THE GUN AND ITS DEVELOPMENT

THE DUKE IN A WARM CORNER.

THE GUN

AND ITS DEVELOPMENT

BY

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SEVENTH EDITION

Rewritten, and with many Additional Illustrations

CASSELL AND COMPANY, LIMITED

LONDON, PARIS, NEW YORK & MELBOURNE

1899

PREFACE TO THE SEVENTH EDITION.

THIS book, first published in 1881, was written with a view to supplying such information relative to firearms as is most frequently sought by a sportsman. Owing to numerous recent inventions it became necessary not only to rearrange the matter, but to rewrite the book when the sixth edition was needed.

The author thanks those critics who have pointed out literal faults in this book, and he has done his best to remove ambiguities and correct errors. He sees no reason to make any alteration of importance, and, in matters of opinion, adheres to what he has already written, so that this seventh edition is practically a reprint of the last one.

In the arrangement of this treatise the author has followed a method which appears to him the best suited to convey an accurate idea of different small arms and of their capabilities under varying conditions.

From the nature of the subjects treated it is impossible that the book could be wholly free from technicalities, but no endeavour has been spared to make the contents readable; intricate mechanisms, instead of being described in detail, have been freely illustrated; technical data are presented in tabular form, and theories relative to the action of explosives, the flight of bullets and shot pellets have been concisely explained.

The thanks of the author are due to many sportsmen and others who by their investigations and experience have added to his knowledge of guns and gunnery; possibly in some instances the sources upon which the author has drawn have not been acknowledged, but the omissions are unintentional.

The object of the author has been to supply trustworthy information relative to fire-arms and their history, but, owing to the quantity and diversity of the contents, it is improbable that all errors have been eliminated; for such as remain the author asks the indulgence of readers and critics. Any mistake notified will be corrected in future editions and a continuous effort made to render THE GUN AND ITS DEVELOPMENT still more useful to those who have need to consult a shooter's cyclopædia.

W. W. GREENER.

BIRMINGHAM,
1899.

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THE GUN AND ITS DEVELOPMENT.

CHAPTER I.

EARLY ARMS.

WEAPONS which would kill at a distance were possessed by man in the prehistoric age; but what those arms were the archæologist and ethnologist must decide. For the purpose of this treatise it is of small moment whether primitive man was better armed than the modern Ainu or the African pigmy. It is probable that the races of men coëval with the mastodon and the cave-bear were better armed than is generally supposed; the much-despised Australian aborigine, notwithstanding his lack of intelligence, is the inventor of two weapons—the boomerang and the throwing-stick for hurling spears—which races much higher in the scale of humanity could not improve upon. So other weapons, as the sling and the bow, appear to have long preceded civilisation, and their use has been traced to times of remotest antiquity. The throwing of sticks and stones was doubtless the readiest method by which the aggressor could effect a result at a distance. Even monkeys will pelt their assailants with nuts; and the throwing of stones in the primitive fashion was one method of fighting generally practised throughout all ages. It was indulged in by the French and English even so recently as the battle of Alexandria (1801).

It was as an instrument of the chase that the weapon which would kill at a distance was developed; it may be that a flint used for some domestic purpose, and found handy because it was the particular flint most often used, led to the securing of that one flint to the wrist or waist by a thong; thus could the chosen weapon be recovered, and quickly used time after time until the prey was taken or the foe vanquished. This weapon, flint-and-thong, is the first form of the sling-shot, an arm still favoured by the Scotch Highlanders; from it too, probably, the sling was developed. Possibly accident caused to be noticed the increased power of the sling-hurled missile over that of the flint thrown by unaided arm. The use of the sling is, or has been, almost universal. Its invention by the Phœnicians the Acarnanians, or the Ætolians is clearly as mythical as the legend relating to Apollo and the production of the bow. The Achaians and Balerians were extremely

expert in the use of the sling, and even prior to the Christian era made use of lead missiles. The sling was used for many centuries as a weapon of war; it still exists as a savage weapon; but its last appearance for military purposes in Europe was at the siege of Sancerre in 1572.

The bow, although possibly a later invention than the sling, can be traced to the earliest times in the annals of every country. It was held in high repute as a weapon of war, but was pre-eminent as a hunting weapon; by striking down the most renowned as well as the most insignificant of warriors its use was deprecated by men of heroic character.

The ancient method of warfare among the most civilised of nations was inferior to that now practised by the most untutored of savages. The two armies—if a few fighting men and a rabble on each side may be so termed—were usually encamped within a half-mile or so of each other. In the space between the camps single combats took place. The heroes of either side would advance and challenge the other side; thus Goliath before the Jews: Goliath having found his David, and fallen, the Philistines ran away. So in the Trojan war Hector could only be fought by Achilles or some "hero" of equal rank.

The bows and the other engines of war were not available at a greater distance than about four hundred yards, and in the heroic age it may be assumed that it was contrary to the usage of war to fire arrows at champions when engaged in mortal combat. This rule was sometimes broken, as the readers of the "Iliad" will remember; the exploits of the archer Pandarus being there referred to in flattering terms.

The method of war changed when Alexander marched his phalanx successfully against every army in the civilised world. The fiercest champion was powerless against the compact body of men acting as one machine; the tricks of the savage—ambush, stealth, surprise, treachery—were more successful. Then the bow and the sling, the weapons of the hunter and the herdsman, were requisitioned for military purposes. It was sought by their use to destroy the solidity of the phalanx. Terror played an important part in all war manœuvres; the array of elephants before the Carthaginian phalanx, the strange engines of war, were designed to dismay the enemy; so the archers and slingers, but more particularly the archers, struck terror alike into the hearts of mounted warriors and foot soldiers. They were particularly successful in disorganising the cavalry; for the horses, wounded with the barbed darts and driven mad as the shafts changed position with each movement, became uncontrollable.

The weapon which would kill at a distance has always been the weapon of the

hunter; the Roman warrior, with his bossed shield and short sword, was unconquerable in hand-to-hand conflict; and in the Roman wars with Gauls, Helvetians, and Britons the bow played no part; the untrained barbarians met their foe in battle array, and were routed. The Greeks were not a hunting race, and they learned the use of the bow from the Scythians, who were hunters one and all; so the ancient Norsemen, although they made frequent use of the bow, and thought highly of it as an instrument of the chase, rarely employed it in war. The Anglo-Saxons, in like manner, regarded the bow as of little use in war.

The first bow is supposed to have been made by thinning down the horns of the ox and joining them at their base. This gives almost the correct form of the

Saxon Bowmen.

classical bow. The bow of Pandarus is said to have been made of the horns of the wild goat; the Grecian bows, originally of horn, were later made of wood; the strings were of horse-hair or hides cut into narrow thongs. The arrows were of light wood or were reeds tipped with barbed points. The bows of the northern nations were longer and were of wood, and when unstrung were almost straight; it is from them that the English long-bow was developed.

The illustration shows the shape of the Saxon bow; it is from the Cotton MS.,

and represents two sportsmen of the eighth century. In the Saxon Chronicles there is little relating to archery. That Harold, William II., and Richard I. were killed by arrows is every-day history; but it was not until the middle of the fourteenth century that the English bow attained its reputation. It would appear that the bandits and outlaws of Britain—living, as they did, by the chase—knew well the power of the bow; when the King's forces were sent against them they used their bows to such advantage that it was deemed advisable to employ archers in the war in France. Creçy, Poictiers, and Agincourt were won by the long-bow; and almost by the bowmen alone. The bow likewise played the most prominent part at the battle of Homildon Hill, and at Shrewsbury. Long after the use of fire-arms for military purposes it was retained by the English as the chief weapon of war. As much as could be done by legislation was done to encourage its use. The learned Roger Ascham was commissioned to "write up" the sport of archery; later Sir John Smith advocated the use of the bow in preference to the hand-gun, but although it lingered beyond the Tudor period it was in only a half-hearted fashion, and the bands of archers raised to defend the King in 1643 appear to have done very little.

The feats of the bowmen have been greatly exaggerated, but there can be little doubt that a skilled archer was a formidable antagonist. The arrows, made with square heads, would pierce armour quite as well as a musket-ball. Possibly the account of Pandarus's prowess is not exaggerated; at any rate, there are well authenticated records of feats as surprising as that of the effect of his arrow upon Menelaus.

> "It struck
> Just where the golden clasps the belt restrained,
> And where the breastplate, doubled, checked its force
> On the close-fitting belt the arrow struck;
> Right through the belt of curious workmanship
> It drove, and through the breastplate richly wrought,
> And through the coat of mail he wore beneath—
> His inmost guard, and best defence to check
> The hostile weapon's force: yet onward still
> The arrow drove."—*Il.* iv. 119

Giraldus Cambrensis states that some archers belonging to the Ventna, a warlike Welsh tribe, shot clean through an oak door, behind which some soldiers had concealed themselves, the door being no less than four fingers in thickness. A party of 100 archers shot before King Edward VI., at doubtless considerably over 220 yards (the recognised minimum range), and pierced an oak plank one inch

in thickness, several of the arrows passing right through the plank and sticking into the butts at the back. The renowned Douglas found that armour was no protection; his first suit of mail, of splendid temper, was pierced in five places at one battle fought in 1402. The North American Indian has been known to drive an arrow right through a buffalo.

With reference to the range of the bow, the measured mile of Robin Hood and Little John, known by honoured tradition, is as fabulous as the wondrous shooting recounted by Firdusi, the Persian poet, of the heroic Arish, whose arrow sped over five hundred miles. The longest well authenticated distance for shooting with flight-arrows is about 600 yards, and at 400 yards hazel-rods were frequently cleft by experts. Modern archers have in a few instances shot their arrows over 400 yards. The Turkish Ambassador shot an arrow, from a short Eastern bow of horn, 480 yards at one of the early meetings of the Toxophilite Society. By a statute of Henry VIII. it was forbidden that any man over twenty-four years of age should shoot at a mark nearer than 220 yards with a flight-arrow or 140 yards with a sheaf-arrow.

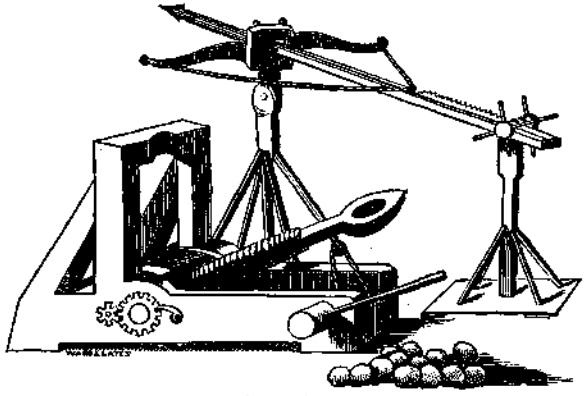
As to the method of shooting, the Persians drew the bow-string to the right ear by means of the thumb, on which not infrequently a ring was worn to strengthen the grip; the ancient Greeks drew the bow-string to the right breast; the English drew to the ear, gripping the arrow and pulling on the string with the fingers.

