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Gases, Ventilations and Explosions.

BY T. F. SMITH.

The first thing to be considered in opening out mines is the amount of territory. Second, how many miners and laborers would be required at one time to make a sufficient output for that amount of territory? Third, what would be a safe velocity for a ventilating current in a gaseous mine?

After the above has been fully considered we can then determine what size of airway will be required to get a sufficient quantity of air for the number of men, with a safe velocity.

The return air-course should always be much larger than the intake, where much gas is given off; not alone for the expansion, but, after air has traversed around the workings it is heavily laden with gas and probably to an explosive point and not safe to meet at the same velocity as that in the intake and by no means should the miners ascend the upcast shaft.

I would assume 8 feet per second a sufficient and safe velocity in the intake to clear out all impurities, but would not be safe in the return air-course to be traveling at 8 feet per second, and meet an explosive mixture at 8 feet per second, making a velocity of 16 feet and the expansion to be added.

There might be some advantage in appointing the mine boss only, to inspect the return air-course with the understanding that he commenced at the extreme and travelled with the current.

One of the most important features in ventilation is splitting the air and dividing it into districts, providing the split is in the proper place. The splits should be made as near the downcast as possible and brought together at the dumb drift—the furnace being supplied with fresh air.

If they go too far in the mine before making the splits it would be no material advantage, as the power or pressure would be spent on friction before making the division, and consequently, the current would be too feeble at the extreme part of the workings and not sufficient friction to collect the impurities.

There are cases where ventilation can be assisted, such as the empties going in with the current and the loads coming out with it, but this is not always convenient.

Doors in main hauling ways should be avoided as much as possible, as there is always more or less stagnation, be the trappers ever so careful, and wherever there is one door there should be two, and always shut the one before the other is opened; and all breakthroughs between the main intake and return in such mines should be built with brick and mortar, and nearer to the intake than return, to provide room for leakages or falls in the return where there is generally no track.

In the first place, we must understand that we shall never have as much gas to contend with in Ohio as they have in England, for the reason that our mines are not deep. My experience proves to me that the deeper the vein the more gas is given off, even with the same vein.

The Early and Rushy Park mines are the deepest in England and are the most gaseous. Coal seams and all other seams in England are pitching seams.

The Early Mine in Saint Helens, Lancashire, can be reached at a depth of 900 feet, whilst Rose Bridge Colliery Wigan, 12 miles distant is 2400 feet and the Rose Bridge gives off the most gas; but the difference is overcome by being able to get a better ventilation in deep shafts for the reason of having a better motive column—that is, a greater difference of pressure between the downcast and upcast shafts which gives rise to a better ventilation with the same furnace power.

The quantity of air passing in a mine changes as the square of the depth of the shaft, so that double the depth produces one-half more air and four times the depth will double the quantity, and the difference of the quantity of gas would be overcome by the difference of the quantity of air in a given time.

I wish to call your attention to the fact that if the mines in Ohio were as deep as the mines in England, as much gas given off, worked as extensively, the same ventilating power, as much air passing per minute, with the same precaution, we could not expect as many explosions as in England for the reason of not having pitching veins.

It might be well to call your attention to the difference of the weight of air and mine gases and also their nature, taking J. J. Atkinson, author of the Ventilation of Mines as a reference. He says, "Mine gases are composed of hydrogen and carbon, two volumes of hydrogen to one of carbon, but the three volumes condensed into one. Fire damp or mine gas is only half the weight of air and consequently is found in pitching veins in the up-grade workings owing to its specific gravity, and where it is found in small quantities it will lodge at the roof and separate from the air at an explosive mixture."

This makes a wonderful difference in the clearing out or freeing a mine of gas, not because they cannot get the same amount of air in the up-grade working, but because they cannot, as conveniently, drive the gas down hill, owing to its specific gravity, and wherever there is a hole or break in the roof it will separate.

