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1887

Mine opening and timbering

George W. Cole

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A

THESIS

MINE OPENING AND TIMBERING

COLE

1887

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Thesis
upon
Mine Opening & Timbering
by
George W Cole.

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MSM
HISTORICAL
COLLECTION

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Mine Opening and Timbering.

I will begin by explaining the meaning of the term "exploitation".

By this term is meant the process by which the valuable minerals and ores are procured often at great depths below the surface.

A common error is that a mine is a mere excavation in the ground without law or rule.

Nothing can be more wrong; for to open a mine if on a vein or deposit of ore and have it a mere excavation open to the air is quite impossible because it is necessary to go below the most moderate depths.

Such is particularly the case with metalliferous veins in which the superficial portion is often of far less value than that beneath it, and frequently of no value at all.

Moreover the richest part of a vein is usually of limited extent and can only be procured by penetrating to great depths.

The next thing to consider is how to get the ore to the surface.

This requires powerful machinery which must be fixed on firm ground directly over the vein.

Also the surface water must be kept from running into the excavation which could not be

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This requires powerful machinery which must be fixed on firm ground directly over the vein.

Also the surface water must be kept from running into the excavation which could not be

avoided were the mine open all the time.

Again the freeing of a mine of water is a very expensive operation and therefore great care should be exercised to get rid of it easy and with as little expense as possible.

On account of the fact that only a limited number of persons can work in a mine at once, it is necessary the mine should be worked day and night. Care must also be taken that a system of ventilation be kept up.

All of which it will be seen easily would be impossible were the mine a mere excavation open to the air.

The first thing to be done in opening a mine is as a general thing to remove the surface water by means of an "adit-level" or horizontal gallery, which must be commenced in some adjacent valley which is above the height of inundation and thus can drain all that portion of the work above it. In large mines large sums are often expended in getting rid of the water.

When there are a number of mines adjoining often a simple adit of great length is driven at their joint expense.

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No pumping or machinery for pumping is required as long as the working is above the adit and when below it the water is pumped only to that point.

Thus in very large mines every foot through which a large body of water has to be raised which can be saved is of great importance.

In some cases where the "adit" is planned with judgment several hundred feet of drainage can be obtained.

If possible it should be drawn on or aside of the vein so that the richness of the vein can be ascertained from time to time.

If sufficient advantages present themselves for the location of machinery at the mouth of the "adit" for washing and draining the ore, it may be conveyed on a "tram-road" laid in the level; and thus save the necessity of hoisting it to the surface.

As a general thing the adit-level is used only to remove the surface water, as very few mines have the greater portion of the work above it. The necessity of ventilation will not allow the adit-level to be driven to any great distance without some communication with the surface.

Hence excavations must be commenced on or near the line of the veins which may intersect the adit or some level leading to it, and which are carried to a still greater depth to open and work the mine.

These excavations are called shafts.

There is no regular angle of inclination for

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When the vein is perpendicular the shaft is vertical.

At other times it is inclined 45° .

Whether the shaft shall be sunk on the vein or aside of it depends on various circumstances.

If the vein-stone can be worked with as much facility as the adjacent rock and the lode is wide it should be sunk in the vein, especially if the "country" is solid so that little ground need be left to support the walls.

When the inclination is 45° it becomes a question whether the shaft be equally inclined and descend perpendicularly until it intersects the vein.

The latter method I think is used most.

If the dip be known the depth to which the shaft will have to be sunk can be estimated.

In English mines the practice of sinking shafts inclined to the lode has not been generally adopted, although when it can be done, a large amount of unprofitable excavation in crosscutting from the shaft to the lode can be saved.

In order to raise the ore in the latter case a double tram-road should be laid in the shaft, and the ore hauled up in cars which run from the levels on to platforms mounted on wheels on which they are raised to surface.

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The dimensions of shafts are variable.

When it is to be used for winding up buckets of ore and at the same time as an engine shaft it should be from 12 to 14 feet long and is usually from 6 to 8 ft wide.

When a shaft has partly or wholly to be timbered it is rectangular in shape. Those built up with stone work are round.

In this country wood is universally used. The timbers are roughly hewn and laid one upon the other. For a distance from 50 to 100 feet the ore can be raised to the surface by means of the windlass worked by hand on which a rope is wound so that one bucket ascends while the other descends. The same means are employed in sinking a "winze" or an excavation from one level to another not extending to the surface.