Under Edward IV. every Englishman was required to

Henry VIII., in Archer's Costume, shooting at the Field of the Cloth of Gold.

have a bow of his own height, made of yew, wych, hazel, or ash, according to his strength. The arrows were required to be of the length of a man's arm or half the length of the bow. Practice was enjoined under certain penalties. In the reign of Henry VII. the use of other bows than the long-bow was forbidden; in the next reign a fine of £10 was ordered to be paid by whomsoever might be found to possess a cross-bow; and during the reigns of Elizabeth, James, and Charles I. the Legislature repeatedly interfered to protect archery.

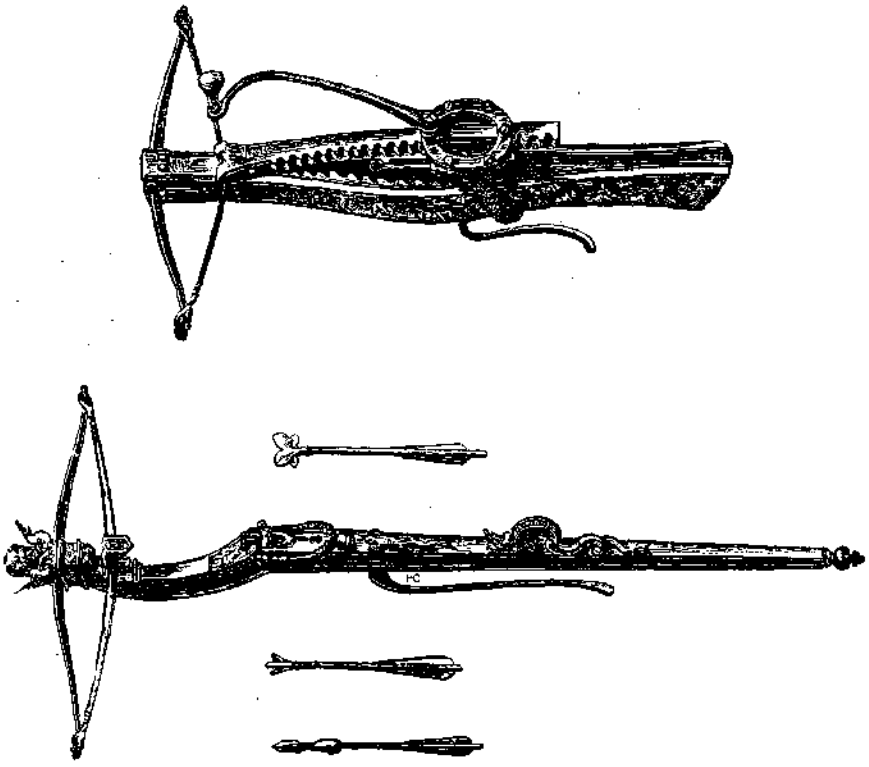
Contemporary with the English bow was the Continental cross-bow or arbalist, a weapon developed from the most ancient engines of war known as catapultæ.



Balista and Catapulta of the Greeks.

Though its invention has been attributed to the Normans, others state that it was invented by the Cretans and introduced into Europe after the first Crusade. In all probability it was a modification of well-known engines of war used in besieging and defending fortified towns. These engines were often of huge proportions; one used by the fifteenth legion against Vespasian at the battle of Cremona, according to Tacitus, discharged stones large enough to crush whole ranks at once. The first mention of such machines is in 2 Chronicles (xxvi. 15), where it is stated that Uzziah "made in Jerusalem engines, invented by cunning men, to be upon the towers and upon the bulwarks, to shoot arrows and great stones." Josephus states that the Jews shot the corpses of men and horses from these machines—a common practice of the Carthaginians, who thought thus to strike terror into their assailants. The catapultæ were sometimes made to shoot at once a whole sheaf of arrows or a number of javelins; the *balistæ* were used to throw stones chiefly.

The cross-bow was looked upon as a most cruel and barbarous weapon, and Pope Innocent III. forbade its use among Christian nations, but sanctioned it in fighting against infidels. Richard I. introduced the cross-bow into the English army against the wish of the Pope; and, he being killed a few years later by a shot



Cross-bows and Quarrels or Bolts.

from one whilst besieging the castle of Chaluz, his death was considered as a judgment from Heaven inflicted on him for his impious conduct.

The cross-bow continued to be much used by the British; the cross-bowmen were second only to the long-bowmen in the expedition fitted out against the Scots by Edward II. In 1572 Queen Elizabeth engaged to find a number of

cross-bowmen to aid Charles IX., and it is said that in 1627 some of the English in the attack upon the Île de Ré were armed with cross-bows.

The cross-bows were of several varieties; in the illustration on page 7, the shorter, called the goat-foot, was the type more generally used for military purposes.

The bow is of steel, and the string is pulled by a hooked rod with a ratchet edge. The ratchet is wound up by means of the lever and cogs until the string is pulled over a movable nut or button fixed to the stock. By depressing the lever underneath the button is brought to the level of the stock, and, the string slipping over it, the bow is released.

In some cases a windlass with ropes and pulleys was used; it was fixed to the stock of the cross-bow after each discharge, but at the time of shooting or marching it was removed, and hung from the soldier's girdle. This type is shown in the illustration of bow-men of the fifteenth century from Froissart. Others were cocked by means of a lever, and some had a pulley fastened in the stock, with a rope passing over it, to which a stirrup was attached.

To bend this bow, its head was rested on the ground, the foot inserted in the stirrup and depressed.

Others were light enough to be set by hand; the one which belonged to Catherine de Medicis is still preserved in the Musée des Invalides, Paris, and is a light ornamental weapon, discharged by a lever trigger which, when pressed towards the stock, lowers the nut or hook clutching the bow-string.

The smaller cross-bow, used chiefly for sporting purposes, was called the prodd; with some such weapon Margaret of Anjou shot deer in Northumberland, and this type was employed by Queen Elizabeth at Cowday.

The bows of the lighter cross-bows were of wood, of wood and horn, or of combined materials. An early Spanish cross-bow was recently examined, to ascertain the material of which the bow was composed. It was found to be mainly of yew, backed with whalebone, the two bound together with sinews, and the whole embedded in a glutinous composition and varnished.

In addition to bolts and quarrels, the cross-bow fired long arrows, occasionally "fire-arrows," and not infrequently was specially designed to propel pellets or stones. The long-bow has also been adapted to the same purpose, for pellet-bows are still not uncommon in the East Indies.

A small cross-bow intended to be concealed about the person, and used as a secret weapon, is preserved in the Birmingham Museum; and the collection of the United Service Institution, London, includes a specimen of a repeating cross-bow—this last a modern Cingalese production.

Cross-bowmen of the Fifteenth Century. (*After Froissart.*)

The arbalist or cross-bow was a clumsy weapon; it fired a variety of missiles, mostly of the type termed *quarreaux*—that is, square bolts, later known as quarrels. These, by reason of their barbed heads and their great weight, caused dangerous wounds; they pierced armour, and not infrequently they were poisoned. An ordinary wound was not easily cured, owing to the clumsy surgery of those days; some of the remedies proposed, and used, must have been worse even than the wounds. The point-blank range of the military cross-bow was about sixty yards, but, if elevated, some were available at more than double that distance.

English Long-bowman.

The cross-bowman was sometimes mounted; the long-bow was quite unsuited for use on horseback; hence perhaps the persistence in the use of the short classical bow by Eastern nations.

Neither the long-bow nor the cross-bow constituted the complete armament of the soldier. The long-bowman carried a mace or mallet with which to kill those whom he had disabled with his arrows; sometimes he was furnished with a pike, which, stuck into the earth in a slanting direction, afforded some slight protection from a cavalry charge. He, like the cross-bowman, was sometimes attended by a *paviser*—that is, a page or varlet—who bore a huge shield, behind which he and his master could shelter from the arrows of the enemy. In the illustration the cross-bowman is taken from the "Chronique d'Engleterre," and the paviser from a copy of the "Romaun de la Rose."

The cross-bowmen usually carried a sword, and it is not to be supposed that they and other archers were the only warriors who sought the shelter and aid of the paviser: even the knights not infrequently put that bulwark as one more thickness of iron between themselves and the missiles they so much dreaded.

The methods of warfare were not greatly changed by the bow; the knights still fought the single combat when they could, and the ordinary rank and file of an army did not count for very much. It is recorded that Richard I., with

Cross-bowman and his Paviser.

seventeen knights and three hundred archers, once sustained the charge of the whole of the combined Turkish and Saracen army, some thousands strong. It is also recorded that *four* English archers landed near a besieged town on the French coast, changed the fortunes of battle, and brought about the rout of the French army. But if the bow was bad, the hand-gun was much worse. Henry VIII., who was erratic in legislation, granted a charter to the Guild of St. George in 1537 authorising its members to practise with every kind of artillery—bows, cross-bows, and hand-guns alike—almost the same year that he forbade guns entirely, and made the possession of a cross-bow a finable offence. In the reign of Queen Elizabeth Sir John Smith, a general of much experience, stated that the bow was the superior of the hand-gun, and although he was taken up sharply by Mr. W. Barwick, Gent., he stuck to his contention. "I will never doubt to adventure my life," he writes, "or many lives (if I had them) amongst 8,000 archers, complete, well chosen and appointed, and therewithal provided and furnished with great store of sheaves of arrows, as also a good overplus of bows and bow-strings, against 20,000 of the best harquebusiers and musketeers there are in Christendom."

Several trials between the gun and the bow are on record, the results generally showing military advantages to the latter. A reliable match decided at Pacton Green, Cumberland, in August, 1792, resulted in a grand victory for the bow. The distance was 100 yards, the bow placing sixteen arrows out of twenty into the target, and the ordinary musket twelve balls only. A similar match took place the same year with very similar results.

Perceiving such results as these so late as the eighteenth century, it is not surprising that in its earlier days the gun proved an inferior weapon to the bow in the hands of a good archer.

There is no record of the muskets used at the trials above quoted, but in all probability the "Brown Bess" would be the one chosen, it being the standard military arm at that period.

CHAPTER II.

THE INVENTION OF GUNPOWDER.

There seems little doubt that the composition of gunpowder has been known in the East from times of dimmest antiquity. The Chinese and Hindus contemporary with Moses are thought to have known of even the more recondite properties of the compound. The Gentoo code, which, if not as old as was first declared, was certainly compiled long before the Christian era, contains the following passage :—

"The magistrate shall not make war with any deceitful machine, or with poisoned weapons, or with cannons or guns, or any kind of fire-arms, nor shall he slay in war any person born an eunuch, nor any person who, putting his arms together, supplicates for quarter, nor any person who has no means of escape."

