past.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 13 cu. ft. per ton for Direct Ore.
17 cu. ft. per ton for Wash Ore.
A rock deduction of 10 per cent was made in the case of the Direct Shipping and Wash ore and 35 per cent for the Rocky Wash. Concentrates are figured on 65 per cent gross recovery.

Hill Bessemer Direct Shipping Ore	636,000	tons.
Hill Non-Bessemer Direct Shipping Ore	1,154,800	"
Hill Bessemer Concentrates	494,750	"
Hill Non-Bessemer Concentrates	506,000	"
TOTAL HILL ORE	2,791,550	"
Trumbull Bessemer Direct Shipping Ore	85,000	"
Trumbull Non-Bessemer Direct Shipping Ore	252,000	"
Trumbull Bessemer Concentrates	2,343,000	"
Trumbull Non-Bessemer Concentrates	1,122,746	"
TOTAL TRUMBULL ORE	3,802,746	"
GRAND TOTAL HILL AND TRUMBULL ORE	6,594,296	"

The ore estimate of January 1st, 1928 shows a net increase of 255,193 tons over that for the previous year, after deducting the shipments for 1928. There was a decrease of 859,155 tons in the Hill estimate, after deducting shipments. This decrease is due to the fact that the ore deposit to the North of the taconite island was not considered. Experience in the mining of the rocky wash ore in the Hill pit during the past season has demonstrated the fact that it is not advisable to make any assumptions on the North ore body until it has been drilled. The information from the old drilling is not adequate for estimating purposes, now that the character of the material is better known, and that part of the deposit, which is unstripped and lying to the North of the taconite island, has been eliminated from the estimate.

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The increase of 1,114,348 tons in the Trumbull estimate was due to our including certain parts of the ore body in our estimate, which we had not heretofore considered. Mining operations in the Trumbull pit during the past two years has proven that the leaner Trumbull ores can be mined and treated advantageously.

The test drifts pushed Westward from the West end of the Trumbull pit and to the North of this pit did not disclose any mineable ore outside of the present open pit limits and such exploratory work as was undertaken did not, therefore, disclose any additional Trumbull ore to be included in our estimate.

b. Prospective Ore:

The drilling of the land to the North of the Hill pit in the vicinity of the taconite island, will no doubt show up additional ore. Test-pits put down during 1925 indicate that the ore makes

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

4. ESTIMATE OF ORE RESERVES: (Continued)

b. Prospective Ore: (Continued)

back beyond the stripping banks and the few old scattered drill holes confirm this. It is not deemed advisable to do any exploratory work with drills for the present at least, as in the event that we were to prove any substantial tonnage, the taxes would be an item of expense over a period of years. We would not need to strip or mine any ore to the North of the present Hill pit for a number of years, according to our present schedule of production.

c. Estimated Analysis:

	Tons	Iron	Phos.	Sil.	Fe.Nat.
Hill Mine:					
Bessemer Direct Shipping,------	636,000	58.00	.045	13.00	53.36
Non-Bessemer Direct Shipping---1,154,800		58.00	.055	13.00	55.36
Bessemer Concentrates---------	494,750	59.50	.045	8.50	55.04
Non-Bessemer Concentrates-----	506,000	60.00	.059	7.50	55.50
TOTAL HILL ORE----------	2,791,550	58.86	.050	10.48	54.31
Trumbull Mine:					
Bessemer Direct Shipping------	85,000	56.40	.040	12.79	51.32
Non-Bessemer Direct Shipping--	252,000	58.04	.060	9.85	52.82
Bessemer Concentrates---------	2,343,000	59.00	.043	9.00	54.57
Non-Bessemer Concentrates-----	1,122,746	59.00	.080	9.00	54.57
TOTAL TRUMBULL ORE----------	3,802,746	58.85	.052	9.16	54.34
GRAND TOTAL HILL-TRUMBULL-----	6,594,296	58.86	.051	9.86	54.32

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

5. LABOR & WAGES:

a. Comments:

(1) Labor:

Labor conditions were satisfactory during the year 1928. No changes in the wage schedule were made for the year.

