

Gun-cotton.—Military Gun-cotton, equal to 0.81 cubic inch NO_2 per grain, enclosed in a very thin brass, common in army service, ignited firedamp once out of three experiments. Mining gun-cotton equal to 8.76 cubic inch, NO_2 per grain, a little less strongly compressed than military gun-cotton, and without a case, ignited the gaseous mixture ten times in ten tests, both with the larger—12.8 per cent.—as well as the smaller—5.7 per cent.—proportions of firedamp. Gun-cotton equal to 0.68 cubic inch NO_2 per grain, strongly compressed, and without a case, fired by the action of two detonators of 23gr. fulminate, ignited the gaseous mixture in the one experiment which was made.

Blasting-gelatine and Gelatine-dynamite.—Blasting-gelatine is a solution of gun-cotton in nitro-glycerine, forming a sort of gum rather than gelatine. The gun-cotton, only in small proportion, should be just sufficient to be completely burnt by the excess of oxygen of the dynamite. Gelatine-dynamite of much more variable composition is formed of blasting-gelatine, with the addition of a dual mixture, such as nitrate of potash, or of soda, and charcoal, or sawdust. In warm weather, such as is experienced in France in May, these explosives are fired easily. During winter their explosion has almost always been incomplete, if not nil, with caps of 23 gr., and with gelatine-dynamite even of 46gr. of fulminate.

This incomplete explosion can be very simply observed by noting the compression produced in the boiler by firing of the cartridges when the boiler was filled with air, or when filled with gaseous mixture, which was not ignited by the explosion. It is certain, when the gaseous mixture was not ignited, the explosion of the blasting-gelatine, or the gelatine-dynamite, did not cause a higher pressure than a few inches of water. The firing of the detonator did not produce a sensible pressure. The cartridge detonated, therefore, but only in a very partial manner, and, under these conditions, did not ignite the gas. By increasing the power of the detonator the ignition of gas with blasting-gelatine and gelatine-dynamite was insured. It may be said the blasting-gelatine and gelatine-dynamite ignite firedamp in which they are suspended any time that they explode more or less completely. These facts have induced the careful study of the method of firing explosives unconfined. The researches on this matter are recorded subsequently.

Hellhoffite.—Hellhoffite has not been exploded unconfined. This explosive is said to be composed of dinitro-benzol mixed with one and a half to two and a half its weight of nitric acid. The mixture is made just before using, which appears to be an obstacle to its customary employment in mines.

Favier Explosive.—Mr. Favier's explosive, as introduced by him to the Explosive Substances Commission, is essentially composed of a mixture of 9 per cent. of mono-nitro-naphthalene, and of 91 per cent. of nitrate of ammonia, so that the nitro-naphthalene exactly utilises, in burning the excess oxygen in the nitrate. The two substances are intimately mixed, and very strongly compressed. A cylindrical hole in the middle of the cartridge, weighing 849gr. contains 77 of powdered material, which acts as an intermediate detonator, and is principally composed of gun-cotton and nitro-glycerine. The Favier explosive does not explode unconfined. This is rather an advantage than an inconvenience, if there was a certainty of its detonation when it is stemmed in a shot-hole, and if under these conditions there was no fear of missed shots. Experiments made in the mine can alone solve this question. Stemmed in metallic tubes, in the manner which will be described further on, this explosive will only be detonated very incompletely, even with 77gr. of fulminate. It happened once out of two tests that the gaseous mixture was ignited by detonation of three plugged caps of 23gr. fulminate, not of the Favier explosive itself in its compressed state, but the material of the explosive reduced to a fine powder.

It is desirable that new trials should be made upon this substance, which, on account of the similarity with the explosive proper, should not be condemned without further consideration as regards safety. In any case, it would be necessary to modify the nature of the intermediate detonator, which, in itself, appears liable to ignite gaseous mixtures.

Bellite.—Bellite, recently introduced by Mr. Lamm, should be, according to the inventor, composed of 80 parts of nitrate of ammonia, and 20 parts of dinitro-benzol. This explosive, as shown later, is completely detonated when confined. Unconfined, it fires incompletely with a detonator of 19gr. of fulminate. Its detonation is still incomplete, although more marked, with 46gr. of fulminate. Two tests were made under the last conditions on a warm moist day without causing the ignition of firedamp. The composition of bellite, as stated by Mr. Lamm, does not seem to be exact. Experiments made with a bomb have, indeed, at a charging-density of 0.3, shown a pressure of 181lb., whilst the theoretical pressure—according to calculations shown subsequently—should be, at that density, about 239 foot-pounds. The mixture of 20 parts of dinitro-benzo and 80 parts of ammonia gave under the same conditions, a pressure of 275 foot-pounds, which more nearly approximates to the theoretical figure, but which is considerably more than that obtained with bellite. A cartridge of 772gr. made with this mixture did not ignite the gaseous mixture in the midst of which it was exploded.

Gun-cotton with Nitrate of Barium.—A powder manufactured some years ago at the Moulin-Blanc Powder-mill, and which was found in the magazines at Sevran, was tested. According to the analysis of Mr. Bruneau, it consists of—Nitrate of barium, 42.6 per cent.; and gun-cotton, 57.4 per cent. A cartridge of this substance exploding in a gaseous mixture ignited it. A nitrated cotton from the Wetteren Powder mill, Belgium, which is also a mixture of gun-cotton and nitrate of barium, also ignited the gas.

Pyroxyline-powder from Moulin-Blanc.—The pyroxyline-powder is a mixture composed of—Nitro-cellulose, equal to 0.69 to 0.73 cubic inches NO_2 per grain, 60 per cent. nitrate of barium; 30 per cent. saltpetre; 6 per cent. bone-gelatine; 3 per cent. and 1 per cent. of paraffin. The substance which is sold to the public as a granular powder has been used in these experiments in the shape of prismatic cartridges, very strongly compressed and coated with paraffin. It explodes easily when unconfined with a detonator of 23gr. of fulminate. In fourteen experiments made with this substance suspended in the midst of a gaseous mixture it only twice happened that the detonation of the explosive caused the ignition of the gas. These two experiments were made on a very warm