Gunpowder

火藥

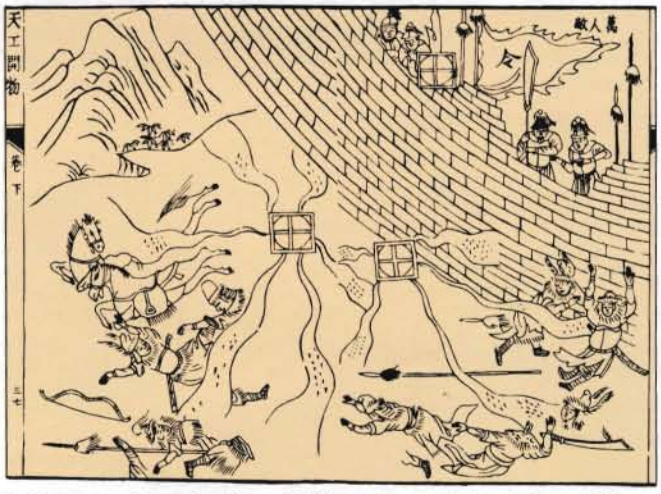
In ancient times the emperors of China sent expeditions to the remotest parts of the empire and beyond in search of the men who were reputed to be immortals, in the hope of learning the secret of their "elixirs of eternal life." Taoist alchemists were brought to court to prepare drugs by heating cinnabar (mercuric sulphide), arsenic and other minerals which were thought to be the essential ingredients of any formula for immortality. No one succeeded in this quest but the search did encourage ceaseless experimentation.

The Chinese alchemists were working with sulphur and saltpetre by the 1st century BC and during the course of their experiments many fires were started. By the 8th century AD, in the mid-Tang dynasty, the potentialities of these substances when combined with charcoal were realized as the Chinese discovered an explosive mixture which they still call *huo yao* ("fire medicine") which came to be known in the west as gunpowder.

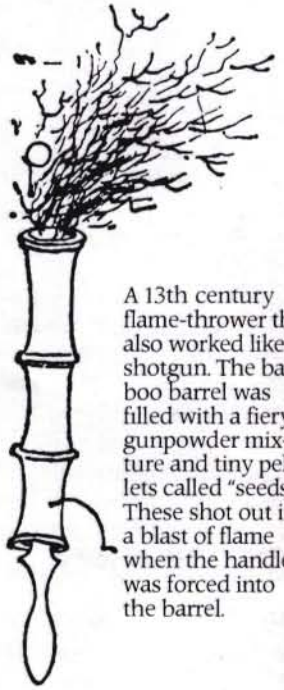
When saltpetre (potassium nitrate), sulphur and charcoal are mixed into black powder and ignited, the three ingredients react violently and emit great heat. Originally the three constituents were used separately as medicines. Sulphur was used to treat skin diseases (as it still is) while saltpetre was used to dispel fevers, treat stomach ailments and to disperse internal accumulations of blood. As recently as the 16th century gunpowder was still classified as a medicine because of its use in treating: "ringworm sores, insects, eczema and pestilence," hence the retention of the name "fire medicine."

Within a few years of its discovery gunpowder was put to use in warfare. In 1044 Zeng Gongliang wrote a military encyclopaedia, the *Wu Jing Zong Yao (Compendium of the Most Important Military Techniques)* which included the oldest recorded formula for gunpowder. It also details the formulae for poison smoke-grenades and spiked pottery firebombs as well as gunpowder for cannon. By the 12th century the first guns were in use for the precision discharge of arrows. Bamboo was used to make the first gun barrels, packed with gunpowder and fired by a fuse. In 1332, the world's first bronze cannon was made, a

Gunpowder—called "fire medicine"—blew up many laboratories from 100 BC onwards as alchemists heated mixtures of charcoal, sulphur and saltpetre in their search for the secret of eternal life. By the 8th century AD, it was used in war but the old name stuck. "Fire medicine" was still prescribed 400 years ago. China's discovery of gunpowder was helped by an abundance of natural saltpetre. In the 13th century, the secret reached Europe, where saltpetre for gunpowder was made by fermenting urine. This was done in pits where the saltpetre was scraped off the walls. Despite its late arrival on the scene, gunpowder had a greater effect on history in Europe than in China.



