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ATHENS MINE:

No serious difficulties have occured with the hoisting equipment during the year. The 10,000 ampere D.C. circuit breaker for the skip hoist has been rebuilt and put into service. The main contacts of the breaker, the buss leads and connections were all silver plated for better contact and consequently less heating.

The failure of a commutating coil in the exciter of the skip hoist motor-generator set was the cause of a short delay. This coil was taken out and repaired at the General Electric Co. shops while the generator was kept in operation minus one coil. The speed adjustment of the skip hoist has been kept at approximately 1440 feet per minute for the entire year. Some changes were made previously on account of shaft repairs.

One of the 2300 volt 2/0 3-conductor power cables in the shaft failed during an electrical storm in September. The break occured near the 4th level about 1800 feet from surface. The load was switched to the #1 cable while repairs were made with no delay in mining operations.

Minor changes have been made in the pump station requiring a four-way subway box and cable for separate service to pump motors, converters and haulage motor-generator sets. On account of bearing and slip ring failure, one of the 400 HP Westinghouse pump motors was taken apart for repairs, which were completed September 17th. Two motor failures occured on the 25 HP pump at the Breitung shaft. These have both been rewound and one spare is now in storeroom at the mine.

The Ingersoll-Rand compressor overheated in February and burned the thermometer near the outlet of the high pressure cylinder. The Fenwal thermo relay was tested and proved to be O.K. It tripped the circuit breaker at 358 degrees F.

Rotor and stator windings of the synchronous motors on the Nordberg and Ingersoll-Rand compressors have been repaire and repainted.

The two haulage converters were taken to the general shops and repaired during the year. One of the G.E. IM-2T6-LL locomotives was taken from the 8th level to the 7th level.

CAMBRIA-JACKSON MINE:

Hoisting has been carried on with some difficulty with the electrical equipment during the year. The contactor and grid control troubles have been cleaned up, but motor difficulties occur intermittently.

The 500 HP Westinghouse motor is now solidly connected to the pinion shaft with the new brake wheel and auxiliary brake. Sevefal failures have occured in the slip ring insulation on the rotor while the main rotor winding has held up well. One failure of the stator winding occured which required cutting two coils out of the winding.

The 7th level pump station work is completed so far as subway box and cable connections are concerned and the rebuilt distribution panel is also connected to both shaft cables through the 7th level switch box. Installation of the new Goulds 100 HP pump and starting equipment on the 7th level has also been completed.

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CAMBRIA-JACKSON MINE: (Continued)

Repairs to the 250 HP synchronous motor for compressor purchased from the Holmes Mine were completed and the machine put in service during January 1946.

Some changes have been made in the electric haulage and tram equipment, including the arrangement for parallel operation of the G.E. 150 KW D.C. generator and the Crocker-Wheeler 150 KW D.C. generator including larger equalizer switches and cables. The D.C. busses and cables at the panels have been rebuilt for the increased load and a larger circuit breaker has been ordered from the General Electric Co.

CLIFFS SHAFT MINE:

Several changes have been made in the controls and emergency brakes of A and B shaft hoists during 1946. New air brakes with solenoid controls were installed to operate with Lilly control circuits. On account of the higher current requirement for the larger solenoids, larger transformers were also installed for the Lilly control circuits of each hoist. Breaks in rotor circuits and band wires on the 750 HP hoist motors have been the cause of three stoppages during the year. New slack rope signal equipment was set up for A and B shaft hoists consisting of red lights and 110 volt grounded system to replace the old battery signal set up.

Two 5 HP compressors were purchased for auxiliary purposes. One was installed in the engine house for air brake purposes and the other in the main pump room for charging air chambers of the plunger pumps.

Installation of the new 1000 GPM Worthington plunger pump has been completed. The electrical equipment consists of one 300 HP synchronous motor with exciter and line starter. A suction pump is also a part of this equipment, which has a 25 HP 440 volt induction motor with a line starter. Two 25 KVA 2300/440 volt transformers formerly used for scraper power distribution at the 2nd level B shaft were set up as a permanent installation in the main pump station to furnish 440 volt 3 phase power for the 25 HP suction pump and for welding purposes in and near the pump station.

The failure of a starting compensator was the cause of a lengthy shut down of #1 compressor in February. The flashover from the broken down coils set fire to the coils and connecting cables, and opened the main breaker in the substation. The necessary equipment required for complete repairs, including the compensator, was borrowed from the Cambria-Jackson Mine. A spare compensator has since been built which is interchangeable with the compressor operating equipment at several of our mines.

Several changes in transformers were made necessary to overcome some of the difficulties encountered by low voltage in the underground scraper power distribution. One 50 KVA transformer was borrowed from the Mather Mine and moved to the 10th level substation, A shaft; and another 50 KVA unit was transferred from the Cambria-Jackson 4th level pump station to the 6th level, A shaft.

The 6-ton LM-101-M1 locomotive recently purchased from the Holmes Mine and used at the Princeton Mine was taken to the Cliffs Shaft and is now stored on surface near the shops.

