THE CLEVELAND-CLIFFS IRON CO.

ISHPEMING, MICH.

MASTER MECHANIC'S REPORT.

NOVEMBER 30th, 1900.

--0--

Annual Report_Mining_MS86100_2066_1900_2 of 2_03.pdf

-- I N D E X --

CLIFFS SHAFT MINE:
Power Plant..... 1
Hoisting Engine..... 1 - 2
Pumping Engine..... 2
Compressors..... 3 - 4
Crusher Plant..... 4
Auxilieries..... 4 - 5
Boiler Plant..... 5

SALISBURY MINE.
Power Plant..... 5
Hoisting Engine..... 5
Cornish Pump..... 6
Air Compressor..... 7
Boiler Plant..... 7

LAKE MINE:
Air Compressor..... 8 - 9
Electric Engine..... 9
Tram System, Electric..... 10 - 11
Mine Pumps..... 12
Steam Auxiliaries..... 12 - 13
Lake Angeline Drainage..... 13 - 14
Boiler Plant..... 14 - 15

CLEVELAND NO. 3 MINE:..... 15

MORO MINE:
Cornish Pump..... 16

VOLUNTEER MINE:..... 16

MICHIGAMME MINE:
Hoisting Plant..... 16 - 17
Compressors..... 17
Crusher..... 17 - 18
Mine Pumps..... 19
Boiler Plant..... 19

IMPERIAL MINE:
Mine Pumps..... 20
Boiler Plant..... 20

WEBSTER MINE:
Webster Power Plant..... 20 - 21

GENERAL RECOMMENDATIONS..... 22

Annual Report_Mining_MS86100_2066_1900_2 of 2_04.pdf

THE CLEVELAND)CLIFFS IRON CO.

Mr. M.M. Duncan, Agent,

Ishpeming, Mich.

Dear Sir:-

I wish to submit the following report on the changes in the Power Equipment of the various mines, that were made during the past year. I submit with this report, a statemene showing the amount of work done, fuel consumed, oil used, etc. for each mine separately, and for each month of the year. This summary is taken from the Engineer's Logs which now have been in use for a little over a year.

CLIFFS SHAFT POWER PLANT.

There has been practically no change in the power equipment of this mine, during the year just finished. We have been rather more fortunate during this year in regard to break downs, than I had anticipated from my experience during the year 1899.

HOISTING ENGINE.

On the hoisting engine, which remains as it was last year, we have had but two stopages, one of which was very fortunate as to the time of its occurance. The first was an accident to the condenser, by which it was necessary to lay up the condenser for about a week, during which time the engine was run non-condensing. This accident caused a delay of only about three hours. The other accident was caused by the breaking of the crank pin at 5 O'clock in the morning of July 18th, but as the mine was to be closed at six on account of it being circus day, thereby giving us twenty-four hours to make repairs, there was but one hour delay through this accident.

There have been a few minor accidents, one caused by the hoisting cable breaking on the "B" Shaft, while there have been some cases of over-winding by the brakemen, and a few cases of the cage being lowered on to the catches too hard. In other respects we have been very fortunate.

HOISTING ENGINE(CONTINUED).

The broken gears of the hoisting plant are still running, as they were last year. In spite of the record this engine has made during the year just finished, I do not feel that it is at all reliable, and it is certainly very far from economical.

PUMPING ENGINE.

The pumping engine and the attached apparatus, has not given as much trouble the year past, as it did during the year before, but I beleive this is due largely to the fact that the iron work on these rods has been replaced as it broke down by new and heavier material.

During July, we broke a tooth from the main pumping gear; this was repaired with pins, and has since been running with little trouble. In June, through the carelessness of a new Engineer, the engine got a large amount of water in the steam cylinder in starting, which cracked the cross head; we at once ordered a new casting, and patched the old one to run temporarily, the patch prooving so effective, that the old cross head is still in service. This pump is still considerably out of balance, the "A" Shaft rods being very much in need of increased balance weights. I beleive it would be advisable to place a hydraulic balance on this pump similar to the one which will very shortly be installed at the Moro Mine.

From the Cliffs Shaft Logs, it will be noticed that the amount of water pumped, became gradually less from December until April. We had comparitively little snow on the ground last winter, it gradually went away the first week in April. From that time on, the amount of water handled, varied to some extent with the amount of precipitation, until the last three months of the year, it has been gradually growing larger, apparently regardless of the rain fall, which fact, I presume is caused by the sinking now being done in both shafts. The following is a table of precipitation, as shown by the Government Report for the city of Ishpeming, Mich. during the past year.