Gunpowder has been known in India and China far beyond all periods of investigation; and if this account be considered true, it is very possible that Alexander the Great *did* absolutely meet with fire-weapons in India, which a passage in Quintus Curtius seems to indicate. There are many ancient Indian and Chinese words signifying weapons of fire, heaven's-thunder, devouring-fire, ball containing terrestrial fire, and such-like expressions.

Dutens in his work gives a most remarkable quotation from the life of Apollonius Tyanæus, written by Philostratus, which, if true, proves that Alexander's conquests in India were arrested by the use of gunpowder. This oft-cited paragraph is deserving of further repetition :—

"These truly wise men (the Oxydracæ) dwell between the rivers of Hyphasis and Ganges. Their country Alexander never entered, deterred not by fear of the inhabitants, but, as I suppose, by religious motives, for had he passed the Hyphasis he might doubtless have made himself master of all the country round them; but their cities he never could have taken, though he had led a thousand as brave as Achilles, or three thousand such as Ajax, to the assault; for they come not out to the field to fight those who attack them, but these holy men, beloved of the gods, overthrew their enemies with tempests and thunderbolts shot from their walls. It is said that the Egyptian Hercules and Bacchus, when they invaded India, invaded this people also, and, having prepared warlike engines, attempted to conquer them; they in the meantime made no show of resistance, appearing perfectly quiet and secure, but upon the enemy's near approach they were repulsed with storms of lightning and thunderbolts hurled upon them from above."

Although Philostratus is not considered the most veracious of ancient authors, other evidence corroborates the truth of this account, and it is now generally acknowledged that the ancient Hindoos possessed a knowledge of gunpowder-making. They made great use of explosives, including gunpowder, in pyrotechnical displays, and it is not improbable that they may have discovered (perhaps accidentally) the most recondite of its properties, that of projecting heavy bodies, and practically applied the discovery by inventing and using cannon. The most ingenious theory respecting the invention of gunpowder is that of the late Henry Wilkinson :—

"It has always appeared to me highly probable that the first discovery of gunpowder might originate from the primæval method of cooking food by means of wood fires on a soil strongly impregnated with nitre, as it is in many parts of India and China. It is certain that from the moment when the aborigines of these countries ceased to devour their food in a crude state, recourse must have been had to such means of preparing it; and when the fires became extinguished some portions of the wood partially converted into charcoal would remain, thus accidentally bringing into contact two of the principal and most active ingredients of this composition under such circumstances as could hardly fail to produce some slight deflagration whenever fires were rekindled on the same spot. . . . . It is certain that such a combination of favourable circumstances might lead to the discovery, although the period of its application to any useful purpose may be very remote from that of its origin."

The introduction of explosives into Europe followed the Mahomedan invasion. Greek fire, into the composition of which nitre and sulphur entered, was used prior to the fall of the Western Roman Empire. In 275 A.D. Julius Africanus mentions "shooting powder." Gunpowder, or some mixture closely resembling it, was used at the siege of Constantinople in 668. The Arabs or Saracens are reputed to have used it at the siege of Mecca in 690; some writers even affirm that it was known to Mahomet. Marcus Græcus described in "Liber ignium" an explosive composed of six parts saltpetre and two parts each of charcoal and sulphur. The MS. copy of this author in the National Library at Paris is said to be of much later date than 846, inscribed upon it; the recipe given is nearly akin to the formula still employed for mixing the ingredients of gunpowder.

Other early uses of gunpowder recorded are: by the Saracens at Thessalonica in 904; by Salômon, King of Hungary, at the siege of Belgrade, 1073; in a sea conflict between the Greeks and Pisanians the former had fire-tubes fixed at the prows of their boats (1098), and in 1147 the Arabs used fire-arms against the Iberians. In 1218 there was artillery at Toulouse. In the Escurial collection there is a treatise on gunpowder, written, it is supposed, in 1249, and it is from this treatise that Roger Bacon is presumed to have obtained his knowledge of gunpowder; he died

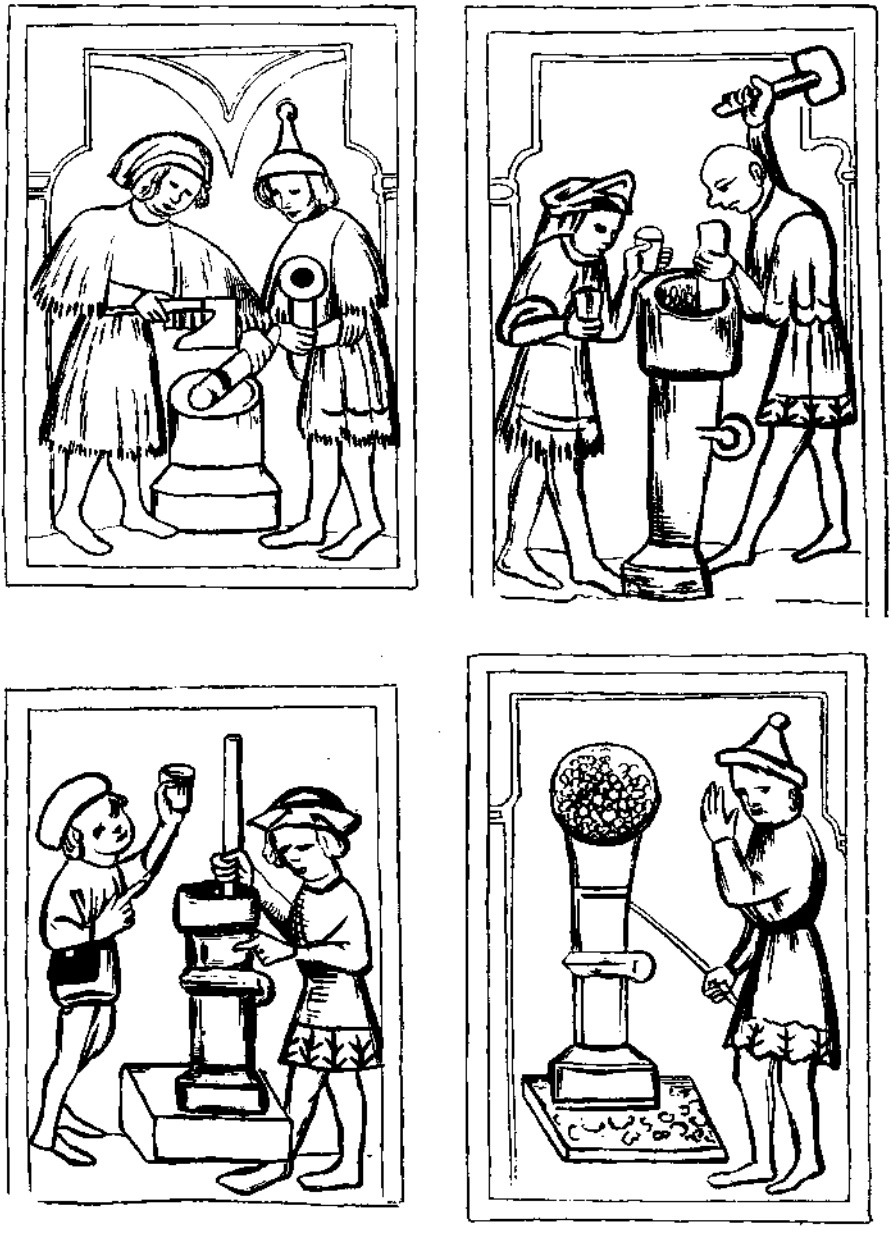
in 1292, and the description is contained in a posthumous work, "De nullitate, etc.," which was probably written in 1269.

Berthold Schwartz, a monk of Friburg, in Germany, studied the writings of Bacon regarding explosives, and manufactured gunpowder whilst experimenting. He has commonly been credited as the inventor, and at any rate the honour is due to him for making known some properties of gunpowder; its adoption in Central

Schwartz Experimenting.

Europe quickly followed his announcement, which is supposed to have taken place about 1320. It is probable that gunpowder was well known in Spain and Greece many years prior to its being used in Central and Northern Europe.

In England gunpowder does not appear to have been made or bought until the fourteenth century. The ingredients were usually separately purchased and mixed when required. Mr. Olliver, of Boklersberry, appears to have been one of the first dealers in explosives; for many years after the use of gunpowder had become general in war the quantities required were purchased abroad, and royal presents to the reigning sovereigns of England often included a barrel or more of gunpowder.



Gunpowder-Making at the End of the Fourteenth Century. *(From a Contemporary German MS.)*

Its manufacture in England, as an industry, dates back to the reign of Elizabeth, when mills were first established in Kent, and the monopoly conferred upon the Evelyn family.

As to what was known of the origin of gunpowder by authorities living prior to the Commonwealth, the following extract from Robert Norton's "Gunner," published in 1628, shows exactly:—

"I hold it needeful for compiling of the whole worke as compleate as I can, to declare by whom and how this so dieullish an invention was first brought to light. *Vffano* reporteth, that the invention and vse as well of Ordnances as of Gunnepowder, was in the 85 yeere of our Lord, made knowe and practized in the great and ingenious Kingdom of *China*, and that in the Maratym Provinces thereof, there yet remaine certaine Peeces of *Ordnance*, both of Iron and *Brasse*, with the memory of their yeeres of Foundings ingraued upon them, and the Arms of King *Vitey*, who, he saith, was their inventor. And it well appearethe also in ancient and credible Historyes that the said King Vitey was a great Enchanter and Nigromancer, whom one Sune (being vexed with cruell warres by the Tartarians) coniured an euill spirit that shewed him the vse and making of *Gunnes* and *Powder*; the which hee put in Warlike practise in the Realme of *Pegu*, and in the conquest of the *East Indies*, and thereby quieted the Tartars. The same being confirmed by certain *Portingales* that have trauelled and Nauigated those quarters, and also affirmed by a letter sent from Captain *Artred*, written to the King of Spaine, wherein recounting very diligently all the particulars of *Chyna*, sayd, that they long since used there both Ordnance and Powder; and affirming farther that there hee found ancient ill shapen pieces, and that those of later Foundings are of farre better fashion and metall than their ancient were."

CHAPTER III.

EARLY ARTILLERY.

