SMALL ARMS OF THE WORLD

A BASIC MANUAL OF MILITARY SMALL ARMS

By W. H. B. SMITH
and JOSEPH E. SMITH

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American—Soviet—British—Czech—German
French—Belgian—Italian—Swiss—Japanese
and all other important nations

by

W. H. B. SMITH
Author of Book of Pistols and Revolvers; Book of Rifles; Walther Pistols; Mauser Rifles and Pistols; Mannlicher Rifles and Pistols; Gas, Air, and Spring Guns; etc.

and

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Preface to the Seventh Edition

Not too many years ago most of us read opinions, frequently expressed in the Sunday pictorial sections of newspapers, news magazines, and even some service journals, that the day of the foot soldier and small arms was nearly over. Some of these opinions intimated that the expenditure of ten cents on the development of or procurement of new small arms would be a flagrant waste of the tax payer's hard-earned money. Recent events in Southeast Asia, which unfortunately could occur in many other areas of the world, bear out the wisdom of those who turned a deaf ear to the siren song of saving the taxpayer's money by ignoring the development and manufacture of conventional weapons. No rational individual denies the necessity of the maintenance and further development of an overawing nuclear power; a necessary adjunct to that power is the maintenance of strong ground forces armed with the most modern conventional weapons, and small arms are the base upon which the larger conventional weapons systems are built. The infantry must hold or the artillery, armor, and support services are lost. I therefore do not consider this book to be in any sense the testament of a lost or dying art; rather it is intended to be a record of a basic, highly essential, and very much alive branch of the weapons family.

I have been in the weapons business long enough to learn that it is not wise to make any all-inclusive claims regarding the accuracy of all the data given in this book. There are multitudes upon multitudes of different variations of weapons. Just at that point when you believe you have learned all there is to know about a certain type of weapon, some bright young collector will come walking in with a specimen which proves that you don't really know as much as you thought you did. It is a somewhat shattering experience for a gun crank and it has happened to me more times than I would like to tell. I will say only this; considering the size and scope of this book, I believe it to be as accurate as is possible for a book of this type to be.

There are many points in relation to characteristics data which have to be considered when a high degree of accuracy is prerequisite. Most countries use the metric system of weights and measurements; these must be mathematically converted to render them in English measurements. Variations will appear which are the direct result of the number of decimal places used in working out a conversion. Variations in weights of weapons reported in different publications are common. There are two basic reasons for this situation: weights are frequently given, even in the manuals of various countries, which unfortunately do not make clear whether loaded or empty weight is meant, or whether the weight includes a sling and accessories, etc. The second factor applies to weapons with wooden stocks and fittings. These weapons will vary in weight between a humid climate and a dry one and even between a humid day and a dry day in the same area. Another area of confusion lies in muzzle velocity figures. There are actually two types of velocity figures for small arms, instrumental velocity and muzzle velocity; and yet, in characteristics charts published by governments, private concerns, and manufacturers, many times the figures reported as muzzle velocities are actually instrumental velocities. The instrumental velocity is always a shade lower than the true muzzle velocity, since it is taken at a point some distance from the muzzle (usually 53 feet or 78 feet). To obtain a muzzle velocity from an instrumental velocity some calculating must be done and there are various formulas for this purpose.

It is the intention of the Stackpole Company and myself to continually improve this book and to correct any errors of fact that it may contain. I am therefore most grateful to those readers of the Sixth Edition who found and pointed out an error in that work. I have tried to answer all correspondents personally. Unfortunately in some cases this has not been possible because of the press of work.

The opinions expressed in the revised sections of this book are my own. They are, for the most part, limited to pointing out what the advantages and/or disadvantages of a particular system might be; I have tried to be absolutely objective. My opinions do not represent the official opinion of the Department of the Army, the Army Materiel Command, or any other agency of the United States Government.

I would like to acknowledge the great help of various individuals and organizations who have assisted me in the preparation of this revision both directly and indirectly. The following individuals and organizations of the Army Materiel Command, have been of great assistance:

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There are many people who have supplied data to me over the past several years which has been helpful in this revision. Outstanding among them are: Mr. J. J. Reen of McLean, Virginia; Col. G. B. Jarrett, Curator of the U.S. Army Ordnance Museum at Aberdeen Proving Ground; Mr. Karl Kempf, and Mr. Robert Faris, all of Aberdeen, Maryland; Mr. Philip E. Valentini of Washington, D. C.; Mr. Martin Hawkins of Arlington, Virginia; Mr. Richard Maguire of Detroit, Michigan; and Mr. Donald Bady of New York City.

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JOSEPH E. SMITH

Vienna, Virginia
July 1962

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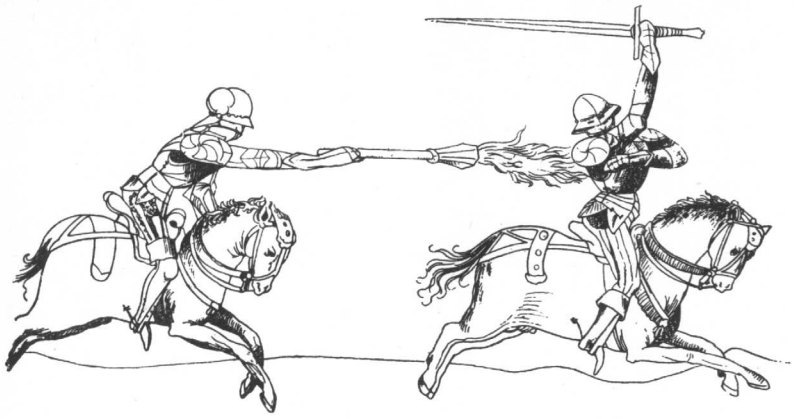
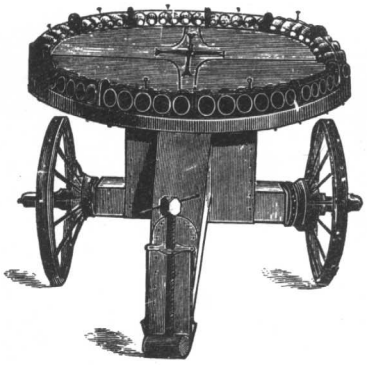
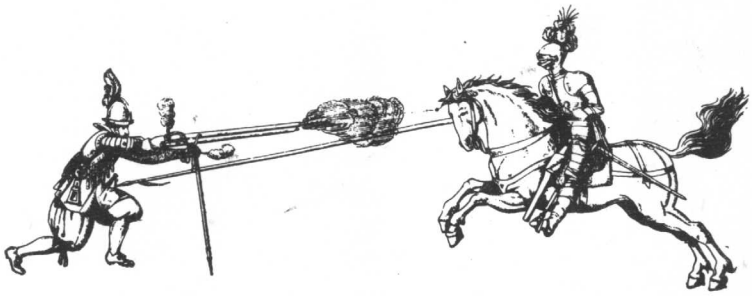


PART I

HISTORICAL





Chapter 1. Origins of Gunpowder and Firearms

GUNPOWDER

THE story of all modern projectile weapons begins, of course, with the first application of gunpowder as a projectile force. A study of all available source material shows definitely that in its obscure origins, gunpowder was known for a long time before it was used to hurl the earliest projectiles.

Who first discovered gunpowder—precisely when and where—under what conditions? No man can give a definite answer to any of those questions.

Ancient records have been mistranslated and quoted out of context to "prove" that the Chinese, for instance, used gunpowder before the time of Moses. These statements are commonly based on the Halhed translation of the Gentoo Code from the Sanskrit, a translation printed by the East India Company in 1776. Any scholarly analysis of the translation will show the twisting done by the translator to establish his case as for instance in the oft-quoted passage that "The Magistrate will not make war with any deceitful machine, or poisonous weapons, or with cannon or guns, or any kind of firearms." It is not until the 13th Century that we find anywhere in written records the use of terms which could reasonably be construed to mean "cannon," "guns," or "firearms."

It is possible to extract sentences from Plutarch's Life of Marcellus and also from Vitruvious to lead one to think that Archimedes was familiar with gunpowder, if the reader happens to be romantic rather than scientific. Valerius Flaccus can be quoted to show that the Brahmins tried to "reproduce thunder." In the Aeneid Virgil tells of a similar attempt by Salmoneous.

History is replete with proof that highly inflammable compounds were known and used in warfare from the earliest recorded times. Many such undoubtedly detonated at times or under given circumstances, just as gas and mine explosions occur today; and reports of such explosions undoubtedly account for most of the ambiguous statements which have been taken erroneously to mean an early knowledge of gunpowder itself.

If we explore the negative side of the matter, we find a tremendous body of evidence to show that gunpowder was neither known nor used before the 13th Century. "The Alexiad," the history of the Roman Emperor Alexius I, who reigned from 1081 to 1118, is a case in point. This work, written contemporaneously by the Emperor's daughter Anna, is accepted by qualified historians as perhaps the chief source of reliable data on the First Crusade and the Byzantine Empire. It lists numerous formulas for "Greek Fire." At no point, however, does it give any indication of a knowledge of gunpowder or any similar projectile or detonating substance. The unquestioned authority of "The Alexiad" completely disproves the efforts of some 19th Century French to establish that gunpowder was first carried to Europe by returning Crusaders who had learned of it from the Arabs.

Also high on the list of negative evidence is the extant report of the fabulous Ambassador Giovanni di Plan Carpin. This unusual man, whose very name is unknown to most historians, far outshone in real ability, knowledge, and experience the highly publicized Marco Polo. Carpin was a highly trained and seasoned soldier. He was thoroughly familiar with all the weapons of his period. In the year 1246 Pope Innocent IV commissioned him to travel to the Court of Genghis Khan, the Mongol conqueror, at Karakorum. The Great Khan was so impressed with Carpin that he permitted him to travel at will across the Mongol Empire. Carpin served as an observer with the Mongol armies in their campaigns against the Chinese, and he wrote in detail of the all but legendary siege of Kai-Fung Fu. Carpin's reports list systematically every type of weapon he saw. His accounts of the use of "balista," the artillery of the day, as well as of all varieties of slings and bows are classic. In dealing with varieties of Greek Fire, he told in detail of the assault and burning of cities by use of machines which hurled melted fat and tallow-loaded projectiles.

The first authenic manuscript known in which we find positive knowledge of gunpowder is the work originally ascribed to an unknown monk, Marcus Graecus. It is true that scholars can trace the original Greek manuscript to the year 846. However, the sections of this manuscript (Liber ignium ad comburendos bostes) which deal with Greek Fire and also with a *specific formula* for "ignis volans" (gunpowder) appear in Latin and were written not earlier than the middle of the 13th Century. Translations and comparisons of copies housed variously in museums at Paris, Munich, Nuremberg, and Oxford all help to establish this later date for the sections dealing with gunpowder. The "Liber ignium" gives 35 different formulas for gunpowder. It is noteworthy too in that it gives instructions for the manufacture of rockets. In passing it should be noted also that one formula specified "1 part quick sulphur, 2 parts willow charcoal, and 6 parts saltpeter"—a mixture which is actually too powerful for use in any known firearms of the 14th or even the 15th Centuries!

The next really positive references to gunpowder all

appear to derive directly or indirectly from the Graecus manuscript. One of these is an undated letter from a Spanish monk, Ferrarius, addressed to one "Anselm," and is in the Bodleian Library at Oxford. Another contemporaneous manuscript is the "Opus de mirbilibus mundi" credit to Bishop Albertus Magnus, (1193-1280). And finally, there is the classic Roger Bacon manuscript "Epistola de secretis operibus Artis et Naturae et de nullitate magiae" (Concerning the Marvelous Power of Art and Nature, and concerning the Nullity of Magic).

The Bacon manuscript was written in 1248 to the Bishop of Paris, William of Auvergne, and was in effect an answer by Bacon to charges that he was giving himself to the practice of magic and the black arts! This manuscript gave, for the first time that we know of, a description of the preparation of saltpeter, which is necessary to the production of refined gunpowder. His gunpowder formula of 7 parts of saltpeter, 5 of young hazelwood (or charcoal) and 5 of sulphur was long the military standard.

It should be noted, however, that Bacon makes no claim to having invented the mixture. In fact, he speaks of it as something then very well known, and talks of its use in fireworks. Moreover, while he suggests that an enemy might be "either blown up bodily or put to flight by the terror caused by the explosion," he seems to have had no awareness of the use of gunpowder for *firing projectiles*. No mention whatever is made of firearms as such.

There is no record of how or where Roger Bacon first learned of explosive mixtures. Since he spent some time in Spain, and since there are at the Escurial several ancient manuscripts dealing with chemical matters, it is possible he may have gathered something there. It is more likely, however, that the source was the Graecus manuscript, since even the most specific Escurial sources are vague by comparison with Bacon's own; while such celebrated Saracen sources as Nedj-id-din Hassan Abrammah show an awareness of the *ignition* factor of saltpeter but do not touch on its *explosive* use as Bacon did.

Passing mention must be made of the German monk Berthold Schwartz (or Bartholdus Niger) who in the past has often been credited with the invention of gunpowder at Freiberg. This monk lived from about 1310 to 1384. He was in fact one of the great experimenters of his time, and devoted great energy to the subject of casting cannons. From accounts and drawings of the period, it is evident that Schwartz was primarily an early-day precursor of the modern Krupps; and that his experimentation with explosives for use in cannon was responsible for the erroneous belief that he actually was the inventor of gunpowder. He opened a shop to cast bronze cannon at Venice late in life, and was condemned to death by the Senate of Venice when he insisted too volubly that he receive payment for work he had done on cannon designing.

Countless books have been written on the subject of the Origin of Gunpowder. Countless studies have been undertaken to prove or disprove them.

But when all the words have been read, when all the theories have been explored, when all the flights of conjecture and fancy have been weighed and all evidence analyzed and sifted, we come again always to the treatise of Roger Bacon, who himself disclaimed the invention. Nowhere else do we find an earlier unquestionable and incontrovertible statement on the subject: "Thus we may imitate thunder and lightning; for sulphur, nitre and charcoal, which by themselves produce no sensible effect, explode with great noise when closely confined and set on fire."

FIREARMS

Definition

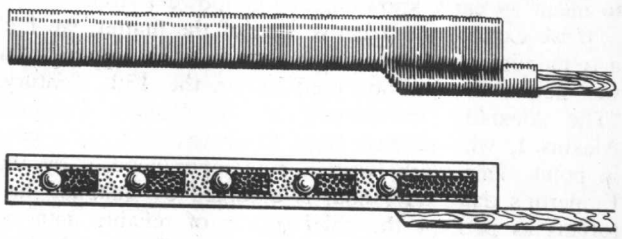
Firearms may be defined as tubes used with a charge of gunpowder (or like explosive substance) to hurl projectiles. In their earliest forms as true projectile instruments, these hurled the same stone or metal balls, or variations of the spears and arrows, which were then in use for launching from bows, slings, ballistae and the like.

Flame Thowing Tubes

It is impossible to establish just when and where firearms as defined above were introduced. Tubes were used long before the advent of gunpowder to direct inflammable mixtures, much as the modern flame thrower does. "The Alexiad" specifies such use, for instance.

"Roman Candle" Tubes

The first use of gunpowder to launch objects without thought of penetration may well have been in the Far East. Both the Tartars and the Arabs are known to have made very early use of a variety of "Roman Candle" to start fires. These instruments were commonly hollow tubes of wood or bamboo. They were tightly wrapped around with hide or hemp or wire for strength. They were loaded from the muzzle with alternate charges of powder and an incendiary ball, often of tallow, though some seem to have been cloth saturated with crude petroleum. They were ignited at the muzzle, and as the fire worked around each ball it touched off the powder to launch the ball ahead. The German "Zeitschrift für historische Waffenkunde," a former learned society which



"Roman Candle" Tube. From a thirteenth century Saracen Manuscript.

went to great lengths to research ancient arms and armor, found mention in old Chinese annals authentically dated 1259 of this use of powder.

The Earliest Records

Early Saracen records have been translated to show that stone-throwing cannon were used in 1247 in the defense of Seville. However, the general evidence indicates that these were actually mechanically operated projectors—not gunpowder types.

German writers have made various claims that the town of Amberg had a cannon in the year 1301. This and similar claims have not been documented. The reports of many writers and researchers of the 19th Century indicating Flanders as the source of the origin of the first projectile gunpowder arms have been seriously questioned by later writers who had far better research facilities, notably Sir Charles Oman and Oscar Guttman.

The Manuscript of Walter de Millimete

The first contemporaneous illustration which can be fully authenticated showing an unquestionable gunpowder cannon is found in the Millimete Manuscript at Oxford. The illustrations on the manuscript show very fine illuminations of cannon. One vignette shows a soldier in armor firing a bottle shaped cannon at a fortress gate at close range. The gun itself is on a four-legged mount. From its muzzle projects a huge spear-like "bolt" of the pattern known as a "garrot" or "carreau" such as is shown in earlier illustrations dealing with mechanically launched projectors like the espringale. Smaller bolts of this type are shown at a later date being used in hand arms. Such "bolts" often had brass "feathers" to stabilize flight, patterned of course after the arrow, though many seem to have been used to impart rotation to the flying missile much in the manner that rifling does.

It must be noted that this manuscript is a dedicatory address Millimete gave to King Edward III upon accession to the throne in 1327. The text makes no mention whatever of the illustrated items. However, since we know that Edward III was among the earliest monarchs to employ cannon in battle, and since the authenticity of the manuscript is beyond question, the historical value is self evident.

Edward III

Shortly after he was crowned, Edward III led an army against the Scots. It is said that he had with him a group of cannoneers from Hainault, indicating that his guns came from Flanders. The weapons were apparently of the type shown in the Millimete manuscript, often spoken of as "pot-de-fer." Records of Ghent for the year 1313 indicate such weapons, while later records refer to their use at Metz in 1324. It is apparent therefore that Edward III used cannon, but did not develop them.

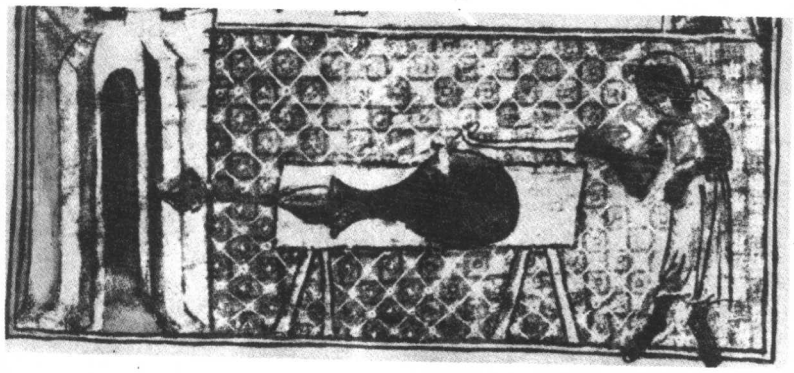
John Barbour's "The Metrical Life of Robert the Bruce" is the most often quoted source on this Scotch campaign, speaking of cannon as "crayks of war." The facts are in all probability accurate in general, though the careful historian must note that Barbour wrote late in life when he was Archdeacon of Aberdeen. He was only seven years old in 1327.

Many historians state that Edward III used two or three cannon at the battle of Crecy. This, too, may be true.

It is impossible to establish whether the hand gun or the artillery cannon was first used as a powder weapon. It is quite possible that the development may have been simultaneous. The construction and the loading and firing principles were the same for all types in the early stages of arms development. The ignition was the same.

In general the only source of recording knowledge in those days rested with the religious groups, more particularly with those in Europe, since few outside church circles could read or write. Moreover, as the era of record keeping developed early in the 14th Century, a new terminology built around the new weapons developed in various countries. The French records speak of "quenon" or "canon," for instance. The Lowlanders described them most often as "vogheleer." Among the Italians they were recorded as "bombardes." The German records still extant list them as "Büchsen."

There are very few firearms made during the early part of the 14th Century whose authenticity can be even vaguely established. However, art in the form of tap-



The oldest verifiable illustration of a weapon using gunpowder for hurling projectiles.

An illustration from the de Millimete Mss. executed in the year 1326 A.D.

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estries, paintings, church frescoes and illustrative drawings was developed to a very high degree about this time, particularly in Italy and France. These art forms together with more detailed written records have enabled arms historians to correlate the terms in various countries, and thus to provide a pattern of continuity to show the development of firearms from this point on.

For the record, however, it must here be set forth that in the last century there were in existence in Italy two hand guns which historians of great ability believed to be the oldest then extant. The first of these was thoroughly discussed by German General Köhler in his comprehensive work on early arms "Entwicklung des Kriegswesens, etc." It was of bronze, ornamented with a Greek cross and oak leaves, bore the number 1322 (believed to indicate the date of manufacture) and the letters PPF. Köhler described it in his book published in 1887, though it had been described earlier (in 1847) by Count 'd' Arco who owned it at one time and also by the reliable Major Angelucci in his "Documenti inediti" published in Turin in 1869. This gun was stolen from the Monastery of St. Orsola at Mantua in 1849.

The second "sclopos" said to date from the early part of the 14th Century was a wrought iron piece having a very roughly finished barrel and shaft attachment which was understood to have been excavated from the ruins of ancient Monte Vermini castle in 1841. Assuming it to be genuine, this piece would date from at least 1341.

While these particular weapons are lost to historians, from this period on Italian records from unimpeachable sources verify the existence of their types; and from these records and those of other European countries we can establish a chronology of development accurate in every respect except that exact dates cannot also be provided. Some of these can be tied down to a given year, but in the main all but the official Annals and Chronicles can be assigned only to a period which may vary as much as 25 years. Of course, even in our own times it is often impossible to exceed that record on quite recent developments.

Chapter 2. Evolution of Firearms

PHASE I—THE CANNON LOCK

THE earliest firearms are classed as "Cannon Locks." These arms whether in the form of hand or artillery types were fired by holding a lighted coal or hot iron against powder placed over a touch hole at the rear of the barrel section. The flame flashed through the hole into the powder charge which had been loaded down the muzzle of the piece.

These were commonly made by casting brass, bronze, or similar alloy. Some were made of wrought iron. Many had straight bores, though others had clearly defined chambers. The hand types were usually attached to staffs or pikes. The heavier types used various forms of mounts ranging from cradles to carts.

Granulation was not known at this period. Gunpowder was actually a true powder. This required considerable wadding between charge and projectile to allow a build-up of gas pressure. The low saltpeter content of the mixtures also was a factor in slowing down combustion. The wads used were usually soft wood. Gas leakage around the wad naturally limited velocity and power.

The projectiles used are shown in profuse detail in many tapestries and manuscript illuminations. Balls of stone, iron, brass and even lead were used. Bolts—called variously "quarrels" and "garros a feu" were also employed. These bolts all developed from the crossbow types of missiles. They were made in a huge range of sizes for hand gun and siege gun work.

It is with these elementary firearms that our Chronology of Development begins.

When we remember that Italy was the best educated and most scientifically advanced country at this period, it is not strange that we find the best records in Italian archives. However, toward the middle of the century some authentic English records appear, most of the important ones indicating actual manufacture of the arms in the Lowlands (specifically Belgian areas which are still a source of export arms). French records at this period also become more specific and authoritative. Toward the close of the century the finest records of all become available as German manuscripts begin to chronicle the developments of that ever scientific and warlike Teuton mentality.

Early Italian Records

The most reliable sources of original material of the earliest days which the present author has been able to weed out of literally thousands of manuscripts, drawings, records and tapestries studied are as follows:

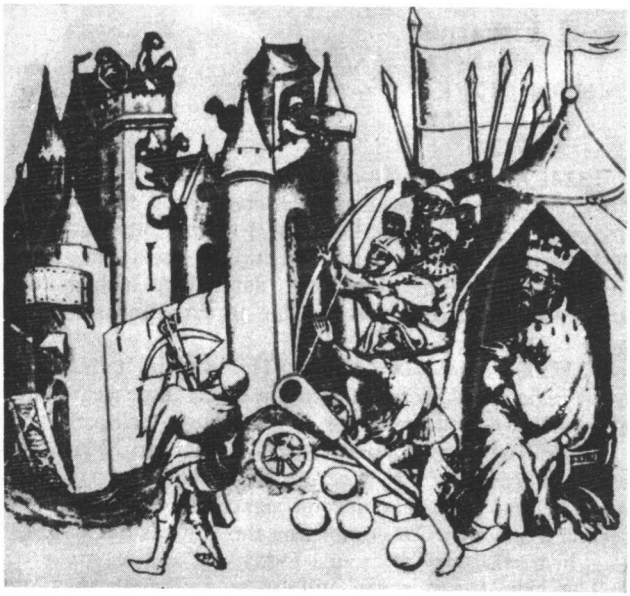
1324: *Archivo de Florence, reg. 23, De riformagioni, Page 65.* This record definitely establishes that various firearms were in general use in Florence at that time. It is obvious that the arms mentioned must have been in use for some time before this date, since such matters are not chronicled until well after all experimental stages have been passed.

1331: *Chronicles of Cividale.* This was an Italian town in Venezia. Its *Chronicon Extense* dated three years later also makes definite mention of hand guns (sclopetus).

1340: The famous artist Paolo del Maestro Neri began work in this year on a series of frescoes in a church near Sienna, Italy. The receipt signed by the artist upon receiving payment for completing the work is dated 1343. It is in the Library at Sienna today.

The Neri frescoes can still be seen, though they are

Cannon locks in military use. From the Italian Neri Frescoes dated 1343.



Wheel mounted cannon in siege. Defenders in tower are firing hand cannon locks. From Neri Frescoes.

Cannon lock drawing. From the English Burney Manuscript Number 169, Folio 127, dated 1469.

badly peeled. They are the most important records in the entire history of early firearms. These frescoes show clearly both land and naval warfare of the period. Besiegers are shown firing cannon against a castle in one panel. The defenders are shown using hand cannon and bows in defense.

The frescoes show guns of various types which are in all essentials identical with those shown in German manuscripts produced near the end of the 14th Century. By showing in the same panels the use of both siege and hand firearms, they establish historically that such developments were either parallel or very closely related.

1364: *Chronicles of Perugia.* These are important as showing the extent of firearms use at this period. They cite an order placed for "500 bombarde." The record shows that the specifications required that these hand arms must penetrate armor!

Early English Records

1347: Among the English records of early days only those of Thomas de Roldeston, Keeper of the King's Privy Wardrobe, are truly specific. He served during the period of Edward III. Items cover work on guns, purchase of gunpowder at 18 pence per pound, and substantial purchases of sulphur and saltpeter.

In other sources mention is made of the "ribauldequin" used by Edward III. This is one of the earliest types of multi-fire weapons which were the precursors of the machine gun. It consisted of several iron barrels arranged to fire simultaneously, and its earliest recorded use is in 1339.

1386: The first recorded use of the term "hand gun" is found in English records. The Chamberlain is recorded as having been sent three such by one Ralph Hutton.

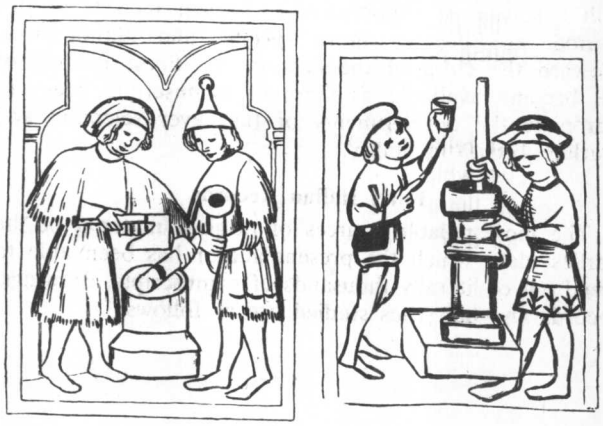
Early German Records

The earliest true scientific approach to recording the progress of all firearms is found in German records. It is unlikely that the original gun as such was of German origin. There can be no question, however, that the most productive of the succeeding development work was done by them.

An instance in point is the *Codex Germanicus 600.* This is a manuscript in the Munich Museum. Some German authorities have dated it as far back as 1345. It is more likely that the date is that set by less prejudiced researchers—about 1390.

This manuscript translates "Directions for Preparation of Gunpowder. How to Load Guns and Discharge Them." It is extensive, detailed and scientific.

Many of the finest examples of German art, manuscript

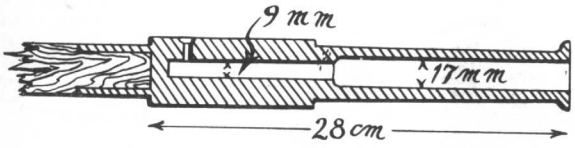


Gun powder manufacture. From Codex Germanicus 600. Dated reliably 1390.

illumination, and tapestries dealing with early firearms were destroyed or looted during the period of the two World Wars in this century; so reference will be made here only generally to certain records which were unquestionably authenticated, or of which copies exist in accepted museums or libraries.

1389: The Vestaburg Inventory listed firearms, among them being "Handbüchsen" or hand firearms. Of course, this is again direct evidence that such arms were in use for a considerable time before the date of the Inventory, or at least had gone through the long experimental stages required in all scientific and mechanical developments.

1399: The *Tannenberger Büchse* is an actual hand gun excavated in 1849 at the site of a once powerful fortress. Vesta Tannenberg was a notorious robber stronghold in the late 14th Century. It was stormed in the year 1399 and every effort was made to destroy it utterly, quite as in the case of Carthage. For centuries tales about its very existence were considered legendary, so utterly was it obliterated.

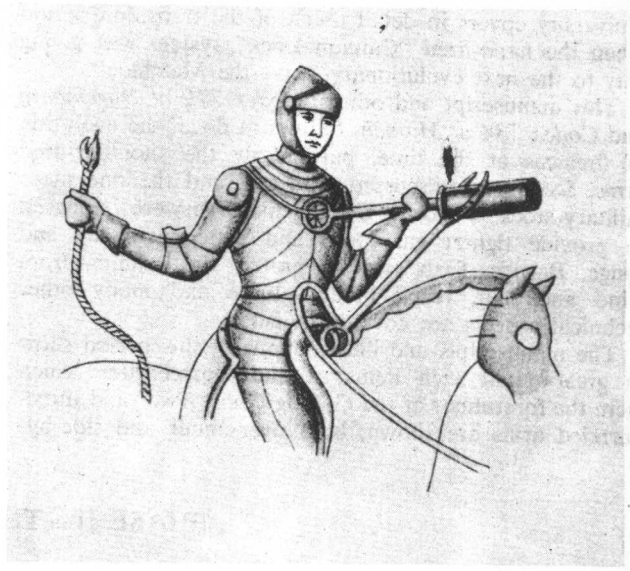


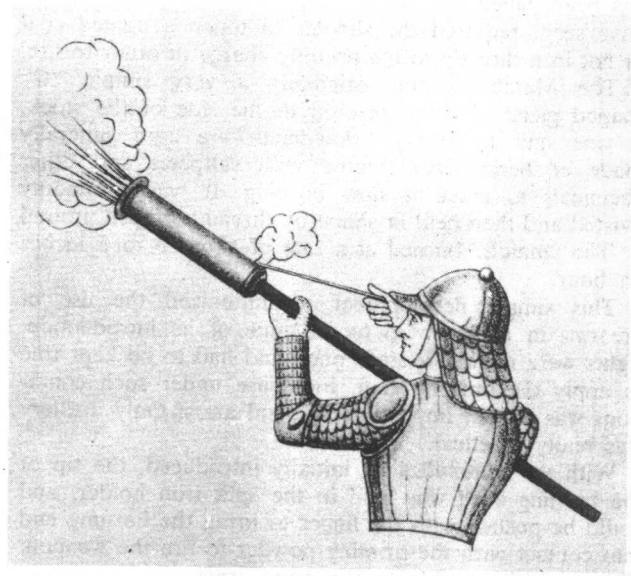
The Tannenberger Büchse in Section.

