LAKE MINE.

THE FOLLOWING IS ITEMIZED STATEMENT OF THE VARIOUS ACCOUNTS UNDER MAINTENANCE.

SIDE TRACKS: Total $1243.93 - The maintenance of Joint Tracks as per bills rendered by the C & N W Ry., is as follows:

(bills rendered)	1910 to Oct. 31st	1909 to Oct. 31st	INCREASE
Total Joint Track Expense	1469.43	1455.03	14.40
Our proportion (one-third of same)	489.79	485.02	4.77
Constructing Joint Track at Lake Angeline Cave as per contract #441 - 4/6/09 - our proportion	74.67		
Moving Tracks for Steam Shovels	679.47		
Total as above			1243.93

SURFACE: Total $880.87 -- Decrease over 1909 $14.46. This amount is for general cleaning of the whole of our surface, such as cleaning roads, tracks and around the several buildings.

DOCKS, TRESTLES & POCKETS: Total $790.48 -- This account shows an increase over 1909 of $517.71. The general repairs on coal dock together with new sheet iron top, cost $642.29. The repairs on trestle amounted to $148.19 as against $160.75 for 1909.

BUILDINGS: Total $789.73 -- Increase over 1909 $492.54.

Office Painting and Kalsoming	52.28
Shops - putting on a new roof	183.90
Shaft House - Scraping and painting	241.46
Engine House - Repairing Roof and Window Glass	16.98
Dry House - Cleaning and Painting	289.02
Miscellaneous Fire Protection	6.09
Total	789.73

SHOP MACHINERY: Total $412.88 --All increase over 1909. This is for one #3 Williams Pipe Cutting Machine, 25 ft. 3" belt and one set dies.

BOILERS: Total $2216.12 -- Increase over 1909 $1089.16. One of the boilers was burned and it had a general overhauling, including 70 - 4" fules.

This with other repairs cost	1207.85
A set of new scrapers and some taking out and replacing on the Economiser cost	759.27
Repairs to heater	249.00
Total	2216.12

HOISTING MACHINERY: Total $452.59 -- An increase of $77.01. This covers two 900 foot hoisting ropes charged out this year $297.56.

COMPRESSORS, RECEIVERS & AIR PIPES: Total $2683.44 -- An increase over 1909 of $1037.28. This includes 17 new power drills purchased during the year as against eight last year.

17 drills purchased	1910	$2186.16
8 " "	1909	1163.04

STEAM PUMPS: Total $1525.32 -- Increase over 1909 $1274.11. This year we put in a new 8" column from the surface to the bottom of the mine.

TOP TRAM ENGINE & CARS: Total $670.88 -- Increase over 1909 $297.03. Items of expense are:

3500 ft. $\frac{5}{8}$" Wire rope	220.50	
Repairs to Engine	185.96	
Repairs to cars	264.42	670.88

SKIPS & SKIP ROADS: Total $893.75 -- A decrease from last year of $22.30. The principal charge was for overhauling skips and cages which was $727.21 as against $667.25 last year, or an increase of $59.96.

UNDERGROUND TRACKS & CARS: Total $2114.42 -- An increase over last year of $831.84, the chief items being 25 tons of 12# rail and general repairs on cars.

ELECTRIC TRAM PLANT: Total $7208.25.

	1910	1909	INCREASE	DECREASE
Electric Engine	15.74	22.30		6.56
Motors	3045.38	2781.63	263.75	
Wiring	924.00	434.55	489.54	
Main Line Tracks & Cars	3223.04	2524.91	698.13	
Total	7208.25	5763.39	1444.86	
Cost per ton	.0126	.0136		.0010

ELECTRIC ENGINE: The Electric Engine was cut out on June 6th, 1910, and we commenced using current from Electric Power Plant.

The following shows each Motor:

	1910	1909	INCREASE	DECREASE
#2 Motor	858.54	434.66	433.88	
#3 "	181.44	187.18		5.74
#4 "	299.49	360.81		61.32
#5 "	289.47	435.57		146.10
#6 "	153.21	147.08	6.13	
#7 "	108.98	93.23	15.75	
Motors General Electrician	1154.25	1123.10	31.15	
Total	3045.38	2781.63	476.91	213.16
Net Increase			263.75	

The repairs to motors covers rewinding armatures, new commutators and replacement of wheels, etc. No. 2 motor received a general overhauling which cost $551.00. Outside of this there were no extraordinary charges this year.

C A R S: Total $1620.07 -- Increase over 1909 $249.41.

Hard ore Shop Labor	453.18
Wheels and Babbitt	230.16
Car Repairs	936.73
	1620.07

TRACKS: Total $1602.97 -- Increase over 1909 $448.72. All of this is for general repairing, there being no extraordinary charges.

The following shows the cost for Maintenance and Operating Electric Tram Plant:

Product 1910	574,302
Product 1909	422410

	1910		1909		
	AMOUNT	PER TON	AMOUNT	PER TON	
Engines	15.74	.000	22.30	.000	
Motors	3045.38	.005	2781.63	.007	- .002
Wiring	924.09	.002	434.55	.001	+ .001
Tracks & Cars	3223.04	.006	2524.91	.007	- .001
Maintenance Total	7208.25	.013	5163.39	.015	- .002
Operating Total	26532.75	.046	23441.95	.050	- .004
Grand Total	33741.00	.059	28205.34	.065	- .006

FIRE IN COAL PILE: Total $13.50 -- All increase over 1909. This is for putting out a fire in the coal pile during November. We have not got in far enough to locate the amount of damage.

LAKE MINE.

ORE STATEMENT FOR DECEMBER 31ST, 1910.

	LAKE	TOTAL LAST YEAR 13 mos.
On hand January 1st, 1910	78,480	118,000
Output for year	574,302	423,958
Total	652,782	541,958
Shipments	524,163	463,478
Balance on hand	128,619	78,480
Increase in output corresponding (12 months - 43%	172,000	
Increase in ore on hand	50,139	

1910 - 2-10-hr. shift - 1909 - 1-10-hr. to August 23rd - 2-10-hr. to Dec. 31st.

SHIPMENTS FOR 1910.

	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Lake Bessemer				19,987
Lake	397,519	126,644	524,163	430,367
Lake Silica				13,124
Total	397,519	126,644	524,163	463,478
Total last year	314,562	148,916	463,478	
Increase - 13%			60,685	

AVERAGE MINE ANALYSIS OF OUTPUT.

GRADE	IRON	PHOS.
Lake	58.51	.108

AVERAGE MINE ANALYSIS ON STRAIGHT CARGOES.

GRADE	IRON	PHOS.
Lake	58.40	.106

LAKE MINE.

TIMBER STATEMENT FOR THE YEAR ENDING DECEMBER 31ST,'10.

KIND	LINEAL FEET	AVG. PRICE PER FOOT.	13 mos. 1910 AMOUNT	12 mos. 1909 AMOUNT
Cribbing				119.13
4" to 6" timber				1816.22
6" " 8" "	88,157	.0169	1489.53	6287.96
8" " 10" "	206,543	.0417	8627.77	5769.46
10" " 12" "	130,025	.0581	7553.45	1393.98
12" " 14" "	22,052	.0813	1792.71	
Total	446,777	.0435	19,463.46	
Total 1909	376,964	.0408		15386.75

	LINEAL FEET	PER 100 FT.	AMOUNT. 1910	AMOUNT 1910
5 ft. lagging	1,357,080	.465	6312.00	5994.25
7 ft. "	14,000	.550	77.00	285.59
8 ft. "	63,124	.626	395.18	
Poles	49,502	.950	470.26	260.83
Total	1,483,706	.473	7254.44	
Total 1909	1,385,607	.472		6540.67

	1910	1909
Feet of timber per ton of ore	.778	.889
Feet of lagging per ton of ore	2.49	3.20
Feet of lagging per foot of timber	3.21	3.60
Cost per ton for timber, lagging and poles	.046	.051
Equivalent of stull timber to board measure	886,045	728,507
Feet board measure per ton of ore	1.54	1.72
Total product	574,302	423,958
Total cost of timber and lagging, 1910 - 12 months		26717.90
Total cost of timber and lagging, 1909 - 13 months		21927.42
Total cost of timber and lagging, 1908 - 12 months		17499.22
Total cost of timber and lagging, 1907 - 12 months		21989.00

LAKE MINE.

COMPARATIVE MINING COST FOR YEAR.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
PRODUCT	574,302	423,958	150,344	
General Expense	.018	.027		.009
Maintenance	.038	.035	.003	
Mining Expense	.723	.726		.003
Cost of Production	.779	.788		.009
DEPRECIATION.				
Improvement		.018		.018
New Construction		.038		.038
Total		.056		.056
Taxes	.042	.056		.014
Central Office	.034	.038		.004
Cost on Stockpile	.855	.938		.083
Loading and shipping	.015	.018		.003
Total cost on cars	.870	.956		.086
No. days operating	298	(115-2-10-hr. (210-1-10 hr.		
No. shifts and hours	2-10-hr.	2 & 1-10-hr.		
Average daily product	1,927	1,305		
COST OF PRODUCTION.				
Labor	.600	.583	.017	
Supplies	.179	.205		.026
Total	.779	.788	.017	.026

LAKE MINE.

STATEMENT OF COMPARATIVE WAGES.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
SURFACE				
Total number of days	20,997¾	20,166¾	3,019¼	
Average rate	2.28	2.21	.07	
Amount	47,868.81	44,552.04	3,316.77	
UNDERGROUND				
Total number of days	108,135½	77,782	39,480½	
Average rate	2.77	2.64	.13	
Amount	299,084.06	205,552.78	93,531.28	
Total days	129,133¼	97,948¾	42,499¾	
Average rate	2.69	2.55	.14	
Total Amount	346,952.87	250,104.82	96,848.05	
Labor cost per ton	.604	.590	.014	

For comparison of days for twelve months, December, 1909, is omitted.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '10 - 574,302 tons PRODUCT '09 - 423,958 "	SURFACE		UNDERGROUND		T O T A L	
	1910	13 mos. 1909	1910	13 mos. 1909	1910	13 mos. 1909
Avg. no. men working	67	60	370	240	437	300
Avg. wages per day	2.28	2.21	2.77	2.64	2.69	2.55
Avg. wages per mo. 25 days	57.00	55.25	69.25	66.00	67.25	63.75
Avg. product per man per day	27.40	21.03	5.31	5.45	4.45	4.33
Labor cost per ton	.083	.105	.521	.485	.604	.590
Diff. in labor cost per ton	-.022	-.002	*.036	-.002	*.014	-.004
Avg. product breakg & tramming			8.30	8.47		
Avg. wages for miners contract			2.816	2.68		
Avg. wages for trammers contract			(None - Electric haulage.)			
Total average wages for contract			2.816	2.68		

Average wages three months to March 31st, - $2.62) Average for year $2.69

Average wages nine months to December 31st - 2.71) Increase in wages 3.4%.

Increase in product per man per day 2.7%.

- minus * plus.

LAKE MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	12 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
50% Powder	116,000	.1025	11890.02	8463.04
60% "	200	.1125	22.70	
80% "	850	.1325	112.62	
Fuse	333,500'	3.78	1260.63	915.54
Caps	101,900	5.94	605.45	479.40
Electric Exploders				5.43
Connecting wire				3.60
Total			13891.42	9876.01
Product			574,302	423,958
Pounds powder per ton of ore			.203	.191
Cost per ton for explosives			.0241	.0233

Respectfully submitted,

M. M. Duncan

Agent.

THE CLEVELAND CLIFFS IRON COMPANY.

ISHPEMING, MICHIGAN.

A G E N T ' S A N N U A L R E P O R T.

F O R

YEAR ENDING DECEMBER 31ST, 1910.

I N D E X

THE CLEVELAND CLIFFS IRON COMPANY.

Ishpeming, Mich.
1st January, 1911.

Mr. Wm. G. Mather, President,

Cleveland, Ohio.

Dear Sir:

I beg to submit the following report of the operations and present condition of the mines of this Company. The inventories, maps and statements appertaining to this report go forward under separate cover.

The tinted portions of the maps, show the extensions for the year, and the location of each contract is indicated by the corresponding number.

The reports of the Negaunee, Maas, Lucy and Jackson Mines were prepared by Mr. S. R. Elliott, Superintendent, those of the Austin, Princeton, Stephenson, Smith and Swanzy District, by Mr. G. R. Jackson, Superintendent, the Imperial Mine by Mr. M. H. Barber of the Engineering Department, the Ashland and Iron Belt Mines by Mr. J. M. Bush, Superintendent, the Crosby Mine by Mr. J. R. Reigart, Superintendent, the North Lake and Barnes Mines by Mr. W. W. Graff, Superintendent, the report of the Geological Department by Mr. E. E. White, Chief Geologist and the report of the Engineering Department by Mr. J. E. Jopling, Chief Engineer.

NEGAUNEE MINE.

NO. 3 SHAFT.

From month to month I have described many details in connection with the construction of this shaft, and for a matter of record, I will review the most important points in the work.

SIZE OF SHAFT.

The walls of the shaft are of concrete, its shape being circular. The inside diameter is 17 feet, the thickness of the walls being about 1½ feet. Its diameter is sufficient to enclose a rectangular shaft of the standard dimensions, or 10'10" by 14' 10" inside of timbers. There are two skip compartments, a cage, ladder and pipe-way.

SINKING.

When the raise from the 9th level holed into the test pit, which was sunk to the ledge, a large conical shaped hole was made around the pit to a depth of about 40 feet from the original surface. From this elevation a hexagon shaped wooden shaft was dropped to the ledge. The object of making the cone shaped hole, was to provide sufficient head-room for the concrete equipment, details of which were described in my 1909 report.

On January 3rd, sinking in rock was started. This consisted simply of drilling a sufficient number of vertical holes around the raise and blasting, stripping the rock so that the diameter of the completed excavation would be approximately 20 feet. On the commencement of the work, the progress was slow. On the start, blasting had to be done with sufficient care to prevent the breaking of the timbers in the hexagon shaped shaft. As the upper 25 feet of the main raise was only about three feet in diameter, at least three rows of holes had to be drilled, making the numberfor each complete round, between 35 and 40. After the main raise was opened, it would require one row of holes on the circumference varying in number from 20 to 24.

The general plan was to strip down as far as practical. The length of the section varied according to the hardness of the rock. From an economical standpoint, the longer the section, the more rapid the progress in concreting. There is considerable time lost in changing from one operation to the other. The ground has always been examined and trimmed carefully. Where it could not be trimmed solid, the length of the section was reduced.

DRILLING.

After a series of carefully made experiments, it was decided that the Murphy

Hand Sinker was the most practical. It is unnecessary to go into details, as our results show what has been accomplished with them. I can conservatively say that three experienced operators can drill as much ground in a shift with three Murphy Sinkers, as six men with the piston type of machine. There is no trouble in getting good results with them as long as the air pressure does not drop below 70 lbs. With low air pressure the cuttings will not be blown out and the hole in the center of the steel, will become plugged.

In ordinary ground we expect to have the shaft drilled over, blasted, and carefully trimmed in two eight hour shifts. For the last six months of the year, this has been accomplished.

SHAFT CREW.

Up to June the 13th, there were three men in two ten hour shifts. The ground, up to September 1st, was exceedingly hard -- hard enough to scratch glass. The gauge of the drills wore rapidly, and it was impossible to get the holes more than three feet deep. An extra blacksmith was put on the night shift, and in addition, many of the drills were sharpened on the drill sharpener at the Maas Mine. Even then there was great delay. On the 13th, the Leyner Drill Sharpener was set up in a shanty near the shaft, and the miners were put on eight hour shifts. The crew from that time consisted of two miners and a boss on each shift. The entire force were selected men. The miners were paid $2.90 and the boss $3.25. The bosses were supposed to push the work and help the men in every way possible by actually doing a part of the work themselves.

From the very day that the drill sharpener was received, the improvement in the progress was marked and the cost decreased rapidly.

BLASTING.

In April we started to experiment with "Delay Action Fuses." Previous to this, the shaft had been blasted in three rounds with the ordinary electric exploder. This operation consumed not less than eight hours.

There are two kinds of "Delay Action Fuses" manufactured, "1st delay" and"second delay". The first delays for example will be exploded from one to two seconds after the current has passed through the connecting wires and the second delays from three to four seconds. These, when used in connection with the instantaneous, will make it possible to blast three distinct rounds in a single operation. The advantages to be gained, can be easily seen. There would be a large saving in time and a considerable reduction in the amount of powder.

