THE CLEVELAND-CLIFFS IRON CO.,
ISHPEMING, MICHIGAN.

MASTER MECHANIC'S REPORT
FOR YEAR ENDING NOVEMBER 30TH, 1906.

(DATED) DECEMBER 19TH, 1906.
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Mr. W. M. Duncan, Agent,

Ishpeming, Mich.

Dear Sir:

Following is the Master Mechanic’s report on the mechanical equipment of the various mines for the year ending November 30th, 1906, together with a summary of the monthly engineer’s logs.

CLIFFS SHAFT MINE.

Considerable improvement has been made in the equipment of this mine and will be noted under the following heads.

HOISTING PLANT.

The old hoisting engine which has done service for so many years, and has been the source of so much trouble and delay, was replaced by a new modern machine. The new engine is a simple, non-condensing, orcliss, single engine, and fly wheel. The engine is 24" x 48", with long stroke cut off. The two drums are each 10 ft. diameter. The engine has sufficient power to hoist from both A & B shafts at the same time. The old hoist was removed and the new one installed in three weeks time. A small hoist was installed temporarily at A shaft to hoist men and supplies while the change was being made. The new hoist has proved to be entirely satisfactory.

PUMPING ENGINE.

We are using the same pumping equipment that was in service last year. That is, the old Cornish pumping engine which serves both A & B shafts, and a Worthington compound condensing pump on the fourth level. The Cornish pumping equipment is very old, and is fast getting beyond repair. It would not be advisable
to rebuild this, and I would recommend in its stead that another steam pump be purchased and placed on the fourth level as a spare to the one there now. This second pump should be larger than the one we now have at this place, as the present pump is barely able to handle the water. I have prices and specifications on a pump suitable for this place. This is a Prescott compound duplex, of the following dimensions: steam 12"/22"-13", and water plunger 7"x13". This pump would cost $2,400.00 installed. This improvement should be made at once as the Cornish pump is liable to completely fail any time, and the steam pump is barely adequate for the work. I wish also to add that this steam pump is one which came from the old Jackson equipment, and is an old pump and very light for this service. A duplicate of this pump was installed in the Mass Mine, and the water end failed entirely within a few months service.

COMPRESSORS.

The old compressors, so long a source of trouble and so extravagant of steam, are soon to be discarded. A modern two stage compound condensing compressor was purchased and delivery was promised June 30th. This machine did not arrive until November. Erection of this is being pushed as fast as possible, and we hope to start this machine by December 10th. This compressor is made by the Nordberg Mfg. Co. of Milwaukee. It is a duplicate of the one we have at the Lake Mine, except it has considerably heavier frame and some improvements in minor details. Its dimensions are as follows:

Steam cylinders 22" & 44" x 48" stroke.
Air " 23" & 37" x 48" stroke.

Running at a moderate speed it will compress 4000 cu. ft. of free air per minute.

The old compressors will be left standing, as the room
is not required, and they can be used in case of accident or delay to the new compressor.

**CRUSHER PLANT.**

No change has been made to the crusher plant during the year, and no trouble of consequence has occurred other than what ordinarily happens to a plant of this kind during operation.

**BOILER PLANT.**

The same boilers are in operation as last year. To remedy our bad draft a power fan was installed with beneficial results. These boilers are considerably over-loaded, but will be largely relieved by the decreased demand owing to the installation of a new and economical compressor.

**CLIFF'S SHAFT AUXILLARIES.**

Another drill sharpener was added to the blacksmith shop equipment, and the old Ajax machine was sent to the Ashland Mine, where their demand for this class of work is comparatively light.

The Word drill sharpeners which we now use at this mine are very rapid and effective, but are rather expensive to maintain. This is owing to some faults in design which we are correcting as much as possible. We are now contemplating building a drill sharpener which we think will more nearly answer our requirements than any thing in the market.

