HOLMES MINE.

MINING COSTS FOR 10 MONTHS, 1917.

	1917.
PRODUCT	68,773
General Expense	.104
Maintenance	.197
Mining Expense	1.768
Cost of Production	2.069
DEPRECIATION.	
Original Purchase	.002
Equipment	.002
Construction	.500
Total Depreciation	.504
Taxes	.100
Central Office	.077
Miscellaneous	.055
Sundry Expense	.019
Total Cost on Stockpile	.251 2.824
Loading & Shipping	.066
Total Cost on Cars	2.890
No. Days Operating	236
No. Shifts and Hours	2-8hr
Avg. Daily Product	291
COST OF PRODUCTION.	
Labor	1.398
Supplies	.671
Total	2.069

HOLMES MINE.

COMPARATIVE WAGES AND PRODUCT.

	1917.
PRODUCT	68,773
No. Shifts and Hours	2-8hr
AVG. NUMBER MEN WORKING	
Surface	23
Underground	58
Total	81
AVG. WAGES PER DAY	
Surface	3.38
Underground	4.57
Total	4.18
WAGES PER MO. OF 25 DAYS	
Surface	84.50
Underground	114.25
Total	104.50
PRODUCT PER MAN PER DAY	
Surface	9.02
Underground	3.93
Total	2.74
LABOR COST PER TON	
Surface	.374
Underground	1.017
Total	1.391
AVG. PRODUCT BRK'G & TRM'G	5.56
" WAGES CONTRACT MINERS	4.19
" " " TRAMMERS	3.59
" " " LABOR	4.11
TOTAL NUMBER OF DAYS	
Surface	7,628¼
Underground	17,485¾
Total	25,114
AMOUNT FOR LABOR	
Surface	25,753.15
Underground	69,966.43
Total	95,719.58

Proportion Surface to Underground Men:
1917 - 1 to 2.5

HOLMES MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1917.

KIND.	LINEAL FEET.	PER FOOT.	AMOUNT.
6" to 8" Stulls	35,680	.02¼	789.30
8" to 10" "	12,792	.04¼	538.18
10" to 12" "	9,896	.06¼	634.90
12" to 14" "	2,816	.085	227.36
Total	61,184	.035	2189.74
	LINEAL FEET.	PER 100'.	
5' Lagging	134,085	.6114	819.87
7' "	165,878	.55	912.33
Total Lagging	299,963	.577	1732.20
Poles	43,194	.95	410.35
Total	343,157	.62	2142.55
Product			68,773
Feet Timber per ton of Ore			.889
Feet Lagging " "			4.36
Feet Lagging per Ft. Timber			4.90
Cost per ton for Timber			.0319
" Lagging			.0251
" Poles			.0059
" Timber, Lagging & Poles			.0629
Equivalent of Stull timber to Bd.Measure			107,543
Feet Board Measure per ton of ore			1.56
Total Cost of Timber,Lagging & Poles			4332.29

HOLMES MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 7.
50% 1½"x8" L.F.	42,850	.191	8,192.43
60% ¼"x8" L.F.	1,000	.1815	181.50
Total Powder	43,850	.1911	8,373.93
Crescent Fuse	126,000'		795.17
Blasting Caps	19,900		252.42
Sundries			29.77
Total Fuse,Caps,Sundries			1,077.36
Total Explosives			9,451.29
Product			68,773
Pounds Powder per ton of Ore			.156 ? .633
Cost per ton for Powder			.121
" " Fuse			.016
" " Explosives			.137
Avg. Price per lb. for Powder			.1911

Mine Started on Operating Basis March 14, 1917.

NEGAUNEE MINE - 1917.

During the year, 1917, the Negaunee Mine operated on a single shift of 8 hours from 8 A. M. to 5 P. M. The night hoisting which was started in October, 1915, was continued throughout the year. The product was 543,757 tons; this including the stock pile over-run of 12,000 tons, 7,000 tons being credited to the Non-Bessemer and 5,000 to the Bessemer product. This output represents 6,671 tons more than the year 1916. On December 31st there was in stock 50,090 tons of Bessemer and 32,140 tons of Negaunee or a total of 82,230 tons. This is 47,259 tons less than we had in stock December 31st, 1916.

The conditions at the mine were favorable for a large product and our only handicap was insufficient force. During the early winter our product was good but with the advent of summer there were practically no applicants for work, this scarcity of labor being not only here but throughout the country. In addition to this there was considerable labor agitation particularly among the I. W. W. which had a large following among the miners here. During the early fall, however, a detachment of the State Constabulary made its headquarters in Negaunee and since then there has been no trouble of any kind. It was shortly after this that the Government arrested the leaders of this organization throughout the country. The draft law affected labor comditions somewhat, a number of our men being taken. As each detachment went to camp there was a noticeable shortage of men at the mine, the friends of those drafted evidently staying home to celebrate and bid them farewell.

The underground conditions are favorable for a good season the coming year if labor is to be had. The equipment is all in good shape.

UNDERGROUND

Following is a brief description of the work on the various sub levels and levels where work was done through the year.

968' SUB LEVEL.

This sub level is located about 400' North of #2 shaft. Work was started here a year ago. The development was continued and the sub level

finished during the year. Several years ago mining had been started in this area but on account of the sand runs all of the workings were bulkheaded to prevent sand from getting into #2 shaft. In the old stopes sand was encountered during the year but not under pressure. The floor of the sub level was lagged down when mining was completed.

945' SUB LEVEL.

This sub was opened North of #2 shaft under the 968' sub. The development was to the Northwest and Southeast of the dike which runs transversely through the sub level. The Northwest area was opened to a point 125' Northwest of the dike and was there cut off by old stopes of lean ore and jasper contact. To the Southwest three contracts have been employed the past month developing near the old stopes. This area has been reached by raises 9, 10, and 11 recently put up from the 918' sub level.

On the Southeast side of the dike the hanging has been outlined; the ore being 150 x 125' in size; about half of this area has been mined and three contracts are now stoping there pulling back to the Northwest toward the line of raises from the 918' sub level.

930' SUB LEVEL.

This sub level was started about November 1st under the 945' sub. The development to date has been to the Southeast of the dike toward the hanging at A-1 to #6 raises inclusive; #6 being the most Northerly. From this raise to the Southeast lean ore and jasper has been encountered although the breast of the drift is now 90' from the raise. At a-1 raise a drift was started to the Northwest which ran into an old stope at 40' from the raise. Double spiling has been used here but to date it has been impossible to get through the stope.

918' SUB LEVEL.

This sub level formerly called the 400' level was opened several years ago, and abandoned on account of sand. The idea was to attack the ore which existed in the Northeast end of the mine near the old Barasa workings. The sub levels were opened at a point 60 to 80 feet above this level but little work had been done when it became necessary to abandon them on account

of the sand encountered in this territory. The968' sub which I mentioned above and which was developed from this level worked within 300' of the old Barasa workings where a very large flow of water had been encountered and which workings are at present full of water.

On this sub level during the year a new travelling road to the sub levels above was made by driving North from the old drift which ran East at a point 200' North of the shaft. This road was driven North and Northwest a total distance of 125' and there a raise was extended to the 945' sub. This travelling way was made with the idea of making a second outlet from the subs above the 918' which could be of use in case sand was encountered and their exit cut off through the ore tramming drift. During the year a little sand had come in on the Northwest side of the 968' sub level, just enough to cause a little anxiety among the miners and to show that extreme care would have to be taken in our mining operations. We felt considerably easier after the second outlet had been provided.

In the main drift to the North raises 9, 10 and 11 have been put up toward the West to the 945' sub level. The ore from above the 918' is dumped into chutes and on this level trammed to the raise which extends to the 825' sub level; on this latter level it is transferred to raises which extend to this level from the 9th level.

825' SUB LEVEL.

The transfer raise through which the ore from the 918' sub is transferred to the 9th level was constructed to fill the cars from the end. This caused considerable delay and during the year was changed so that the cars could be filled from the side. This slight change helped conditions greatly, the cars being filled much more quickly.

756' SUB LEVEL.

This sub level is located in the Northwest end of the mine in the American Mining Co. pillar and was opened under the Maas shrinkage stope. 56-B raise from the 10th level extended to an elevation of 733'. From this elevation small raises were put up to the 756' sub. The whole territory here was badly shattered and open stopes were found to the North, South and

Northeast, as well as above. No mining could be safely done as it was at the top of the available ore pillar on the Negaunee side. It was thought that a considerable quantity of ore might be found on the foot side under the shrinkage stope which had been started on the Negaunee side of the line. If ore extends there it is so mixed with sand and rock as to make it practically unmerchantable.

733' SUB LEVEL.

This is also in the Northwest end of the mine principally in the American Mining pillar and was developed from 56-B and 56-C raises. The sub level extends 165' from the foot to the hanging and is split into by a horse of jasper dividing it into Northeast and Southwest bodies. The Northeast area extends to the Maas line on the West, the foot wall on the North, and the old Negaunee workings on the East. The Southwest body was cut off on the South and West sides by jasper and on the East by the old workings. Mining has beencompleted in this sub level.

720' SUB LEVEL.

A body of ore was left on the North foot wall East of the 1000' East coordinate line or to the East of 40 raise to support the old 6½ level which extended [illegible] in this territory from the 9th level to the 720' elevation. This sub level extends East from 40 raise, 300 feet, and was 100 feet wide from the foot to the hanging or fault which extends along the South edge of the deposit. The mining on this sub level has been completed.

6½ LEVEL.

Work at this elevation was carried on in two sections of the mine.

In the Northwest end in the American Mining Co. pillar immediately adjacent to the Maas mine on the completion of the 733' sub level. The mining area here was bounded on the North and Northwest by the Maas, on the North by the foot, South by jasper, and East and Southeast by the old Negaunee workings. The mining is now in progress, two contracts being engaged. A squeeze occured in this section of the mine early in November probably caused by the settlement of the hanging wall but necessitating our abandoning work

here for two weeks. When work was resumed it was necessary to retimber the old drifts which had been broken down by the pressure.

The other area mined on this level was East of 40 raise along the North foot wall; work was started here on the completion of the 720' sub above. Mining is still in progress, two contracts in the West end are taking out the pillars, while on the East, two contracts are developing.

700' SUB LEVEL.

In the extreme Northwest end of the mine in the American Mining Co. pillar a new sub level has just been started. This development is carried on from 56-C raise. At present this little sub level is being used as a travelling road to the $6\frac{1}{2}$ level above, where the drifts were crushed in the November squeeze.

In the South end of the mine at 17-C raise a sub level was started; this is just to the North of the dike which runs through the formation in an Easterly and Westerly direction. Evidently, we are at the top of the ore as the sub level consists of little more than a drift. The hanging cutting off the ore on three sides, and the dike on the fourth.

690' SUB LEVEL.

North end of Mine.

Here on the North foot wall East of 40 raise a sub level has just been opened running from 40 raise East to 37 raise a distance of approximately 100 feet. This is only for development purposes as no mining can be done until the completion of the sub level above at the $6\frac{1}{2}$ level elevation.

South end of Mine.

At 17-C raise a new sub level has been outlined extending from 17-C raise to 17-G raise. This sub level is being cut off on the West and North by the hanging and on the South by the dike. To the East at a point 5 0 ft. from 17-C and 17-D raises a large crack 18" wide was encountered. At first this was supposed to be a water course but as old timber has been found in it it has evidently been caused by the pulling of the mined area to the East of this point; large rooms were formerly located there.

663' SUB LEVEL.

This sub level is wholly in the Northwest end of the mine. To

the East of the American Mining Co. pillar and West of 40 raise on the North foot wall; was started a year ago and finished during the present year; it extended from the foot to the caved hanging. The latter contained considerable sand. This is in the section of the mine that was dropped after the sand flows of several years ago. The formation was very much broken up and required considerable timbering.

653' SUB LEVEL.

This sub level is also in the Northwest end of the mine under the 663' sub and is located on the North foot wall between the American Mining Co. pillar and 40 raise. It was entirely opened and mined during 1917 with the exception of a few pillars that are now being taken out. On the South side of this sub level old workings and sand were continually encountered.

In the South end of the mine at 12-D raise a drift was started at an elevation of 657'. This raise was located in the pillar between old rooms. Open stopes were found to the Northeast and Southwest, these spaces being directly over the old 8th level rooms. As the old 8th level maps show mining in this area to be only one set high and as the 8th level was at the elevation of 640' ore must have been run here at some time or other from these rooms. In places mining has extended above the elevation of 683' which was reached by the engineers in making their surveys. The idea of opening this 670' sub level was only for exploratory purposes.

640' SUB LEVEL.

In the Northwest end of the mine East of the American Mining Co. pillar the 640' sub level has just been started on the foot wall from 31 to 48 raises. Drifts have been extended to the foot and South to the caved area. This sub level will be developed to the East as the mining above is finished. The mining South of the raises here is in crushed ground as this whole area was dropped at the time of the sand runs. Jasper, sand, and old timber are encountered. This section of the mine is wet and requires continual retimbering.

In the South side of the mine at 12-D raise a drift has been extended toward the foot to explore. This little sub level is in the pillar

with square set rooms on either side of the drift. It is about the same elevation as the sill floor of the old 8th level.

630' SUB LEVEL.

This was located in the Northwest end of the mine between 29 and 31 raises South of the large dike. This area was badly cut up with old square set rooms and jasper in place; the openings were extremely irregular.

9th LEVEL.

In the extreme Northwest end of the mine a drift was driven to the West under the American Mining Co. pillar to hole to the raises put up from the 10th level to attack the ore on the Maas-Negaunee sides of this pillar; as soon as the shrinkage stope above the 6½ level was completed. These raises on the Negaunee side were 56-C and 56-D; the otherswere on the Maas. The sub levels opened to date in this area are the 756', 733', 700', and the 6½ level, already mentioned in this report. Between raises 31 and 35 on the South of the big dike all remaining pillars have been mined.

In the South end of the mine, a main level drift has been driven to the North at a point 20 feet East of the 800' coordinate line and raises 17-B and 17-H inclusive have been put up to the hanging. At a point 120 feet East of this drift another main level drift is now being driven to the North. This area is being opened to mine the ore shown to exist there from the developments on the 595' sub level at160 raise. Raises 12-C and 12-D were put up in the pillars between the square set rooms for exploratory purposes. The conditions found were mentioned under the 663' sub level, South side.

595' SUB LEVEL.

This sub level was opened under the hanging between 159 and 161 raises. Mining was stopped at this elevation as ore was found to exist above it on the East.

588' SUB LEVEL.

The only mining in this large sub level during 1917 was to the Northeast of the dike in the roll in the hanging between 165 and 167 raises and two small pillars in the main sub level at 72 raise.

580' SUB LEVEL.

A year ago this sub level had been opened ready for mining from 73 raise West to 95 raise. This year the development was extended West to 99 raise and the whole sub level mined. Southwest of the main sub level in the roll in the hanging and Northwest of the large dike, mining is in progress between 165 and 167 raises.

565' SUB LEVEL.

This sub level is also in the main ore body directly below the 580' sub level. It has been opened and mined from 75 raise West to 94 raise. From 94 to 98 raises inclusive the remaining pillars are now being taken. In the roll in the hanging to the Northwest of the dike and under the hanging the ore has been mined at 165 raise. The ore on the Northeast of this raise will be taken when the mining above is completed.

555' SUB LEVEL.

This sub level is being developed in the main ore body between 76 and 96 raises inclusive. Drifts have been extended to the foot and toward the hanging and stoping is about to commence.

545' SUB LEVEL.

This sub level is in the roll in the hanging; a small pillar has been taken Northwest of the dike under the hanging Southwest of 167 raise. No further mining can be done in this sub level until the ore above has been taken.

530' SUB LEVEL.

This was opened a year ago in the roll in the hanging; a small pillar between raises 169 and 170 was mined during the year. Nothing is being done there at present.

10th LEVEL.

A new main level drift was started from the main shaft cross cut on the 1000' East coordinate line to the North and after drifting about 150 feet was turned Northwest parallel to and midway between the present ore drifts. The idea of this drift was to cut down the tramming distance in the sub levels. Heretofore in the main sub level between the 9th and 10th, 100'

drifts were driven from the tops of the raises toward the foot and hanging. We have found that before the ore could be mined back to the raises the drifts had to be repaired several times. By driving this new main level drift the tramming distance in the subs above can be cut down 50' to the foot and hanging from the tops of the raises. We hope that this will materially decrease the timbering.

11th LEVEL.

Last year the development of this level was at the winze, the main level drift had been extended to the North 110 feet, and South about 73 feet. During the year 1917 this North drift was extended 330 feet and a branch drift off of this to the Northwest, 100 feet. At #3 shaft part of the plat has been opened and concreting will start there early this coming year.

12th LEVEL.

A year ago a drift driven from the winze for the development of this level had reached a point 900' distant from #3 shaft. During the year this distance was driven and the plat opening partially cut out on the North side. Arrangements were than made to raise the shaft. This level is now being used for tramming purposes, all of the rock excavated in stripping down the shaft and cutting the 11th level plat and pocket, is handled on this level back to the winze and there hoisted to the 10th level.

