soon as possible and discomnected the transformer. There was a delay of one hour.

On June 18th, shortly before 8 P. M., there was trouble on the transmission line during a severe storm. The delay in hoisting amounted to 1 1/2 hours. Up until midnight the circuit breaker was being continually thrown out.

On September 19th, from 4:30 A.M. until about 7, there was no current. This delay was caused by trouble somewhere on the line. The men in the mine did not care to walk to surface and consequently had to stay underground until 7 o'clock.

On November 8th, during a storm, there was a delay of one hour on account of trouble on the transmission line.

INCREASE IN WAGES.

On Feb. 1st an increase in wages amounting to practically ten cents per day for all men working by the day went into effect.

GRADING ORE.

Much trouble was experienced during the year in grading the ore. The variation in the phosphorus in the Negaunee Mine takes place rapidly. It is not unusual to have stopes change from .050 to .200 between shifts. During the stocking season in the latter part of the year it seemed almost impossible to grade the Bessemer properly. On December 1st it was decided to put an extra shift in the laboratory and sample the stopes on both day and night shifts. During December no improvement was noticed in the result. It has been decided to sample the stopes on the night shift and the chutes on the day shift. In this way it will be possible to obtain some check between the stopes and the chutes. We hope that this will give better results. To obtain a representative sample from any stope is an exceedingly difficult thing. A single blast in the back may bring down twenty-five or thirty tons. It does not stand to reason that any man can obtain a proper sample small from this pile to represent the material. Each stope sample

as a rule weighs about 2 1/2 pounds. If a much larger sample than this was taken it would be necessary to put on additional sample men as it would be impossible for one man to take these samples from the workings to the shaft. Personally I have little faith in a stope sample. If the sample is taken conscientiously it will show whether the material is good or bad. If a judgment sample is taken it is possible to obtain a result which shows much higher in iron than the material would really run. Almost invariably stope samples show higher results than is obtained from the chutes. It is extremely difficult at the Negaunee to get a satisfactory grading of the ore due to the limited number of stopes which run low enough in phosphorus.

LABOR CONDITIONS.

Due to the serious trouble on account of frequent runs of sand from the first of the year up to the middle of May, the labor conditions at the Negaunee Mine have been particularly bad. After each delay, due to the shutting down of the mine on account of there being sand in the main drifts, we always lost a number of good men. In addition, while it was possible to hire good men at other mines, they do not care to work at the Negaunee. The consequence was that the great mass of our labor was made up of young unskilled men. Considerable trouble was experienced with these men as a large percentage of them were Finlanders. Young Finn's, as a rule, are rank Socialists. Commencing with March, when there was considerable talk of a possible strike, we started to lay off undesirable men. During the summer months the conditions were not greatly improved for, when we were able to hire good men, we laid off undesirable ones. The force therefore could not be materially increased. In December we added quite a number of men when the Lake Mine went on a single shift. During the month of December other mines on the range have reduced their working forces. A large number of men daily applied for work. The great majority of these were young Socialistic Finns. With the exception of a few Finns, who came from the Lake Mine and were recommended by the Captain, no others have been hired. We still have quite a number of undesirable men and are constantly making

every effort to weed them out.

ESTIMATE OF PROBABLE ORE.

The estimate of the probable ore in the Negaunee Mine has been figured a great number of times. As previously explained it is difficult to arrive at figures which are close, due to the fact that in a large part of the mine the ore body has been cut up by square set rooms. In addition there are places where ore was mined in open stopes. These open stopes were not plotted on any of the old maps. During the present year we have run across several of which there was no record. Many of the old rooms are filled with rock. Where these have been crushed and the rock forced out laterally there is a considerable loss in mining. The assumptions made in 1912 were as follows: Above the 6 1/2 level, or 700' above sea level, in solid ore, 10 cu. ft. per ton with a deduction of 10 per cent for rock and loss in mining. Below the 700' contour and to the 600', or between the 6 1/2 and 9th levels, a deduction of 25 per cent was made for ore already mined in square set rooms and in addition 10 per cent for rock and loss in mining. Below the 600' contour 11 cu. ft. was allowed for a ton and a deduction of 10 per cent for rock and loss in mining. Figures submitted to the tax commission were more conservative and in order to have the present estimate the same as the one submitted to the tax commission, the following assumptions have been made: Above the 6 1/2 level, in solid ore, 12 cu. ft. to one ton, 10 per cent deduction for rock and 10 per cent for loss in mining. Below the 6 1/2 level, in the territory of old rooms, a deduction of 25 per cent for ore already mined, 10 per cent for rock and 10 per cent for loss in mining. The following is the estimate:

Estimate of Probable Ore

Above 6 1/2 Level, Shaft Pillars		
6 1/2 to 6th Level,	125,000	
6th to 5th Level,	119,000	
5th to 4th Level,	83,000	
4th to 3d Level,	42,000	
Total in Shaft Pillars,		367,000
North of Fault "B" Above 700' Contours		
Vertically below 733' Sub to 700' and East to 1050' East,	34,000	
Above 6 1/2 level West to 1050' East,	25,000	
Above Old 400' Level,	31,800	
Between 700' and 600' Contours,	362,700	
Total North of Fault "B",		453,500
South of Fault "B"		
Between 733' and 6 1/2 level and North of 719' Sub,	19,000	
Between 700' and 600' Contours,	1,181,600	
Total South of Fault "B",		1,200,600
Total Above 600' Contours,		2,021,100
Total Ore Between 600' and 500' Contours,		2,705,000
Total Probable Ore Above 500' Contour,		4,726,100
" " " Below 500' "		8,347,000
Total Probable Ore in Mine,		13,073,100

ANALYSIS OF COST SHEET.

PRODUCTION -

1913,	348,055	tons
1912,	270,232	"
Increase,	77,823	tons

During 1913 the mine has worked on two eight-hour shifts. In 1912, on June 18th, we changed from one eight-hour to two eight-hour shifts. The

delays due to runs of sand in both years were serious. The class of labor applying for work in both years has been very inferior. It has been impossible to employ sufficient good men. A large number of firstclass miners have left on account of the frequent caves. During the latter part of the year labor was more plentiful and, on account of flows of sand having stopped, much better results were obtained.

GENERAL EXPENSE -

No. 26-Insurance - 1913 Amount $382.86 - Cost Per Ton $.001
1912 " 518.25 - " " " .002
Decrease, $135.39 - $.001

This decrease is due to the canceling of insurance on old plant at Nos. 1 and 2 Shafts.

No. 27-Engineering - 1913 Amount $1,829.62 - Cost Per Ton $.005
1912 " 3,564.05 - " " " .013
Decrease, $1,734.42 - $.008

In 1912 there was a large amount of engineering necessary in connection with the new plant at No. 3 Shaft. A reduction in 1913 is natural.

No. 28-Analysis - 1913 Amount $6,841.05 - Cost Per Ton $.020
1912 " 6,824.33 - " " " .023
Increase, $ 16.72 - Decrease, $.003

The conditions in these two years were practically the same. On account of the larger tonnage the cost per ton shows a decrease.

No.30a-Mine Office - 1913 Amount $10,479.16 - Cost Per Ton $.030
1912 " 11,876.31 - " " " .044
Decrease, $ 1,397.15 - $.014

This decrease is due principally to a smaller direct charge from the central office. The actual

charge from mine office shows an increase of $215.45. This was principally accounted for under Superintendent's choreman.

Total General Expense - 1913 Amount $19,829.60 - Cost Per Ton $.057
1912 " 22,974.39 - " " " .085
Decrease, $ 3,144.79 - $.028

A large part of this decrease is in Engineering and the balance in Mine Office, due to a decrease in direct charges from the Central Office.

MAINTENANCE -

No. 125-Tracks and Yards - 1913 Amount $2,423.23 - Cost Per Ton $.007
1912 " 2,066.72 - " " " .008
Increase, $ 356.51 - Decrease, $.001

In 1913 a larger amount was expended on improvement around grounds at No. 3 Shaft.

No. 126-Docks, Trestles, and Pockets - 1913 Amount $1,940.84 - Cost Per Ton $.006
1912 " 351.53 - " " " .001
Increase, $1,589.31 - $.005

This increase is for sollar plank purchased in 1913 and grading of East stocking grounds. If the stockpiles at No. 2 Shaft had been shipped there would have been sufficient plank to have covered the grounds at No. 3 Shaft.

No. 127-Buildings - 1913 Amount $2,762.19 - Cost Per Ton $.008
1912 " 921.14 - " " " .003
Increase, $1,841.05 - $.005

A coal dock was constructed at No. 3 Shaft to supply coal for the heating plant which is located in the dry. The cost of this was $1,731.38. In addition a cooling tower at a cost of $692.73 was built. The consumption of water in the engine house used for cooling the motor generator set

and the new compressor has been very heavy. There was a constant waste of a large amount of water. This is now pumped to the cooling tower and used over and over again. This improvement will therefore pay for itself in a very short time.

No. 128-Shop Machinery - 1913 Amount $1,005.23 - Cost Per Ton $.003
1912 " 1,030.57 - " " " .004
Decrease, $ 25.34 - $.001

In 1913 one new motor was installed costing $439.40. The balance of this charge is for a circular saw in the carpenter shop and coke oven for sharpening tools in the blacksmith shop.

No. 129-Boiler Plant - 1913 Amount $1,075.16 - Cost Per Ton $.003
1912 " 1,211.25 - " " " .006
Decrease, $ 136.09 - $.003

In 1912 it was necessary to put in new water lines from No. 1 to No. 2 boiler house. There were no extraordinary expenditures in 1913.

No. 130-Hoisting Machinery - 1913 Amount $ 788.40 - Cost Per Ton $.002
1912 " 1,558.94 - " " " .006
Decrease, $ 770.54 - $.004

This decrease is principally in hoisting ropes. In 1913 they cost $326.88, while in 1912 it was $985.44, or a decrease of $658.56.

No. 131-Compressors and Power Drills - 1913 Amount $ 570.03 - Cost Per Ton $.002
1912 " 2,715.32 - " " " .010
Decrease, $2,145.29 - $.008

In 1912 nineteen drill machines were charged off at a cost of $2292.92, while in 1913 one machine was charged off at a cost of $114.75, or a decrease of $2,178.17.

No. 132-Pumping Machinery - 1913 Amount $1,857.37 - Cost Per Ton $.005

1912 " 1,177.84 - " " " .004

Increase, $ 679.53 - $.001

Two new poles for the 6 1/2 level main pumps cost $419.75. General repairs at Hard Ore cost $404.06. In 1912 the cost for repairs was not as heavy as 1913 for the reason that in 1913 a much larger amount of sand was handled by these pumps.

No. 133-Top Tram Engines and Cars - 1913 Amount $3,209.61 - Cost Per Ton $.009

1912 " 880.12 - " " " .003

Increase, $2,329.49 - $.006

In 1913 the cost for wire rope was, $937.46

Two new top tram cars cost, 566.64

Roller bearing wheels, 62.08

In addition a large number of sheaves and rollers were replaced in 1913. Much trouble was experienced in 1913 due to motors burning out. The charge for rewinding was very heavy.

No. 134-Skips and Skip Roads - 1913 Amount $ 976.62 - Cost Per Ton $.003

1912 " 5,192.93 - " " " .019

Decrease, $4,216.31 - $.016

In 1912 it was found that the steel guides which had been installed for skip runners were not practical. These were removed and changed so that they could be reinforced with wooden guides. This was an exceedingly heavy cost. The charge in 1913 is for general repairs and rebuilding skips.

No. 135-Underground Tracks and Cars - 1913 Amount $2,270.48 - Cost Per Ton $.006

1912 " 1,803.13 - " " " .007

Increase, $ 467.35 - Decrease, $.001

In 1913 a larger territory has been opened up, more gangs added, and consequently a larger expenditure against this account.

No. 136-Electric Tram Plant - 1913 Amount $18,416.94 - Cost Per Ton $.053

1912 " 6,818.61 - " " " .025

Increase, $11,598.33 - $.028

During 1913, as explained in detail in another part of this report, it was necessary to commence to rebuild all of the underground motor cars. In the present year we have rebuilt twenty cars at a cost of approximately $250.00 apiece, or a total of $5,000.00. 1980 feet of 40# rail was laid on the 10th level at a cost of $319.56. A large additional trackage was put into use in 1913 and a much larger amount expended on maintenance of them.

No. 137-Telephones and Safety Devices - 1913 Amount $395.88 - Cost Per Ton $.001

1912 " 637.59 - " " " .002

Decrease, $241.71 - $.001

The cost in 1913 is for the installing of guardrails around machinery in the shops and engine house. In 1912 the expenditure was much larger due to the fact that safety methods were then put into effect.

Total Maintenance - 1913 Amount $37,691.98 - Cost Per Ton $.108

1912 " 26,365.69 - " " " .098

Increase, $11,326.26 - $.010

This increase is explained under Accts. 126, 127, 133 and 136. There was a much larger tonnage produced in 1913 and for this reason, although there was a larger expenditure, the cost per ton is practically the same.

MINING EXPENSE -

No. 150-Air Pipes - 1913 Amount $2,523.81 - Cost Per Ton $.007
1912 " 2,321.34 - " " " .009
Increase, $ 202.47 - Decrease, $.002

As there was a larger territory being worked in 1913 the expenditure for extending air pipes in sub levels is naturally greater.

No. 151-Compressors - 1913 Amount $20,870.05 - Cost Per Ton $.060
1912 " 22,961.86 - " " " .085
Decrease, $ 2,091.81 - $.025

During 1912 a large amount of air was used in rock drifting and in hoisting rock from the 10th level. In addition a number of pumps were being operated by air. During 1913 these conditions were improved. Further, in September a compressor was installed at the Negaunee Mine.

No. 152-Hoisting - 1913 Amount $16,368.03 - Cost Per Ton $.047
1912 " 13,686.58 - " " " .050
Increase, $ 2,681.45 - Decrease, $.003

During the first half of 1913 the tonnage was small and the cost for running the electric equipment was high. Electric machines are not economical unless they are working at full capacity. During the periods when sand is in the mine it was necessary to continue to run the motor generator set and no tonnage was hoisted. There was one man more on each shift in the engine house in 1913 than in 1912.

No. 153-Pumping - 1913 Amount $30,698.07 - Cost Per Ton $.088

1912 " 30,387.90 - " " " .112

Increase, $ 310.17 - Decrease, $.024

This increase is partly accounted for by extra labor in running small pumps at No. 3 Shaft. When the new pumps are in commission the cost for pumping should be greatly decreased.

No. 154-Sinking and Shaft Repairs - 1913 Amount $324.74 - Cost Per Ton $.001

1912 " 326.76 - " " " .001

Decrease, $ 2.02 - .000

No. 155-Rock Drifting - 1913 Amount $10,656.73 - Cost Per Ton $.031

1912 " 7,029.15 - " " " .026

Increase, $ 3,627.58 - $.005

In 1913 rock drifting amounted to 1233 feet.

In 1912 " " " " 1164 "

Rock raising 1913, " " 800 "

" " 1912, " " 1794 "

Cost per foot - 1913, $5.24

" " " - 1912, 2.37

The increase in the cost in 1913 is due to the much smaller amount of rock raising completed in this year. In addition the drifting in 1913 was principally large drifts, while in 1912 most of the work was done in sub levels.

No. 156-Breaking Ore - 1913 Amount $151,482.86 - Cost Per Ton $.435

1912 " 110,614.94 - " " " .409

Increase, $ 40,867.92 - $.026

There was a much larger tonnage produced in 1913, therefore a larger expenditure is natural. In addition, in February there was an increase in wages amounting to approximately ten cents per day

for each man underground. The conditions underground were not quite as favorable for cheap cost as in 1912 for the reason that a large part of the work consisted of ore drifting.

No. 157-Tramming - 1913 Amount $28,240.33 - Cost Per Ton $.081
1912 " 20,774.87 - " " " .077
Increase, $ 7,465.46 - $.004

In order to handle the larger product it was necessary to put on more motormen, brakemen, and chutemen. In addition for the first half of 1912 the mine was only on a single shift.

No. 158-Filling - 1913 Amount $5,566.01 - Cost Per Ton $.016
1912 " 160.06 - " " " .001
Increase, $5,405.95 - $.015

In a very large territory below the area of cave, where sand has been entering the mine, extensive filling was necessary. During the previous year the charge against this account was small.

No. 159-Timbering - 1913 Amount $49,143.20 - Cost Per Ton $.141
1912 " 40,688.36 - " " " .150
Increase, $ 8,454.84 - Decrease, $.009

The increase in the amount is due to the larger tonnage in 1913.