Annual Report_Mining_MS86100_2066_1900_2 of 2_06.pdf

Precipitation for year November 30th, 1899 to November 30th 1900, by months.

December	1899	3.19"
January	1900	.85"
February	"	2.35
March	"	1.75"
April	"	3.15"
May	"	2.54"
June	"	2.43"
July	"	7.15"
August	"	3.32"
September	"	10.60"
October	"	2.68"
November	"	.65"
Total		40.66"

(September 11th, we had 2.7" from 10 P.M. to 4 P.M. during 18 hrs.) In this table, melted snow is figured as inches of rain fall. It will be noticed that the rain fall has very little effect on the amount of water made by the Cliffs Shaft Mine.

COMPRESSORS.

These compressors have been working throughout the year with comparitively little trouble, except the fitting of one new crank pin and the breaking of the piston in the No. 4 Air Cylinder. They were run at an average air pressure of 67# until the beginning of October, when the safety valve was set at 80#, and the running pressure raised to about 75#.

I beleive, from what observations I have been able to make, that we break more ore with a given amount of free air, when compressed to 75# pressure, than with the same amount of air, with 65# pressure. As we have had only two months for observing, namely October and November, we have not proven anything as yet. It must be borne in mind, however, that during these months we have been sinking the shaft and have been working the hoist and steam pump with air. These compressors make on an average

Annual Report_Mining_MS86100_2066_1900_2 of 2_07.pdf

now, of about 35 millions feet of free air per month. These machines are very far from economical, and are somewhat more uneconomical with 75# Air pressure than with 65#. They should have been discarded several years ago.

CLIFFS SHAFT CRUSHER PLANT.

The crusher plant is running just as it was last year. We have returned to the use of chilled cast iron face plates, with manganese steel side liners. I may add that the first liner which was put in use, one year ago in September, is still in service, and from all appearances will almost complete the year 1901. From my experience with the Michigamme Crusher Plant, it has led me to beleive that we could reduce the cost of crushing and top tramming at this mine to about 1/3 its present cost, by reorganizing the present crusher plant and tram system. There would also be a saving of about $1800 per year, by being able to dispense with a large amount of sledging and block holeing underground, which could be done by using crushers, large enough to take in the large pieces of ore, without having to undergo the sledging process. The crushers we have in service here are only, 24" X 24", while the crusher we have at the Michigamme Mine is 30" X 30", so that there would necessarily be a large amount of ore, larger than 24" X 24", but smaller than 30" X 30", which has to be broken up with sledges.

The present crushers, owing to their construction, are also very expensive in labor of operation, in oils and in repairs. These present crushers have about all they can take care of, when breaking the entire product of this mine down to 2½".

CLIFFS SHAFT AUXILIARIES.

The auxiliaries at this mine are the same in size and number as last year. Up to the present time, however, the heating at this mine has always been done with live steam, in the dry, new office building, old laboratory, and a part of the heating in the other buildings.

We are at present installing, and will soon have in operation, the Wester Vacuum System of steam heating, by which we will use the exhaust from the #1 compressor, which will be more than ample for all the

Annual Report_Mining_MS86100_2066_1900_2 of 2_08.pdf

heating. We expect to carry from two to three pounds back pressure, and when this compressor is not running, which is only about two hours per day, and from Saturday night until Monday morning, we will have to use live steam. We expect to save at least 30 tons of coal per month, by this method of heating, while it will impose but little additional load on the compressor.

The feed water heater, which supplies hot water to the boilers at this mine is rather too small, as the temperature is only 185° to 195°, while we should get from 208° to 210°. I beleive the change in the heating system will help this out to some extent.

CLIFFS SHAFT BOILER PLANT.

The boilers are running under identically the same conditions as last year, and we are using the same grades of fuel. We have had during the year considerable repairs on the #7 and #8. These two boilers are much older than any of the others, and are apparently becoming frail. These two, however, are almost continuously in service, except for their regular cleaning.

We have had no repairs on the other boilers during the year, and are still allowed the same pressure by the Hartford Inspector, as we were permitted to carry last year, namely 80#.

SALISBURY MINE POWER PLANT.

This plant is running identically as last year.

HOISTING ENGINE.

The engine handling the skip, is much too small for the work it hasto do, and I would ernestly advise, that in case it is decided to do nothing in relation to the new equipment, through steam or electricity, that the present 18" X 48" Cylinder be replaced by a 22" X 48". By this change, I beleive the engine will run much steadier, and will certainly give us very much better economy.