No. 3 SHAFT.

When the drift on the 12th level reached the shaft site, a raise was started and holed into the bottom of the present shaft below the 10th level. A rock pentise was left to protect the men working but an opening was made under the ladder compartment for ventilation purposes and also to lower the shaft sets into place. Below this pentise stripping was started and by the end of the year the shaft had been opened out to regular size and timbered down to within one set of the back of the 12th level. At the 11th level a plat opening was partially cut and below was made the excavation for the measuring pocket and part of the storage pocket. The material at the 11th level plat is mixed jasper and breaks off in large slabs. In order to secure the shaft timber and properly support the plat opening concrete was

run around the sets below the floor of the 11th level, back of the lath. The storage pocket at the 11th level will now be finished and the plat opening cut and concreted as rapidly as possible.

UNDERGROUND IN GENERAL

The development to the North of #2 shaft I have mentioned above ashaving started during 1916. This work is at an elevation of about 918' mean sea level which is in the neighborhood of the 400' above the 9th level. During the summer timber is taken into this sub level from #2 shaft and in the fall before freezing weather comes as much timber as possible is piled in the drifts of the old 400' level. Last year in the early spring we ran out of timber; this meant that it would be necessary to hoist timber from the 9th level a distance of nearly 400' if operations were to be continued. It was impossible to get timber through #2 shaft as it was filled with ice. Operations here were consequently cut down so there were only one or two contracts operating early in the spring until warmer weather made it possible to operate again through #2 shaft.

In the Northwest end of the mine in the Railroad pillar work started on both the Maas and Negaunee sides as soon as the shrinkage stope on the Maas side was completed. This is in the area that has been held up for years.

On the 10th level I have mentioned the new main level drift that had been started. This was made between the main level drifts at a 100' interval and cuts down the tramming distance in the sub level which heretofore had been 100 feet both toward the foot and hanging, to 50 feet in these directions. It was figured that by shortening this distance the sub levels could be mined faster and consequently there would be less retimbering. This will be determined by the operations the coming year. This new 10th level drift disclosed the fact that the foot at this point extended to the dike which crosses the formation between raises 81 and 164. This makes the foot 300' farther to the Northwest than we expected to find it.

The developments have been carried on above the 8th level on the foot side in the South end of the mine for exploratory purposes as some time in the future this ore body will have to be attacked. This territory is

full of old rooms and possibly considerable sand will be encountered. On the 9th level two main level drifts were driven in the South end to mine the ore under the hanging, while on the 12th level the main cross cut started a year ago was driven back to the shaft; raises put through at the bottom of the present shaft and stripping and timbering is now in progress. It is hoped that this shaft will be completed and the 11th level drift extended through to the ore formation by the middle of the coming year.

The water pumped remains about the same as we had a year ago and during the year averaged about 1300 gallons per minute.

METHOD OF MINING.

This has not changed. We are working as near as possible under the lagging of the sub level above. For the most part 40% powder is used, tamping bags being employed at all times. Larger air lines have been run to the sub levels from the main lines and wherever new raises are constructed, two compartment crib raises are used in preferance to those without timber. We have found thatin the old raises where no timber was used that as we approach the levels these have enlarged to openings of such size as to make mining operations difficult. By using two compartment raises the timber can be taken into the sub levels readily by means of a little tugger hoist or a larger timber hoist. This obviates the tramming of timber long distances on the sub levels.

SCRAPER.

In April an innovation was introduced in the method of getting the ore into the chute at the sub level other than by the use of tram cars. This was demonstrated by the Ingersoll-Rand Co. A small hoist with the capacity of 1000 lbs. was mounted on a column near the raise. It was attached by means of a 5/16" rope to a 3 cu. ft. scraper and the ore scraped from the breast of the drift after blasting; one of the miners operating the hoist, the other holding the scraper. The latter following it to the raise to dump it, after which he would drag it back to the breast for another load. The scraper and rope weighed approximately 70 lbs.. While this is not extremely heavy it was thought that if the scraper could be brought back mechanically to the breast rather than being pulled back by the miner the arrangement might

prove more efficient; consequently, a second hoist was set up on the column; the rope from this hoist was run through a sheave located at or near the breast and from there connected to the scraper. By this means, after the scraper was dumped it was immediately pulled back to the breast by the miner at the post who operated both hoists. This latter scheme worked fairly well at first - the arrangement being to have three men in one contract work two breasts, two men working the scraper while the third did the drilling. We were handicapped greatly on account of insufficient air pressure which made it impossible to operate the hoist at all when the pressure was low. If the air pressure could have been maintained at 80 lbs. or slightly less, I think it would have prooved a most successful method of tramming if the distance was not too great, say 75. ft. or thereabouts. The Ingersoll-Rand representatives watched out experiment and designed a single hoist with a double drum so that by means of one hoist the scraper could not only be pulled to the ore chute but also dragged back. This would make a much better arrangement than using two hoists and much less expensive. We found, however, that after using the device a couple of months that on account of the insufficient air pressure we could not average any more ore per man by this method of tramming than by our old method, the tram car, so it was discontinued. We suggested to the Ingersoll-Rand people that they might provide a more powerful hoist without greatly increasing the price by simply installing a low gear to start the scraper as it was taking its load. We experimented a number of ways before finally discarding the scraper, one of which was to load the scraper in the breast and pull it backward to the raise. This worked nicely for a short tram but when the tram increased in length considerable of the ore was lost. The experiment practically cost us nothing as all of the tugger hoists are now being used in hoisting timber from the main level to the subs. They are easily set up and strongly made requiring few repairs.

SQUEEZE.

I have mentioned that a squeeze occured in the Northwest end of the mine early in November. This was in the Railroad pillar between the Maas and Negaunee Mine. No settlement has occured since that date but we hope

to find that the barrier between the two mines has broken down so as to lessen the possibility of sand runs occuring at this point.

LOW PHOSPHORUS ORE.

Our Bessemer product had run consistently low in phosphorus during the season. We were anxious to make a still lower phosphorus product. In order to do this we carefully selected those contracts which showed the lowest phosphorus content and separated them into the Bessemer grade. Our results were no lower in phosphorus than before but cut down our product considerably. After experimenting a few days with this we decided to return to our former method of grading and which we have continued from that date.

MAIN LINE CARS.

A year ago I mentioned that we were having considerable trouble with our roller bearings and axles on these cars. The 7" bearing which we have used this past year has been somewhat more satisfactory than the old bearing which was 1" shorter, but we are still having excessive break downs in these assemblages. We have adopted a heavier spring 1" higher than we formerly used and made of 7/8" steel rather than 3/4". These have held up fairly well, practically eliminating our trouble from this cause. We still have occasional broken axles although not as often as a year ago. We are endeavoring to keep our main line tracks as clean as possible, feeling that this has as much as anything to do with the operation of the cars. New cars have been purchased for the 11th level which have not yet been taken into the mine but will be in a month or so. Instead of roller bearings these are fitted with M.C.B. bearings. The wheels instead of being manganese are cast iron.

A new locomotive is on the ground which was purchased for the 11th level.

FATAL ACCIDENT.

A fatal accident occured Monday, October 15th at 4 P. M. when Gust Lisku, miner in 43 contract, on the 565' sub level was killed by a fall of ground. Lisku and his partner, Sylvester Suppala, were slicing at a point about 20 feet from 94 chute. They had blasted on Friday and timbered Sat-

urday after tramming most of the ore. On the left of their working place was their abandoned drift which was partly crushed. During Sunday some of the caved material from the mat had fallen down on the floor of this abandoned drift. Lisku was standing in this drift shovelling the mixed ore into his car when, without warning, there was a run of rock and timber from above and he was pinned to the floor and covered with the exception of his head. Before he could be extracted he died. From the position of his body he must have been badly crushed.

SURFACE

Last winter considerable trouble was had with the butterfly which deflects the ore from the skips to either tram car. Frozen ore made it impossible to operate this at times until it was thoroughly thawed out. To obviate this trouble this season we have enclosed theheadframe from the top landing up including the dump. This should help matters greatly and also cut down considerably the steam consumption.

GARDENS.

Early in the year when the Federal Food Administration requested that all available space be planted so as to provide food for the coming season, our Company fenced and plowed all our vacant desirable ground and parcelled it out to our employees and others for garden patches. The new land, that is land that was in sod, was fenced and plowed by the Company without expense to the gardener. Potatoes were procured and sold to our employees at actual cost. The movement was appreciated greatly by the men and although the price for the seed potatoes was extremely high we heard no complaints. The season was not a good one and the harvesting time was cold and wet so that the yield was only average. However, most of our men have requested permission to have the same plots the coming season.

FIRES.

A small fire occured at #2 shaft head frame on September 5th at 11 o'clock A. M. The fire was caused by lightening and no great damage was done. Located as it was, directly over the mine opening it caused a little anxiety at the time.

ENGINE HOUSE.

A new 450 H. P. motor for the fly wheel set which operates the skip and cage hoists was set up and installed in May. This took the place of the 350 H. P. set which has given us continual trouble on account of being overloaded. Since this installation we have had no trouble at all with the set.

NEW TOP TRAM.

Ever since #3 shaft has been operating trouble has been experienced with the top tram engine. During the summer it was decided to install new engines similar to those in use at the Stephenson Mine, Gwinn District, and the one installed last year at the Maas Mine. This is a single sheave type which has worked very successfully both places. The engine house has been built and foundations are now in place. It is hoped that this installation will be working by the 22nd of January. The motors and controllers which are used with our present top tram system will be employed. With the new system of tramming there is less friction on the rope and less power is needed to operate.

STOCKING TRESTLE.

On July 11th, the South side of the West trestle buckled between bents 5 and 6. Early in the spring ore had been stocked around the knee braces, which run from the girders to the concrete column. This had been dug away so as to take away any strain on these members. One cut had been taken on the South side of the stock pile, the ore on the North side of this cut standing almost vertically. This slabbed off occasionally which it did at this time; at the same moment, however, a loaded car was passing. The weight of the slab hitting the braces, which were under strain from the rolling load of the car, caused them to buckle. It was necessary to place a wooden bent there temporarily until the trestle could be repaired.

GENERAL.

West of the shop building a snow fence has been erected to protect the motor tracks going into the lagging piles.

A new water pipe line was installed early in the season at the office and laboratory; the old pipes being practically choked.

The painting of the trestle which started a year ago was completed during the year.

PRODUCTION.

Month.	Bessemer		Negaunee	Total	Rock
January	11,244		35,815	47,059	2,072
February	11,864		30,996	42,860	1,860
March	13,340		32,368	45,708	2,152
April	9,420		28,840	38,260	2,424
May	10,356		32,483	42,839	1,988
June	11,996		34,084	46,080	1,524
July	11,913		36,005	47,918	748
August	11,261		36,862	48,123	1,268
September	6,637		33,461	40,098	1,084
October	11,083		34,993	46,076	1,736
November	10,809		32,787	43,596	1,660
December	11,764		31,376	43,140	1,460
Total	131,687		400,070	531,757	19,976
Stock pile over-run	5,000		7,000	12,000	
	136,687		407,070	543,757	
Transferred from	6,533	to	6,533		
" to	152	from	152		
Total	130,306		413,451	543,757	19,976

ESTIMATE OF PROBABLE ORE.

Following is an estimate of the ore shown above the 10th level, December 31st, 1917.

Original tonnage in area above 500' contour from 100' sections,	9,907,812 tons,
Total ore mined to Dec. 31st, 1917, (excluding American Mng. Co.) (American Mng. Co. 17,256 tons)	6,830,771 "
Balance left in mine Dec. 31st, 1917	3,077,041 "

GRADED AS FOLLOWS:

Bessemer ore,	Trade name,	
Developed,	Negaunee Bessemer,	307,704 "
Non-Bessemer Ore,	Negaunee	2,769,337 "
Total Bessemer and Non-Bessemer		3,077,041 "

ASSUMPTION:

12 cu. ft. equals one ton. 10% deduction for rock.
10% " for loss in mining.

Percentage of Bessemer, 10

Area 9th level, 400,750 sq. ft.

ESTIMATED ANALYSES.

	Iron.	Phos.	Sil.	Mang.	Alum.	Lime.	Mag.	Sul.	Loss by ignt.	Moist.
NegauneeBess.dried 212°	60.90	.060	7.12	.270	2.37	.710	.340	.010	2.04	
Soft Hematite - natural	53.59	.053	6.27	.238	2.09	.625	.299	.009	1.80	12.00
Negaunee dried 212°	59.20	.094	7.65	.310	2.93	1.05	.540	.015	3.00	
Soft Hematite - natural	52.04	.083	6.72	.272	2.58	/92	.475	.013	2.64	12.10

ANALYSIS OF PRODUCTION.

Production 1917,	543,757 tons,	
" 1916,	537,086 "	
Increase 1917,	6,671 "	
Cost of production 1917,	$604,367.46 - cost per ton	1.111
" " 1916,	494,140.49 " " "	.92
Increase 1916,	110,226.97	.191

During 1917 the mine worked one eight hour shift for 303 days. The average number of men employed during the year was 360 for a total of 109,223 days. In 1916 an average of 358 men were employed for a total of 107,598 days - an increase of 2 men and 1625 days. The average tons per man underground in 1917 was 5.94 or an increase of .003 per man over 1916 whenthe average tons per man was 5.91. The total tons per man in 1917 was 4.81 while in 1916 it was 4.99 a decrease of .18 tons per man.

There were practically three increases in wages affecting the 1917 cost; December 16th, 1916, May 1st, 1917, and October 1st, 1917. The total increase this year over last year is $.73 per day or 25.93%. The actual amount paid due to increase in wages this year over last year is $79,732.79 which based on actual product equals .147 per ton.

In 1917 the total supply cost was $190,730.36 against $161,324.28 or an increase of $29,406.08 which based on actual product equals an increase of $.05 per ton.

The increase of .147 per ton for labor account of increases in wages and the increase of .05 per ton for supplies totals an increase of .197 per ton. This increase deducted from the 1917 cost per ton of $1.111 equals .914 which shows that if conditions were normal with 1916 the cost per ton would be .006 less than 1916.

GENERAL EXPENSE.

No. 26, Insurance,	1917 Amount $46.87 - cost per ton	.000
	1916 " 47.20 "	.000
	Decrease .33	

No. 27, Engineering, 1917 Amount $3010.58 - cost per ton .006

1916 " 2461.49 " .005

Increase, 549.09 .001

This increase due to more engineering work being necessary. underground and increase in wages.

No. 28, Analysis, 1917 Amount $13,841.33 - cost per ton .025

1916 " 11,470.14 " .021

Increase 2,371.19 .004

In 1917 the total operating cost for the laboratory was $12,019.44 and the total number of determinations 130,432. In 1916 the cost was $9,446.74 and the determinations 112,636. An increase in expenditure of $2572.70 and an increase of 17,796 determinations.

Cost per determination in 1917 .09215

" " " " 1916 .0838

Increase, 1917 .00835

Due to increased cost of labor and supplies.

No. 30, Personal Injury Expense, 1917 Amount $8750.50 - cost per ton .016

1916 " 5857.27 " " " .011

Increase 2893.23 .005

Increase includes - fatal accident on Oct. 15th to Gust Liska, and several serious accidents Jno. Chirio - loss of right hand -- Frank Carilli fracture and crushed 9th and 10th vertibrae.

No. 30-A, Mine Office, 1917 Amount $14533.44 - cost per ton .027

1916 " 10012.87 " " " .018

Increase 4520.57 " " " .009

SUB DIVISION

	Direct charges	Dentral Office
1917	8816.26	5717.18
1916	5932.57	4080.30
Increase	2883.69	1636.88

Increase in direct charges due to police protection put on at the mine in Feb. 1917. Also Negaunee mine absorbed a proportion of the State Constabulary expense while they are in town.

Total General Expense

1917 Amount $40182.72 - cost per ton .074
1916 " 29848.97 " " " .055
Increase 10333.75 .019

Accounted for in 27 - 28 - 30

MAINTENANCE

No. 125, Tracks & Yards,

1917 Amount $2098.16 - cost per ton .004
1916 " 1684.35 " " " .003
Increase 413.81 .001

This increase due to increase in wages.

No. 126, Docks, Trestles, & Pockets,

1917 Amount $1861.82 - cost per ton .003
1916 " 2062.73 " " " .004
Decrease 200.91 .001

Decrease due to 1916 accounts absorbed cost of building 10th level auxiliary pocket.

No. 127, Buildings,

1917 Amount $2761.80 - cost per ton .005
1916 " 207.10 " " " .000
Increase 2544.70 .005

This increase due to a new Brooks Brand roof put onEngine House; Shaft House Building enclosed from the top landing to top sheaves; a new concrete top tram transfer house erected.