No. 160-Captain and Bosses - 1913 Amount $ 9,508.91 - Cost Per Ton $.027
1912 " 10,107.46 - " " " .037
Decrease, $ 598.55 - $.010

During 1912 the wages of Captain Thomas were charged against the work in No. 3 Shaft, the total cost being $1925.00. This should have been charged during 1911. In the first

half of 1912 four shift bosses were employed while in the second half there were six. In 1913 six bosses have been employed for the full year. In addition, for the larger part of 1913 there was an underground foreman on the night shift.

No. 161-Dry House - 1913 Amount $4,654.65 - Cost Per Ton $.014
1912 " 3,395.97 - " " " .013
Increase, $1,258.68 - $.001

The increase is due to the cost of heating and the hot water service in the dry and various buildings.

No. 162-Top Landing and Tramming - 1913 Amount $5,376.12 - Cost Per Ton $.016
1912 " 4,342.15 - " " " .016
Increase, $1,033.97 - .000

A larger tonnage was stocked in 1913 and, in addition, in 1912 the mine was on a single shift for half of the year. In 1913 there was a heavier cost for electric power.

No. 163-Stocking Ore - 1913 Amount $ 156.49 - Cost Per Ton $.001
1912 " 2,057.57 - " " " .008
Decrease, $1,901.08 - $.007

The small cost in 1913 is for hauling snow, rock, and pieces of timber from the stockpile grounds. In 1912 most of the charge is for erecting stocking trestles at No. 2 plant.

No. 164-Sorting Ore - 1913 Amount $357.30 - Cost Per Ton $.001
1912 " 127.65 - " " " .001
Increase, $229.65 - .000

More labor has been necessary in 1913.

No. 166-Cave In - 1913 Amount $9,735.84 - Cost Per Ton $.028

1912 " 7,456.00 - " " " .028

Increase, $2,279.84 - .000

Under the head of "CAVES", in another part of the report, will be found a detailed account of the various caves. I call particular attention to the fact explained in the detailed account that the amount which it is possible to charge directly against "Cave In" in no way covers the actual expense. These runs of sand effect every mining account and greatly increase the cost.

Total Mining Expense - 1913 Amount $345,788.14 - Cost Per Ton $ .994

1912 " 276,438.52 - " " " 1.023

Increase, $ 69,349.62 - Decrease, $ .029

The increase in the amount is due to more days being worked and to the fact that there was a larger tonnage produced. The decrease in the Cost Per Ton is due to there being no runs of sand during the last seven months of the year. The conditions in the mine greatly improved and better results could be obtained.

Cost of Production - 1913 Amount $403,309.72 - Cost Per Ton $1.159

1912 " 325,778.60 - " " " 1.206

Increase, $ 77,531.12 - Decrease, $ .047

The same remarks for "Total Mining Expense" apply to the "Cost of Production". Cave ins have a tremendous effect on the cost, and if these can be avoided the cost per ton will naturally decrease.

UNDERGROUND.

3D LEVEL ORE.

In my previous report I have described the starting of five raises near No. 2 Shaft to go up near the old 3d level to remove ore in No. 2 Shaft pillar. Two of these raises were taken direct from the 9th level to the 3d, a distance of 250 feet, while two others were taken up 190 feet. By raising from the 9th to the 6 1/2 and connecting with an old raise which extended from the 6 1/2 to the 3d level, the latter could be utilized. The completion of these raises was difficult on account of the extreme height to which they had to go and therefore poor ventilation. At a short distance below the floor of the old 3d level, or at an elevation of 825 feet, drifting was commenced. Raises 58 and 59 were connected and the gang then turned towards the hanging and connected No. 57. This provided good ventilation. After No. 57 was connected the drift was turned to the Northwest in order to reach the foot. A total of 235 feet of drift was completed. In the latter part of May the work in this sub level was stopped as these particular men were needed to do more important work in other parts of the mine. This sub level is under the old stockpile at No. 2 Shaft. As long as this stockpile remains no extensive mining can be done. It has been thought advisable to abandon this territory until the conditions in the mine greatly improve and further until such a time that the stockpiles are removed when there will be no danger of disturbing them.

AMERICAN MINING CO.

In the land of the American Mining Co. two raises, Nos. 56 and 56A, were carried to a height of 175 feet above the 6 1/2 level. This was a great surprise as it was supposed from the work on the Maas Mine and also near the boundary on the Negaunee that the ore would not extend to a great height. On each side of this property rock had always been encountered. The raises were connected and upon crosscutting to the hanging and foot it was found that the ore body was exceedingly narrow. One hundred feet above

the 6 1/2 level the raises were again connected and the drifts extended to the boundary line. Here the ore was about 15 feet in width. A third sub level about 30 feet above the 6 1/2 level showed the ore to be considerably wider, being about 50 feet. The second raise, No. 56A, was completed from the 9th to the 6 1/2 and in addition two short raises from the 6 1/2 to the sub 30 feet above. As the ore body was of such a small extent, and as rock had been found on both the Negaunee and Maas sides, it was decided to remove it in a shrinkage stope. The ore was sliced off between the foot and the hanging and the gang commenced to blast down the material in the back, standing on this broken ore gradually increasing the height of the stope. Only sufficient ore would be removed to allow the men to reach the back and continue the drilling and blasting. In order to provide a safe outlet for the men working in this sub a raise was started from the 700' level of the Maas Mine to go up parallel to the boundary in rock. After this raise had reached a height of about 60 feet it went through the rock and passed into ore. It was seen at once that work in the shrinkage stope would have to be stopped until this ore could be thoroughly developed. Raising from the Maas side was continued until a height of 150 feet was reached. Drifting was started from the breast to connect with No. 56A raise in the land of the American Mining Co. On the end of the year this connection has not been made. The present indications are that the rock on the Maas side, against which all of the sub levels stop, is not the real capping. The development of this territory has been exceedingly slow due to the height of the raise and poor ventilation. The conditions were bad as the dirt from the drift had to be dumped down the same raise which was used as a traveling road. It is possible that the plans for removing this ore may have to be entirely changed.

733' SUB LEVEL.

During the present year the East end of this sub level has been completed. To the East a pillar has been left to prevent any possible flow

of sand from the mined out area still farther to the East. Unless the ore is mined down evenly for its entire length, there is danger of the filling being pulled by the work which is done at the lowest elevation. It was to avoid this possible danger that a pillar has been left.

6 1/2 LEVEL.

During the present year all of the ore on the West end has been removed. The East end was somewhat delayed due to the gangs above having a larger width to remove. In December four contracts have drifted to the footwall and are preparing to pull back. To the hanging two contracts have drifted to the rock and are also pulling back. Retimbering has been necessary in the drift between Nos. 37 and 47 raises and also in the hanging drift going to No. 35 raise. During the year the main drift to No. 2 Shaft has not been crushing severely. From time to time a small amount of timbering has been necessary. Due to the fact that the largest volume of water entering the mine passes through this drift it is necessary to keep it open.

690' SUB LEVEL.

This is a new sub level opened up during November and December. The raises have all been connected and gangs have started to block out ore into pillars of regular size. Each month additional gangs will be placed at this elevation and the territory will be developed rapidly. At the contact between the ore and the rock on the hanging side of the 6 1/2 level there is a main fault striking approximately East and West and dipping at an angle of about 45 deg. to the North. On the elevation of this new sub the crosscuts towards the hanging should go out for a great distance in ore. Above the main drift on the 9th level, in which is located from Nos. 25 to 33, a very large territory has been undercut on the 646' sub level where a single slice has been removed. For this reason, until this 646' sub level is under considerable pressure, the driving of crosscuts on the 690' will have to be watched with great care. As soon as the 646'

is under pressure, it will be possible to drift over the entire territory from the 690' elevation and be reasonably sure that all open spaces below have been filled. During the month of December considerable trouble has been experienced with water on the 690' sub. There is every indication that on this end of the mine the water is increasing while it is probably decreasing towards the hanging. Water enters the raises making the chutes difficult to operate. The ore will pack in the bottom of the chutes and when an attempt is made to empty them a large amount of wet ore will flow out so rapidly that it cannot be stopped. In a number of cases the stoppers of the chutes have been broken. It has also been found that this water is having a great tendency to cause the raises to increase rapidly in size. This is a serious condition and steps will have to be taken to timber the raises in order to save them. A part of these raises passed up through the fault zone where the material has been shared and has a great tendency to slab off. The timbering is going to be extremely difficult.

673' SUB LEVEL.

This entire sub level from Nos. 15 and 16 raises has been opened up and completed in the present year. To the East of No. 15 the ore has been mined up to the shaft pillar. On the footwall side crosscuts were driven into an area where old rooms were filled with broken rock.

663' SUB LEVEL.

To the East of No. 15 raise no ore has ever been mined. This line was established on the 6 1/2 level and has been followed to the present elevation. The ore to the East is left to support the shafts. On the footwall side of No. 16 raise no more ore will be mined to the East of the main crosscut for the time being. This sub level is within 150 feet of the South end of a stockpile at No. 2 Shaft. There has been no movement on the surface near the stockpile and as an extra precaution it was thought advisable not to mine on the East side of No. 16 raise. On the hanging side of Nos. 15 and 16 the work consists of driving crosscuts to the hanging.

646' SUB LEVEL.

In the previous year the only work done on this sub level was a small amount of drifting and crosscutting. During the present year a very large area has been mined out. The work on this sub level was conducted with great care. As explained in my previous report, it was decided to remove a single slice over the entire width and length of the ore body in the territory adjacent to the area of cave of Dec. 13, 1909. From the first of the year up until May 18, 1913 this work was greatly delayed due to numerous bad runs of sand. The places, particularly on the East end, opposite Raises 26, 27, and 28, were wet and for this reason difficulty was experienced in procuring men to work in them. In addition to this the sand invariably entered opposite these raises and men were nervous about working there. The floor over the entire territory was poled down and then lagged. Opposite Nos. 27, 28, and 29 raises old stopes, which were partly filled with rock, were encountered. On the West end, near the boundary line, an open stope of considerable size was run into. On the hanging side, opposite Raises 28 and 29, it was evident that the previous company had commenced to make large open stopes. These open places in every instance have been filled as completely as possible. The reason for doing this was to avoid the possibility of a cave extending to the bad territory above and providing a free passage for the large amount of sand which is known to exist. We are reasonably sure that all openings have been filled. In pulling back great care was used. The ore was sliced off between the crosscuts in most cases to the width of two sets. If the timber showed the least signs of taking weight it was immediately blasted in. In certain places on the foot side, where the ore was exceedingly hard and solid, the slicing was continued for three sets before the places were blasted in. Above this entire territory many thousand tons of ore have been undercut and allowed to drop. When the conditions are such that this ore can be attacked from a higher elevation the cost of mining should be considerably decreased. On the extreme West end, opposite Raise 32, on

the end of the year there are still two gangs working. These contracts, Nos. 9 and 42, are engaged in undercutting the few remaining pillars. Near the boundary line No. 42 has filled a large open stope. Early in the following year all of the remaining pillars will be removed. On the end of the year considerable pressure is being exerted from Raises 26 to 32. From Raises 26 to 28 to the foot and also the hanging crushing was first noticed in May. After that time the water from above greatly increased. This crushing undoubtedly is the cause of the flows of sand having stopped. Previous to this time the water passed to the main level through certain channels. After the territory commenced to crush the water seeped through a great thickness of broken ore, leaving the sand above. In this way sufficient cracks must have developed to have prevented the gradual accumulation of water in cavities extending towards the surface. As the dangerous part of the territory is now under pressure the chances are that practically all open spaces directly above have been closed. The probability of future runs of sand are therefore greatly decreased.

640' SUB LEVEL.

This entire sub level has been opened up during the present year. As previously explained, the floor in the 646' sub level was first poled down and then closely lagged. On this sub level the caps have taken up the lagging in the upper slice. Considerable trouble was experienced with breaking through the lagging in the back due to the inexperienced class of men which it was necessary for us to employ. In a number of instances the places were caved. This was a condition which we wanted to particularly avoid as the running of any place might cause sand to enter the workings. In two instances a small amount of sand did come into the sub level, but as it was not under great pressure the flows were stopped. On the end of the year the pressure over practically the entire sub level from Raises 26 to 31 is very heavy. This is of course what we are trying to obtain, but it greatly delays the completion of the work and causes an increase

in the cost of the ore. In Raises 26 and 27 the drifts have been retimbered a number of times. The lagging above has been pressed down until it is within four or five feet of the rail. The constant reopening of these drifts give us little ore. It has been decided, instead of retimbering the old drifts, to drop down 3 feet in the raises and drift in again. On the footwall side, on the end of the year, four contracts, Nos. 8, 28, 19, and 34 are slicing. On the hanging side there are eleven gangs, all of which are slicing. When this sub level is completed, if it is possible to do so, mining on this end of the mine will be stopped. The reason for doing this is that the ore can be taken to much better advantage by commencing at a higher elevation, on the 690' sub level, and working down. As explained under the 690' sub level, the new crosscuts which are being driven will pass over a large part of this territory. As the depth increases the crosscuts will extend farther to the South before striking the hanging.

630' SUB LEVEL.

In the previous year a small amount of crosscutting was done and during the present year the entire West end of the sub level has been completed. On the East end seven contracts are engaged in slicing back the ore which has been blocked out. Constant retimbering is necessary on this end of the mine as the places crush rapidly.

9TH LEVEL.

During the present year the ore on the 9th level between Raises 20 and 24, inclusive, has been removed with the exception of a few pillars on each side of the main drift which have been left to support the same. It is necessary to keep open this main drift for a traveling road and to get timber to the working places. The conditions here have been particularly bad as the drift has been crushing heavily. A large amount of water flows through it and it has been difficult to keep this from entering the raises. For two sub levels above the 9th level, or approximately 32 feet, pillars were left on each side of the main drift. No. 24 raise has been reopened

and two contracts have commenced to crosscut preparatory to taking out the pillars.

New raises from the 10th level, from Nos. 70 to 76, inclusive, have holed near an old main drift on the 9th level. Going from No. 3 Shaft a track has been laid through the old footwall drift. It is now possible to get timber from the main drift to these new raises. Beyond No. 70 raise the old drift was caved and for this reason the raises have been connected by a small new drift driven by No. 1 contract.

Raises 71, 72, and 74 have been carried above the 9th level to a height of 64 feet. These raises were timbered and as they passed through old square set rooms on the 8th and 7th levels, the completion of them was extremely difficult. No. 73 raise ran into a room filled with rock and had to be abandoned. It is the intention to try to carry all of the raises up to the rock. It is doubtful whether we will be successful in this as when raises run into rooms filled with loose rock the completion of them is practically impossible. Fifty-six feet above the 9th level, or on the same elevation as the 663' sub level from Nos. 15 and 16 raises, a sub level is being opened up. Towards the hanging the rock was found within 15 to 20 feet of the raises. Two gangs are now engaged in drifting North towards Nos. 15 and 16. The crosscuts are at the elevation of the 7th level and have to pass through old rooms, some of which are filled with rock. Where they are not filled with rock there is a mass of old timber to go through.

In the previous year mining had progressed so close to the main drift in which is located Raises 15 to 24, inclusive, that it was impossible to maintain this drift. In addition, ore from this territory could not be handled unless these raises were connected with new raises from the main drift on the 10th level. It was therefore decided to put in a new short drift between Raises 12 and 26. This work was started in January and completed in the following month. To the East of Raise 25 a tight bulkhead was constructed. The object of this was to prevent, in case of a run of sand,

this material reaching the 10th level through Raises 17 to 24. If sand entered the 10th level the delay in handling it would be most serious as there are no large pumps at that elevation. It was therefore absolutely necessary to plan the work in such a way so as to avoid this possibility. From the 10th level new raises have been completed to within a few feet of the bottom of Raises 25 to 28, inclusive. These could not be knocked through on account of the danger of sand reaching the 10th level. In case of caves the sand and water is forced to pass through the new drift and out towards the footwall of the mine. This new drift passed through a dike and after May, when the territory on the 646' was under great pressure, the maintaining of it was most difficult. For several months a gang was kept constantly busy retimbering. In November it crushed so rapidly that it was necessary to put on two gangs. It could not be kept open and it was decided to put in a switch to the West of No. 33 raise and switch back to the East. This delayed considerably the handling of ore as it was necessary for two motors to pass over the same tracks where most of the ore of the mine is being obtained. In the latter part of the year it has been decided to reopen the drift between Raises 12 and 26.

10TH LEVEL.