There is a difference between opening out new work in gaseous mines and bringing out the pillars. For instance, when they are opening out new work, they are tapping gas and the coal is somewhat drained but that by no means lessens the quantity in a mine. As they get a larger area and are still opening new work and tapping gas and are constantly driving it out; and when they commence to bring out pillars in upgrade workings they commence to make a gasometer, for there is no successful way to ventilate old working and it is consequently left there by the acre, and whenever a small explosion takes place they may expect a large one to follow.

The most prosperous collieries I ever knew in pitching veins were the Crow Orchard Collieries, Skelmersdale, Lancashire. They did not expect to find much water there, and their expectations were not over-reached. They sunk their shafts on the crop and the coal lay to the dip, which was hauled by a tail rope and made a larger output than any other of the neighboring collieries at a less cost. and no dread of explosions, as the old workings lay to the dip and the gasometer empty.

All the explosions, or at least those that came under my notice, were where up grade and down-grade workings took place in the rise of the mine. The most of the explosions in England took place in February. February in England is generally a rainy, snowy or sleety month, which lessens the atmospheric pressure and gas makes its appearance from the old goafs. This, in addition to outbursts of gas where blasting was practiced, has in all probability been the cause of so many disasters.

The difference of the atmospheric pressure would require an increased furnace power to make the same difference of pressure between the upcast and the downcast as before, but this will by no means compensate for the atmospheric pressure as a whole, and will still have more gas with the increased power than before and more liable to explosions.

After an explosion there is generally an excuse, and that excuse is generally in the mouths of many, that some one has tampered with a safety lamp or matches; but I never held that idea, for I do not believe that any man would strike a match and his own life at stake; even if he did, were there no gas there could be no explosion.

I think I have touched on the weak points. It is contrary to the old idea that a moist atmosphere is a light one, but it is nevertheless true. I have heard people say this is a damp, heavy day.

People feel languid and heavy for want of pressure, and when the atmosphere is heavily laden with moisture it is light on account of its expansion. The air is heaviest when it is dry and cold and is more dense.

A common pump or water fountain, when in good condition, will throw water 34 feet from sea level, which is a counterpoise for the atmosphere and give the best results in cold, dry weather. A barometer is also a counterpoise and at sea level on a dry cold day, it will register 31 inches, but can never be got in damp weather. And I always had the understanding from a boy, that a falling barometer indicated rain, and the class book of modern science also proves my argument.

It might be well to state that I was engaged as Fire Boss for two years at the Garswood Hall Colliery, near Wigan, Lancashire. The Mining Law compelled each Mine Boss to inspect each miner's working place, roadways, aircourses, etc., every morning and make out a report as a reference for the Company and Mine Inspector, before the miners were allowed to descend. This gave me considerable careful practice.

We drove some twenty places or a breast of coal to a fault; and when the first place was abandoned, which was at the return, I kept about 30 feet at the fault unventilated for my own experiments and put on a danger signal.

We had a barometer at the top and also one at the bottom of the shaft; and when the barometer registered 30 inches, the 30 feet contained about 15 feet of gas.

I made a chalk mark at the 15 feet of standing gas and examined it every morning in my inspection of the working places, etc. I noticed the barometer every morning and when it registered less than thirty inches I could not reach the 15 foot mark and the less the barometer registered the nearer the gas approached; and, what was more striking than all, if I happened to be making my round at the change of the weather the gas made its appearance before the change on the instrument. This proved to me that gas was more sensitive than mercury. And I am fully convinced from my own experience, irrespective of writers, that moisture lessens the pressure, lessens the quantity and endangers the mine.

I may also add that an increased temperature at the surface will also have a tendency to lessen the quantity in a given time; but this tendency could be overcome by an increased temperature at the upcast.

It might be well to state that a gradual fall of the barometer would not be so bad if precautions were taken in due time and a barometer kept at the furnace; and even then a rapid fall on the barometer would leave the furnace man no option, as gas would gush out from the goafs before they could make any material difference in the ventilation. And under these conditions where blasting of powder has been practiced, there have no doubt been serious results to both life and property.

These are only a few hints on the subjects, but nevertheless important; and as they are so seldom put in practice the writer thought they might be worthy of your attention at this meeting.