No. 128, Shop Machinery,

1917 Amount $282.19 - cost per ton .001
1916 " 323.90 " " " .001
Decrease 41.71

No. 129, Boiler Plant,

1917 Amount $726.13 - cost per ton .001

1916 " 133.06 " " " .000

Increase, 593.07 .001

This increase due to a new hot water tank and one smoke stack erected in 1917.

No. 130, Hoisting Mchy.

1917 Amount $3041.09 - cost per ton .005

1916 " 2659.66 " " " .005

Increase, 381.43

SUB DIVISION

	Wire rope	Machy. repairs
1917	528.72	2512.37
1916	646.44	2013 .22
	Decrease 117.72	Increase 499.15

Increase in Machinery repairs due to two brake magnets and installing frame on cage hoist $406.00

No. 131, Compressor and Power Drills,

1917 Amount $1509.28 - cost per ton .003

1916 " 1563.69 " " " .003

Decrease 54 .41

SUB DIVISION

	Repairing Compressor	Power Drills.
1917	380.04	1129.24
1916	410. 29	1153.40
	Decrease 30.25	24.16

Six auger drills and two Leyner drills charged in 1916. Six auger drills and 1 BCRW 430 Ingersoll Rand charged in 1917.

No. 132, Pumping Machy.m

1917 Amount $1588.75 - cost per ton .003

1916 " 2850.91 " " " .005

Decrease 1262.16 .002

Less repairs made to electric pumps in 1917.

No. 133, Top Tram Engine & Cars,

1917 Amount $4165.72 - cost per ton .008

1916 " 2945.55 " " " .006

Increase, 1220.17 .002

SUB DIVISION

	General Repairs	Wire rope
1917	2050.37	2115.35
1916	1780.41	1165.14
Increase	269.96	950.21

Increase in general repairs due to the installation of a new top tram transfer started in December.

No. 134, Skips & Skip Roads,

1917 Amount $1921.30 - cost per ton .003

1916 " 1782.62 " " " .003

Increase 138.68

This increase due to increase in wages.

No. 135, Underground Tracks & Cars,

1917 Amount $3251.83 - cost per ton .006

1916 " 2627.89 " " " .005

Increase 623.94 . 001

This increase due to replacing of ten sets of 10" roller bearing trucks for sub level cars.

No. 136, Electric Tram Plant,

1917 Amount $23294.45 - cost per ton .043

1916 " 20725.96 " " " .039

Increase 2568.47 .004

SUB DIVISION

	Eng.&Dynamo	Loco.	Wiring	M.L. Tracks	M.L.Cars
1917	79.98	4015.02	3026.07	11218.96	4954.42
1916	23.67	2988.38	3618.35	9478.57	4616.99
	56.31 Inc.	1026.64 Inc.	592.28 Dec.	1740 .39 Inc.	337.43 Inc.

Increase in Locomotives due to high cost of all repairs necessary for their up keep.

Decrease in wiring due to 1916 cost extra

ordinary high on account of bonding rails on the main levels.

Increase in Main Line Tracks due to increase in wages and price of main line rail.

Increase in main line cars due to increase in wages, and 10 cars equipped with roller bearing trucks 1917.

No. 137, Telephones & Safety Devices,

1917 Amount $452.85 - cost per ton .001
1916 " 466.81 " " " .001
Decrease 13.96

Total Maintenance,

1917 Amount $46955.37 - cost per ton .086
1916 " 40044.23 " " " .075
Increase 6911.14 .011

MINING EXPENSE

No. 150, Air Pipes,

1917 Amount $6295.15 - cost per ton .012
1916 " 4643.38 " " " .009
Increase 1651.77 .003

This increase due to increase in wages and cost of supplies, also extension of 4" line on 12th level for new development.

No. 151, Compressors,

1917 Amount $10920.59 - cost per ton .020
1916 " 11072.03 " " " .021
Decrease, 151.44 .001

	1917	1916
Air made by Negaunee Comp.	343,334,250	350,118,000
" purchased from Maas Mine	112,191,000	111,101,000
Total cu. ft.	455,525,250	461,219,000
Cost of operating Neg. Comp.	9120.59	9188.03
Amt. charged by Maas Mine	1800.00	1884.00
Total	10920.59	11072.03
Cost per 1000 cubic foot	.024	.024

No. 152, Hoisting,

1917 Amount $21821.87 - cost per ton .040

1916 " 19928.48 .037

Increase 1893.39 .003

This increase due to increase in wages and increased production.

No. 153, Pumping,

1917 Amount $32684.87 - cost per ton .060

1916 " 32091.15 " " " .060

Increase 593.72

SUB DIVISION

	1917	1916
Operating Elec. Pumps	$32529.80	$32017.21
Cleaning Sump	155.07	73.94
Total	32684.87	32091.15
Total gals. water pumped	676,485,880	702,167,100
Gals. water pumped per minute	1287	1332

Increase due to increase in wages.

No. 154, Sinking and Shaft Repairs,

1917 Amount $9726.46 - cost per ton .018

1916 " 284.78 " " " .001

Increase 9441.68 .017

This increase due to development of 11th and 12th level. The shaft has been sunk an additional 148 feet and work has been done on the 11th level plat and pocket.

No. 155, Rock Drifting,

1917 Amount $20346.20 - cost per ton .037

1916 " 19073.37 " " " .035

Increase 1272.83 .002

SUB DIVISION

	Drifting	Per Ft.	Raising	Per Ft.
1917	-2854	4.54	582	2.24
1916	-2778	3.30	1222	1.86
	Inc. 76	Inc. 1.24	Dec. 640	Inc. .38

Of the 2854 feet drifting in 1917, 1589 ft. was main level drifting on the 10th, 11th, and 12th levels.

No. 156, Breaking Ore,

1917 Amount $248513.51 - cost per ton .457

1916 " 193206.52 " " " .360

Increase 55306.99 .097

This increase due to increase in wages and cost of supplies.

EXPLOSIVES.

	1917	1916
Total lbs. of powder	199,000	191,425
Av. price per lb.	.165	.129
Total amount	32,743.20	24,854.05
Fuse, caps, etc.	6,064.70	4,863.47
Grand Total	38,807.90	29,717.52
Lbs. powder per ton ore	.366	.356
Cost per ton for powder	.060	.046
" " " all explosives	.071	.055

No. 157, Tramming,

1917 Amount $38061.72 - cost per ton .070

1916 " 28710.10 " .054

Increase 9351.62 .016

SUB DIVISION

	1917	1916
Tramming	31457.24	23349.85
Skip Tender & Bellmen	3356.38	2930.78
Cleaning Skip Pit	3248.10	2429.47
	38061.72	28710.10

The principal increase is in labor.

No. 158, Filling,

1917 Amount $3519.24 - cost per ton .006

1916 " 1484.57 " " " .003

Increase, 2034.67 .003

No. 159, Timbering,

1917 Amount $97306.60 - cost per ton .179

1916 " 92596.73 " " " .172

Increase 4709.87 .007

	1917	1916
Timber cost	12074.13	12247.48
Lagging & Poles	10063.38	9263.19
Total	22137.51	21510.67
Ft. Timber per ton ore	.588	.574
Cost per ton for timber, lagging & poles,	.0407	.04

The principal increase in in labor.

No. 160, Captain & Bosses,

1917 Amount $13356.44 - cost per ton .025

1916 " 9992.41 " " " .019

Increase 3364.03 .006

This increase due to increase in wages.

No. 161, Dry House,

1917 Amount $7002.49 - cost per ton .013

1916 " 4911.44 " " " .009

Increase 2091.05 .004

Increase due to increase in wages and the increase in price of 3/4 coal. Dry house acct. stands 50% of our heating plant expense.

No. 162, Top Landing and Tram.

1917 Amount $6137.35 - cost per ton .011

1916 " 5021.06 " " " .009

Increase 1116.29 .002

Due to increase in wages.

No. 163, Stocking Ore,

1917 Amount $331.61 - cost per ton .001

1916 " 317.81 " " ".000

Increase 13.80

No. 164, Sorting Ore,

1917 Amount $346.38 - cost per ton .001

1916 " 329.69 " " " .000

Increase 16.69

No. 171, Mine Ventilation, 1917 Amount $769.89 - cost per ton .001

1916 " 423.49 " " " .001

Increase 346.40

Increase due to extension of ventilation pipe on 12th level.

Flooding Lands Rental,

1917 Amount $125.00 - cost per ton .000

1916 " 125.00 " " " .000

Total Mining Expense, 1917 Amount $517229.37 - cost per ton .951

1916 " 424247.29 " " " .790

Increase 92982.08 .161

DELAYS.- ELECTRICAL.

Mar. 20 - 1 hour - no current and trouble with main cable in shaft.

May 18 - ¾ " transmission line near engine house burnt off.

DELAYS - NOT ELECTRICAL.

Mar. 21 - 27 - Decrease in product account of Maas-Negaunee air line frozen.

Aug. 22 - 4 hours - skip hoisted too far in dump wrecking skip and skip road.

NEGAUNEE MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR - 1917.

GRADE	IRON	PHOS.	SILICA
Negaunee Bessemer,	61.36	.055	6.06
Negaunee,	59.11	.083	7.66

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1917.

	Mine			Lake Erie		
GRADE	IRON	PHOS.	SILICA	IRON	PHOS.	MOIST.
Negaunee Special,	61.42	.055	6.14	61.50		12.03
Negaunee Bessemer,	61.43	.055		61.08	.057	12.49
Negaunee,	59.21	.083		58.85		12.64

ORE STATEMENT - DECEMBER 31ST,1917.

	NEGAUNEE BESSEMER	NEGAUNEE	TOTAL	TOTAL LAST YEAR
On Hand Jany. 1st, 1917,	77,317	52,172	129,489	123,958
Stockpile Overrun,	5,000	7,000	12,000	25,541
Output for Year,	125,306	406,451	531,757	511,545
Total,	207,623	465,623	673,246	661,044
Shipments,	157,533	433,483	591,016	531,555
Balance on Hand,	50,090	32,140	82,230	129,489
Increase in Output-1%			6,771	
Decrease in Ore on Hand,			47,259	

1917 - 1-8 Hr. Shift during year.

1916 - 1-8 Hr. Shift during year.

NEGAUNEE MINE.

NEGAUNEE MINE

SHIPMENTS FOR YEAR - 1917.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Negaunee Bessemer,	65,420	92,113	157,533	80,571
Negaunee,	256,329	177,154	433,483	450,984
Total,	321,749	269,267	591,016	531,555
Total last Year,	286,365	245,190	531,555	
Increase - 11%			59,461	

NEGAUNEE MINE.

NEGAUNEE MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 7.	1 9 1 6.	INCREASE.	DECREASE.
PRODUCT	543,757	537,086	6,671	
General Expense	.074	.055	.019	
Maintenance	.086	.075	.011	
Mining Expense	.951	.790	.161	
Cost of Production	1.111	.920	.191	
DEPRECIATION.				
Plant Account	.030	.674	.704	
Equipment	.001	.001		
Total Depreciation	.031	.673	.704	
Taxes	.180	.143	.037	
Central Office	.042	.036	.006	
Miscellaneous	231	.007	.007	
Cost on Stockpile	1.364	.419	.945	
Loading & Shipping	.025	.017	.008	
Administrative	.009	.010		.001
Total Cost on Cars	1.398	.446	.952	
No. Days Operating	303	299	4	
No. Shifts and Hours	1-8hr	1-8hr		
Avg. Daily Product	1794	1796		2
COST OF PRODUCTION.				
Labor	.751	.609	.142	
Supplies	.360	.311	.049	
Total	1.111	.920	.191	

NEGAUNEE MINE.

NEGAUNEE MINE.

COMPARATIVE WAGES AND PRODUCT.

	1917.	1916.	INCREASE.	DECREASE.
PRODUCT	543,757	587,086	6,671	
No. Shifts & Hours	1-8hr	1-8hr		
AVERAGE NO. MEN WORKING				
Surface	58	54	4	
Underground	301	304		3
Total	359	358	1	
AVERAGE WAGES PER DAY				
Surface	3.26	2.67	.59-22%	
Underground	3.88	3.12	.76-24%	
Total	3.78	3.05	.73-24%	
WAGES PER MO. OF 25 DAYS				
Surface	81.50	66.75	14.75	
Underground	97.00	78.00	19.00	
Total	94.25	76.25	18.00	
PRODUCT PER MAN PER DAY				
Surface	30.79	32.26		1.47
Underground	5.94	5.91	.03	
Total	4.98	4.99		.01
LABOR COST PER TON				
Surface	.106	.083	.023	
Underground	.653	.528	.125	
Total	.759	.611	.148	
AVG. PRODUCT BRK'G & TRM'G	10.14	10.98		.84
AVG. WAGES CONTRACT MINERS	4.10	3,23	.87	
" " " TRAMMERS	0	0		
" " " LABOR	4.10	3.23	.87	
TOTAL NUMBER OF DAYS				
Surface	17,657½	16,658¼	1.004¼	
Underground	91,565¾	90,945¾	.620½	
Total	109,223¼	107,598½	1.624¾	
AMOUNT FOR LABOR				
Surface	57,642.42	44,400.62	13,241.80	
Underground	354,953.74	283,728.85	71,224.89	
Total	412,596.16	328,129.47	85,466.69	

Proportion Surface to Underground Men;

1917 - 1 to 5.20
1916 - 1 to 5.63
1915 - 1 to 5.05
1914 - 1 to 4.69
1913 - 1 to 4.51
1912 - 1 to 2.68

NEGAUNEE MINE.

NEGAUNEE MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1917.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1 9 1 7.	AMOUNT 1 9 1 6.
4" to 6" Timber	816	. 015	12.24	
6" to 8"	127,566	.021	2689.52	1024.55
8" to 10"	109,010	.041	4423.07	7469.97
10" to 12"	73,852	.058	4258.87	3153.48
12" to 14"	8,503	.081	690.43	599.48
Total 1917	319,747	.0378	12074.13	
Total 1916	308,468	.0397		12247.48
	LINEAL FEET.	PER 100'.		
7' Lagging	1,184,345	.55	6459.17	7089.95
Poles	383,426	.94	3604.21	2173.24
Total 1917	1,567,771	.6419	10063.38	
Total 1916	1,530,214	.6053		9263.19

Product		543,757	537,086
Feet timber per ton of ore		.588	.574
Feet lagging " "		2.178	2.392
Feet lagging per foot of timber		3.74	4.165
Cost per ton for timber		.0222	.0228
" lagging		.0119	.0132
" poles		.0066	.004
" timber, lagging, poles		.0407	.04
Equivalent, of still timber to board measure		574,798	528,803
Feet Board measure per ton of ore		1.057	.985

Total Cost for timber, lagging & Poles	1917	22137.51
"	1916	21510.67
"	1915	19783.21
"	1914	13236.64
"	1913	12327.95
"	1912	12191.04
"	1911	15137.84
"	1910	14654.57
"	1909	14530.85
"	1908	11992.30

NEGAUNEE MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 7.	AMOUNT 1 9 1 6.
40% Powder	187,950	.159	29,888.90	19803.12
50% "				4184.30
60% "	11,050	.258	2,854.30	334.61
80% "				532.02
Total Powder	199,000	.165	32,743.20	24854.05
Fuse	659,000	6.02	3,966.33	2968.24
#6 Caps	107,600	12.87	1,383.64	1478.30
#8 Caps	14,100	21.10	297.64	224.27
Cap Crimpers	146	.422	61.72	55.41
Electric Exploders	200	5.595	11.19	43.50
Connecting Wire	1,288	.393	50.62	66.71
Tamping Bags	71,000	2.25	159.99	15.64
Powder Bags	192	.70	133.57	4.00
Leading Wire				7.40
Total Fure, Etc.			6064.70	4863.47
Total All Explosives			38807.90	29717.52
Product			543,757	537,086
Pounds Powder per ton Ore			.366	.356
Cost per ton for Powder			.060	.046
" " Fuse, Caps,Etc.			.011	.009
" " All Explosives			.071	.055
Avg. Price per Lb. for Powder			.165	.129

MAAS MINE - 1917.

During the year 1917 the Maas Mine operated on a single shift until June, when it was thought advisable to put on extra contracts to mine above the first level near the American Mining Co. pillar. Hoisting, however, continued throughout the year on both the day and night shifts. The product was 320,356 tons; the only over-run this includes was what was obtained during the summer months; the stock piles were not cleaned up so it was impossible to estimate what the over-run might be there. On December 31st there remained in stock 94,854 tons of Maas and 12,282 tons of Bessemer.

There were a number of changes in the surface equipment during the year. Anew spray condensor built in the fall of 1916 was put in operation. A new crushing plant was built adjoining the mine site, a boiler house erected, etc. These will be taken up and commented on individually.

Underground considerable development work was carried on and at the same time more contracts were employed as places were made available; the product showed a good healthy increase over that of 1916. This process we hope to continue so that during the coming year the product should show a still larger increase; having in mind to work up the mine to its full capacity just as early as possible. However, the manner in which this mine was opened with rooms opening off of each level make it impossible to start at either top or bottom and work it in any large sub levels. Operations are very much scattered but as time goes on we hope to bring these closer together; to increase the stoping and cut down on the drifting.