On Feb. 14th the main 10th level drift, which was being driven from the shaft North and from the winze to the South, was holed. This connection was perfect. During the latter part of the month the gang was engaged in timbering a few soft spots. Since March Contract 36 has continued to drive the second main crosscut which is parallel with the first one and at a distance of 200' to the South. On the end of the year this crosscut is within a short distance of the boundary line. At intervals No. 38 gang has continued the main footwall drift to the boundary line and has run South along the boundary and are now turning to connect with No. 36. These drifts have been mostly in ore. It was of course necessary to timber and for this reason the progress has not been as rapid as in rock drifts. The men have not worked in either place constantly and have been always taken

out during the times when sand was in the mine.

During the year No. 55 gang has worked in raises from No. 70 to 79, inclusive. Up to the 9th level these raises contained no timber, but above the 9th it is necessary to timber them. The chances are that in some of the raises it will be necessary to put in timber from the 10th to the 9th.

It was necessary to provide some means of cleaning the skip pit without delaying the hoisting of ore. In order to accomplish this it was decided to sink the winze, which is 50 feet to the North of the shaft, to an additional 20 feet; drift South to the shaft, and raise to the bottom of the same. The accumulation in the skip pit could be caught in small pockets and the material run out into a small car in the lower drift. This car would be dumped into a small skip in the winze and the material hoisted at any time without stopping the hoisting of ore. The work was started in January and completed in March. Numerous flows of sand delayed this work as the men were taken out to be used in other parts of the mine.

ROCK DRIFTING.

During the year we have raised 800 feet and drifted 1233 feet in rock. In addition 228 feet has been raised in ore.

NEGAUNEE MINE.

AVERAGE MINE ANALYSIS OF OUTPUT.

GRADE	IRON	PHOS.
Negaunee Bessemer	60.45	.059
Negaunee	59.10	.083

AVERAGE ANALYSIS ON STRAIGHT CARGOES.

	MINE		LAKE ERIE	
	IRON	PHOS.	IRON	PHOS.
Negaunee Bessemer	60.45	.057	60.28	.061
Negaunee	58.96	.082	58.63	

ORE STATEMENT - DECEMBER 31st, 1913.

	NEGAUNEE BESSEMER	NEGAUNEE	TOTAL	TOTAL LAST YEAR.
On hand Jan.1,1913,	9,856	82,112	91,968	268,054
Output for year	67,866	280,189	348,055	270,232
Total	77,722	362,301	440,023	538,286
Transferred to Lake Stockpile at Presque Isle		468	468	
Shipments	59,928	268,453	328,381	446,318
Balance on hand	17,794	93,380	111,174	91,968
Increase in Output 29%			77,823	
Increase in Ore on hand			19,206	

1913 - 2-8hr.shifts during year.
1912 - 1-10hr.shift to March 11th; 1-8hr.shift from March 11th to June 19th; 2-8hr.shifts from June 19th to Dec.31st.

SHIPMENTS FOR 1913.

	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Negaunee Bessemer	36,545	23,383	59,928	61,222
Negaunee	145,650	122,803	268,453	385,096
Total	182,195	146,186	328,381	446,318
Total last year	179,092	267,226	446,318	
Decrease 26%			117,937	

Note: In addition to the shipments of 328,381 tons shown, 468 tons of Negaunee Ore was diverted to the Lake stockpile at Presque Isle.

NEGAUNEE MINE.

COMPARATIVE MINING COST FOR YEAR.

	1913	1912	INCREASE	DECREASE
PRODUCT	348,055	270,232	77,832	
General Expense	.057	.085		.028
Maintenance	.108	.098	.010	
Mining Expense	.994	1.023		.029
Cost of Production	1.159	1.206		.047
DEPRECIATION				
Inventory	.012	.006		.006
Equipment	.003	.004		.001
New Construction (new shaft)	.118	.387		.269
Total	.109	.385		.276
Total Depreciation	.109	.385		.276
Taxes	.195	.278		.083
Central Office	.054	.065		.011
Fire Loss	.000	.002	.002	
COST ON STOCKPILE	1.517	1.932		.415
Loading and Shipping	.022	.033		.011
Total cost on cars	1.539	1.965		.426
Number of days operating	285	283	2	
Number of shifts and hours	2-8hr	1-10hr 1-8hr 2-8hr		
Average daily product	1,221	955	266	

COST OF PRODUCTION				
Labor	.787	.782	.005	
Supplies	.372	.424		.052
Total	1.159	1.206		.047

NEGAUNEE MINE.

STATEMENT OF COMPARATIVE WAGES.

	1913	1912	INCREASE	DECREASE
SURFACE				
Total number of days	20,427½	26,418		5,990½
Average rate	2.42	2.34	.08	
Amount	49,334.46	61,895.08		12,560.62
UNDERGROUND				
Total number of days	87,682½	67,936¼	19,746¼	
Average rate	2.73	2.59	.14	
Amount	239,457.49	178,415.52	61,041.97	
SURF.& UNDERG.				
Total days	108,110	94,354¼	13,755-3/4	
Average rate	2.67	2.55	.12	
Total Amount	288,791.95	240,310.60	48,481.35	.059
Labor cost per ton	.830	.889		.059

No. shifts and hours: 2-8hr 1-10hr
1- 8hr
2- 8hr

1-8hr shift was established March 11,1912, from 1-10 hour.
2-8hr shifts were established June 18th,1912, and continued on this basis to date,

Remarks:

Increase Wages for 1913:

Surface	.08 per day -------	3.4%
Underground	.14 per day -------	5.4%
Total	.12 per day -------	4.7%

NEGAUNEE MINE.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '13 348,055 TONS	SURFACE		UNDERGROUND		TOTAL	
PRODUCT '12 270,232 TONS	1913	1912	1913	1912	1913	1912
Avg.no.men working	64	85	289	228	353	313
Avg.wages per day	2.42	2.34	2.73	2.63	2.67	2.55
Avg.wages per month 25 days	60.50	58.50	68.25	65.75	66.75	63.75
Avg.product per man per day	17.04	10.23	3.97	3.98	3.22	2.86
Labor cost per ton	.142	.229	.688	.660	.830	.889
Diff.in labor cost per ton	-.087	+.040	+.028	+.065	-.059	+.105
Avg.prod.breaking & tramming			7.27	7.37		
Avg.wages for miners contract			2.83	2.65		
Total avg.wages for contract			2.83	2.65		

		TONS	%
Product per man per day	SURFACE Increase	6.81	66.6
Product per man per day	UNDERGROUND Decrease	.01	-
Product per man per day	SUR.& U.G.Increase	.36	12.6

Proportion of surface to underground men:
1913 - 1 to 4.51
1912 - 1 to 2.68
1911 - 1 to 2.95
1910 - 1 to 3.95

NEGAUNEE MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31,1913.

KIND	LINEAL FEET	AVG.PRICE PER FOOT	AMOUNT 1913	AMOUNT 1912
6" to 8" Timber	10,055	.017	186.13	151.04
8" to 10" "	141,734	.0427	6,055.01	5,006.63
10" to 12" "	3,630	.06	217.80	1,168.68
12" to 14" "				19.80
Total 1913	155,419	.0415	6,458.94	
Total 1912	151,856	.0418		6,346.15

	LINEAL FEET	PER 100'	1913	1912
7" Lagging	871,383	.53	4,585.42	4,388.68
8" "				749.48
Poles	134,590	.95	1,283.59	708.73
Total 1913	1,005,973	.583	5,869.01	
Total 1912	919,986	.636		5,846.89

	1913	1912
Feet of timber per ton of ore	.446	.562
Feet of lagging per ton of ore	2.50	3.13
Feet of lagging per foot of timber	5.62	5.57
Cost per ton for timber,lagging and poles	.035	.045
Equivalent of Stull timber of Board measure	208,931	231,724
Feet Board measure per ton of ore	.60	.857
Total product	348,055	270,232

Total cost of timber and lagging - 1913	12,327.95
Total cost of timber and lagging - 1912	12,193.04
Total cost of timber and lagging - 1911	15,137.84
Total cost of timber and lagging - 1910	14,654.57
Total cost of timber and lagging - 1909	14,530.85
Total cost of timber and lagging - 1908	11,992.30
Total cost of timber and lagging - 1907	15,449.01
Total cost of timber and lagging - 1906	13,582.02
Total cost of timber and lagging - 1905	12,038.46

NEGAUNEE MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	AMOUNT 1 9 1 3	AMOUNT 1 9 1 2
40% Powder	139,350	.09	12,541.50	9,936.52
60% "	900	.11	98.22	253.00
80% "	8,800	.135	1,188.00	20.25
Total Powder	149,050	.0928	13,827.72	10,209.77
Fuse	372,900	.0038	1,420.63	1,225.56
Caps	78,700	.0063	497.58	385.99
Tamping Bags	500	1.38	69	
Electric Exploders				7.55
Total Fuse,etc.			1,918.90	1,619.10
Grand Total			15,746.62	11,828.87
Product			348 ,055	270,232
Pounds powder per ton ore			.428	.418
Cost per ton for powder			.040	.038
Cost per ton for fuse,caps,etc.			.005	.006
Cost per ton for all explosives			.045	.044
Avg.price per lb.for powder			.0928	.090

Increase average cost per lb. for powder .0028 due to more 80% being used.

MAAS MINE.

ELECTRIC CURRENT DELAYS.

On March 14th there was a bad delay due to trouble on the transmission line during a severe storm. From 10:20 until 11:25 P. M. the current was off. Between this time and until 3:30 the circuit breaker was being continually thrown out. From 3:30 until 8 A. M. there was no current. An extra boiler was fired as soon as possible and shortly after eight the turbine was started. A few hours later the trouble on the line was located and it was found that some of the wires had been broken.

On May 19th one of the transformers at the Maas Mine station went wrong. The current was shut off for an hour before the trouble was located.

On June 18th, at 8:00 P. M., there was a terrific electric storm which caused a delay from 1 1/2 to 2 hours. On the floor of the transformer house there was a transformer which had been disconnected for repairs. A bolt of lightning came in from the arresters, jumped across to the transformer, setting it on fire and doing considerable damage. As soon as the main switches could be thrown out a stream of water was played on the transformer and inside of half an hour the fire was extinguished. Up until midnight the circuit breaker was being continually thrown out. There was a delay in lowering the men into the mine. While the cage was being lowered the circuit breaker was thrown out and the engine house was in darkness. The cage had to be stopped in the shaft until candles could be lighted. The brakeman then lowered the cage to the level. This emphasized the necessity of providing lamps at all hoists in case the current for any reason should be off. A rule was recommended by the Central Safety Committee, and approved by the Agent, which required that in every engine house it would be necessary to continually keep lamps burning over all hoists.

This rule has been in effect since July.

On Sept. 19th, due to trouble on the transmission line, the current was off from 4:30 until 7 A. M.

In the afternoon on Nov. 8th, during a severe snowstorm, there was a delay of one hour due to trouble on the transmission line.

STOCKPILES.

In April the mine was notified that during the shipping season we would have to be prepared to stock ore on short notice. At that time the Maas pile was practically filled. It was necessary to order additional legs and to raise four bents during this month. In May five additional bents were erected. A side-dump car was purchased from the Negaunee Mine and the width of the old piles increased. Up until September only a very small amount of ore had been shipped from the stockpiles. It was most important that sufficient ore be loaded with the shovel from the East end of the Maas pile to make it possible to commence to erect a second trestle parallel with the old one. The small amount of ore which had been loaded previous to this time had simply exposed the legs on the West end of the pile, causing them to receive excessive weight and to break. In order to continue to stock ore it was necessary to shovel out the ore around the legs by hand and to put new ones in their place. On the middle of September a shovel came to the mine and loaded about two thousand tons from the East end. This made it possible to get off with the curve from the permanent trestle and run parallel with the old pile. In October the Bessemer trestle was extended six bents. In November new sollar plank was laid to to the North of the Maas grade and 250 feet of trestle erected. The work then had to be stopped on account of the delay in receiving sollar plank. During December two hundred additional feet was constructed. On the South side the full width of the pile cannot be obtained as the trestle is too close to the old stockpile. For this reason the capacity is considerably reduced. In order to keep the ore from pushing the trestle out of line, we have been very careful in first dumping a sufficient amount around each

leg. By using this precaution we have been able to keep the trestle in good alignment.

TRANSFER ENGINE.

In the previous year there was some delay due to the cracking of the foundation of the transfer engine. On June 19th work was started to reinforce this foundation. Arrangements had been previously made with the shipping department so that the mine would be supplied with cars. Through some misunderstanding the railroad failed to give us cars and there was a delay of six hours on the night. In the original foundation the concrete piers were long and very narrow and were not sufficiently strong to withstand the pressure. The engine was blocked up and the old piers torn out, new reinforced concrete being put in place. The present foundation should give no trouble. The engine can now be kept in alignment and much better results should be obtained.

On Dec. 15th a pin in the piston rod broke. Before the engine could be shut down the head of the piston was knocked out. This put the transfer entirely out of commission until a new piston could be obtained. The mine was idle until the night shift of the 17th.

HANDLING ASHES.

The handling of ashes from the boiler house had never been satisfactorily solved. The material from the boiler house was wheeled through the North door and dumped in a large pile. It accumulated rapidly and at times it was necessary to hire an additional team to dispose of it. This large pile of waste material has always been an eyesore. It was decided to make the following change to avoid this bad condition: In front and parallel to the boilers there is a track on the concrete floor. The ashes from the boiler pits are shoveled into a small car. This car is trammed to the elevator and hoisted to a point about 6 feet below the top of the coal dock. During August a light trestle was constructed from the boiler house to the East, running through the coal dock. The trestle

was extended to the East of the coal dock for a distance of about 30 feet. In order to construct the track and to have it lead from the elevator shaft at the right elevation a new door was cut on the East side of the engine house. This work should have been completed in September but the carpenters were busy in erecting stocking trestles and it had to be put off until October. The part of the track leading through the dock was entirely enclosed with plank. In order to prevent any possible chance of hot ashes setting the plank and dock on fire, the bottom and sides were covered with sheet iron. A special very light car was constructed. It is found that one man can handle this car with much greater ease than he could formerly dispose of the ashes by wheeling it out of the building.

In order to provide against the possibility of men being injured by walking under the elevator while it was above the lower floor, or walking into the open elevator shaft from the upper landing, safety gates were put in. These provide absolutely against the chance of men being caught. When the elevator is spotted at the lower opening the upper gate is automatically closed. When the elevator is at the upper landing the upper gate is automatically opened and the lower closed.

COAL DOCK.

In May the railroad inspector called attention to the fact that a number of legs in the dock had become decayed. These were replaced. In order to comply with the recommendation of the safety inspector a railing was placed on the outer edge of each side of the dock for its entire length.

In previous years fires have occurred in the coal. During the present one this trouble has not been experienced. It is believed that the present plan of first removing the upper layer of coal will in most cases prevent the possibility of serious fires. Since this has been done at the Maas trouble from fires have greatly decreased.

TIMBER TUNNEL.

To the South of the shaft, during August the cribbed work was

extended for a short distance in order to carry the tunnel beyond the line of fill. A track was put in and turned to the East to run parallel with the railroad tracks. A part of the new timber which is being received will be stocked from the tail track. This new track will make it possible to reach these timber piles and to tram the timber directly to the shaft without requiring the services of a team. To the North about 100 feet of crib work varying in height from 1 to 2 feet was put in. The track was turned to the East to run approximately parallel with the approach to the coal dock. This made it possible for the lagging piles to be reached and for this material to be trammed directly to the shaft.

COMPRESSOR.

Some delay has been caused by trouble with the compressor, although it has not been nearly as serious as in the previous year. On March 4th, on the beginning of the morning shift, the piston on the low pressure, steam side, worked loose. The compressor had to be shut down and there was a delay of four and one-half hours before it was again started. Trouble with the pistons has occurred at various times during the past year. During the month of June for some reason there was considerable delay due to low air pressure. The probable reason for this was that the compressor was overloaded. During July trouble was experienced on account of low air pressure in both the Maas and Negaunee Mines. On the afternoon of the 2d a very severe pound was noticed. The compressor was run at a low speed until the end of the shift. During the following night men worked continually trying to find the trouble but were unable to do so. For each following Sunday the compressor was worked on, and the pound not located. It was not thought safe to run the machine except at a slow speed. In September, after the Negaunee Mine compressor commenced to work, the conditions were greatly improved. Since that time no trouble has been experienced with the compressor.

SURFACE IMPROVEMENT.

In the early part of June it was decided to increase the enclosed

area and to remove a number of fences around small grass plots. The West fence was shifted 50 feet to the West of the office and run North and connected with the right-of-way fence of the railroad. It was extended South to a point opposite the Southwest corner of the engine house. From here it ran East. This work was done at a small cost as the entire West fence was shifted bodily in one operation. During the following year some grading and planting should be done. I think that the shifting of the fences will greatly improve the appearance of the location.