LLOYD MINE:

Several delays in ore hoisting have occured during the year due to broken coil connections in the 500 HP hoist motor. After these several temporary

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LLOYD MINE: (Continued)

repair jobs, the motor was taken apart, the laminations repaired and the slots filled to stop vibration and avoid breaks in coil connections. There has been no difficulty since this last repair on October 20th.

A similar repair job was recently completed on the synchronous motor of the Sullivan compressor, made necessary by the movement of the stator coils in the slots due to shrinkage and drying of the insulating material.

The changes and repairs to the haulage system have been very much routine during the year. In order to improve the D.C. voltage on the 8th level, a 4/0 concentric cable was installed to connect the 7th and 8th level trolley and rails through a raise near the ore body.

MAAS MINE:

The ore hoist electrical equipment has drifted into several difficulties during the year largely due to overloading of skips near the bottom of the shaft. On several occasions, the skip jammed with ore between the stringers and skip guides, causing extreme overloads with consequent burning of brushes and slip rings of the motor.

The failure of a cable from the contactor panel to the motor was the cause of the most serious shut down. A complete new cable and connections were installed to replace the faulty equipment. The liquid rheostat and controls have also been rebuilt.

All electrical equipment for the 200 HP hoist from the Maas winze which was recently repaire dor the Lloyd Mine, including control panels, grids, controller switches and 200 HP motor is stored in the Lake Mine storage house. The hoist and drum equipment is on surface near the Lloyd Mine shaft.

Several changes have also taken place with the pumping equipment. The new section of the 3rd level pump station is now completed and the 350 HP plunger pump installation completed and operating. This set up of electrical equipment consists of the 350 HP 2300 volt slip ring motor from the Gardner-Mackinaw Mine, the grids, switches and controls from the Allis-Chalmers centrifugal pump at the Maas. The old Alberger pump controls have been transferred to the 1000 GPM Allis-Chalmers pump. The 125 HP centrifugal pump from the 7th level at the Princeton Mine was taken to the Maas 5th level pump station and installed there with a 150 HP General Electric starting compensator from storage. After several attempts to use the pump while cleaning the 5th level sump, a failure in the pump rotor occured and the entire set up was taken to the general shops for repairs. The No. 1 surface well pump has continued to run during the year, while No. 2 has been tied up intermittently for repairs. Three hundred feet of #4 3-conductor cable and 3/8" messenger wire was installed to replace old wiring under the east trestle which is a part of the 2300 volt line to the well pumps.

Minor repairs have been made to the compressor motors and exciters. The No. 2 compressor motor is still operating with seven coils cut out of the stator.

MATHER MINE:

The installation of a connection changing panel between the two hoist motor-generator sets for switching the set up from one to two set operation on the skip and cage hoists has been completed and tested. The hoisting operations are at present carried on with the two motor-generators sets in operation.

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MATHER MINE: (Continued)

The 100 KW Westinghouse rotary converter from the Princeton Mine was sent to the Mather Mine with D.C. and A.C. panels, transformers, meters and all necessary equipment for its complete installation and will be kept in the engine house basement for use in case of failure of present D.C. equipment.

Installation of the new 200 KW Westinghouse Ignitron has been completed and it is in service. The three Westinghouse-Whitcomb 8 ton trolley locomotives are also underground and in service.

Changes in the pumping equipment includes moving the 40 HP 250 gallon Allis-Chalmers pump and line starter from the Cambria-Jackson Mine storage to the 5th level. This pump was formerly used for surface water supply from the Cambria sub shaft.

NEGAUNEE MINE:

Several interruptions in the ore hoisting occured early in the year due to open coils in the 500 HP skip hoist armature. Installation of the rebuilt armature was completed in March. The old armature with the faulty winding is stored outside near the engine house in a sheet iron enclosure.

The pumping equipment has served very well during the year with routine repairs.

On account of difficulty encountered with the auxiliary compressor with its low capacity and overheating due to continuous operation, the 15 HP compressor from the Princeton Mine was moved to Negaunee Mine and installed with the auxiliary compressor equipment. The synchronous motor for the Rand compressor failed several times during the year. After the necessary repair jobs this motor is now operating with six coils cut out of the stator winding.

SPIES-VIRGIL MINE:

The skip hoist motor windings and bearings were repaired in April.

The final section of the new 2/0 2300 volt power cable from the engine house to the 3rd level has been completed with the necessary subway boxes and switches for parallel operation with the #1 cable from the engine house to the 8th level.

Failure of the rotary converter for the D.C. haulage and scraper system occured in the month of May. Shop tests revealed several breaks in the rotor winding which would be very costly to repair and it was therefore decided to move the 100 KW motor-generator set from the Princeton Mine. Equipment including the 100 KW General Electric D.C. generator, the Westinghouse 215 HP synchronous motor, AC and DC panels with circuit breakers and meters for parallel operation with the present haulage equipment has been set up and is now in continuous service.