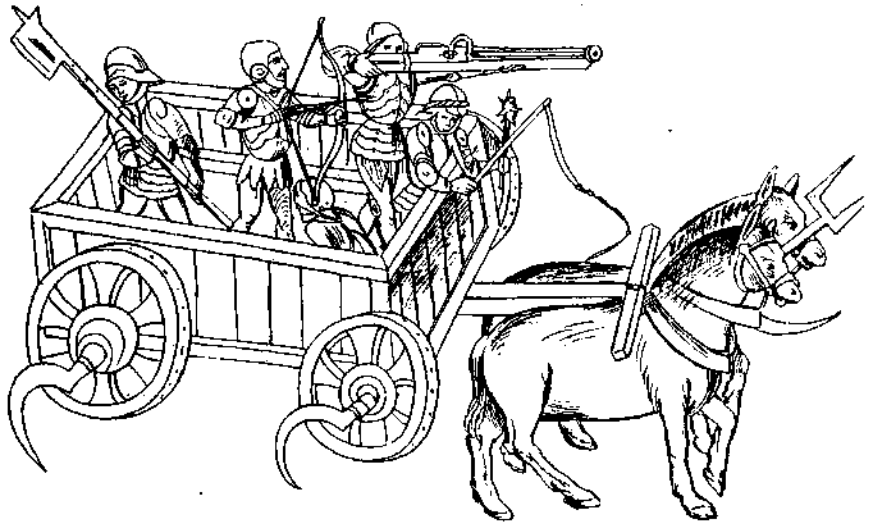
THE FIRST FIRE-ARMS.

FIRE-ARMS of various kinds were well known to the ancients; the accounts given of them are so incomprehensible, exaggerated and generally unreliable, that from them little beyond the fact of the existence of fire-arms can be learned. The development of fire-arms will therefore be traced from their introduction into Europe.

Seville is said to have been defended in 1247 by "cannon throwing stones." On a cannon in the castle of Coucy is "Fait le 6 Mars, 1258, Raoul, Roi de Coucy"; the dates are in Arabic figures. In 1259 Melilla was defended by a machine which, from the description, must be a cannon or like fire-arm. In 1273 Abou Yuesof used canon, firing stone shot, at the siege of Sidgil-messa. In 1301 a "fire mouth" was made at Amberg. In 1308 Ferdinando IV. of Castille employed guns (marquenas de Trueñas) at the siege of Gibraltar. A cannon was found in 1560 among the ruins of the castle of Heyer, on the Rhine, which was destroyed in 1308. In 1311 Ismail attacked Bazas, in Granada, with machines "throwing balls of fire, with a noise like thunder." In the archives of the town of Ghent it is stated that in 1313 the town was possessed of a small cannon; and in the records of the Florentine Republic it is stated that in 1325 two officers were ordered to manufacture cannon and iron bullets for the defence of the castles and villages belonging to the republic. From this date references to their use on the Continent are frequent.

Fire-arms are said to have been possessed by the English in 1310, and to have been used by them at the siege of D'Eu in that year. The first mention in a *contemporary* record is in an indenture dated 1338, between John Starlyng and Helmyng Leget, which mentions, as part of the equipment of the King's ship, "*Bernard de la Tour*," "ij. canons de ferr sanz estuff; un canon de ferr ove ii. chambers, un autre de bras ove une chambre, un ketell," etc.; also for the ship "*X'ofre de la Tour*" "iij. canons de ferr ove v. chambres, un handgone," also "un petit barell de gonpouder, le quart plein." In 1346 John Cooke, a clerk of the

King's wardrobe, to which department the arms and munitions of war belonged, states that 912 lbs. of saltpetre and 846 lbs. of sulphur were provided for the use of the army in France; later in the year, before Calais, he obtained a further supply. That fire-arms were used by the English at Creçy in 1346 is a well-ascertained fact. In 1347 the words "gunnis" and "bombarde" first appear in the



Fire-arms in War Chariot: Fifteenth Century.

State records. When Chaucer wrote his "House of Fame" (about 1373) the use of fire-arms must have been widely known, since he draws a simile for speed from the firing of an engine filled with an explosive :—

> "Swift as a pillet out of a gonne
> When fire is in the pouder ronne."
>
> "House of Fame," b. iii.

In 1344 the household of Edward III. comprised: "Ingyners, lvij.; artillers, vj.; gonners, vj." Their pay was sixpence a day in time of war. John Barbour wrote in 1375 that in 1327, at the battle of Werewater, the Scotch first saw fire-arms :—

> "Twa noweltys that dai thai saw,
> That forouth in Scotland had bene nane

Tymris for helmys war the tane
That thaim thoucht than off grete bewte;
And alsua wondre for to se
The tothyr crakys war off wer,
That thai befor herd nevir er."

An inventory of Baynard Castell in 1388 includes "j. petit gonne de feer." In the records of Henry IV., for 1400, there are mentioned payments for "quarrel gonnes, saltpetre and wadding"; in 1428 entries for "bastons à feu" (fire-sticks —that is, hand-guns).

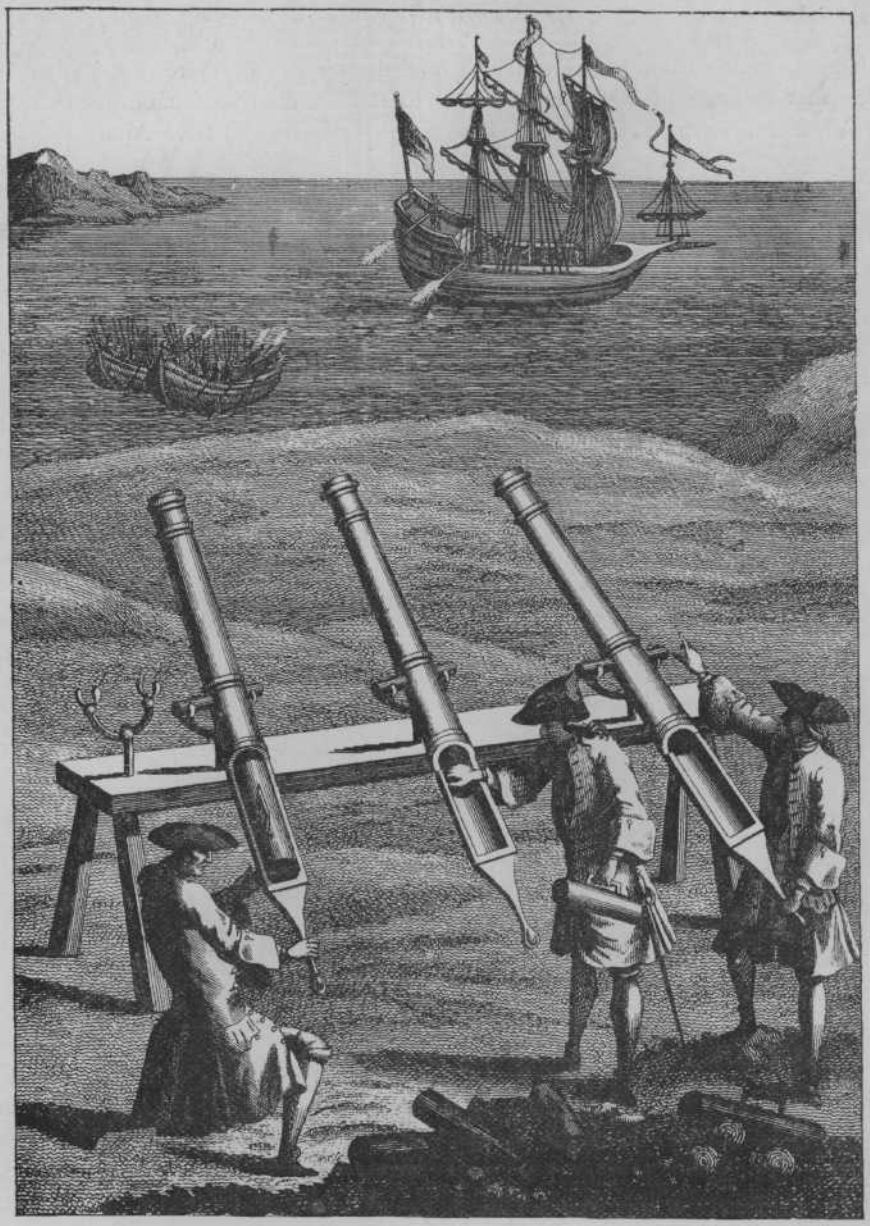
Early fire-arms were variously named in Europe, hence much confusion as to the dates at which fire-arms were used. Valturius, who wrote in the fifteenth century, terms both cross-bows and cannon "balistæ." Before gunpowder was used to propel missiles it was employed *in* or upon projectiles, sometimes affixed to lance-heads made tubular for the purpose; hence, it is argued, the name "cannones" or tubes. Robert Norton has the following with reference to the naming of fire-arms:—

"*Beraldus* saith that at the first invention of Ordnance they were called by the name of *Bombards* (a word compounded of the verbes *Bombo*, which signifieth to sound, and of *Ardeo*, to burne), and they that used them they called Bombardeer, which name is yet partly retained. After which, as Bertholdus saith, they were called *Turacio* and *Turrafragi*, of the breaking-down of towers and walls: and by *John de Monte Reggio* they were called *Tormenti*, their shot *Sphæra tormentaria*, and the gunners *Magistri* tormentorum. But now [1628] Ordnance are eyther named at the will of the inventor, either according to his own name (as the Canon was) or by the names of birds and beasts of prey, for their swiftness or their cruelty; as the Faulconet, Faulcon, Saker, and Culvering, etc., for swiftnesse of flying; as the Basiliske, Serpentine, Aspitic, Dragon, Syrene, etc., for cruelty."

The Germans called their early arms "buchsen," or fire-boxes; the Netherlanders "vogheleer" or "veugliares." The name "gun" is supposed to be derived from "maguinale" or "mangonel," an engine of war like the "balista."

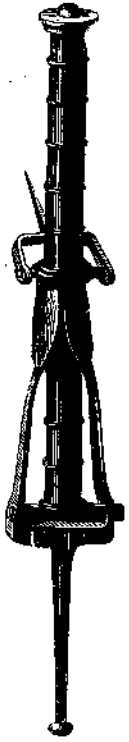
EARLY CANNON.

