

FRANCIS MINE

WORK FOR THE YEAR

On January 23rd it was decided to open the Francis Mine and work was started on January 25th.

The only equipment that remained on surface was a 125 H. P. Burt locomotive type boiler and the small Sullivan compressor. The other two boilers that were originally there having been sent to the Crosby Mine several years ago. The Sullivan compressor was the one originally bought for the Austin and had a capacity of 500 cu. ft. When the boilers were removed to the Crosby it was thought that all new equipment for this mine would be electrically operated. The Austin Compressor, therefore, had had the steam end cut out. It was set up and belted to a motor.

The air from this compressor and the supply from Central Power Plant through a four inch pipe was deemed sufficient by the Mechanical Department for our needs in shaft sinking. Later in the year it was found that we had an inadequate supply of both steam and air and arrangements had to be made to install extra equipment.

The work for the year was confined to surface improvements and sinking the shaft.

The work of unwatering the shaft was started early in March. The water was lowered with air blower to a depth of about 87 feet. An electrical centrifugal sinking pump was then installed on the 9th set in the skip compartment and unwatering of the shaft completed.

Two No. 10 Cameron pumps were then installed in shaft. Solars and ladders were then placed in ladder compartment and the work of casing up shaft between cage and ladder compartments completed on March 22nd.

The bottom of the shaft was then reinforced in the following manner:

Three inch plank was placed on edge and spaced about one foot apart on top of the concrete in the bottom of the shaft and 12" timbers placed on top of the 3" plank. These timbers being braced with stulls placed

against the cast iron brackets which are bolted to the concrete walls of the shaft.

Preparations were then made to grout the holes which had been drilled in the bottom of the shaft previous to closing down in 1911. A grout machine was installed on a collar in the West end of cage compartment about 15 feet above the bottom of the shaft. A 6" air line to act as receiver for high pressure air was placed in North side of ladder compartment and connected with 2" low pressure air line in such a way that either high or low pressure air could be forced into the grout machine. A 4" feed pipe was placed in West skip compartment for sending down grout. The grout being mixed on surface at the collar of the shaft.

The grout pipes were made from 1 1/2" standard iron pipe 3 to 4 feet long. To the end driven in the hole a bell made from a piece of 2" pipe 8" long was welded. The 1 1/2" pipe is pushed into the large end of the bell until its end is even with the unexpanded end of the bell and welded at this point. The other end of the pipe was equipped with 1 1/2" stop cock, a 1 1/2" nipple and a 1 1/2" Tee, which was left open on the side to prevent the full flow of water while the pipe was being driven, and a nipple to which was screwed a cap. Before the pipe was driven in the hole the bell was wrapped with Oakum and this in turn coated with clay after driving the pipe in the hole the collar is made tight by forcing in oakum and wedging with wood and steel wedges. When ready for grouting the nipple in the stop cock with its attached tee and cap was replaced by another nipple to which was attached a half union for the coupling with the grout hose.

Grouting was started on March 26th. The first hole grouted was one of the old holes drilled in 1911 and was located near the concrete wall in West end of cage compartment. This hole was about three feet deep and was making about 250mgallons of water per minute. This hole was grouted under a pressure of 50 lbs. which was later raised to 65 pounds. Under this pressure quite a few of the other holes sprung a leak, the old plugs were then removed and replaced with new dry pine plugs. Grouting was again resumed and continued until all leaks gradually took up and were entirely

eliminated and grout pipe took no more. 18 bags of cement having been used.

Grouting was then discontinued until the 29th to give cement time to set up.

On March 29th six holes were drilled about equal distance apart around the perimeter of the shaft close to the wall and dipping at an angle of about 70° towards the outside of the shaft. These holes were continued until they struck water. The following day these holes were grouted and for the next two days work was suspended to give the grout time to set up.

A total of 41 holes were drilled and 27 were grouted. As the work progressed the holes were drilled deeper until 14 feet holes put in at an angle of 45° encountered no water.

On any days grouting the hole showing the largest flow of water was generally the first one connected to and grout forced into it as long as it could be made to take any. When once started the grouting of a hole was finished with out any stop for if the cement was allowed to start to set no more could be forced in and the hole would be lost. Hole No. 13 required 332 bags of cement. Grouting was started at 8:30 A. M. and ran continuously until 3 P.M.