(2) New Construction:

The only new construction work undertaken at the Hill-Trumbull property during 1928 was the erection of housing and installation of the Layne & Bowler pump on the edge of the Trumbull pit and the centrifugal pump on a raft in the Hill pit. An explanation of this work is taken up under the heading of No.12 "New Construction".

b. Comparative Statement of Wages & Product:

	1928	1927	Increase	Decrease
PRODUCT----------	488,897	516,385		27,488
No.Shifts & Hours-------	1- 10	1- 10	-	-
Avg. No. of Men Working-	117	107	10	
Avg. Wages Per Day------	5.27	5.31		.04
Product Per Man Per Day-	31.97	26.11	5.86	
Labor Cost Per Ton------	.1647	.2033		.0386
Total No. of Days-------	1529$2\frac{1}{4}$	1978$0\frac{3}{4}$		448$8\frac{1}{2}$
Amount Paid for Labor---	$80,540.67	104,986.78		$24,446.11

In 1923 - Production from May 5th to October 3rd.
1924 - " " Apr. 26th to September 13th.
1925 - " " Apr. 25th to Octobef 6th.
1926 - " " May 7th to October 9th.
1927 - " " Apr. 25th to October 12th.
1928 - " " May 7th to September 26th.

In order to furnish cargoes for boats the Hill-Trumbull pit was operated 240 hours overtime and the Washing Plant 226 hours. This compares with 274 hours for the pit and 258 hours at the Washing Plant for the year 1927.

6. SURFACE:

a. Buildings, Repairs:

The office, garage, barn and houses Nos. 7, 8, 10, 11 and 12 were painted. House No.2 was painted and also re-roofed. House No.3 was painted, interior decorated, re-roofed and a new toilet installed. House No.4 was painted, interior decorated and furnished with a new porch. Houses Nos. 6 and 9 were painted and the interiors decorated.

In connection with the painting of the buildings, it was necessary to repair the siding.

The total cost of these repairs amounted to $2,926.68 and came well within the amount estimated.

c. Tracks, Roads, Transmission Lines:

A track crew of twenty-five men started work on March 5th, laying tracks along the West side of the stripping dump. This job was completed on March 17th. During the latter part of March and the fore

HILL-TRUMBULL MINE.
ANNUAL REPORT
YEAR 1928

6. SURFACE:

c. Tracks, Roads, Transmission Lines: (Continued)

part of April the crew worked on the main line tracks to the Washing plant, changing rail, putting in new ties - raising and relining the tracks. A track was laid on the South side of the dump near the Washing Plant for the disposal of waste rock.

A small amount of work was necessary on the stripping track between the yards and the dump.

During the latter part of April the track gang were engaged on the ore loading tracks in the pit.

Upon the completion of the ore season the track crew were employed in putting in a line for the waste ore operations.

From time to time during the summer some work was done on the stripping track grade for our large shovel operations. Upon the completion of the ore season a track was laid here and extended from time to time as the 350 shovel advanced in it's cut.

While stripping was in progress the track crew worked on the waste ore loading tracks, the stripping and dump tracks. A small revolving shovel was used in connection with the stripping grade, but due to a slide of the soft bank it was put out of commission and the balance of the work had to be done by hand. This shovel was not damaged to any extent and was later picked up by the locomotive crane and sent to the shops for repairs.

Trumbull Pit Well:

During the summer of 1928 it was deemed necessary to start drainage operations in the Trumbull pit as our ore cuts had been taken down to the water level and no further drainage could be expected in this pit from the Jones & Laughlin pump operations.

On account of the cost per foot of drilling a well for a Layne and Bowler pump, it was decided to sink a test-pit to the water level. This was done, the pit being put down for 35 feet at a point on the approach between the operating tracks and the coal dock.

The Layne & Bowler Company were given a contract to drill the well and the work was started on October 4th. The well was bottomed on November 24th. Drilling progress was made slow at times by having the bits stuck and by caving ground.

The Layne & Bowler pump was installed and operations started on December 17th.

