GOVERNMENT TESTS OF SAFETY DEVICES FOR MINES.

Determined endeavors to stop the appalling sacrifice of human lives in the coal mines of the United States are to be made at once by the fuel division of the Geological Survey, thus supplementing its efforts to lessen the waste of fuel in mining operations.

Plans have been drawn for a unique experimental station at which tests of the various dynamites and powders used in blasting coal will be made with a view to determining accurately their safety in the presence of the deadly fire-damp and perhaps equally deadly coal gas. Explosives of all sorts will be hurled by means of a mortar into a mammoth boiler-plate cylinder which has previously been filled with gas, and the effects will be carefully noted. If ignition fails after severe test the explosives will be known as "permissible explosives" and their use will be urged upon the mine owners of the country.

In addition there will be important experiments in rescue work. One part of a station will be fitted up as a miniature coal mine, and miners and operators will be taught the noble art of saving the lives of fellow men. It is declared that in serious gas explosions in mines, hundreds of lives could be saved were it possible for the rescue party to enter immediately after the accidents. As it is now, the deadly fire-damp often holds the men back for hours while their comrades are slowly being suffocated or burned to death.

In their investigations so far, the government experts have found an apparatus in Europe, which when worn by the members of a rescue party, enables them to enter any place where there is gas. At the experimental station, the miniature mine will be filled with dense smoke and practical demonstrations in the saving of life with this apparatus will be made.

A definite location for the experimental station has not yet been selected, but it is probable that the station will be in the Pittsburg district.

"We intend to begin the erection of this station within a few weeks," said Dr. J. A. Holmes, chief of the fuel testing branch of the Geological Survey. "There seems to be no end to the gas and coal-dust explosions in mines. Instead of growing less, these horrors appear to be multiplying. On the first of this month, twenty-one men lost their lives in the Whipple Mine, in Fayette County, West Virginia, by an explosion of gas. This gives West Virginia a record of 103 lives lost in mine explosions during the first months of this year. On January 29 eighty-two men were killed in the Stuart Mine, also in Fayette County.

"In 1906, the coal mine death roll in Pennsylvania was 500. Two hundred and fifty died as the result of gas or dust explosions. The others were the victims of other accidents. We believe that this tremendous loss of life is unnecessary and it will be our purpose to investigate the subject in a most thorough and practical manner. We shall not be satisfied until we have reduced these accidents in coal mines to a minimum.

"From our investigations so far, the United States is behind Europe in safeguarding the lives of the men in the mines. England and Belgium have had for years splendid experimental stations, and in these countries there are but few casualties in the mines. The Belgium mines are notorious for the presence of fire-damp, yet that country has enjoyed a wonderful immunity from these terrible explosions.

"As a result of the experiments in England there are a number of 'permissible explosives,' and these must be used by the miners in the blasting of coal and no others. They also have in England what is known as the 'limit charge' which must not be exceeded on pain of severe penalty.

"In the various States here there are but few regulations, and none in many States when it comes to the kinds of powder to be used.

"While we cannot compel the adoption of regulations we will conduct the investigations and will give the facts to the public in the hope that great good may follow."

Officials of the Geological Survey have been watching with considerable dismay for some time the frequently recurring accidents in different parts of the country. Some of the recent mine explosions in one State, West Virginia, are as follows:

Mine.	*Date.*	*No. killed.*
Red Ash	March 6, 1900	100
Rush Run	March 18, 1905	24
Bluefield Coal Dale Mine	January 4, 1906.	22
Paint Creek, Detroit Mine	January 18, 1906.	18
Fayette County, Paral Mine	February 8, 1906.	22
Phillipi Century Mine	March 25, 1906	26
Fayette County, Stuart Mine	January 29, 1907.	82
Fayette County, Whipple Mine	May 1, 1907	21

Clarence Hall, explosive expert for the government, who has charge of the plans for the proposed experimental station, recently returned from England and Belgium where he examined the stations there. In these and other European countries, the mine owners, the miners, the government, and the manufacturers of explosives all co-operate in the effort to prevent the dreadful explosions. The results of these experiments go to show that a large number of the explosions in coal mines are due to coal dust rather than gas. The worst explosion that has occurred in Germany in the last few years was due to coal dust. Nearly two hundred lives were lost in the Reden Mines. Perhaps the greatest accident in many years occurred at the Courrieres mine at Pas de Calais, France, on March 10, 1906, when 1,300 lives were lost. This explosion was probably due to coal dust.