Raiders attacking the Great Wall are shown being driven off by grenades belching flames and poisonous smoke. They contained arsenic, poisonous plants, irritating oils and other unpleasant substances that could penetrate cracks in armour, cause choking and blister the skin. The men firing the bombs were advised to "suck black feathers and liquorice." Toxic substances were found to have other uses. The Chinese learned how to fumigate ships and buildings by burning sulphur inside them to drive out the vermin.



A 13th century flame-thrower that also worked like a shotgun. The bamboo barrel was filled with a fiery gunpowder mixture and tiny pellets called "seeds." These shot out in a blast of flame when the handle was forced into the barrel.

broad blunderbuss. This weapon is now on display in the Chinese History Museum in Beijing.

When gunpowder was introduced to the west it was mostly used in explosive bombs and mines. These things existed in China but there the main emphasis was on rockets and fire-weapons. More than thirty kinds of fire-arrow were developed between the invention of gunpowder and the 17th century. One of these, the "flying-bird" rocket was shaped like a crow. Its body was plaited from thin strips of bamboo and packed with gunpowder. Four pipes issued from the tail of the bird-rocket which had a range of 300 metres. It was an incendiary weapon that could be used to set an enemy's camp on fire or to burn his ships.

The Chinese also invented the world's first two-stage rocket, the "fire-dragon." When the gunpowder in the four rockets of the dragon's main stage was burnt up it ignited many small fire-arrows in its belly, causing them to shoot out of the fire dragon's mouth. These rockets were used in naval warfare where they looked like "fire-dragons" coming across the water.

The principle of these ancient rockets was the same as that which drives the rockets of today. Ignition of the gunpowder created a high temperature and an enormous pressure of gas. When this gas was allowed to escape at the rear the reaction propelled the rocket forward at high speed.

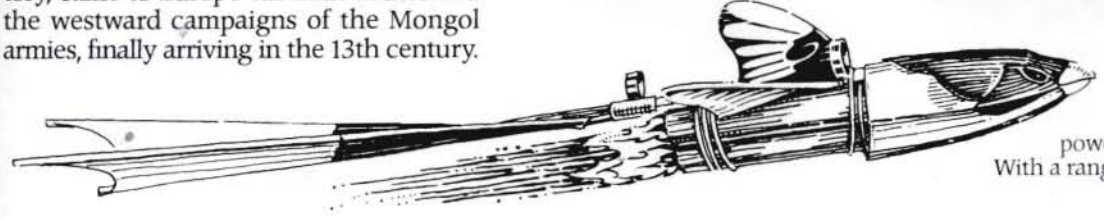
During the 12th century gunpowder was first used in firecrackers and fireworks in the celebration of festivals. A particularly elaborate example was the box-lantern. This was a multilayered, many-sided firework about one metre high. Inside it were folded fire-resistant paper illustrations of folk-tales, characters from plays and flowers. When the box-lantern was hung in a high place and ignited it exploded layer by layer so that the story gradually unfolded in whirling spark trails amidst a sea of light.

Gunpowder and firearms, which were to have a tremendous impact on western history, came to Europe via trade routes and the westward campaigns of the Mongol armies, finally arriving in the 13th century.

"Bees' Nest" multiple rocket launchers fired 32-100 fire arrows covered with gunpowder and tar. Mounted on wheelbarrows, they were light, mobile and deadly. The armies of the 14th-17th centuries preferred them to the cannon used in the west which were less useful against wooden targets.

A "Box Lantern" explodes to reveal flowers and folk characters in a shower of sparks. Fireworks are as old as gunpowder itself; like firearms, they were used in the time of the Vikings. In fact, the Chinese were exploding bits of bamboo by throwing them into a fire to make firecrackers long before they had gunpowder. Today, the making of firework displays is an exacting 1,300-year-old science and a great art.

As early as the 17th century, bombs were used to wage war on China's capricious climate. This bomb from Guizhou was fired into hail clouds to turn them into rain. The technique may not have worked but it was on the right track. Today, attempts to suppress hail formation with silver iodide crystals dropped or fired from aircraft are quite common.



This bird bomb had a woven bamboo body packed with gunpowder. Four rockets protruded from its tail. With a range of 300 m, it could swoop down on an enemy, burning his camp or his ships.