The engine running the trolley is running very satisfactorily. It handles the men, timber and supplies. There is very little work re-

Annual Report_Mining_MS86100_2066_1900_2 of 2_09.pdf

quired of it, as it only makes about from 40 to 45 hoists per day.

CORNISH PUMP.

The cornish pumping engine has been running throughout the year, with very little trouble. We have had very little difficulty from having to run this pump at an excessive speed, as we frequently had to do last year. This was caused by a large amount of water going into the mine through the various caves from the large drainage area above this mine. Last spring we provided an emergency pumping plant to take the water from above the mine and elevate it about 30', passing it over a low place in the range of hills just south of this mine. This pumping plant consists of a Diamond Drill boiler, and large duplex jet condenser pump, formerly used with the Smith Vaile Pump at the Hematite Mine, rigged up as a direct acting duplex steam pump. With this plant we have been able to pump as much as 600 gallons per minute, over the hill, which has greatly reduced the amount of water that would have gone into the mine.

This pumping plant will explain some of the apparent vagaries in the number of gallons of water, pumped from the mine per month. It will be understood that with a steady rain, of say two days duration, when most of the water goes into the ground, this pumping plant would not be run, but the water would nearly all soak into the mine. However, in case of a heavy downpour, when the water would run freely on surface, this plant would be in operation. This explains why, for the month of September with its 10.6" precipitation, which came generally in heavy rains, shows no more water pumped from the mine than for October with 2.68" precipitation.

We have had but two break downs on this pump, both due to breaking the rods and connections, owing to bolts becoming loose; otherwise we have had little or no trouble with this pump.

Annual Report_Mining_MS86100_2066_1900_2 of 2_10.pdf

AIR COMPRESSOR.

The air compressor at this plant is sadly overworked, as may well be imagined when it is remembered it is only one-half of the duplex 16" X 30" machine, such as we have at the other mines, still is has made as high as 21 million feet of free air per month. It probably never makes less than 13 million feet, and with this as compared with the 30 to 35 million feet handled by four air cylinders at Cliffs Shaft, or by the 12 to 15 millions made by a single machine at #3 Engine House, it may readily be seen that this machine is too small for the work. Of course, the greater part of this air is used for ventillation, but I am not willing to beleive that the miners waste the air, or use a greater quantity than they they really need.

We are seldom able to raise the pressure to 60#, so that it is hardly possible to do very effective drilling with the low pressure, which we are able to get. We are now sinking this shaft and the compressor runs the small #5 Cameron Pump together with he small hoist. This mine should at any event be provided with a larger compressor.

BOILER PLANT.

The boiler plant is working under the same conditions as last year, except that we are using a little larger proportion of slack than last year. There has been no trouble with the boilers, but we were unfortunate in having a smoke stack blown down, during a violent storm last February, which caused us a few hours delay. The stack was old and badly decayed, and we at that time had one under order at the boiler makers, which was soon installed.

During the past summer the coal dock was considerably enlarged so that it now holds our winter's supply of fuel, and the dock at the same time was arranged so that the car would run back itself, thereby considerably reducing the labor required for stocking coal.

CLEVELAND LAKE MINE.

There have been but few changes made in the equipment of this mine during the past year. The hoisting engine has run throughout the year without accidents to the machine itself, and with very little cost for maintenance or repairs. Last February, we removed the first hoisting rope, this engine ever used, which was installed in August 1892 and which hoisted every pound of ore brought from this mine, since the plant was installed until that time. The rope which replaced it, will not last nearly so long.

We have had two accidents to the skip at this mine, caused by dirt freezing in the dump holding the skip temporarily until some rope was paid out, and before the slack could be taken up, the skip would fall breaking the rope. There seems no way to prevent this, with the kind of dump in use, except to depend upon the watchfullness of the men to prevent the dirt from accumalating.

We are now installing a top tram system which we trust will be able to take the ore away from the shaft almost as fast as it is desired to bring it up. It must be borne in mind, however, that the extreme length of this tram, from one end to the other is 2000', so that when the stock pile ground is pretty well filled, it will be necessary for the tram cars to make the round trip of 4000' every two minutes, if there is to be no delay in hoisting.