In order to determine the progress to be made in draining the Trumbull pit, five holes were put down by the Cyclone drill, scattered over the Trumbull pit bottom. These holes were cased. By the end of the year the water in the Trumbull pit had been lowered from a maximum of 34.25 feet at a point in the East center part of the pit to a minimum of 7 feet at the North side of the pit and 4.38 feet at the extreme West end of the pit. The lowering of the water level has

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928.

6. SURFACE:
(Continued)

been much more rapid than was anticipated and it now looks as though we would soon have the water reduced to such an elevation that twelve hours pumping out of each twenty-four would be sufficient.

The pumping in the Trumbull pit has not effected the water in the Hill pit thus far.

A sub-station was being constructed at the end of the year. This installation will take care of the pit pumping, the washing plant line not being sufficient to take care of this extra requirement.

A drainage ditch was blasted across the swamp to the East of the shops to take care of the water from the Trumbull pump.

A short piece of road was built around the end of the Washing Plant tail track trestle, as this structure was becoming rickety and it was deemed advisable to fill it with stripping material.

7. OPEN PIT:

a. Stripping:

The 100-ton No.27 steam shovel started operations in the lean ore area to the West of the approach on October 1st and finished digging out this material on November 14th. Seven short cuts were taken, the material handled being as follows:

	Tons		Cubic Yards
Lean Ore----------	3,000	or	1,800
Waste Ore----------	102,033	or	60,009
Wash Ore----------	5,850		

The wash ore was dumped back into the pit at a convenient place, to be loaded out later. This was not figured in with our stripping operations.

The 350-ton shovel started stripping to the East of the approach on October 3rd. This job was conducted until weather conditions became so severe that satisfactory results could not be obtained and the work was shut down December 22nd. At the beginning of the cut progress was somewhat slow due to the fact that the bank could not be blasted on account of it's proximity to the approach tracks, and there was no width to the cut. After the first week good results were obtained on the stripping job. As the East Trumbull boundary line was approached, a heavy layer of gumbo clay was encountered in the cut and this slowed down the operation somewhat. The 6-yard dipper was not adequate for this job and so an 8-yard dipper was rented from the A. Guthrie Company and was put in service on November 11th.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

7. OPEN PIT:
(Continued)

a. Stripping: (Continued)

The first cut with the 350-ton shovel was completed on December 11th. The yardage handled for several days thereafter was greatly reduced, as the shovel had to cut in along the Trumbull line and square around for the second cut. Frost conditions became somewhat troublesome the last week that this job was being conducted. The clay seam contained sufficient moisture so that the frost penetration was considerable between shifts, the work being conducted on day shifts only.

When the stripping operations were started the dumps were quite soft on account of the heavy rains. The capacity of our stripping dumps was hardly sufficient for both the waste ore and stripping. When the weather became colder and the waste ore job was completed, the yardage of stripping handled per shift was increased.

Two gangs of drillers were engaged in putting blast holes into the stripping bank during the time this operation was being conducted. They will be employed until about the middle of January, when the holes will be blasted, in preparation for spring stripping.

The yardage of stripping handled by the 350-ton shovel amounted to 321,755.

The A. Guthrie Company began stripping operations on their contract October 24th and pushed this work along until January 2nd, when the frost conditions became too severe. The contractor employed a large revolving electric shovel, mounted on caterpillars and equipped with a 10-yard dipper for this work. The shovel was served by three trains of 30-yard cars.

Two short cuts were taken from the Hill-Annex side on to Hill land to work back the point of surface material which projected Northward along the boundary line. The third cut was well on toward completion when stripping operations were suspended, this cut to be extended to the Western limit of the area. It is the contractor's intention to complete this cut in the spring, then turn the shovel around and move back Eastward.

The total stripping handled by the A. Guthrie Company amounted to 438,811 cubic yards.

d. Timbering:

Statement of Railroad Ties Used:

1928	1927	Increase	Decrease
6,563	6,993	-	430

The pit operations during 1928 were quite scattered and this was

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

7. OPEN PIT:
(Continued)

d. Timbering (Continued)
also the case during the previous year. The amount of ties to be used in 1929 will probably be about in line with 1928, as a track will have to be laid into the direct ore area at the Southeast corner of the Hill pit.