The old electric dynamo was discarded, and a 15 K.W.-D.C. dynamo installed in its stead. This allows us to use incandescent as well as arc lights on this circuit, and therefore permits us to light our offices from this plant. This was desired, not only as a matter of economy, but on account of the poor service rendered by the city plant. This installation has proved very satisfactory.
SALISBURY MINE.

The equipment of this mine has not been changed during the year.

Several accidents have happened to the Cornish pump on account of its age. We hope to be able to make this pump serve the life of this mine.

A new skip drum was placed on the hoisting engine, but it has proved to be very disappointing.

The Lake Shore Engine Works have pleaded very earnestly for a share of our heavy hoisting work. They were given the contract for this drum, and it has proved their inability to handle this class of work. This drum began breaking before it had been in operation 6 weeks. By careful handling we hope to make it outlast the mine.

The air compressor and boiler plant have not been changed in any way.

LAKE MINE.

The equipment of this mine has operated very successfully during the year.

AIR COMPRESSOR.

This machine proves as satisfactory as formerly. Only a few delays occurred during the year and these were due to hot boxes. Air is furnished the Hard Ore Mine from this plant, and service is entirely satisfactory. The highly satisfactory and economical operations of this machine fully warrants our duplicating it where necessary.

HOIST.

This hoist is a Sullivan first motion with a pair of 7 ft. drums. The engines are Duplex Corliss, 30" x 42", non-condensing. This hoist operates entirely satisfactory. There is only
one difficulty. It has one drum for the cage, and one for the
skips, both operated by one man. When one drum is operating the
other necessarily must stand still, and often causes delay to one
side or the other. This is more especially true for the reason
that the demand on both drums is constantly increasing. When they
terribly discontinue lowering timber at the old shaft I think it
will be necessary to install a separate hoist for the cage.

ELECTRIC HAULAGE.

This equipment has operated entirely satisfactory during
the year. The increased size of conductor we put in last year has
made our locomotives operate much more satisfactorily. We have a
spare generator, but had no occasion to use it as the old one has
given no trouble.

PUMPS.

The pumping equipment has not been changed during the
year, nor given any trouble.

At the pump station on the fourth level we have a Deane
Duplex Compound, 12" x 20" & 6" x 12", and a Prescott Duplex Com-
pound, 14" x 26" & 10" x 18". Both pumps operate condensing.

BOILER ROOM.

The boiler room equipment at this plant continues to
operate satisfactorily.

Our demand for steam is such that we often have to
operate the entire 5 boilers which does not leave a spare for
emergency. This is especially true during the break-up in the
spring when our pumps are working hard. I have recommended the in-
stallation of a sixth boiler to overcome this difficulty. The
necessity for this extra boiler will become greater as the plant
becomes older and the furnaces have to be rebuilt. The boiler
room was built with space for another boiler.

CLEVELAND.

No changes or accidents worthy of mention have taken place during the year.

NO. 4 ENGINE HOUSE.

The Cornish pump does all the pumping at this mine except in case of emergency. In such case the steam pump is put in service. Both the steam pump and the Cornish pump work very poorly because of the low steam pressure we are compelled to carry. This is on account of the age and condition of the boilers. It is expected to install two of the boilers from the Maas Mine as soon as the new equipment at that mine is put in service.

HARD ORE SHOP.

No changes have been made during the year. There is one improvement which must be made during the coming year. Our blacksmith shop is entirely too small and will have to be enlarged. During the summer considerable of our heavier repairs can be done outside the shop, such as repairing skips, cages, etc., but in the winter this is impossible on account of the severity of the weather. There is considerable new work which we could do advantageously if we had the room. We could not hope to manufacture cheaper than we can buy on the outside, but we could often equal prices, and could save considerable time on work for which there is urgent need.

It is intended to buy some new shop tools during the year and remove some of our older and antiquated machines to the outlying mines where the demand on these tools is less urgent.
STEAM SHOVELS.