The earliest arms were small; usually they were of iron forged, and shot arrows weighing about half a pound, and were charged with about a third of an ounce of powder. The fire-arm at Rouen in 1388 was of this description. With it were forty-eight bolts—feathered iron arrows: these were put in from the muzzle. The charge of gunpowder was usually put in a separate movable breech-block or

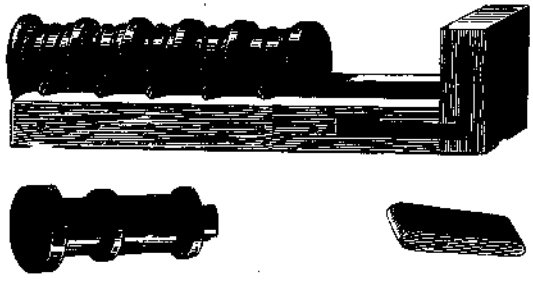


Early Cannon. (*After Grose.*)

chamber. Each cannon was usually supplied with two or more extra chambers. The first mention of cast cannon relates to thirty made by a founder named Aran at Augsburg, Germany, in 1378. These were of copper and tin. Another variety

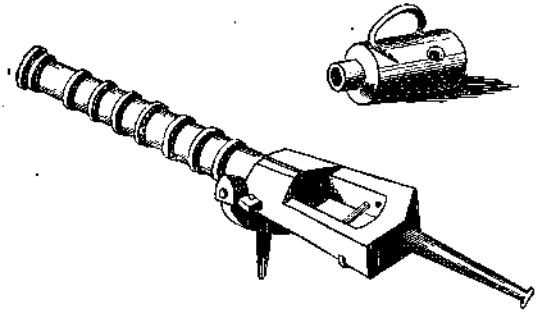


Iron Breech-loading Cannon of the Fourteenth Century.



Breech-loading Cannon of the Fourteenth Century.

Italian Bombard, after Marianus Jacobus.

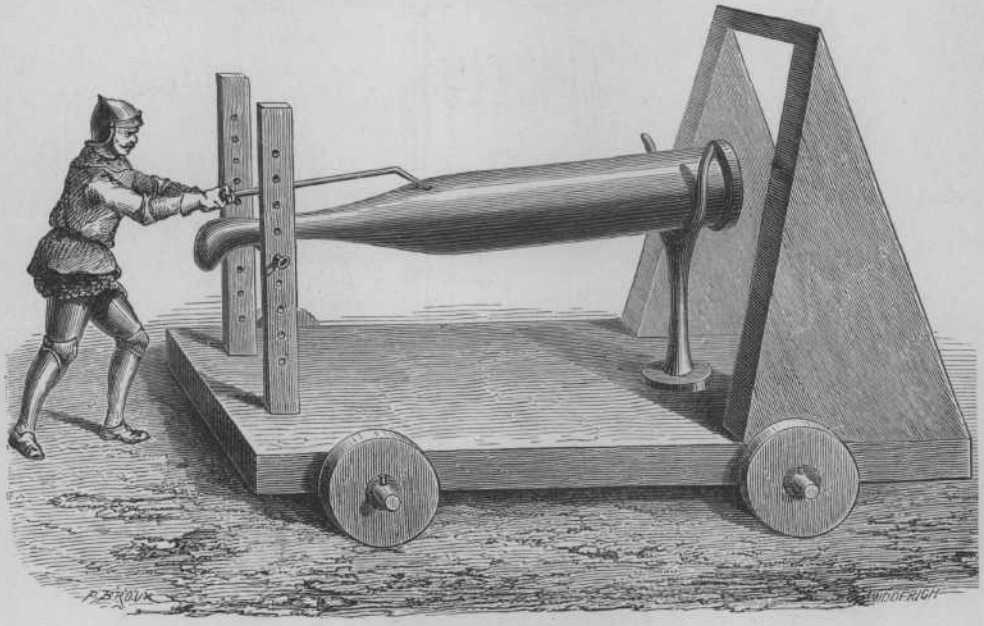


Early English Breech-loading Cannon.

of the same early breech-loading cannon for use on ship-board differs only from the foregoing in having a wooden frame. These cannon were built up of iron strips surrounded by iron rings—a method which continued for several centuries. The cannon often had trunnions, and were mounted as wall pieces, or, attached to wooden frames, were used as in the illustration from Grose's "Military Antiquities."

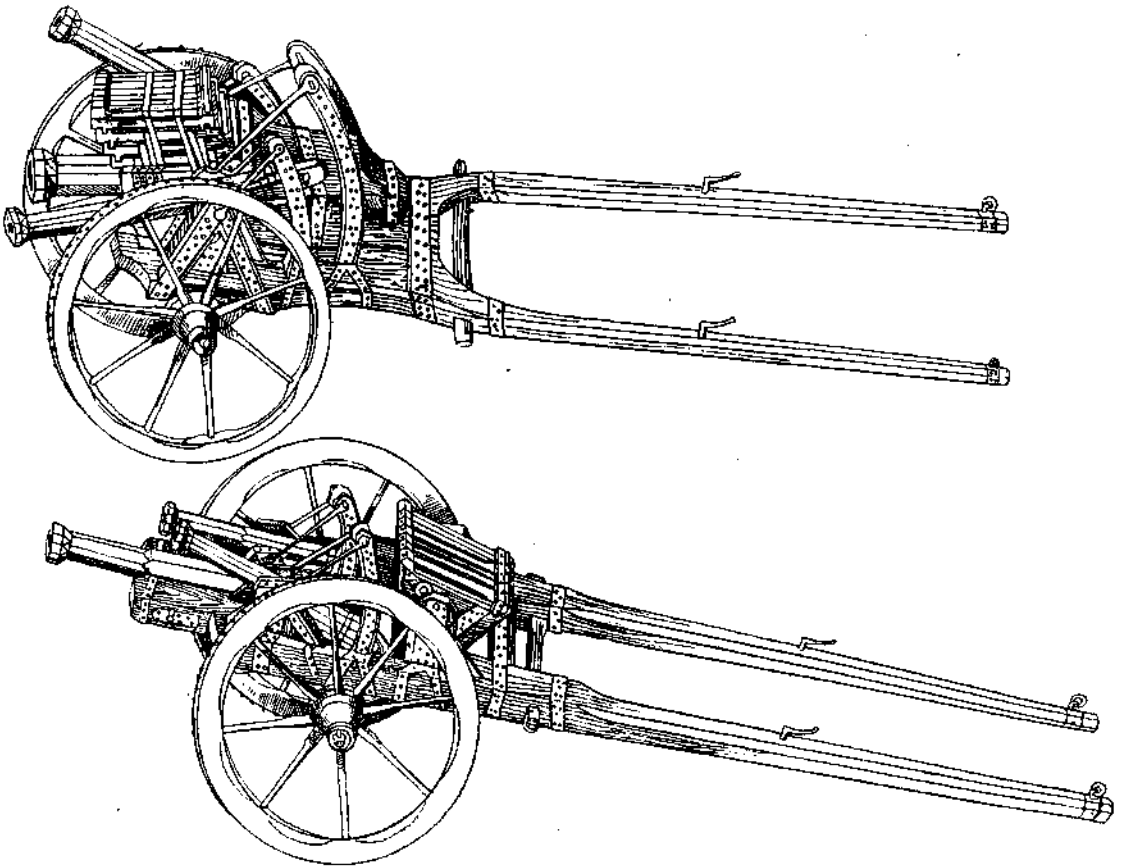
The smallest among the early fire-arms were the Italian bombards, one of which is here shown. These bombards were muzzle-loading, and had the powder chamber of much smaller calibre than the forward portion of the weapon—this fore part was usually more or less taper both inside and out so that shot of different diameters might be fired from them.

There is little doubt that at first the chief advantage supposed to be possessed by fire-arms was the terror and confusion produced by their use; as fighting men



Italian Cerbotain of the Fourteenth Century Mounted upon a Semi-portable Carriage.

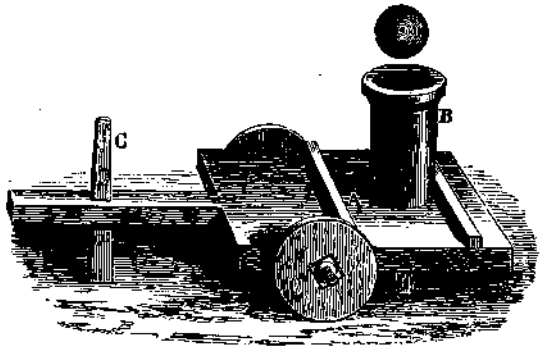
became more accustomed to them they were as far as possible improved, their range and calibre both increased, and they were employed for new purposes—as, for instance, at sieges in lieu of battering-rams. An arm of this description, mounted upon a semi-portable carriage, and so placed as to afford some protection to the gunner, is shown next. The illustration is after a manuscript decoration, and has no pretence to accuracy of detail either in the construction of the carriage or the



German Field Artillery, 1500-50.

supports to the gun. This particular style of fire-arm is referred to by the name of "blow tube," or cerbotain. Another early weapon was the "bombardo cubito," or "elbow-joint gun." In this, the tube of the cannon was fixed at right angles to the powder chamber, A, an aperture in the side of B permitting its introduction; it was held in position by a wedge driven between a cross-piece of the frame and the rear of the powder-box. The angle of firing was adjusted by means of the prop, C.

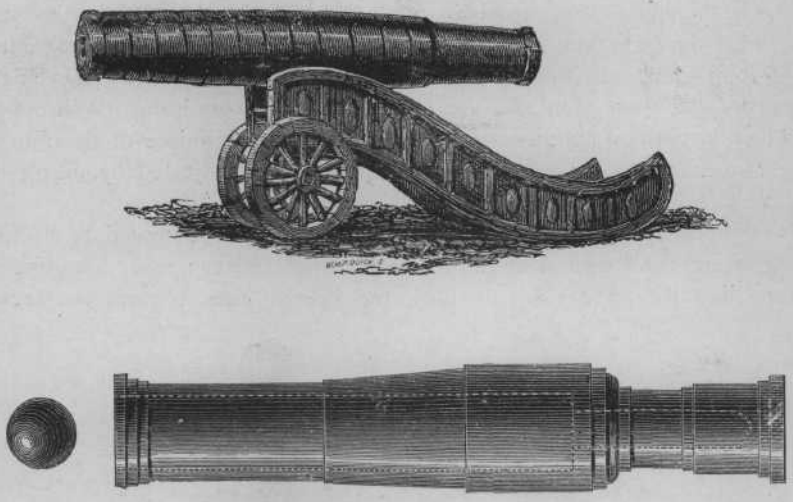
The difficulty in discharging fire-arms quickly was attempted to be met by making several cannons and uniting them on one carriage; sometimes they were arranged like the spokes of a wheel, the breech ends towards the centre, at



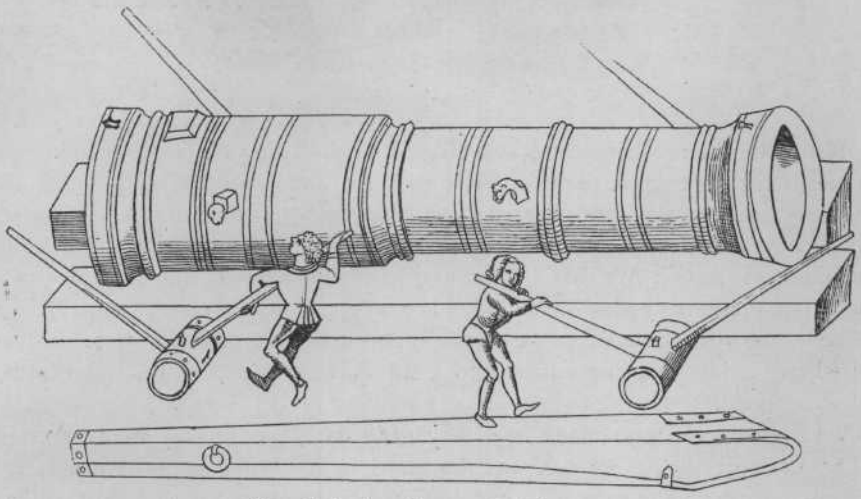
The Elbow-joint Bombard.

which point the revolving table was pivoted vertically to a suitable stand. Sometimes it appears to have been suggested that the cannon should be arranged as the felloes of the wheel; in this case the disc turns on a horizontal pivot. Illustrations of such arms appear in old treatises, particularly in various editions of the military writings of Robert Walther (Valturius), but, like many of the drawings of this date, are presumably ideal sketches, and not copied from weapons actually in use. The bombards arranged on a vertically pivoted disc or table were frequently used, the principle being adhered to until quite recently, as will afterwards be demonstrated.