We experimented during April using batteries and also the current from the gen-

erator, connecting the wires in every conceivable way. THe results were discourging, as we continually had missed holes. Our electrician suggested the connecting in parallel, and sending the mine current through a No. 14 wire. From the very start the results were perfect and we have used them continually. The round can now be blasted with great satisfaction in one hour, where it formerly took eight. It is most uncommon to ever have a missed hole.

COVERING RAISE.

After blasting it is necessary to cover the raise in order to prevent the men from falling away. A heavy platform was built consisting of two cross pieces of round timber about 10" in diameter, to which three inch plank was spiked. The timbers are tied together by iron rods, the size of the platform being 8' x 10'. To the ends of the round timbers, chains are attached which are brought together in a ring at a point over the center. While the men are drilling, this platform is resting on the bench of rock around the raise, and covers the holes. Just before blasting the ring is attached to a chain below the bucket and the platform is hoisted to the bottom steel set. It is then hung by short chains and disconnected from the bucket. After blasting, it is again attached to the buecket and lowered to the bottom. This is found to be a practical and rapid method of covering the raise. In addition, when the blasting is close to the concrete, it protects the steel work and runners from damage due to flying rocks.

CONCRETING, - PLATFORM.

Many of the details of the work in our shaft which have made it possible to increase the speed and reduce the cost, are due to the fact that we were able to investigate similar work at the Brier Hill Shaft, where the conditions were practically parallel.

When a section has been stripped to the required depth, always a multiple of ten feet, a platform is built to support the forms on. Short pieces of 12" x 12" timber are p placed around the bench of rock so that the tops will be level and at a determined elevation. It is then necessary to build a light floor extending completely around the circumference of the shaft and against the vertical walls of the same. Instead of using innumerable small pieces of plank, many of which would have to be specially cut to fill the irregular holes around the circumference, a much more rapid and practical way was devised. Two inch hardwood plank seven feet long, were sawed on a radius of 10'6", which is the approximate outside diameter of the shaft. When these are placed lefel with the small end towards the center, they make a circle with a hole about 6'6" in diameter in the center. The outer ends are shoved up against the rock and any small remaining holes are filled with little pieces of wood. The object of the hole in the center is to make it possible for

men to go below the platform and remove it after the concrete has set.

FORMS.

The forms are simply rings which are five feet high, properly braced and made in four sections in order to be able to collapse them and handle without difficulty. We have four of these rings, or enough for a vertical height of 20 feet.

The first form lowered is a special one intended to cut off the lower face of the concrete on an angle of 45°. It resembles a collar on a smoke stack. The first five foot section is lowered and placed approximately in position and bolted together, the collar referred to above fitting closely up against it, its upper circumference being about 1½ feet above the floor.

The steel sets which devide the shaft into compartments, are next placed in position. These rest in slots, which are cut in the forms, the ends extending for about a foot towards the walls. Lines are dropped from the points above them, and the sets and also the forms are shifted until they are in the correct position. The sets are then bolted to the forms, by simple clams which prevent them from shifting in any direction.

The concrete is dumped from the mixer into a kibble and trammed on a small truck to the cage compartment. The kibble is attached to the rope and lowered. On a temporary platform, which is constructed on the steel sets, there is a specially constructed trough long enough so that when the high end is in the center of the shaft, the lower will extend beyond the edge of the forms. The concrete is dumped into the trough by attaching a hook into the ring on the bottom of the kibble and continuing to lower, the hook being on the end of a rope which is supported above. The trough is shifted from time to time so that the concrete is kept approximately level. Much time is saved by placing the steel sets in slots in the forms and concreting them in position. The common method is to leave openings where the sets are supposed to go, and concrete them in place later. This not only takes considerable more time, but we do not consider the completed job nearly as good as ours.

When the first ring of form is filled, as soon as the concrete is sufficiently hard, the upper surface is trenched with a spade and made quite rough to insure a good joint with the following section.

The next operation is to lower ten feet of forms and line the steel sets into position. It takes two full days to concrete the first 15 feet. By this time the concrete is sufficiently hard to enable the bottom five feet of forms to be removed.

MAKING JOINT.

When the lower section has been concreted up to a point which is level with the

lower end of the upper section, there is a triangular portion to be filled. Horizontally it is about 1½ feet wide and vertically 1½ feet high. If the lower face of the upper section was horizontal, it can be easily seen that there would be no head in order to pour in the concrete, while with our method, we have 1½ foot head. To the top of the last steel form a special ring is bolted. This is one foot high with a six inch lip inclined towards the center of the shaft, on an angle of 45°. A rich mixture of concrete is poured into this ring to a depth of one foot, and allowed to set for about two days. If there is water in the rock it will find its way through this small section, following the face of the upper section. We next calk between the old and new face with oakum, always leaving two or three points open to relieve the pressure. The remaining space is then filled by hand with a mixture of one part of plaster paris and two parts of cement. A day or two later, the small areas, which were left open to relieve the pressure, are calked and filled with the above mixutre. This is found to give us an excellent joint, and if the work is done carefully, every drop of water can be shut off.

After the forms are removed, it is always found that there is some water seeping through the walls. These pores in time become plugged and I am quite sure that finally the shaft will be absolutely dry. The improvement can be noticed from month to month, the wet walls gradually receeding from the top towards the bottom.

GRAVEL PIT.

The original pit was about 250 feet East of the shaft. In March, when the first cut was put through for the stockpile ground, a pit about 100 feet North of the Shaft was shown up. A temporary trestle was built across the cut and this new pit opened.

In the beginning of the work, the gravel was screened, but it was soon found that it was cheaper to add a small amount of additional cement. The gravel is not absolutely clean, and for this reason, the strength of the mixture, as shown in an accompanying table, is richer than is ordinarily used. For speed it was necessary to have the concrete set rapidly. These two factors determined the amount of cement necessary, after making a great number of tests.

MIXING CONCRETE.

The entire equipment was carefully planned to enable us to handle the material rapidly at a small cost. Fifteen feet below the original surface, there are two bins with a capacity of about 35 yards. The gravel from the pit is trammed directly into them. It is drawn out of the bins into a small car, holding exactly the proper charge. This is dumped into the hopper of the mixer. The water is kept above the hopper in a small tank, where it is heated to boiling by exhaust steam. A short distance below the large tank, there is

a smaller one which is regulated to hold the proper amount for a charge. The bags of cement are thrown into a launder which runs from one end of the cement house to a point directly above the hopper of the mixer. When one bag is removed at the lower end, another comes in its place.

While one charge is being mixed, another is being placed in the hopper. At a lower elevation the kibble is run in on a small track and filled by inverting the mixer.

The concrete can be handled by this method very rapidly and at a small cost. The entire crew on top consists of five men and one boy. Concreting and shifting of the forms is always done on the morning shift. One day the surface crew will be concreting and the next day filling the bins with gravel.

GENERAL ROUTINE.

As soon as the first fifteen feet of any section is completed, the afternoon and night shift begin to remove the floor upon which the forms are placed to commence stripping. Our aim is to have the stripping progress with the same speed as the concreting. We cannot average more than five feet of concreting in a day. In favorable ground this is about the rate of stripping in two eight hour shifts with three men. For the last five months of the year, the two operations have been kept about parallel and the cost has shown the great economy of it. The length of each section has been determined entirely by the condition of the walls. It has been our aim to make these as long as practical. If there was any indication that the rock was inclined to slab off, we have not attempted to sink below it. The following statement gives the length of the various sections:

SECTION NO.	LENGTH	STARTED	COMPLETED	TOTAL DEPTH
1	55	Feby 7, '10	March 1st	55
2	20	Mar. 1,	Mardh 8th	75
3	60	Aor. 11,	Apr. 28th	135
4	80	June 7,	July 1st	215
5	91	Aug. 4,	Aug. 27th	306
6	70	Sept. 8,	Sept. 23rd	376
7	50	Sept. 29,	Oct. 10th	416
8	50	Oct. 17,	Octo. 31st	466
9	40	Nov. 3,	Nov. 12th	506
10	60	Nov. 23	Dec. 6th	566
11	40	Dec. 12	Dec. 29th	606

The next statement shows the total cost per foot at the end of each month. Some

small changes and additions will be made in these figures when the work is entirely completed, as there are certain items which will have to be more accurately adjusted. The runners in the skip roads, for example, are not in place, neither has the expanded metal lathing been put in. The cost for the material, however, is included.

NEGAUNEE MINE.

STATEMENT SHOWING TOTAL COST PER FOOT AT THE END OF EACH MONTH.

	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SINKING IN SAND.											
Surface to ledge 68' Collar to ledge 48'											
Feet concreted	28	20									
Sinking in Sand, feet	68	59.50	53.51	53.51	53.51	53.51					
Cost of Concreting		21.26	21.26	21.26	21.26	21.26					
Steel Forms		1.99	1.49	1.49	1.49	1.25					
Steel Shaft Frames		6.50	6.64	6.64	9.44	9.44					
Temp. Surface Equip't		6.54	6.72	6.72	6.72	6.63					
Compressed Air		1.00	1.00	1.00	1.00	1.00					
Total Collar to Ledge		121.59	112.90	112.90	115.74	115.29					115.29
SINKING IN ROCK - FROM LEDGE TO RAIL OF NINTH LEVEL - 738 FEET.											
Ledge to bottom of Shaft 888'											
Feet Stripped	30	53	20	58	36	64	64	57	89	74	90
Feet Concreted	27	0	60	0	80	0	91	85	85	75	66
Depth completed shaft	75	75	135	135	215	215	306	391	476	551	617
Cost stripping to date		20.13	25.35	25.35	26.46	25.50	24.78	23.41	20.83	19.46	17.96
Cost concreting to date		39.54	22.74	23.09	19.09	19.53	17.66	17.43	17.60	17.23	17.49
Steel Forms - 888' - cost		1.99	1.49	1.49	1.49	1.26	1.26	1.26	1.26	1.26	1.26
Cost Steel Shaft frames		4.69	4.83	4.90	7.81	8.06	8.12	8.27	8.52	8.87	7.48
Cost Raising - 738'		16.76	16.76	16.76	16.76	16.76	16.76	16.76	16.76	16.76	16.76
Cost Temporary Surface equipt		6.53	6.71	6.81	7.20	5.93	5.90	5.97	6.33	6.63	6.65
Compressed Air		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total cost of shaft from Ledge at end of each monthly period		90.60	79.38	79.40	79.81	78.04	75.48	74.10	72.30	71.21	68.60
Monthly cost for stripping		17.98	46.52	25.53	31.41	22.57	21.82	15.61	9.75	10.72	8.90
Monthly cost for concreting			15.18		14.72		14.26	16.75	18.04	15.13	19.44
Yards concrete per month		62.6	183.5		267.7		241.6	249.6	223.1	193.5	194.9
Avg. thickness of concrete		18.0"	16.8"		17.9"		14.7"	15.5"	14.4"	14.6"	16.2"
No. bags cement monthly		460	1280		1879		1921	1879	1816	1503	1507
Yds. concrete per foot		3.13	3.06		3.34		2.66	2.90	2.60	2.60	2.95
No. bags per yard		7.35	6.90		7.02		7.95	7.61	8.10	7.80	7.70
Cost per yard		6.78	4.96		4.40		5.35	5.77	6.96	5.86	6.58

NEGAUNEE MINE.

NEGAUNEE MINE.

STATEMENT SHOWING TOTAL COST PER FOOT AT THE END OF EACH MONTH (cont.)

NOTES:

From March to August inclusive the cost for stripping was high on account of exceedingly hard rock.

In April "Sinking in Sand" credited $407.50, which was charged to stripping for s stockpiles.

In July cost for "Steel Forms" and "Temporary Surface Equipment" was decreased on account of the 150' of additional depth to which it was decided to sink the shaft, the sinking in rock being changed from 738 feet to 888 feet.

NEGAUNEE MINE.

SINKING WINZE.

It would be extremely expensive to sink any part of the shaft direct, hoisting the large volume of rock to the surface where we are not prepared to handle it. Even if we could handle the rock cheaply on the surface, the cost for mucking in the shaft, would be very great. My figures show that the cost would be considerable over $100.00 per foot by sinking direct. I estimated that it would be much cheaper to sink a winze for 150 feet at a distance of 40 feet North of the shaft, drift back to the shaft and then raise for 150 feet; then to attempt to sink this distance direct. It has been proven that our total cost for the winze and the raise will only be a small amount more per foot than the cost of the main raise above the 9th level. The present plan is to have the main sump on the 10th level, or 100 feet below the 9th. The winze will be used as a means of hoisting a part of the rock from the pump house and sump. When the entire work is completed, it will be used to convey the water to the main sump.

In stripping, the shaft from the 9th level to the bottom - 150 feet - the rock will be trammed from the raise to the winze and hoisted to the 9th level in a skip.

In August, we started to prepare to sink the winze, which is 8' x 8' in size. In September, the men were only sinking about half of the month, the rest of the time being consumed in concreting around the collar to prevent the water from flowing to the bottom, and completing the pocket. In the first week in October, only nine feet was sunk, there being a delay in receiving the Murphy Sinkers. We, however, finished the month with 61 feet. This I consider excellent work with two men on two ten hour shifts. We could never have made this progress with the piston type machines, with such a small force. These men were not experienced with the sinkers and had to be broken in. In November, the first eight days of the month were consumed on timbering and commencing the small drift to t the shaft on the elevation of the 10th level, the amount sunk being 15 feet. On December the 17th, the remaining 25 feet was completed, making the total depth 160 feet. This allows for a ten foot skip pit.

As the winze will be used to make the excavation for the sump and pump house, and to convey the water to the same after the work is completed, its total cost should not be charged directly to the shaft.

As soon as the winze was completed, drifting was at once started to the shaft at the elevation of the 10th level. Early in January we will be raising. The following is a statement of the cost:

SINKING WINZE - 160 FEET.

	TOTAL COST	COST PER FOOT
Building Pocket & Skip Road Installing Hoist	394.18	2.46
Miners Labor and Supplies	1693.16	10.58
Timbering	63.75	.40
Hoisting	369.18	2.31
Electric Haulage Tramming	124.10	.78
Total cost of Winze	2644.37	16.53

BURNING OF DRY.

On the first of January at about 2:00 o'clock A. M., the dry caught on fire and was completely destroyed. A few men had changed at 11:00 o'clock and there were no signs of fire at that time. The old dryman must have been asleep, for he was seriously burned in getting out of the building. The fire deparment responded to the alarm and did all they could to save the old structure, but in spite of their efforts, everything was destroyed. The clothing of nearly 300 men was lost. These cost the men on an average of about $12.00. The Company refunded each man $5.00.

The morning after the first, the location of the new dry was decided, and the lumber for a new building ordered. As many men as could be procured, started in to level off the ground, while others fitted up the rope house and the rear of No. 1 boiler house so that a part of the men could change on the morning of the second. Half of them were sent to the Maas Mine dry.

DRY.

The new building is 20' x 125' and is located just West of No. 1 coal dock and parallel with it. On the afternoon of the first a part of the lumber was received, and on the 2nd, twenty four men started to work. Most of them were laborers, but all of the carpenters we could find were employed. On the 4th it was sufficiently completed to be occupied, but the men did not move in until the end of the week.

ENGINE HOUSE ON FIRE.

In March and again in June the Engine house was set on fire due to some defect in the transmission line. The damage to the building was very slight, as the current was immediately shut off. It is claimed that the proper changes have been made to avoid any trouble in the future.

FENCING.

In June we built 1200 feet of fence in order to enclose the area which is settling.

CAVES.

During the year no new holes have appeared on the surface. A very large area, however, is slowly settling. For the past three years it has been necessary each Spring to regrade the tail track above No. 2 shaft. There are no signs that the ground is settling as no cracks are visable. It may be possible that the weight of the fill is sufficient to make it sink into the swamp.

NO. 2 SHAFT.

There has been a slight movement at No. 2 shaft. I believe the large rock pile

to the east is settling in the Swamp, changing slightly the elevation near the shaft. A short distance below the surface, some of the timbers have been shoved a little out of line. As soon as this was noticed, the dumping of rock was stopped near the shaft.

FATAL ACCIDENTS.

These accidents will only be described briefly, as the details have been given in special reports.

NICHOLAS PEARCE.

Just before noon on June the 17th, Pearce and his partner, Wm. Holman were descending No. 34 raise from the 600' to 646' sub-level. When near the bottom, a piece of cribbing fell from the 646' sub-level and struck Pearce on the head, causing an injury from which he died the following day. The cribbing had been carelessly left by some one on the 600' sub-level, leaning up against the timber near the raise. One of the men on the 600' sub-level, probably dislodged this, although denied doing so. Apparently no one had noticed that the cribbing was in a dangerous place until the time of the accident.

ABEL HEMATTI.