The shipping season has been long and the quantity of ore handled large. Our shovels have answered every demand and have given us little or no trouble. One new shovel was added during the year for the Princeton group of mines. It is a Bucyrus, 70 ton, duplicating the one bought for the Migma Mine. An order is soon to be placed for a shovel for the Crosby Mine, and I advise duplicating our last shovel. Our shovels should all be of one make on account of repairs, and for the reason that we can then shift our men from one shovel to another if they all operate the same.

The old shovel which we brought down from the Ashland last year, and proved of so little use to us here, was sent back to the Ashland. They use it there where the demand is light, and it saves shunting the other shovel so much.

MAAS MINE.

No changes have been made to the temporary equipment of this mine.

Work was commenced early in the summer on the permanent equipment. The engine and boiler house is now complete. The engine room is 80 ft. x 52 ft. inside, with a basement containing foundations, heater and auxiliaries, and one floor which is the engine room floor. Space is allowed for the skip hoist, cage hoist, air compressor and electric equipment. The skip hoist is the old Lake compound condensing hoist, rebuilt as a duplex, simple, first motion hoist. It has just arrived. Foundation for this machine is complete and it will be erected at once. The cage hoist has been purchased, and foundation is now being built, so that it can be erected as soon as it arrives. The question of furnishing compressed air to this mine has not been decided, hence no compressor has been purchased. This question, as well as the question of electric equipment, depends upon the disposition of
the water power proposition.

The boiler room joins the engine room, and is 50 ft. x 88 ft. The boiler room equipment includes 3-350 H.P. Stirling water tube boilers, with Sturtevant economizers, and induced draft and Murphy stokers. A Baragwanth heater receives the feed water direct from the pumps, and from here it is passes through the economizer to the boilers. Piping is so designed that feed water can by-pass the heater or the economizer in case either need inspection or repairs. The economizer and fan are so designed that either of both may be by-passed by the boiler gasses when inspection or repairs are necessary. Feed pumps are duplicated, and are large enough to furnish water for fire protection.

The stokers are built in furnaces extending in front of the boilers in what is called "Dutch oven setting". Coal bins are built on top of these furnaces and coal is fed through the bottom. Coal is brought into the boiler room in a tram car, elevated on a platform elevator to height of bin. A track passes over top of bins allowing coal to be dumped direct into the bins. When the coal comes from the dock it passes over a platform scale and is weighed. A track is built into the floor in front of the boilers and the same car which handles coal can be pushed in front of the boiler and receive the ashes, go to the elevator, and from there be dumped from trestle, or in suitable bin.

One of the boilers in this plant will be put in service during December, and when working properly, the old boiler plant is to be shut down.

A steam line will still have to be maintained to the old engine room to operate the hoist and air compressor until the new ones are in place. The present compressor is not large enough for the requirements, and a ten drill Sullivan straight line compressor was purchased to relieve this necessity until provision is made for permanent air equipment. This compressor will be placed
temporarily in the basement of the new engine room.

The foundations for the shaft house are completed and the steel is all on the ground. The erection of this structure will begin about December 15th, and should be completed February 1st. The foundation piers for this structure are settling, and as this is liable to continue for some time, cavities were left in the top of these piers to receive jack screws, by which we will be able to keep this structure level. There is a small amount of quick sand accumulating in the sump at the ledge pump station, which I think accounts for the settlement noted.

CORN MNNE.

This mine was not operated during the year.

LUCY MNNE.

This mine has not been operated during the year. The Rand Imperial Compressor was removed to the Negaunee Mine, and is now in operation there.

NEGAUNEE MNNE.

No change has been made to either boiler plants, nor have we had any serious trouble. A new fly wheel was put on hoist, removing the old one which was badly cracked and dangerous.

Electric haulage operated entirely satisfactory through the year.

The demand for air having exceeded the capacity of the old compressor, the Rand Imperial was taken from the Lucy and installed here, and is doing good service.