The greatest rate, of which we have knowledge, at which we have hoisted ore at this mine has been 29 skips in 27 minutes. At this rate it would be necessary to run a tram car at a speed of 22 3/4 miles per hour continuously, exclusive of stops, in order to take the ore away. Including the stop for loading and reversing the car, the speed would probably have to be nearly 30 miles per hour. It is readily seen that this is impossible, but we hope to maintain a speed that will cause very little delay to the hoisting. It will not require so much labor for its operation.

AIR COMPRESSOR.

We are still using the 16" & 16½" X 30" Rand Duplex Compressor, which formerly came from #3 engine house. This compressor is very uneconomical in the use of steam, and is not anything like large enough for the work it has to do. We are very rarely able to get 60# air pressure, and it

Annual Report_Mining_MS86100_2066_1900_2 of 2_12.pdf

is frequently run at its maximum speed, for hours at a time, with the air pressure not above 45#.

This machine has had considerable repairs during the year, having had two new crank pins, a set of keys in the fly wheel, new main bearing brasses, new valve stems, one new air cylinder head, and almost all of the other air valves have been replaced.

There is considerable drifting in rock and hard ground being done at this mine, and with the pressure we are able to maintain, a drill is almost useless. How we are to provide additional power for sinking a new shaft, and driving the connecting drifts, I cannot say. I hope ~~immed-iate~~ steps will be taken in relation to our power very shortly, in order that something may be done towards giving this mine increased compressor capacity.

This compressor now makes regularly, from 30 to 35 million Cu. Ft. of air per month, and even then is not able to supply anything like the quantity required. The greater part of the air used at this mine, is blown away in the stopes, for ventillation, and it is impossible for the men to work in the majority of them without this ventillation. As the mine becomes deeper, this demand will, in all probability be larger, and it appears to me, that the demand for a machine of greater capacity and greater economy is very urgent.

A very large proportion of the fuel used at this mine, is used by the compressor, and a modern compressor should supply this air with a consumption of only about 2/5 the fuel required by this uneconomical machine.

ELECTRIC ENGINE.

This 16" X 42" Allis Corliss engine, originally in use at the Hematite Mine, was built for about 80# steam pressure. We are giving it all the work it can do with 120#, so that it appears that the machine is working beyond an economical rate, and from the high steam pressure, the strains on the engine are excessive.

The style of frame was not adapted to the high rotative speed and the high pressures at which the engine is working, and the amount of work required of it has become so great, that it is hardly safe. We have

Annual Report_Mining_MS86100_2066_1900_2 of 2_13.pdf

had no delays during the past year on this machine, but there have been considerable repairs made on cross heads, connecting rods, brasses and pins.

ELECTRIC TRAM SYSTEM.

We have added during the year, one Westinghouse mining locomotive in addition to the four originally in use. There are now four locomotives on the second level, with three continuously in use, while one, the #4 motor (Jeffrey Manufacture) has been transferred to the 3rd level. The cars, trac tracks and equipment on the second level, as well as some of our motors, are getting old and there is necessarily greater maintenance expense under such conditions.

The motor tram cars originally installed in this mine, were about as bad, from a mechanical stand point, as it would be possible to conceive. The frames were very rigid, there being no elasticity in them whatever, excepting when the rivets became loose; the wheels were small in diameter being only 12", running on 3" axles, so that friction from that cause alone, was necessarily great at high speeds, while the wheels were so arranged, that it was impossible to keep the dirt out of the bearings, and it is not infrequent that a car comes down to the shaft with two wheels sliding.

The tracks and cars are in such condition, that recent tests have shown as high tractive power required for trains of four loaded cars, as was originnally required for ten loaded cars, when the tracks and cars were new. In addition, no reduction in load had been made on the motors to allow for this heavy pull, until within the last few months, the result being, large repairs required for motors, and frequent burning out of armatures, due to excessive heating and roasting from the heavy over loads.

We have recently received the installment of ten cars of different design, which promise a great reduction in the tractive power required, and since they have spring trucks, will undoubtedly be much easier on the tracks and switches. They are side dumping cars, with the doors opening on the side so that any spilling of dirt along the track, will be at the sides instead of being dropped along the middle, as was the case with the old cars, which had bottom doors and spilled a great deal of dirt on the track.

Some of these new cars were recently started, and from the preliminary

Annual Report_Mining_MS86100_2066_1900_2 of 2_14.pdf

tests made, show considerably less power than the old ones. I am fully convinced that it would pay us to equip the mine throughout with these new cars, as I beleive their cost would be saved in the cleaning of tracks and repairing of cars, in less than a year and one-half.