On July the 29th, at 12:40 A. M., Abel Hematti fell from the bucket in No. 3 shaft and was instantly killed.

The platform which is used to cover the raise had been hoisted and hung from the bottom steel set as the men were preparing to blast. This platform is 8' x 12'. While the bucket was resting on the platform, the three miners got on and the signal was given to hoist. There was a slight jerk, as there often is, when starting from rest. Hematti must have had a very loose hold on the rope as his feet slipped of. He landed on the platform, but lost his balance and fell over backwards, going to the bottom of the raise, a distance of 550 feet. The engineer had absolute control of his engine, as it was stated positively that the bucket did not move more than a foot when it was stopped by a signal from one of the men. I regretted this accident particularly, as we had instructed the men so many times to be careful and had taken special precautions in the shaft to protect them.

The following statement shows the production for the year. I call your attention to the large amount of rock which has been hoisted.

MONTH	BESSEMER	NEGAUNEE	TOTAL O	ROCK
January	11,068	12,766	23,834	834
February	17,936	7,746	25,682	1,616
March	21,420	6,886	28,306	1,372
April	17,209	11,252	28,461	1,512
May	13,275	16,672	29,947	2,684
June	10,961	18,635	29,596	1,416
July	12,567	16,485	29,052	2,060
August	11,417	22,155	33,572	2,648
September	8,510	21,041	29,551	1,700
October	7,345	22,659	30,004	2,560
November	5,729	21,208	26,937	2,428
December				
Overrun	8,955	2,428	11,383	
Total				

ROCK DRIFTING AND RAISING.

We have driven 578 feet in rock, raised 418½ feet in rock, and 2925½ feet in ore.

GRADING OF ORE.

There has been a decided reduction in the proportion of Bessemer in the last half of the year. A large part of the workings have been close to old rooms which were filled with sand, caused by the large cave of the Oliver Iron Mining Company. The rooms finally were crushed and the sand was forced out laterally. It became mixed with the ore, and so discolored that it is now difficult to detect. This sand runs very high in phospherous and has been the cause of serious trouble in grading the ore. In the course of a few months, we will be below the old rooms and the conditions will improve.

NEW ENGINE HOUSE.

The new brick engine house at No. 3 shaft was started in September and enclosed by the end of the year. The floor has not been put in and I do not suppose that this will be done until the machinery is in place.

D., S. S. & A. RY.

On October the 13th, the D., S. S. & A. abandoned their old line and since that time all trains have been run over the new tracks, which are to the South of the mine. It was particularly important to have the change made at as early a date as possible, as we were much cramped for territory for the men to work in. As it was the intention to shut down the Maas Mine on about the first of December, we wanted to have ample time to prepare the territory in the railroad pillar so as to employ a large part of the Maas miners. It was too short a time to do the large amount of work, but by the morning the Maas shut down we were able to take ten gangs.

FOURTH LEVEL.

Just East of the right of way there is a large open room. This had been partly filled some years ago, but the work was not completed as it was thought that it might endanger the railroad tracks if we worked to a greater height up into the hanging.

On November 1st, we started to raise from the 4th level in the hanging and continued it to a vertical height of 75 feet. A drift was then driven North for about 25 feet and holed into the open stope. The back was found to be about 30 feet above the drift, or 100 feet above the fourth level. A large amount of rock has been broken and up to the end of the year, we were still on this work. We will continue to blast rock from the hanging until the place is filled as completely as possible.

To the East, in October a gang filled another room of considerable size. We have always been particularly careful to fill all open spaces. I think that this is an important

point in all mines, but especially so in the N egaunee.

541' SUB-LEVEL.

In June it was decided to do a limited amount of work on the east end of the railroad pillar at a point about 375 feet East of the boundary. I was sure that this could not endanger the railroad and every day I expected to hear that the old line would be abandoned.

Two gangs have mined pillars up to the 1st of December, when they were moved to the 555' sub-level. The conditions on the 541' were not particularly good as it was necessary to pull filling from the East towards the West. The rock naturally ran down on a flat angle from above. For this reason we went in over the workings and blasted additional rock.

On the 4th ~~XXXX~~ of December, eight new gangs started to mine in the railroad pillar. The ore body here is quite narrow but will increase rapidly in depth.

555' SUB-LEVEL.

In December, Nos. 11 and 13 started to connect the new raises on the 555' sub-level.

NEW RAISES.

In August we started to prepare to get ready to mine in the railroad pillar. Two gangs started to raise from the foot-wall drift on the 9th to the 6½ level. Seventeen raises were completed to within 10 feet of the floor of the 6½ level, or to a height of 90 feet. As soon as we received word that the old line had been abandoned, we started at once to knock these raises through to the 6½ and to build the chutes on the 9th.

On the first of November two gangs started to raise from the 6½ to the 541' sub-level, the work being pushed as hard as possible. On the first day of December seven of thes raises had been completed to the 541' sub-level, and five of them had been connected by a small drift. One gang established a new record of raising 390 feet in one month, our previous record being 350 feet.

These raises are all put up without being timbered and are only 30 feet from center to center. In time there will be only one gang dumping into each raise. By this method we will be able to grade the ore more carefully, mine it at a smaller cost and get a larger number of contracts in any given territory. We will be able to tell exactly what each gang does each day. The ore can be mined in a systematic way. The final results are certain to be better than under the present system, where there are a number of gangs dumping into a single raise. This system can not be worked to advantage where the ground is crushed and the raises have to be timbered, as in places they are extremely difficult and expensive to complete and maintain.

NEGAUNEE MINE.

578' SUB-LEVEL.

This is a very small sub-level under the hanging in the main deposit. The height of the ore here was a little beyond the reach of the 586' sub-level and a small raise was put up and the part next to the capping mined in a sub. Work here was completed in May.

586' SUB-LEVEL.

In July, work at this elevation was completed. Below this it was decided to leave a 50 foot pillar parallel to the main foot-wall drift on the 6½ level, as it is necessary to keep this open as a water course. We are not prepared to handle a large volume of water on the 9th level, and the entire foot-wall drift will be maintained until the new pumps are installed at No. 3 shaft.

On the hanging side there is a small pocket of ore which was partly mined in a square set room, extending down as far as the 7th level. On December 13th, 1909, when the mud came into the ~~xxxxxxx~~ mine, a general disturbance was noticed in several places, one of them being in this old partly filled room. The men were taken out and no mining was done until about the middle of February. In March all of the ore had been removed and the gang started to drift South through 60 feet of rock to take another slice. At the end of the year, they are on the elevation of the 6½ level, having again drifted through about 60 feet of rock to the ore.

600' SUB-LEVEL.

This sub-level was started in March and is at the elevation of the old 6th level, where the square set rooms were filled with sand. We also encounter sand at the elevation of the 6½, where it is found in the back of the sub-level. This territory has given much trouble and has caused rapid changes in the grade of the ore.

On the West end where the cave of December 13th, 1909, occurred, no work was done until March. The bulkheads were then removed and we started to take a slice one set high. The floor was very carefully lagged and as soon as there were any signs of crushing, the timbers in the rooms were all drilled and blasted. In July the slice had been completed, and the timbers in the last room were blasted. The material above settled at once and filled all open space.

The gangs then dropped to the elevation of the 6½ directly below the lagging on the 6½, and at the end of the year have finished this slice and have dropped down one set below. This entire territory has been watched closely and worked with great care. During the year we have discovered no facts which would account for the cave of December 13th. There is nothing to indicate that we will have any trouble in the future.

NEGAUNEE MINE.

6½ LEVEL.

For the last three months, a number of gangs have been working at this elevation, where we have had the trouble from sand described above. We will have some trouble on the next sub-level below as the lagging in the bottom of the old rooms, has rotted. I think that it will be necessary to leave a thin slice of ore to keep the sand away from the lower sub-level.

During the year, from time to time it has been necessary to retimber the main foot-wall drift.

629' SUB-LEVEL.

Only a small amount of work has been done on both ends of this sub-level, for the reason that there were workings at a higher elevation at both to the East and West. The East end is particularly difficult to keep open, and men have to be kept retimbering continually.

636' SUB-LEVEL.

The ore body is separated by a dyke running practically East and West, and varying in width from 20 to 50 feet. In order to save the cost of drifting throught this dyke in each crosscut, it was decided to work the South part from a new drift on the 9th level. For this reason a number of raises were put up on the hanging side.

On the foot side the drifts crush rapidly and the gangs have been corwded as close together as possible. It was found that here it was not practical to work directly below the lagging. Before we are able to complete the mining, the timber has been shoved for about three feet into the lower workings. On the lower subs, we have dropped ten feet and find the conditions improved.

646' SUB-LEVEL.

This is being worked in the same way as described above. The general plan is to work the ends ahead of the center, in order to continually reduce the length of the main drift to be kept open. As soon as a gang has mined back to the main drift, they drop below to the next sub-level. By this method, the amount of retimbering necessary on the main drift, is reduced to a minimum.

656' SUB-LEVEL.

Five contracts are working in December opening up at this elevation, connecting the raises and crosscutting, making room for the gangs as they play out above.

9TH LEVEL.

On account of the small available territory, it was necessary to drive four

main crosscuts in ore. In No. 54, which is the one to the North, a great number of raises have been completed to the rock. The two crosscuts to the South were stopped when they reached the hanging.

On the foot-wall side the location of 21 raises, all of which are at least 90 feet high, are shown. A number of these extend above the 6½ level to the 541' sub-level. Here is a good object lesson to show the advantages gained by laying out work in a systematic way. These raises were all put up by lines and holed exactly where planned in the main drift on the 6½ level. The pillars are all of equal size and the main drift was not damaged in the slightest, although the raises holed within a few feet of it.

CONCLUSION.

With the exception of the ore on the foot-wall, discovered by this Company, practically every sub-level in the mine has to pass through old rooms. Many of these were filled with rock and a part of the 6th level with sand. This is a great drawback in working the mine, and increases the cost considerably. Below the 6th level, there will not be any trouble with sand, but we will still have the rooms to pass through. The old timber has to be chopped out, which is slow and expensive work. The principal trouble is due to the fact that the entire territory being honeycombed, and the footing is not secure. In places the rooms are not thoroughly crushed, and the sub-levels are difficult to keep open. The caps break and the bottom heaves, making it necessary to continually lower the tracks. I am of the opinion that when the workings get deeper over the part of the foot-wall which is much flatter, that the conditions will improve.

No new ore has been developed during the year. From a drift on the 646' sub-level, we almost have positive proof that there will be considerably more ore to the North of the main fault "B", than has been estimated. We have always assumed that there was ore directly back of this, but it was not thought advisable to put it in the estimate until it was actually developed. There will be no addition to the North of fault "B" in the present estimate.

ESTIMATE OF ORE IN SIGHT.

ABOVE 6½ LEVEL - NO. 1 SHAFT.

6½ level to 6th level	150,000 tons	
6th " " 5th "	143,000 "	
5th " " 4th "	100,000 "	
4th " " top of ore	50,000 "	
Total No. 1 shaft		443,000 tons

NO. 2 SHAFT NORTH OF FAULT "B" IN RAILROAD PILLAR.

4th level to 541' sub-level	14,000 tons	
541' sub-level to 555' sub-level	30,000 "	
555' " " 570' "	46,000 "	
570' " " 6½ level	371,000 "	
Total		461,000 tons

NORTH OF FAULT "B" OUTSIDE OF RAILROAD PILLAR.

586' sub-level to 6½ level		75,000 tons

SOUTH OF FAULT "B" BETWEEN RAILROAD PILLAR & SHAFT PILLAR.

E. of 1300' coordinate and W. of 1600' coordinate	42,000 tons	
Total above 400' level	59,000 "	
E. of 1600' coordinate to No. 2 shaft	160,000 "	
Total above 6½ level	1,240,000 "	
Total between 6½ and 9th levels	2,185,000 "	
Total below 9th level	13,650,000 "	
Total		17,336,000 tons
Total ore in mine		18,315,000 tons.

18,315,000
1,300
17,015,000

ANALYSIS OF NEGAUNEE MINE COST SHEET, EXPLAINING INCREASE OR DECREASE BETWEEN THE TWELVE MONTHS OF 1910, AND THE THIRTEEN PREVIOUS MONTHS CONSIDERED AS THE YEAR 1909.

GENERAL EXPENSE:

Personal Injury - 1910 total $5,531.30 -- Cost per ton $ .016.
1909 " 736.68 " .002.

Increase in 1910 is due to settlements for eight accidents, five of which occurred prior to January 1st, 1910.

MAINTENANCE:

Buildings - 1910 total $ 695.00 -- Cost per ton $ .002.
1909 " 3,630.00 " .012

In 1909 No. 2 shaft house was practically rebuilt, which accounts for the high cost in that year.

Hoisting Machinery - 1910 total $2,424.76 -- Cost per ton $ .007.
1909 " 672.29 " .002.

Wire ropes amounting to $1,588.33 were bought in 1910, and also two large bycicle sheaves. In the previous year only one hoisting rope was purchased.

Compressors and Air Pipes -1910 total $ 288.80 -- Cost per ton $ .001
1909 " 3,182.32 " .010.

In 1910 we bought 17 drill machines and one air meter at a total cost of $2,582.75 while in 1910 we only purchased one second hand machine.

Electric Tram Plant - 1910 total $ 8,536.43 -- Cost per ton $.024.
1909 " 5,063.05 " .017.

During 1909 it was necessary to dismantle the 30 motor cars and build them over again. The rivets had all become loose and the cars were in poor repir. Changes were necessary in design of the draw heads, as these have been difficult and expensive to maintain. Every car is now as good as new.

MINING EXPENSE:

Air Pipes - 1910 total $ 3,060.76 -- Cost per ton $.009
1909 " 1,661.13 " .006

The increase in 1910 is due to extending long air lines to new main drifts on the 9th level.

Compressors - 1910 total $9,242.44 -- Cost per ton $.026.
1909 " 5,423.05 " .018

In 1909 and also in 1910 we received air from the Maas Mine. Up to December, 1909, the charge was estimated on

the basis of the cost when air was made at the Negaunee Mine. From December, up to the end of 1910, the bills were figured by readings from the air meter, the amounts being as follows:- 1909 - $ 5012.43 - 1910 - $9056.29. We have been extremely careful not to waste the air. In 1910 we mined more ore than in 1909, but the cost per ton should not increase.

Pumping - 1910 total - $24,487.83 -- Cost per ton $ .069
1909 " 24,255.45 " .081
Decrease in cost per ton due principally to increased tonnage. There was a smaller consumption of coal.

Drifting - 1910 total $5,117.01 -- Cost per ton $ .015
1909 " 8,398.51 " .028
In 1909 there were more main drifts driven in rock.

Breaking Ore - 1910 total $152,969.88 --,Cost per ton $ .432
1909 " 121,885.68 " .409
Increase due to advance in wages in April, 1910 - amounting to 7½%.

Tramming - 1910 total $24,969.75 -- Cost per ton $ .070
1909 " 21,853.55 " .073
Increase in total cost in 1910, due to increase in wages and addition of the fourth motor. This for the past year has been run at intervals on the 9th level, and for the last two months of 1910, constantly.

Filling - 1910 total $1,297.20 -- Cost per ton $ .004
Nothing charged to this account in 1909. In 1910 we have broken a large amount of rock above the 4th level just to the East of the boundary.

Timbering - 1910 total $55,991.52 -- Cost per ton $ .158
1909 " 43,692.94 " .147
Extra cost in 1910 due to extreme crushing and also to the fact that it has been found to be much more advantageous to make the sub-levels ten feet apart instead of sixteen.

Mining Captains & Bosses - 1910 total $7,444.67 -- Cost per ton $ .021
1909 " 6,498.32 " .022
Increase in total due to increase in wages.

Dry House - 1910 total $1,989.04 -- Cost per ton $.006
1909 " 2,430.13 " .008
In 1909 extra piping and carpenter work was necessary.

Top Landing & Tramming - 1910 total $5,885.20 -- Cost per ton $ .017
1909 " 5,243.60 " .018
Increase in total in 1910 due to increase in wages, and small amount of additional labor to keep trestles clean.

Stocking Ore - 1910 total $3,021.36 -- Cost per ton $ .009
1909 " 4,446.23 " .015
Extra cost in 1909 due to fact that it was necessary to use additional timber to fan out the piles. This was not necessary in 1910 as most of the ore in stock-piles was shipped.