An extra flow of water in this mine made it necessary to
start up the Worthington pump on the fourth level and to run both pumps on the 6 1/2 level. This we are now doing constantly. With this amount of water we have no spare pump. When repairs are necessary they have to be done in the quickest possible time and the pump put in service again, as the remaining two pumps will not handle the water. Should any serious accident happen to one of the pumps we would have to put on a bailer, and very much hinder mining operations. The two pumps on the 6 1/2 level are designed to operate from the 9th level. I recommend that another be bought of the same size and installed in the 9th level, and the present two moved to this level when necessary. This pump should be ordered at once, as delivery on this class of machinery is very slow. This improvement, including cutting of pump house for the three pumps, sump, extension of steam pipe and water column, and installing the one pump, would cost about $15000.00, and would take seven months from date of authorization.

Since this mine caved and the water increased we do not get any water at the ledge, and hence do not operate that station. We will be able to remove these pumps and use them elsewhere.

No change has been made in the top tram system.

**AUSTIN MINE.**

The boiler equipment of this mine has not changed since last year. It consists of 2 Burt, fire box boilers, one of 125 H.P. capacity, and one of 150 H.P. The water has increased so much here, and the style of pumps used are so extravagant of steam, that these boilers are fully loaded. This will be relieved in the near future, as a triple expansion pump has been purchased of a size sufficient to serve both the Austin and the Stephenson Mines. This will soon be placed in the Stephenson Mine, and the Austin
Mine water drained to this point. This will be a great improvement over our present method of handling this water.

A central machine shop is being built. The equipment from the Austin shop will be moved to this new shop as soon as it is complete.

ASHLAND MINE.

There has been no change in the hoisting plant. The compressor has not been changed, but a cooling tower was built, so that the compressor now runs condensing.

MINE PUMPS.

The mine pumps are practically the same as last year. A large triple was bought for the 16th level. When the 16th level was reached it was thought more advisable to place this pump on the 17th level, and it will be installed as soon as a pump station is prepared. The pump is at the mine.

BOILER PLANT.

No change has been made in the boiler plant, except the installation of a new steam header, which was purchased some time ago.

TCP TRAM PLANT.

This plant operated satisfactorily, and has not been changed during the year, except to repair it thoroughly.

CROSBY MINE.

The Crosby Mine was started up and has been operating
during the year. One Burt fire box boiler was added to the boiler plant, which now consists of 2 Burt boilers, 125 H.P. each.

The pump station was changed to a more accessible place and repiped.

An electric underground haulage was installed, similar to what we have at the Lake and Negaunee Mines. This consists of a Sturtevant high speed engine, belted to a General Electric, 45 K.W. generator. Two 6½ ton General Electric locomotives. This installation has given us complete satisfaction.

IRON BELT MINE.

The equipment of this mine is the same as last year. The mine is now pumped out and a pump station and sump is being cut on the 8th level. A triple expansion pump is soon to be installed on this level.

STEPHENSON MINE.

No changes have been made to this mine's equipment during the year, and no serious trouble encountered. A new boiler has been purchased, which when installed, will complete the boiler installation. This will make 3 Burt fire box boilers, 125 H.P. each. The permanent engine and boiler house is completed, as is the foundation for the skip hoist. This hoist has arrived and will soon be installed. The shaft house is completed and head sheaves are in place.

PRINCETON MINES.

These mines are operating with the same equipment as last year. The trouble we were having with the boilers at these mines has been overcome by providing river water for steaming pur-
poses, and further by providing a heater for No. 2 plant, which had been operating without one. The flues in these boilers were renewed, and since these improvements were made have given us no trouble.

SOUTH JACKSON MINE.

The South Jackson Mine was equipped during the year.

BOILER PLANT.

This consists of 2 fire tube boilers, 72" x 18 ft., set with Dutch oven furnaces and rocking grates.

HOIST.

The hoist is one from the Old Jackson Mine, rebuilt into a single drum reversible hoist. Engines, 14" x 20", and drum 5 ft. diameter. It operates the skips in balance and proves very satisfactory.

COMPRRESSOR.

This machine is the one formerly used at the Ogden Mine. It furnishes air to operate the chute closers.

CRUSHER.

