THE WORKING AND VENTILATION OF THE MONONGAH COAL MINES, MARION CO., W. VA.

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The subject of this paper will be treated as briefly as possible under the following heads:

1. Description of the coal and coke plant.
2. The system of working.
3. Ventilation.

The Monongah coal and coke plant is located in Marion Co., W. Va., on the west fork of the Upper Monongahela River, and on the line of the Monongahela River Railroad, about six miles S. W. from Fairmont, and 25 miles N. E. from Clarksburg. The Monongahela River is not navigatable at this point.

The Monongah Coal and Coke Company's property comprises 990 acres of land and 13,000 acres of coal, 200 miner's frame houses, and 6 six roomed houses for the different officials. Three coal mines and 323 coke ovens. Four years ago where the village of Monongah now stands, and the wheels of industry gives employment to 600 persons, was nothing but a briar patch. The village is regularly laid out in streets and alleys and is furnished with good water from hydrants and drive wells. The miners' houses are well built containing from three to five rooms each. There are three hotels, two school houses, three churches and five stores in the village. The coke plant consists of 222 block ovens at mines number 1 and 2, and 101 bank ovens at mine number 3, they are of the bee-hive type, are 12 feet in diameter by 7 feet high in the clear.

The coke is made from the slack coal that falls through between the screen bars, the slack passing through a crushing machine is elevated to the coal washer where it meets a stream of water that carries it through a trough to the washing jigs, and by disintegration the refuse is deposited on the bottom of the jig sluice, the coal being carried by water into a vat and elevated by perforated buckets into bins of a capacity of 400 tons each. The slack in the bins is partially filtered, the water flowing off

through the sides and floor of the bin. The refuse or waste from the washing jigs is carried by water through troughs to the refuse heap.

I will remark here that the miner is paid by the ton for Run of mine coal. All the ovens are charged from "larries" containing one charge each, which runs on tracks upon the top of the ovens extending the full length of the lines of ovens. The coal is dumped through an opening in the crown of the oven. The larries receive the coal from the bins by a system of doors and levers. The ovens are charged with 6 tons of coal for 72 hour coke which produces 3½ tons of coke, and 4½ tons of coal for 48 hour coke which produces 2½ tons of coke. The coke is of silvery lustre, cellular, with a metallic ring, tenacious, comparatively free from impurities and is capable of bearing a heavy burden in the furnace.

The water system of the plant consists of two duplex compound pumps, each having a capacity of 750 gallons per minute. The water is pumped from the Monongahela River into two reservoirs each having a capacity of 510,000 gallons, from which the water runs by gravity through an eight inch pipe to the ovens, boilers, coal washer and other various places.

Steam is furnished for the plant from 16 tubular boilers 66 inches in diameter and 16 feet long, containing 57 four inch tubes each.

The three hoisting engines, one at each mine, geared 6 to 1, cylinders 14 by 24 inches, and fitted with all the modern improvements, were built by the Nelsonville Machine Company, Nelsonville, Ohio.

Three electric dynamos and engines furnish power to run eight Jeffrey electric mining machines and three pumps. The generator or dynamo is driven by an R. M. Beck engine 11½ inches diameter by 15 inches stroke, running with a piston speed of 700 feet per minute. The armature makes about 840 revolutions per minute at 260 volts.

The mines are called number one, two and three. The coal is the Pittsburgh seam or number 8, of the Ohio geological survey. The average thickness is 8 feet, of clean coal, excepting two small bands of "bone coal" intermingled with slate, which never exceeds an inch in thickness, the first comes in four feet, six inches, from the floor, the second seven inches above the first. The coal is brought down by powder after being undermined. The roof is a hard black shale and sand-stone. The coal has long bright facings, is of a remarkable good and uniform character, its slight dip, great thickness and easy mining makes it com-

pete favorably with the best class coals, as a commercial coal as well as a coking and gas coal.

Mines 1 and 2, are slope openings and number 3, a drift opening, located S. 48° W. 3780 feet, from number 2. It will be but a short time until a connection will be made between number 2 and 3, when the entire products of both mines, or part of either, if required can be deviated to either tipple. At this point the coal lies about 800 feet above tide water, the dip of the coal is N. 6° W. and dips about 1 foot in 100. The coals from number 1 and 2 are hoisted to the same tipple house and dumped by two Mitchel tipples. The mine cars are each two and one half tons capacity. The distance from the tipple house including the length of inclined plane 175 feet, to the foot of slope number 1, is 414 feet, on a pitch of 18 degrees, the trip is composed of four cars. Number 2 inclined plane is 1,500 feet long, the slope 150 feet, total length 1,650 feet from the tipple house to foot of slope, trips are composed of seven cars.

The inclined plane at number 3, is 1550 feet long, trips are composed of 14 cars.