Sorting Ore - 1910 total $ 451.07 -- Cost per ton $ .001
1909 " 557.27 " .002

Flooding Land - 1910 total $2,625.00 -- Cost per ton $ .007
1909 " 3,805.85 " .013

COST OF PRODUCTION - 1 9 1 0 - $ .998
COST OF PRODUCTION - 1 9 0 9 - 1.021

The Mine is in good condition. In the last month of the year we began to mine in the Railroad pillar. When the tonnage is increased, the cost will decrease.

NEGAUNEE MINE.

NEGAUNEE MINE.

ORE STATEMENT FOR DECEMBER 31, '10.

	BESSEMER	NEGAUNEE	TOTAL	TOTAL LAST YEAR 13 mos.
On hand January 1st, 1910	32,940	15,731	48,671	62,810
Output for year	152,843	205,050	357,893	298,080
Total	185,783	220,781	406,564	360,890
Shipments	176,911	171,909	348,820	312,219
Balance on hand	8,872	48,872	57,744	48,671
Increase in output corresponding (12 months - 28%			78,395	
Increase in ore on hand			9,073	

SHIPMENTS FOR 1910.

	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Negaunee Bessemer	77,276	99,635	176,911	149,209
Negaunee	123,106	48,803	171,909	163,010
Total	200,382	148,438	348,820	312,219
Total last year	163,669	148,550	312,219	
Increase - 12%			36,601	

AVERAGE MINE ANALYSIS OF OUTPUT.

GRADE	IRON	PHOS.
Bessemer	60.42	.056
Negaunee	58.77	.090

AVERAGE MINE ANALYSIS ON STRAIGHT CARGOES.

GRADE	IRON	PHOS.
Bessemer	60.02	.057
Negaunee	58.88	.083

NEGAUNEE MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31ST, 1910.

KIND	LINEAL FEET	AVG. PRICE PER FOOT.	12 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
6" to 8" timber	56,203	.02	1124.06	2007.48
8" " 10" "	159,488	.0421	6713.12	3061.18
10" " 12" "	2,042	.0441	90.06	2052.27
12" " 14" "	382	.109	41.60	1655.12
14" " 16" "				3.36
Total	218,115	.0365	7968.84	
Total 1909	227,376	.0386		8779.41

	LINEAL FEET	PER 100 FT.	AMOUNT 1910	AMOUNT 1909
5 ft. lagging	1,161		54.00	846.00
7 ft. lagging	824,971	.554	4570.22	3224.37
8 ft. lagging	228,184	.537	1226.27	913.20
Poles	87,862	.950	835.24	767.87
Total	1,142,178	.585	6685.73	
Total 1909	1,015,870	.560		5751.44

	1910	1909
Feet of timber per ton of ore	.609	.763
Feet of lagging per ton of ore	2.945	3.41
Feet of lagging per foot of timber	4.83	4.46
Cost per ton for timber, lagging and poles	.0409	.0487
Equivalent of stull timber to board measure	287,875	434,120
Feet board measure per ton of ore	.804	1.46
Total Product	357,893	298,089

Total cost of timber and lagging 1910 - 12 months	14,654.57
Total cost of timber and lagging 1909 - 13 months	14,530.85
Total cost of timber and lagging 1908 - 12 months	11,992.30
Total cost of timber and lagging 1907 - 12 months	15,449.01

NEGAUNEE MINE.

COMPARATIVE MINING COST FOR YEAR.

	1910	1909	INCREASE	DECREASE
PRODUCT	357,893	298,080	59,813	
General Expense	.067	.060	.007	
Maintenance	.050	.067		.017
Mining Expense	.870	.894		.024
Cost of Production	.987	1.021		.034
DEPRECIATION				
Inventory	.004	.012		.008
New Construction - New Shaft	.123	.079	.044	
Fire Loss	.003		.003	
Total	.130	.091	.039	
Less credits	.005	.002	.003	
Total depreciation	.125	.089	.036	
Taxes	.090	.105		.015
Central Office	.034	.039		.005
Cost on Stockpile	1.236	1.254		.018
Loading and shipping	.020	.020		
Total cost on Cars	1.256	1.274		.018
No. days operating	300	323		
No. shifts and hours	2-10 hr.	1-10-hr.219 104-2-10 hr.		
Average daily product	1193	923		
COST OF PRODUCTION.				
Labor	.703	.713		.010
Supplies	.284	.308		.024
Total	.987	1.021		.034
M E M O.:				
Tax Rate	2.62	2.52		

NEGAUNEE MINE.

STATEMENT OF COMPARATIVE WAGES .

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
SURFACE				
Total number of days	22,130	20,423¾	3,413¼	
Average Rate	2.31	2.22	.09	
Amount	51974.14	45293.78	5780.36	
UNDERGROUND				
Total Number of days	82,985¾	71,315¼	17,991¾	
Average Rate	2.63	2.54	.09	
Amount	218033.58	181260.88	36772.70	
Total days	105,115¾	91,739	21,405	
Average Rate	2.56	2.47	.09	
Total Amount	269107.72	226554.66	42553.06	
Labor cost per ton	.752	.760		.008

For comparison of days for 12 months, December, 1909, is omitted.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT 357,893 tons 1910 PRODUCT 298,080 " 1909	SURFACE		UNDERGROUND		T O T A L	
	1910	13 mos. 1909	1910	13 mos. 1909	1910	13 mos. 1909
Avg. no. men working	70	59	2.77	2.16	347	275
Avg. wages per day	2.31	2.22	2.63	2.54	2.56	2.47
Avg. wages per month 25 days	57.75	55.50	65.75	63.50	64.00	61.75
Avg. product per man per day	16.17	14.59	4.31	4118	3.4o	3.25
Labor cost per ton	.143	.152	.609	.608	.752	.760
Diff. in labor cost per ton	-.009	*.010	*.001	-.029	- 008	-.019
Avg. product breaking and tramming			7.15	7.06		
Avg. wages for miners contract			2.68	2.57		
Avg. wages for trammers contract (none O Electric Haulage)						
Total avg. wages for contract			2.68	2.57		

Avg. wages three months to March 31st, - $2.47) Average wages for year $2.56
Avg. wages nine months to December 31st - 2.59) Increase in wages 4.9%.

Increase in product per man per day 4.6%.

NEGAUNEE MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	13 mos., 1910 AMOUNT	12 mos. 1909 AMOUNT
40% Powder	1,050	.0925	97.12	
80% "	10,450	.1325	1384.44	13.24
50% "	112,700	.1033	11641.49	9422.20
60% "	350	.1124	39.34	341.45
Fuse	340,100	.0038	1289.36	801.92
Caps	76,700	.0062	476.01	341.30
Electric Exploders	500	.0365	18.23	
Connecting wire				1.80
Fuse Lighters	500	.0025	1.25	
Total			14947.24	10921.91
Product			357,893	298,080
Pounds powder per ton of ore			.348	.317
Cost per ton for explosives			.0418	.0366
Cost per pound for explosives			.1057	.1036

MAAS MINE.

SURFACE.

TURBINE.

In March this machine was started and operated for two weeks when it was shut down as there was not sufficient load. Up to May the 18th the current was bought from Negaunee. Since that date we have generated our own electricity.

BOILERS.

On the last of January, the fourth boiler was connected. This was installed in order to furnish additional steam for the turbine.

COAL DOCK.

A contractor extended the coal dock a distance of thirty feet, the work being started in August and completed in the middle of September.

In November a small fire started in the coal at the bottom of the pile and it was thought on the end of the month that it had been extinguished. Early in December it again broke out and up to the end of the year, we are still fighting it. It is known that a number of legs have been burned off, as the railroad tracks have settled on the North end. I think that it is under control and will give no serious trouble.

SURFACE IMPROVEMENT.

In May, additional grass seed was sown in the enclosure between the buildings and fertilizer added. During the summer we had a splendid stand of grass, which was kept well trimmed and greatly improved the general appearance of the location. Outside of the main enclosure, small plats were sodded around the buildings. The men take a decided interest in this improvement, and it has not been necessary to make any rules in order to protect the work which has been done.

SHAFT.

FEED CABLE & BELLS.

The present method of protecting the feed cable and bell wires by putting them in vulcanized, galvanized iron pipes, is not at all satisfactory. Moisture collects inside of the pipes and it is only a matter of time when electrolisis will be set up and destroy the cables. In places, the main feed cable has been completely eaten out. With the bell wires we have had the same trouble. It takes time to replace these cables and the delays are serious and costly. Cables which are more carefully ~~xxxxx~~ insulated should be used.

SKIP ROADS.

I do not think it necessary to give a summary of all of the delays which have occurred during the year, due to our inability to keep the runners in the shaft. There has not been a single month when we have not had trouble from this cause, and in some months, the delays will amount to several days.

The runners are $3\frac{3}{4}$" x $7\frac{1}{2}$". The dividings between the skip compartments are only 4" x 12". In the crooked part of the shaft, it is necessary to have much clearance in order to allow the skips to pass around the curves. When the empty skip is going down, it is thrown violently from side to side. The rope continues to swing for the entire depth of the shaft. This rocking motion loosens up the small runners and also the dividings. In the crooked part of the shaft, it has been impossible to keep the runners in position. What I have feared the most was that the skip would catch some of the shaft timbers above the ledge, which are rotten, and either pull them out or break the rope. We have had many peculiar accidents, but none of them have been disasterous. We have had the South Skip in the North compartment, and it was extremely difficult to get out. Once when the cage was going down, it suddenly stopped. The engineer noticed that something was wrong and put on his brakes. An investigation proved that the skip had torn out two dividings and forced them into the cage compartment. If this had happened a few minutes later, the cage would have been coming up with a load of men, as it was just before noon. You can imagine what a disaster might have occurred. On another occasion the South Skip landed on the plat of the 1100 foot level, after the runners had been torn out. It could have gone through to the other compartment and landed on top of the cage just as readily. We were continually fearing that some of our men might be injured.

REBUILDING SHAFT.

On account of continual trouble with the skip roads and also because the close timbered part of the drop shaft was rotting and would only last for a limited time, it was decided in August to give the Foundation Company a contract to rebuild the shaft from the surface to the ledge.

On December 4th the shaft was turned over to the Foundation Company. Their general plan of operation is as follows. A hexagon shaped timbered shaft will be started from the surface and sunk around the present shaft to a depth of about 80 feet. This timbered shaft is large enough to contain a circle 29 feet in diameter. It is thought that below a depth of 80 feet, there will be no broken rock, and from this point it will be possible to drop a concrete shaft to the ledge, using compressed air to make the seal with the same.

The outside of the circular concrete shaft will be 27 feet in diameter, the

inside being rectangular in shape, 11'2" wide and 15'2" long. The size of the rectangular shaft above the shoes gradually increases, until at a point 100 feet above it is 13'2" x 17'2". This point is directly opposite the bottom of the hexagon timbered shaft. From here to the surface, both the inside and outside will be rectangular in shape. The inside dimension will be 10'10" by 14'10" or standard.

The ledge dips at a very steep angle, between 60° and 65°. The rock would be struck by the shoe at a point 40 feet higher on the North side than on the South. The excavating of this large amount of material under pressure, would be slow and exceedingly expensive. In order to decrease the cost and hasten the completion of the work, we started in November to work on Sundays to get ready to remove as much of the rock as possible. At a point 190 feet from the surface, which will be approximately the point where the entire concrete shaft will be in rock, the end pieces on the West side were removed for a height of five feet. Much trouble was experienced with the water and the pumps in the bottom of the shaft were lost, until we could drift in far enough to make a new gutter, to force the water to flow back of the timbers. It was necessary to send another pump to the bottom to reclaim those which were drowned. On the end of the month we have stopped completely around the West, North and East sides of the shaft. The plan was to carry this stope at least 20 feet high on the North side, but this was not found to be practical as several slips running up to the ledge were found. The work done has in no way interfered with the work which is being carried on from the surface with the exception of delaying the moving the shaft house for two days, while we were reclaiming the pumps on the bottom level.

Our miners, under the direction of Capt. Thomas, are now cutting a small drift completely around the shaft at an elevation of 200 feet below the collar. This will be the point where the seal will be built. The object of this seal, is to prevent the ledge water from flowing into the mine and to make it possible to use compressed air in sinking.

On December 2nd, we started to remove the skips and ropes. On the 3rd and 4th we disconnected the trestles from the shaft house. Between the 4th and 8th there was considerable time lost. The man in charge had not received proper instructions and the delay in moving the shaft house was most annoying. On the 10th when the Foundation Company were already to move the Shaft house, we had trouble with water in the lower level and had to use the cage on this day and the 11th. The cage was taken off on the morning of the 12th, and by the morning of the 14th the shaft house was moved.

Up to the latter part of the month, the principal part of the work was blasting the piers and making a large excavation to the old surface level. They wanted to depress the trusses from which the shaft sets are hung for a depth of 10 feet. On the end of the month the work is progressing fairly well, the distance from the original collar to the last set of timber being 23 feet. I see absolutely no reason why they should not average four feet in twenty four hours. As full time, including Sundays, is put in, the timbered shaft should be completed by the 20th of January, certainly not later than the first of February.

RUNNERS.

As soon as our men complete the work of cutting out for the seal, they will start to put in new steel runners from the bottom to the ledge pump house. The small dividings will be held firmly in place by short pieces of angle iron bolted to the end pieces and also the dividings between the skip and cage compartments. The new runners will be 40 lb. rail, which are attached to the dividings and also the end pieces by special clamps. The rails will be riveted together and hung at intervals to prevent the weight from accumulating. Near the top, where there is great change in temperature, special precautions will be taken to allow for expansion.

WATER.

After the seal is made above the ledge pump house, there will be no ledge water flowing into the mine. The coming water on the levels will be pumped to the 700 foot level and from here to the Negaunee Mine. There will be only a very small amount and will cost practically nothing for the Negaunee to handle it. If this were not done it would be necessary to use an annular caisson and continue to pump all of the water to the surface. Mr. Jarrett estimated that by using the latter method it would take about one month longer to complete the shaft and the cost would be from $5,000.00 to $7,000.00 additional.

SURFACE FORCE.

Every man who was not absolutely necessary has been laid off. The surface boss has been given the job of helper to the mechanic and also continues to look after the unloading of timber. The brakemen have all been provided for, they having taken the place of laborers in handling coal. They are, however, paid laborers rate. There are two surface laborers and one dry man. The machinist and electrician were laid off on the last of the year.

PRODUCT.

The following is the production for the year:

MONTH	BESSEMER	MAAS	TOTAL
January	518	17,013	17,531
February	53	16,449	16,502
March	60	19,235	19,295
April	186	18,052	18,238
May		20,200	20,200
June		17,125	17,125
July		17,821	17,821
August		21,509	21,509
September	192	18,192	18,384
October		17,963	17,963
November		17,019	17,019
December			
Total			

UNDERGROUND.

470' SUB-LEVEL.

The long raise which was completed in the previous year, was for the purpose of locating a lean ore body, which was shown by diamond drill hole No. 11. We were anxious to develop this ore, as the samples showed that it was very low in phospherous. In attempting to get to the top of the deposit a dyke was passed through on top of which was found a small pocket of good ore, but high in phospherous. The other ore body must be somewhere below the dyke referred to above. The foot-wall evidently has made a slight roll, aspart of the raise was not in Jasper.

This place has been exceedingly slow to develope on account of its hieght and the water which was found. It was difficult to keep the contract filled. The deposit is about 100 feet long and varies in width from 25 to 40 feet. Its height which has been located by raises, varies from 20 to 40 feet.

It has been decided to mine this small pocket without timber, A plan of mining has been devised which I feel sure will enable us to get practically all of the ore cheaply and with great safety to the men.

On the 485' sub-level in the bottom of the trough, a drift was driven East in

MAAS MINE.

ore to the end of the pocket. On the 500' sub-level, a drift directly below the one on the 485' sub-level was driven in rock. From this rock drift holes are knocked through to the 485' sub-level at intervals of about ten or twelve feet. From the 485' sub-level on the East end two raises were put up vertically to the capping, the distance between them being only about ten feet. The small pillar between these raises, will be drilled and blasted. On the 470' sub-level a raise was put up on the foot wall side to half of the height of the ore and one drift started to follow the footwall East and another to crosscut to the dyke and follow it East. When these drifts reach the East end of the ore, they will be turned so that both of them will connect with the hole which was made by blasting the pillar between the two raises, which went to the top of the ore. Work can be done from both drifts, the ore being blasted into the hole, the gangs slowly receeding back to the West. The miners will always be under solid ground and will be provided with a good outlet. We are going to watch this with considerable interest as the important points about the method are new as far as I know.

The ore will fall to the drift on the 485' sub-level and will be drawn out through the small raises from the 500' sub-level. The trammers at this lower elevation are also perfectly protected. On the end of November, this place is all ready for breaking ore, and when we start the mine agin, the product should be greatly helped.