CASING SHAFT.

In June men commenced the work of putting in casing between the cage and skip compartments. On the bottom of each steel set there is a small angle and to this angle 1 1/2" hardwood plank has been bolted. Early in July this casing was completed through the concreted part of the shaft. The work had to be done on Saturday nights and Sundays.

DISCHARGE - Acct. #11. E. & A. #247.

In the early part of November the mechanic worked on shifting the pipes in the shaft so that the new discharge could be put in place. This had to be done when the mine was idle, or on Saturday nights and Sundays. On the 16th the large cast elbow was placed in position on the 3d level. In the previous month a concrete pier had been constructed for this elbow to rest on. Considerable work was necessary before this pier could be put in. The endpieces on the East side of the shaft were cut out for a distance of 10 feet and the rock trimmed down until a solid face was exposed. On the floor of the level the loose rock was excavated. A form was built and the concrete mixed in the mine and put in place. The pier was heavily reinforced by rail and old scrap iron. During Saturday nights and Sundays the mechanic and a crew of men put the main 12" discharge in position from the 3d level to the bottom of the concreted part of the shaft. The remainder of this piping will be easy to complete as there is sufficient room to handle it through the cribbed part of the shaft without

causing delay. In the timbered part the pipe compartment is only 2' 2" wide. In order to get the pipe into it, it was necessary to cut out dividings at intervals of 100 feet. The pipe was lowered on a crosshead swung into the openings and lowered into position. This work was slow on account of the very small size of the compartment.

PUMP HOUSE - Acct #12. E. & A. #247.

In February we commenced to clean out the large amount of rock which had been blasted down in excavating for the pump house. This rock could not be handled by the skips without causing some delay. For this reason it was loaded into a car and trammed to the cage. On the surface a special track had been completed, starting at a short distance above the collar and extending to the South from the shaft. On the night shift, when no timber is handled, rock could be disposed of without causing any delay. The handling of this rock was continued up until May. The work of excavation was considerably delayed on account of our inability to obtain the dimensions of the pumps so that the size of the excavation could be determined. In September the final plans were received and work was immediately started on increasing the size of the excavation. The size of this chamber is approximately 48' long by 30' in width by 13' in height. During December the excavation was completed. Work was then started to prepare to sink to open up for the sump. This sump will run parallel with the main drift to the South of the shaft and will be attacked from two points. Every effort will be made to complete it and to install the pumps as soon as practical. It is exceedingly important that these pumps be put in commission at an early date. At the present time we are only able to handle a small amount of water. If a cave should occur we would be in serious difficulties. The only way that the mine could be saved would be to use bailers. By the use of bailers it would be necessary to cease hoisting. It is impossible for any one to say at what time a hole will extend to the surface. This may occur within a short time or it may not take place for several years. As soon as the sump is sufficiently underway

so that the blasting will not interfere with the construction of the foundations, carpenters will commence to erect the forms. The pumps and motors have been received.

FATAL ACCIDENT.

On June 10th, at 10 P. M., J. J. McCarthy was killed by a fall of ground in No. 31 contract, which is in a small sub level about 20 feet above the 3d level. The accident occurred in a place which was well timbered and where there were no signs of the slightest trouble. One slice had been removed directly below the hanging and McCarthy and his partner were engaged in taking out the second slice. The place was well timbered and lagged up to the back. Without the slightest warning a large mass of ore settled off from the rock, crushed the timber and covered McCarthy. Directly under the hanging the ground is very treacherous and is liable to break off in large masses. This fact is wellknown and the timber is put in with the object of protecting the men in case of sudden falls. I do not know of any additional precautions which could be taken to protect the men under this treacherous ground. This accident was certainly a trade risk.

PRODUCTION.

Month	Bessemer	Maas	Total	Rock
January,	150	19,113	19,263	174
February,	154	18,410	18,564	276
March,	417	20,260	20,677	354
April,	980	24,091	25,071	288
May,	1,379	25,072	26,451	363
June,	1,284	20,572	21,856	297
July,	1,199	22,773	23,972	363
August,	570	29,233	29,803	96
September,	255	27,384	27,639	00
October,	2,801	27,490	30,291	54
November,	574	24,894	25,468	276
December,	924	25,109	26,033	234
Total,	10,687	284,401	295,088	2,775

ESTIMATE OF PROBABLE ORE.

The estimate has been recalculated from the various cross-sections of the mine. In the previous years 10 cu. ft. was assumed for a ton and a deduction of 10 per cent for rock and loss in mining. In the present estimate it has been assumed that it will require 12 cu. ft. per ton, 10 per cent deduction for rock and 10 per cent for loss in mining. This is the basis used in calculating the tonnage for the tax commission. In the territory above the 1st level there is a larger amount of ore than previously estimated. On the West end of the mine large intrusions of rock have been found. This has decreased the estimate. Above the 3d level, on the East end, the amount of ore is considerably larger than previously estimated. The old rooms on the 3d level, with the exception of two near the boundary, were all stopped against rock which was supposed to be the hanging. By work done in the present year it has been found that this is not the real hanging and that the ore extends for a considerably greater distance to the South. No attempt has been made to estimate the probable ore below the 3d level as the data is entirely too limited to arrive at any figures which would even be approximately correct. The following is the estimate:

Estimate of Probable Ore

Above 1st Level North of Fault,	127,000	
" " " South " "	25,000	
At D. D. Hole No. 11,	5,300	
Total Ore Above 1st Level,		157,300
Between 1st and 2d Levels,		837,100
" 2d " 3d "		2,252,200
Total Ore Above 3d Level,		3,246,600

UNDERGROUND.

931' SUB LEVEL.

Above this elevation a small open stope was worked. In February mining was stopped as all of the high grade ore had been removed. No. 4

contract then dropped down 31 feet, or to the 900' sub and commenced to drift West to locate some low grade ore shown in D. D. Hole No. 11. According to the record there is 48 feet of ore which will average 55.53 Iron and .032 Phos. On the first of March, on account of great difficulty in handling the rock, this place was stopped after the breast had been advanced 40 feet. There has always been considerable trouble in working this territory on account of its great height above the main level and the difficulty with gas and in hoisting the supplies. In the following year the drift will be continued to determine whether this ore is of a good enough grade to be mined for Bessemer.

796' SUB LEVEL.

With the exception of a very small amount of crosscutting this entire sub level has been completed during the present year. On the foot-side of the West end there still remains a few small pillars. These had to be left temporarily on account of movement on the extreme West end near the old square set room on the 777' sub level. From the first of the year up until March no work was done on the West end as the square set room was not completely filled. Between March and the 1st of July this end of the sub level has been attacked. On account of continual movement we have not yet been able to take the small pillars along the foot. No. 5 is now engaged in doing that work and inside of a very short time this sub level will be entirely completed.

On the 13th of January No. 3 contract on the West end broke through into an open space run up from the workings to the South of the main drift which in the previous year had been taken to an elevation of 32 feet below the 1st level. Although a large amount of filling had been blasted in this particular territory the hole was of considerable size. This hole contained a large amount of filling on the footwall side, but to the hanging there was quite an opening. Two gangs of miners commenced to put in long vertical holes in order to fill the open space. While this was being done it was not considered safe to work the six gangs in the

immediate neighborhood. In four days the place was sufficiently filled so that work could be continued with safety, but at this time the entire West end commenced to take weight and the five gangs, Nos. 2, 3, 5, 7, and 8, had to be moved. No work was done on this end of the mine with the exception of the removing of two pillars to the West of the boundary of the cemetery until the early part of April when mining was again commenced. During this idle period the territory continued to settle caused largely by the gradual collapse of the square set room on the 777' sub level. The movement on this end of the mine caused a considerable reduction in the hoist as we were not sufficiently opened up to work the men to advantage in other parts of the mine.

777' SUB LEVEL.

This was the first sub level opened up to the North and above the 1st level. From the small number of raises which had been put up it was thought that this was the top of the ore. By raising in the center of the deposit it was found that the ore extended to a considerably greater height. Before this was done, however, a square set room was opened on the West end and taken to a height of 21 feet. During the present year a large number of gangs have worked here and have sliced the ore back to within a short distance of the main footwall drift. On the end of the year, under the Roman Catholic cemetery, two gangs, Nos. 6 and 41, are slicing. On the West end No. 40 is mining alongside of the old square set room. In order to reach the few pillars above, No. 5 drifted into the foot and raised to the 796' sub level. Until these pillars on the 796' are removed it is impossible to take the small pillars on the 777' sub level.

762' SUB LEVEL.

This sub level has been entirely opened up during the present year. On the East end, under the Roman Catholic cemetery, there is nothing of particular interest to mention. The ore has simply been blocked out and the pillars are now being removed. In this part of the mine Contracts 4,

12, 45, 3, 9, 8, and 6 are slicing. On the West end, during the month of June, the seven contracts to the West of the boundary of the Roman Catholic cemetery all ran against dike at practically the same time. This caused a reduction in the product as these seven gangs were knocked out at the same time. On the 777' sub level the dike was only about a foot in thickness while in a difference of elevation of 15 feet it has increased to about 16 feet. As gangs above were using the raises to dump ore into, it was difficult to drift through the dike and to dispose of the rock. The work here was stopped temporarily until the gangs above completed the sub level. Near the end of the year a contract commenced to follow the dike from the Roman Catholic cemetery side, the drift being to the South of the rock. In a very short time mining to the South of this dike will commence. On the West end much trouble has been experienced in keeping open the footwall drift. This, as will be noticed, passes under the old square set room. A second drift was driven which would run close to the hanging. This also has crushed severely.

On the extreme East end rock has always been found which was supposed to be the capping of the ore. The Negaunee Mine had commenced to work a shrinkage stope in the land of the American Mining Co. As a part of this ore would have to be hoisted through the Maas shaft it was planned to work this stope jointly. In order to provide a safe traveling road it was necessary to put up a raise on the Maas side in rock to approximately 175 feet above the 1st level. On the 762' sub level rock had been encountered on the East end. At 25 feet above the 762' sub ore was found in the raise and it continued in it for 145 feet. One hundred and fifty feet above the main level No. 13 contract commenced to drift East to connect with No. 56A raise of the Negaunee Mine. When this connection is made it will be necessary to drift West and also to the hanging to determine the outlines of the ore. The finding of this ore has greatly delayed the work in the shrinkage stope. On account of the great height of the raise and extremely poor ventilation the progress has

been slow.

On November 26th a heavy fall of ground occurred on the hanging side from the West boundary line of the Roman Catholic cemetery to No. 9 contract, or a distance of about 200 feet. A large mass of rock settled down from the hanging, completely filling the part which had been stoped out. This of course is an excellent thing and has saved us the expense of blasting a large amount of rock for filling. This cave gave ample warning and worked for several hours before the heavy fall occurred. The tools, buggies, etc., were immediately taken out at the first sign of trouble. No damage was done as the crosscuts were only slightly crushed near the points where slicing had been carried on.

746' SUB LEVEL.

The work on this sub level simply consists of connecting the raises which are practically on the footwall. A drift has been opened up across the property of the Roman Catholic cemetery and No. 44 gang is now drifting to the boundary line of the American Mining Co.

FIRST LEVEL.

With the exception of a small amount of timbering in soft spots, between Raises 3 and 18, no work has been done on this level.

660' SUB LEVEL.

This sub level has been opened from new raises, Nos. 34, 35, and 36, from the 2d level. In January drifting was commenced from No. 36 raise to hole into old No. 37 raise. After this connection was made an outlet was provided to the 1st level. During the time that the mine was idle the lower part of No. 37 raise caved due to the rotting of the timber. Several attempts were made to reopen this raise but the work was abandoned on account of the danger to the men. This entire sub level has been opened up and completed in the present year. On the West end I call your attention to a large intrusion of rock. This did not appear on the upper sub level and the present indications are that it is of considerable size. During December

No. 16 contract removed the last pillars near the main drift.

639' SUB LEVEL.

This is a new sub level opened up entirely during the present year. It is at the same elevation of a very small sub which was partly developed before the mine shut down in 1910. The intrusion of rock referred to above can be plainly seen again on this sub level. At the present time three contracts, Nos. 20, 14, and 7, are slicing. In order to provide a better outlet a drift was driven into the footwall and a raise put up to the 1st level. The material in No. 37 raise was dike and on account of its continually slabbing off it was thought advisable to provide a permanent outlet in rock.

623' SUB LEVEL.

During the last two months of the year No. 1 contract has been connecting raises, drifting to the North to the permanent outlet, and opening this new sub level. At this elevation considerable trouble was experienced due to the drifts breaking through into an old sub level which is midway between the 2d and 1st levels. During the time that the mine was idle the timber in the drifts completely rotted out. In places the drifts ran up to as great a height as 25 feet. Before extensive work could be done on the 623' it was therefore necessary to completely retimber the old sub level. This was expensive on account of the height of the back and the great amount of lagging necessary to fill the openings.

2D LEVEL.

During the year one raise has been completed at a point near the contact of the ore up to the 639' sub level. In addition Raises 41 and 42 have been completed between the 2d and 1st levels and Nos. 43 and 44 are about to hole into the 1st level. In order to facilitate raising to this great height, 230 feet, at an elevation of 610 feet the raises have been connected by a small drift. Work has not been done continually in these raises as there was ample time to complete them. When the men were needed

in other parts of the mine they were taken out of the raises.

The 2d level is at practically the same elevation as the 10th level, Negaunee. There was only a short distance between the drifts in the month of October. During the time that the mine was idle the drift caved and in October, in order to provide a second outlet, work was commenced to retimber the drift and to connect with the Negaunee. This was completed in December and now a second outlet is provided. When this connection was made it was found that there was a tremendous draft passing from the Maas to the Negaunee. A temporary door was put in to shut off this draft. It will be necessary to put in a permanent door made of steel and concrete in order to prevent the possibility of either sand or water passing from the Negaunee to the Maas. The heavy casting for this door has been ordered and as soon as it is received this permanent work will be started.

At the shaft the plat as originally cut was not sufficiently wide to make it possible to tram timber directly from the cage to the main track. The reason for this was that the shaft had been remodeled and the cage is now in a different position than it was formerly. The corner of the plat has been widened and timber can now be handled without delay.

494' SUB LEVEL.

This sub level was completed in April.

478' SUB LEVEL.

This sub level was completed in September.

455' SUB LEVEL.

It will be noticed on the map that there are two parts of this sub level separated by a large barren area. The developments below the 2d level on the extreme West end have been disappointing. From the information which was available it was naturally assumed in previous years that the ore at this elevation would be continuous. In addition, for local

reasons the hanging wall on the East end has come in rapidly towards the foot. It may be found that still farther to the East this apparent shortage will be made up by the increased distance between the hanging and the foot. At the present time the indications are that there is a considerable reduction in the ore which it is possible to estimate. With the exception of a small amount of crosscutting, which was done on the West end in 1912, this entire sub level has been opened up in the present year. In order to provide some means of getting timber from the East to the West end it was necessary to drift through rock for a distance of 140 feet. The West end has been entirely completed while on the East end there are a few small pillars which are being taken by Contracts 21 and 22.

440' SUB LEVEL.

On the East end the roll in the hanging is again evident but on each side of it the ore body has increased considerably in width. In the center the distance between the foot and the hanging is only about 30 feet. Timber reaches this sub level through a flat raise from the 2d level to the drift on the East end. In order to get this timber to the isolated stope on the West end it is trammed across the length of the sub, elevated to the 455' sub, trammed through the rock drift already described, and dropped down into the working places on the West end. At the present time there are five gangs on the East end who are slicing the pillars which have been blocked out. On the West end the ore body is exceedingly pockety as can be easily seen by examining the map. Here No. 18 contract is scramming out the irregular pockets of ore.

422' SUB LEVEL.

On the East end Nos. 26 and 28 have connected Raises 90, 91 and 92. In a very short time crosscutting to the foot will be started. I call your attention to the rapid dropping back of the hanging. It is expected that this will considerably increase the area of the ore body on this elevation. In a distance of 18 feet the indications are that the rock has

fallen back for at least 30 feet. One of the present troubles on these small sub levels on the East end is that they are worked out too rapidly and not sufficient ore is obtained on each sub level. If the width increases much better results can be obtained. On the West end Nos. 15 and 19 are scramming in the irregular shaped ore body.

401' SUB LEVEL.

For the last few months of the year a company account gang has been busy retimbering the old drifts on this sub level. On the West end the workings have approached so close to it that in several places they broke through. The timbering was difficult on account of the drifts having caved to a considerable height. A large amount of lagging was used in blocking the holes above the new timber.

355' SUB LEVEL.

