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SELECTED QUESTIONS AND ANSWERS.

(Science and Art of Mining.)

SINKING.

Q.—Describe the method of sinking by means of compressed air. State why this method cannot be employed in sinking to an unlimited depth, and name a limit beyond which it cannot be safely employed.

A.—This method of sinking is sometimes adopted for sinking through very loose, wet ground, such as running sand, gravel, and moss. When the loose ground is near the surface and not beyond the limit of depth to which this system can be successfully adopted, sinking by means of compressed air may be employed safely and in some cases economically.

In this method of sinking a cast iron cylinder is sunk through the strata or beds of sand, by means of weights or hydraulic jacks. The cylinder is closed at the top, and compressed air is forced in to keep back the water, and to enable the men to work in the pit bottom. The cylinder may be said to be a type of diving bell.

The system and method of its adoption is as follows:

A strong timber frame is erected around the shaft at the surface, which forms a guide to keep the cylinder vertical. The cylinder is supplied with a sharp edge at its lower extremity for the purpose of allowing it to pass easily through the loose ground, and is built up of cast iron segments bolted together in the usual way. It is composed of three compartments, the lower one being the working chamber wherein the sand, stones, etc. are filled into hoppits, the sinkers working the loose material away from the cutting edge of the cylinder so as to facilitate its passage through the loose ground. The chamber is always kept under pressure by means of compressed air through a column of pipes travelling from the air compressing plant on the surface to the working chamber. The inner or middle chamber is called the air lock and has double doors. When men are descending into the mine or shaft they first of all enter the air lock, and the outer doors are closed. This chamber is then put under compression by means of air from the compressor, to about half the amount of compression in the lower chamber; when the men have accustomed themselves to this compression, the inner doors are opened, and they change places with the men in the lower or working chamber, the latter entering the air lock, and the men from the air lock entering the working chamber. After the late working party which are now in the air lock have got accustomed to the lesser pressure of the air lock the pressure therein is gradually reduced until they can with safety enter the third chamber which is open to atmospheric pressure, and then to the surface. Besides the men having to pass through the air lock, all material has to pass through i going both up or down the shaft, and in consequence thereof, this chamber is very often made as small as conveniently possible by means of a reduced diameter to minimise the loss of air consequent upon the opening of the doors. The inner and outer doors of the air lock must never be opened at one end the same time, but one must be kept closed as a check upon the other one. The cylinder is forced down the shaft as the strata are removed from the bottom of it either by the gravitation of its own weight (by having additional weight attached to it), or by means of hydraulic jacks applied at the surface. The men at work at the bottom assist the descent of the cylinder by the removal of any hard substances, boulders, etc., which may come into contact with the cutting edge. The water is kept from coming into the cylinder solely by the pressure of the compressed air, therefore the pressure of the air must be in excess of the pressure of the water, and as the pressure of water depends upon its vertical head we can ascertain the limit of depth to which this system can be employed. The rule is the pressure in lb. per sq. inch of a column of water one foot high = .434 ∴ vertical head × .434 = lb pressure per square inch. Therefore, as there is a limit to the successful compression of air, and the pressure of the air must always exceed the pressure of the water when men are in the shaft, this is one limit to its depth in working. But the limit which must always be taken into consideration, neglecting the above, is that when the pressure of the air is high the men employed in the cylinder can only work very short shifts, and then under great discomfort. In some instances they have not been able to work more than two hours out of the 24. It has been found that the greatest pressure under which men can work is about 45lb. per square inch, and this will, therefore, give us a depth limit of

$$\frac{45}{.434} = 103.686 \text{ feet.}$$

so that the limit of depth to which this system can be safely employed is about 100 feet.

After the sinking has reached the stone head a suitable place is prepared a sufficient distance down the stone head, and a waterproof joint made between the stone head and the cast iron cylinder, which may be left in the shaft to act as tubbing with or without an inner lining of masonry; or the cylinder may be extracted if desired, but it is usual to leave it in for tubbing.

FAULTS.

Owing to the great igneous and volcanic activity at the close of the deposition of the carboniferous system of strata, the coal measures exhibit what are known as 'faults' in abundance. The mountain limestone, where it outcrops at the surface, is observed to be much joint-