UNDERGROUND

Following is a brief descriptionof the work on the various sub levels and levels where work was done throughout the year.

762' SUB LEVEL.

The remaining pillars were taken between raises 10 and 20. Under the Roman Catholic Cemetery, three pillars adjacent to the Railroad pillar were mined. This work completed the mining on this sub level.

746' SUB LEVEL.

In the West end of this sub level ore was mined between raises 3 and 13. Under the Roman Catholic Cemetery, two pillars were taken adjacent to the Railroad pillar completing the mining on this sub level.

730' SUB LEVEL.

The bottom of the trough between raises 4 and 12 was mined early in the year. This is only one drift wide at this elevation but fanned out to 50 feet wide at the sub above at its widest point, pinching out on both ends. In the East end of this sub level mining was principally in the Railroad pillar and under the Roman Catholic Cemetery, with the exception of the small pillar opposite #17 raise which is partly to the West of the Cemetery. This pillar is now being mined and when completed will finish the mining on this sub level.

SHRINKAGE STOPE.

This stope in the pillar between the Maas and Negaunee Mines took the ore from the Roman Catholic Cemetery, Cleveland Cliffs Iron Co. strip, American Mining Co. and Negaunee Mine interests. The stope extended to 850' mean sea elevation or 140 feet above the first level Maas. The top of the ore was reached early in the year. On February 20th, a settlement occured to the West of this stope which crushed down the first level Maas necessitating the opening of a new transfer chute to the 2nd level for the shrinkage stope ore. The material here had been running quite lean and early in March the stope was abandoned. The object of this stope was to mine the ore in this pillar and cut the formation to permit the settlement of the hanging which was supported at this point. It was along this pillar that the sand entered the Maas from the Negaunee side in 1914, and to avoid the possibility of other runs it was important to cave this area so as to fill the openings with rock. Early in November a settlement occured here which crushed down the timbers and sub levels below making it unsafe to mine on either the Maas or Negaunee sides adjacent to it for about two weeks. We hope that this settlement filled the openings. The ore taken from the shrinkage stope from the various interests was 23,660 tons as follows:

MAAS SHAFT

Roman Catholic Cemetery,	1844 tons,	
American Mining Co.,	5208 "	
Cleveland Cliffs Iron Co.,	9540 "	
Total through the Maas shft,		16,592 tons

NEGAUNEE SHAFT

American Mining Co.,	7068 "	
Total through Negaunee shaft,		7,068 "
Total ore from stope,		23,660 "

FIRST LEVEL.

The rock foot wall drift started a year ago near #3 shaft was completed in 1917 holing West of #12 raise. This makes a good haulage road in solid rock which will last indefinitely. The mining under the Cemetery which was also started last year was continued. A few pillars still remain near the foot wall. Under the Railroad pillar mining was started as soon as the shrinkage stope was finished. The few ore pillars remaining here will be mined early the coming year.

695' SUB LEVEL.

The development of this sub level started last year was from 41 to 49 raises. It was continued this year and stoping is now in progress under the Roman Catholic Cemetery in the Railroad pillar. A portion of the Railroad pillar crushed badly in November when this whole area was affected due to a squeeze, probably caused by a settlement of the hanging.

675' SUB LEVEL.

This sub level has been developed entirely this year. It extends along the foot wall from the Northwest edge of the Roman Catholic Cemetery to the Negaunee line in the Railroad pillar. The sub level has been connected with raises 45 to 51 inclusive.

655' SUB LEVEL.

The sub level at this elevation has been started along the foot under the Roman Catholic Cemetery and now extends from 43 to 47 raises.

623' SUB LEVEL.

This was started several years ago but was abandoned as the mining was caving the main first level drift. It was above this point on the first level that the new main level drift in the foot wall was completed early this year. This sub level was reopened and mining has been in progress for some months. The area is extremely wet most of the water which enters the Maas Mine coming in at this point. The old drifts were caved so that new drifts had to be driven.

596' SUB LEVEL.

This also was a sub level opened several years ago but abandoned on account of caving the first level. It had been opened from a point above the second level shaft cross cut East to 41 raise. It is now being developed from raises from the new second level foot wall drift. Timber is supplied from the new timber raise,#59,put up opposite #41 raise. This is directly under the 623' sub level and it is exceedingly wet. No mining is being done here at present awaiting the completion of the 623' sub level.

575' SUB LEVEL.

This is another old sub level which was reopened from 60 raise West to 33 raise. Raises 71, 72, and 73 from the new second level foot wall drift have holed to this sub level and opposite 72 raise a drift was driven toward and into the foot, from which drifts were driven to the West about 80 feet and East 60 feet, the idea being to put short raises from these foot wall drifts to the foot wall above to carry off the water. The formation in which these drifts are driven is very soft and the material swells so badly that I am afraid it will be impossible to hold them open. One short raise from the West cutting above the foot wall above is draining a great deal of water. However, to make this a success I think the drifts will have to be driven further back in the foot. Any water than can be caught on the foot and taken to the rock drifts below will help mining below this point as the water will be kept out of the ore.

SECOND LEVEL.

The only work here was the opening of a new foot wall drift from the

main shaft cross cut to the old main foot drift. This drift was driven Easterly at a point about 80 feet North of the old drift. It was started in April and finished in August. It is located under the new drift driven to the first level and had to be driven for the same reason as it was impossible to keep the old main drift open. It holed into the latter drift just West of 41 raise. Several raises were put up from here during the year; they were 69, 71, 72, 73, and 74.

In the Railroad pillar raises 51 and 52 were completed during the year and timber raise #59 was put up opposite #41 raise.

SUBS BETWEEN THE SECOND AND THIRD LEVELS

465' SUB LEVEL.

The development here in 1917 was at the Northeast end. The last cross cut just West of the Roman Catholic Cemetery was extended to the North to the foot wall. Three drifts from this cross cut were driven East to outline the jasper "dropper" that projects to the South end of the Roman Catholic Cemetery.

450' SUB LEVEL.

Mining and developing continued here from 99 raise. The development drifts to the North outline the foot, while the drift to the East, jasper. Little stoping was done under the hanging between 98 and 100 raises.

435' SUB LEVEL.

The development of this sub level started a year ago in December at 96 raise, which was continued during the year. Two drifts were driven to the foot wall and hanging was outlined from 96 and 99 raises. East of 99 raise the main sub level drift has been driven 150 feet and jasper boundary outlined on the foot and hanging.

401' SUB LEVEL.

Stoping, under the hanging, started a year ago near the Negaunee boundary was completed. Development is now being carried on to the Northeast under the Roman Catholic Cemetery and along the Railroad pillar.

395' SUB LEVEL.

Mining here has been along the East side of the sub level adjacent

to the Negaunee line. Mining is still in progress; this all being under the hanging. Stoping was also done under the hanging above F cross cut.

385' SUB LEVEL.

This sub level was developed last year and completed this. It is located in the West end of the mine between raises 80 and 93. Practically all of the ore on the hanging side of this sub level between 84 and 93 was Bessemer.

375' SUB LEVEL.

Mining was conducted at various points in this sub level; in the West end a small sub level was opened between 80 and 81 raises. North of 92 and 93 raises a small block of ore was mined to the North foot wall. In the South under the hanging;between square set stopes at F cross cut another small block was taken. At the East end of the mine stoping under the hanging was continued and the development started to the Northeast in the Railroad pillar.

365' SUB LEVEL.

The main cross cut drift connecting raises 84 and 93 was driven last yeaMining has been in progress since. The foot wall side has been completed and stoping isnow confined principally to the hanging side. This sub level should be finished in about three months.

355' SUB LEVEL.

This sub level is located directly under the 365'; the development drift has been driven from 86 to 94 raises and cross cuts started on the foot and hanging; At F cross cut mining under the hanging started a year ago was completed during 1917.

345' SUB LEVEL.

Work here was at F cross cut and was started in 1916 on the East and West sides. This work is entirely under the hanging; operations extended from E to G cross cuts.

335' SUB LEVEL.

Mining under the hanging near the Negaunee line at G cross cut which was started 1916 was continued throughout the year. A few small pillars yet remain.

THIRD LEVEL.

The only work here was at F and G cross cuts both of which were advanced to the South a distance of about 100 feet. These have not yet reached the true hanging and will be continued. At E cross cut the two compartment raise, #224, from the 4th level holed early in the year; this provided a second opening to the 4th level before the shaft was holed.

SUBS BETWEEN THE THIRD AND FOURTH LEVELS

200' SUB LEVEL.

This sub level midway between the third and fourth levels has been opened from the winze to the South for a distance of nearly 800 feet. It was started to develop the Bessemer ore which was discovered by #9 drill hole, the ore lying directly under the hanging. The raises were put up from the 4th level to this sub level; the principal development has been directly under the center of the syncline which is located about 600 feet South of the incline shaft which connects the third and fourth levels. Developments show that the sub level was really started a little above the regular ore body in pockets in the hanging as the drifts continually encountered jasper. Raises have been put up from the development drifts to the top of the ore so that its outlines are now well defined. To the West the development has extended within a few feet of the East line of the Race Course tract or until cut off by the jasper; on this edge a little stoping was done. The following raises from the 4th level have holed through to this sub; 402, 404, 406, 408, 410, 420, and 422. To the South of this line of raises the hanging is considerably higher. A new main level drift will be driven and raises put up to the top of the ore rather than transfer it as we are now doing for development purposes. Most of the ore here is of the Bessemer grade.

185' SUB LEVEL.

This sub level under the 200' sub level has been developed this year from 402 to 412 raises and across the formation at 406 raise 300 feet to the North and South or 600 feet in all. Drifts have extended West to the boundary. No stoping has been done at this elevation. In the drift North from 406 riase the drill rods lost at hole #9 in 1901 were found. Arrangements are being

made to recover the bit be reaming out the hole from this sub level. The bit will probably be reached at a point 50 or 60 feet below the sub level. This but contains 6 diamonds, three outside and three inside stones, and is worth between $2500 and $3000. The rods were found on the sub level 135 feet North and 30 feet East of the drill hole location on surface.

FOURTH LEVEL.

The main shaft cross cut was projected to the North during the year 1000 feet. This includes 100 feet beyond the shaft location for tail room purposes. The formation here was wholly in the foot quartzite and was extremely hard, making the progress slow. The main ore cross cut toward the Negaunee Mine was extended 100 feet; the breast is now on the edge of the Railroad pillar in lean ore, this being the formation directly under the ore body. The following raises were put up to the North from this cross cut.

410 raise,	100 feet,
412	25
414	23
416	34
418	85
420	103
422	99

In the North drift, that is the drift which runs to the East of the plat at the winze, raise 224, started last year, was extended through to the third level. In the main drift which has been driven Southeast along the West line of the Baldwin Kiln road, work has been started at the South end. To date it has been extended only 20 feet but a new main level drift will be driven toward the East to the Railroad pillar; a cut out has been made to the West to extend a drift in that direction if desired, South of the Race Course boundary.

SHAFT.

The raise from the 4th level was put through to the bottom of the present shaft. A pentise of 12 feet was left to protect the shaftmen. Stripping is now in progress; on December 31st, three sets were in place. The

material encountered in raising was extremely hard quartzite. We are now having difficulty in stripping down on account of this same hard rock. It has required as many as 600 drills to complete a round of drilling in this material. The work here will be pushed as rapidly as possible. Assoon as stripping is completed the shaft will be sunk about 60 feet below the 4th level and a pocket installed after which the 4th level plat will be opened.

UNDERGROUND IN GENERAL

We have followed the year's work in the mine from above the first level down to the development of the 4th level. With the completion of the shrinkage stope in the American Mining Co. pillar effort was made to hurry the mining above the first level. This was done by putting on night shift in all contracts in this section of the mine. By the end of the year practically everything above the first level had been taken out except a few pillars. This permitted the Negaunee Mine, which adjoins the Maas at this point to start operations on their side of the American Mining Co. pillar.

Rock drifting on the first, second, and fourth levels was considerable but was absolutely necessary. In the case of the first and second levels the main drifts had caved so badly that it required continual repairing and at the same time they were holding up mining which could be done if new drifts were provided. This mining has since been started.

The developments above the fourth level were at an elevation of about 100 feet above the main level and were to open the Bessemer ore deposit located there. This development is still underway.

On the second the third level concret supports were put in the main cross cuts near the shaft to act as temporary dams which could be used in case of a large flow of water as the sump capacity at the mine is small. These dams can be used to back up the water in the main cross cuts and on account ofthierlength have a larger capacity than most sumps. The expense for the construction was small, but might prove a great benefit in case the electric current was shut off the pump for afew hours. At the fourth level the bottom of the incline shaft was used for a sump, the electric pump had considerable trouble in taking the water on account of the long suction. When the

starting compensator burnt out it was decided to make a new sump. An opening was cut West of the winze and North of the drift near the winze plat. This had the same capacity as the bottom of the inclined shaft and has worked very satisfactorily;no trouble having been experienced since that time.

SURFACE

COAL DOCK.

When the coal was placed in the dock in the fall of 1916 it was in first class condition none of it having become wet in transit. We had expected to get through the winter without trouble with our dock; however, in January a fire started and continued throughout February and into March when it was extinguished. About 24 legs were burnt off together with the braces and part of one side of the dock. In May repairs were started which were completed in July, in time to take in the coal for the coming season. On account of it being necessary to run the turbine from the middle of the summer throughout the fall and winter as large stock of coal had to be taken as could be handled. It was necessary not only to fill the dock but to tear off the North side to handle the 1500 to 2000 tons extra.

TOP TRAM.

A year ago I mentioned in my report that a new top tram was being installed which was of the same type as that in use at the Stephenson Mine where a single 8' sheave was used in place of a small drive sheave and idlers. An accident occured to our old plant on February 10th before the new one was ready for use. The mine was shut down until the 13th when one side of the new plant was put in commission and on the 20th, the second side. The old plant ran by steam but the new plant is driven by 50 H. P. motors. The steel for the controller house which was to be erected at the top landing did not arrive until April so it was necessary for the controllers to be installed in the engine room. During the summer these were moved to the new controller house on the top landing and were in shape to operate when the stocking started in the fall. The new stocking system has worked perfectly since its installation.

CONDENSOR PLANT.

Immediately North of the old cooling tower beyond the L. S. & I. tracks a spray pondensor pond was built late in the fall of 1916. It was put in commission in February and has been in operation since; it is working nicely.

SUB-STATION

During the early summer the switch boards that one time were in the West end of the transformer house at the Maas sub station were moved out and set up in the back end of the large engine room. The Dead River transformer which caused the fire a year ago was moved out in the open and set on concrete foundations together with the lightning arrestors. As this transformer is air cooled we will probably have no trouble with it in the future.

CRUSHER.

Early in the year it was decided to erect in Negaunee a crusher to handle the Ishpeming and Negaunee ores which were to be shipped to Charcoal Furnaces from stock piles and mines where there was no crusher installation. The site selected was just to the North of the L. S. & I. tracks opposite the Maas Mine. Work was started in March. The fill for the tracks being made by the L. S. & I. construction crew. The concrete work for the pocket and crusher installation being built by our own force. In May the crusher and the pan conveyor were erected and early in July the crusher was put in operation. The ore dumping directly from cars into a dump pocket is elevated by means of a pan conveyor to a point above the crusher. It passes over a grizzly, the fines going through to a Robbins belt conveyor which conveys them up an incline to the loading pocket. The ores which pass over the grizzly are fed directly into the crusher the product passing onto the same belt as those from the grizzly. This crushed ore is then taken up the incline belt to the loading pocket from which it is loaded into railroad cars. The loading pocket is located about 200 feet down grade from the dumping pocket. The crusher worked satisfactorily most of the summer, some trouble being experienced with the Scotch ore which contains some very large lumps which broke several caps of the spider. The only other serious accident.

to theequipment was the ripping of the rubber belt about two weeks after the crusher went into operation. This was done by a pinch bar being caught in a timber; one end of the bar coming in contact with the belt. The damage, however was repaired by means of steel lacings so that the same belt wasused throughout the balance of the season.

As in all installations of this kind a number of adjustments had to be made during the year to catch the drip, etc. A much larger product can be handled at a much smaller cost than at the Jackson Crusher, which this installation replaced.

PLANTING.

Early in the year when word was sent broadcast to plant all available ground, the Company asked all those that wished garden plots to notify the mine office. Most of our employees and a great many towns people asked us for planting space; 56¾ acreas of meadow land were plowed, 30 of which it was necessary to disc harrow; 16 acres were given to the school children. The plowing, discing, harrowing as well as the fencing was done for the employees of the Company without charge. Further than this the Company also secured seed potatoes wherever possible and sold them to the employees at actual cost. The season was not a particularly favorable one so the yield was only average, the harvesting season being combined wet and freezing weather. However, a great many of the men have applied for the same ground during the coming year.

EQUIPMENT.