During the year the 521', 534' and 553' sub-levels have all been completed. These were small sub-levels which gradually increased in size with depth. As soon as there was sufficient open space we went up into the hanging and broke a large amount of filling. As the sub-levels gradually increased in length, we have had to continue to break filling as far as the 572' sub-level. We will have to continue this work on still lower sub-levels as we are getting under new capping to the East.

572' SUB-LEVEL.

The mining on the East end has always been ahead of that to the West, for the reason that the ore was found to extend to a greater height on the West end.

All of the crosscuts are layed out in a systematic way, forming pillars of practically the same width. The ore is mined from the ends towards the center, which plan constantly decreases the length of the main drift necessary to keep open. Only a few pillars now remain in the 572' sub-level.

589' SUB-LEVEL.

The West end has been blocked out and a little mining done. The center of the deposit just West of the cemetery, has been mined.

MAAS MINE.

In APril I received word that we could work under the Roman Catholic Cemetery. We at once started to put up five raises to the top of the ore which was found to be at the 586' sub-level. You will notice by the map that on the East end we are up against the hanging and it will be necessary to drop down for another sub-level before we can go to the East boundary in ore. We have pushed this work hard and were just beginning to get good results when the mine was shut down.

605' SUB-LEVEL.

There is not particular to say about the 605' sub-level. The West end has not been crosscutted on account of the mining above. On the East end, only a few pillars remain. The ore under the cemetery has not been opened up yet at this elevation.

624' SUB-LEVEL.

The only work done here has been to extend the drift East, following the foot-wall under the Roman Catholic Cemetery and connecting the raises from the main level.

700' LEVEL.

The principal work done has been the completing of five raises to the 589' sub-level under the Roman Catholic cemetery. A small amount of ore was removed from three of the old square set rooms. This was mostly caved ore, and the rooms were not increased in height.

900' LEVEL.

In June a small drift was driven South in ore from the West main drift to connect the new raise from the 1100 foot level. After striking the first raise, the drift was continued West on the hanging side of the two old rooms and holed into five raises. Crosscuts were then driven North and on the end of November there were four gangs mining, Nos. 13, 16, 18 and 24.

907' SUB-LEVEL.

Directly below the above work, No. 5 has been drifting West connecting the same raises just referred to.

Still farther West is a small pocket of ore which was located by raises from the 1100' level. This ore should increase quite rapidly in size with depth. The upper part has been mined and work is being done below.

923' SUB-LEVEL.

This is a continuation of the pocket just described, and No. 23 contract is robbing the remaining ore at this elevation.

1000' SUB-LEVEL.

From the first of the year up to September, No. 23 contract drifted East to con-

nect the raises from the 1100' level. It was much too expensive to raise in a single lift for 230 feet and this sub-level cut the distance in half, making it possible to do much cheaper and more rapid work, and also, decreasing the chance of injuring the men. It is risky work to blast with fuses in raises over 200 feet high. THe danger of material falling while the men are climbing is also great. Even a small piece of ore falling from a considerable height, is sufficient to kill a man. I consider this the most dangerous class of work. We, however, have never even had a man badly injured, although we have put up many thousand feet of raises in the Maas and Negaunee Mines.

1100' LEVEL.

Most of the work here has been in square set rooms, the four to the East having been entirely made during the year. It is most unsatisfactory to mine in square set rooms, and we only removed a small amount of ore, the gangs being transferred as soon as places could be made for them. In no case are they over three sets wide and three sets high. The three rooms to the East have given a great deal of trouble. The formation here is becoming flat rapidly and the ore settles off on the timbers in large masses. When this occurs, the place is difficult to retimber with saftey. Several caves occurred, coming apparently with little warning. In one instance, the men barely had time to get out before seven sets were crushed. A little work was continued in the two rooms farthest East up to the end of November.

When the main drift came close to the boundary line, it was turned to go North-East parallel to the same under the land of the Cleveland Iron Mining Company. It was stopped against the foot-wall.

We have experienced considerable trouble with the main drift along the foot-wall. The air apparently effects the ore, causing large masses to settle off on the timbers. The caps in many places have been broken and the legs shoved out of line. There is nothing to do but retimber it.

NEW CHUTE CLOSER.

In loading into skips, we have always had much trouble due to the fact that considerable ore would spill, going to the bottom of the shaft, making it necessary to continually clean the skip pit. As our skips were only 2'6" wide, some ore would jump over the sides as the chutes could not be made narrower than two feet.

The new closers are on the same general principal as an apron, except that the axle is in the center instead of the upper end. The lower end, when revolved in position to load, extends over the skip, the bottom being flush with the permanent slide. Its sides

are 11" high. When revolved out of position for loading, the bottom is vertical and its sides are flush with the inside of the shaft timbers. On the upper end there is a section of a cylinder which closes the permanent slide when the chute is out of the loading position. This catches all of the fine material which dribbles between the fingers of the air stoppers. It is opened and closed by a system of levers which are attached to a wheel. On this wheel there is a plate which completely covers the bell when the skip is being loaded, making it impossible to give the signal to hoist until the closer is in the proper position. The great objection to aprons has been that the men forget totake them out of the shaft and they are pulled out by the skips. The simple arrangement of the bell described above makes our closers practically fool proof.

ROCK DRIFTING.

During the year there has been 850 feet drifted in rock, 664 feet raised in rock, and 2116 feet raised in ore.

ESTIMATE.

The work on the 1100' level has changed the sections considerably. Above the 700' level the ore shown up in No. 11 drill hole can be included and there is nowadditional information under the Roman Catholic Cemetery. The estimate has been recalculated, and is as follows:

	DEVELOPED	MINED TO DATE	ORE IN SIGHT.
Above 700' N. of fault	438,000	219,000	219,000
Above 700' Main Deposit	72,000	35,000	37,000
At D. D. hole No. 11	10,500	500	10,000
Total ore above 700' level	520,500	254,500	266,000
Between 700' and 900' levels	1,178,000	97,000	1,081,000
Between 900' and 1100' levels	3,230,000	97,000	3,133,000
Total ore above 1100' level	4,928,500	448,500	4,480,000

ANALYSIS OF MAAS MINE COST SHEET, EXPLAINING INCREASE OR DECREASE BETWEEN THE TWELVE MONTHS OF 1910 AND THE PREVIOUS THIRTEEN MONTHS CONSIDERED AS THE YEAR 1909.

GENERAL EXPENSE:

1910 total $9,941.20 -- Cost per ton $ .049
1909 " 9,620.39 -- " .062

There is little difference in the amounts charged to the accounts under this general head. The reduction in the cost per ton for 1910 is due to the fact that the product was 203,257 tons against 155,577 tons in 1909.

MAINTENANCE:

Trakcs & Yards -

1910 total $2,687.08 -- Cost per ton $.013
1909 " 2,462.12 " .016

This shows that a little more money was spent in 1910 than in 1909, which was due to the large amount of improvement work around the buildings.

Boilers -

1910 total $ 771.24 -- Cost per ton $ .004
1909 " 496.85 " .003

In 1910 the economizer was overhauled. The steel work around the fan was covered with asbestos.

Hoisting Machinery -

1910 total $1,927.98 -- Cost per ton $.010
1909 " 1,403.73 " .009

The increase in cost in 1910 was due to one additional hoisting rope.

Compressors & Air Pipes -

1910 total $ 990.01 -- Cost per ton $.005
1909 " 2,807.36 " .018

The great reduction in 1910 is due to the fact that little repairs have been necessary and no expensive changes have been made.

Skips & Skip Roads -

1910 total $2,206.28 -- Cost per ton $ .011
1909 " 1,400.00 " .009

The increase in 1910 was caused by constant repairs to skip roads, due to the serious trouble in the shaft.

MINING EXPENSE:

Air Pipes -

1910 total $2,624.67 -- Cost per ton $ .013
1909 " 3,144.92 " .020

In 1909 the main pipe lines were extended on the 700 foot level, while in 1910 the work was less expensive on account of the smaller amount of large pipe used.

Drifting -

1910 - total $ 6,331.84 -- Cost per ton $ .031
1909 - " 14,210.08 " .092

In 1909 much more rock drifting was done than in 1910, and also a large amount of raising in rock.

Breaking Ore -

1910 total $103,177.45 -- Cost per ton $ .507
1909 " 85,339.34 " .549

The cost per ton for both years is high due to the fact that such a large proportion of the gangs have been drifting and opening up new sub-levels. Also on account of ore on the 1100 foot level being mined in square set rooms which is expensive. We have done a tremendous amount of raising in ore. As soon as we can get a sufficient percentage of the gangs stoping, the cost will be materially decreased. Up to April, 1910, the territory was very restricted, making it impossible to increase the product. After that date we were allowed to begin to prepare to mine under the Roman Catholic Cemetery.

MAAS MINE.

Tramming - 1910 total $19,297.25 -- Cost per ton $ .095
1909 " 14,488.75 " .093
Increase to hoisting of ore from 1100 foot level where there was an increase of two motormen, one brakeman and one skip tender. There was considerably more current used in 1910 than in 1909.

Sinking & Repairing Shaft -1909 total $ 992.93 -- Cost per ton $.006
There is no corresponding charge in 1910. In 1909, from May 25th to June 6th, the mine was idle while the sharp curves in the crooked part of the shaft were reduced in order to give better operating conditions.

Filling - 1910 total $280.41 -- Cost per ton $ .001
This was for breaking the capping to fill an open space above the 200 foot level.

Timbering - 1910 total $12,571.69 -- Cost per ton $ .062
1909 " 14,163.90 " .091
In 1910 there was more work done in sub-levels where the cost for timbering is less than in main drifts. In 1909 it was necessary to repair motor drifts on the 900 foot and 1100 foot levels.

COST OF PRODUCTION - Total 1910 - $212,920.78 - Cost per ton $1.043
COST OF PRODUCTION - " 1909 207,333.77 " 1.333

A fair comparison can not be made between 1910 and 1909. The territory has been so limited that it has been impossibleto work a sufficient number of gangs to reduce the cost to a reasonable figure. The operating conditions in the shaft have been bad, causing constant and serious delays. After the present improvements in the shaft are completed, the reduction in the monthly cost will be shown.
There was an advance in wages in April, 1910, amounting to about 7½%.

MAAS MINE.

ORE STATEMENT FOR DECEMBER 31ST, 1910.

	BESSEMER	MAAS	TOTAL	TOTAL LAST YEAR 13 mos.
On hand January 1st, 1910	246	29,785	30,031	33,651
Output for year	902	202,355	203,257	155,577
Total	1,148	232,140	233,288	189,228
Shipments	85	208,018	208,103	159,197
Balance on hand	1,063	24,122	25,185	30,031
Increase in output corresponding (12 months - 37%			55,185	
Decrease in ore on hand			4,846	

SHIPMENTS FOR 1910.

	POCKET	STOCKPILE	TOTAL	LAST YEAR
Maas Bessemer	85		85	9,668
Maas	121,507	86,511	208,018	149,529
Total	121,592	86,511	208,103	159,197
Total last year	108,163	51,034	159,197	
Increase - 30%			48,906	

AVERAGE ANALYSIS OF OUTPUT.

GRADE	IRON	PHOS.
Bessemer	62.20	.060
Maas	58.62	.094

MAAS MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31ST, '10.

KIND	LINEAL FEET	AVG. PRICE PER FOOT.	12 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
6" to 8" timber	24,296	.0212	516.30	220.58
8" " 10" "	9,078	.04	363.12	365.48
10" " 12" "	8,492	.05	471.98	696.45
12" " 14" "	6,916	.08	553,28	680.37
14" " 16" "	3,257	.105	341.99	368.96
Total	52,039	.0432	2246.67	
Total 1909	55,776	.0519		2331.84

	LINEAL FEET	PER 100'	AMOUNT 1910	AMOUNT 1909
5 ft. lagging	1.720	.465	8.00	382.00
7 ft. "	421,788	.640	2706.18	800.23
8 ft. "	127,736	.550	702.55	1792.78
Poles	11,322	.950	107.57	686.89
Total	562,566	.628	3524.30	
Total 1909	613,078	.597		3661.90

	1910	1909
Feet of timber per ton of ore	.256	.358
Feet of lagging per ton of ore	2.71	3.94
Feet of lagging per foot of timber	10.59	10.99
Cost per ton for timber, lagging and poles	.0284	.0406
Equivalent of stull timber to board measure	347,887	140,270
Feet board measure per ton of ore	1.71	.901
Total product	203,257	155,577

Total cost of timber and lagging, 1910 - 12 mos.	5770.97
Total cost of timber and lagging, 1909 - 13 mos.	6324.50
Total cost of timber and lagging, 1908 - 12 mos.	4373.23

MAAS MINE.

COMPARATIVE MINING COST FOR YEAR.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
PRODUCT	203,357	155,577	47,680	
General Expense	.049	.062		.013
Maintenance	.091	.141		.050
Mining Expense	.903	1.130		.227
Cost of Production	1.043	1.333		.290
Exploratory	.003	.001	.002	
DEPRECIATION				
Inventory	.013	.008	.005	
Improvement		.002		.002
Cost of Mine	.200		.200	
Opening Mine	.250		.250	
Total	.463	.460	.003	
Taxes	.066	.072		.006
Central Office	.040	.049		.009
Cost on Stockpile	1.615	1.915		.300
Loading and Shipping	.020	.018	.002	
Total cost on cars	1.635	1.933		.298
No. days operating	279	319		
No. shifts and hours	2-10-hr.	2-10-hr.		
Avg. daily product	728	488		
COST OF PRODUCTION.				
Labor	.737	.901		.164
Supplies	.306	.432		.126
Total	1.043	1.333		.290

MAAS MINE.

STATEMENT OF COMPARATIVE WAGES.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
SURFACE				
Total number of days	12,812¼	13,993½		79¼
Average rate	2.32	2.24	.08	
Amount	29,678.31	31,358.91		1,680.60
UNDERGROUND				
Total number of days	46,583¼	43,585	7,441½	
Average rate	2.61	2.49	.02	
Amount	121,507.85	108,668.31	12,839.54	
Total days	59,395½	57,578½	7,362¼	
Average Rate	2.54	2.43	.11	
Total Amount	151,186.16	140,027.22	11,158.94	
Labor cost per ton	.74	.90		.16

For comparison of days for twelve months, December, 1909, is omitted.

PRODUCT '10 - 203,257 tons PRODUCT '09 - 155,577 "	SURFACE		UNDERGROUND		T O T A L	
	1910	13 mos. 1909	1910	13 mos. 1909	1910	13 mos. 1909
Avg. no. men working	43	42	167	132	210	174
Avg. wages per day	2.32	2.24	2.61	2.49	2.54	2.43
Avg. wages per mo. 25 days	58.00	56.00	65.25	62.25	63.50	60.75
Avg. product per man per day	15.86	11.12	4.36	3.57	3.42	2.70
Labor cost per ton	.146	.202	.598	.698	.744	.900
Diff. in labor cost per ton	-.056	-.231	-.100	-.497	-.156	-.728
Average product breakg & trammg.			6.38	5.63		
Avg. wages for miners contract			2.80	2.62		
Average wages for trammers contract (None - Electric Haulage)						
Total average wages for contract			2.80	2.62		

Average wages three months to March 31st, - $2.44) Average wages for year - $2.54
Average wages nine months to December 31st, - 2.58) Increase in wages 5.7%.

Increase in product per man per day 26.7%.

MAAS MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	12 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
40% Powder	30,750	9.25	2844.49	1953.27
50% "	77,950	10.25	7991.42	8126.12
60% "				47.00
Fuse	266,400	3.78	1007.00	1000.38
Caps	43,100	6.25	269.40	262.60
Electric Exploders				7.08
Connecting wire	3#	.27	.81	1.31
Crimpers	34	.35	11.87	9.48
Total			12124.99	11407.24
Product			203,257	155,577
Pounds powder per ton of ore			.534	.650
Cost per ton for explosives			.0596	.0733

SOUTH JACKSON.

On April the first a small crew started to clean up and prepare to mine ore by the 15th. On the West face, a part of a bar of rock was removed in order to get at the better material back of it. The rock which had been picked out the previous year, was wheeled away from the faces to give more room for loading. Two gangs of miners were kept busy breaking ore. As the distance on the West face was too great to use wheelbarrows, tracks were laid for tram cars.

While the pit was idle in the previous winter, a part of the old tunnel caved. This material was loaded into railroad cars and shipped. It took considerable time to clean up the tunnel as the back was not secure and had to be continually trimmed, and a part of it retimbered. The ore had to be shoveled up to a platform and then thrown into the end of a railroad car. The cave in the tunnel cut off the upper end of the tail track, and it was therefore only possible to load a certain number of cars. The product was gradually increased until the month of August, when we were able to spot as many cars as it was possible to load from the faces.

