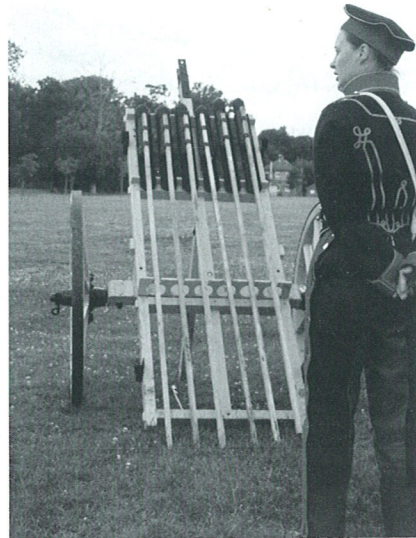


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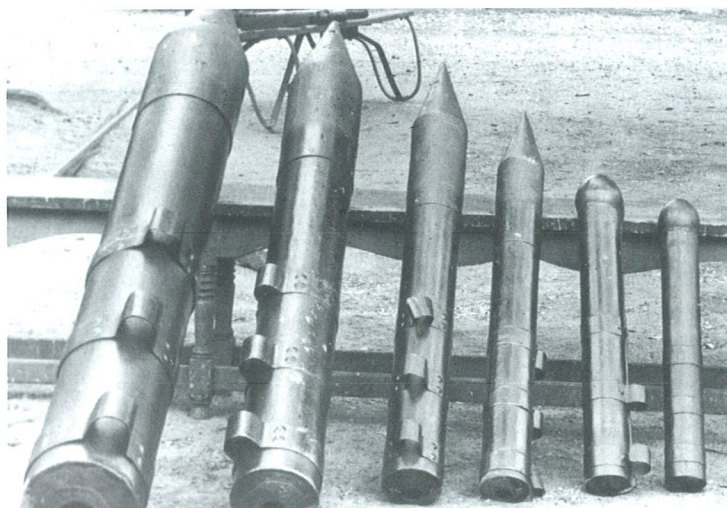
One of William's most memorable inventions was the improved gunpowder rocket. A crude form of the missile had been used against British troops in India during the late eighteenth century. By the early nineteenth century Congreve, through his experiments, had doubled the range of the rocket to around two-thousand yards and he later set up a factory to manufacture them on West Ham Marsh, adjacent to the River Lea at Bromley-by-Bow. As would be expected, he obtained all his powder for rocket production from the Royal Gunpowder Mills at Waltham Abbey.



Rocket Troop member standing next to Congreve rockets ready for firing. The largest Congreve rocket ever manufactured weighed 32 pounds; the head measured three feet and required a stabilising stick of 15 feet (4.57 metres).

Although not always accurate, sometimes due to the strength and direction of the prevailing wind, the rockets were used with some effect during the Napoleonic campaign at Boulogne, Copenhagen, Leipzig and Waterloo. When such new weapons were introduced to the theatre of war there were reports that their noise, glare and incendiary power caused panic amongst the enemy. Interestingly, Congreve's rockets are famously recorded in the United States national anthem in the verse "the rocket's red glare, the bombs bursting in air". This refers to the conflict with America between June 1812 and December 1814 when the rockets were employed in the bombardment of Fort McHenry.

By the middle of the nineteenth century there was a growing need for an explosive more powerful than gunpowder, as the size of guns increased, through advancements in manufacturing machinery and engineering technology. These improvements in artillery caused



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A range of William Congreve's gunpowder rockets.



Sir Frederick Abel (1827–1902) KCB, FRS, was the War Office Chief Chemist. He was responsible for developing the explosive Cordite, which was manufactured in large quantities at Waltham Abbey.

the demise of Congreve's rocket for battlefield purposes but they were adapted as flares (the parachute flare was a Congreve invention) and they were also used for firing safety lines to ships in distress during rescues at sea.

On the Continent, gun cotton (a mixture of nitrating acids on raw cotton) was emerging as the new powerful explosive. Production however was slow and hazardous. In 1863, Sir Frederick Abel, the War Office Chief Chemist set up an experimental plant at Waltham Abbey to test his ideas regarding the safe production of gun cotton. His experiments were successful and the end product proved stable, which gave the ability to manufacture large quantities of the material. Perhaps the greatest compliment to Abel was that his process was widely copied and the product was welcomed not only by the military but also by civil engineers who used it for blasting in quarries and mines.

In 1847 the Italian chemist Ascinao Sobrero, working under T.J. Pelouze at the University of Torino discovered Nitroglycerine, a highly volatile liquid explosive formed by the combination of glycerol and nitric and sulphuric acids. In 1867 the Swedish chemist, Alfred Nobel was able to combine Nitroglycerine with absorbent clay and his invention became Dynamite. In 1890 Sir

Process workers at the Royal Gunpowder Mills in front of a Cordite press. The woman to the left of the picture is holding a length of Cordite, a so-called smokeless explosive. Women workers were taken on at the factory for the first time during the Great War.