Three thousand four hundred and sixty feet of mining timber and thirteen cords of lagging were used in the exploratory drifts along the edges of the Trumbull pit and at the Northeast corner of the Hill pit.

f. Explosives, Drilling and Blasting:

The Cyclone and Keystone drills were taken into the pit the latter part of March in order to put down blast holes ahead of our ore operations. These two machines were engaged throughout the balance of the year.

Statement of Explosives Used:

Kind:	QUANTITY	AVERAGE PRICE	AMOUNT 1928	AMOUNT 1927
25% Hercules	1,900	.1165	221.35	-
35% Hercules	150	.1275	19.12	
40% Hercules	11,309	.1275	1,451.93	646.96
60% Hercules	4,300	.1450	623.75	705.00
Hercules Special #1,	7,500	.1350	1,012.50	1,785.00
Trojan 40C				390.00
Trojan 50%C				700.00
Hercules Pluto	3,100	.1130	350.30	5,147.15
Mesabi Bag	76,500	.1025	7,841.25	
Hercomite #2	15,800	.1350	2,133.00	
Hercomite #4	2,500	.1350	337.50	
Total Powder,	123,059	.1137	13,990.70	9,374.11
Fuse	2,720	.0057	15.48	6.78
Caps	1,480	.0115	17.05	9.01
Electric Exploders	2,265	.1026	232.44	177.55
Connecting Wire	10	.0782	7.82	6.31
Crimpers	0	-		
Total Caps, etc.			272.79	199.65
TOTAL EXPLOSIVES			14,263.49	9,573.76

	1928 CRUDE & DIRECT	1928 CONCTS. & DIRECT.	1927 CRUDE & DIRECT	1927 CONCTS. & DIRECT
Product	717,070	488,897	789,775	516,385
Lbs.Powder per ton of Ore	.1716	.2517	.0964	.1471
Cost per ton for Powder	.0195	.0291	.0119	.0182
Cost per ton for Caps,etc	.0004	.0006	.0002	.0003
Cost per ton for all Explosives	.0199	.0297	.0121	.0185
Avg.Cost per Lb.for Powder	.1137	.1137	.1234	.1234

Commenced operation May 7th, 1928; suspended operation September 26th, 1928:

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

7. OPEN PIT:
(Continued)

g. Open Pit Mining & Loading:

Wash Ore:

Wash ore operations were started May 7th. The 100-ton No. 27 shovel was cut in on the lower Trumbull pit bench and dug this bench back to the North, taking nine cuts during the season. This operation was very favorable throughout and the grade of ore was satisfactory except at the West end of the last two cuts, where lean material was encountered.

Direct ore was encountered by the No.27 shovel about the center of the last several cuts. This direct ore was of only fair grade, but we were able to absorb it as well as the lean material loaded out at the West end of the cuts.

No.26 (100-ton) shovel started the season in the Northeast corner of the Hill pit. The first cut was taken in the upper bench along the toe of the stripping, thus cleaning up all of the ore that would be possible to get from open pit operations. The fee owners were entirely in accord with this method of mining. The material from the first cut was a mixture of direct shipping and wash ore and rock, The second cut taken by this machine was in the lower bench and consisted of a mixture of wash ore and rock. At times when the amount of rock encountered was excessive, this machine was operated on night shifts so as not to tie up too much equipment and cause delays at the Washing Plant. Five cuts were taken in the lower bench, final operations being concluded in this area on June 27th. Test-pits showed that there was no commercial ore left in this corner of the Hill pit.

The No.26 shovel was moved to the bottom of the old Hill pit and started loading operations in this rocky area on June 28th. The machine took four cuts, digging in an East-Westerly direction and pushing Northward. The wash ore encountered here was badly mixed with rock and the loading was comparatively slow. At times when the rock was very excessive, this shovel's operations were conducted on night shift so as to avoid delays.

