HIGH EXPLOSIVES FOR ARTILLERY.

In order that an explosive may be suitable for use in artillery shells it has to possess special qualities not necessary in other uses. The essential features are as follows. It must have great power, i.e. it must develop much gas and heat, it must not be too sensitive, i.e. it must be capable of withstanding the enormous shock due to firing and that due to piercing armour plate so that it does not explode before the fuse acts, it must have a high density so that a large weight may be enclosed in the limited space, it must have a high velocity of detonation giving a great shattering effect, and it must be capable of complete detonation with certainty of action when required.

All the nitroglycerine and chlorate explosives are excluded on account of their sensitiveness. Ammonal and other ammonium nitrate explosives are on the other hand too insensitive requiring as they do large fulminate detonators which are unsafe in shells.

No high explosive answers all the requirements as set out above and those used today have little more than half the shattering power of blasting gelatine and all are products of coal distillation.

From the period of 1871 when picric acid was first detonated to the present day, many explosives have been produced. Prior to 1871 gun powder was the only explosive known. In 1885 shells were first filled by picric acid and the French adopted it under the name of Melinite and later the British under the name of Lyddite. Later Tri-nitro-cresol, Tri-nitro-toluene and other nitro-compounds were introduced and are now in use.

When coal tar is distilled the first portion which comes over at temperatures up to 150 degrees C. is the 'light oil' which is crude benzol, mostly benzene and toluene in percentages varying, according to the character of the coal used, from 50 to 70 benzene, 10 to 40 toluene and 1 to 3 xylene, with small traces of naphthalene and acids. The second portion, or 'middle oil' contains phenol and other bodies and the last portion—the 'heavy oils'—also contains valuable compounds.

The benzine is used as a nitro-compound in explosives and in a synthetic process for making phenol while toluene is used for making T. N. T. explosive.

Phenol, commonly called Carbolic Acid when mixed with concentrated nitric acid, a violent reaction takes place and the trinitro compound, **Picric Acid** is formed. In appearance it is yellow, needle shaped. It is slightly soluble in cold water, has an intensely bitter taste and is poisonous. Formerly, its chief use was as a dye for silk and wool.

It is not very sensitive and will only just detonate when hammered on an anvil and 1 to 2 grams of fulminate of mercury will detonate any quantity with certainty. It can also be detonated by picrates and other compounds less sensitive than fulminate.

As has already been stated **Lyddite** is the British name for Picric Acid. When fully detonated it gives a dense black cloud of smoke owing to its deficiency of oxygen which renders it useful for observation purposes. The rate of detonation is about 7.700 metres per second.

Lyddite has, however, the disadvantage of its liability to form picrates when in contact with metallic substances and these picrates being sensitive to shock introduce a dangerous feature if present in the shell. Hence all shells have to be properly cleaned and lined with a non-metallic varnish and no lead paint or lead alloys in the fuze are allowed in contact with the filling.

With pure picric acid and proper precautions it forms the most powerful and reliable shell filling in use. It is not affected by high temperatures.

Tri-Nitro-Cresol.—Cresol is similar to Phenol and is also obtained from coal tar. When nitrated it forms tri-nitro-cresol. Its properties are very similar to those of picric acid.

Tri - Nitro - Toluene (commonly known as 'T.N.T.' is the most important of shell high explosives. In the service it s known as **Trotyl.** It is made by nitrating Toluene which, as before stated is obtained from coal tar.

Pure T. N. T. forms yellow crystals insoluble in water. When heated to about 300 degrees C. it ignites and burns with a hot but very smoky flame. When a large mass of T. N. T. is involved the heat generated will be sufficient to raise the temperature to the detonating point. The disasters of East London and Halifax are instances of this.

It is more sensitive than picric acid and very difficult to detonate by hammering. It is fully detonated by fulminate and can be detonated by less sensitive substances. When T. N. T. is detonated a thick black smoke is produced, giving rise to the name 'coal boxes' and 'Jack Johnsons'. The velocity of detonation is 7000 metres per second. The power is about 9 per cent less than picric acid. It has advantages over picric acid in the matter of manufacture as the melting point is lower. It is a neutral substance and does not form sensitive compounds such as picrates with metallic substances.

Amatol is made by mixing T. N. T. with ammonium nitrate, and gives a little grey smoke on detonation.

Tetryl (known in the service as C.E.) is made by nitrating methyl or di methyl aniline. The uses of C.E. are extending although it will probably prove too expensive as well as too sensitive for use as a shell filler.

Tetra-Nitro-Aniline is made by the nitration of ordinary aniline. It is not adopted as a service explosive but has great possibilities. It flashes without smoke, is semi sensitive, is easily detonated by fulminate and is said to be as powerful as pure nitro-glycerine.

Hexa - Nitro - Diphenylamine is made by nitrating diphenylamine. It is a powerful high explosive but rather too sensitive for shell filling. A mixture with T. N. T. has been used by the Germans for aerial bombs.

Tri-Nitro-Anisol is made by nitrating Anisol. It resembles picric acid and has been used in shells and bombs.

Nitro-Benzines. Bellite and Roburite are mixtures of di-nitro-benzines and ammonium nitrate the former being used largely in grenades.

WAIL FROM QUARANTINE CAMP.

Will our field postmaster kindly explain why a letter properly and fully addressed, (in type) and mailed at Winnipeg September 14th, did not reach the addressee until Tuesday, October 2nd, when it bears field post office receiving stamp dated September 16th.

Pte. No. 3346687.

In the good old days our mail came along regularly under an Engineer Sergeant but now we have an Officer and Sergeants and even a Cadet there too. The present postal arrangements are far from satisfactory and yours is not the only complaint of this nature we have received, and we feel confident that they are one and all well merited.—Ed.

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