The material was watched most carefully and it was kept up to the guarantee. This was largely due to the fact that better ore was found, going East. The West face was not good as we worked up against a slip of very lean material. It was from eight feet to ten feet thick, its length being about 125 feet. This was cut through in two places and better ore was found back of it.

The average analyses for the entire production was, Iron 41.12, Phos. .077, Man. 2.59. This is 1.72 higher than the guarantee. I am sure that it is not safe to sell this ore on a guarantee higher than 42% Fe. and Man. combined.

The floor of the pit is now covered with rock which has been picked out of the ore. Before any mining is done at a lower elevation, this rock will have to be moved.

STRIPPING.

On the end of the first week in October, the amount of ore which had been sold was shipped. About 25 men started in at once to strip. Half of the crew started to clean the broken ledge and drift material from the ore on the West side, and the others worked on the East side where the material to be moved consisted chiefly of sand. No attempt was made to keep the force full, as we knew that the work could be completed before cold weather set in. On the 19th

of November, all of the men were laid off. I am unable to give any figures as to the cost per yard for stripping. THe engineering force has been considerably reduced, and they have not been able to measure the work.

The production was as follows:

April	1,430 tons
May	5,763 "
June	6,211 "
July	7,035 "
August	9,080 "
September	8,750 "
October	2,051 "
Total	40,320 "

CRUSHER.

On the 16th of April we started to crush the ore which was brought to the Jackson from the Moro Mine and also the South Jackson. On the 1st of May, the second shift was added.

In April the fingers in the pocket were worked by steam, the small compressor having been taken to some other mine. Much trouble was experienced on account of condensation in the cylinders, causing the fingers to work slowly. Considerable fine dirt went to the bottom of the shaft, filling the skip pit rapidly. This has always been the most serious trouble at the crusher and the cost for keeping the skip pit clean is considerable. In order to avoid delays, in July a raise was connected with the surface from the tunnel level and the ore, which fell to the bottom of the shaft, was loaded into a bucket and hoisted to the surface by a puffer. On the surface, a small pocket, holding a skip full was constructed. It was necessary to hoist the ore from the tunnel level, as all of the openings at this elevation had been practically filled. Up to this time we have avoided delays, be wheeling the ore away from the shaft on the tunnel level.

The design of the pocket and stoppers are not satisfactory, and before the crusher is again operated, I plan to make several changes.

Beginning with October, there were many delays due principally to the fact that the ore did not go forward fast enough. On the 9th, one shift was

laid off, but even after that date there was not sufficient work to keep the men continually busy. On November 3rd, all of the men were laid off.

There is not sufficient data to figure an estimate which would be of any value.

JACKSON IRON COMPANY.

AVERAGE ANALYSIS OF OUTPUT YEAR 1910.

GRADE	IRON	PHOS	SILICA	MANG.
South Jackson	41.12	.077	32.42	2.59

AVERAGE ANALYSIS ON STRAIGHT CARGOES.

GRADE	IRON	PHOS.	SILICA	MANG.
South Jackson	41.11	.078	31.73	2.58

ORE STATEMENT AND SHIPMENTS.

	SOUTH JACKSON	LAST YEAR
Output	40,320	11,060
Shipments	40,320	11,060

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICE	12 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
40% Powder				185.00
50% Powder	9350	.1025	958.38	
Fuse	9600	3.78	36.30	2.00
Caps	900	6.25	5.64	.70
Total			1000.32	187.70
Product			40,320	11,060
Pounds powder per ton of ore			.232	.180
Cost per ton for explosives			.025	.0170

SOUTH JACKSON MINE.

COMPARATIVE MINING COST FOR THE YEAR.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
PRODUCT	40,320	11,060	29,260	
General Expense	.025	.059		.034
Maintenance	.003		.003	
Mining Expense	.248	.340		.092
Cost of Production	.276	.399		.123
DEPRECIATION				
Inventory	.001			
New Construction	.150	.150		
Crushing Ore - Fuel Adjustment	.003			
Total	.154	.150	.004	
Taxes	.130		.130	
Central Office	.014	.022		.008
Cost on Stockpile	.574	.571	.003	
Loading and Shipping	.224	.262		.038
Total coston cars	.798	.833		.035
No. days operating	147	75		
No. shifts and hours	2-10-hr.	2-10-hr.		
Average daily product	274	148		
COST OF PRODUCTION.				
Labor	.088	.146		.058
Supplies	.188	.253		.065
Total	.276	.399		.123

Operations commenced April 18th, 1910.

Operations suspended October 7th, 1910.

SOUTH JACKSON MINE.

STATEMENT OF COMPARATIVE WAGES.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
SURFACE.				
Total number of days	723¼	228½	494¾	
Average Rate	2.08	2.57		.49
Amount	1506.85	587.59	919.26	
UNDERGROUND				
Total number of days	5184	1939¼	3244¾	
Average Rate	2.20	2.12	.08	
Amount	11435.80	4102.99	7332.81	
Total Days	5907¼	2167¾	3739½	
Average Rate	2.19	2.16	.03	
Total Amount	12942.65	4690.58	8252.07	
Labor cost per ton	.3210	.424		.103

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '10 - 40,320 tons PRODUCT '09 - 11,060 "	SURFACE		UNDERGROUND		T O T A L	
	1910	13 mos. 1909	1910	13 mos. 1909	1910	13 mos. 1909
Average No. men working	3	1	25	28	28	29
Average wages per day	2.08	1.94	2.20	2.12	2.19	2.11
Avg. wages per mo. 25 days	52.00	48.50	55.00	53.00	54.75	52.75
Avg. prod. per man per day	55.74	48.40	7.78	5.64	6.83	5.10
Labor cost per ton	.037	.053	.284	.371	.321	.424
Difference in L abor cost (per ton	-.016		-.087		-.103	

No increase in wages as operations were not commenced until April 18, 1910.

Increase in product per man per day 34%.

LUCY MINE.

SURFACE.

On February 1st the water had been pumped out of the workings, and we commenced to mine and hoist ore.

HOISTING ENGINE.

The engine was very old and not capable of doing the work. After we had been working for a short time, it commenced to give trouble. It was decided to install a small hoist which belonged to the Jackson. This was being operated on the latter part of March.

BOILERS.

There were two boilers in the old equipment, one 150 H. P., and the other only 50. It was soon found that they were not capable of furnishing sufficient steam to run the plant. The small boiler was crowded so hard that one day the stack set the building on fire. This was extinguished without damage and a much larger hole cut in the roof to prevent the recurrence of this trouble. In April, a 150 H. P., boiler was received from the Ashland Mine. It was unloaded from the pocket track and pulled by block and tackel on a skidway up to the boiler house.

In the middle of May, the small boiler was replaced. On the end of the month, the new one was put in commission. A leak was discovered in one of the arch tubes, and it had to be shut down. This defective tube was replaced and since then we have had sufficient steam. It was shown the first month, that the small boiler which we had been attempting to get along with, was most uneconomical, as there was a considerable reduction in the fuel.

TOP TRAM ENGINE.

A small puffer was first installed, but this was found not to be capable of doing the work. In March, a considerably larger engine was set up on a concrete foundation, which has given excellent results.

TRESTLE.

It was found that practically every leg in the long trestle was rotten. These legs rested on sills, which now is not considered good practice. The sills were removed and the lower part of the legs sawed off and new blocking put under them. The trestle was guyed by old wire rope in a number of

places. We did everything we could to make it serve the purpose, but finally it started to give away and it was necessary to replace the old legs. The stringers were strengthened by spiking 3" plank on the outside of them. Most of the floor had to be renewed as the plank was so rotten that it did not have strength enough to hold the spikes. The rails were continually spreading, causing the car to jump the track.

The track arrangement was poor. There were two parallel tracks for the entire length of the trestle, bringing the car too close to the edge. If it should jump, it would endanger the life of the car rider, as he would have little time to save himself. In the middle of June, the old tracks and complicated frogs and switches, were all removed and new track layed down the center of the trestle. The light 20 lb., rails on the stockpile were replaced by heavier 40 lb., rail. This was found to give us much better operating conditions.

TOP TRAM CARS.

Up to September, we used the common type of end dump car. There was much trouble in keeping the dump in good condition and preventing delays. It was decided to try a different method, using a car only dumping on one side. After the pile had been extended to its full length, the track is shifted to the edge of it, the outer rail being elevated about two inches. This slight elevation counteracts the tendeny of the car to turn over. The ore is dumped along the entire length of the pile, beginning first at the far end and gradually working back towards the permanent trestle. This plan is found to be far ahead of the one in common use. At the end of the year, our dump is 200 feet in length, and it is only necessary to shift the track about once in eight days. By the old method, the dump is continually changing, and it is difficult to keep good tracks on soft, loose ore.

REPAIRING BUILDINGS.

The buildings are all temporary and of the cheapest construction. They served the purpose during the mild weather, but were not warm enough for winter work. The roofs leaked and the weather strips had sprung, leaving open cracks. The roofs were re-covered with rubberoid and the weather strips renailed.

SAMPLE SHANTY.

LUCY MINE.

Near the shaft a small shanty was built to enclose the sample plate, providing a suitable place for the samples to be prepared. The plate was set on a small concrete base.

HOISTING IN NO. 5 SHAFT.

We are anxious to get the cheapest possible means of handling the dirt coming from No. 5 Shaft while it is being sunk, and also in driving the drifts on the lower levels back towards No. 3 Shaft.

An old wire rope was run West from one of the drums of the old hoist, then around a turn sheave, taking it to the South, to the Shaft. At the collar of the shaft, it passes over another sheave, taking it to the bottom. The skip-road was only repaired from the 6th level down, as it was not necessary to have the skip run above this. In sinking, a bucket is attached to the bottom of the skip and the rock dumped into a pocket on the 6th level. The regular brakemen in the engine house, do all of the hoisting in No. 5 Shaft as well as in No. 3. The equipment - skips, rope, sheaves, etc., was all old stuff which was picked up around the other mines and will be returned and scrapped when the Lucy has finished with it.

SHAFT HOUSE.

This light structure was shaking considerably, probably due to the decaying of the timbers. It has been strengthened by adding several guy ropes.

GRADE ON RAILROAD TRACK.

We have had considerable trouble, due to cars running away. The grade must be 3% or better. We have had several bad runaways doing considerable damage to the cars. The pocket men have been changed a number of times and we did our best to try and prevent trouble. A large snubbing post was put in the ground and the cars lowered with a rope. One day in December, the brake chain broke, throwing the man off the car. The snubbing rope was snapped and two cars were damaged.

WATER FROM MILWAUKEE AND DAVIS MINES.

In the latter part of March, I reported to you that the Breitung interests were sending the water from their mines across the Lucy property. I explained to their Superintendent, that I was sure that some of it was finding its way into the workings of the Lucy, and further that they had not even gone

through the formality of asking for permission to send the water across the property. Upon your instructions, I wrote them that they would be required to put the water in a launder. They made no attempt to adjust the matter and on the 5th, their water added to that which came into the mine from heavy rains, flooded the bottom level. In your absence, I requested them to shut down the pump immediately, or stand the consequences. The pumps were shut down, and the following morning the water was out of the level. Since then they have disposed of the water in some other way.

FATAL ACCIDENTS.

I regret exceedingly to report two fatalities during the year.

On February 24th, at about 7 P. M., Charles Saari fell into No. 3 shaft from the surface, and died at 3:20 A. M., the following morning.

The regular entrance to the ladder road is on the West end of the Shaft, it being customary for the men to walk to it from the North side. Saari tried to enter it from the South side. The bars were down and he fell into the skip compartment.

I was not here at the time and upon my return about two weeks later, was unable to find out who was responsible for leaving the bars down.

The skip had been repaired on the day of the accident, but no one seemed to remember whether the bars had been taken down or not. It was impossible for me to determine who the guilty person was.

On July 26th, John Ayotte, a miner, was blown to pieces while making up his charges on the 5th level. It was presumed thatin some way, he either set off the box of caps or a stick of powder, which caused the remainder to explode. There was a terrific explosion. The concussion was great, as probably a box and a half of powder went off. The unfortunate man was blown into very little pieces, and it took several days to collect even a small part of his remains.

The old abandoned Pump House was demolished. The air and discharge pipes were broekn and the skip runners torn out. The pumps had to be shut down, but were running by 8:00 P. M. The men reported for work but the trammers had to be sent home as the water was over the 6th level.

LUCY MINE.

The following is the production by months:

MONTH	MANGANESE	LUCY	TOTAL
February		3,256	3,256
March		5,960	5,960
April		6,079	6,079
May	41	7,162	7,203
June	27	7,166	7,193
July		6,494	6,494
August		7,904	7,904
September		6,824	6,824
October		7,081	7,081
November	44	7,368	7,412
December	____	6,356	6,356
TOTAL	112	71,650	71,762

UNDERGROUND.

FOURTH LEVEL.

Between the old workings of Nos. 3 and 5 shafts, a drift was driven for a distance of 150 feet in ore, connecting the old levels. This wark was started from a raise which was put up from the 5th level and holed near the East end of the 4th level, No. 3 shaft. This ore has now been practically all stoped out back towards No. 3 shaft and is shown on the map as Contract #6. Its width varies from 20 to 35 feet, the upper part being cut off by rock a short distance above the level.

No. 1 contract on the end of the year, is taking a part of the floor of an old stope.

To the South of No. 3 Shaft, after drifting through about 70 feet of rock, we found ore. On the surface there is a string of open pits, bounded on the south by a well defined dyke. The object of driving the rock drift was to determine whether this ore would continue with depth. Where it was passed through by the crosscut, it was of a good grade and about 30 feet wide. Going East along the dyke at a distance of 175 feet, it is only about eight feet wide. Going West there has been practically nothing found although the drift has followed the dyke for about 125 feet. There are local enrichments, but no

continuous vein in the West.

The development of this territory was delayed for about two months on account of a small cave in the traveling road through an old stope. It was then necessary to raise from the 6th level.

No stoping has been done as we wanted to determine first the height of the ore. Five raises have been put up, the highest being 60 feet, where rock was encountered. At an elevation of 40 feet, from the raise farthest West, a drift is being driven East (in December) to connect the other raises. A cross-cut to the South shows the ore only about 12 feet wide. Sufficient work has not been done to show what we have. I feel confident that this ore will extend through to the old open pits, but the present indications are that it is very narrow.

In December, No. 8 is taking a part of the floor of an old stope.

FIFTH LEVEL.

To the South and East of No. 3 Shaft, a drift was driven in ore 175 feet, holeing into the 5th level, No. 5 Shaft. Two stopes, one to the North and one to the South, are being worked by contracts Nos. 9 and 1. The ore here is about 60 feet in width, but will undoubtedly decrease rapidly as we go West, as it is only eight feet wide a short distance South of the Shaft.

Nothing of importance has been found in the drift to the South of the Shaft. This was driven to test the formation for the ore found on the 4th level. The dyke was located and a very small stope continued East. The showing is poor and the place has been stopped.

To the North of No. 3 Shaft in the early months of the year, two of the old stopes were continued West. The ore was finally cut off by rock.

SIXTH LEVEL.

After September, the only work done on the 6th level has been in the drift going East, driven by No. 3 contract. To the East of No. 5 Shaft, there is a large open pit. As far as the records show, none of the levels have gone in this direction. On account of the size of the pit, it would not be surprising to find the ore extending to this depth. During December, the showing has been more favorable than at any other time. We have had some ore running about 50%, which may lead to the main deposit. If nothing is found in

LUCY MINE.

the drift, we will raise under the pit.

The stopes from which most of the product previous to September was obtained, were opened by us and completed. They are on the South side of the main deposit. This ore was shown up after drifting through a few feet of rock.

To the West of No. 3 Shaft we also had a good stope. The one to the South of the drift showed soft ore in the bottom and should be better on the next level. To the North of the drift there was some high manganese ore, with strong indications that there would be considerable more of it below the level. The rock was close to the level and the stope had only a small height.

No ore was found in the straight drift Southwest of the Shaft. A stringer was followed East, but the ore did not increase in width.

SEVENTH LEVEL.

A small amount of work had been done by the Old Company on the 7th level, which is only 36 feet below the 6th level. It was decided to sink the shaft for an additional 18 feet for the level and eight feet for the skip pit. This makes the new level 50 feet below the 6th level at No. 3 Shaft. The Shaft was sunk in August and in Septemberwe started to drift. On the last of the year, we are under No. 3 Shaft preparing to raise.