The rapidity at which things move in this mine when hoisting uninterruptedly, is surprising. The car mileage during the past year has been 113,972, while actually hauling ore, rock, mud and timber. Switching and extra work would probably increase this 5%, while the locomotive mileage has probably been not less than thirty thousand. These figures have been obtained from the reports of ore, rock, mud and timber handled, and on file at the office at the mine, multiplied by the known distance that a car has to travel in making a round trip to the part of the mine from which the material has been handled.

The above mileage may give some idea of the work actually done by these cars. They have handled 155,225 cars of ore, 7589 cars of rock to the shaft, 5041 cars of rock that have been put away in the mine, 492 cars of mud, and 4374 cars of timber, a total of 172,721 cars.

Annual Report_Mining_MS86100_2066_1900_2 of 2_15.pdf

MINE PUMPS.

The pumping during the past year has been done almost entirely by the 12 & 20 & 6 X 12 Duplex Deane Pump on the 3rd level. There is a #7 Knowles at the bottom of the shaft, a #6 Knowles on the 3rd level in #3 shaft, while two #10's are still installed at the 3rd level for emergency work.

We did not have the revolution counter on this pump until Oct. The amount of water handled from the mine, in ordinary conditions of weather is comparitively small, being an average of 138.9 gal. per minute for for November. During the Spring and summer, when we have considerable rainfall, this quantity will undoubtedly be considerably increased. This amount of water is surprisingly small for a mine situated under an old lake bottom, and with so many caves on surface.

In view of the fact that we will soon abandon the #3 shaft, with its separate steam driven hoist, we will then have use for steam in the mine only, to handle this small amount of water. As the lift is 400', to handle 200 gallons per minute with an electrically driven pump, would require only about 12 H.P. I beleive it would prove highly profitable, since we have electric power passing through the pump room, to install a small electrically driven pump, as we would then be able to dispense with the use of steam in the mine entirely. Our present electric engine could take care of this slight increase in load without difficulty. The present pump and piping should be left as they now are for emergency work.

In view of the fact that we will undoubtedly maintain the electric tram system at this mine, until the ore is all taken out, I beleive it would prove very satisfactory to install an electric pump, whether we should ultimately install electric power throughout or not.

STEAM AUXILIARIES.

We still use the steam driven hoist, hoisting ore from the 3rd level South deposit, to the 2nd level. This engine has 1135' of 4" pipe running from the shaft ~~of~~ to its location, and the condensation from this pipe alone is undoubtedly several times the amount of steam used by the pair of 12" X 16" engines on the hoist. However, we will soon dispense with this hoist, as a drift is being run on the 3rd level to connect the

Annual Report_Mining_MS86100_2066_1900_2 of 2_16.pdf

South deposit, when the ore will be trammed out by the electric pump, on the 3rd level instead of on the 2nd as at present.

There is also a 7" X 10" Duplex engine in the shaft house, which handles the top tram cars to and from the pocket. We are installing a pair of 13" X 12" engines, for operating the stock pile tram system.

There is also a 6" X 12" engine in the shaft house, for driving the sampling crusher. These are all the engines using steam, outside of the main engine house and mine.

In the main engine house there is a 9" X 12" engine driving the fans for producing draft for the stokers. Thers is also a 14" X 18" steam cylinder on each stoker; a small Duplex Knowles pump 5¼-3½ X 5" for operating the brake on the hoisting engine. There is also a Deane Condenser maintaining a vacuum for the hoisting engine. A #10 Knowles pump for taking the mine water from the condenser pump and putting it across the lake into the launder.

We have recently installed a 10" - 6" - 10" Prescott Duplex boiler feed pump as an auxiliary to the old #5 Knowles, which was formerly used for this purpose, as it was not considered safe to have this large plant with only one boiler feed pump. This pump was made large enough to throw a stream of water in case of fire.

LAKE ANGELINE DRAINAGE.

The #1 emergency pump, 14" & 14" X 18" Prescott, we are preparing to move, since the ditch bringing the water to this pump has been lost by caving ground, and the discharge pipe will soon follow. This pump is only run in case of heavy rains.

We have one #10 Knowles back of the dry, which ordinarily handles the water from a large spring under the rock dump, and the waste water from the dry and steam plant, as well as the water coming from the lake bottom.

There is a #7 Cameron pumping from the open pit at the rock dump, two #5 Knowles at open pits on the south side of the lake, two #7 Knowles in the "Root House" near "B" raise.