After a couple of days work with 60 lbs. of air it was decided that the seal and bracing were strong enough to stand a pressure of 80 lbs. and from then on this pressure was used almost entirely. Some holes that would not take grout at 80 lbs. were made to take a few batches under 150 lbs. pressure. Finally a few holes, No's 38, 3 A, 40 and 41, were put down in the interior of the shaft to reach any seam that might run up into the shaft parallel to the incline holes which these holes might have missed. As no water was encountered all was now ready for the excavating of the bottom of the shaft.

The grouting was finished on April 26th, a month after starting.

After it had been demonstrated that the water had been all cut off the rectangular shaft was started. Eight foot holes were drilled around the perimeter of the rectangle two feet back from the West line of the shaft and as close together as possible. The first four feet were then broken out by

milling with wedges. Below these four feet shallow holes and very light charges of powder were used. For the next cut the holes were drilled on the outside of the shaft as before and ground broken out by drilling and blasting with light charges. Not over a half stick of powder to the hole and never more than two or three holes at a time.

This operation was continued until the shaft was 18 feet below the shoe of the concrete shaft sunk by the Foundation Company.

To secure further the portion of the shaft which had been grouted, the sides of the shaft traversed by the filled seams were lined with a reinforced concrete wall averaging two feet in thickness. Hitches were cut 12 feet below the shoe and 9" I-Beams put in for bearers along the small dimension of the shaft. To these bearers hanging bolts were attached so that sets could be hung below. Forms were then constructed along the West line of the shaft from the top of the concrete seal to two feet below the bearers. 1 3/4" cramp rods spaced two feet apart were put in the walls of the shaft, wire rope, iron bars and pieces of old angle iron and channel were fastened in for reinforcing. The space was then filled with concrete. This was given a couple of days to set up and then the work of sinking was resumed. For the first two or three cuts the perimeter was drilled around as in the previous cuts and holes blasted carefully so as not to damage the concrete.

When the bottom of the shaft was taken up it was found the seal had a good contact with the ledge over the entire area of the bottom of the shaft but there was a large seam varying from 2 to 6" in width cutting across the entire shaft. On the South and East sides it was within a few inches of the bottom of the seal.

From six places in the sides of the shaft small streams of water issued, the combined flow of which was not over 25 gallons per minute. Holes were drilled in the rock at these points and plugged with grout pipes. In addition several weep holes were put in which all ran dry as soon as the concrete set after the concrete lining had been allowed to set six weeks. The holes making water and the weep holes were grouted. Although some of the water was shut off and total flow cut down to about 15 gallons per minute it could not be entirely cut off with the available air pressure. During the

time between the installation of the concrete lining and the last grouting the shaft was sunk 16 feet.

After the weep holes were grouted the forms were removed, dividings installed and shaft equipped for sinking in the ordinary way. Up to this time the work was done on day shift only.

To reach this stage four months were required, from March 26th to July 27th. The greater part of the last three months were spent in sinking.

Two eight hour shifts were started on August 1st and continued up to November 8th at which time three eight hour shifts were adopted, and so continued for the balance of the year.

In the Southeast corner of the shaft was diamond drill hole No. 11. The grout entered this hole to a depth of thirty feet or there about. However, when this depth was reached water was found coming from the hole. When attempts to grout it were made the water came into the shaft through the seams in the rock. The formation of Slate was found to contain seams which were quite open, most of which contained water. This continual increase made more water than the shaft pump could handle so it was necessary to provide a temporary pumping station in the shaft at 295 feet below the collar. The station was cut out from the ladder compartment of the shaft and provided room for a small steel tank.

When sinking was again resumed more or less trouble was had with the newly installed centrifugal pump which was run by a high voltage line. As there was inadequate steam and air capacity in our equipment it was decided to install another boiler and compressor and dispence with the centrifugal pump in the shaft. A second temporary pumping station 11 1/2 x 15 and 9 feet high, was cut out from the skip compartment of the shaft and a sump 11 1/2 x 6 x 8 feet deep excavated in the back end of this station. The elevation of the floor of this second pumping station is about 395 feet below the collar of the shaft. Concrete foundations for two Prescott sinking pumps were constructed and pumps installed.