In June a Sullivan drill sharpener was bought and set up in the blacksmith shop. This is an up-to-date sharpener and is absolutely essential in the present day blacksmith shop.

COOLING TOWER.

The small cooling tower built two years ago to handle the water for the jacket/compressor, transformers, etc., was put in operation.

BOILER HOUSE.

Early in June extra men had to be employed at the boiler house on account of lump coal being received in place of slack. In addition to this

the coal was of a poor quality so that at times six extra men were necessary to keep up the steam. In August, when the turbine started operating and all four boilers were fired as hard as possible, trouble was experienced at once with the arches falling down. This trouble continued throughout the late summer and fall. It was impossible for the boiler plant to carry the compressor, hoists, and turbine; the latter only being able to carry half a load. In December it was decided to set up a new boiler plant consisting of four Burt boilers. These were brought from the Imperial Mine, west of Michigamme and a new boiler house erected just to the Southeast of the present brick building. They will be ready to start early in January and will carry the compressor and hoists leaving the regular boiler plant to operate the turbine It was absolutely necessary to do this as our water power could not supply the current demanded by the mines and, even with this installation, it is doubtful if we can get through the winter without having to shut down some of the mines for a short period.

MAAS MINE ORE ESTIMATE * DECEMBER 31st, 1917

DEVELOPED ORE

Above the 1st level,	7,244 tons,	
Between 1st and 2nd levels,	784,818 "	
" 2nd and 3rd "	1,737,029 "	
Total developed ore ,		2,529,091 tons,

PROSPECTIVE ORE

Between 3rd and 4th levels,		1,839.988 "
Total Developed and Prospective ,		4,369,079 "

ASSUMPTION: 12 cu. ft. equals one ton; 10% deduction for rock;

10% deduction for loss in mining.

Area 3rd level,	241,750 sq. ft.,
" 4th level, North side,	16,500 " "
" 4th " South "	133,600 " "
Percentage of Bessemer,	5%

Grading of above estimate as follows:

Bessemer Ore,	Trade Name	Tons	
Developed,	Maas Bessemer	126,455	
Prospective	" "	92,000	
Total,			218,455 "
Non-Bessemer Ore,			
Developed	Maas Ore	2,402,636	
Prospective,	" "	1,747,988	
Total,			4,150,624 "
Total Bessemer and Non-Bessemer,			4,369,079 "

ESTIMATED ANALYSIS:

	Iron.	Phos.	Sil.	Mang.	Alum.	Lime.	Mag.	Sul.	Loss by Ignition.	Moist.
Maas-Dried 212°	60.05	.100	7.60	.290	2.46	1.05	.360	.011	2.70	
Natural,	53.14	.088	6.73	.257	2.18	.93	.319	.010	2.39	11.50
Bessemer Dried 212°	60.90	.060	7.12	.270	2.37	.710	.340	.010	2.04	
Natural,	53.59	.053	6.27	.238	2.09	.625	.299	.008	1.80	12.00

PRODUCTION.

Month.	Bessemer	Maas	Total
January	2,576	21,804	24,380
February	1,776	19,300	21,076
March,	1,712	23,204	24,916
April	956	19,044	20,000
May	2,764	21,898	24,662
June	6,168	18,980	25,148
July	4,435	22,121	26,556
August	6,696	24,369	31,065
September	6,803	20,522	27,325
October	8,460	27,415	35,875
November	7,710	22,311	30,021
December	5,900	23,432	29,332
Total,	55,956	264,400	320,356
Transferred from	18,636 to	18,636	
Total	37,320	283,036	320,356

ANALYSIS OF PRODUCTION.

Production 1917	320,356 tons,	Cost per ton,	1.632
" 1916	264,428 "	" " "	1.255
Increase	55,928 "		.377

During 1917 the Maas worked one eight hour shift for 304 days. The average number of men employed during the year was 265, who worked a total of 82,518½ days, as against 233 men in 1916 who worked 72,803¼ days, an increase of 32 men and 9,715¼ days.

The average tons per man per day produced for the 68,557 days worked underground in 1917 was 4.67 as against 4.84 in 1916 or a decrease of .17 tons per man, largely due to the development work on the fourth level which requires the services of many extra men for a comparatively small product, as this product has to be handled twice.

The increased cost per ton for labor was caused by the three wage increases, starting with the one of December 16th, 1916 and those of May and October 1917. This amounted to $63,597.75 equivalent to .75 cents per day, or .198 per ton. The amount expended for supplies for the year 1917 was $178,828.64 as against $137,784.55 for 1916, an increase of $41,044.09. Of this amount $29,120.92 was due to increased operations (production) and $11,923.17, (based on cost per ton of supplies for previous year) was directly due to the increased cost of supplies, this increase amounting to .037 cents per ton.

GENERAL EXPENSE

No. 26, Insurance,

1917 Amount $123.66 - cost per ton .000
1916 " 124.32 " " " .000
Decrease .66

No. 27, Engineering,

1917 Amount $2686.28 - cost per ton .008
1916 " 1738.33 " " " .007
Increase, 947.95 .001

Increased operations called more of the engineer's time at increased pay.

No. 28, Analysis,

1917 Amount $9841.61 - cost per ton .031
1916 " 7193.52 .027
Increase 2648.09 .004

Increased operations and production called for more determinations and increased labor at increased wages at the mine. The laboratory having made 10,668 more determinations in 1917; the increase in charges for these being $1194.34

No. 30, Personal Injury,

1917 Amount $2609.80 - cost per ton .008
1916 " 2319.41 .009
Increase 290.39 .001

There were numberous minor accidents and

t two that drew compensation for a long time. Peter Koski injured April 27th, 1917 is still drawing compensation.

No. 31, Mine Office, 1917 Amount $12644.54 - cost per ton .040
1916 " 8517.99 " .032
Increase 4126.55 .008

Of this increase $2300.00 was at the mine direct and was due to there having been added two police officers salaries to the amounts charged to this account, increased wages and cost of supplies; $1800.00 of the increase was Ishpeming office charges, added at the Central Office.

No. MAINTENANCE

No. 125, Tracks & Yards, 1917 Amount $2277.81 - cost per ton .007
1916 " 1722.72 " .007
Increase 555.09

Increased wages and supply costs.

No. 126, Docks, trestles, and pockets, 1917 Amount $1126.46 - cost per ton .003
1916 " 488.22 " .002
Increase 638.24 .001

During the year it became necessary to extend the rock trestle seven or eight bents, and on this and repairs to permanent trestle $800.00 was expended.

No. 127, Buildings, 1917 Amount $1162.10 - cost per ton .004
1916 " 570.03 " .002
Increase, 592.07 .002

A shower bath was installed in the Captain's room at a cost of $180.00 Repairs to coal dock exceeded previous year by $278.00 partly due to small fires and partly to dry rot of some of the

timbers. It became necessary to renew the greater part of the water piping in the dry, and some $250. was expended on this work.

No. 128, Shop Machinery, 1917 Amount $1516.47 - cost per ton .005
1916 " 207.91 " .001
Increase 1308.56 .004

A Sullivan drill sharpener was installed in the blacksmith shop at a cost of $1600. to replace an antiquated machine built ten years ago at the General Shops.

No. 129, Boiler plant, 1917 Amount $5117.21 - cost per ton .016
1916 " 2318.56 " .009
Increase, 2798.65 .007

In July owing to low water in the Carp and Dead Rivers, the turbine was started and loaded to from 500 to 700 K.W. As the water power decreased the turbine load was added to, and the four Sterling boilers were forced to capacity during the balance of the year. Previous to the starting of the turbine, the expenditures for repairs and renewals to plant had varied from $37.00 to $300.00 per month. Thereafter the expenditureswere as follows: - July $453.23; August- $914.40 - September $1532.20 - October $2238.69 - November $2331.81 - December $2414.66.

No. 130, Hoisting Machy., 1917 Amount $4546.25 - cost per ton .014
1916 " 2407.70 " .009
Increase 2138.65 .005

In May a safety overwind device was installed on the cage hoist at a cost of $1300.00. A new

cross head and some other minor parts for same plant cost $200.00. There were continued minor monthly repairs to cage hoist and in a lissor degree to the skip hoist. Increased cost of labor and supplies added to the general increase.

No. 131, Compressor and Power Drills,

1917 Amount	$2080.87	- cost per ton	.006
1916 "	1717.87	"	.005
Increase	663.00		.001

Due to the addition of seven Sullivan drills to our equipment at a cost of $1230.00.

No. 132, Pumping Machy.,

1917 Amount	$2120.39	- cost per ton	.007
1916 "	451.00	"	.002
Increase	1669.39		.005

The 4th level pump stripped the gear and pinion and a new set was put on at a cost of $225.00. A new panel with regulator and instruments were also added to this set at a cost of $1220.00

The 3rd level centrifugal was thoroughly overhauled and the plunger had several parts renewed amount altogether to some $1045.22

No. 133, Top Tram Engine and Cars,

1917 Amount	$8032.76	- cost per ton	.025
1916 "	1075.82		.004
Increase	6956.94		.021

The actual repair charges to this account were but $816.22 or $259.60 less than the previous year. The balance of increaseis due to the fact that the charges to "E & A #312" - Electric Tram Plant- were charged off each month as charged over the mine recaps.

No. 134, Skips and Skip Roads,

1917 Amount $1086.74 - cost per ton .003

1916 " 1558.82 " .006

Decrease 472.08 .003

There were noextraordinary repairs to this account for the year.

No. 135, Underground Tracks and Cars,

1917 Amount $2417.51 - cost per ton .008

1916 " 1717.76 " .006

Increase 699.75 .002

Owing to the development of the 4th level it was necessary to build seven or eight cars at a cost of more than double that of 1916, the trucks alone having jumped from $22.00 to $48.00 each. There was 21 tons of 12# rail used in the various sub levels, and this cost us $59.25 a ton as against $29.57 per ton for previous year, or an increase of $623.00 in cost of rail alone.

No. 136, Electric Tram Plant,

1917 Amount $11759.62 - cost per ton .037

1916 " 12980.51 " .049

Decrease, 1220.89 .012

The wiring of the 4th level was practically finished in August, cutting down the charges for the last four months to about normal.

MINING EXPENSE

No. 150, Air Pipes,

1917 Amount $6228.50 - cost per ton .019

1916 " 4552.17 " .017

Increase 1676.33 .002

In addition to the increased cost of labor and supplies contributing to the total increase in this department, was the increased use of pipe and fittings in 1" - 1½" - 2" sizes account of the development work on the 4th level, sub levels,

and main to new shaft.

No. 151, Compressor,

1917 Amount $20638.68 - cost per ton .065

1916 " 11185.12 .042

Increase 9453.56 .023

Air made in 1917-991,999,672 cu. ft. - cost .0367

" " " 1916-887,215,066 " " .0151

Increase 104,784,606 " " .0216

An increase of 10 drills in use (44 in 1917, 34 in 1916) would partly account for the increased amount of air made.

Of the total increase in this account $9453.56, ap roximately $4000.00 was due to the increased production of air. Higher wages and costs made up the greater part of the balance of $5453.56. The average boiler house charge as figured by the Mechanical Dept. for the first six months of the year averaged $1244.00. The turbine started up in July and for the following 6 months the boiler house charges jumped to an average of $2080.19, or monthly as follows: - July, $2211.01 - August, $2329.67 - September, $1940.23 - October $1948.95- November $2112.00 - December $2039.32.

As there was 506,206,007 cu. ft. of air made in the first six months and but 485,793,665 in the last six months. The $836.00 additional charge per mo. to this account for the last six months was due part ly to the increase in cost of coal of inferior quality and evidently a too small charge of the boiler house expense to the turbine when it is not running efficiently due to low load.

No. 152, Hoisting,

1917 Amount $30631.33 - cost per ton .096

1916 " 17311.54 .066

Increase 13319.79 .030

There was an increased tonnage of 62,362 tons of which there were 56,072 of ore and 6,290 of rock. Of the $13319.79 increased expenditures probably $5986.00 was caused by the increased tonnage of 62362 tons. Increased labor and supplies charges were largely responsible for the balance of $7333.00. Boiler house charges during the last six months of the year while the turbine was operating might have something to do with it. If the turbine was not getting its just share. Boiler house charges to this account averaged $1419.39 each month during the first half of the year, while for the second half they ran as follows: - July, $2032.29 - August, $1797.59 - September, $3018.13- October, $1708.74 - November, $2925.28 - December, $2655.51 or an average of 2356.26. The explanation is the same as for Compressor.

No. 153, Pumping,

1917 Amount $18933.77 - cost per ton .059

1916 " 19030.91 " .072

Decrease 97.14 .013

Gals. pumped, 1917 - 293,420,640

" " 1916 339,518,230

Decrease 46,097,590. The decrease in current charges were $2251.00 which slightly more than off set the increase in wages.

No. 154, Sinking and Shaft repairs,

1917 Amount $4479.02 - cost per ton .014

1916 " 601.91 .002

Increase, - 3877.11 .012

Of this amount $353.52 was "Shaft Repairs, and the balance of $3523.59 was "Sinking". The 4th level main drift to line of shaft was finished during August and a small raise to reach the 3rd level was started. This raise was finished in November and work started cutting out under pentise, getting in bearing pieces and sinking, 25 feet during December the amount of $3523.59 representing the expenditure to this account sinceethe small raisewas started.

No. 155, Rock Drifting, 1917 Amount - $25606.49 - cost per ton, .080

1916 " 11118.68 " .042

Increase 14487.81 .038

	1917	1916	Increase
Feet rock,	3744	2271	1473
Cost per ft.,	6.64	4.59	2.05

Increased labor and supply cost account in a large way for this increase. The average price for powder, for instance, jumped from 13.15 in 1916 to 16.83 in 1917or .0368 per lb. and other costs in proportion. Air drill spares doubeling in cost. There wasmore main level rock drifting this year than last mainly on 4th level. The 1473' increased footage accounts for $9780.00

No. 156, Breaking Ore, 1917 Amount $187667.88 - cost per ton .586

1916 " 129107.18 " .489

Increase 58560.70 .097

The was an increased tonnage of 55,926 tons and this would account for $32773.80 of the total increase in expenditure. The balance of $25786.90 represents the amount due to increased labor and supply costs and added about 8 cents for ton to the cost of the product. The cost per ton was slightly increased from the fact that the results underground

were not up to previous year, 4.67 per man per day having been produced in 1917 as against 4.84 in 1916. The shrinkage stope operating in 1916 helped the product per man per day underground.

No. 157, Tramming,

1917 Amount	$40292.87 - cost per ton	/126
1916 "	27927.64	.106
Increase,	12365.23	.020

Of the total increase approximately $7857.00 represents the amount it cost to tram the increased tonnage of 62362 tons. The balance of $4507.62 represents the increased cost of labor and supplies for electric haulage and the 14 hand trammers employed on sill floor work the first eight month of the year on the 1st, 2nd and 4th levels.

No. 158, Filling,

1917 Amount	$2196.16 - cost per ton	.007
1916 "	974.18 "	.004
Increase,	1221.98	.003

Early in the year the old shrinkage stope was filled and more rock was put away in worked out places than in 1916.

No. 159, Timbering,

1917 Amount	$56805.82- cost per ton	.177
1916 "	42484.96 "	.161
Increase	1 4320.86	.016

Some $9900.00 of this amount is attributable to the increase of 55928 tons in product, and this amount as well as the balance of $4420.00 was mostly due to increased cost of labor and supplie though during the year in addition to the regular timber crowd, there were large expenditures for re-timbering and repairing in the upper subs and 2nd and 3rd main levels.

No. 160, Mining Captain and Shift Bosses,

1917 Amount $9113.42 - cost per ton .028

1916 " 6495.18 " .025

Increase 2618.24 .003

Increase due to increase in wages and salaries.

No. 161, Dry House,

1917 Amount $3925.07 - cost per ton .012

1916 " 4448.33 " .017

Decrease 523.26 .005

Decrease in boiler house charge to this building accounts for the decrease.

No. 162, Top Landing,

1917 Amount $5561.21 - cost per ton .017

1916 " 4504.55 " .017

Increase 1056.66

Due to increased tonnage handled and increased cost of labor and supplies, though on the whole there was a great saving due to the new electric plant having replaced the old steam plant for the greater part of the year. At .017 per ton it would have taken $950.77 of the $1056.66 to have handled the increase of 55928 tons leaving but $105.89 to account for. The figures below show the great saving in the use of electricity over steam.

	1916 Boiler House Charge	1917 Electirc current Charge
Jan.	$107.84	$43.55
Feb.	122.32	44.50
Mar.	147.51	55.00

No. 163, Stocking Ore,

1917 Amount $4954.31 - cost per ton .016

1916 " 1682.80 " .006

Increase 3271.51 .010

In addition to the increased cost of labor

and supplies, additional trestle was necessary to take care of increased product, and heavy renewals were needed of the old parts, the expenditure for new legs, stringers, caps and plank amounting to $1118.94 as against $150.00 in 1916.