When however the depth of a shaft becomes great, steam power must be used or horse-power.

One of the common machines for this purpose is the ~~winze~~ ^{horse} whim which consists of a vertical drum around which the rope winds, and a horizontal bar at the bottom of the drum to each end of which is hitched a horse. When the depth becomes greater than 200 feet it is customary to use the steam whim.

The drum on which the rope or chain is wound being placed horizontally. The steam engine is not brought into use in working a mine until

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there is good reason to suppose that the mine will be profitable. Like the shafts the levels may be driven into the vein itself or by the side of it, according to its width texture, et cetera.

The contents of a block of ground thus prepared are removed by what is called "stopping" or working in steps: The object of which is to take out all that portion of the vein which reserves for the ore.

There are two methods, the over hand and the under hand, the difference being that by the former method the vein is taken down by working from below upwards, and in other excavations from above downwards. The proper timbering of mines

is a matter of great importance in their management when the rock is soft and liable to inward crushing, the side timbers require to be kept apart by pieces laid across from above and below.

The first great explosive is Gunpowder which is a mixture of saltpetre, sulphur and charcoal. A good powder must possess the following properties: firm, hard, angular and of equal sized grains.

Powder may be ignited by impact but with great difficulty.

The next is Gun Cotton which is a nitro compound, prepared by exposing dry cotton for a sufficiently long time to the action of a mixture of nitric acid with sulphuric acid and then thoroughly washing

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Timbering

Explosives

Gunpowder

Gun Cotton

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Gunpowder

Gun Cotton

The gun cotton to remove the excess of acid.
Its best effect is produced when exploded by a
detonator.

For firing it wet a primer is needed made of a
cake of the dry with a fulminating fuse attached.
On being exploded gun cotton turns to water and gas
without leaving appreciable residue, dust, smoke,
or blackening.

Nitro-glycerine Nitro-glycerine is the most important of the
explosive compounds of the day.
In transporting it is advisable to pack it in
large earthen jars with a layer of water on top.
By an accident it was discovered that nitro-glycerine
when fully congealed is difficult to explode.
No instance has been recorded of nitro-glycerine
decomposing spontaneously when properly made
and pure. The firing point is maintained to be
360°F.

It is a detonating not an igniting compound.
Its full effect can only be produced completely
by the shock caused in exploding some other
explosive compound in sufficiently close
proximity to it, so that the concussion effected
by the latter shall produce sympathetic explosion.

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the one hand the mixture contains sufficient nitro-glycerine to form an efficient explosive compound and on the other hand the proportion of the absorbent used is sufficiently large to hold the nitro-glycerine against leakage.

Infusorial earth has so far been found to excel all other substances tried as absorbents.

Dualin

Dualin is a mixture of Nitro-glycerine, sawdust and nitrate of potassa. It is more sensitive to heat than dynamite.

Some of the names of the other explosives are, Rend Rock, Mica Powder in which the mica powder is the absorbent, - It is also claimed that in the latter as the mica scales give an almost infinite number of comparatively clear interstitial air-spaces between the individual scales of the mixture this condition enables the flame and vibration of the exploder to reach every portion of the cartridge more quickly than with the same weight of pure Nitro-glycerine in liquid form.

Respectfully Submitted
George W Cole

To

Major G. D. Emerson,
Professor in Civil Engineering.

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Rock Drill

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In 1813 Richard Trevethick the distinguished English engineer is said to have suggested rock drilling by machinery.

The Singer drill as used in Illinois is considered to have been the first successful machine for its purpose.

In the ordinary method of boring holes for blasting by striking at the end of the bar with heavy hammers, a great portion of the effect is lost by what is commonly called "inertia" of the bar.

To overcome this Mr Nasmyth proposed to convert the bar into a piston rod to work in an air tight cylinder through a stuffing box. By this means when the piston is drawn to the end of the cylinder the pressure of the atmosphere will force it back again with an accumulating velocity and the blow struck will have much greater effect.

The first American percussion rock drill was invented by Couch of Philadelphia. In his drill the drill bar passed ~~th~~ directly through the piston of the engine and was alternately caught, drawn back and thrown like a lance against the rock.

Some of characteristics of a good rock drill are:

It should be simple in construction & strong in every part

" " consist of few parts

" " be light in weight

No other part than the piston should be exposed to violent shocks.

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