Large cannon were made at a very early date, even if they were never used. The fact that such a weapon was possessed by a town possibly terrorised opponents. If so small a cannon as may be lifted by one man has wrought such havoc, how can any number of men stand before such fire-arms as these people possess?



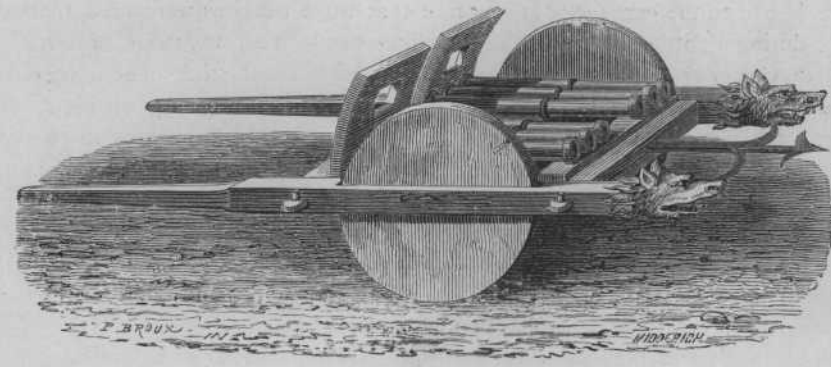
The "Mons Meg" of Edinburgh Castle, as it is, and as restored by M. Louis Figuier.



Fifteenth-Century German Cast Cannon.

In 1413 Mahomet II. had one of these huge weapons at the siege of Constantinople. It is reported to have been forty-eight inches in diameter, and to have fired a stone bullet of 600 lbs. weight. Froissart states that the people of Ghent made a large cannon which was used by D'Ardevelde at the siege of Oudenarde: "Therefore to terrify the garrison he caused to be made a marvellous great bombard; which was forty feet long, and threw great heavy stones of wonderful bigness."

At the middle of the fifteenth century the production of large cannon became quite common in Germany; several of these huge weapons are often referred to by name, and have repeatedly figured in local chronicles. The "Foulenette"



French "Orgue des Bombardes.

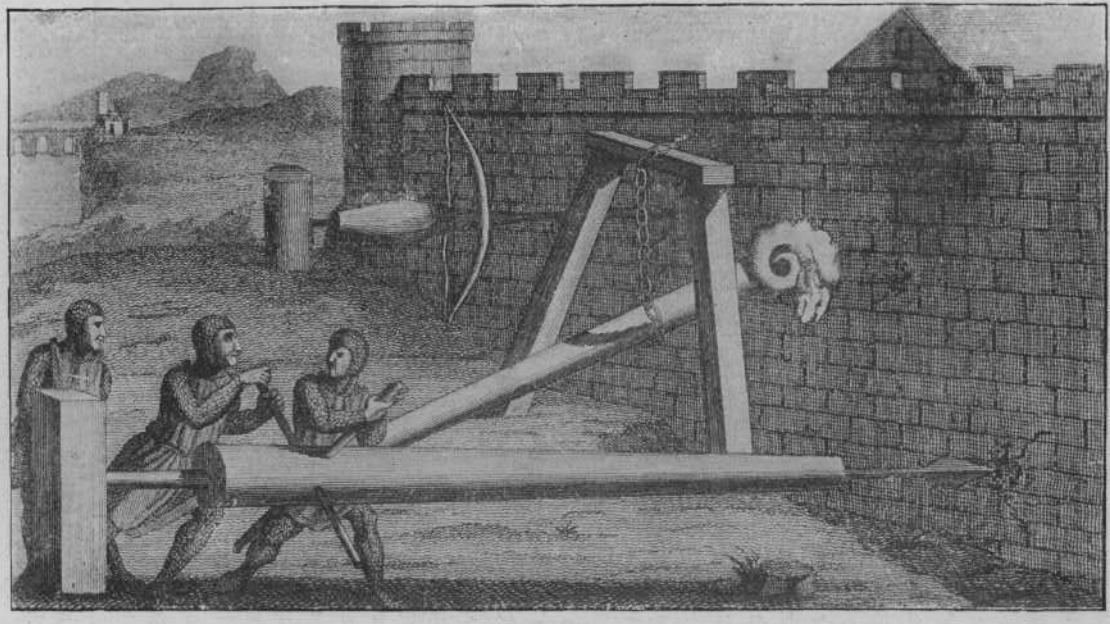
was one, the "Helfant" another, the "Endorfferen' made for Sigismund of Tyrol in 1487, and was a pair with "Bassina" of the Paris Museum. A still larger cannon was the "Faust bucleæ" of Frankfort, made in 1399 and used at the siege of Tannenburg Castle. Its bullet is said to have weighed 8½ cwt. The "Mons Meg" of Edinburgh Castle is supposed to have been of the same general construction as the cannon which in 1460 killed James II. of Scotland. "Mons Meg" was made at Mons, from which town it takes its name; it is now badly broken. It weighs nearly four tons, and its stone shot is calculated to have weighed over 350 pounds. The touch-hole is placed a little in front of the powder chamber, and runs in an oblique direction. These large cannon all appear to have been muzzle-loaders; ordinarily the powder chamber was of about one-third

the diameter of the bore of the cannon, and the usual method of construction was of iron strips and rings welded together as already described. These cannon were for the most part used in the defence of fortified towns or for besieging strongholds; it was not unusual for them to be made where they were to be used and, having served their purpose, they were broken up or retained for further use, since their removal was almost impossible.

Small cannon were used at Creçy, the first credited employment of them on the field of battle. Such weapons were of a semi-portable character, were removed in carts or carried by hand from battle-field to battle-field with the camp baggage. The only pieces designed specially for field use were the "ribeaudequins" or "orgues des bombardes," which consisted of a number of small cannon on a common carriage, the cannon often supplemented by a "chevaux de frise," or pikes were lashed to the carriage. It was rare that these weapons were fired more than once during a battle. Most of the early fire-arms shot arrows, stone, and iron shot, and in Germany the mortars were filled up with small stones about the size of walnuts—the first form of what was afterwards long known as grape-shot. Other German States forbade the use of "hail shot" entirely. Monro, writing in 1626, with reference to early cannon states: "It is thought that the invention of cannon was found first at Nuremberg for the ruin of man, being at first used for battering down of walls of cities . . . . till at last they were used in the field to break the squadrons of foot and horse, some carrying pieces called spingards of four foot and a half long, and shot many bullets at once no greater than walnuts, which were carried on the fields on little chariots behind the troopers."

In the Wars of the Roses cannon were but little used; the Lancastrians had them in the field at Northampton, but, owing to the heavy rain, could not use them. At the taking of Bamborough Castle several were employed, and these were of different sizes—some of iron, others of brass—but the Yorkists did not wish to destroy the castle, but to take it whole and keep it for King Edward. For the siege of Harlech Castle a large cannon was requisitioned. It was brought specially from Calais, and had done good service in France, but it burst at Harlech —probably because overloaded in order to obtain the range required.

Very little more is known respecting these cannon except that each was separately named, as "The King's Daughter," "King Edward," "Bombartel," etc.; that they were painted either bright red or black, or, if of brass, were brightly polished. They were the property of the King; of the nobles; or of the towns; sometimes of humble individuals, who held their weapons and their own services for hire.



Mediæval Battering-ram and Engines of War. (*After Grose.*)

The battering-ram was the most important engine of war at sieges until the middle of the fifteenth century. Some of the larger rams were far more powerful than the largest of the early cannon: it has been computed that one worked by a thousand men had a force equal only to that from a 36-pounder at close range. In the Middle Ages the rams used were smaller, and other engines were used in conjunction with them to make breaches in the walls; some of these are shown in the accompanying illustration from Grose's "Military Antiquities."

To the improved cannon must be attributed the losses of the English in France during the reign of Henry VI.; the artillery of Charles VII. was greatly superior to that possessed by any of the English garrisons, and fortress after fortress, impregnable with the earlier conditions of warfare, fell to the French artillery. At the siege of Orleans Metz lent the beleaguered town a gigantic cannon, and when Joan of Arc went to raise the siege she had with her an immense quantity of fire-arms. The few cannon then in the possession of the English in France are enumerated in a contemporary record cited in Stevenson's "Wars of the English in France."

It was in Italy and Germany that cannon were manufactured and the early fire-arms developed; and it was from these countries that the French were supplied with guns larger and in every way superior to any possessed by the English. After the Wars of the Roses the English remedied the defect. King Henry VIII. was particularly anxious to add to his store, and sometimes, as in 1522, he levied princely blackmail of fire-arms from the Venetian galleys trading to Flanders; yet as early as 1513 the Venetian Ambassador has reported to the Doge that Henry had "cannon enough to conquer hell." A visitor to the Tower of London in 1515 states that there were then in the Tower about 400 cannon, and that most of them were mounted on wheels. It was in the reign of Henry VIII. that cannon were first cast in England. Peter Bawde, a Frenchman, was the artificer; he cast brass cannon in Houndsditch in 1525. Later, about 1535, John O'Ewen was engaged in the work, and by 1543 the industry was flourishing at Uckfield, Sussex, then the centre of the iron trade in Britain.

About this period also so numerous and divers were the pieces in use that they were divided into classes and arranged and named according to the calibre, length, or weight. In France in the reign of Charles V. cannon were mounted upon carriages, and had trunnions and handles, and the touch-holes were covered with hinged flaps. The cannon of the French army then consisted of mortars, four sizes of cannon throwing bullets weighing from 6 to 40 lbs. each, and were called respectively, cannons, culverins, sackers, and falconets. In 1551, under Francis I.,

the artillery of the French army consisted of six pieces, and as they included the leading styles of cannon of this period, a full description will not be out of place.

The "cannon" was nearly 9 feet 10 inches long, weighed 5,300 lbs., carried a bullet 33¼ lbs., and was drawn upon a carriage by twenty-one horses.

The "great culverin" was nearly 10 feet long, weighed 4,000 lbs., carried a bullet 15 lbs. 2 ozs., and was drawn by seventeen horses.

The "bastard culverin" was 9 feet long, weighed 2,500 lbs., and carried a bullet weighing 7 lbs. 2 ozs.; it was drawn by eleven horses.

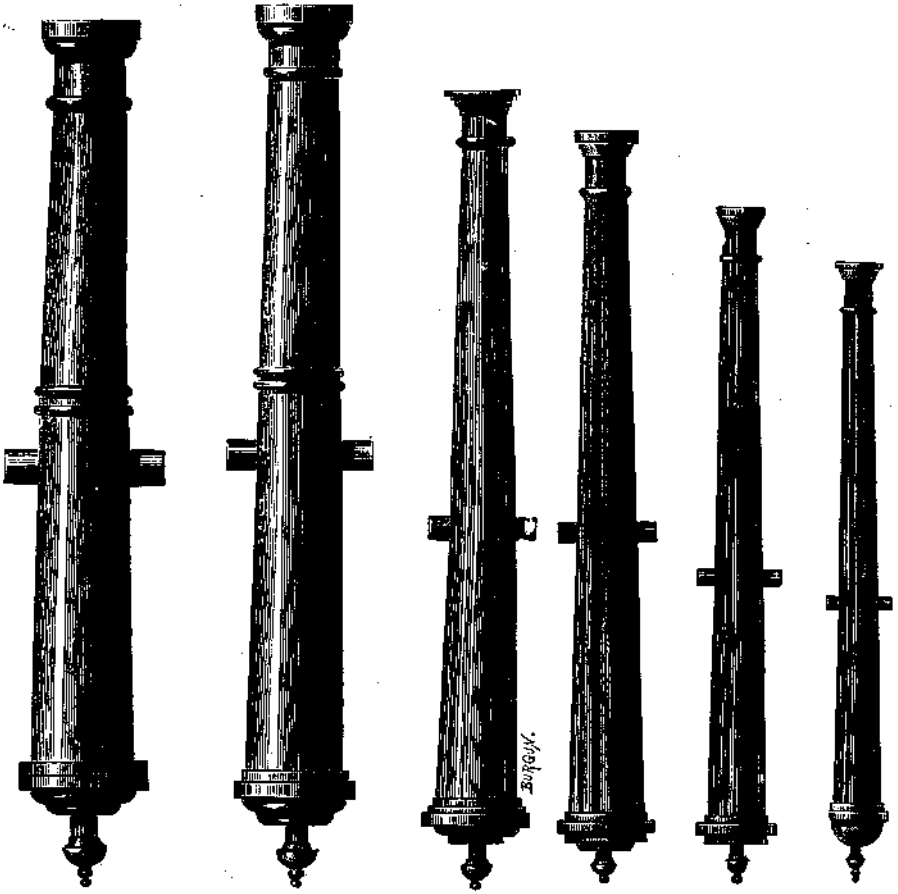
The "small culverin" weighed 1,200 lbs., and carried a bullet weighing 2 lbs. The "falcon" weighed 700 lbs., and carried a bullet of 1 lb. 10 ozs.; and the "falconet," which was 6 feet 4 inches long, weighed 410 lbs., and carried a 14-oz. bullet.

These cannon were of a bronze alloy, formed by mixing nine parts of copper to one part of tin.

The following is an account of names, dimensions, weight of cannon, shot, and powder of the ancient English ordnance. (Time, Elizabeth and James I.; but properly applicable to latter period.)

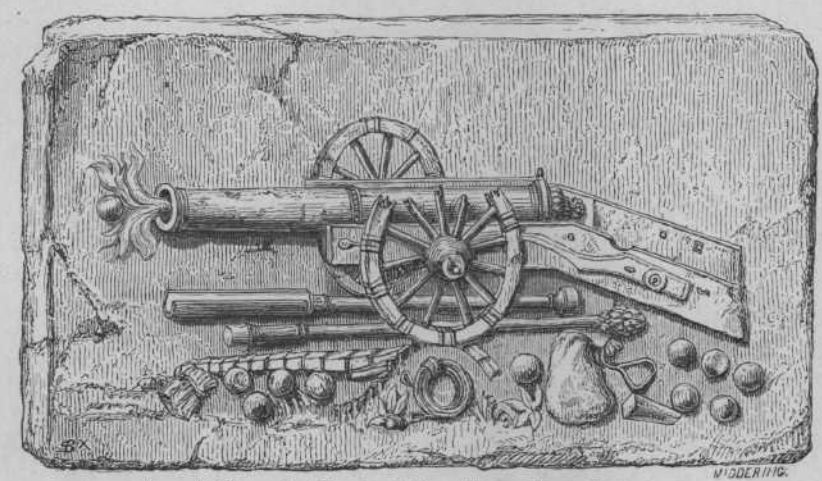
Names.	Bore of Cannon.	Weight of Metal.	Weight of Shot.	Weight of Powder.
	inches.	lbs.	lbs.	lbs.
Cannon royal	8½	8000	66	30
Cannon	8	6000	60	27
Cannon serpentine	7	5500	53½	25
Bastard cannon	7	4500	41	20
Demi-cannon	6¾	4000	33½	18
Cannon petro	6	4000	24½	14
Culverin	5½	4500	17½	12
Basilisk	5	4000	15	10
Demi-culverin	4	3400	9½	3
Bastard culverin	4	3000	5	5¾
Sacar	3½	1400	5½	5⅛
Minion	3½	1000	4	4
Falcon	2½	660	2	3½
Falconet	2	500	1½	3
Serpentine	1½	400	¾	1½
Rabinet	1	300	½	¾

Note.—The weight of spherical lead shot of the diameter of the bore is often less than the weight of shot given in the table; probably the weights indicate the safe limit of the load for grape, bar, spherical, or double shot.



Cannon. Great Culverin. Bastard Culverin. Cu'verin. Falcon. Falconet.

The Cannon of France under Francis I. (1515-47).



Bas-relief from the Church of Genouillac: Sixteenth Century.

A carving on an old French church shows a gun mounted without trunions; apparently fixed to the frame underneath by a loop, through which passes a transverse pin, so that the gun is capable of being elevated from the breech end.

EARLY MORTARS.

The first fire-arms, being made with a powder chamber of smaller diameter than the remainder of the short barrel, were therefore constructed upon the principle of the mortar. The touch-hole was usually placed in the front of the powder chamber. Mortars were classed separately from the cannon by Charles V.; but they appear to have thrown stones or solid metal bullets, not shells. It is stated that red-hot iron shot were fired in defence of Cherbourg in 1418, at the siege of La Fère in 1580, just as at Gibraltar in 1782. The early gunners usually fired their guns with a red-hot iron rod heated in a charcoal fire made for the purpose on the battle-field.

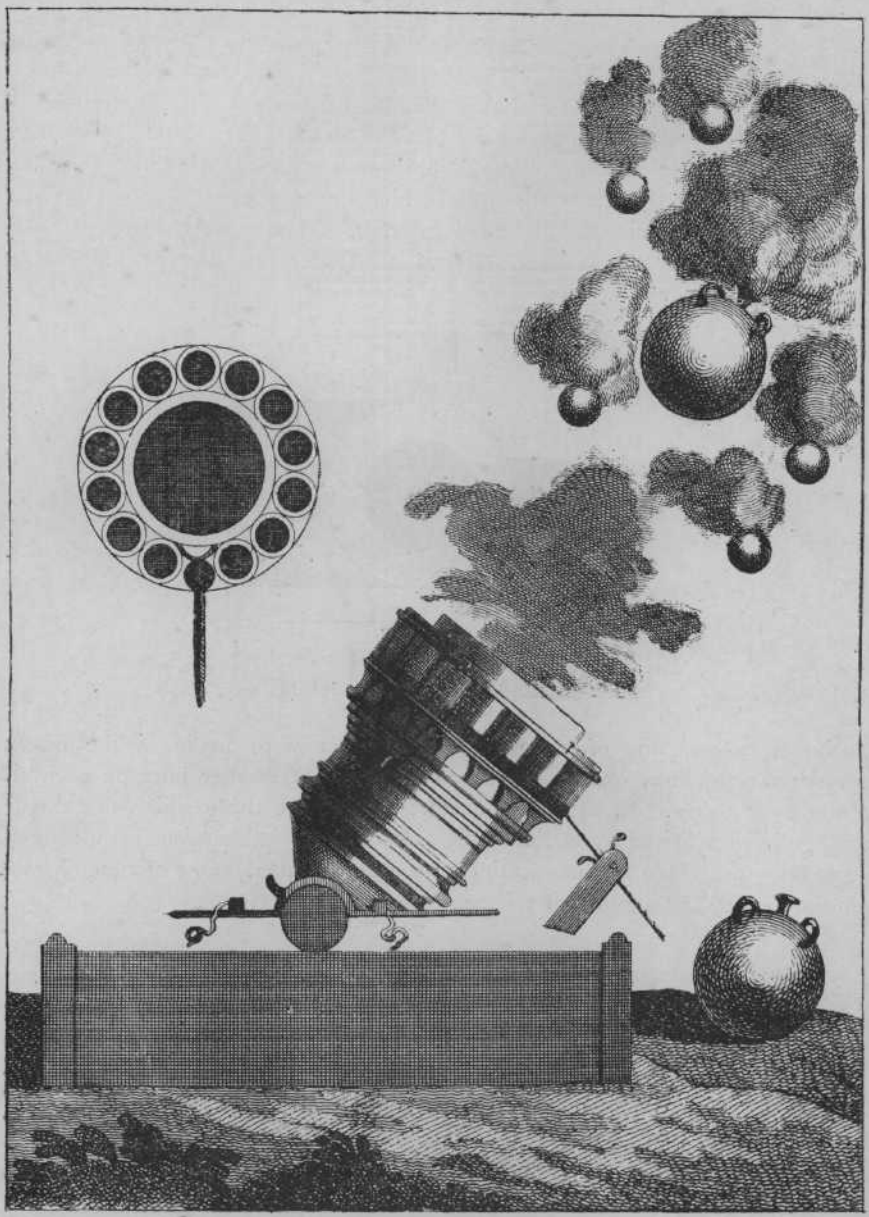
Paul Jove, a historian contemporary with Charles VIII., and who chronicles the campaign of that monarch in Italy, says that the falcons and cannon of smaller calibre fired leaden bullets containing "bloqueraulx," or thimbles of iron. Explosive bombs, or "grenades," appear to have been first used by the Germans. They consisted of hollow metal balls filled with fine gunpowder; the ball was surrounded by a slow-burning coat, and the whole contained in a case, the inflammable coat

being ignited immediately before throwing the bomb. To the Netherlanders, however, is due the honour of successfully applying the explosive shell to fire-arms. This nation appears to have greatly improved the cannon and mortars and other fire-arms during the fifteenth, sixteenth, and seventeenth centuries. In the sixteenth century they successfully employed the explosive shell in conjunction with other missiles fired from their mortars. The accompanying illustration represents the mode of firing a mortar and bomb-shell, or, as they were then called, explosive bullets or grenades.