No. 171, Ventilation, 1917 Amount $981.27 - cost per ton .003

1916 " 1128.85 .004

Decrease 147.58 .001

No. additions were made after the completion of the 4th level rock drift and the raise from the 4th to the 3rd levels in #1 shaft.

DELAYS - ELECTRICAL.

December 20th, 1 hour - no current.

DELAYS- NON ELECTRICAL.

April 3rd,	4 hrs., -	skip pit full of rock, cross head on stopper broke and skip pit ran full of rock.
4th,	2 "	Cleaning skip pit.
May 5th,	2 "	cage hoist out of commission.
July 21st,	3 "	Shaft pump bucking-skip pit full of water.
August 9th,	1½ "	water in on 4th level-couldn't hoist.
" 11th and 12th,		No ore hoisted from 4th level-water in.

MAAS MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR-1917.

GRADE	IRON	PHOS.	SILICA
Maas Bessemer,	61.15	.049	8.36
Maas,	58.90	.088	9.27

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1917.

	Mine		Lake Erie	
GRADE	IRON	PHOS.	IRON	MOIST.
Maas,	59.19	.088	59.41	11.20

ORE STATEMENT - DECEMBER 31ST, 1917.

	MAAS BESSEMER	MAAS	TOTAL	TOTAL LAST YEAR
On Hand January 1st, 1917,	21,106	84,357	105,463	109,160
Output for Year,	37,320	283,036	320,356	264,248
Total,	58,426	367,393	425,819	373,408
Shipments,	46,144	272,559	318,703	267,945
Balance on Hand,	12,282	94,834	107,116	105,463
Increase in Output-21%			56,108	
Increase in Ore on Hand,			1,653	
1917-- 1-8 Hr. Shift.				
1916-- 1-8 Hr. Shift.				

SHIPMENTS FOR YEAR - 1917.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Maas Bessemer,	28,184	17,960	46,144	898
Maas,	138,896	133,663	272,559	267,047
Total,	167,080	151,623	318,703	267,945
Total last Year,	145,876	122,069	267,945	
Increase - 19%			50,758	

MAAS MINE.

MAAS MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 7.	1 9 1 6.	INCREASE.	DECREASE.
PRODUCT	320,356	264,248	56,108	
General Expense	.087	.075	.012	
Maintenance	.139	.109	.030	
Mining Expense	1.305	1.071	.234	
Cost of Production	1.531	1.255	.276	
Exploratory	.004	.040		.036
DEPRECIATION.				
Original Purchase	.078	.336	.414	
Plant Account	.250	.250		
Equipment	.006	.006		
Construction	.004		.004	
Total Depreciation	.338	.080	.418	
Taxes	.176	.192		.016
Central Office	.060	.051	.009	
Miscellaneous		.001	.001	
Fire Loss	.001	.009	.008	
Sundry Expense	.017	.013	.004	
Cost on Stockpile	2.125	1.461	.664	
Loading & Shipping	.019	.019		
Total Cost on Cars	2.144	1.480	.664	
No. Days Operating	303	299	4	
No. Shifts and Hours	1-8hr	1-8hr		
Avg. Daily Product	1057	884	173	
COST OF PRODUCTION				
Labor	1.016	.804	.212	
Supplies	.515	.451	.064	
Total	1.531	1.255	.276	

MAAS MINE.

COMPARATIVE WAGES AND PRODUCT.

	1917.	1916.	INCREASE.	DECREASE.
PRODUCT	320,356	264,248	56,108	
No. Shifts and Hours	1-8hr	1-8hr		
AVERAGE NO. MEN WORKING				
Surface	50	42	8	
Underground	224	178	46	
Total	274	220	54	
AVERAGE WAGES PER DAY				
Surface	3.28	2.67	.61-22.8%	
Underground	3.91	3.18	.73-23 %	
Total	3.79	3.08	.71-23 %	
WAGES PER MO. OF 25 DAYS				
Surface	82.00	66.75	15.25	
Underground	97.75	79.50	18.25	
Total	94.75	77.00	17.75	
PRODUCT PER MAN PER DAY				
Surface	19.73	19.56	.17	
Underground	4.67	4.84		.17
Total	3.78	3.88		.10
LABOR COST PER TON				
Surface	.166	.137	.029	
Underground	.837	.657	.180	
Total	1.003	.794	.209	
AVG. PRODUCT BRK'G & TRM'G	8.20	8.15	.05	
" WAGES CONTRACT MINERS	4.32	3.33	.99	
" " " TRAMMERS	0	0		
" " " LABOR	4.32	3.33	.99	
TOTAL NO. OF DAYS				
Surface	16,239¾	13,510¾	2,729	
Underground	68,557½	54,586½	13,971	
Total	84,797¼	68,097¼	16,700	
AMOUNT FOR LABOR				
Surface	53,235.51	36,063.22	17,172.29	
Underground	268,010.08	173,667.22	94,342.86	
Total	321,245.59	209,730.44	111,515.15	

Proportion Surface to Underground Men:

1917 - 1 to 4.50
1916 - 1 to 4.24
1915 - 1 to 2.5
1914 - 1 to 5.48
1913 - 1 to 6.18
1912 - 1 to 2.88

MAAS MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1917.

KIND	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1 9 1 7.	AMOUNT 1 9 1 6.
6" to 8" Timber	63,856	.0212	1355.08	643.40
8" to 10"	78,550	.0415	3261.24	3216.16
10" to 12"	32,864	.0617	2027.40	1923.36
12" to 14"	13,946	.0836	1166.48	704.64
14" to 16"				4.32
Total 1917	189,216	.0413	7810.20	
Total 1916	154,260	.0421	6491.88	6491.88
	LINEAL FEET.	PER 100'.		
7' Lagging	1,244,086	.55	6842.51	5879.62
Poles	11,662	.943	110.00	419.35
Total 1917	1,255,748	.554	6952.51	6298.97
Total 1916	1,115,615	.565	6298.97	

Product	320,356.	264,248
Feet timber per ton of ore	.591	.584
Feet Lagging "	3.88	4.04
Feet Lagging per foot of Timber	6.57	6.93
Cost per ton for Timber	.0244	.0245
" Lagging	.0213	.0222
" Poles	.0003	.0016
" Timber, Lagging, Poles	.0460	.0484
Equivalent of stull timber to board measure	356,896	260,597
Feet Board Measure per ton of ore	1.11	.986

Total cost for Timber, Lagging, Poles	1917	14762.71
"	1916	12790.85
"	1915	3980.64
"	1914	7411.85
"	1913	11905.86
"	1912	3726.32
"	1911	0
"	1910	5770.97
"	1909	6324.50
"	1908	4373.23

MAAS MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1917.	AMOUNT 1916.
40% Powder	139,200	.1609	22406.16	17473.89
50% "	200	.2015	40.30	3111.75
60% "	13,850	.2420	3352.62	1443.70
80% " Gelatin				397.80
Total Powder	153,250	.1683	25799.08	22427.14
Fuse	418,300	6.054	2539.59	2289.64
Caps	92,500	12.89	1192.90	1238.54
Cap Crimpers	32	.49	15.69	19.31
Tamping Bags	36,700	17.67	64.87	8.47
Connecting Wire	17	46	7.86	6.37
Total Fuse, Etc.			3813.91	3562.33
Total All Explosives,			29612.99	25989.47
Product			320,356	264,248
Pounds Powder per ton Ore			.478	.645
Cost per ton for Powder			.0805	.0849
" " Fuse, Caps,Etc.			.0119	.0134
" " All Explosives			.0924	.0983
Avg. Price per lb. for Powder			16.83	.1315

ATHENS MINE - 1917

During the year 1917 the Athens shaft was sunk a distance of 263 feet. In addition to this three feet extra were sunk under the cage compartment. After sinking was finished it was concreted from 2024 to within 12 feet of the bottom. Casing plank was installed between the cage and skip compartments, sets straightened, that had been bent by blasting, counterweight and pentise removed, also the concrete and small air pipes that were used in connection with concreting the circular shaft.

Plats and pockets were cut at the 1800, 2200, and 2400' levels; in addition 42 feet below the latter a small drift was driven, through which pump sumps will be cleaned and at the bottom of the shaft a small plat was cut to handle the cars for cleaning the skip pit.

The cutting of the 1800' plat was not decided on until some time during the year. As this section of the shaft had been concreted in 1916 the work of cutting the plat was somewhat slower than it would otherwise have been. The time required in cutting this plat was not included in the schedule as planned. About November first drifting on the 2200 and 2400' levels commenced, also the cutting of the pump house on the 2400' level.

During the year preparations were made to get the mine in shape to handle ore early in thespring of 1918. The mine buildings were erected, stock pile and timber yards graded, sewer and water and steam pipes installed, trestles built and railroad tracks graded. Before all of this could be completed cold weather set in but enough has been done so that there will be no delay in handling ore in case it is reached before.

The work in detail is as follows:

SINKING SHAFT.

On December 31st, 1916 the shaft was 2223 feet deep. In January 1917,120 feet were sunk. The material was siamo slate with hard quartzite. The strike to the Northeast and Southwest and the dip 20° to 30° Northwest. In February after sinking 66 feet the work was stopped to cut out the 2400'

plat. The formation at this point was siamo slate with quartzite somewhat softer than in January. It was expected to start sinking again as soon as the skip hoist could be put in commission. However, the sprocket chains which operate the indicator and overhoisting device had not arrived nor were they received until about the middle of March. When the engine was then put in commission one of the bearings of the fly wheel set which operates in connection with this hoist ran hot so the engine could not be used until this trouble was remedied. As the expert sent here by the General Electric Co. could not remedy the trouble at once, on April 8th sinking was started again by means of the cage hoist; 50 feet were sunk in April and a drift was cut out to the South of the shaft of the cage compartment for cleaning sumps. On May 10th the shaft was completed, 26' having been sunk making a total of 263' for the year. In addition to this three feet were sunk under the cage compartment as mentioned above. The elevation of the skip pit plat below the collar is 2487, and the bottom of the skip pit, 2490.

PLATS.

When sinking stopped February 19th to cut out the 2400' plat it was thought that the skip hoist would be in shape to continue sinking when this plat was completed. When it was found there would be considerable delay, it was decided to put a collar in the shaft and cut out the plat at the 2200' level. This was completed early in April.

In the bottom of the skip compartment are chutes which catch the drippings that come down the shaft, They are loaded into a car on the plat, the same as cars are loaded from the chutes, on the levels. The loaded car is then switched back to the cage and taken to the level above where it is dumped into the storage pocket. This arrangement has been used by a number of the mines of the Company to handle the skip pit drippings and works very satisfactorily.

A small sump was cut on the 2400' level for a new Aldrich pump, on the completion of the shaft.

The 1800' plat was not cut until June after the shaft and the 2200 and 2400' plats had been completed.

CONCRETING.

Last year the shaft had been concreted to a point 2024' below the collar. The space between this point and the bottom of the shaft was concreted between May 19th and June 2nd a total distance of 369 feet. This concreting consisted of 945 yards averaging 2.56 yards per lineal foot with an average thickness of 14½". The rate per shift was 12.72 lineal feet of shaft.

SHAFT INSTALLATIONS.

After the concreting and before the runners and skips could be put in commission certain sets that had been blasted had to be repaired, the counterweight which had been used in one of the skip compartments removed; the bulkhead below this counterweight taken out; concrete pipes used in the circular shaft removed, and the bottom of the shaft cleaned. Oak runners were then installed in the skip compartments and 2" pine casing plank was placed between the cage and skips; the latter were fitted and bolted in place to the shaft sets so that they could not become loose and fall in the shaft. Two electric cables were installed; one in May and the second in September. The installation of the counterweight pipe started at the bottom of the shaft and had to be stopped in September, 950' from surface. The balance of the pipe not having been received from the manufacturers. This was received late in the year.

POCKET EXCAVATIONS.

When the runners had been installed in the skip compartments down to the 1800' level the plat was cut. The storage and measuring pockets were cut so that the material could be loaded directly into the skips. This work together with the buildings of the pockets, installing the opening and closing device on the 1800, 2200 and 2400 levels required nearly four months so that drifting to the ore body and cutting pump houses and sumps did not start until November first. The pockets are designed similar to those in use at the Negaunee Mine; three compartments, a center one having about twice the capacity of the two on the ends. A measuring pocket is arranged for each skip. One being fed by either an end or center compartment, the other by the opposite end compartment of the center one. The pocket opening and closing

device is made of 2¼" square iron fingers which are connected to a cross head by chains, the cross head being operated by an air cylinder. The dumping device at the measuring pockets is a toggle and counterweight arrangement which drops the bottom of the pocket and dumps the ore on a chute, below which the skip is spotted. With an arrangement of this kind a great deal of time can be saved in loading skips as the measuring pocket is filled when the skip is going to surface. It takes only a few second to fill the skip after it has been spotted.

DRIFTING.

Drifting on the 2200 and 2400' levels started November 1st. The material was hard compact siamo slate and quartzite. In order to make as rapid progress as possible a new Sullivan DR6 machines were installed. On January 1st, 426' had been drifted on the 2200' level, and 450' on the 2400'. Both drifts had passed out of the slate formation and had encountered a very compact find grained diorite; this material being as hard as the quartzite.

When drifting started we adopted the regular 8 hour schedule, working day and night shifts. Better progress could be made if three shifts were employed but on account of the time lost after blasting it was decided to work only two shifts. We had expected to have the motor haulage as soon as drifting started. However, the motor generator set had not arrived so hand tram cars were made and are still in use. The mechanical department has decided to install the motor generator set in the pump room.

PUMP ROOM.

When drifting started on the levels, work was at once commenced on cutting out the pump room Northeast of the shaft. A drift was driven East to the edge of the pump house and when the pump room has been excavated this room will average about 30 feet wide, 40 feet long, and 12 feet high. On the completion of the North room a similar one will be excavated to the South. After which the sumps will be cut.

At the 2300' level instead of cutting a plat at the shaft and installing storage pockets it was decided to handle the ore through raises put up from the 2400' plat pocket to the 2300'. Two raises have been started and as soon as these reach the 2300' level a drift will start toward the ore body.

It is thought by handling the ore from this level in this manner, it will eliminate at least one or two men at the shaft that would be necessary if the pocket were there.

NUMBERING LEVELS.

For convenience sake it was decided to number the levels; the top-most being at 1500' from the collar the bottom 2400'. Following has been adopted.

Collar Elevation	No. of level	Mean sea level
1500	1	-100
1600	2	-200
1700	3	-300
1800	4	-400
1900	5	-500
2000	6	-600
2100	7	-700
2200	8	-800
2300	9	-900
2400	10	-1000

VENTILATION.

When the shaft was completed the ventilating pipe was taken out of the compartment in which it had beeninstalled for sinking purposes, the fan set up on the 1800' level and the pipe installed down to the 2400' level-openings being left at each phat. This is ready for use whenever it is necessary by simply extending the pipes into the levels.

PUMPS.

On April16th, was received one 4 x 10 Vertical Triplex Plunger Pump and 1 - 50 H. P. 600 revolutions per minute, General Electric Co. motor, purchased from Aldrich Pump Co. at a cost of $2257.00. This was installed on the 2400' level on May 14th. It has a capacity of 100 gallons per minute against al400 foot head. The water from this pump discharges into a small sump at the bottom of the circular shaft 1084' below the collar. Here a similar pump purchased from the Aldrich Co. discharges the water to surface.

The following permanent equipment for the 2400' level pump house has been received.

One 500 gallon, 2400' head, plunger pump, purchased from Prescott Pump Co., at a cost of $14,000.00; received on November 26th.

One 400 H. P. 514 revolutions per minute motor purchased from Westinghouse Electric and Manufacturing Company at a cost of $3,300.00; received November 29th.

COST OF SHAFT.

Attached to this report is a detailed statement the "Cost of Sinking Shaft"; cost per foot sand and rock shaft $117.34; rock shaft $117.75. This statement is actual and contains items which are included under other headings than Sinking in the superintendent's estimate. These items include temporary surface structures andequipment, mining captain, and power drills.

Under the superintendent's division was estimated, Sinking in Rock item #4 as follows:

1033.5' circular shaft,	$109.00	per foot,
976' rectangular shaft,	105.00	" "
430(illegible)' rectangular shaft,	109.00	" "
2439.5' shaft	107.40	average estimated cost per foot.

At the end of the superintendent's estimate was added 10% for contingencies. If this were added to the above we would have:-

Estimate,	107.40	per foot,
10% for contingencies,	10.74	" "
Total Supt's. estimate,	118.14	" "

Account #4 as shown by the December 31st, 1917, Opening Statement is as follows:

Sinking in rock, 2436.5', $251.376.79

Cost per foot, $103.17

This figure shows that the shaft was actually sunk for $4.13 less than estimated, or $14.97 less if the 10% for contingencies were included in the estimate. This saving was made in the face of adverse conditions. Company

account mining in August, 1915, being $2.55 while in October, 1917, it was $4.07 per day an increase of 56%. All supplies have increased greatly; powder along advancing about 150% from 1912 to 1917.

