

Discovering the wheel-lock mechanism of a 16th-century weapon from Museo delle Armi di Brescia, Italy: microstructural analysis and production technique

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The invention of a fully automatic igniter using the so-called wheel mechanism dates back to the early 1500s [1]. This was a fairly sophisticated mechanism for the time, consisting of many pieces: a knurled wheel (which could be loaded with a spanner), a spring-loaded arm (the dog) holding a piece of pyrite between the vise-like jaws, and a pan with a lid (pan cover), filled with very fine gunpowder [2]. Until now, few studies have comprehensively characterized each component of the wheel-lock mechanism. Hypotheses have often been based on mechanical properties and production techniques, without actual confirmation [3,4].

This work aims to provide reliable information on the production technique of ancient wheel-lock mechanisms and the high degree of metallurgical specialisation in the 16th century. Analyses were carried out on a late 16th century wheellock from the Museo delle Armi 'Luigi Marzoli' in Brescia, and of German origin. The museum houses a collection of antique weapons and armour, which is one of the richest and most unique in Europe. Samples were taken from various components of the wheellock mechanism, including the wheel, wheel cover, main spring, pan, pan cover, dog, dog spring, and sear. The purpose of the study was to identify the manufacturing process of each individual part. Microscopic analysis was conducted using the Metallographic Optical Microscope (LOM) and the Scanning Electron Microscope (SEM). The characteristic microstructures and hot-forged lines detected were essential in identifying the thermal and mechanical treatments undergone by the materials during their manufacturing process.

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