Heavy rains flooded the Hill pit on August 16th and the No.26 shovel was shut down.

A centrifugal pump was installed on a raft and had lowered the water sufficiently so that mining activities could be resumed on September 12th. Work here was continued until the end of the season.

A small tonnage of direct ore was loaded out by the No.26 shovel, operating in the Hill pit bottom.

A Model 60-ton Marion shovel (No.22) was taken into the pit on May 17th and started work in the Trumbull pit, just West of the approach. The bench of ore was dug back to the approach tracks by August 27th, the cuts extending Southward to the lean ore area. This operation was not continuous, the ore being loaded as conditions warranted. The grade was on the average below our guarantee and most of the Concentrates from this ore had to be sweetened. Some Bessemer ore was secured from this operation but not as much as we had anticipated from the test-pit results.

The No.22 shovel was taken to the Hill pit on September 10th and worked for a matter of two weeks in mining out a narrow layer of ore on the rock to the East of the approach.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

7. OPEN PIT:
(Continued)

g. Open Pit Mining & Loading: (Continued)

Direct Ore:

A comparatively small tonnage of direct ore was loaded during the season of 1928. There was no definite area to be mined, the ore being secured in connection with the wash ore operations. The No.27 shovel loaded out the bulk of the direct material from the cuts along the North side of the Trumbull pit. The No.26 shovel secured a small tonnage from the Northeast corner of the Hill pit and the old Hill pit bottom.

Lean and Waste Ore:

This work has been explained under the heading of "Stripping".

k. Water Level in Pit:

The water level in the Hill pit rose .4 of a foot during the past year, the elevation on January 1st, 1928 being 1248.4 and on January 1st, 1929 - 1248.8. The capacity of the Jones & Laughlin pump was reduced during the summer of 1928 and the elevation of the water in the Hill pit appears to have reached a permanent level so far as this drainage is concerned. There is some likelihood that our Trumbull pumping may effect this drainage, as the water level is further reduced by that equipment.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

8. COST OF OPERATION:

a. Comparative Mining Costs:

	1928	1927	INCREASE	DECREASE
PRODUCT:				
Direct Shipping,	39,551	73,385		33,834
Concentrates,	449,346	443,000	6,346	
Total Production,	488,897	516,385		27,488
Avg. Daily Product,	3,943	3,512	431	
Tons Per Man Per Day,	31.97	26.38	5.59	
Days Operated,	124	147		23
Budget, Estimated Production	500,000	500,000		
" " Cost at Mine,	1.703	1.545	158	
COST:				
Total Cost at Mine:				
Open Pit Direct Shipping Ore	.132	.177		.045
Open Pit Wash Ore,	.212	.258		.046
Concentrates,	.150	.154		.004
Total,	.343	.379		.036
Depreciation - Plant & Equipment -	.200	.200	-	-
Taxes,	.311	.234	.077	
Minnesota Royalty Taxes-	.055	-	.055	
Occupational Taxes,	.020	.035		.015
Central Office,	.012	.011	.001	
Welfare, Safety, Hospital, etc.,	.000	.000	-	-
Cost Adjustment,	-	.002		.002
Stripping,	.519	.519	-	-
Winter Expense,	.173	.189	-	.016
Misc.Credits & Debits,	.016	.009	.007	
Expense of Other Mines	.015	-	.015	
Administrative Expense	.100	.100	-	-
Cleveland Office Itrms	.012	.016	-	.004
Total Cost at Mine	1.778	1.694	.084	

d. Detailed Cost Comparison:

(1) Product:

There was a decrease in the 1928 production of direct shipping ore of 33,834 tons as compared with the previous year. The bulk of the direct shipping ore secured during 1928 came from the Trumbull pit and was mined in conjunction with the wash ore. Heretofore most of the direct ore secured from these properties has come from the Northeast corner and North bank of the Hill pit. In the future we aim to secure in the neighborhood of 100,000 tons of direct shipping ore per season from the Southeast corner of the Hill pit, until the ore body is exhausted. The southeast corner of the Hill pit is now being stripped by the A. Guthrie Company.