There remains only a slight amount of work to complete the shaft, the casing off of the ladder from the cage compartment. This has been purposely postponed until the discharge pipe has been installed.

SURFACE

The skip hoist was tried out January 10th by the Mechanical Department. I have already mentioned under "Shaft" the delays in getting the sprocket and chains and trobble with the fly wheel bearing. This bearing was taken off and scraped a couple of times, an oil cooling device installed but finally a new bearing was procured before it ran satisfactorily. The expert from the General Electric Co. spent most of the summer trying to make the adjustment.

ROCK TRESTLE.

During the time the shaft was being sunk the rock was dumped into a gully to the West of the mine, the rock being used to grade the surface at that point. It was necessary to handle the rock from the top landing when the skips were installed. Piers were built in July, and the trestle was erected in September and October, 496 feet in all. As the top tram engine motors have not been received, it is necessary to operate the rock car on the trestle by means of a puffer with a tail rope, the car going out by gravity and is pulled back by the puffer.

STEEL TRESTLE.

The permanent trestle which extends from the head frame to the ore trestle is of steel. This trestle, 108' in length, extends over the pocket tracks, main line, and stock pile loading track. Piers were placed in July and the steel erected by the Worden Allen Co. in August. This is to the East of the head frame and extends over the tracks in a Southeasterly direction.

MINE BUILDINGS.

In April a contract was let with Albert Proksch for the mine buildings. Work was started on April 25th. The contract covered the following buildings; change and boiler house, shops, warehouse, office, laboratory, and crusher house. All are of the standard permanent construction adopted by

the Cleveland Cliffs Iron Co. of Green Bay light buff brick. The construction work lasted throughout the summer and fall. The change and boiler house, shops and warehouse being occupied by the Company in November. On the first of December all that remained to be done to complete the buildings was a slight amount of plumbing which was delayed on account of materials not being received.

CONCRETE TIMBER TUNNEL.

A concrete timber tunnel has been provided at the Athens which extends under the Railroad tracks on the South side of the shaft. This turns and runs West after crossing the tracks and has been constructed wholly of concrete for 177'2". By means of this tunnel men and timber can be taken on the cage without crossing the loading tracks. The elevation of the tunnel is about 10 or 12 feet below the collar. The tracks extend from this concrete tunnel Westerly to the timber yard; here the tracks are protected by a covering of galvanized iron construction except on the North side where there is a concrete wall, doors will be provided on both the North and South sides so that timber and lagging can be loaded directly on the trucks. This arrangement is similar to that employed at the Negaunee Mine which has been most satisfactory.

CONCRETE ROAD TUNNEL.

In order to provide the proper grade for the empty cars above the pocket to be lowered by gravity it was necessary to make a fill West of the head frame. At the point opposite the shops building this fill was about 14 feet. To provide a road to Ann St. through from the mine buildings on the South side of this fill it was necessary to construct a road tunnel. This was built of concrete, with an opening 10 feet wide and 12 feet high; the top of the tunnel being about 35 feet long. Two railroad tracks extend over the top which had to be very heavily reinforced to carry the rolling load of an engine. The wing walls project to protect both openings.

GRADING.

Considerable grading had to be done at the location of the mine buildings, timber yard, office site, coal dock, and stocking ground. This was delayed until late in the fall as the only time that teams could be procured

was after the city had finished its road construction work. Most of the grading has been done except at the stock pile sollar and timber yard which will be completed early in the spring if teams can be secured. The mine road leading from the shops and warehouse building North past the office to Ann St. will also have to be rocked as the material here is sand and hauling is extremely heavy. At the stock pile sollar plank was laid covering an area of 115 x 310 feet. This will give sufficient surface for the expected winter's stocking.

COAL DOCK.

The coal dock is located immediately West of the boiler house; the grading started in July, the timber was framed in August and the dock completed in September. Coal was received in the dock in October. It has a capacity of 1000 tons of coal, but in addition two bents on the approach side are provided to hold blacksmith coal.

RAILROAD TRACKS.

The L. S. & I. Railroad Co. started grading their mine tracks in September and continued until December. Most of the work was completed by the end of October except a little to the East of the head frame on the North side where material had been piled that had to be removed before the grading could be completed. The air line from the receiver to the shaft had to be removed to a new position farther North so as to escape the railroad track fill. Most of the material used by the Railroad Co. for this grading was obtained from the rock pile immediately South of the head frame. The surfacing material was gotten immediately West of the mine in a gravel bank.

SEWER, WATER, AND STEAM LINES.

Sewer and water mains were laid during the summer before the Railroad ffill started. The city extended a 4" cast iron pipe to the South of the proposed Railroad tracks and installed two fire hydrants. The latteral sewer from Ann St. trunk line was laid South along the new roadway to accomodate the office, laboratory, and change house. This is an 8" glazed sewer pipe and was installed by the Company. The surface water is to be handled through an independent sewer which discharges South of the boiler house in the gully. The steam line header for heating purposes is a 3" pipe from the

boiler house covered with sheet asbestos enclosed in a wood water pipe. This was very carefully laid and tested so as to prevent possible leaks in the future.

TRANSFER HOUSE.

The transfer house is located to the South of the main line track near the head frame. Foundations for this building and engine bed were started in October and the side walls and roof were built in November. Cold weather prevented our putting on the concrete sides so that it was closed for the winter with building paper. HY-rib construction is to be used on the walls of this building.

CRANE.

In October a steel crane was constructed at the Southeast corner of the head frame by means of which the top tram stocking cars can be hoisted to the top landing platform from the ground.

DWELLING HOUSES.

The office site selected by the Company was on lots,3, 4, and 5 Sterling Addition. Before the construction of this building could start the houses located there had to be moved to a new site. Three houses and one barn were moved East on Ann St. about 1000 feet to lots 36, 37, and 38 Sterling Addition. This was done in June and July. On account of our inability to secure labor the foundations for these buildings were not completed until late in the fall. For the same reason the repairs could not be started until the houses had been lowered on the foundations. All houses will be occupied by tenants early this year as soon as repairs are finished.

SINKING STATEMENT - 1917

Month	Concreted	Total Concreted	Sunk	Total Sunk
January	15'	2041'	120'	2343
February	7	2048	66	2409
March	12	2060		2409
April	6	2066	51	2460
May	369	2435	27	2487
Total,	409		264	

COST OF SINKING SHAFT.

	TOTAL TO DATE	COST PER FT.
Sand Shaft 50'6"		
Sinking in Sand,	2,183.58	50.19
Temporary Surf. Structures & Equipment,	20.52	.41
Steel Shaft Frames,	1,306.18	25.86
Concreting 50'6",	1,339.24	26.51
Steel Concrete Forms,	45.50	.90
Compressed Air,	50.00	1.00
Total,	4,945.02	104.87
Circular Shaft 1033'6"		
Sinking in Rock,	50,460.44	48.82
Temporary Surf. Structures & Equipment,	6,480.04	6.27
Steel Shaft Frames,	13,940.13	13.49
Concreting 1033'6"	22,021.25	21.33
Steel Concrete Forms,	3,263.98	3.15
Compressed Air,	13,041.14	12.61
Pumping,	5,082.96	4.91
Total,	114,289.94	110.58
Rectangular Shaft 1403'		
Sinking in Rock,	73,698.88	52.53
Temporary Surf. Structures & Equipment,	8,749.04	6.23
Steel Shaft Frames,	46,138.04	32.88
Concreting 1351' ,	21,356.65	15.81
Lathing,	7,362.12	5.25
Compressed Air,	10,640.90	7.58
Pumping,	4,661.11	3.32
Total,	172,606.74	123.60
Total cost of shaft,	291,841.70	
Total Depth of shaft,	2487 ft.	
Cost per foot,	117.34	
Cost per foot rock shaft,	117.75	

Note the difference in cost per foot of sets, circular $13.49, rectangular, $38.13. This latter includes lathing. The former requiring no lathing as concrete was placed behind the steel forms which were afterward removed. The great difference in the cost is due to two reasons; 1st, - The rectangular sets were placed at 6 foot intervals while the circular sets were placed at 10 foot intervals. 2nd - The rectangular sets contained a great deal more steel than the circular and the price was much higher than when the circular sets were bought.

DETAIL OF ACCOUNT #4-A " SINKING IN ROCK"

CIRCULAR SHAFT

Labor.	Total to date,	Cost per ft.
Mining Captain,	3,157.51	3.06
Miners,	22,154.14	21.44
Landers,	3,723.10	3.60
Pufferman,	55.77	.05
Compressor,	62.70	.06
Hoisting,	2,592.24	2.51
Blacksmiths,	2,018.11	1.95
Teaming,	10.63	.01
Surface Foreman,	252.62	.24
Labor on Drill Machines,	503.10	.49
Dry House,	308.51	.30
Muckers,	1,054.57	1.02
Total Labor,	35,893.00	34.73
Supplies,		
Powder, Fuse, and Caps,	3,814.68	3.69
Small Supplies for Miners,	838.95	.81
Air Hose,	564.22	.55
Drill Steel,	641.44	.62
Pipe & Fittings,	211.20	.20
Teaming,	117.19	.11
Electric Power,	62.06	.06
Machine Repairs,	1,406.48	1.36
Hoisting,	4,435.07	4.29
Dry House,	458.83	.44
Top Landing,	110.33	.11
Drill Machines,	1,906.98	1.85
Total Supplies,	14,567.44	14.09
Grand Total,	50,460.44	48.82
Total feet sunk,	1033' 6"	

Average wages,	1914	1915
Underground,	3.09	3.44
Surface,	2.46	2.39
Total,	2.68	2.97

DETAIL OF ACCOUNT #4-A "SINKING IN ROCK"

RECTANGULAR SHAFT

Labor	Total to date	Cost per foot.
Mining Captain,	1,550.05	1.10
Miners,	37,081.55	26.43
Landers,	4,983.31	3.55
Hoisting,	3,406/92	2.43
Blacksmiths,	2,208.78	1.58
Surface Foreman,	412.86	.30
Labor on Drill Machines,	567.93	.40
Dry House Expense,	716.01	.51
Powder Tender,	474.13	.34
Total Labor,	51,401.54	36.64
Supplies,		
Powder, Fuse, and Caps,	8,778.99	6.26
Small Supplies,	1,441.61	1.03
Air Hose,	203.67	.15
Drill Steel,	695.38	.49
Pipes & fittings,	115,78	.08
Machine Repairs,	3,181.22	2.27
Hoisting,	5,545.59	3.95
Dry House,	346.23	.25
Top Landing,	525.20	.37
Drill Machines,	1,407.41	1.00
Electric Current for Fan,	56.26	.04
Total Supplies,	22,297.34	15.89
Grand Total,	73,698.88	52.53
Total feet sunk,	1403	

Average wages	1916	1917-to June 1st
Underground,	4.41	4.81
Surface,	2.80	3.13
Total,	3.69	4.00

DETAIL COST OF CONCRETING SHAFT

	Total to date,	Cost per ft.
Circular Shaft, 1033'6"		
Labor mixing and pouring,	1,155.91	1.12
Cement and other supplies,	6,669.85	6.46
Heating Gravel,	945.92	.92
Labor moving & setting forms,	7,933.58	7.69
Hoisting supplies,	2,186.43	2.12
Labor on gravel,	2,193.04	2.11
Supplies on gravel,	936.52	.91
Total,	22,021.25	21.33
No. of yds. constructed,	2,877	
Average thickness,	14.8"	
No. of yds. per ft.,	2.78	
No. of bags cement,	18,370	
No. of bags cement per yard,	6.38	
Cost per yard for concrete,	$7.65	
Vertical feet constructed,	1,033½	
Rectangular Shaft		
Labor mixing and pouring,	7,469.36	5.53
Cement and other supplies,	10,522.04	7.79
Prop. Boiler house expense,	300.94	.22
Heating Gravel,	245.95	.18
Gravel Cost,	2,818.36	2.09
Total,	21,356.65	15.81
No. of yds. constructed,	3,810	
Average thickness,	16"	
No. of yds. per ft.,	2.80	
No. of bags cement,	21,424	
No. of bags cement per yd.,	5.62	
Cost per yd. for concrete,	$5.62	
Vertical feet constructed,	1,351	

DELAYS.

Feb.	8 - 2	hours -	Blasting battery broke,
	9 - 3½	"	" " "
	11 - 2	"	Bell"line in"shaft broke
	6 - 1	"	Air compressor broke.
Marc.	19 - 16	"	Bearings on motor generator set run hot.
	20 - 24	"	" " " "
	21 - 16	"	" " " "
Apr.	14 - ½	"	Rope off of sheave on pulley stand.
May.	5 - 3	"	Blasted shaft set.
	9 - 2	"	Top tram car off track.
July	16 - 4	"	Chainging skip rope (put on new rope)
Oct.	17 - 4	"	Electric pump cable blasted and cable burnt.
Dec.	11 - 7	"	Hoisting delayed on account of sheaves on pulley stand.

ELECTRIC DELAYS.

Apri	20 - ½	hour -	no current - trouble at power plant
	20 - 4½	"	burn out on electric pump cable on surface.
May	10 - 1	"	no current.
June	9 - 2	"	" "
Aug.	17 - ½	"	" "
Dec.	6 - 8	"	Had to stop work to conserve electric current, acct. water being in at Stephenson.
	8 - 12	"	" " " " " " " " "

ATHENS MINE

ORE STATEMENT AND SHIPMENTS FOR YEAR-1917.

	ATHENS
On hand Jany. 1st, 1917,	530
Output for Year,	0
Shipments,	0
Balance on Hand,	530

This ore encountered in shaft during 1916.

SOUTH JACKSON AND CRUSHER - 1917

Work started at this pit overhauling cars, air pipes, etc., on April 23rd. As nothing had been done in the year 1916, considerable repairing was necessary. The announcement was made that mining would start as soon as men could be secured. Loading ore started on May 4th and continued throughout the season until November 10th. A product of 47,336 tons was mined. During the months of May and June practically all of the work was on the East side of the Railroad track which runs through the pit; seven breasts were worked but the product of the two most Northerly was so poor that these two had to be abandoned. On the West side the face of the ore was high - in places nearly 100 feet - and it was too dangerous to start work in that area until the frost was thoroughly out of the ground, as slabs fell off and it was impossible to trim the face. One contract started on this West side in June and others in July. The product improved in quality from that time. Throughout the season there was a scarcity of men, which was an unusual condition at this open pit as in previous years men could be secured here when there was a general shortage at the underground mines. These silicious ores were in demand and we could have sold a greater tonnage if it could have been mined.

Mining operations in this open pit have been conducted for a great many years. The formation is very much broken and contains seams of lean material. It has been the habit to throw this rock in piles in the bottom of the pit as mining advanced; as a consequence the whole bottom of the pit is covered with great piles containing thousands of tons of this lean ore and rock which is unmerchantible. I have stated above the breasts on the North ran into such lean ore that they had to be abandoned. In addition to this there was considerable over-burden encountered which had been dumped from open pits and early mining work. This had to be removed to get at the merchantible ore. At the end of the season on the East side operations had extended nearly to the Lucy line; to the South, we were cut off by dikes;

in the Southwest end some good material was found but the tonnage here is limited on account of dikes also. As there is still a large demand for this ore it became necessary to start exploring to develope the tonnage to be mined the next few years. This was done by means of churn and diamond drills which I will treat under the head of explorations.

EXPLORATIONS.

A churn drill was brought into the pit in June, the bottom of the pit tested thoroughly for a vertical distance of between 50 and 60 feet. On the East side of the pit, that is, Northeast of the loading track, sixteen holes were drilled. In all but four of these ore of the South Jackson guarantee was found. On the Southwest side eight churn drill holes were put down. In these only two found merchantible ore. The tonnage found from this drilling was 70,000 tons. After completing the churn drilling in the pit this drill was moved to the South of the pit on section 12 where holes 9 and 10 were drilled. Both of these were 135' in depth and although they were within 25 feet of the face of the pit no merchantible ore was found. Two churn drill holes were then drilled a little to the Southeast on the Lucy property. These were stopped at a depth of 130' but neither found merchantible ore; the manganese, however, averaging slightly better than 4%. Years ago at the North end of the pit some mining was done in a seam of manganese ore called the "The Manganese Pit". It was decided to test this area with the churn drill. Up to December 31st, holes 97 to 104 were drilled in this area. This is located about 200 feet due West of the Crusher building. The material found in practically all of the holes has been of merchantible grade. The ore developed here December 31st is 90,000 tons but explorations in this territory will be continued. This is covered with an averaged of 4' sand and 6' loose rock which was dumped there in former years.

In addition to the churn drill, a diamond drill was employed for exploratory purposes. Hole 93 was located in the South foot wall of the pit about 100' West of the loading track. It was a flat hole, dip -5°, and

was drilled in a Southerly direction; the first 45 feetwere good, the balance of the hole contained lean material; it was stopped at 120' in caving ground.