The development on the 7th level has been most encouraging. Just after the turn from No. 5 Shaft the drift passed from dyke into ore and continued in it for 270 feet. The stope samples averaged about 50% in iron and 3% in Manganese. There were places where the ore was soft and of a good grade. There is every indication that the mine is improving with depth.

CONCLUSION.

I am strongly of the opinion that we will find still better ore on the 8th level than was found on the 7th. It is not at all improbable that nearer the bottom of the basin we may find high grade ore.

In the upper levels, the ore exists in small pockets, which are simply local enrichments. There is absolutely no regularity to the formation. I am quite sure that it will not pay to do any more dead work above the 6th level. The present plan is simply to mine the ore which has been opened up, in order to try and pay for the dead work which has and is being done below.

There is considerable ore between the 6th and 7th levels, but as there

is only a single drift on the latter, I could not do more than guess at the width of the deposit. Such an estimate would be absolutely unreliable and therefore, I will not submit one until I have more data. As I have said before, the upper part of the mine is simply small pockets, the higher grade of ore having been practically all mined.

During the year there has been 632 feet drifted in rock, 38 feet raised in rock, and 803 feet raised in ore.

Lucy Mine.

ORE STATEMENT AND SHIPMENTS FOR 1910.

	LUCY	MANGANESE ORE	TOTAL	TOTAL LAST YEAR
On hand January 1st, 1910	0	0	0	1,085
Output for year	71,650	112	71,762	0
Stockpile Overrun				587
Total	71,650	112	71,762	1,672
Shipments **	11,257		11,257	1,672
Balance on hand	60,393	112	60,505	0

** All 1910 shipments from pocket.

AVERAGE MINE ANALYSIS ON STRAIGHT CARGOES.

GRADE	IRON	PHOS.
Lucy	45.40	.054

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	11 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
50% Powder	64,400	.1025	6602.36	
Fuse	92,400	3.78	349.19	
Caps	18,000	6.12	110.07	
Total			7061.62	
Product			71,672	
Pounds powder per ton of ore			.897	
Cost per ton for explosives			.984	

LUCY MINE.

COMPARATIVE MINING COST FOR '10.

	11 mos. 1 9 1 0
PRODUCT	71,762
General Expense	.048
Maintenance	.149
Mining Expense	1.062
Cost of Production	1.259
DEPRECIATION	
Improvement	.025
Reopening	.250
Total	.275
Taxes	.020
Central Office	.038
Cost on Stockpile	1.592
Total cost on cars	1.592
No. days operating	273
No. shifts and hours	2-10-hr.
Avg. daily product	263
COST OF PRODUCTION.	
Labor	.834
Supplies	.425
Total	1.259

Mine closed down December 1st, 1903.

Mine commenced operating February 1st, 1910.

LUCY MINE

STATEMENT OF COMPARATIVE WAGES 1 9 1 0.

	1 9 1 0	(nothing for 1909)
SURFACE		
Total number of days	6630	
Average Rate	2.29	
Amount	15168.84	
UNDERGROUND		
Total number of days	18075¾	
Average Rate	2.50	
Amount	45204.16	
Total days	24705¾	
Average Rate	2.44	
Total amount	60373.00	
Labor cost per ton	8.41	

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '10 - 71,762 tons PRODUCT '09 - 000 "	SURFACE 11 mos. 1910	 13 mos. 1909	UNDERGROUND 11 mos. 1910	 13 mos. 1909	T O T A L 11 mos. 1910	 13 mos. 1909
Avg. no. men working	21		62		83	
Avg. wages per day	2.29		2.50		2.44	
Avg. wages per mo. 25 days	57.00		62.50		61.00	
Avg. prod. per man per day	10.83		3.97		2.91	
Labor cost per ton	.211		.630		.841	

Avg. prod. breakg & trammg	5.33	
Avg. wages for miners contract	2.72	
Avg. wages for trammers contract	(None - all Company account.)	
Total average wages for contract	2.72	

Avg. wages three months to March 31st,	$2.34
Avg. wages nine months to December 31st,	2.46
Avg. wages for year	2.44

Increase in wages - 5.1%.

IMPERIAL MINE.

SURFACE.

Generally speaking, the surface conditions at the Imperial mine during the past year have been very favorable. Aside from a few accidents to the hoisting equipment, everything has run along smoothly. The usual repairs have been made to buildings, skip ways, pockets, etc. The more important items relating to the surface will be described briefly below under the headings caving ground, loading ore, accidents affecting the mine's output, improvements and diamond drilling.

CAVING GROUND.

The ground to the East and West of No.2 East shaft has settled considerably during the year, extending the limits of the caved area in this vicinity appreciably.

A very noticeable settlement has occurred over the old 115' sub and 2nd level workings to the Southwest of No.1 shaft.

LOADING ORE.

Over 10,000 tons of ore were loaded by hand from June to October inclusive from the Eastern side of the West stockpile. It was impossible to get at this portion of the pile with the steam shovel. Considerable grading was also done here, extending the limits of the stocking ground. The steam shovel was not operated during the year.

ACCIDENTS AFFECTING THE MINE'S OUTPUT.

The hoist broke down on the 6th of June and again on the 14th, causing in all a delay of five days. A broken tooth of the pinion was responsible for the first delay and a crooked bed plate, resulting in the breaking of the pillar block, was the second and more serious accident. A number of minor repairs were made to the hoist from time to time during the remainder of the year. Several of the pinion teeth were replaced.

During November a packing ring bolt broke and fell into the cylinder, resulting in the shearing off of several cylinder head bolts. A shut-down of 67 hours duration was the result of this accident.

IMPROVEMENTS.

Two fire tube boilers shipped from the Iron Belt mine were generally overhauled and installed during May.

A new coal dock, situated North of the railroad spur leading into the mine, 500' West of No.1 shaft, or just West of the stocking ground, was erected during May. Five men were employed for slightly over a month on this job. This coal dock has a capacity of approximately 15,000 tons. Four men were employed a week during June, filling and grading for the approach to the coal dock.

The water launder leading out of the West shaft open pit was abandoned August 1st and the mine water from the West shaft workings has been pumped and drained through a raise put up from the 3rd level and holed to the surface on the Three River side of the bluff.

DIAMOND DRILLING.

Twelve diamond drill holes were put down during the past year within a zone 200' wide and extending in a Northwest-Southeasterly direction to the South of the mine workings and diverging slightly to the South from the footwall. For convenience the general location of these holes will be described as follows: beginning with No.1, which is located by measuring approximately 900' Northwest along the footwall from the West shaft and 500' South from this point, the holes are all included in the zone as mentioned before 200' wide and extending to hole No.12, which is located by measuring approximately 400' to the Southeast along the footwall from the East shaft and thence South for 700'.

This drilling has proven up the existence of a fault in the hanging of the deposit, striking at a slight angle with the footwall and dipping Northward towards the foot at an angle of from 63° at the Western end of the property to an angle of 78° at the Eastern end. The fault cuts into the footwall about the elevation of the 4th level, a short distance to the West of the West shaft and thus limits the deposit at depth to the Eastern areas. The foot, hanging and fault contours have been mapped at elevations of 81' and 181' below the 4th level, or at sea elevations of 1400' and 1300'. These contours show that the ore formation extends a short distance below the 1300' contour at the Southeastern end of

the property. The fault cuts through the hanging above the 1300' contour, or in other words, forms a trough with the footwall at this elevation and below.

Drilling has also demonstrated the necessity of sinking the East shaft for the majority of this new ore and it is planned to put the shaft down on such an inclination as to tap the ore body at depth to the best advantage and at the same time doing the minimum amount of rock work.

The following table shows the dates of starting and completing the diamond drill holes put down during the year, the location referenced from the West quarter corner of Section 25, 48-31, the depths of the ore and the depths of the holes:

TABLE I.

HOLE NO.	STARTED.	COMPLETED.	ORE.	DEPTH.	LOCATION. From W¼ corner Sec.25, 48-31.
1.	Dec.7,'09	Dec.28,'09	(54 - 64 (72 - 80	106'	N. 1164' - 191' E.
2.	" 29, "	Jan.17,'10		237'	" 1004' - 403' "
3.	Jan.18,'10	Feb. 5, "	106-150	239'	" 744' - 1229' "
4.	Feb. 7, "	Mar. 1, "	194-236	296'	" 542' - 1237' "
5.	Mar. 2, "	" 16, "	105-152	176'	" 773' - 946' "
6.	" 17, "	Apr. 2, "	(154-169 (174-179 (184-232	254'	" 399' - 1656' "
7.	Apr. 5, "	" 28, "		400'	" 189' - 1631' "
8.	" 29, "	May 19, "	209-249	276'	" 267' & 1807' "
9.	May 16, "	June 2, "		184'	" 780' - 748' "
10.	" 20, "	" 17, "	285-340	365'	" 136' - 1955' "
11.	June 3, "	" 21, "		261'	" 558' - 964' "
12.	" 18, "	July 31, "		389'	" 15' - 2118' "
13.	" 23, "	" 31, "		292'	" 368' - 1294' "

The following table shows the hoists reported by months during the fiscal years of 1909 and 1910:

TABLE II.

	1909.		1910.	
MONTHS.	ORE.	ROCK.	ORE.	ROCK.
January	4,349		11,294	
February	4,477		9,026	18
March	6,533	418	11,631	48
April	5,415	388	11,613	
May	5,571	398	11,389	
June	6,794		10,536	
July	6,029		12,238	
August	7,563		13,418	
September	8,375		12,295	
October	8,702		12,231	
November	7,883		10,163	
December	9,814		12,379	
X December	3,519			
Totals	85,024	1,204	138,213	66
	Overrun		752	
			138,965	

X 1908

The following table gives the territories considered, the ore in sight January 1st, 1910, the ore mined from these territories during 1910, the ore in sight January 1st, 1911 and the increase of decrease in the latter figures after deducting the yearly product from the estimate of January 1st, 1910.

A factor of 15 cubic feet per ton was used in the estimates. This is rather a large factor, but considering the low iron content of the ore and as it includes the rock deduction, it is not far on the side of safety.

TABLE III.

Territory considered.	Ore in sight Jan.1, 1910.	Ore mined during 1910.	Ore in sight Jan.1, 1911.	Increase.	Decrease.
On & above 1st level (East shaft)	27,000 tons.	8,660 tons.	18,000 tons.		340 tons.
Between 1st & 2nd level (East shaft)	74,000 "	24,270 "	32,000 "		17,730 "
" 2nd & 3rd level (East shaft)	95,000 " "	25,687 "	74,000 "	4,687 tons	
On & above 2nd level (West shaft)	54,000 "	22,519 "	42,000 "	10,519 "	
Between 2nd & 3rd level (West shaft)	177,000 "	43,311 "	175,000 "	41,311 "	
" 2nd & 3rd level (both shafts)		14,518 "	190,000 "	204,518 "	
Totals	427,000 tons.	138,965 tons.	531,000 tons.	261,035 tons.	18,070 tons.

Net increase equals 242,965 tons.

A considerable portion of the ore estimated above the 1st level and between the 1st and 2nd levels (East shaft territory) is the shaft pillar and is not available for mining as long as the shaft is in operation below. The decrease of over 17,000 tons in the area between the 1st and 2nd levels East shaft is due to the iron content of the ore in the pillars not holding up and consequent deductions having to be made.

The increase of 10,519 tons for the territory on and above the 2nd level (West) is due to the development work of contracts Nos. 1 and 14 at the extreme Western end of the workings and the 41,311 ton increase in the deposit between the 2nd and 3rd levels (West) is explained by this development work on the 2nd level and the lateral extension of the stopes on the 3rd level.

The 190,000 tons estimated between the 3rd and 4th levels is due mostly to the opening up of the deposit on the 4th level. The year's development work on the 3rd level is also a factor.

UNDERGROUND.

The maximum force employed at any time during the year has been 22 gangs and the minimum, 20 gangs, which compares with a maximum force of 23 and a minimum of 15 gangs during 1909. Underground conditions were very favorable, at least comparatively, as with but a slightly larger force, an increase of over 50,000 tons in the year's product was realized.

The iron content of the developed ore on the 4th level has been very gratifying and shows, together with the results of the diamond drilling, that the grade of ore is becoming slightly better with depth. Further development work during the year has borne out the statement made in last year's report, namely, "that the leaner grades of ore have been encountered in the immediate proximity of the foot and hanging". In places large bunches of leaner material are found in the lenses of richer ore.

The bulk of the year's output has come from the 2nd and 3rd levels and the 140' sub (15' below the 2nd level). Out of a total product of 138,965 tons, over 110,000 tons have been extracted from the above areas. The average grade of ore has held up very well considering that all the ore running above 50% in iron has been taken and there has been sufficient ore of high grade to hold the total well up to the guarantee.

At the beginning of the year, mining operations were being carried forward on the 86' sub, 1st, 2nd and 3rd levels No.2 shaft (East) and the 2nd and 3rd levels No.1 shaft (West). With the exception of the shaft pillars, practically no clean ore remains on the 86' sub and 1st levels and mining at these elevations has been discontinued. Slicing, robbing and caving are being carried on over the 2nd level. The 3rd level has been quite thoroughly developed and the West shaft was sunk to the 4th level (40' below the 3rd level) and a body of ore blocked out over 500' in length and varying in width from 40' to 170'. A sub 15' below the 2nd level has been partially opened up, most of the work having been done in that portion of the deposit located West of No.1 shaft. Caving

and slicing on the 140' sub will be somewhat restricted for a time, except in such areas as are located immediately under the caved stopes on the 2nd level.

A description of the progress made by the several contracts will be taken up under the sub and level headings.

EAST SHAFT TERRITORY.

86 FOOT SUB-LEVEL.

Operations at this elevation were confined (as during 1909) to the territory between the East shaft and the West shaft open pit, extending over a distance of 550'. The grade of ore encountered here was fairly satisfactory, especially in the more Westerly portion where bunches of a hard variety of ore were encountered, necessitating machine drilling.

No.11 was engaged here during the month of January, taking a small pillar standing in the hanging stopes. Nos. 4 and 9 mined out the pillars standing along the footwall in the vicinity of the open pit during the months of January and February. Before the gangs left this area the workings were blasted in, the settlement following extending through to surface.

The product from this sub was nearly 3,000 tons and figures out approximately 600 tons a month per gang. Aside from the shaft pillar, the clean ore at this elevation has now been entirely cleaned up.

FIRST LEVEL.

No.5, operating at this elevation during January, and No.9 from March to the end of the year, have beaten down the floor to the 2nd level from points 100' to 200' East of the open pit. The deposit here has an average width of 40' and is located under the high grade ore mined on the 86' sub. No.9 is now engaged in taking the back in the 50' footwall stope immediately East of the above workings. A shell of ore remains along the footwall and in the back of the old stopes between No.9's workings and the shaft, a distance of 300', and eight pillars, ranging from 15'X 20' to 50'X 50', including the shaft pillar are left standing in the old workings adjacent to and West of the shaft. Over 6,000 tons were gained from the 1st level.

SECOND LEVEL.

This level had been opened up during 1909 to the East and West of the shaft, 600' along the deposit with a variance in width of from 140' at the shaft to 70' at the Eastern and 100' at the Western end. Operations here during 1910 have consisted entirely of slicing out the pillars, robbing and caving. The floors were lagged before the stopes were blasted in.

The ore remaining in this territory includes the shaft pillar, some dozen small pillars standing along the hanging wall workings to either side of the shaft, a few small scattered pillars of leaner ore in the central portion of the deposit and a shell of ore from 10' to 20' wide along the footwall to the West of the shaft. The ore along the foot to the East of the shaft has all been drawn off.

Nos. 3, 4, 8 and 19 have been employed on the 2nd level, No.3 during the entire year, No.4 during the month of May, No.8 from January to October and No.19 from January to November. No.3, the only gang remaining, is engaged in slicing out the pillars standing to the East of the shaft. As soon as the 140' sub, 15' below the level, is opened up several gangs will be added to the force on the 2nd level and the deposit cleaned up.

Approximately 23,000 tons were mined on the 2nd level.

140 FOOT SUB-LEVEL.

In June, No.4 was transferred to this elevation from the 2nd level and has been engaged during the balance of the year blocking out the ore at the Eastern extremity of the lens. A number of raises were put up from the 3rd to the 2nd level and No.4, together with No.18, operating here since September, and No.8 since October, have connected nine of these raises. No.4 is continuing this work, while Nos. 8 and 18 are engaged in outlining the deposit along the footwall.

To the West of the shaft, No.12 has been employed since September and No.19 since October, connecting the raises put up from the 3rd level in this locality. This will be the scene of increasing activity during the coming months.

Nearly 6,000 tons have been gained from the 140' sub (East shaft territory).

THIRD LEVEL.

For convenience the 3rd level (East shaft territory) is considered as extending West of this shaft to a point midway between the shafts.

The deposit at this elevation was partially outlined during 1909, the past year's operations having thoroughly blocked out the ore between the foot and hanging. The 3rd level East shaft has a length of 650' and varies in width from 120' at the shaft to 50' at the Eastern end and 100' at the Western end. The better class of ore lies in about the center of the lens, grading down towards the foot and hanging. No clising or caving has been done to date; in fact this work cannot be carried on to any extent until the deposit on the 140' sub above has been gained.

At the beginning of the year, two gangs, Nos. 18 and 24, were employed here. No.18 finished in September and No.24 operated the entire year. No.7 was engaged in this territory from February to October, No.20 from March to September and No.21 from August to the end of the year. Some two dozen raises have been pushed through to the 2nd level, No.18 putting up most of those located West of the shaft and No.24 those to the East.

The year's output from the 3rd level was approximately 20,000 tons.

WEST SHAFT TERRITORY.

SECOND LEVEL.

Operations in this territory have consisted in development work along the hanging wall, fault zone and footwalls at the Western end of the level; also in the slicing and robbing of the pillars standing in the footwall stopes from 300' to 500' West of No.1 shaft. No work was done during the year to the East of the shaft. With the above development work and a number of hanging wall raises put up from the 3rd level during the year, the deposit at this elevation to the West of the shaft has a proven length of over 700' and from widths of 160' at the shaft and 80' at the Westerly extremity widens out to a maximum width of 300' at a point 400' West of the shaft.

No.1, engaged here the entire year, has developed an extension of the lens to the West for 100'. This ore runs extremely high in phosphorus in spots and the hanging is less than 10' above the floor of the level in places. No.1 is now caving and robbing the stopes back towards the East. No.14 de-

veloped, mined out and caved a body of ore approximately 40'X 120' extending into the faulted area and indicates a local cross-faulting or abrupt folding. There is no evidence of this cross-fault in the footwall to the Northeast,however, which rather favors the idea of an abrupt fold. The caving of this stope caused the settlement to extend through to surface.

No.2 was engaged during January, No.6 from January to May and from September to October, No.17 from January to May, No.12 from February to July and Nos. 10 and 23 from September to the end of the year, slicing and robbing the pillars standing along the footwall from 300' to 5oo' West of the shaft. The yearly output in this territory was over 22,000 tons.

140 FOOT SUB-LEVEL.

The hanging and central portions of the ore lens have been studded with raises holed through from the 3rd to the 2nd level during the past year and from two to six gangs have been employed steadily at this elevation connecting these raises and blocking out the ore between them and the footwall. The workings, which are located entirely to the West of No.1 shaft, have outlined the deposit 600' along the lens and vary in width from 20' at the Western and 40' at the Eastern end to a maximum width of 200' at a mid point.

No.10 operated here from February to September, No.21 from February to July, Nos. 11 and 17 from April to the end of the year, No.6 from June to September and from October to the end of the year, and No.12 during July. As the 2nd level deposit above is worked out the pillars at this elevation can be attacked vigorously. The three gangs operating here will be able to block out the unproven ground to the West of the shaft during the succeeding few months.

Approximately 23,000 tons were drawn off from this area during the year.

THIRD LEVEL.

The deposit at this elevation was pretty thoroughly outlined during 1909 and the past year's operations have consisted in driving crosscuts from foot to hanging, leaving approximately 40' pillars between and cutting up these pillars by drifting at right angles to the crosscuts. It would not be practical to honeycomb the deposit any further until the ore is gained on the

2nd level and 140' sub immediately above. As noted before, numerous raises have been put up from the hanging and central portion of the deposit to the 2nd level.

Four gangs, Nos. 16, 20, 22 and 23, were employed here the first of the year. No.20 left in March, No.16 in November and Nos. 2 and 23 in September. No work is being done on the 3rd level (West) at present.

The fault dipping Northward at an angle of 63° was encountered at the extreme West end of the level and cuts down materially the Westward and Southerly extensions of the deposit at this elevation.

Over 20,000 tons were produced in this area.

WEST SHAFT SINKING.

No.5 sank the shaft from the 3rd to the 4th levels, a distance of 163' measured on its inclination of 18°. This gives a vertical distance of 40' between levels. The shaft work was started the latter part of February and completed and the 4th level plat cut by the end of April. With the exception of the first 10', the shaft passed through a good grade of ore.

FOURTH LEVEL.

Five gangs are found on this level at the close of the year, No.5 having been engaged since April, No.2 since June, No.20 since September, No.22 since October and No.16 since November. The deposit has been proven up along the footwall 140' to the West and 370' to the East of the shaft and several crosscuts driven Southward to the fault. The ore body developed has a length of 520' and varies in width from a maximum of 165' at the shaft to 10' at the Eastern and 80' at the Western end.

The fault dips to the North at an angle of 70° and cuts down the Southerly limits of the deposit West of the shaft. The fault cuts through the hanging between the 3rd and 4th levels in this locality, but naturally as the workings are carried Eastward the hanging will be found at increasing depths as the fault strikes off at an angle to the footwall.

No.5 is at present drifting in a Southeasterly direction towards the line of the East shaft, which is bottomed at the 3rd level. After the proper inclination of this shaft has been decided upon it is the intention

of raising on that inclination from No.5's workings and stripping the shaft down. The breast of No.5's drift at the end of the year is 246' distant from the projected line of the East shaft.

COMPARATIVE COSTS 1910 AND 1909.

1910 - two ten hour shifts.

1909 - one ten hour shift to September 1st, and two ten hour shifts thereafter.

Following is an analysis of the increase in expenditures of Maintenance Accounts for the year 1910:

SHOP MACHINERY: Total cost $237.84 -- no expenditures for 1909. This covers cost of Drill sharpener which was installed during the year. The Machine cost $123.00 and the repairs and setting up charges were $114.84. Repair costs have been high.

HOISTING MACHINERY: In this is included repair costs of $296.57 and a new wire rope $266.88, the balance being incidental repairs.

COMPRESSORS AND AIR PIPES: Eight new drills were purchased during the year.

CORNISH AND STEAM PUMPS: Repairs to pumps at the Hard Ore Shops cost $484.64.

UNDERGROUND TRACKS AND CARS: This includes an expenditure of $1440.15, covering new rail and new cars.

MAINTENANCE: The expenditures for Maintenance was $7378.35 in 1910 -- cost per ton $ .053. Expenditures in 1909 were $6221.33 -- cost per ton $ .073.

BREAKING ORE: This is $ .031 higher than in 1909, $.029 of the cost being labor. The total average wages for 1910 was increased 18¢ per day over 1909, this being approximately $ .047 per ton on an average output of 3.80 tons per man per day.

TIMBERING: The cost for timbering during 1910 is $4365.72 as against $2694.71 in 1909, being an increase of $1671.01.

STOCKING ORE: This expense for the year is $522.90 higher than for 1909, due to the increase in the amount of ore stored during the year (approximately 55,000 tons) together with the expense of preparing for stocking grounds and also stocking from both shafts.

SORTING ORE: Expenditures for year 1910 - $1077.45 -- Year 1909 - $1715.67. This decrease is due to smaller shipments of ore from stockpile. The decrease in tonnage shipped from stockpile is 58,638 tons.

COST OF PRODUCTION: Total cost 1910	-	$ .958
" 1909	-	1.051
Decrease		.093

IMPERIAL MINE.

ORE STATEMENT FOR DECEMBER 31ST, 1 9 1 0.

	IMPERIAL	13 mos. LAST YEAR
On hand January 1st, 1910	22,213	52,667
Output for year	138,213	85,024
Total	160,426	137,691
Shipments	83,403	115,478
Balance on hand	77,023	22,213
Increase in output corresponding 12 months - 70%	56,708	
Increase in ore on hand	54,810	

SHIPMENTS FOR 1910.

	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Imperial	72,069	11,334	83,403	115,478
Last Year	45,506	69,972	115,478	
Decrease - 28%			32,075	

AVERAGE MINE ANALYSIS OF OUTPUT.

GRADE	IRON	PHOS.
Imperial	52.09	.306

AVERAGE MINE ANALYSIS ON STRAIGHT CARGOES.

GRADE	IRON	PHOS.
Imperial	51.94	.282

IMPERIAL MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31ST, '10.

KIND	LINEAL FEET	AVG. PRICE PER FOOT	12 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
6" to 8" Timber	44,400	.020	888.00	491.68
8" " 10" "	4,800	.040	192.00	449.13
10" " 12" "	2,360	.060	141.60	241.44
Total	51,560	.237	1221.60	
Total 1909	39,496	.299		1182.25

	LINEAL FEET	PER 100 FT	AMOUNT 1910	AMOUNT 1909
5 ft. lagging	253,659	.55	1395.12	
7 ft. lagging				894.18
Poles				12.83
Trestle Timber				113.36
Total	253,659	.55	1395.12	
Total 1909	156,105	.65		1020.37

	1910	1909
Feet of timber per ton of ore	.373	.464
Feet of lagging per ton of ore	1.83	1.83
Feet of lagging per foot of timber	4.92	3.95
Cost per ton for timber, lagging and poles	.019	.026
Equivalent of stull timber to board measure	71,087	58,265
Feet board measure per ton of ore	.514	.685
Total Product	138,213	85,024

Total cost of timber and lagging - 1910 - 12 mos.	2616.72
Total cost of timber and lagging - 1909 - 13 mos.	2202.62
Total cost of timber and lagging - 1908 - 12 mos.	3229.96
Total cost of timber and lagging - 1907 - 12 mos.	2635.28

IMPERIAL MINE.

COMPARATIVE MINING COST FOR THE YEAR.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
PRODUCT	138,213	85,024	53,189	
General Expense	.036	.050		.014
Maintenance	.053	.073		.020
Mining Expense	.869	.928		.059
Cost of Production	.958	1.051		.093
Exploratory	.060	.009	.051	
DEPRECIATION				
Inventory	.002		.002	
Improvement	.032		.032	
New Construction		.022		.022
Total	.034	.022	.012	
Less credits	.005	.002	.003	
Total depreciation	.029	.020	.009	
Taxes	.005	.007		.002
Central Office	.035	.043		.008
Cost on Stockpile	1.087	1.130		.043
Loading and shipping	.017	.083		.066
Total cost on cars	1.104	1.213		.109
No. days operating	294	(223-1-10 hr. (102-2-10 hr.		
No. Shafts and hours	2-10-hr.	(1-10- hr. (2-10- hr.		
Average daily product	470	262		
COST OF PRODUCTION.				
Labor	.657	.722		.065
Supplies	.301	.329		.028
Total	.958	1.051		.093

IMPERIAL MINE.

STATEMENT OF COMPARATIVE WAGES.

	12 mos. 1910	13 mos. 1909	INCREASE	DECREASE
SURFACE				
Total number of days	9,224¼	9,509	833	
Average Rate	2.45	2.31	.14	
Amount	22582.25	21938.53	643.72	
UNDERGROUND				
Total Number of days	27,203	17,546¼	11,610½	
Average Rate	2.74	2.57	.17	
Amount	74577.84	45290.65	29287.19	
Total days	36,427¼	27,055¼	12,433½	
Average Rate	2.67	2.48	.19	
Total Amount	97160.09	67299.18	29930.91	
Labor cost per ton	.703	.791		.088

For comparison of days for 12 months, December, 1909, is omitted.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '10 - 138,213 tons PRODUCT '09 - 85,024 "	SURFACE 1910	SURFACE 1909 13 mos.	UNDERGROUND 1910	UNDERGROUND 1909 13 mos.	T O T A L 1910	T O T A L 1909 13 mos.
Avg. no. men working	21	29	91	53	122	82
Avg. wages per day	2.45	2.31	2.74	2.57	2.67	2.48
Avg. wages per mo. 25 days	61.00	57.75	68.25	64.25	66.50	62.00
Avg. prod. per man per day	14.98	8.94	5.08	4.85	3.80	3.14
Labor cost per ton	.163	.258	.540	.533	.703	.791
Diff. in labor cost per ton	-.095	*.073	*.007	-.035	-.088	*.038
Avg. prod. breakg & tramng			6.00	6.64		
Avg. wages for miners contract			2.77	2.60		
Avg. wages for trammers contract			2.78	2.43		
Total avg. wages for contract			2.77	2.59		

Avg. wages to March 31st, - $2.62) Average wages for year - $2.67

Avg. wages to December 31st 2.67) Increase in wages - 1.9%

Increase in product per man per day 21%.

- minus * plus

IMPERIAL MINE.

IMPERIAL MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	12 mos. 1910 AMOUNT	13 mos. 1909 AMOUNT
40% Powder	46,950	.0925	4342.88	5883.04
50% "	25,450	.1103	2808.65	353.65
60% "	27,350	.1125	3076.88	
Fuse	238,900	.0380	908.32	537.70
Caps	53.300	.0629	335.79	194.67
Connecting wire	500	.06	3.00	
Total			11475.52	6969.06
Product			138,213	85,024
Pounds powder per ton of ore			.721	.789
Cost per ton for explosives			.083	.082

The operations the past year in the North Lake District have been confined to the opening and equipping of three mines, viz., No. 1 and 2 Shafts, North Lake, and the Barnes. Work at all of these properties was started in 1909. Of these three, both No. 2 and the Barnes Mine are rapidly nearing the production stage. It will require at least eighteen months to bottom No. 1 Shaft, and it is expected that ore will be reached on the first level about the same time. Exploring by diamond drills has been continued on Section 6, T 47 R 27, and on Sections 1, 2 and 3, T 47 R 28. On the whole the explorations have been satisfactory and another mine is assured on Section 2.

NORTH LAKE MINE, NO. 1 SHAFT.

On January 1st, 1910, No. 1 Shaft was down 18 ft. below the concrete joint, or 114 ft. below the collar. The 18 ft. which had been sunk, had been taken out very carefully by drilling holes three inches apart entirely around the shaft, virtually cutting the ground out on the four sides. Considerable water was coming in on the North side of the shaft and the slips were loosening due to the action of the air. In January the shaft was sunk 8 ft. and several slips were cut on the North side which extended up behind the concrete joint. To prevent these slips from breaking loose, strong props were put in against them until the shaft was down far enough so that steel sets could be put in with concrete re-enforcement. Owing to this work requiring constant supervision, it was done on the day shift only. At a point 16 ft. below the joint, hitches were cut for bearers, and the first set of timber was put in, the steel sets were also installed and concrete put in on the North side of the shaft for a distance of 11 ft. below the joint. The concrete varied in thickness from ten inches to two feet and was heavily re-enforced with wire rope. Drain pipes were put in through the concrete to draw off the water, and after the concrete was firmly set these pipes were closed. Owing to the dangerous character of the work at this point, it required the entire month to finish it, the shaft being worked on the single shift only. In March the sinking was resumed on single shift for the first three weeks of the month, the last week on three eight-hour

shifts. The shaft was sunk 19 ft. as great care had to be taken so that the concrete re-enforcing below the joint should not be broken. Sinking has continued for the balance of the year, and on December 31st the shaft was down 410 ft. below the collar.

At a depth of 64 ft. below the concrete joint, a ring was cut around the shaft and a small sump blasted out on the West side; a concrete ditch was put in behind the timber to carry the water to the sump, and in this way eighty percent of the water was caught and for a month afterwards very little trouble was experienced with water. After a time, however, the water started to come in through the cracks in the rocks and for the balance of the year it was necessary to keep a pump in continual operation at the bottom of the shaft. The quantity of water varied, never being less than fifty gallons per minute, and sometimes for short periods it would amount to eighty gallons. The water came in through the soft ground between the slips, and as it was impossible to stop it, it has proven a serious hindrance to sinking, for it has been almost impossible to get men to work here.

The strike of the ground in the shaft is East-West, the dip varying between eighty and eighty five degrees to the South. Several times when the slip on the North side was cut some 15 or 20 ft. below the timber, a block of ground would break out, falling into the shaft, which on several occasions amounted to from forty to sixty tons and required a full shift to hoist. To avoid danger to the men from this cause, it was decided to carry the timber within 12 or 15 ft. of the bottom. This proved a serious hindrance to rapid sinking, as shorter holes had to be drilled and lighter charges used, resulting in smaller cuts.

In July the small air hoist was discarded and the electric cage hoist went into commission. This change caused some delay and afterwards caused the loss of several shifts owing to trouble which developed with the automatic switches. At times the air pressure was very poor, and for the last six months of the year the pressure did not average more than 65 lbs. at the