The system of working is the double entry and room and pillar plan. Entries and rooms are driven by the point of the compass. The main entry in number 1, is driven on a course N. 30° E., butt entries S. 75° E. The main entries in numbers 2 and 3, are driven on a course S. 15° W. Butt entries S. 75° E., and N. 75° W. The entries are driven 9 feet wide, the pillars between parallel entries is 40 feet, breakthroughs are made every 30 yards.

The rooms in number 1, are only worked to the rise and are worked up to within 30 feet of the next air-course above.

Working the coal to the dip in numbers 2 and 3, is not a matter of great disadvantage as the dip is so slight and rooms comparatively dry that it does not materially increase the hauling expenses. A pillar 100 feet thick is left between the main entry and the first room turned off the butt entries. A barrier pillar 80 yards long by 33 wide, is left between every tenth and eleventh room along the entry, by providing barriers of coal in such situations even if a squeeze should take place it cannot extend beyond the barrier. Thus all general squeezes may be provided against.

Rooms are turned off the butt entry every 54 feet apart, they are driven in for the first 24 feet, 9 feet wide, they are then widened out on one side to a width of 24 feet, leaving a pillar 30 feet thick. The track is laid straight up the side of the room from the opening of the entry. Breakthroughs are made every 30 yards into the next room. The rooms are driven up 80 yards.

When a room is driven up to its boundary, the miners attack the pillar and draws it back as rapidly as possible to the point at which the room was widened out. Having a very strong roof overlying the coal and a soft yielding floor, it has been proven by practical demonstrations that a 24 foot pillar is the least size that will hold the roof and prevent the bottom from heaving, by adopting the 30 foot pillar, the weight of the overlying strata is much easier resisted, and the coal is not crushed to such an extent, therefore produces a larger percentage of good merchantable coal.

The coal is mined by both pick-men the Jeffrey electric mining machine. I need not describe the construction of the machine in length. The coal cutter consists of a 15 horse power motor, which transmits power from the armature to a center shaft by means of cog-gearing to the cutter bar. The transmission of electricity to the coal cutter requires two wires, one to and from the point where the power is applied. The wires are suspended by brackets or props along the side of the entry. In short, the coal cutter is the old Lechner-Jeffrey machine run by electricity instead of compressed air, the power transmitted through a copper wire 7–16 of an inch in diameter instead of a pipe 6 inches in diameter.

Improvements have been made of late years in the system of working and ventilation of mines. We are now able by experience to divide by means of a regulator and overcast the currents of air in such a manner as to give one district or pair of entries a greater quantity of air and another a less quantity as the circumstances of the case may require. This is a great advantage over the old system of coursing the air in one unbroken current through a mine. The division of the air is accomplished by what is commonly termed an air-crossing, which carries one current of air over or underneath another current which is passing in a different direction, one current fresh air and the other impure air. I think the invention of the air-crossing belongs to the late Mr. Buddles an eminent coal viewer in the North of England.

Mine number one generates fire-damp, no miner is allowed to enter his working place until it has been examined by the fire boss. The mine boss or his assistant travels at least once a week in the return air-courses of the mine, sees that the air-courses are in good order and attends to the precaution of good ventilation. The mine is ventilated by a fan of the Guibal type 20 feet diameter by 6 feet face, located at the top of the air shaft 300 feet from the bottom of the slope and can be readily changed from an exhaust to a pressure blower. The air is split into six

different currents by the use of regulators and overcasts. When the air has traveled through the different working places in a pair of entries it returns and goes direct to the upcast shaft. In order for each pair of entries to get their proper share of air a regulator is put in the return air-course near the main entry.

No fire-damp has been discovered in mines one and two, each mine is ventilated by a 12 foot exhaust fan. The system of ventilation is duplicate of number one, overcasts are used whenever they can be to advantage. Against this plan of ventilation it may be said to be too expensive. The expense of an overcast made of two inch plank is not much more than a trap-door, the saving of trappers will soon offset the difference. The advantages derived of splitting the air, are, it takes less power to ventilate, shortens the passage of air, gives a greater area and consequently a lower velocity. Each pair of entries receives its own quota of fresh air direct from the inlet, and workmen are not compelled to breathe noxious gasses totally unfit to breathe. Besides it is an economical advantage, which may be mentioned that both men and boys and beasts can perform more work in a given time by having good air to work in.

In closing I would beg to remark that an adequate ventilating power will not insure safety in a mine nor give the workmen the required quantity of air unless a close attention of conducting the air without waste in the proper channels, should be observed by a constant inspection and effective discipline. It is not too much to say that the daily work of a mine should be conducted on the supposition that danger is always to be looked for and always to be provided against.

THE CHAIR: Gentlemen, you have heard this paper read by the secretary. It is now open for discussion. We have a number of papers and our time is limited.

PROF. ORTON: Since our attention has been directed to ventilation, I will ask if cross-course could not be provided here, whether we are up to the state standard.

THE CHAIR: The next paper is by Mr. Morrison. The paper will be read later by the secretary.

The next paper on the list is on the subject "The Technical Education of Clayworkers" by Edward Orton, jr. I take pleasure in introducing Mr. Orton.