During January it was decided to remove triangular pieces of ore above the 3d level directly under the hanging. For this reason crosscuts were laid out to pass midway between the old rooms. On the East end the ore body is very wide and in crosscuts Nos. 11, 13, and 15 raises were put up to a height of about 50 feet. From these raises sub levels were started and drifts completed to the hanging.

In the eleventh crosscut Contract 29 drifted about 40 feet to the South of the breast of the old square set room below. It was not expected that the work in this crosscut, or in those to the East, would extend to the South of the breast of the old rooms as these had all stopped against rock which was naturally supposed to be the hanging. It is now found that the hanging is at a considerable distance to the South of these rooms and the amount of ore is therefore increased. It was soon evident that the sub levels were not located at a great enough height and that further work would be necessary in order to determine the hanging. During the last two months of the year raises have been put up from No. 29 and the hanging actually outlined. Near the North end of this small sub level

the hanging is at least 50 feet above the present workings. We have therefore dropped down for a short distance and will commence to slice from the top. Each slice will be lagged down and the sub level directly below will take up this lagging. Before this can be done rock will have to be blasted from the back to serve as filling.

In the thirteenth crosscut the ore extended for over a hundred feet to the South of the South end of the old rooms. Raising in this crosscut shows rock to be about 20 feet above the drift at a point one hundred feet from the breast. Farther to the North the capping has not been located.

In the fifteenth crosscut rock was encountered near the boundary line. This was unexpected as the indications from the crosscut in the thirteenth room showed the rock to be much farther to the South. A raise inclined to the South at an angle of 45 degrees was put up to try and pass through this rock as it was supposed not to be the hanging. This raise reached a height of 50 feet in solid Jasper and it is therefore assumed that the hanging has taken a very sharp turn to the North. No. 11 has started to pull back the small amount of ore to a point about 60 feet to the North of the breast. Near the North end of this crosscut raises show that the rock runs up at a steep angle and that the ore extends 60 feet above this sub level.

315-325' SUB LEVELS.

In the third, fifth, and seventh crosscuts small sub levels have been started. Those at the elevation of 325 feet have been completed. The floor was closely lagged and filling blasted from the hanging. In the third and fifth crosscuts Contracts 32 and 33 have dropped down directly below the lagging and are removing a single slice. The work in these new crosscuts consists simply of slicing the small pillars between the old square set rooms. When these square set rooms are broken into a large amount of ore naturally runs into them. This ore will of course be obtained at a later date when work is started below the 3d level.

3D LEVEL.

In January work was started to extend the main drift to the North of the track to provide additional tail room. At the time the mine was shut down this drift was only in 25 feet. Early in March, by working here at odd times, it was extended 50 feet. A sink has been taken up in the bottom of this drift and sufficient room provided for a motor pit.

In the previous report I described the crushing of the main drift on the 3d level. During January and February the work of retimbering was carried on. In the latter part of February a point was reached where the old timber was found to be standing and in fairly good condition. The progress from this time was much more rapid as it was only necessary to put in lining sets.

At the shaft the plat has been widened in order to make it possible to put in a track running from the cage compartment and connecting with the main line. Timber can now be loaded on a truck and trammed directly into the mine without rehandling.

CLEANING SKIP PIT.

Some means had to be provided to clean the skip pit without causing delay in the hoisting of ore. It was decided to remove the material which had accumulated in the bottom of the shaft and to put up a raise which would hole at the plat, back of the storage pocket. This work was started in March and, as the men could only work in the shaft during the time when ore was not being hoisted, it naturally progressed slowly. Below the skips a pocket was put in which would empty into a small skip operated in the raise. This skip could be hoisted above the plat and the ore dumped into the storage pocket. The raise was approximately 55 feet in length and was completed in September. During October the track and puffer were installed and the small pocket built. Since that date there has been no extra time charged against cleaning skip pit. The men can enter the shaft at any time and remove the dirt from the small pocket without delaying the hoist.

ROCK DRIFTING.

During the year we have drifted 402 feet in rock, raised 470 feet in rock, and raised 1557 feet in ore.

MAAS MINE.

AVERAGE MINE ANALYSIS OF OUTPUT FOR YEAR 1913.

GRADE	IRON	PHOS.
Maas Bessemer	63.54	.053
Maas	58.85	.100

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR 1913.

	Mine		Lake Erie	
GRADE	IRON	PHOS.	IRON	PHOS.
Maas Bessemer	All Mixed			
Maas	58.82	.097	58.16	

ORE STATEMENT FOR DECEMBER 31st.

	MAAS BESSEMER	MAAS	TOTAL	TOTAL LAST YEAR
On hand Jan. 1st,1913,	1,201	18,429	19,630	6,236
Output for year	9,881	285,207	295,088	60,058
Total	11,082	303,636	314,718	66,294
Transferred to Lake Stock-pile at Presque Isle		770	770	416
Shipments	7,080	163,625	170,705	46,248
Balance on hand	4,002	139,241	143,243	19,630
Increase in Output			235,030	
Increase in Ore on hand			123,613	

1913 - 2-8hr shifts during year;
1912 - Mine idle Jan.1st to Aug.12th. 2-8hr shifts from Aug. 12th to close of year.

SHIPMENTS FOR 1913.

	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Maas Bessemer	7,080		7,080	487
Maas	155,545	8,080	163,625	45,761
Total	162,625	8.080	170,705	46,248
Total last year	37,283	8,965	46,248	
Increase 268%			124,457	

COMPARATIVE MINING COST FOR YEAR.

MAAS MINE.

	1913	1912	INCREASE	DECREASE
PRODUCT	295,088	60,058	235,030	
General Expense	.048	.122		.074
Maintenance	.078	.138		.060
Mining Expense	.911	1.150		.239
Cost of production	1.037	1.410		.373
DEPRECIATION				
Inventory		.001		.001
Equipment	.006	.017		.011
Original Purchase	.200	.200		
New construction	.078	1.811		1.733
Plant	.250	.250		
Total	.534	2.279		1.745
Total depreciation	.534	2.279		1.745
Taxes	.149	1.009		.860
Central Office	.052	.056		.004
Sundry Expense	.083		.083	
COST ON STOCKPILE	1.855	4.754		2.899
Loading and shipping	.007	.011		.004
Total cost on cars	1.862	4.765		2.903
Number of days operating	300	116	184	
Number of shifts and hours	2-8hr	2-8hr		
Average daily product	1,132	518	614	
COST OF PRODUCTION				
Labor	.760	.948	.188	
Supplies	.277	.462	.185	
Total	1.037	1.410	.373	

Mine closed Dec.3,1910; resumed mining Aug.12,1912.

MAAS MINE.

STATEMENT OF COMPARATIVE WAGES.

	1 9 1 3	1 9 1 2	INCREASE	DECREASE
SURFACE				
Total number of days	11,728¼	5,520	6,262¼	
Average rate	2.43	2.37	.06	
Amount	28,569.68	13061.85	15,507.83	
UNDERGROUND				
Total number of days	69,650¼	15,867	53,783¼	
Average rate	2.78	2.62	.16	
Amount	193,745.16	41622.52	152122.64	
Total Days	81,432½	21,387	60,045½	
Average rate	2.73	2.56	.17	
Total Amount	222,314.84	54684.37	167630.47	
Labor Cost per ton	.754	.911		.157
No.shifts and hours	2-8hr	2-8hr		

Increased wages per day:

Surface	.06 -------	2.53%
Underground	.16 -------	6.10%
Total	.17 -------	6.64%

MAAS MINE.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '13 295,088 Tons	SURFACE		UNDERGROUND		T O T A L	
PRODUCT '12 60,058 Tons	1913	1912	1913	1912	1913	1912
Avg.no.men working	37	18	229	53	266	71
Avg.wages per day	2.43	2.37	2.78	2.62	2.73	2.56
Avg. wages per month 25 days	60.75	59.25	69.50	65.50	68.25	64.00
Avg.product per man per day	25.04	10.88	4.24	3.79	3.62	2.81
Labor cost per ton	.097	.218	.657	.693	.754	.911
Diff.in labor cost per ton	-.121	+.072	-.036	+.095	-.157	+.167
Avg.product breaking & tramg.			6.85	6.72		
Avg.wages for miners cont.			2.92	2.70		
Total avg.wages for cont.			2.92	2.70		

			TONS	%
Tons per man per day	SURFACE	INCREASE	14.16	130
Tons per man per day	UNDERGROUND	INCREASE	.45	11.9
Tons per man per day	SURF.& U.G.	INCREASE	.81	28.8

Proportion of surface to underground men: 1913 1 to 6.18
1912 1 to 2.88

MAAS MINE.

TIMBER STATEMENT FOR YEAR ENDING DEC.31,1913.

KIND	LINEAL FEET	AVG.PRICE PER FOOT	AMOUNT 1913	AMOUNT 1912
6" to 8" Timber	16,434	.015	253.70	360.89
8" to 10" "	55,330	.0425	2,331.10	719.68
10" to 12" "	28,320	.06	1,699.00	839.64
12" to 14" "	6,650	.0825	548.67	255.76
Total 1913	106,734	.0453	4,832.47	
Total 1912	.52,069	.042		2,175.97

	LINEAL FEET	PER 100'	AMOUNT 1913	AMOUNT 1912
5" Lagging	574	.46	2.67	
6" "	5,490	.40	21.96	
7" "	897,667	.60	5,340.42	1,484.04
8" "	101,112	.60	606.67	6.48
Poles	21,226	.95	201.67	59.83
Total 1913	1,026,069	.602	6,173.39	
Total 1912	253,231	.612		1,550.35

	1913	1912
Feet of timber per ton of ore	.362	.867
Feet of lagging	3.40	4.11
Feet of lagging per foot of timber	9.42	4.74
Cost per ton for timber,lagging and poles	.037	.0620
Equivalent of Stull timber to board measure	185,363	103,230
Feet board measure per ton of ore	.628	1.72
Total product	295,088	60,058

Total cost of timber and lagging - 1913	11005.86
Total cost of timber and lagging - 1912	3726.32
Total cost of timber and lagging - 1911	None
Total cost of timber and lagging - 1910	5770.97
Total cost of timber and lagging - 1909	6324.50
Total cost of timber and lagging - 1908	4373.23

MAAS MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	AMOUNT 1 9 1 3	AMOUNT 1 9 1 2
40% Powder	58,650	.09	5,278.50	
50% "	83,900	.10	8,390.00	3,144.15
Total powder	142,550	.0958	13,668.50	3,144.15
Fuse	355,100	3.825	1,358.18	300.69
Caps	67,800	6.38	432.45	96.40
Cap Crimpers	80	.25	19.85	8.25
Tamping Bags	2,500	1.35	3.36	
Electric Exploders				35.95
Connecting Wire	22	.32	6.96	
Total fuse,etc.			1,820.80	441.29
Grand total			15,489.30	3,585.44
Product			295,088	60,058
Pounds powder per ton Ore			.483	.525
Cost per ton for powder			.046	.053
Cost per ton for fuse,caps,etc.			.006	.007
Cost per ton for all explosives			.052	.060
Avg.price per lb.for powder			.0958	.0997

ATHENS MINE.

E. & A. No. 261.

Engine House - Acct #30.

On May 7th a boss and six men commenced the work of cleaning up at the site of the new engine house. This building is located on the top of a high hill. After cutting down the trees it was found that there was only a small amount of surface on top of the ledge. The South half of the floor of the building is below the grade of this ledge and it was necessary to remove rock which varied in thickness from 0 to 6 feet. A diamond drill boiler was procured from Ishpeming and set up at the base of the hill. A steam line was run to the top and on the 20th the drilling of rock was commenced. A jackhammer was bought from the Carp River Power Plant and was used in putting down these holes. This work progressed slowly as extra precautions were necessary in blasting. Directly below the hill there are a large number of houses at only a short distance away. Each hole was covered down with thick brush and only one blasted at a time. No damage of any extent was done to the surrounding property. In June, on account of the great hardness of the rock and the poor progress being made with the jackhammer, a piston machine was used. This machine put in long flat holes which broke a great deal more rock than short vertical ones. In addition there was not the same danger of damaging property in the neighborhood by blasting flat holes as in short vertical ones. On the beginning of August the excavation had been completed. We then commenced sinking the pits for the flywheels of the hoist and compressor. In the early part of September mine carpenters commenced to build the forms for the foundation for the compressor. This was completed in the middle of the month. In the middle of September a contractor commenced to erect the forms for the concrete walls of the building. In the latter part of the month a small force started to put in concrete. The walls were

completed in the middle of October. It was the original intention to put in the foundation for the compressor on company account, but it was finally decided to let a contractor do it as he had his equipment all on the ground and our men were busy at other work. This foundation was completed early in October.

When our carpenters completed the compressor forms they commenced on the forms for the cage hoist. Near the end of October these forms were filled with concrete.

To the South of the building an excavation had been made for a cooling tower. Mine carpenters built the forms for the concrete foundation and the concrete work was done by the contractor.

TEMPORARY BUILDINGS - Acct. #9d.

It was necessary to provide a few inexpensive buildings. A small powder house and an old hose house was sold by the Negaunee to the Athens. These were loaded on a wagon and hauled to the Athens at a small cost. In July a compressor house, 9 by 28 feet, with a flat roof was completed. This building was made out of old material purchased from the Negaunee Mine. The sides and roof were covered with tar paper. Another small building, 12 by 28 feet, was constructed to be used as a temporary blacksmith shop and change house. This was completed early in August. This building also has a flat roof and is covered with tar paper. In August a small building was constructed out of material taken from the old Negaunee Mine laboratory. This will serve as a temporary office and storehouse.

SINKING TEST PITS - Accts. #3c and 4c.

On May 16th a test pit was commenced at the proposed location of the shaft and on the last day of the month had reached the ledge at a distance of 40' 6". The material passed through was as follows: From 0 to 3 feet, sand; from 3 to 31 feet, gravel; from 31 to 40' 6", hardpan and boulders. Most of the material graded as gravel was of a good enough grade to be used in the making of concrete. A large number of small pits

were then sunk at intervals of 25 feet to try and outline the gravel bed in order to determine approximately the amount of this material. The outlines of the bed were found to be quite irregular and no very definite information could be determined by the pits. We are, however, reasonably sure that there is a large thickness of gravel which can be used in the making of concrete.

SINKING IN SAND - Accts. #3a and b.

A boom and a small puffer were set up near the location of the shaft. On the first day of July the sinking in sand was commenced and on the end of this month the cribbed shaft had reached a depth of 27' 6". On the surface six bearers 40 feet in length were placed in position. These bearers formed two equilateral triangles. They were so arranged that from each timber two pieces of the twelve sided shaft could be hung. For the first 20 feet two foot studdles were used. Three inch plank was placed around the entire circumference for lathing. At 20 feet very soft sand was encountered. A small run occurred which extended to the surface. On account of the shallow depth this was easily stopped. Below 20 feet the interval between sets has varied from 3 inches to 1 foot. It was found that by placing the sets a short distance apart timbering could be done rapidly and without the slightest danger of sand running in. Only sufficient ground was removed to place only a single piece of timber in position at one time. As soon as it was supported on the hanger and drawn up tightly to its proper place the blocking was placed below it, wedging it up firmly from the solid ground. The object of this blocking is to receive the weight of all of the timber above instead of having it go on the bearers. The great advantage of placing the sets a short distance apart is that in case sand commences to flow spiling can be driven in between the sets to stop it. The set directly below can therefore be put into position without danger of a hole appearing behind the timber. The entire weight of the timber was very great, although practically none of this was transferred to the bearers. For the first few days we followed

the old custom of employing miners and laborers. It was soon determined that better results could be obtained by using laborers so long as they were properly supervised. In the first month four men on a single shift sank 27' 6" and completed all of the timbering. The timber used was principally obtained from the old Negaunee Mine trestle. By making a twelve sided shaft the timber did not have to be longer than 6 feet and therefore there were many broken caps and stringers which could be used.

SINKING IN ROCK - Acct. #4a.