A 14 & 10 5/8" X 12" Worthington Duplex, and a #7 Knowles on the "Scow". The discharge from the scow pumps has been changed, and run

Annual Report_Mining_MS86100_2066_1900_2 of 2_17.pdf

into the launder near the Lake Angeline Company's ware house, in order to pass the cave made by the Lake Superior people during the summer. This has added about 1000' more pipe to the discharge from this pump.

We have also five steam syphons, taking the water from the various pits and caves. The #2 emergency pump on Lake Superior property at the West end of the lake, is left as it was first erected. The amount of steam condensed in the 4000' of steam pipe on this lake bottom, probably is not less than 125 H.P., while the foot pounds of work actually done in lifting the water, probably does not amount to 15 H.P. This lake bottom pumping is very expensive, but unless we should substitute electric pumps I see no way to reduce the expense. Even then we will probably have some trouble in operating the motors in caves which are liable to be flooded w with water, suddenly and without notice. If the water from these caves could be taken into the mine, and handled with one central plant, the expense of pumping would be very greatly reduced. As stated in my report of last year, I beleive if we had electric power sufficient for the purpose, that a centrifugal pump directly connected with an electric motor would greatly reduce this expense.

LAKE BOILER PLANT.

The four original boilers 72" in diameter X 16' in length are still in operation as originally installed with the "Jones Under-feed Mechanical Stoker". Early last year, we put in operation a 72" X 18' boiler with the same number of flues as the other boilers, with common grates fired by hand.

This boiler apparently steams more economically than the ones with the "Mechanical Stokers", and is certainly much more of a favorite with the firemen. I hope shortly, to make tests that will enable us to get direct comparison with these stokers and the hand fired boiler.

The steam header at this plant has been entirely renewed during the past year, and now presents a much neater appearance and has so far given very good satisfaction, remaining perfectly tight. The demand for steam at this mine is very great, and these five boilers are worked as hard as they should be, about all of the time. If one boiler is shut down from any cause, the other four have all they can possibly do, to

Annual Report_Mining_MS86100_2066_1900_2 of 2_18.pdf

make sufficient steam to do the work. The uneconomical type of most machines in use at this mine together with the labyrinth of steam pipes, probably cause a consumption of, at the very least, three times the amount of fuel that should be burned. Any additional improvement, however, is hardly advisable on the present plant, since it will very shortly have to be moved to a new location when the new shaft is put down.

I would ernestly advise that steps be taken at once to determine the character of power we will install, so that the work may be proceeded with as soon as the shaft is located, and that we may begin reaping the benefit of the investment at the earliest possible moment.

THE CLEVELAND #3.

There have been no changes in this plant during the past year, except some minor repairs to the steam piping. There have been no repairs to the boilers, and they have run throughout the year without trouble. The hoisting engine of this plant has had no repairs excepting new valve stems, the old ones being worn out.

The compressor has run without interruption throughout the year, the principal repairs being some new brasses, new valve stems and new air valves. This compressor now makes from 12 to 15 million Cu.Ft. of air per month, running 20 hours per day. It is doing about all the work it can do.

The shop engine is the only auxiliary using steam from this boiler plant, except the boiler feed pump. The piping to the machine shop has given some trouble during the past year, and if required for service much longer, will need to be renewed.

During the past fall the dry was moved to a new location, about 150' from the #3 Engine House and steam heating apparatus provided. The steam for heating the dry is supplied by the exhaust from the boiler feed pump, which is ample for the purpose.

MORO MINE #4 ENGINE HOUSE.

The old boilers in this plant have had no repairs during the year, and have done very much better since the Cornish Pump was started, and the great demand for steam which we had while unwatering the mine,

Annual Report_Mining_MS86100_2066_1900_2 of 2_19.pdf

was reduced.

The coal consumption at this mine is only about 80 tons per month during the summer, and 90 to 95 tons during the winter. The only heating required on these boilers is in the engine house, shaft house and small dry house on the 9th level in the mine.

CORNISH PUMP.

There has been no trouble or repairs with the engine during the year, but there have been some repairs to the pump. The rods have broken on two separate occasions, causing in one case 36 hours delay until new ones could be put in place. These rods have not been repaired since the mine was unwatered and some of them have decayed during that time. The only other repairs to the pump have been some brasses on the bob at the knuckle. This pump is badly out of balance, but we will shortly overcome this difficulty by the installment of a hydraulic balance, which is now under way.