That part of the experimental stations in which the explosives are to be tested will be in the form of a cylinder, 100 feet long and 6 feet in diameter, lying on the ground. An explosive mixture of fire-damp and air in one case or coal dust and air in another will be pumped into the cylinder and the explosive to be tested will be shot into it from one end by a big steel mortar so that the flame and products of combustion will go right into the fire damp. If the station is erected within the Pittsburg coal district, natural gas will be used for testing purposes.

The cylinder is to be made of heavy boiler plate. Safety valves will be placed all along the top and will be left unfastened in such a manner that whenever there is an explosion, the valves will fly open on their hinges. A series of port holes on the side, covered with ½-inch glass, will enable those conducting the experiments to witness the explosions from the observation house, sixty feet away. The steel mortar which will hurl the explosives into the cylinder will be fired by electricity from the observation house, which is to be parallel with the cylinder itself.

While these tests are being conducted, operators and miners will be invited to be present. In order that they will be able to see clearly the explosions of gas or dust, a piece of oil paper will be placed across the face of one of the safety valves with a piece of gun cotton suspended about six inches away. When an explosion occurs, the flame will burn the oil paper and ignite the gun cotton.

While in England, Mr. Hall received courteous attention from Capt. J. H. Thompson, his Majesty's chief inspector of explosives. Capt. Thompson declares that although Great Britain was one of the most important coal mining countries in the world, gas and dust explosions had been reduced to a minimum by the precautions taken.

In Belgium, Mr. Hall witnessed also a unique test of safety lamps. The lamp which is used mostly in the mines of the United States behaved the worst and ignited the gas each time. A self-igniting lock lamp made in Germany proved the best. Belgium's experimental station was intensely interesting to Mr. Hall, the gas used in the tests coming from an abandoned coal mine.

At the rescue station there he found apparatus which is capable of sustaining life where there is fire-damp or among the poisonous vapors that follow the mine explosions. He hopes to have this apparatus introduced in this country, believing it will be the means of saving many lives. It consists of a canvas jacket equipped with cylinders of compressed oxygen connected with the operator's mouth by a flexible, rubber-lined metallic tube. The use of the oxygen is regulated by a pressure gage. The exhalation of the operator is passed through small lumps of potassium hydroxide, the carbon dioxide being absorbed, and the remaining product, together with more oxygen, is again available for the operator.

With this jacket on, in the event of an explosion, one could enter a mine immediately and undoubtedly save many from a terrible death by suffocation. At present no apparatus of such a nature is known to be in the United States. It would be the purpose, if the experiments are satisfactory here, to urge mine owners to keep these jackets in the mine and also above ground. The device will be given a thorough test in the miniature mine which is to be erected in connection with the experimental station. In this mine there will be drifts, headings, rooms, and ladders. After it is filled with smoke, miners will be instructed to enter and search as they would for their fellow-workmen.

When the most recent explosion occurred in West Virginia at the Whipple Mine, Mr. Hall visited the mine to learn if possible the exact cause of the explosion. The explosion occurred May 1 at 3:30 P. M., and Mr. Hall arrived on the ground within a few hours. In but a short time he learned that the explosion was the result of heavy blasting, which in itself was due to the hurry of two men to complete a disagreeable job. The men had struck a fault in the coal, and were going through a rock heading to get to the coal again. The men were being paid $2.50 per day while blasting away the rock, and as soon as they completed this work, were to be placed back at coal mining, which netted them between $5 and $6 per day. Hurrying through with their work, it is said they failed to undercut the coal, as it would take time. This in itself is against the laws of West Virginia. Blasting on the solid required a heavy charge of dynamite and this it is believed led to the explosion.