Hole #96, 250' to the Northwest of 93 was also a flat hole drilled to the South. This stopped at 110' when it encountered old workings, the material throughout the whole length of this was merchantible.

Hole #8, section 12, was located near the end of the loading track against the South wall of the pit. This is about 200' to the Southeast of hole 93. The material encountered was lean.

The last hole drilled was in the Lucy pit in the North face. This was #100, section 6, 47-27, a flat hole at a dip of -5° and drilled about North 28° East; 100' were drilled most of the material being merchantible.

METHOD OF MINING.

The explorations conducted this summer show that the present method of open pit mining will soon have to discontinued on account of the breasts running out. This means that some other method will have to be adopted. Two methods have occured to me, one is placing a steam shovel in the bottom of the pit, the other is by a milling.

The steam shovel proposition, if it could be worked out, would probably be the cheaper method. However, I am afraid that the shovel might encounter lean streaks which would bring the product below the guarantee, which would get us into serious trouble. Another obstacle in the way of the steam shovel method is the quantity of lean material that has been left in the pit and the possibilities of running into more refuse in the workings that were conducted underground which were afterwards filled from surface. If enough breasts stopes of good quality ore could be maintained it is possible that we might be able to "sweeten" the steam shovel product to such a degree as to make it merchantible, however, it would be impractical to take out more than one cut in depth if loaded directly into railroad cars on account of railroad operating condition. Further cuts would require an expensive approach and heavy grades.

By milling method a mixture from several different mills might give a merchantible grade even if one mill should happen to run lean. It

happens too that the pit lends itself admirably to this scheme without any great expense. Several years ago a drainage tunnel was constructed which runs from under the pit North beneath the County road and discharges into the open field. The shaft located in front of the Crusher extends to this drainage tunnel; the elevation of the shaft plat at this tunnel is 1381.4 ft. while the top of the ore where most of the drilling was done averaged between 1455' and 1465'. This means that if a drift were driven from the shaft under the pit most of the ore found by the churn drill could be mined. The ore body to the west of the crusher would give practically the same amount of ore vertically. After the main drifts were driven, raises put through to surface and stripping completed, I do not think the cost of mining by milling would be a great deal in excess of the present cost. It is my idea to start exploratory work by means of drifts in the direction of these ore bodies early in the spring. In anticipation of this, a couple of sets were put in the bottom of the shaft, and the skip pit sunk a distance of 5 or 6 feet so that ore can be dumped directly into the skips from the tram cars. The tunnel timbering was repaired so that work underground can start as soon as the pit is opened for the summer.

The ore hoisted from the drifts will be dumped at the top of the Crusher building and can be crushed directly or loaded into cars and sent to the Maas crusher.

NEW STEAM SHOVEL TRACK.

Throughout the whole summer we were handicapped considerably on account of lack of track room in the pit. Most of the work in the East end was near the section corner and adjoined the open pit of the Lucy Mine. The tram to the present track was long. It was seen that if another loading track could be provided which would lead into the Lucy pit that the tramming distance would be shortened greatly and two tracks could be used in the pit instead of one. One December 1st a steam shovel was taken to the Jackson pit and a new cut was started on the Northeast side of the present one, the idea being to make a cut through the pit as deep as possible with the steam shovel wasting the dirt on either side. This necessitated

a cut of approximately 25 feet in width. They were able to maintain this width and carry the breast from seven to nine feet high. Horinxontal holes were drilled in the breast, these holes being made as deep as possible to drill them. Enough powder was put in the holes to shake the ground thoroughly after which it was excavated by the steam shovel. An average of about two cuts were made per day - some days the breast of the cut advancing 20 to 25 feet. This work continued until the shovel reached a point where it could not waste the material on either side so this work had to be abandoned. This was on January 4th. There is still about 120 feet of cut to be made before the track can be laid into the Lucy pit. This can be taken by means of a breast stope this summer. The ore excavated by the shovel in places looked very good and I hope a few cars can be loaded by means of the steam shovel during the coming season to see how the product will run. If it is satisfactory a considerable quantity can be taken by this means.

STRIPPING.

Immediately after work of loading the ore stopped in the pit, the men were transferred to stripping. This was conducted in three places, North of the Lucy pit, near the Southeast corner of the South Jackson pit, near the section corner $\frac{1}{12}\left|\frac{6}{7}\right.$; and the Southwest edge of the pit over the vertical face.

To the North of the Lucy pie an area about 50' wide was cleaned.

At the section corner, the quantity to be removed was considerable. In order to reach this a bridge had to be built over some of the Lucy pit workings. The material at this section corner was principally sand that had accumulated there by stripping conducted for years. Work had to be abandoned there in January without being completed. This is unfortunate as it is dangerous to strip in that particular location in the summer where the face is vertical and liable to slab off.

At the Southwest end stripping was done along the edge of the vertical wall to prevent its mixing with the ore that will be taken from there during the coming season.

JACKSON CRUSHER.

Overhauling of the crusher was started on the 10th of April. Crush-

ing started on the day shift of the 18th, a night shift crew was put on the 20th. A great deal of trouble was had on account of frozen and sticky ore, most of the ore received was from stock pile loading. It was necessary to start the boilers to get steam to thaw out the cars. Trouble with the frozen and sticky ore continued through most of the month of May when conditions improved. The crusher operated on a day and night shift until July 15th when one of the crews was taken to start operating the new Maas Crusher. The Jackson was operated for the next two days by a day shift only and on the 17th the crushing was stopped. A crew started cleaning up around the buildings and crusher but it was necessary to operate here again on the 24th and 25th of July on account of an accident to the rubber conveying belt at the Maas Crusher. From that time to the end of the season this crusher was idle, however, it is in condition to operate at any time it may be necessary.

SOUTH JACKSON MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR THE YEAR - 1917.

GRADE	IRON	PHOS.	SILICA	MANG.
South Jackson,	36.98	.055	37.91	2.68

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR THE YEAR-1917.

	Mine				Lake Erie		
GRADE	IRON	PHOS.	SIL.	MANG.	IRON	MANG.	MOIST.
South Jackson,	36.95	.055	38.03	2.65	38.23	2.79	7.44

ORE STATEMENT AND SHIPMENTS FOR YEAR-1917.

	SOUTH JACKSON
Output for Year,	47,836
Shipments,	47,836
Balance on Hand,	0

Mine operated 1-10 Hr. Shift April 27th to November 10th

Mine idle in 1916.

SOUTH JACKSON MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 7.	1 9 1 5.	INCREASE.	DECREASE.
PRODUCT	47,836	56,026		8,190
General Expense	.027	.020	.007	
Maintenance	0	.010		.010
Mining Expense	.538	.363	.175	
Cost of Production	.565	.393	.172	
Exploratory	.121		.121	
DEPRECIATION.				
Original Purchase	.803	.200	.603	
Equipment		.006		.006
Total Depréciation	.803	.206	.597	
Taxes	.038	.029	.009	
Central Office	.031	.018	.013	
Sundry Expense	.005	.065		.060
COST ON STOCKPILE	1.563	.711	.852	
Loading & Shipping	.114		.114	
Total Cost on Cars	1.677	.711	.966	
No. Days Operating	158	112		
No. Shifts and Hours	1-10hr	1-10		
Avg. Daily Product	303	500		
COST OF PRODUCTION				
Labor	.461	.270		
Supplies	.104	.123		
Total	.565	.393		

Idle 1916; 1915 used for comparison.

SOUTH JACKSON MINE.

SOUTH JACKSON MINE.

COMPARATIVE WAGES AND PRODUCT.

	1917.	1916.	INCREASE.	DECREASE.
PRODUCT	47,836	56,026		8,190
No. Shifts and Hours	1-10hr	1-10hr		
AVERAGE NUMBER MEN WORKING				
Surface	4	7		m 3
Underground	22	35		13
Total	26	42		16
AVERAGE WAGES PER DAY				
Surface	3.86	2.08	1.78-85%	
Underground	3.24	2.14	1.10-51%	
Total	3.34	2.14	1.20-56%	
WAGES PER MONTH OF 25 DAYS				
Surface	96.50	52.00	44.50	
Underground	81.00	53.50	27.50	
Total	83.50	53.50	30.00	
PRODUCT PER MAN PER DAY				
Surface	36.71	75.84		39.13
Underground	7.61	9.12		1.51
Total	6.30	8.14		1.84
LABOR COST PER TON				
Surface	.105	.027	.078	
Underground	.425	.235	.190	
Total	.530	.262	.268	
TOTAL NUMBER OF DAYS				
Surface	1,303	738¾	564¼	
Underground	6,266¾	6,145½	121¼	
Total	7,569¾	6,884¼	685½	
AMOUNT FOR LABOR				
Surface	5,032.24	1,534.44	3,497.80	
Underground	20,308.80	13,164.65	7,144.15	
Total	25,341.04	14,699.09	10,641.95	

Proportion Surface to Underground Men:

1917 - 1 to 6.5
1915 - 1 to 5.
1914 - 1 to 13.

Idle 1916; 1915 used for Comparison.

NORTH JACKSON - 1917

During the year nothing was done at the North Jackson except the tearing down of the old engine house opposite Cyr Street. This was a delapidated structure. The material in the building was sold to a Finn so that the dismantling cost nothing to the Company.

On August 4th a portion of the State Constabulary which had been located at Bessemer moved to Negaunee on account of threatened labor trouble from the I. W. W. The North Jackson office was fitted up as a barracks. It will accomodate 30 men very comfortably. The large Jackson barn was repaired and is now used by the Constabulary as a stable.

LUCY MINE - 1917

The workings of the South Jackson pit broke into the Lucy open pit Northwest of the shaft during the latter part of the season. During the coming year it is hoped to conduct open pit mining along the North and South walls of this pit. At the former place a flat diamond drill hole #100, section 6, was drilled to the North a distance of 100' to test the material. Here ore running about the South Jackson guarantee was found. To the South of the open pit two churn drill holes were drilled, #9 and 10, section 7. Although these were located within a few feet of the South edge of the old open pit workings, non-merchantible ore was found. Between the churn drill holes and the main open pit there are seams that appeared to have ore of a merchantible grade. These will be tested during the coming year.

During the summer the Mechanical Department dismantled the machinery that remained at the Lucy that could be used at other places. There still remains considerable quantity of old pipe and the like; as this is being stolen, on account of the high price for scrap iron, all loose material should be salvaged by the Company this coming year.

MORRIS-LLOYD MINE.

GENERAL

Operations at this mine were carried on as vigorously as labor conditions would permit during the entire year. We have been short of men during the entire time, which materially interfered with our total production. We, however, show the largest tons per man this year than that for any other year in the history of the district.

No new work was undertaken on surface during the year, and operations here were confined to the caring for and shipping the product of the mine, and other regular surface work. Owing to the shortage of men the streets at the new houses were not graded during the year.

Our costs for the year will average about 12% over last year, due to increases in wages and material.

Hoisting on day shift only has been under way at the Morris Mine, with the exception of a little rock from the shaft sinking, which could not be conveniently handled on day shift, and this was hoisted at odd times on the night shift.

In May month the work of putting the Morris shaft down to the 6th or 1200 ft. level was started. A raise was driven from this 6th level up to and holed into the present bottom of the shaft below the 4th level. The shaft was then stripped down and timbered, and at the end of the year had reached a point 15 ft. above the 6th level. A pump house must now be cut and pumps moved to the new location before the shaft work can be completed.

MORRIS-LLOYD MINE.

LABOR.

We started the year with 289 men employed, and kept losing men every month, and close the year with but 217 men as shown by our Labor Statement.

It is difficult to keep men in these outlying districts when the demand for labor becomes as heavy as it is right now. We have also had six of our men drafted and taken into the army. In addition to the draft, we have lost a number of our men to the Canadian troops. We have also lost some of our best workers during the last two months due to their having been prosecuted for selling liquor in the location.

The following statement shows the number of men employed during the past four years, viz:

MEN EMPLOYED.

	SURFACE.				UNDERGROUND.				TOTAL.			
	1914	1915	1916	1917	1914	1915	1916	1917	1914	1915	1916	1917
JAN.	50	48	64	49	215	203	242	240	265	251	306	289
FEB.	43	49	59	47	197	200	245	230	240	249	304	277
MAR.	44	53	62	51	222	214	253	230	266	267	315	281
APR.	42	47	62	46	195	188	247	229	237	235	309	275
MAY.	48	50	61	44	207	216	240	220	255	266	301	264
JUN.	46	54	60	44	213	201	237	216	259	255	297	260
JUL.	44	54	65	43	190	194	232	207	234	248	297	250
AUG.	42	63	61	42	189	197	225	187	231	260	286	229
SEP.	45	56	59	46	197	210	210	177	242	266	269	223
OCT.	46	58	55	45	203	206	219	181	249	264	274	226
NOV.	38	57	53	48	172	217	216	174	210	274	269	217
DEC.	43	57	48	41	186	234	222	176	229	291	270	217
AVG.	44	54	59	45	199	207	232	206	243	261	291	251

It will be noted we show a distinct reduction in the number of men employed on surface as compared with previous years in spite of the fact that we have added two police officers during the year 1917. This saving is due largely to the changed methods of handling our top landings, etc.,etc.

LABOR.
(CONTD)

Our labor costs per ton are higher in spite of our increased tons per man, due to the large increases in wages. Two increases of 10% each were made on May 1st and October 1st, 1917. The average increase over last year is 23-7/8%, and the average over the year 1915 is 41.16%.

The labor costs per ton for the past four years are as follows, viz:

COST PER TON FOR LABOR.

	SURFACE.				UNDERGROUND.				TOTAL.			
	1914	1915	1916	1917	1914	1915	1916	1917	1914	1915	1916	1917
JAN.	.167	.205	.228	.180	.868	1.027	1.043	.946	1.035	1.232	1.271	1.126
FEB.	.159	.211	.219	.178	.868	1.003	1.072	.888	1.027	1.214	1.291	1.066
MAR.	.157	.175	.175	.173	.957	.844	.831	.853	1.114	1.019	1.006	1.026
APR.	.172	.181	.189	.172	.971	.878	.836	.876	1.143	1.059	1.025	1.048
MAY.	.159	.160	.180	.159	.873	.856	.757	.897	1.032	1.016	.937	1.056
JUN.	.159	.169	.161	.176	.842	.755	.702	.960	1.001	.924	.863	1.136
JUL.	.234	.151	.180	.166	1.183	.673	.722	.907	1.417	.824	.902	1.073
AUG.	.188	.20	.161	.170	.937	.753	.671	.851	1.125	.953	.832	1.021
SEP.	.203	.163	.182	.198	.996	.746	.700	.869	1.199	.909	.882	1.067
OCT.	.168	.164	.174	.229	.891	.74	.735	.954	1.059	.904	.909	1.183
NOV.	.195	.163	.187	.232	.878	.772	.798	.977	1.038	.935	.985	1.209
DEC.	.167	.173	.173	.254	.873	.853	.840	1.077	1.040	1.026	1.013	1.331
AVG.	.172	.174	.184	.186	.92	.811	.809	.908	1.092	.985	.993	1.094

Our labor costs per ton show an increase of approximately 12% over last year.

The following statement shows the average wages monthly, and for the past four years, viz:

	SURFACE				UNDERGROUND				TOTAL.			
	1914	1915	1916	1917	1914	1915	1916	1917	1914	1915	1916	1917
JAN.	2.47	2.25	2.48	3.19	2.97	2.65	2.99	3.51	2.88	2.57	2.89	3.45
FEB.	2.44	2.23	2.69	2.96	2.96	2.61	3.15	3.52	2.86	2.53	3.06	3.46
MAR.	2.43	2.23	2.70	3.16	2.95	2.66	3.12	3.53	2.87	2.57	3.03	3.47
APR.	2.40	2.22	2.74	3.10	2.92	2.70	3.05	3.53	2.83	2.61	2.98	3.44
MAY.	2.31	2.23	2.91	3.40	2.92	2.63	3.16	3.88	2.81	2.64	3.12	3.80
JUN.	2.49	2.28	2.91	3.42	2.88	2.74	3.20	3.90	2.81	2.65	3.12	3.81
JUL.	2.47	2.20	2.90	3.39	2.89	2.69	3.17	3.98	2.81	2.58	3.09	3.87
AUG.	2.48	2.51	2.89	3.43	2.81	2.98	3.18	4.05	2.75	2.87	3.11	3.93
SEP.	2.51	2.46	2.88	3.44	2.63	3.03	3.17	4.16	2.76	2.91	3.12	4.00
OCT.	2.21	2.38	2.91	3.86	2.68	3.03	3.19	4.42	2.55	2.89	3.14	4.29
NOV.	2.21	2.47	2.91	3.83	2.68	3.07	3.23	4.37	2.60	2.94	3.16	4.28
DEC.	2.22	2.45	3.04	3.88	2.70	2.97	3.37	4.34	2.61	2.87	3.31	4.25
AVG.	2.39	2.33	2.83	3.44	2.85	2.83	3.17	3.93	2.77	2.72	3.10	3.84