The amount of concentrates turned out from the Hill-Trumbull mill in 1928 was 6,346 tons higher than in 1927, operating conditions being about the same for the two years.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

8. COST OF OPERATION: (Continued)

d. Detailed Cost Comparison:

On account of over-shipping our 500,000-ton schedule in 1927, the 1928 requirements were reduced by better than 13,000 tons. The difference in total shipments for the two years amounted to 27,488 tons.

The average daily production was 431 tons greater in 1928 than in the previous year, and the tons per man per day was 5.59 higher.

(2) Direct Ore Costs:

The cost per ton for producing the direct shipping ore during 1928 was $ .045 per ton less than for the previous year. This was due to the fact that the bulk of the direct ore secured in 1928 was mined in conjunction with the wash ore in the Trumbull pit and the track and operating locomotives and steam shovels was less than in 1927. During 1926 and 1927 most of the direct ore came from the East end of the Hill pit and the track expense was rather high. The operation of locomotives and steam shovels in 1926 and 1927 was also high due to short cuts and difficult spotting conditions.

(3) Wash Ore Costs: (Concentrated Basis)

The wash ore costs (concentrated basis) showed a decrease of $.036 per ton in 1928, as compared with 1927. The items under this caption which showed the large decreases in 1928 were - "Track Expense" - "General Open Pit Expense" - "Insurance" and "Analysis".

During 1927 it was necessary to do considerable track work at the East end of the Hill pit and in laying the tracks into the bottom of that pit. During the past year we only had the normal amount of track work to do in connection with open pit operations.

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Less general open pit expense was necessary in 1928 than for either of the previous two years. We were able to get along with less men carried through "General Expense".

Due to an adjustment in the insurance accounts in 1927, the charges for that year were exceptionally high, whereas they were normal in 1928.

The analysis charges for 1928 were much lower than for the previous year, due to the fact that considerable less test-pitting was done, including the sampling and analytical work in connection therewith.

The one item which showed a decided increase in 1928, as compared with 1927, was "Drilling and Blasting". We mined considerable rocky wash ore in the Hill pit bottom during 1928, which explains the increase over the previous year.

(4) Concentrating:

There was a decrease of $.004 to this account in 1928, as compared with 1927. This was due to our securing a larger tonnage per shift in 1928 and to the fact that a smaller average force was employed at the mill.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

8. COST OF OPERATION: (Continued)

d. Detailed Cost Comparison: (Continued)

(5) Miscellaneous Group:

The 1928 Ad Valorem taxes were $.077 higher than for the previous year, as the result of the Tax Commission having increased very decidedly the valuation of the Hill Mine. We have petitioned the Tax Commission for a re-estimate of the Hill ore body on the part of their engineers and we feel that the tonnage will be reduced somewhere in line with our figures. Providing this is done, the Ad Valorem taxes of 1928 would be slightly less per ton than for the previous year.

There was no royalty tax charged to the 1927 accounts, whereas in 1928 it amounted to $.055 per ton.

The items: Occupational Taxes, Cost Adjustment, Winter Expense and Cleveland Office Expense, were somewhat lower in 1928 than for the previous year.

Adjustments in the account "Miscellaneous Debits & Credits" during 1928rresulted in showing an increase of $.007 per ton - and "Expenses to Other Mines", where there was no charge in 1927, caused an increase of $.015.

With the reduction in the Ad Valorem taxes, which we expect to secure, the total cost at the Mine would be $1.70 per ton, which is the estimated cost which was submitted at the time of making up our Budget for 1928 expenses.

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Five test drifts were pushed into the Trumbull banks and two were started in the Northeast corner of the Hill during the past year.

Drift No. 1 was driven West from the West end of the Trumbull pit, the work undertaken being as follows:

Main drift, ----------	350 feet
Crosscuts, ----------	220 feet
Winzes, ----------	85 feet
Raises, ----------	187 feet

These workings were sampled and hand-wash tests made. The result of this work did not show any commercial ore.