The gun itself is of cast bronze. Its design and construction is so superior to most authenticated arms of the period that scientists for a time related it to a much later date, but archeologists finally established the date satisfactorily.

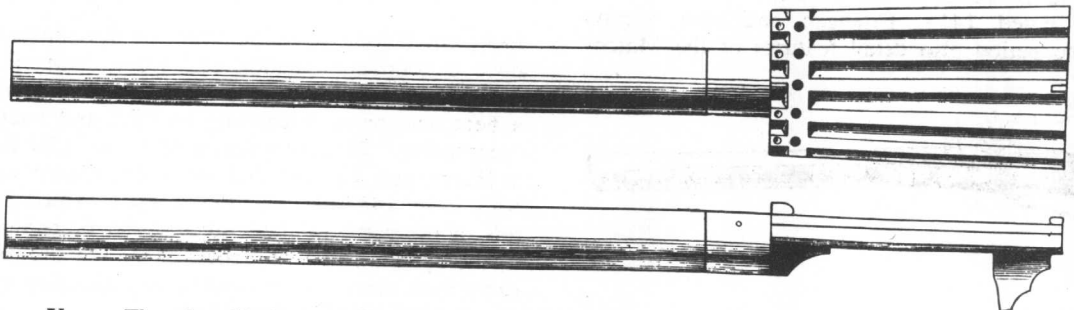
Among other early German records meeting the qualifications given above may be mentioned the following: The *Gemeiner Regensburger Chronik*. Here is, for instance, an entry by a Ratisbon gunsmith delivering hand guns set in wood stocks, and weighing about 11 pounds each. In 1381 in the *Chronicles of Augsburg* are listed firearms purchased by the City Council to ward off expected attacks. *Chronicles of Nuremberg, Mohringen and Kaufbeuren* of this period all list firearms.

From 1396 to 1405 considerable research was recorded, notably the *Kriegsbuch Bellifortis* by Konrad Kyeser. This manuscript, Codex Ms. phil 63 at Göttingen





From contemporary fourteenth century drawings. Upper: Firing the cavalry Petronel cannon lock. Lower: Firing the infantry hand cannon.



Upper: Five shot "Lade Büchse" with bronze barrels. Early German cannon lock. Lower: Early German Hakenbüchse for wall firing.

University covers in detail much of the transition period when the hand-fired "Cannon Lock" system was giving way to the next evolutionary step—the Matchlock.

This manuscript and others, *Codex 719 at Nuremberg* and *Codex 734 at Munich,* follows in detail the evolution of firearms at the time, particularly the shoulder-fired arms. Stocks are discussed in detail, and the one piece military stock is shown. Drilling methods were improved to provide tighter gas locks and better accuracy and range. Barrels, flash pans to protect the priming from wind and rain, recoil blocks—these and many other technical aspects are covered in detail.

The manuscripts and illuminations of this period show in great detail such items as multi-barrel guns which were the forerunner of the Gatling Guns. Two- and three-barreled arms are shown, both over-under and side-by-side types. There are guns to fire single balls. Others on the shotgun principle to fire a charge of shot. It is safe to say that every type of firearm in existence today was to some extent visualized and attempted in Germany in this period. The one thing that prevented great advances then was the lack of a suitable cartridge—a development which did not occur until five centuries later.

As the 14th Century drew to a close, primitive forms of a new firing mechanism began to appear, apparently developed in Burgundy. No advance in scientific method ever immediately wipes out the old methods, and so the Cannon Lock continued to be used far into the 15th Century. All early dates, therefore, must be taken as general except where otherwise specified with reference to new developments.

PHASE II—THE MATCHLOCK

Since the earliest times the ignition system in firearms has been called the "lock." The "Cannon Lock," as we have seen, required the shooter to touch a lighted coal or hot iron directly to the priming charge in order to fire.

The Matchlock was originally a very simple "C" shaped piece of metal pivoted to the side of the stock. It was split to grip a "slowmatch"—a cord generally made of hemp, fiber treated with saltpeter and other chemicals to make it slow burning. It was commonly twisted and then held in shape by thread wrapped around it. The "match" burned at a rate of about 3 to 5 inches an hour.

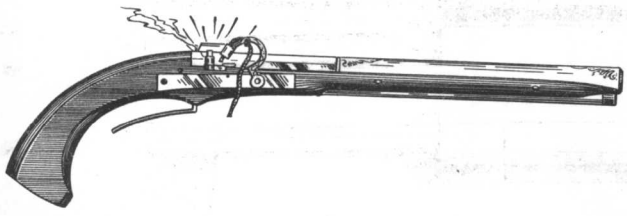
This simple development revolutionized the use of firearms in its day. Up to the time of its introduction, sights were not used, since one hand had to be kept free to apply the burning coal. Field use under such conditions was all but impossible in hand arms. Only artillery was really practical.

With the Matchlock as initially introduced, the tip of the burning cord was held in the split iron holder, and could be pushed with the finger to bring the burning end into contact with the priming powder to fire the weapon. This made it possible to aim hand arms.

This revolutionary device was immediately seized upon by the soldiery of all nations, and development speedily brought it to its peak of possible perfection. The first positive record is found in the *Codex 3069 at Vienna* authentically dated 1411. Erlangen and also Vienna records of the period also detail features of the Matchlock; but it took some 50 years of development to produce a good combination of trigger, hammer and pan mechanism. The "C" form of holder was replaced with a bent iron piece resembling an "S," and known as the "serpentine." This form was used in 1471 by Edward IV at Ravenspur. English Yeomen of the Guard were armed with it in 1485. It was the weapon which turned the tide of the battle of Pavia against the French when used by the Spaniards. Swiss models of the era still in existence carry both ramrods for loading and cleaning needles for clearing the priming touch-hole.

The early developments of this lock included the addi-

From Codex Icon. 222, Munich. Harquebussier of Maximilian I with early matchlock.



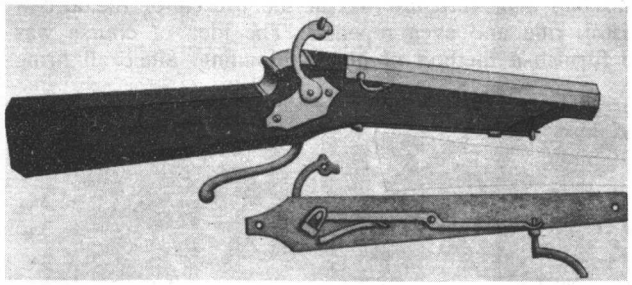
Original drawing from specimen early matchlock pistol. Showing ignition system.

tion of a sort of hammer spring. A button trigger was supplied. This feature of course speeded the ignition and made sighting still easier. At a later date the more formal trigger type was introduced.

The Merz Matchlock

Martin Merz was the most celebrated firearms authority of the time. A truly revolutionary form of the Matchlock was developed by him. It is shown in detail in the *Codex Germanicus 599* published in 1475.

This arm might have revolutionized warfare had its significance been grasped by the rulers of the day. It featured a lock plate covering a series of levers and springs which allowed use of a short sear. It brought the burning match forward away from the eye of the



Merz matchlock and plate. From Codex Germanicus 599, published in 1475.

shooter, making aiming still easier. Like the Swiss matchlocks previously mentioned (which seem to have been developed from Merz' ideas) it carried both a cleaning needle and a ramrod. The importance of this latter item, which is meaningless to us in this day, cannot be overrated. It was not until 1698 that the iron ramrod below the barrel for ready field use in reloading was introduced. Prince Leopold I of Anhalt Dessau armed his forces with it. It was credited with playing a major part in providing the fire power which won the battle of Mollowitz in 1730! In addition to these other features, the Merz Matchlock had both front and rear sights, allowing a maximum of accurate aiming in those days when most arms did not have even a muzzle sight.

Had Merz been an unknown, the failure of the military to pick up his ideas would have been understandable; but in light of his standing it is one of the unsolved riddles of firearms history that they were so long overlooked.

Early use of matchlock in war. From Codex Germanicus 734.

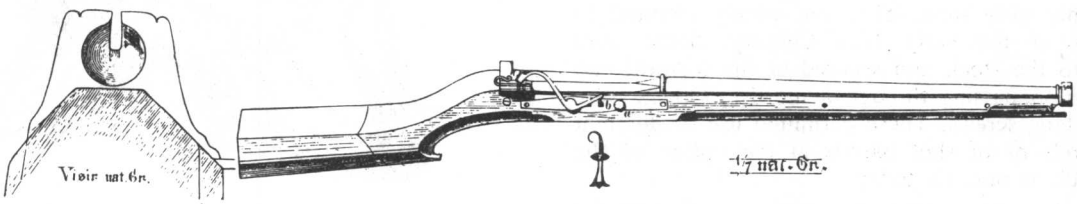
Varieties of Matchlocks

The earliest form of the Matchlock, as we have seen, was merely a pivoted iron holder for the slowmatch which was pushed by the firer manually.

The Germans seem to have been the first to develop the next form already mentioned—the Button Lock. The cock or serpentine (equivalent to a hammer) was drawn back and held by a sear under spring pressure. Pushing a button released the cock and brought the lighted end of the match down on the priming. This was the standard military form used on all small arms until about 1520. It is shown in all the important arms research works of the time, such as the Arsenal Book of the Emperor Maximilian.

The next development was the most successful. It is used even to this day in some areas of Africa and Asia. This was the Pressure Lock. Cornelius Johnson, an English gunsmith, manufactured locks of this pattern as early as 1521 in the Tower of London, but available evidence again indicates the originals were probably German. This type in all its varieties consists essentially of a cock (equivalent of a hammer), a tumbler, sear, two flat springs and a hammer. Basically, it is the thumb-cocked "single action" system as shooters know it today. Pulling the trigger released the tumbler. It revolved 90 degrees to bring the match into contact with the priming.

The final form of the Matchlock was the "Snap Lock" which was in use in Europe in the 1570's and later. It was called by the Germans "light snapping lock" or in some forms "tinder lock." The names derived from the fact that instead of a long dangling slow match as in the regular Matchlock forms, this pattern held a small



Early button lock with receiver sight and cleaning rod from Basle, 1500 A.D. Gun has a bronze barrel.

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