At a depth of 31 feet hardpan was encountered. This was filled with a great many large boulders and the progress in sinking was slow. On August 23d, at a depth of 43' 6", the ledge was encountered on the West end. On the Southeast side the rock pitched down to a depth of 5 or 6 feet. On the end of the month the depth of the shaft was 46 feet. After finding rock over the entire shaft 6 foot drill holes encountered clay. This delayed the progress somewhat as the blasting had to be done carefully in order not to loosen the material for a great distance around the shaft. During August we experimented with several kinds of drills, a 3 1/4 Rand, a Waugh sinker, a Jackhammer, and a Cleveland Self-Rotating Sinker. All tests showed that the heavy self-rotating Cleveland sinker using the 1 1/4" hollow steel gave much better results than the smaller machines. In a shaft of the size of the Athens much time would be lost in setting up tripods which are necessary in other types of machines. It is wellknown that Water-Leyners will outdrill any machine on the market, but the time lost in setting up these machines and also the fact that they require two men to operate them would give a much higher cost in sinking than by using one man self-rotating sinkers. On the end of September the shaft had been sunk to a depth of 60 feet but some of the rock in the bottom had not been cleaned up. At a depth of 56 feet below the original surface, or 12' 6" below the ledge, the floor was put in to commence the first ring of concrete. As practically all of the water was coming in through one crack in the rock

on the North side, a pipe was inserted and the water forced to flow through this. This pipe was taken through the wooden filling piece in the first form and the water allowed to flow into the center of the shaft. At a later date the hole will be plugged and the water shut off. Sinking will be resumed probably on the first of May when the permanent hoist and compressor are in commission.

CONCRETING - Accts #3c and 4c.

On the 8th of October concreting was started and on the last day of that month the total amount concreted was 60' 6". This is divided as follows: 10' in rock, 43' 6" from the original surface to the rock, and 7' above the original surface to the collar, or a total of 50' 6" to be charged against "Sinking in Sand". During the past year or so, in other mining districts concrete has been conveyed in pipes to as great a depth as 1050 feet. In our work the concrete was dumped into a hopper which took it into a 4" pipe. The lower end of the pipe was bent on an angle of 45 deg. A kibble was hung in the center of the shaft. The bent section of pipe extended from the side of the shaft to the kibble. From the lower part of the kibble there was a steel chute of sufficient length to reach the inside of the steel forms. This chute could easily be swung around the entire circumference of the shaft and the concrete evenly distributed. On commencing work the gravel was screened through a 2" mesh. It was soon found that a much smaller screen was necessary as this would allow long flat pieces of rock to pass through. Some trouble was experienced due to blockage in the pipe. A few changes were necessary and the scheme finally worked with great satisfaction. We were able to place in position as much as 15 feet of concrete in eight hours. At great depth it is necessary to control the speed of the flow of concrete. Directly below the hopper into which the concrete is dumped there is a branch "Y". As long as the hopper is kept full of concrete the material does not fall with great force if the "Y" is partly closed. In this particular case the depth was so small that

it was entirely unnecessary to attempt to control the flow. I am positive that this method of handling concrete will work most satisfactorily and will mean a large saving in the cost per yard. In other large jobs the gravel has been screened and a considerable proportion of coarse rock lowered into the shaft and dumped into the concrete. The final plans for the concrete equipment have not been completed but I am sure that it will be very simple to lower rock into the shaft and dump it behind the forms. This will of course mean a very great saving in the cost per yard. The average thickness of the section in the ledge was 2' 6". Above the ledge, in the part of the shaft which had been timbered, the thickness was reduced to 1' 3".

Experience in work in the Negaunee Shaft made it possible for us to considerably decrease the cost in the part of the shaft through sand. The method of timbering was different and could be done at a smaller cost than that at the Negaunee. The method of building the barrel to form the outside diameter through the cribbed shaft was a great improvement over that used at the Negaunee. In addition there was sufficient gravel obtained in sinking to the ledge to concrete the entire surface section. The following statement shows the cost from the collar to the ledge. I will not attempt to show the cost in the ledge because it has been necessary to carry a great many charges against this small footage and the cost does not show as it actually is.

Collar to Ledge - 50' 6"

	Amount	Per Ft.
Sinking in Sand - 43' 6",	$1,936.08	$44.51
Temporary Surface Structures and Equipment,	20.52	.4065
Steel Shaft Frames,	720.98	16.57
Concreting - 50' 6",	1,318.24	26.10
Steel Forms,	45.50	.901
Total,	$4,041.32	$80.02

STEEL SETS - Accts. #3e and 4e.

In the Negaunee shaft the steel sets were concreted in place as the work progressed. The conditions in the Athens are entirely different as the sinking must be done direct. The heavy blasting would greatly damage the sets if they were close to the bottom. For this reason a change was necessary. The sets are designed in the same general way as those at the Negaunee, the ends being inserted for a distance of about a foot in the concrete. At a distance of about 1 1/2 feet from the end of each steel member the "I"-beams are sawed off. The parts are bolted together, there being heavy plates on each side. During the process of concreting the sets are put in position and as soon as the concrete has sufficiently set the bolts are loosened and the sets removed to the surface, the stubs remaining in the concrete. When the sinking has progressed to a distance of, say 50 feet below the bottom of the shaft, the sets can be lowered and bolted to the stubs. The danger of the blasting damaging these short stubs will be very slight.

INCLINE TRACK - Accts. #76 and 77.

In order to get machinery to the top of the hill a standard gauge track was laid in September. On the level ground at the base of the hill a small hoist, obtained from the Negaunee Mine, was set up. A hole 8 feet square and 4 feet deep was dug. Over this hole the baseplate of the hoist was supported on pipes. The anchor bolts were put in and the holes filled with concrete, no forms or templets being used. This hoist is located only a short distance from the two temporary diamond drill boilers and can therefore be run by steam. In the handling of machinery it has been found that the installing of this hoist has saved a great deal of time and considerable expense. During November, by using a double block and tackle, the heaviest parts of machinery could be hoisted directly to the engine house.

CONCRETE PIERS - Accts. #44 and 78a.

Between the engine house and shaft there are five pulley stands. All of these, with the exception of the one closest to the shaft, required six concrete piers. Half of the pulley stands are above the general elevation around the shaft. The putting in of concrete would have been very expensive if a mixer had been set up at each pulley stand. In order to avoid this the standard gauge track was extended to the mixer which was located near the shaft. A concrete buggy, which was obtained at Ishpeming, was filled at the mixer. This buggy was pulled by a puffer to a point above each pier. By using long steel chutes the concrete could be run from the buggy into the forms. The only difficulty experienced was that the concrete set up very rapidly and considerable shoveling was necessary in order to get it out of the buggy. During September the forms for all piers were completed. In the latter part of the month all of the piers for the shaft house, with the exception of the two large back ones, were completed. These remaining piers were completed early in October.

PULLEY STANDS - Acct. #44.

On Oct. 14th the Wisconsin Bridge & Iron Co. commenced to erect the pulley stands between the shaft and engine house. On the end of the month these were completed.

SHAFT HOUSE - Acct. #78b.

On Nov. 3d the work of erecting the shaft house was commenced. The contractor was somewhat delayed in this on account of difficulty in our completing the upper section of the shaft. It was not thought advisable to place the heavy steel members on concrete which was green. As the contractor still had a certain amount of work on pulley stands the work on the shaft house was delayed. On Dec. 13th the shaft house was completed.

GRAVEL PIT - Accts. 3c and 4c.

To the South of the shaft stripping was continued during a part of November. This work was stopped when the ground started to freeze. A small gravel pit has been opened up and will be extended when it is necessary to do so.

TEMPORARY COMPRESSOR - Acct. #7a.

In order to supply air for the excavation for the engine house and also to sink the short distance in the shaft the small electrically driven Jackson compressor was set up. This machine worked most satisfactorily and supplied us sufficient air to run two drills in the shaft and also for hoisting purposes.

PERMANENT COMPRESSOR - Acct. #77a.

Up to the end of the year no work has been done in regard to installing the permanent compressor. The heavy parts of machinery are in the engine house and I presume that the erection will be started early in the following year.

PERMANENT HOIST - Accts. #76d-e-f.

During December a small crew of men from the shops have been engaged in erecting the permanent cage hoist.

SOUTH JACKSON AND CRUSHER.

CRUSHER.

On April 26th work was started on a single shift at the crusher.

In the previous year much trouble was experienced in handling coarse ore through the pockets. The openings above the skips were not sufficiently large to allow big pieces to pass through without wedging. The pocket as designed is suitable for Jackson ore but not for very coarse material coming from Ishpeming. It was therefore decided to remodel the pockets, making the openings about 3' square and using a type of stopper which had been proven to be a great success at hard ore mines. These stoppers are made out of 6 by 6 Oak and are "L" shape. The upper end is counterweighted sufficiently so as to prevent the weight of the ore from opening the fingers. The fingers are operated by compressed air and from the very start it was found that much better results could be obtained.

On May 5th the night shift was added. On the commencing of operation there was much delay on the night shift due to the fact that there is not sufficient track room to hold enough loads and empties for the entire shift. This was finally straightened out by the railroad putting on a night crew. During the month of May there was a delay of twenty-two hours due to either the railroad failing to report promptly for the switching or to the shortage in cars.

On the morning of the 3d of May the large shaft, to which the head of the crusher is attached, broke. Work was immediately started on replacing this and by Monday morning the 5th the crusher was again started. In replacing the shaft it was necessary to remove a very heavy casting called a spider which is on top of the crusher. It was found that a crack was in this piece. Another casting was telegraphed for and the old one was used until the new one arrived.

During June the crusher continued to work on a double shift. In addition to Scotch ore we commenced to handle ore from the Chase Mine. The handling of this ore was slow and difficult as a part of it was so soft and sticky that it would not run on the flat bottom of the pocket. It accumulated rapidly and extra labor was necessary to keep the pockets in working condition. From the 1st until the 17th of July there was considerable delay due to the ore not being received fast enough at the crusher. It was difficult to keep the crew busy. They were used in cleaning up around the plant and also in taking up sollar plank and rail at the Lucy Mine. On the 17th it was decided to shut down the crusher until a sufficient amount of ore could be accumulated. From the 21st to the end of the month the crusher continued to work on a single shift handling principally Chase ore. During August the work was intermittent. In order to try to keep the crew busy while the trouble with the grades of the ore being crushed was straightened out, we commenced to build forms for the new electric machinery. When the crusher was idle the crew was used in mixing concrete and filling foundations. On the end of August the foundations were completed. During September ore was not received fast enough and there was much trouble in keeping the crew busy. In October it was decided to ship an additional tonnage from Ishpeming and North Lake. This ore was loaded by steam shovels and a large number of cars brought to the crusher. Before it could be dumped it had frozen. On the 27th the double shift was added and on Nov. 1st the crusher was shut down. The conditions at the crusher were somewhat improved during October due to the small tonnage which was taken from the South Jackson pit. After the crusher shut down the skips were removed and overhauled. A machinist and a crew started the work of setting up the new electric machinery. During the coming year this plant will be worked electrically.

SOUTH JACKSON MINE.

On September 25th word was received to open up the pit for a

shipment of 1500 tons. On the 26th men commenced to fill railroad cars. On the end of the month the shipment amounted to 896 tons. Early in October the pit was shut down. The grade of the ore was good and no trouble was experienced in keeping up to the guarantee.

SOUTH JACKSON MINE.

A VERAGE MINE ANALYSIS OF OUTPUT FOR 1913.

GRADE	IRON	PHOS.	SILICA	MANG.
South Jackson	40.60	.094	33.67	.182

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR 1913.

	Mine		Lake Erie	
	IRON	PHOS.	IRON	PHOS.
South Jackson	No Shipments			

ORE STATEMENT AND SHIPMENTS FOR 1913.

	SOUTH JACKSON	TOTAL LAST YEAR
Output for year	1,519	50,166
Shipments	1,519	50,166

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICE	1913 AMOUNT	1912 AMOUNT
No explosives used during year 1913.				
50% Powder				975.00
Total powder				975.00
Fuse				35.92
Caps				7.07
Total fuse,etc.				42.99
Grand total				1,017.99
Product				50,166
Pounds powder per ton ore				.194
Cost per ton for powder				.019
Cost per ton for fuse,caps,etc.				.001
Cost per ton for all explosives				.020
Avg.price per lb. for powder				.100

SOUTH JACKSON MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 3	1 9 1 2	INCREASE	DECREASE
PRODUCT	1,519	50,166		48,647
General Expense	.171	.040	.131	
Maintenance	.054	.002	.052	
Mining Expense	.419	.261	.158	
Crushing and shipping	.035	.142	.177	
Cost of production	.609	.445	.164	
DEPRECIATION				
Construction	.064		.064	
Plant	.150	.150		
Total depreciation	.214	.150	.064	
Taxes	1.201	.032	1.169	
Central Office	.026	.019	.007	
Miscellaneous	.011		.011	
COST ON STOCKPILE	2.039	.646	1.403	
Total cost on cars	2.039	.646	1.403	
Number of days operating	12	114	102	
Number of shifts and hours	1-10hr	1-10hr		
Average daily product	126	440	314	
COST OF PRODUCTION				
Labor		.275		
Supplies		.170		
Total		.445		

SOUTH JACKSON MINE.

STATEMENT OF COMPARATIVE WAGES.

	1 9 1 3	1 9 1 2	INCREASE	DECREASE
SURFACE				
Total number of days	48¼	538		489-3/4
Average rate	2.17	1.97	.20	
Amount	104.96	1,060.15		955.19
UNDERGROUND				
Total number of days	263-3/4	5,472¼		5,208½
Average rate	2.28	2.17	.11	
Amount	601.62	11,899.88		11298.26
Total days	312	6,010¼		5,698¼
Average rate	2.26	2.16	.10	
Total Amount	706.58	12,960.03		12253.45
Labor cost per ton	.465	.258	.207	
No.shifts and hours	1-10hr	1-10hr		

Mine operated 1-10hr shift for 12 days.

STATEMENT OF COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '13 1,519 Tons	SURFACE		UNDERGROUND		TOTAL.	
PRODUCT '12 50,166 Tons	1 9 1 3	1 9 12	1913	1912	1913	1912
Average no.men working	1	4	3	32	4	36
Average wages per day	2.17	1.97	2.28	2.17	2.26	2.16
Avg.wages per month 25 days	54.25	49.25	57.00	54.25	56.50	54.00
Average product per man per day	31.48	93.26	5.76	9.17	4.87	8.35
Labor cost per ton	.069	.021	.396	.237	.465	.258
Diff. in labor cost per ton	+.048	+.002	+.159	-.002	+.207	.000

NORTH JACKSON.

This mine has been idle for the entire year and, with the exception of a watchman, no one else has been employed. There is nothing of interest to report.

LUCY MINE.

During September the small remaining strip of the Lucy grade was shipped. The sollar plank was loaded on flat cars and sold to the Maas and Negaunee Mines. To the South of the old ore pocket a small pile of high Manganese had been stocked. In order to ship this the old pocket was blasted down. By building a very short piece of track the pile was loaded by the steam shovel. During the summer months practically everything of value such as sollar plank, rail, pipe, etc., has been collected and sold to either the Maas or Negaunee mines. The work of collecting this material was done by men from the crusher when the latter was idle on account of the lack of cars.

LUCY MINE.

ORE STATEMENT AND SHIPMENT FOR 1913.

	LUCY	LUCY MANGANESE	TOTAL	TOTAL LAST YEAR
On hand Jan.1st,1913,	800	774	1,574	73,375
Stockpile Overrun	298	153	451	1,319
Total	1,098	927	2,025	74,694
Shipments	1,098	927	2,025	73,120
Balance on hand	0	0	0	1,574

Mind idel during 1912 and 1913.

I beg to submit my report on the work done in the Gwinn District for the year ending December 31st, 1913.

I have taken the various subjects under the following heads, viz:

GENERAL REMARKS

AUSTIN MINE

STEPHENSON MINE

PRINCETON MINE

GWINN MINE

JOPLING MINE

FRANCIS MINE

MACKINAW MINE

GARDNER MINE

GENERAL SURFACE

ACCIDENTS

ANALYSIS OF COST SHEETS

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GENERAL REMARKS

MINES

The principal work in the district has been that of the mines.

The Austin Mine worked two eight hour shifts up to April 1st and one eight hour shift from April 1st to October 31st, at which time the mine closed down.

The Stephenson Mine worked two eight hour shifts throughout the year.

The Princeton Mine, at No. 2 Shaft, worked one eight hour shift up to August 30th, at which time the mine closed down for an indefinite period.

The product for the different mines for the year was as follows.

Austin Mine product for the year was 68,259 tons,

Stephenson Mine product for the year was 255,979 tons,

Princeton Mine product for the year was 74,884 tons,

The Total product for the district was 391,257 tons.

At the Gwinn Mine the work was confined to surface improvements and development work on the 5th, 6th and 7th levels and sump level below the 7th level.

At the Jopling Mine no work was done during the year.

At the Francis Mine no work was done during the year.

At the Mackinaw Mine the work was confined to surface improvements, consisting principally of the erection of mine buildings and steel head frame.

At the Gardner Mine the work was confined to surface improvements, consisting of the erection of Engine House, steel head frame and pulley stands.

GENERAL

The Princeton and Austin Mines, only operating one shift the greater part of the year and finally closing down, had a very depressing effect on the district.

In the Gwinn Townsite we have 15 empty houses and in the Austin Location four empty houses and one empty boarding house.

There were very few changes made at the Gwinn Townsite, only one lot being sold and one building erected during the year.

The resumption of work at the Gwinn, Mackinaw and Gardner Mines will help the district this coming season.

At the Mackinaw Gardner Location site five double houses were erected and Captains Residence. All of the Company houses are now occupied and contract has been let for the erection of five more double houses.

AUSTIN MINE

The product for the year was as follows:

Austin Bessemer,	45,164
Austin No. 2,	43,095
Total,	68,259
Rock,	1,374
Total Ore and Rock,	69,633

43,741 tons were shipped from Austin Bessemer Stockpile.

2,298 tons were transferred to Austin from Stockpile.

27,938 tons were shipped from Austin No. 2 Stockpile.

20,082 tons were shipped from Austin Bessemer Pocket.

3,897 tons from Austin Bessemer Pocket were transferred to Austin.

48 tons from Austin Bessemer Pocket were transferred to Austin No. 2.

9,361 tons were shipped from Austin No. 2 Pocket.

THE MINE

The Austin Mine was worked two eight hour shifts up to April 1st, and one eight hour shift from April 1st up to October 31st, at which time the mine was closed down.

The principal work for the year consisted in mining on Sub. Levels above the 4th, 5th and 6th levels.

The estimated ore in sight December 31st, was 194,626 tons as against 236,452 tons a year ago.

MAIN THIRD LEVEL

WORK FOR YEAR

No. 8 Contract started at a point 30 feet Southwest of shaft and drifted North in rodk 130 feet.

SUB. LEVELS ABOVE 4TH LEVEL

250 FOOT SUB.

WORK FOR YEAR

The work of removing the shaft pillar on the hanging side of this Sub. Level was completed early in the year by Contracts No's 10 and 21.

260 FOOT SUB.

WORK FOR YEAR

The shaft pillar on this Sub. Level was removed by Contracts No's 1, 16, and 27.

MAIN 4TH LEVEL

WORK FOR YEAR

No. 10 Contract removed pillar around top of S_5 Raise.

No. 15 Contract put up A_a Raise from 295 foot Sub. Level to main 4th Level and drifted Northeast 60 feet and holed to old foot wall drift just South of A_1 Raise. This drift was then caved back by No. 1 Contract and pillars removed on West side of drift as it came back.

The pillar Southwest of M Raise was removed by No. 7 Contract. It then caved back old foot wall drift to a point 30 feet Southeast of L Raise stoping ore from foot as it returned.

SUB. LEVEL ABOVE 5TH LEVEL

295 FOOT SUB.

WORK FOR YEAR

The pillar South and West of P Raise was removed by No. 7 Contract in the early part of the year. The ore Southwest of the foot wall drift from Q Raise was removed by No. 15 Contract. It then caved back the foot wall drift, stoping the ore from the foot as it returned.

The greater part of the ore North and West of S Raise was removed during the year by Contracts No's 15, 21, 10, 7 and 3,. Practically all of the ore has now been mined on this sub. level.

300 FOOT SUB. LEVEL

WORK FOR YEAR

U Raise was put up from the 5th level to the 300 foot Sub. Level by No. 6 Contract and from the top of the raise, drifted Northeast to the foot. It then came back and drifted North to V Raise, and with No. 9 Contract removed all the ore between U and V Raises.

No. 20 Contract put up P_1 Raise from the 5th level to the 300 foot Sub. and drifted Northwest along the foot and holed to workings from W Raise. It then mined all the ore that was left Southwest of the foot between P_1 and W Raises.

MAIN 5TH LEVEL

WORK FOR YEAR

The ore on the Stephenson Boundary on the West side of the deposit was mined in the early part of the year by No. 13 Contract and Contracts No's 19, 15 and 9 removed the pillars just South of the old foot wall drift, between N and N_2 Raises. The ore along the boundary on the East side of the deposit was stoped by Contracts working on the 321 foot Sub.

SUB. LEVELS ABOVE 6TH LEVEL

321 FOOT SUB.

WORK FOR YEAR

The pillar Southwest of D Raise was mined by No. 20 Contract. No. 13 cut out on the East side of D Raise and drifted East 20 feet and holed to C Raise. No. 27 Contract cut out on the North side of A Raise and drifted Northeast 50 feet to the foot and 22 feet up on the foot and holed to the 5th level. Then from a point 53 feet Northeast of the raise drifted Southeast along the foot, 60 feet to the boundary, then with Contracts No's 26 and 9, stoped up on the foot and removed all the ore that was left in this end of the deposit above the 321 foot Sub.

No. 18 Contract cut out on the South side of A Raise and drifted Southeast to the boundary, thence East along the boundary and holed to foot

wall drift driven by No. 27 Contract. Contract No's 18 and 26 then mined the ore in the pillar North and East of A Raise. A drift was also driven by No. 26 Contract from the North side of A Raise. This drift was extended up on the foot 65 feet to the North and holed to the 5th level.

338 FOOT SUB.

WORK FOR YEAR

Contracts No's 13 and 20 cut out from the South side of D, C and B Raises and mined the ore from the foot to the Stephenson boundary. These contracts then drifted up on foot and holed to the 5th Level and then caved back removing all the ore from the foot.

UNDERGROUND IN GENERAL

WORK FOR YEAR

The greater part of the ore in the Austin Mine has now been removed below the 4th level. The ore that remains below this elevation consists of a small pillar of the foot side, 321 foot Sub, between A and B Raises. The ore along the foot on the East side of the 5th level and a pillar Southwest of N_2 Raise. Also pillars along the foot on the 300 and 295 FOOT SUBS.

The ore on the 4th level and above the 4th level is confined to the shaft pillars.

It has been decided to mine the ore that remains below the 3rd level, through the present shaft and the shaft pillars above the 3rd level, through the timber raise in the Northwest side of the mine. The bottom of this raise is now on the 2nd level. It is proposed to extend it to the 3rd level and convert it into an inclined shaft.

A rock tramming drift was started late in the year from a point near the shaft on the 3rd level. This drift will be extended to the Northwest and holed to the proposed inclined shaft.

AUSTIN SURFACE

There were practically no changes made on Austin Surface during the year.

The cracks in the surface are gradually approaching the shaft house from the South. This is shortening our tail room and may mean a rearrangement of these tracks early this coming shipping season.

As soon as the ore below the 3rd level is mined, the present shaft will be abandoned and the timber raise converted into an inclined shaft. This will necessitate the erection of a new head frame and a permanent trestle from the shaft to the proposed pockets which will be erected on the sput Northwest of the Austin engine house.

AUSTIN MINE.

AVERAGE MINE ANALYSIS OF OUTPUT FOR 1913.

GRADE	IRON	PHOS.	
Austin Bessemer	59.72	.051	
Austin	59.74	.102	
Austin #2	59.26	.283	

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR 1913.

	MINE		LAKE ERIE	
	IRON	PHOS.	IRON	PHOS.
Austin Bessemer	All Mixed			
Austin	"			
Austin #2	"			

ORE STATEMENT - DECEMBER 31ST, 1913.

	AUSTIN BESS.	AUSTIN	AUSTIN N O.2	TOTAL	TOTAL LAST YEAR
On hand Jan. 1,1913,	39,122		79,028	118,150	104,745
Output for year	38,921	6,195	23,143	68,259	115,934
Total	78,043	6,195,	102,171	186,409	220,679
Shipments	63,823	6,195	37,347	107,365	102,529
Balance on hand	14,220	0	64,824	79,044	118,150
Decrease in Output				47,675	
Decrease in Ore on hand				39,106	

1913- 2-8hr shifts Jan.1st to March 31st; 1-8hr shift Apr.1 to Oct.31st; Mine idle balance of year.
1912 -2-10hr shifts Jan.1st to Mar.11th; 2-8hr shifts Mar.11th to Dec.31st.

SHIPMENTS FOR 1913.

	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Austin Bessemer	20,082	43,741	63,823	65,702
Austin	3,897	2,298	6,195	3,775
Austin #2	9,409	27,938	37,347	33,052
Total	33,388	73,977	107,365	102,529
Total last year	57,376	45,153	102,529	
Increase 5%			4,836	

AUSTIN MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 3	1 9 1 2	INCREASE	DECREASE
PRODUCT	68,259	115,934		47,675
General Expense	.145	.164		.019
Maintenance	.069	.064	.005	
Mining Expense	.838	.974		.136
Cost of production	1.052	1.202		.150
DEPRECIATION				
Plant	.064	.046	.018	
Total depreciation	.064	.046	.018	
Taxes	.109	.075	.034	
Central Office	.059	.072		.013
Idle Expense	.037		.037	
Sundry Expense	.073		.073	
COST ON STOCKPILE	1.394	1.395		.001
Loading and shipping	.064	.032	.032	
Total cost on cars	1.458	1.427	.031	
Number of days operating	248	302		54
Number shifts and hours	2-8hr 1-8hr	2-10hr 2- 8hr		
Avg.daily product	275	384		109

COST OF PRODUCTION				
Labor	.788	.890		.102
Supplies	.264	.312		.048
Total	1.052	1.202		.150

AUSTIN MINE.

STATEMENT OF COMPARATIVE WAGES.

	1913	1912	INCREASE	DECREASE
SURFACE				
Total number of days	4,584½	8,580		3,995½
Average rate	2.47	2.34	.13	
Amount	11,302.64	20,006.64		8,704.00
UNDERGROUND				
Total number of days	14,231	29,120½		14,888½
Average rate	2.85	2.70	.15	
Amount	40,487.56	78,720.54		38,232.98
Total days	18,815½	37,700½		18,885
Average rate	2.75	2.62	.13	
Total amount	51,790.20	98,817.18		47,026.98
Labor cost per ton	.759	.852		.093
No.shifts and hours	2-8hr 74 da. 1-8hr174 "	2-10hr 2-8hr		

Mine closed October 31,1913.
Operated 2-10hr to March 10,1912; 2-8hr from Mar.11,1912, to Mar.30,1913; 1-8hr from April 1,1913.

Increased wages for 1913:

Surface .13 per day ------ 5.56%
Underground.15 " ------ 5.55%
Total .13 " ------ 4.96%

AUSTIN MINE.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '13 68,259 Tons	SURFACE		UNDERGROUND		TOTAL	
PRODUCT '12 115,934 Tons	1913	1912	1913	1912	1913	1912
Avg. no.men working	15	25	48	75	63	100
Avg.wages per day	2.47	2.35	2.85	2.90	2.75	2.77
Avg.wages per mo.25 days	61.75	58.75	71.25	72.50	68.75	69.25
Avg.product per man per day	14.89	13.51	4.80	3.98	3.63	3.07
Labor cost per ton	.166	.173	.593	.619	.759	.852
Diff. in labor cost per ton	-.007	+.031	-.026	-.035	-.093	+.056
Avg.product breakg.& tramming			6.64	5.97		
Avg.wages for miners cont.			2.92	2.79		
Avg.wages for trammers cont.			2.58	2.42		
Total avg.wages for cont.			2.84	2.72		

		TONS	%
Product per man per day	SURFACE Increase	1.38	10.2
Product per man per day	UNDERGROUND "	.82	20.6
Product per man per day	SURF. & U.G. "	.56	18.2

Proportion Surface to Underground - 1913 - 1 to 3.2
1912 - 1 to 3.
1911 - 1 to 4.03
1910 - 1 to 3.05

AUSTIN MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31,1913.

KIND	LINEAL FEET	AVG.PRICE PER FOOT	AMOUNT 1913	AMOUNT 1912
6" to 8" Timber	816	.02	16.32	36.84
8" to 10" "	18,152	.04	726.08	1,518.48
10" to 12" "	4,086	.06	245.16	1,958.38
12" to 14" "	224	.0825	18.40	1,506.86
Total 1913	23,278	.0432	1,005.96	
Total 1912	90,709	.0553		5,020.56

	LINEAL FEET	PER 100'	1913	1912
5" Lagging	99,330	.465	462.00	1,028.00
7" "	14,582	.55	84.01	41.58
8" "	47,283	.55	260.07	462.60
Poles	38,069	.95	362.65	799.05
Total 1913	199,264	.586	1,168.73	
Total 1912	396,783	.538		2,331.23

	1913	1912
Feet of timber per ton of ore	.341	.782
Feet of lagging per ton of ore	2.36	2.70
Feet of lagging per foot of timber	6.92	3.45
Cost per ton for timber,lagging and poles	.0318	.0634
Equivalent of Stull timber to board measure	38,118	241,644
Feet board measure per ton of ore	.558	2.08
Total product	68,259	115,934

Total cost of timber and lagging - 1913	2,174.69
Total cost of timber and lagging - 1912	7,351.79
Total cost of timber and lagging - 1911	6,214.48
Total cost of timber and lagging - 1910	3,378.03
Total cost of timber and lagging - 1909	6,356.25
Total cost of timber and lagging - 1908	7,490.71
Total cost of timber and lagging - 1907	6,522.69

AUSTIN MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY	AVERAGE PRICES	1913 AMOUNT	1912 AMOUNT
40% Powder	450	.10	40.50	373.50
30% "	6,000	.083	498.17	1,640.32
50% "	12,850	.10	1,285.00	324.00
80% "				33.75
Total powder	19,300	.0945	1,823.67	2,371.57
Fuse	48,800	3.83	187.19	300.72
Caps	13,400	6.40	85.76	145.82
Cap Crimpers	14	.25	3.50	2.75
Connecting Wire			.62	.31
Total fuse,etc.			277.07	449.60
Grand Total			2,100.74	2,821.17
Product			68,259	1,159.34
Pounds powder per ton ore			.354	.234
Cost per ton for powder			.027	.020
Cost per ton for fuse,caps,etc.			.004	.004
Cost per ton for all explosives			.031	.024
Avg.price per lb.for powder			.0945	.087

Increase cost per pound for powder due to more 50% being used in 1913 and less of the 30%.

STEPHENSON MINE

The product for December, from Daily Reports, was as follows:

Stephenson Bessemer,	5,605	tons,
Stephenson No. 2,	17,513	"
Total,	23,118	"

The product for the year, was as follows:

Stephenson Bessemer,	65,407	"
Stephenson No. 2,	190,572	"
Total Ore,	255,979	"
Rock,	31,912	"
Total Ore and Rock,	287,891	"

7,486 tons were shipped from Stephenson Bessemer Stockpile.

636 tons were transferred to Stephenson from Stockpile.

9,385 tons were shipped from Stephenson No. 2 Stockpile.

40,197 tons were shipped from Stephenson Bessemer Pocket.

8,926 tons from Steph. Bessemer Pocket were transferred to Steph.

220 tons from Steph. Bessemer Pocket were transferred to Stephenson No. 2.

29,429 tons were shipped from Stephenson No. 2 Pocket.

THE MINE

The work for the year consisted in developing Sub. Levels above the 4th and 5th levels, extending the foot-wall drift along the contact on Southwest side of the 5th level to the boundary. Driving rock tramming drifts in the foot on Southwest and Northeast side of the 5th level and extending the 5th level cross-cut from the foot to the hanging.

The mining was confined to Sub. Levels above the 3rd, 4th and 5th Levels and main 3rd level.

The estimated ore in sight December 31st was 573,802 tons as against 441,583 tons shown a year ago.

SUB. LEVELS BELOW 2ND LEVEL

There is no work being done on these Subs. at the present time.

WORK FOR YEAR

3RD SUB. BELOW 2ND LEVEL

Contracts No's 8, 16, 3, 37 and 15 developed and mined all the ore that remained on this Sub. Level between A_1 and N Raises.

MAIN 3RD LEVEL

WORK FOR YEAR

The work for the year consisted in mining practically all the ore on the Northeast side of the 3rd level from Q_2 Raise Southwest to A_4 Raise. The greater part of this work being done by Contracts No's 16, 25, 15, 37, 42 and 22.

Four raises were put up from the 4th level tramming drift during the year and drifts driven from the top of these raises and holed to 3rd level foot wall drift.

No. 3 Contract cut out on hanging side of A_3 Raise and drifted Southeast 50 feet, thence Northeast 15 feet to hanging. It then removed the greater part of the ore South of its raise between its cross-cut and A_4 Raise.

A drift was driven by No. 16 Contract which started at the end of cross-cut from A_3 Raise and was extended 30 feet Southwest along the hanging. No. 16 also drove a cross-cut from a point 25 feet Northeast of the forks of 3rd level foot wall drifts. This cross-cut was extended 35 feet Southeast to hanging. A drift was then driven by No. 15 Contract from the end of this cross-cut 10 feet to the Southwest along the hanging.

No. 6 Contract started 30 feet North of the breast of its old drift from 4 O_2 Raise and drifted Southeasterly 185 feet. This drift was then extended by No. 2 Contract 50 feet Southeast.

WORK FOR DECEMBER

No. 2 Contract, 4 O_2 Raise,

No. 2 extended its drift Southeast 13 feet. Then 23 feet back of its breast drifted East 11 feet, thence Southeast 8 feet.

No. 16 Contract, 4 A_3 Raise,

No. 16 extended its drift South 13 feet and Southwest 11 feet and caved back taking pillar to East. Then 16 feet Southeast of its raise drifted South 28 feet to caved ground and caved back.

No. 3 Contract, 4 A_3 Raise,

No. 3 extended its drift North 16 feet and caved to main cross-cut, then 16 feet Southeast of its raise drifted Northeast 32 feet and caved back.

No. 25 Contract, 4 A_2 Raise,

No. 25 caved back last months drift taking pillar to Northwest and ore on foot, then from cross-cut to 4 A_3 Raise drifted Northwest 24 feet and East 17 feet.

SUB. LEVELS BELOW 3RD LEVEL

1ST SUB. BELOW 3RD LEVEL

WORK FOR YEAR

At the close of last year all the ore on this Sub. Level had been mined on the Northeast side of the deposit South and East of O_1 and O_2 Raises. Drifts had also been driven outlining the foot to the West as far as M_1 Raise. The work for this year consisted in driving drifts along the hanging and then mining all the ore between foot and hanging from M_1 Raise East to O_2 and O_1 Raises.

The greater part of this work being done by Contracts No's 17, 3, 11, 42, 25, 40, 10, 23, 36, 14, 5, 16, 35, 13, 39, 44 and 22.

No. 36 Contract started on hanging side of M_1 Raise late in the year and drifted South 65 feet to hanging.

No. 8 Contract started in cross-cut South of 4 M_1 Raise and drifted Southwest 50 feet and holed to A_4 Raise.

On the Southwest side of the mine No. 33 Contract put up C_1 Raise from 4th level and from top of raise drifted Northwest 60 feet and holed to 3rd level. Then from raise drifted Southeast 24 feet, thence Southwest 16 feet to hanging, then along the hanging 26 feet.

WORK FOR DECEMBER

No. 15 Contract, 4 A_4 Raise,

No. 15 in early part of month repaired top of 4 A_3 Raise, then extended No. 16 drift from 4 A_2 Raise 8 feet Northeast along the hanging, then 15 feet Southeast of 4 A_4 Raise drifted Southeast 9 feet.

No. 8 Contract, 4 A_4 Raise,

No. 8 repaired top of 4 M_1 Raise, then 14 feet South of raise drifted Southwest 53 feet, thence Northwest 14 feet to 4 A_4 Raise and is now repairing its drift.

No. 33 Contract, 4 C_1 Raise,

No. 33 extended its drift Northwest 11 feet and holed to 3rd level. Then from its raise drifted Southeast 24 feet, thence Southwest 16 feet to hanging and 26 feet along hanging.

No. 32 Contract, 4 C_1 Raise,

No. 32 took slice along its old drift on 2nd Sub. below 3rd level 4 M_4 Raise, then moved to 1st Sub. below 3rd level and starting 24 feet Northwest of 4 C_1 Raise drifted Northwest 24 feet.

No. 36 Contract, 4 M_1 Raise,

No. 36 extended its drift Southeasterly 46 feet and caved back within 28 feet of its raise, now on first turn starting another slice.

No. 22 Contract, 4 M_2 Raise,

No. 22 caved its last months drift, then removed ore on foot side.

No. 42 Contract, 4 M_2 Raise,

No. 42 caved back last months drift, then from raise drifted Southwest 40mfeet and caved back starting at raise it drifted Southwest 26 feet and caved back. It then came back to raise and drifted East 10 feet.

2ND SUB. BELOW 3RD LEVEL

WORK FOR YEAR

This Sub. Level was developed from raises put up from 4th level on both hanging and foot sides of the deposit and the greater part of the ore removed from P_1 and Q_2 Raises on the East to M_4 and R_2 Raises on the West. This work being done by Contracts No's 32, 34, 26, 28, 31, 14, 38, 29, 40, 18, 2, 11, 17 and 23.

A drift was also driven from the hanging side of M_3 Raise by No. 37 Contract and extended Southeast 63 feet and holed to drift driven by No. 17 Contract.

No. 11 started 15 feet South of M_3 Raise and drifted Northeast along the foot 35 feet and caved back stoping ore from foot. It then came back to raise and starting 5 feet Southeast of raise drifted Southwest along the hanging 35 feet.

No. 26 Contract cut out on North side of R_5 Raise and drifted North 50 feet. A drift was also driven from top of R_6 Raise by No. 24 Contract. This drift was extended North 25 feet and holed to drift from R_2 Raise.

WORK FOR DECEMBER

No. 11 Contract, 4 M_3 Raise,

No. 11 removed ore on foot side of last months drift. It then started 9 feet Southeast of its raise and drifted Southwest 22 1/2 feet along foot.

No. 37 Contract, 4 M_3 Raise,

No. 37 from a point 53 feet Southeast of its raise drifted Southeast 24 feet along its old drift and caved back, then 38 feet from its raise drifted Southwest 17 feet, thence West 7 feet.

No. 10 Contract, 4 M_4 Raise,

No. 10 caved back last months drift to cross-cut, then 24 feet Southeast of its raise drifted Southwest 13 feet.

No. 29 Contract, 4 N_1 Raise,

No. 29 caved last months drift from 4 N_2 Raise, then caved back No. 26 drift from N_1 Raise. Then from raise drifted South 33 feet.

No. 38 Contract, 4 N_2 Raise,

No. 38 caved back last months drift and is now removing ore off of foot.

No. 23 Contract, 4 N_3 Raise,

No. 23 came down 12 feet in its raise and cut out on hanging side and drifted Southeast 47 feet, thence East 17 feet to caved ground and is now caving back.

No. 40 Contract, 4 O_5 Raise,

No. 40 caved last months drift. Then from its raise drifted North 54 feet to caved ground and caved back. Then starting 13 feet from its raise drifted Northeast 11 feet.

No. 24 Contract, 4 R_6 Raise,

No. 24 extended its drift on 4th level and holed to old drift, then 15 feet West of point of holing raised 26 feet, then drifted Northwest 18 feet and holed to No. 18 drift.

No. 26 Contract, 4 R_5 Raise,

No. 26 put up 4 R_5 Raise and from top of raise drifted Northeast 50 feet.

No. 6 Contract, 4 R_5 Raise,

No. 6 caved back last months drift from 4 O_7 Raise, then on Southwest side of 4 N_1 Raise, raised 11 feet. It then moved to a point 17 feet North of 4 R_5 Raise and drifted East 14 feet.

No. 28 Contract, No. 33 Raise,

No. 28 worked the greater part of the month on 4th level, where it extended its drift Northeast 39 feet holing to old drift near 4 P_5 Raise. It is now retimbering its drift on Northeast side of its raise.

3RD SUB. BELOW 3RD LEVEL

WORK FOR YEAR

In the early part of the year Contracts No's 37, 29 and 38 developed this Sub. Level from S to Q_2 Raise and removed the greater part of the ore. On the Southwest side of the Mine, Contracts No's 33 and 7 mined the ore South of A raise.

No. 33 then put up B_1 Raise from 4th level and drifted North 40 feet from top of its raise and then drifted East 50 feet to hanging and North 20 feet to old foot wall drift from A Raise, and then stoped the ore between hanging and foot-wall drift between A and B_1 Raises.

WORK FOR DECEMBER

No. 17 Contract,

No. 17 worked the greater part of the month on 2nd Sub. below 3rd level. It then put up 4 N_7 Raise and from top of its raise drifted Southwest 12 feet.

No. 31 Contract, 4 O_8 Raise,

No. 31 caved back its drift on 2nd Sub. below 3rd Level. Then put up 4 O_8 Raise and from top of its raise drifted Southeast 33 feet.

FOURTH LEVEL

WORK FOR YEAR

The following work was done on the 4th level during the year:

A drift was started by No. 24 Contract in cross-cut 100 feet South of O_4 Raise and extended East 70 feet, thence Northeast 84 feet, 4 raises were then put up from this drift to mine the ore along hanging on Sub. Levels above the 4th level.

No. 19 Contract cut out from the top of No. 26 raise from 5th level and drifted Easterly 41 feet and holed to hanging wall drift. A launder was then installed in this raise and the water from 4th level hanging wall drift taken down this raise to 5th level.

No. 1 Contract put up a raise, for traveling road, to 3rd level, at end of stub drift 70 feet Southwest of forks of 4th level foot wall drift. This raise affords a second exit for the men to the 3rd level.

A drift was driven by No. 24 Contract from a point 100 feet Northeast of the forks of the foot wall drifts and extended Easterly 185 feet and holed to cross-cut. Two raises are now being put up from this drift to mine the ore along the hanging on 2nd Sub. below 3rd level.

No. 28 Contract cut out from top of No. 35 Raise from 5th level and drifted Northeast 65 feet and holed to foot wall drift.

No. 18 Contract started 10 feet Northwest of R_2 Raise and drifted Northeast 20 feet and holed to top of No. 33 Raise from 5th level.

WORK FOR DECEMBER

No. 24 Contract,

No. 24 Contract extended its drift 60 feet East and holed to cross-cut.

No. 28 Contract,

No. 28 extended its drift Northeast 40 feet and holed to foot wall drift.

FIRST SUB. BELOW 4TH LEVEL

WORK FOR YEAR

The ore on this Sub. Level was developed on the Southwest side of the deposit from No. 2 raise to the boundary and ore mined from foot West of No. 4 and No. 5 Raises. The work in detail was as follows:

No. 9 Contract cut out from No. 2 raise and drifted Northeast 35 feet to hanging, thence North 25 feet and from Southwest side of raise it drifted Southwest 20 feet and from a point 30 feet Southwest of No. 2 Raise it drifted Southeast 45 feet to the top of No. 3 Raise, thence Southerly 87 feet and holed to cross-cut from No. 4 Raise. It then put up No. 5 Raise from 5th level and from top of raise drifted West 15 feet and holed to No. 30's drift, moving across this drift it extended its cross-cut 45 feet and holed to foot wall drift. Then starting 30 feet East of the above foot-wall drift, it drifted Southwest 25 feet, thence Northwest 35 feet to foot and Northeast along foot 31 feet and caved back removing ore from foot. It also mined the pillar South of its cross-cut betweem foot and No. 30's drift for a distance of 40 feet.

No. 13 Contract started 20 feet Southwest of No. 2 Raise and drifted 60 feet Southwest to foot, thence Southeast 60 feet, then 50 feet Northwest of its breast. It drifted Southerly 135 feet, then mined the ore on the West of this drift and two slices on the East as far South as cross-cut from No. 4 Raise.

No. 30 Contract cut out from No. 4 Raise and drifted Southerly 360 feet and holed to cross-cut from No. 10 Raise. It also extended cross-cut from No. 4 raise 20 feet and then moved to end of cross-cut from No. 7 raise and drifted Southerly along the foot for 57 feet and holed to No. 43 Contract. It then caved back removing ore from foot as it returned.

No. 19 Contract put up No. 7 Raise from 5th level and from top of its raise drove cross-cut 70 feet West to the foot, thence North along the foot 80 feet and caved back 50 feet stoping ore from foot as it returned.

No. 43 Contract put up No. 11 Raise from 5th level and holed to No. 30's drift. It then moved to a point 30 feet Southwest of raise and drifted West 63 feet to foot. Thence Northwest 30 feet along foot and holed to No. 30's drift. It then came back to cross-cut and drifted South 30 feet, thence Northwest 135 feet.

A drift was driven from No. 9 raise 18 feet to Northwest by No. 5 Contract, this contract then moved to cross-cut from No. 10 raise and starting 60 feet West of the raise drifted West 100 feet to hanging, thence Northwest 120 feet.

No. 12 Contract cut out from top of No. 10 raise and drifted Southwest 50 feet, thence South 30 feet. It then moved North 30 feet and drifted East 70 feet to hanging, thence South along hanging 40 feet and caved back stoping ore from hanging.

No. 44 Contract cut out on Northeast side of No. 9 Raise and drifted Northeast 30 feet, thence West 70 feet and Northwest 60 feet holing to No. 5. It then came back to a point 30 feet Northeast of No. 9 Raise and drifted East 55 feet to caved ground.

WORK FOR DECEMBER

No. 13 Contract, No. 2 Raise,

No. 13 caved back last months drift and is now stoping ore off of foot.

No. 4 Contract, No. 4 Raise,

No. 4 extended its drift Southwest 11 feet and caved back. It is now repairing drift to No. 3 Raise.

No. 9 Contract, No. 5 Raise,

No. 9 extended its drift West 23 feet and caved back 23 feet. Then drifted Southeast 18 feet.

No. 19 Contract, No. 7 Raise,

No. 19 - 15 feet from cross-cut took slice along its drift to the North for 23 feet and stoped back taking ore from foot.

No. 30 Contract, No. 7 Raise,

No. 30 stoped ore from foot all the month.

No. 43 Contract, No. 11 Raise,

No. 43 extended its drift Northwest 39 feet to foot, thence Westerly 28 feet along foot.

No. 44 Contract, No. 10 Raise,

No. 44 extended drift on hanging side of No. 9 Raise East 24 feet holing to hanging wall drift and stoped back along hanging to turn from turn it drifted Northwest 24 feet along hanging and caved back.

No. 12 Contract, No. 10 Raise,

No. 12 extended its drift Northwest 77 feet to foot.

FIFTH LEVEL

WORK FOR YEAR

The work on new 5th level Pump Station (E & A #257) was completed in May. The work done during the year was as follows:

The capacity of the sumps were increased by stripping the sides of the drifts, wood dams were installed near the bottom of the winzes in both drifts to retard the velocity of the water to allow the dirt to settle at this point, 2 - 5 foot concrete dams were constructed in sump drifts at Pump House, a concrete floor was laid over the sump at pump house and a concrete floor was also laid in the Pump House and electrical pumps installed. A concrete door was constructed in pipe drift leading to shaft and concrete walls fitted with water tight door constructed at entrance to pump room on the North side of tail drift.

The water raise which was being put up at the close of last year was extended and holed to 4th level cross-cut and wood launder installed in the raise.

The 5th level plat was cleaned up, the bottom of the drift filled with crushed rock and a 4" concrete solar laid on top of the rock.

On the Southwest side of the 5th level the drift along the contact was extended by No. 12 Contract from a point 25 feet South of No. 4 Raise, 300 feet South, thence Southeast 190 feet to the boundary.

The rock tramming drift was also extended by No. 43 Contract to the South 457 feet to a point about 25 feet North of the C. & N. W. Section 19 boundary. Five cross-cuts were started from this rock tramming drift and two of them extended and holed to the foot wall drift. This work being done by No. 43 Contract. Ten raises were put up from the above drifts to develop

the ore on 1st Sub. below 4th level.

The cross-cut from shaft was extended by No. 44 Contract 340 feet Southeast to the hanging.

On the Northeast side of the 5th level the rock tramming drift was extended to the Northeast 139 feet by No. 19 Contract. No. 20 contract then extended it East 260 feet thence Southeast 214 feet.

Six cross-cuts were also driven towards the contact from this tramming drift. Five raises were put up from the Northeast side of the 5th level and holed to the 4th level. This work being done by Contract No's 1 and 19.

WORK FOR DECEMBER

No. 20 Contract,

No. 20 extended its drift in turnout Southwesterly 45 feet and main drift to the Southeast 58 feet.

No. 1 Contract,

No. 1 extended No. 32 Raise 51 1/2 feet to 3rd Sub. below 3rd level. It is now putting up raise from No. 5 Cross-cut.

UNDERGROUND IN GENERAL

WORK FOR YEAR

All the ore has now been mined above the 3rd Sub. below 2nd Level with the exception of the pillars Northeast of the shaft above the 1st level. On the main 3rd Level all the ore has been removed North and East of N_3 Raise. Below the 3rd Level all the ore has been mined East of M_1 Raise on the 1st Sub. and on 2nd Sub. below 3rd level the ore has been removed East and South of N_1 Raise.

On the West side of the deposit the ore has been mined above the 3rd Sub. below 3rd level to a point 50 feet North of B_1 Raise. There was no mining done on the main 4th level this year.

The 1st Sub. below the 4th level on Southwest side of the mine was developed from No. 2 Raise to the boundary and ore mined from the foot side of the Sub. Level West of No. 4 and No. 5 Raises.