Drifts Nos. 2, 3, 4 and 5 were driven into the North bank of the Trumbull pit, the work consisting of the following:

No. 2 Drift:

Main drift, ----------	120 feet
Winzes, ----------	62 feet
Raises, ----------	32 feet

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

9. EXPLORATIONS AND FUTURE EXPLORATIONS: (Continued)

No.3 Drift:
Main drift, ---------- 220 feet
Winzes, ---------- 64 feet
Raises, ---------- 29 feet

No.4 Drift:
Main drift, ---------- 170 feet
Winzes, ---------- 38 feet
Raises, ---------- 16 feet

No.5 Drift:
Main drift,---------- 160 feet
Winzes, ---------- 25 feet
Raises, ---------- 15 feet

The results of sampling and hand-washing showed that there was no ore in these workings beyond the present toe of surface bank that would justify any further stripping.

The two drifts which were started in the Northeast corner of the Hill pit were discontinued on account of the force engaged here being transferred to the Boeing Mine for the drainage drift work. The two drifts in the Hill pit are in 5 feet and 14 feet, respectively.

Some test-pitting was done at the West end of the upper bench in the Trumbull pit, as well as in the area now being stripped by the 350-ton shovel.

Test-pits will be sunk in the Trumbull pit bottom as soon as the water has been lowered sufficiently. Test-pits will also be put down in the Southeast corner of the Hill pit as the Guthrie operations are now sufficiently advanced to accomplish this work.

It has not been decided when drilling will be done to the North of the Hill pit in the vicinity of the taconite island. We have sufficient Hill ore for several years operations and it has been deemed inadvisable to do the drilling, as in the event a large tonnage of ore were developed here, we would be obliged to pay taxes for several years before mining activities would be started.

11. ACCIDENTS AND PERSONAL INJURY:

To accurately determine the outline of the stripping to be conducted by the A. Guthrie Company at the Southeast corner of the Hill pit, it will be necessary to put down several drill holes. There is a question as to the Southerly limits of the commercial ore in this area and the drilling is for the purpose of determining this condition. There will be at least two, and possibly as many as four holes.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1928

10. TAXES:

The following statement shows the taxes and average rate for 1928 and 1927, covering the Hill-Trumbull, Bingham and North Star Mines, the Hill-Trumbull washing plant, the Bingham-North Star washing plant site and the Hill-Trumbull shops. The reason for including the Bingham and North Star Mines and washing plant site is that the Hill-Trumbull operations carried the taxes on these properties through 1928 and as the Bingham and North Star are not operating, the taxes on these mines would not be shown otherwise in the annual report of the Mesaba District.

	1928	1927	Increase	Decrease
Hill Mine	$99,537.86	53,007.11	46,530.75	
Trumbull Mine	33,851.01	48,342.34		14,491.33
Hill-Trumbull Shops	1,109.84	1,250.58		140.74
Bingham Mine	7,699.10	8,034.03		334.93
North Star	5,881.34	6,114.34		233.00
Washing Plant	3,875.47	3,527.58	347.89	
Bingham-N.Star W.P.Site	81.19	75.31	5.88	
TOTAL	$152,035.81	120,351.29	31,684.52	
Village lots	621.87	649.18		27.31
GRAND TOTAL	152,657.68	121,000.47	31,657.21	
Average Rate	7.97	8.92		.95

The large increase in the Hill Mine taxes is due to the fact that the Tax Commission's engineers included a large quantity of lean, non-concentrating ore in their estimates. A petition has been presented to the Tax Commission, asking that their engineers review their estimates and we are assured that this will be done. The Tax Commission's engineers visited the Hill pit, subsequent to making their estimates and their error in including the low grade ore was pointed out to them. The engineers were convinced of their mistake and it is hoped that their re-estimate will be in line with our figures. No report has been made on their revised estimate to the Tax Commission.

11. ACCIDENTS AND PERSONAL INJURY:

There were eleven accidents at the Hill-Trumbull Mine during 1928, as compared with four for the previous year. The total number of days lost in 1928 were 251 against 93 for 1927.

There was only one accident of a semi-serious nature, that to John Carlson. A brief description of the eleven accidents follows: