

3. Scientists and Craftsmen

Literature Hayward, John F., Kunst der alten Büchsenmacher, Hamburg, 1968, p. 19 - 26, HaJo
Lugs, Jaroslav, Handfeuerwaffen, Berlin, 1956, Vol. 1, p. 466 - 549, LuJa

Introduction

The following statements represent the simplified summary of a very extensive subject only. It should provide some insight on the subject of the production of firearms. It is certain that in many cities and regions, the production of fire arms had particular importance.

Conquerors, Inventors, Researchers, Developers and Designers

Human beings are driven to improve existing ideas and inventions. It is man's desire to intellectually conquer and create great inventions. Inventors have the need to search and find ways to achieve this goal. Often large research projects are the inspiration needed to get an idea to the point of fruition. From these research projects the developer or designer creates a product that fulfills the wishes of the client, shows a clear function, and can be produced. The manufacturing techniques of propellants developed by these intellectual founders were and still are the base for good accessories and effective weapons.

Ballistic Experts

Niccolò
Fontana
Tartaglia

Ballistics is the science of the motion of projectiles. It is a part of physics that describes the actions of and reactions to an object flying through space. Niccolò Fontana Tartaglia, mathematician (1499-1557) of Brescia, Italy is considered the father of ballistics. He discovered the trajectory, and recognized the possibility to break down the movement of projectiles or other moving bodies into single components, and in this way to calculate it. Ballistics describes the process that affects the projectiles shot from a firearm.

Definitions

The following categories are covered:

- Internal ballistics: actions in the barrel and when firing the projectile
- Exit ballistics: actions at the muzzle when firing
- External ballistics: actions during the flight of the projectile
- Terminal ballistics: effect of the projectile at the target
- Rocket ballistics: effect of the projectile from its own propulsion

Aero-
dynamics

In ballistics, the aerodynamics of the missile plays a significant role. Aerodynamics is a part of the science of fluid dynamics and among other things, describes the behavior of the flow of gases and the effect on the missile. Drag, thrust, lift and sectional density are phenomena of aerodynamics, and have an influence on the trajectory of projectiles.

When designing loads, projectiles, and barrels, the knowledge of Tartaglia was often replaced by assumptions and experience. Up until the 19th century, the development of firearms came more often from practically minded people than from scientists. Theories had to be proven or complimented by tests and trials.

The ballistic expert as a profession is of recent times. Earlier, the thinking and subsequent trials came from the gunsmith.

Stone Mason, Bullet Caster and Maker

As mentioned earlier, the first firearms shot arrows similar to the bolts of a crossbow. The manufacturing of these bolts was done by craftsmen from the bow and crossbow trades. For the first cannons and hand arms, natural rocks or rocks shaped by a stone mason were used. They were later replaced by metal balls made from bronze, steel or lead, cast by a founder. For hand arms, lead balls were first cast by founders and when the demand increased, they were manufactured in foundries.

Gun Smith

A firearm has a rather complicated mechanism. The demanding expectations and complexities for the fabrication of firearms required the cooperation of many different and highly specialized craftsmen. The manufacturing of lock, stock, barrel, metal fittings and decorations, required distinct abilities and craftsmanship. This was the reason why over the centuries only a few gunsmiths had all of the craftsmen required for these multiple purposes employed in their shop. A manufacturer of utility weapons of a single design was most likely to employ barrel makers, fitting makers, locksmiths and stock makers full-time. A gunsmith for luxury weapons did not get as much work. Therefore, he could not provide permanent employment to all of the craftsmen and artists needed to manufacture a firearm of high quality and beauty. The gunsmith trade had a tendency to be split up into specialty areas. When a décor of extraordinary quality was desired, and cost was no object, gunsmiths would call on artists specialized in this trade, but worked also in other fields.

Markings

In some manufacturing centers, the division of the work was very distinct, so that the markings of the gunsmith on a barrel or lock were in reality only the markings of the seller. Sometimes the marking was that of the gunsmith, who organized the assembly of the gun. Often he bought the blanks from specialty shops, worked on them, assembled the weapon and then sold it. With the increasing numbers of firearms, specialized factories were established. In those factories, barrels, locks or complete firearms were made. In many countries state owned firearm factories emerged. They were set-up for the mass production of military guns.

Barrel Maker

With the introduction of spiral forged iron barrels, the high demand on the quality of the barrels, required the specializing of the manufacturing process.

Precision work was required by the barrel maker to manufacture thin and narrow strips of iron, with clean and parallel edges of graduating thickness. To manufacture a barrel, one wrapped the iron strips in spiral fashion around a mandrel. The spiral shaped seams were changed into a high quality welded seam by hammering. The barrel blank was finished by straightening, drilling, polishing and cutting the inside breach thread. A good barrel was the foundation of a good firearm.

Damascus Smith

With the increasing use of the Damascus barrels, competent barrel makers improved their skills to meet the highest standard of the blacksmith trade. Besides the ability of forging a well wound barrel, the manufacturing of the Damascus iron band was the artistry of the Damascus Smith. The trade of the Damascus Sword Smith was refined for years. It can be assumed that in the beginning, Sword Smiths took on the artistry of manufacturing Damascus blanks.

Lock Smith

It is easy to understand that the ignition devise of the muzzle loading gun is named the same as the lock on a door. In both cases, lock plates and springs are present and the serpentine or hammer has a similar shape and purpose as a door handle. Looking at their manufacturing process and their parts, the mechanism in an old door lock and that of a firearm's lock, have many similarities. This is the reason it can be assumed that over a long period, locks for firearms were manufactured by the same craftsmen who manufactured locks for trunks, cabinets and doors. When numbers became greater and demands for exact craftsmanship arose, different jobs on the parts of the locks were done by specialists.

The manufacturing of springs and their heat treatment, manufacturing of lock plates with their precise drilling, forging or pressing of the hammers and engraving, belonged to these products. As the demand for firearms grew, locks were produced in weapons factories and delivered as finished product to the gunsmith.

Timber Framer, Cabinet Maker and Stock Maker

Since early man kind, wood played an important part in the building of shelters, tools and also blow and thrust weapons. At the time of introduction of the first firearms, there were enough good craftsmen available to produce the simple rods and stocks for firearms. Since the demand for strength, quality and beauty of wooden buildings and furniture was on the rise, the training knowledge and the tools for woodworking had to improve continually. In the beginning, stocks were made by carpenters, cabinet makers or timber framers. Later, with the rising demand for elaborate decorations, the carvings and inlays were created by the same specialists who also produced splendor furniture.

Saddler and Strap Cutter

With the introduction of cartridge bandoliers and their often with leather covered powder flasks and ball pouches for the musketeers, the skills of the saddler and the strap cutter were called on. Besides the products for everyday needs and for saddle and draft horses, they also produced the leather accessories for firearms. Weapons factories employed saddlers for mass production of leather products.

Craftsmen for Decorative Work

Often, the craftsman who produced a particular piece also made simple decorations. For example, the blacksmith did the flat chisel work and the embossing the stock maker did the carving and inlays.

Artist	Most of the time, artful and elaborate décors were designed by an artist and then sold to the gunsmith. The implementation of the designs was often left to an expert or artist in the particular field. The cabinet maker or carver worked on inlays and carvings in wood, the goldsmith on flat and relief engravings as well as inlay work in metal and the Armourer on acid etch designs. The gold or silversmith was often responsible for the beautiful engravings in horn and ivory. The beautiful relief decorations on the cast bronze cannons or on the brass knobs of the pistols were mostly done by an artist as a true model and then delivered to the foundry. After casting, the decorations were cleaned and enhanced by embossing and chasing.
Carver	
Goldsmith	
Engraver	

Fig. 3 – 1

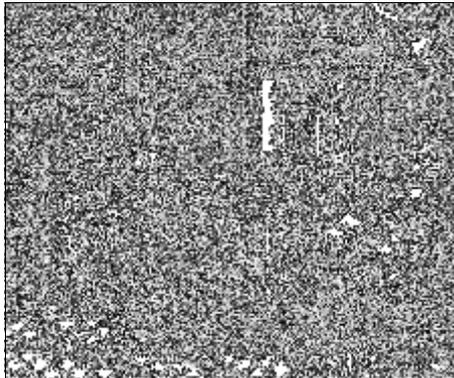
**Ca. 1830: Goldsmith and Engraver in his Workshop**

Unknown Painter

Photo: KuPe

Trades required for the Manufacturing of Muskets

Fig. 3 – 2

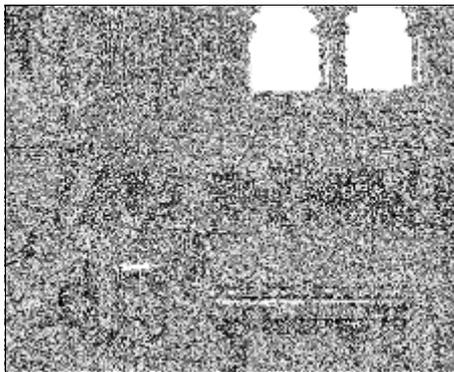


C. Jacquinet, 1660, Paris
Photo: GrSt, Page 29

Inventing, Developing and Designing

- Inventors, scientists and ballistic experts in the study calculating and debating

Fig. 3 – 3



Cesar Fiosconi, 1718, Lisbon
Photo: GrSt, Page 100

Forging of Barrel Blanks

- The blacksmith checks the quality of a newly forged barrel
- In the foreground there is a barrel drill
- Finished barrel blanks are on the wall in the background

Fig. 3 – 4

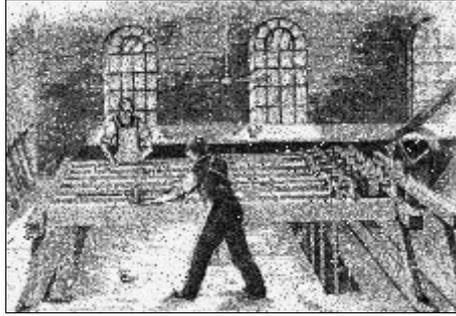


Christoph Weigel, Ständebuch, 1698
Photo: MüHe, Page 115

Production of Barrel Drilling

- In the foreground, the craftsman inserts the barrel in the horizontal boring or drilling machine
- In the background, the rifling is drawn into the barrels on a draw bench

Fig. 3 – 5

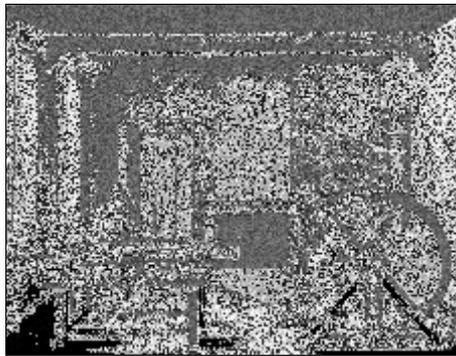


Etching Ca. 1850, Unknown Artist
Photo: LuJa, Vol. 2, Page 417

Broaching of the Rifling in the Barrel

- At five stations, the twisting grooves of the rifling are cut at the same time
- A guide system imposes the twist to the broaches
- The production method Ca.1700 was essentially the same except there would have been only one hand powered working station

Fig. 3 – 6

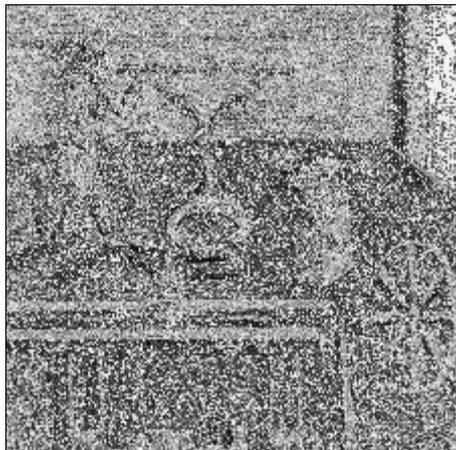


Diderots Encyclopaedia, Ca. 1800
Photo: LuJa, Vol. 2, Page 413

Polishing of a Barrel

- After roughing the outside of the barrel with files or a lathe, the sanding and polishing followed
- On the left, a journeyman clamps a barrel into a polishing machine
- Another journeyman runs the machine over a crank on the fly wheel

Fig. 3 – 7

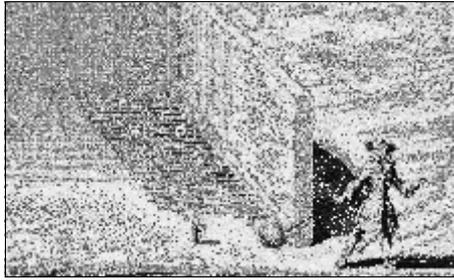


Cesar Fiosconi, 1718, Lisbon
Photo: GrSt, Page 101

Adjusting of the Barrels

- Working on the barrels, warp them and they will have to be readjusted by a specialist
- In the foreground there is a hand powered polishing machine to remove possible dirt particles

Fig. 3 – 8

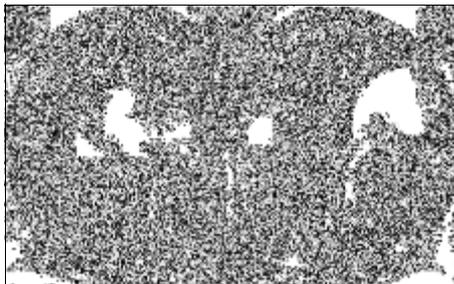


Unknown Artist
Photo: PoAp, Book Cover

Proofing or Testing of the Barrels

- After the breech plug is threaded in, and the barrel has passed a visual inspection, an inspector and helper tested each with a triple load of black powder
- When the barrel passed the test it was often given an approval stamp

Fig. 3 – 9

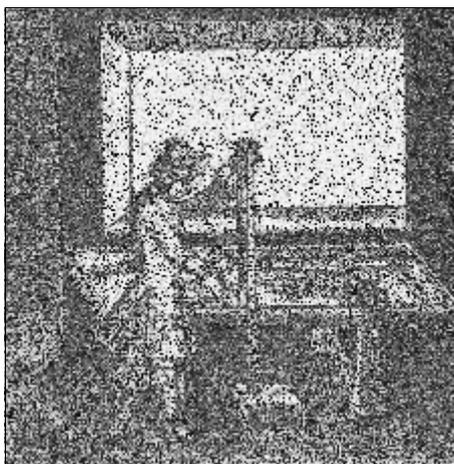


C. Jacquinet, 1660, Paris
Photo: GrSt, Page 29

Production of the Stock

- After an order was received and the barrel delivered, the stock maker began to make a stock according to the wishes of the customer mainly from walnut
- This was done with saws, chisels, files, draw knives, planes and barrel groove planes

Fig. 3 – 10

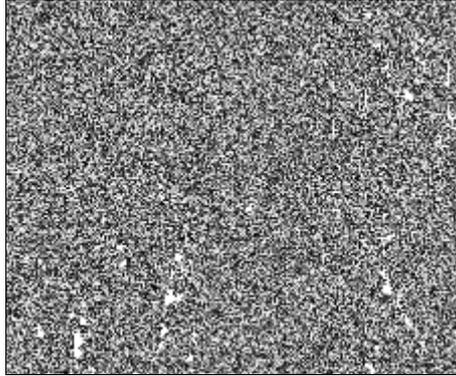


Cesar Fiosconi, 1718, Lisbon
Photo: GrSt, Page 104

Checking of the Stock

- Controlling of the unfinished stock was done with compass, tape measures and specialty gauges
- The gunsmith does the final fitting when assembling the parts of the firearm

Fig. 3 – 11



C. Jacquinet, 1660, Paris
 Photo: GrSt, Page 28

Assembly of the Firearm

- After receiving the unfinished stock and the parts for the musket, these are fitted into the stock with care
- In the center, the butt plate is fitted, while on the right, a helper threads the breech plug into the barrel

Fig. 3 – 12



Unknown Artist
 Photo: LuJa, Vol. 2, Page 409

Order and Delivery of the Firearm

- An important part of the gunsmith's job is taking the customer's order including their special wishes
- He also subcontracts to the barrel smith, the lock and fitting smith, the stock maker and the strap cutter as well as to artists such as carvers and engravers to make necessary decorations
- Together with the customer, he conducts the first shooting tests
- The trade of the gunsmith is interesting and challenging

Fig. 3 – 13

**Ca. 1830: Portrait of the Smith Pat Lyon in his Workshop**

John Neagle, 1829, Pennsylvania Academy of Fine Arts

Photo: KuPe