Precautions Against Mine Gas by Thomas Mark

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For every ton of coal removed from the working face, anything up to 200 m3 (7000 ft3) of mine gas is released; the average amount in the Ruhr coal-mining district is 30 m3 (about 1000 ft3). This gas consists of hydrocarbons, chiefly methane (CH4) and is known as firedamp, more particularly when it occurs in an explosive mixture with air (when the gas concentration in the air is between 4.5 and 14.5%). Methane is a colorless, odorless, and tasteless gas.

Firedamp explosions have been the cause of many catastrophes and a vast number of deaths in the history of coal mining. The initial explosion is liable to ignite the cloud of coal dust that the blast disperses. When the air contains between 700 and 1000 grams of coal dust per cubic meter, it constitutes an explosive mixture. A coal-dust explosion produces carbon monoxide (CO), which is a serious danger to human life because of its toxicity.

Accordingly the main object of research, supervision and legislation relating to safety in coal mines is to develop and improve the precautions against the occurrence of such mishaps. Essentially, the aim is to eliminate all possibility of ignition of such explosive mixtures. The emission of gas from the coal is a natural phenomenon associated with the constitution of the coal and adjacent strata, and except in some rare circumstances where methane gas can be removed in advance by suction, it is not possible to reduce or effectively control this emission.

The application of special procedures in extracting the coal, high speed of advance at the coal face, complete sealing off of old workings by suitable stowing (backfilling), etc., may have a favorable effect. It nevertheless remains essential to conform closely to safety regulations and to take all manner of technical precautions to prevent the occurrence of any spark or flame that might set off an explosion, including a strict ban on smoking. There remain potential sources of ignition in the use of explosives and electricity underground. Frictional heating of machinery and spontaneous-combustion phenomena, which may arise under certain conditions are also hazards.

An effective measure consists in keeping the workings supplied with fresh air in quantities large enough to ensure that the mine-gas concentration will at all times remain below the explosive level. The first important development in overcoming the firedamp menace was the invention of the safety lamp by Davey in 1816.

The lamp which burns a liquid fuel is provided with an enclosure of metal-wire gauze above the glass. If the air surrounding the lamp contains mine gas, the flame of the lamp will ignite the gas, but the latter will burn only inside the gauze enclosure; the flame will not ignite the gas all round the lamp. It is the high thermal conductivity of the gauze that arrests flame propagation.

The lamp is used today as a detector for gas, which burns with a characteristic flame called a gas cap that appears when the flame in the lamp is lowered. The length of the gas cap provides an indication of the percentage of gas in the air. A countermeasure against the formation of highly inflammable and therefore explosive coal-dust clouds consist in dusting i.e., specified quantities of stone dust are deposited throughout the mine, more particularly just before blasting is to take place.

The cloud of dust thrown up by the explosion is rendered nonflammable by the presence of the stone dust. Stone dust is also used as a means of arresting the propagation of explosions. For this purpose a device called a stone-dust barrier is installed at strategic points in the mine. It may take the form of a light tilting platform on which a quantity of stone dust is placed. In the event of an explosion in the vicinity, the dust is flung off and forms a dense cloud which absorbs some of the

energy of the blast and also exercises a cooling action which smothers the flame.

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