The amount of water handled by this pump varies somewhat, but the average speed is now about 5 per minute. It varies somewhat throughout the year, being greatest during the months of greatest precipitation.

The lift is 735' and the cost per 1000 gallons of water pumped, is approximately 40 cts. The details of its operation, as to fuel consumed, water handled, etc. may be readily seen from the summary of Engineer's Logs which are attached to this report.

VOLUNTEER MINE.

This mine was shut down July 2nd, and the machinery was left in as good condition as when we began its operation. It was carefully laid up, being well protected from dust and corrosion, and was left in as good condition as could be.

MICHIGAMME MINE.

HOISTING PLANT.

There have been very little repairs to this plant since we began hoisting on July 1st. There has not been any great amount of hoisting

Annual Report_Mining_MS86100_2066_1900_2 of 2_20.pdf

required, and we are hoisting only from #4 and #6 shafts. One drum has been used for pulling coal from the pocket, up on to the coal dock. The gears on these trams have so far required no repairs, but they are watched very carefully, and we fear may need repairs any time. We have had more good luck with this plant than we had expected, for which we are duly thankful.

COMPRESSORS.

The compressor has given us considerable trouble. We have had to put in two new crank pins, several new brasses, one new connecting rod, have lined the machine up throughout, and still it is generally running hot, and giving us no end of annoyance. The size and dimensions of this machine throughout, are entirely too light for the service required of it, and it has to be watched very closely in order to keep it going at all. We have been fortunate in anticipating repairs as much as possible, and so so far have had no extended shut down.

CRUSHER.

We have installed a complete new crusher plant which has so far proven very satisfactory in its operation. The crusher itself, is of the Blake type, of jaw crusher built by Cleves and Son, of Houghton, Mich. It weighs about 70 tons and has a 30" X 30" opening. No block holeing or sledging of ore is necessary at this mine, as the crusher takes the ore as it is broken in the stopes.

There is a set of Lidgerwood drums in the top of the crusher house, above the crusher, which are driven by a belt from the main shaft. These pull the car up to the crusher from either shaft house, where the ore is automatically dumped, the small pieces going through a screen, the large pieces to the crusher. The cars run back by gravity from the crusher building to either shaft house. These trams have one man to operate them. This man together with a top lander in either shaft house, are the only men employed in the top tramming.

As the ore leaves the crusher it drops into a large pocket underneath, from which it is loaded into the tram car for the stock pile, or into Rail Road cars for shipment. There are two men at the pocket who

Annual Report_Mining_MS86100_2066_1900_2 of 2_21.pdf

pick the rock from the ore in the shoot as it is loaded into the cars. We have arranged a system of tail rope haulage which takes power from the main engine for pulling the tram cars down to the stock pile, where it is automatically dumped and returning the car to the crusher house. This system is worked by one of the rock pickers, who are common laborers, so that it costs practically no more to put the ore in the stock pile than it does to load it into the Rail Road cars for shipment. This system was started about December 5th, and it has since worked uninterruptedly, with almost no attention at all. The power for both top and stock pile tram & for driving crusher is furnished by a 14" X 36" Alliss Corliss Engine taking steam from the main boiler plant, which engine runs with very little attention. There is but one man about the crusher house, aside from those already mentioned, and he performs the following duties; he is engineer, attends to the oiling, the shafting and stock pile tram system, also feeds and oils the crusher, and he together with the top tram operator, have plenty of time to spare. This entire plant has operated from the time it was first started with very slight repairs, there being practically, no repairs at all except of the wearing plates of the crusher. The crusher has removable brass shells, babbitted, and the wearing surfaces are large and ample for the work, so that the amount of oil required is much less than that required on either one of the much smaller crushers at Cliffs Shaft. This plant with its present labor, could probably handle five times the amount of ore which it is now getting, but it would not have been advisable to install a small crusher, as it would entail the expense of sledging the ore underground to make it small enough to go into the crusher.

The exhaust from the crusher heats all of the buildings and dry on the location, except the warehouse which is heated by stoves, the #4 shaft house, the main engine house and machine shop. It is an ordinary gravity heating system, and does not carry at any time over 2# back pressure on the engine.

MINE PUMPS.

This mine makes very little water, and the original intention to install a Duplex Compound Pump, has not been adherred to.

We have a small Duplex Pump in the bottom of #6 shaft which is run by air and raises the water to the 7th level, from whence it runs into the launder, over to the #4 shaft. There is also a small pump operated by air in the bottom of #4 shaft, which raises the water to the 7th level.

