

Smokeless Powders

Every year since the site closure programme thirty years ago, a number of former Royal Ordnance Factory employees meet up for a Christmas lunch; always a very enjoyable affair which I try not to miss. This year it was at the Royal Automobile Club (RAC) on Pall Mall, London. One of those present was David Izod. Back in the seventies he and I had adjacent offices in the British Embassy, Washington DC. David went on to be Superintendent of Explosives at Fort Halstead, subsequently taking on senior positions in what was by then Royal Ordnance plc and later British Aerospace. One of these was at RSAF Enfield. His final appointment was as a Visiting Professor at the Defence Academy, Shrivenham. Anyway, over the RAC lunch we got to discussing our various adventures with “energetic materials” and he mentioned smokeless powders, including “Rifleite”. Now this was a new name to me so I asked him what he knew about it. His notes on the subject are below; I can do no better than to reproduce them verbatim.

“War is the realm of uncertainty; three quarters of the factors on which war is based are wrapped in a fog of greater or lesser uncertainty.”

Carl von Clausewitz 1832

One of the factors of uncertainty was the “fog of war” caused by use of black powder in cannon and small arms, preventing the ability to see what was happening on the battlefield.

The .303 British rimmed rifle cartridge was developed as a black powder-based round and put into service in 1888 for the Lee-Metford rifle which had rifling designed to lessen fouling from this propellant. The British Committee on Explosives caused experiments to be conducted on many smokeless powders then coming to the market. Amongst these were Ballistite, Cordite and Rifleite.

The Committee on Explosives, chaired by Sir Frederick Abel, monitored foreign developments in explosives and obtained samples of the French Poudre B developed by Paul Vieille in 1894, and Ballistite. Neither of these smokeless powders were recommended for adoption.

In 1887, Alfred Nobel invented and patented a smokeless propellant he called Ballistite. It was composed of 10% camphor, 45% nitroglycerine and 45% collodion (nitrocellulose). Over time the camphor tended to evaporate, leaving an unstable explosive.

Abel, Sir James Dewar and W Kellner, who was also on the committee, developed and jointly patented (Nos 5,614 and 11,664 in the names of Abel and Dewar) in 1889 a new ballistite-like propellant consisting of (by weight) 58% nitroglycerine, 37% guncotton (nitrocellulose) and 5% petroleum jelly. Using acetone as a solvent, it was extruded as spaghetti-like rods initially called "cord powder" or "the Committee's modification of Ballistite", but this was swiftly abbreviated to Cordite. Sadly, Nobel sued Abel and Dewar over patent infringement, eventually reaching the House of Lords and Court of Appeal where Nobel lost his case. Nobel felt that his trust had been betrayed.

Cordite began as a double-base propellant. In the 1930s triple-base was developed by including a substantial proportion of nitroguanidine. Triple-base propellant reduced the disadvantages of double-base propellant – its relatively high temperature and significant flash.

In 1891 cordite was selected because of its high Force Constant, lowest barrel wear and barrel erosion. The Royal Small Arms Factory changed the land profiles, and the gun became known as the Lee-Enfield. Later, the form of the propellant was changed to cut tubular and produced before WW2 and onwards at many commercial, Royal Ordnance Factory sites and Waltham Abbey. Because of the peace dividend, by the 1980's ICI Ardeer was the sole supplier based on a Ministry of Supply contract dating back to those earlier days. Unfortunately, because of privatization, Royal Ordnance were unable to compete on the world stage with its 5.56 mm ammunition without switching to the cheaper ball powder.

ICI stuck to their original contract or “guns” if you pardon the pun so the change to ball powder occurred and Ardeer sadly closed down.

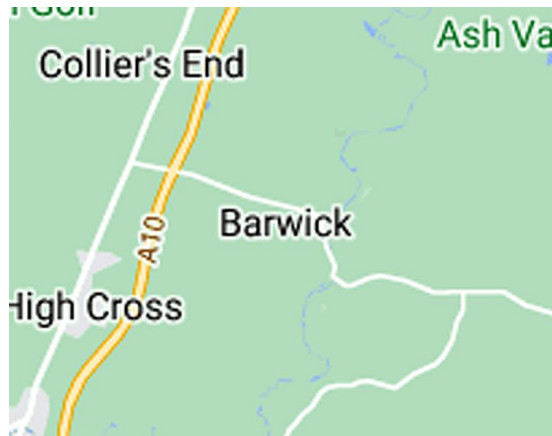
Turning to the other main contender, Rifleite. The Smokeless Powder Company (SPC) of Barwick Hertfordshire manufactured their



A 303 round showing cordite propellant

propellant consisting of nitrocellulose and dinitrotoluene to which barium and potassium nitrates and wood meal were added to improve the oxygen balance and probably slow the burning rate. Kynoch's also made a similar smokeless propellant. The snag with dinitrotoluene is that it is decidedly poisonous. There are four isomers of dinitrotoluene with melting points in the range of 48 deg.C to 70.5 deg. C. so it is easily melted safely with hot water. It was produced in the form of flakes.

SPC was founded in 1888 by James Daziel Dougall Jr., son of the famous Glaswegian gunsmith. He took a 99-year lease for 126 acres of land from the Youngsbury Estate and built a factory estate called Barwick. This was designed and superintended by Ernest Spon who was a well-respected engineer.



The venture was successful as the first modern producer of smokeless powders for use in torpedoes, artillery shells, small arms, and mine blasting, selling to overseas governments as well extensively in the UK. It must have been a bitter blow to lose the Committee on Explosives competition. The company experienced two fatalities in 1893 caused by a fire and explosion in a drying house. Later in 1898, SPC was sued by the Dynamite Nobel Trust for patent infringement. They won their case but the financial drain in doing so caused the company to enter liquidation.

Explosive materials continued to be manufactured by different companies on the site including Sabulite, a blasting explosive and later producing snaps for Christmas crackers. However, it is now a derelict works. Some of the remains of the original SPC facilities can be seen such as concrete magazines with their blast mounds, rifle butts and the remains of the drying houses.

Geoff Hooper