Is a No. 8 McCully, driven by a corliss engine. This engine was formerly used at the Lake Mine to drive the electric generator for the underground haulage. It is exactly right for the work it is now doing. This equipment has been entirely satisfactory with the exception of a little trouble with the crusher near the end of the season. This has not been taken apart yet, but I think the trouble is a worn bearing on the main shaft. This will soon be overhauled so as to be ready to operate at the beginning of next season.
NORTH JACKSON MINE.

The old boiler plant at the North Jackson Mine was put in commission to furnish power to do some work on this property. The hoist already in the building was used. A small air compressor which was formerly at the Princeton No. 1 Mine was used. This compressor was in very bad condition, but was put in thorough repair and did very good service. It is about a two drill machine. This equipment is now being enlarged somewhat, and will be thoroughly repaired, as operations are to be carried on next year on a larger scale.

IMPERIAL MINE.

The equipment of this mine is to be overhauled and put in first class condition for next seasons work. The old boilers, which were past repair, were taken out and two Burt fire box boilers (second hand) are being installed. The present hoist will be used. A compressor will be borrowed from some other mine until the compressor which belongs to this mine can be returned. It is now in service at the Stephenson, but they will not need it after the central power plant is installed, which will be early next summer. Effort is being made to get this plant operating as soon as possible.

PUMP STATION AT PRINCETON.

A pump station is being built on the river above Princeton, and a new pipe line laid of sufficient size to furnish water for the present group of mines, and a prospective town, with very liberal allowance for future demands. The pumps are duplicated, and space is left for a third if demands should ever require it. Two boilers are being installed and space is provided for a third should it ever be required. The pipe line is 8" wood line. This
is banded to stand a working pressure of 150 lbs. which exceeds
the pressure we will need to carry. The pumps are Prescott, direct
acting, duplex, compound condensing, and will prove very economical
of steam and very reliable. The pumps are 9" x 18" & 8" x 13",
and the condensers are of the independent jet type, 6" x 8" x 10".
One boiler is the 50 H.P. that was removed from the Austin, and
the other is a new boiler of 60 H.P. Both are fire box boilers.
Feed water is provided.

The work of installing this equipment is progressing in
a satisfactory manner, and it is expected to start up some time
in January.

CENTRAL POWER PLANT.

Boilers and compressors have been bought for this plant,
but have not arrived. Building is under way, and it is expected
to have this enclosed by the 1st of January. The machinery will
begin to arrive about that time and its installation will be
hastened as much as possible. This equipment is very similar to
that being installed at the Mass Mine, including mechanical stokers,
economizers and induced draft.

A shop building is being built at this point and will
be equipped to do all work for this group of mines.

SMITH MINE.

Boilers have been purchased for temporarily equipping
the Smith Mine. These are intended only for opening the mine. In
the meantime a permanent plant is contemplated which will be
similar to the Mass installation. The boilers for the temporary
plant are overdue now, but I do not expect them before January
1st. This work will be at a great disadvantage owing to severe
weather, and it will therefore take about two months to install these boilers. Building is about completed to receive them.

Following are the comparative tables for the various mines, as complete as our records will permit, together with a summary of the engineers' logs.

Very respectfully submitted,

Master Mechanic.
## COMPARATIVE TABLES

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COAL</th>
<th>ORE</th>
<th>CUBIC FT. AIR</th>
<th>TONS HOISTED</th>
<th>CUBIC FT. AIR PER TON COAL</th>
<th>CUBIC FT. AIR PER TON HOISTED</th>
<th>GALLONS OF WATER</th>
<th>SHIFTS</th>
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<td>YEAR</td>
<td>BURNED &amp; ROCK</td>
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## CLIFFS SHAFT

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<th>COAL</th>
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<th>SHIFTS</th>
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## SALISBURY MINE

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<td>1900</td>
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**ASHLAND MINE.**

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<th>Cubic Water</th>
<th>Gallons of Water</th>
<th>Shifts</th>
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**NENGAUNEE MINE.**

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**AUSTIN MINE.**

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**MAAS MINE.**

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