There is a #7 Knowles Pump at the 11th level, which catches a considerable amount of water from other parts of the mine, which would otherwise go to the bottom of #4 shaft. This pump also raises water to the 7th level from whence it is thrown to surface by a Prescott sinking pump which was used in unwatering the mine. None of these pumps work more than a few hours per day.

BOILER PLANT.

The boiler plant consists of three 66" X 18' boilers, which we installed a year ago in November and have run throughout the year with no expense for repairs except a few bricks in the furnace. They have about all the work they should be called upon to do, and two of them will not run the plant at all. All of the piping about the mine and boiler plant is new and has proven very satisfactory.

We have installed a coal pocket under the track leading to the crusher into which the coal is dumped from the ore car, from which it is dumped into the coal car, and hauled up the hill on to the coal dock by the hoisting engine, where it is automatically dumped. With this arrangement two men will unload from 15 to 20 ore cars of coal per day, and put it in the coal pile, thus avoiding teaming which was necessary from the old dock. From the coal dock it is taken directly into the boiler room in the tram car.

Annual Report_Mining_MS86100_2066_1900_2 of 2_23.pdf

IMPERIAL MINE.

The hoisting plant has given us comparitively little trouble during the past year, but it should be of larger capacity, as it is crowded very badly to handle the amount of ore required from this mine during the shipping season. It is only handling one ton skips, while we should have at least two tons.

The compressor is the 16" X 24" straight line, formerly in use at the Fitch Mine. This is a very uneconomical machine in fuel, but has not required any repairs.

MINE PUMPS.

The pumping during the winter is all done in the west pit by the #7 pump, there is a drift connecting the east shaft with the west, and the pump in the east shaft has been shut down for the winter. We will install a #10 pump in the west shaft before spring, which will be able to handle all the water during the wet season.

BOILER PLANT.

The two old boilers 48 X 14' at this mine, are very uneconomical and are very old. They are also greatly overworked, and if we are to operate this mine longer, we should install a new boiler about 60" or 66" X 18' in length, which would enable us to make steam for the entire mine. I beleive this boiler would save its cost in fuel alone, over the present boilers in two years time.

The only other demand for steam at this mine is at the spring some 1300' south of the mine, where we have a diamond drill boiler and a #6 Knowles pump supplying water to the mine for feeding the boilers and supplying the dry. The dry is heated by exhaust from the compressor and hoist.

WEBSTER MINE.

We have installed at the Webster Mine the 60" X 16' boiler which was formerly in the separator plant at the Michigamme Mine. There was originally a 42" X 14' boiler similar to the ones at the Imperial

Annual Report_Mining_MS86100_2066_1900_2 of 2_24.pdf

Mine.

The hoist installed is the 20" X 32" Webster Camp & Lane plant formerly in use at the Fitch Mine. It was run for about two months with steam from the small boiler. We found a considerable saving in fuel when we started the larger boiler, but the mine was shut down before a sufficient test had been made, to determine the saving in fuel.

There is but very little pumping required in the Webster pit, though a #5 pump is installed there, and is run only a few hours per day.

The water for the boilers is supplied by the #5 pump located by a spring about 1000' from the boiler house, steam being supplied from the mine boiler.

The dry will be heated by steam, and will get hot water from the feed water heater in the boiler house. The heating plant was under construction, when the mine closed down.

GENERAL RECOMMENDATIONS.

I beleive the general recommendations for the mines of Ishpeming and immediate vicinity are covered by the two estimates; one for electric power equipment, the other for new steam equipment.

There are still a few comparitively inexpensive changes that might may be made on these old plants, that would effect some slight saving, but none that I would recommend at present, until the question of new equipment has been settled, for or against.

It is my opinion, that the best investment for the company to make would be the installation of the electric power plant.

The changes I would recommend being made before spring at the Michigamme Property, is the installation of a large boiler at the Imperial Mine, as noted.

I beleive our machinery generally, is in somewhat better condition throughout, than it was last year, perhaps from the fact that we have given the men considerable instruction, so that they are better able to handle the machinery in their charge. We have had fewer accidents during the year just passed, than we had during the previous year.

The men in the Mechanical Department are, without exception loyal, and the majority of them are very anxious to be informed when they are at fault, or when conditions can be improved by them.

Respectfully submitted,

Will E. McKee

Master Mechanic.

Annual Report_Mining_MS86100_2066_1900_2 of 2_26.pdf