The mean sea elevation of the bottom of the shaft December 31st was 699.44 or 405.33 below the collar of the shaft. The total sinking for

the year being 302.47 feet. 47 steel sets were installed during the year.

WORK FOR DECEMBER

The work for December consisted in sinking the shaft 50 feet, excavating for pump room and sump off the skip compartment of the shaft at an elevation of 710 feet. The pump room being 11 1/2 x 15 x 9 ft. and sump 11 1/2 x 6 x 8 ft. Concrete foundations for two pumps were constructed on the floor of the pumping station and two Prescott sinking pumps installed.

Eight steel sets were installed during the month of December.

FRANCIS MINE SURFACE

WORK FOR THE YEAR

The following surface improvements were made at the Francis Mine during the year:

The 4" air line from Gwinn Mine was opened up.

Concrete foundations for temporary hoist constructed East of the permanent engine house and the Webster, Camp and Lane geared hoist brought from the Gwinn Mine and installed on the above foundation and hoist enclosed by temporary frame building.

A room 30 x 12 ft. was constructed in the Northeast corner of the boiler house for temporary dry. Steam coils placed in the center of the room and ventilator placed in the roof of the building over the coils.

The steel lockers were brought in from the Mackinaw Mine and installed in the temporary dry.

A "Booster" for generating high pressure air was installed in the Francis engine house and connected with the 6" high pressure pipe in the ladder compartment of the shaft. This "Booster" was from a Westinghouse Air Brake Compressor such as is used on a locomotive.

Railings for safety device were constructed around the landing floor of the shaft house and on both sides of the rock trestle.

A temporary landing floor and chute for dumping the bucket were constructed above the permanent landing floor of the head frame.

Three sets of doors were also constructed over the cage compartment, one at the collar of the shaft, one at the permanent collar of the shaft, one

at the permanent landing floor and one at the temporary landing floor. These doors were constructed for safety device to prevent anything from falling into the shaft.

Right of way cleared and road graded from a point just West of the Jopling Shaft to the Francis Mine.

Shop building constructed by the company carpenters.

Mine office and permanent dry buildings were built by contract. These buildings were completed during the month of May.

A brick man hole was constructed just West of the South end of the shop building and drains laid from this man hole to office and dry buildings and from man hole drain pipe laid to Johnson Lake. The total length of the sewer or drain being 1502 feet.

Land was cleared and brush and stumps burned Southwest of the Francis Shaft on the N.E. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ Section 28 - 45 - 25. This land to be utilized for stocking ground. The area cleaned consists of a strip 700 feet long by 120 feet wide and a second strip just West of the above 120 feet wide by 250 feet long.

Permanent walks and roads to the various buildings were laid out and graded.

Eight bents were erected for coal dock and connected with the bulk head on coal dock approach of which was constructed by the C. & N. W. Ry. Co. in 1911.

A motor driven fan was installed on surface with a 10" pipe line down the shaft.

A second cross-head and bucket were installed in the West skip way so that rock can be hoisted with two buckets.

A chute and three doors were also constructed over the skip compartment, one door at the temporary landing floor, one at the permanent landing floor and one at the collar of the shaft.

A landers shanty was constructed on the West side of the permanent landing floor. This building was built of rough hemlock and covered with poultry netting and this in turn covered with concrete, thus making a fire

proof building. The building is heated with steam.

The Sullivan air compressor that was in the old boiler house at the Gwinn Mine was brought over to the Francis and installed on a concrete foundation that was constructed on the South side of the boiler house. This compressor was in a small building North of the Gwinn boiler house at the time of the fire in September. It was necessary to take it completely apart, provide new bearings and gaskets. The foundation frame shows a small crack but it is possible this will give no trouble if it can be securely anchored to the concrete foundation. This compressor will be enclosed in a temporary building.

A 150 H. P. boiler was brought over from the Princeton Mine and installed in the boiler house and stack erected over the boiler.