The explosion in the mine gathered force as it went along, for the reason that there was not enough air at the origin to cause a complete combustion. At a distance of 1,200 feet away, the greatest destruction was found. Altogether twenty-one men were killed and three injured. The two men whose hurry to get back to piece-work caused the explosion were found dead side by side, some distance from the scene of blasting, whither they had gone to await the outcome of the shot. Mules in one underground stable were found slightly burned, and in another stable they were untouched, only hungry. A mule in one of the passageways was found wandering about in the most disconcerted manner. His driver, who had abandoned him to make his escape when the explosion occurred, was found dead a short distance away. Had he remained with his mule, undoubtedly he would have been saved. The Whipple Mine, owned by the White Oak Fuel Company, is considered the best equipped in the State, and no one seems to attach any blame to the management for this explosion.

SCIENCE NOTES.

The excavations in Rome being conducted on the Palatine Hill have shown a curious and interesting circumstance. The Necropolis has been found to contain remains of the ninth, eighth, sixth, and fourth centuries before Christ. All fragments of the seventh and fifth centuries are lacking and archeologists are engaged in a close study of the field in order to find the reason.

A new compound of tantalum has been prepared by C. Chabrie, of Paris. The chloride of tantalum $TaCl_5$ is the only one which has yet been prepared, but it seemed likely that others existed, seeing that several inferior oxides of tantalum are now obtained. The author prepares a sub-chloride corresponding to the lower oxide Ta_2O_2 by reacting with the above-mentioned chloride upon sodium amalgam taken as a reducing agent. He places in a Jena glass tube a mixture of pentachloride of tantalum and a three per cent sodium amalgam. This mixture heats up spontaneously. It is brought gradually to a red heat after a vacuum is made in the tube. Cooling the mass *in vacuo*, we pour the contents of the tube into a capsule containing acidulated water, then filter and concentrate rapidly under pressure so as to avoid overheating. The solution, which has at first a dark green color, becomes lighter and deposits a green crystalline powder, and this is dried and examined. When seen under the microscope, the powder shows hexagonal crystals of a fine emerald green. Analysis shows the new body to have the formula $TaCl_2$, $2H_2O$. This compound is soluble in water when freshly prepared; it is but slightly soluble, however, and more so in hot solution. When left in the air the solid product is changed to a brown body, while keeping its crystalline form. Heated in air upon platinum foil it decomposes at a red heat with incandescence, giving off chlorine and leaving tantalic anhydride. The green crystalline body treated with nitric acid does not give tantalic acid, but a reddish brown powder which seems to be formed by an oxidation coming between the tantalic anhydride and the sub-oxide above mentioned. Nitric acid or bromine water transforms the green solution into a red liquid which tin chloride restores to the green color.

Up to the present, but a single combination of silicon and tungsten has been made. The two elements, heated in the electric furnace, give a compound of metallic appearance which is crystalline and hard enough to scratch the ruby. It corresponds to the formula Si_2Tu_3. M. Ed. Defacqz now succeeds in forming a new silicate of tungsten having the formula Si_2Tu. It is prepared by two different methods. In the first, silicide of copper is heated in the electric furnace with amorphous tungsten prepared by reducing tungstic anhydride by hydrogen at a red heat. We take 90 parts silicide of copper and 10 per cent of tungsten, heating for one minute with a current of 900 amperes and 50 volts. The metallic mass is then treated by nitric acid and soda, and we finally have a residue of small crystals, which form the new body. The alumino-thermic process can be also used, taking calcined silica 180 parts, tungstic anhydride 45 parts, flowers of sulphur 250, and powdered aluminium 200 parts. After igniting the mass in a crucible and cooling, we have a metallic ingot from which the new compound can be separated. As regards its properties, the silicide of tungsten appears in the form of fine prismatic needles, which are very brilliant and of a light gray color. Its density is 9.4 at the freezing point. It is non-magnetic. Chlorine attacks it easily at about 450 deg. C. forming chloride of silicon and hexachloride of tungsten. When heated in air to 900 deg. C. it is not changed. Copper decomposes it at 1,200 deg., forming silicide of copper and also tungsten. Gaseous hydrochloric acid has no action upon it at a red heat, nor most of the other acids. A mixture of hydrofluoric and nitric acids attacks it violently, leaving a residue after calcination of tungstic anhydride. Oxidizing mixtures such as alkaline nitrates and chlorates will dissolve it when heated above their fusing point.