The bomb, after being filled and a slow match placed in the aperture, was put into the mortar with the match projecting from the mouth of the mortar. This was first lit and afterwards the charge ignited. This system was found to be dangerous

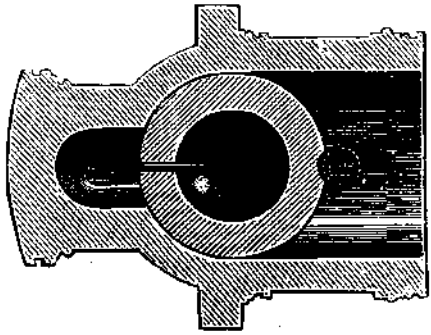
Soldier firing a Mortar and Bomb-shell requiring Double Ignition.

to the users, as in case of a misfire of the charge in the mortar, there was every probability of the shell bursting before the priming could be replaced or the shell extracted. The Germans improved upon this plan by the bomb with a single ignition. Senfftenberg of Dantzic, in his book written in 1580, describes the new invention as consisting of a slow match composed of two different materials. The tube was capped on the outside of the shell by a coil of highly inflammable vegetable composition. The bomb was placed in the mortar, as shown, with the coiled cap of the shell projecting into the powder chamber. Upon the discharge of the mortar the powder ignited the cap, which fired the slow-match in the tube



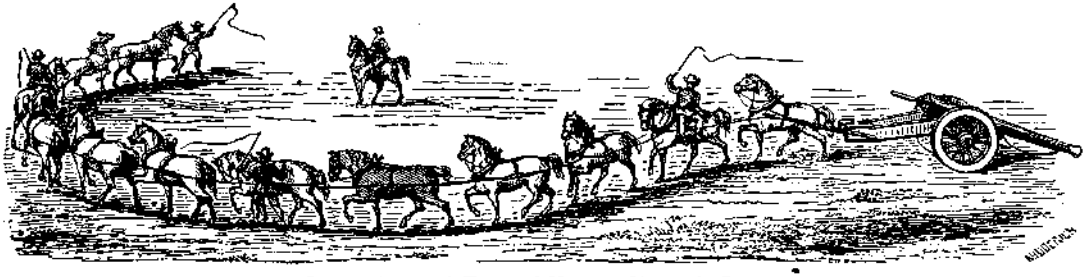
The Partridge Mortar. (*From Grose's 'Military Antiquities.'*)

leading to the interior of the shell. Senfftenberg states that there was one drawback to this shell, viz. in making night attacks the burning tow on the shell lit up the surrounding country and showed to the enemy the position of the besiegers. Shortly afterwards oval bombs were successfully used, and shells made in two or more pieces and bolted together. Mortars were affixed to stands capable of firing a bullet at any elevation between 40 degrees and the perpendicular.



Mortar and Shell requiring Single Ignition only.

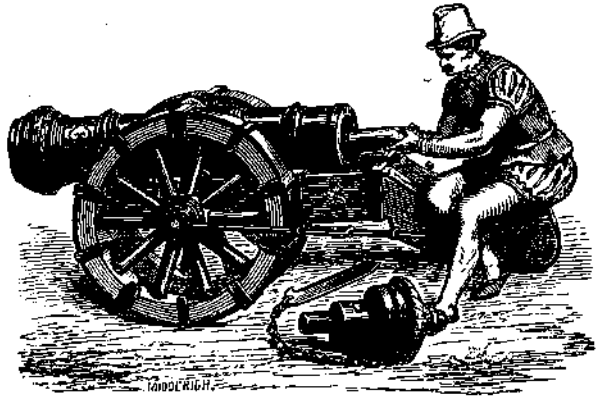
Numerous weapons of a compound character were made in the fifteenth century; for instance, one large cannon with one of smaller bore on each side, or above or below. In mortars the most notable are those which fire three or more projectiles at the same time; these were fired simultaneously by means of a common touch-hole communicating with each chamber. One of nine chambers is in the Tower, and another of thirteen is illustrated by Grose.



Gun-carriage and Team of Horses: Sixteenth Century.

EARLY BREECH-LOADING CANNON.

In addition to the primitive breech-loaders, in which the charge of powder was loaded into a separate breech-box and wedged up to the cannon, there were numerous methods employed for closing the breech of the cannon after inserting the charge. One of these is shown in the annexed illustration. The intercepted screw was used about the same time; but in the seventeenth century, when cannon of greater strength were designed and grained gunpowder was used, it was found impossible to prevent the escape of gas at the breech, and the muzzle-loading



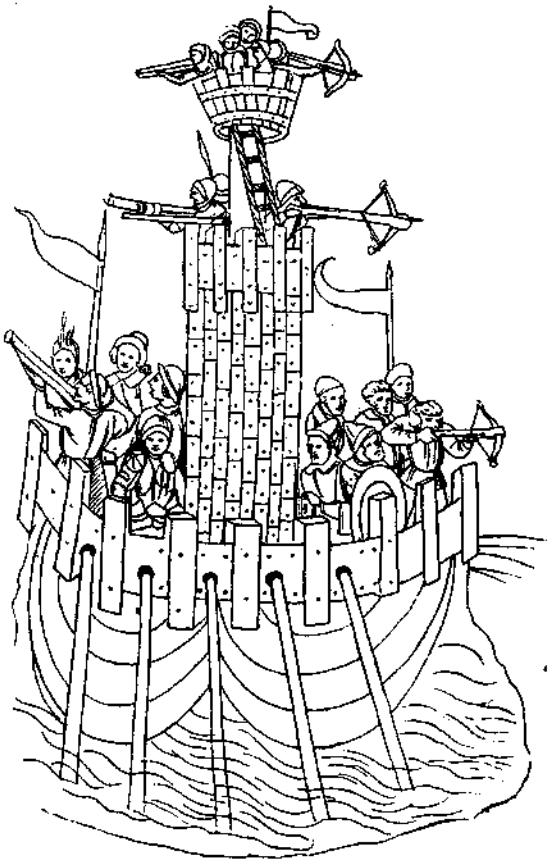
German Breech-loading Cannon of the Sixteenth Century.

cannon quickly superseded all methods of breech-loading for ordnance; and have but recently disappeared in favour of the perfected breech-loaders fitted with effective gas checks.

EARLY SHIP CANNON.

The use of fire-arms on shipboard dates to the latter part of the fourteenth century, but the weapons had no distinctive feature. At the end of the following century it was usual for trading vessels to carry two or more bombards. The war vessels of the early sixteenth century were furnished with small cannon which were fired from the taffrail, and others which were fixed to the decks and fired through ports, as shown in the pictures still extant of the *Great Harry*.

The *Mary Rose*, an English vessel, was wrecked in the reign of Henry VIII., about 1545, while standing along the coast. During a distant firing from the French

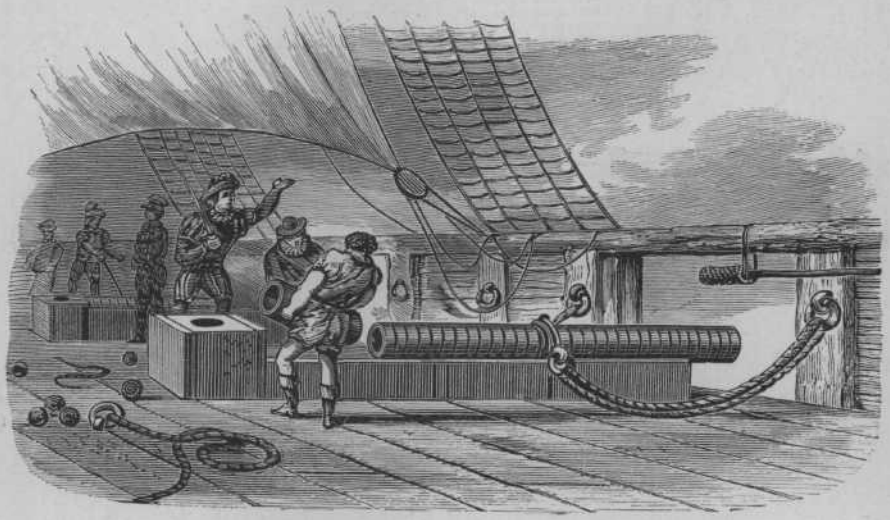


Warship carrying Cannon. (*After Valturius*, 1470-1500.)

fleet, under Admiral Annebout, she was overpowered by the weight of her ordnance, and sunk, together with her commander and 600 men. Owing to the praiseworthy exertions of Mr. Dean, several brass and iron cannon were recovered

from the wreck about fifty years ago, and these relics throw some light upon the manner in which the English vessels were armed in the sixteenth century.

The gun shown is composed of a tube of iron, its joint overlapping and running the entire length of the barrel. Upon this tube is a succession of hoops composed of iron three inches square, being, in fact, immense rings. These were driven on whilst red-hot, and by their contraction formed a much stronger gun than would at first



Breech-loading Cannon of the *Mary Rose.*

appear probable. It was affixed to a large beam of timber by means of iron bolts, similar to the manner in which an iron musket-barrel is fastened to its stock. The loading was effected by removing a breech-block, inserting the charge, replacing the block, and wedging it into the barrel from behind, as shown on page 22. The recoil was prevented by means of a "bitt," or large beam, fixed perpendicularly in the deck.

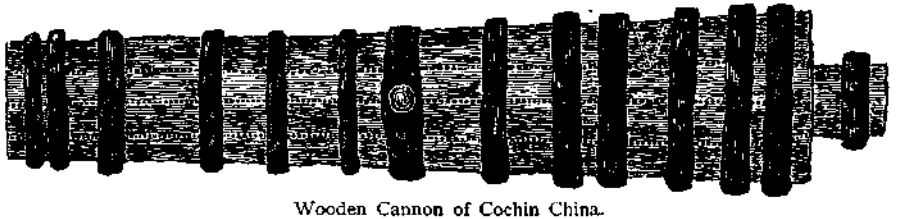
Similar cannon were found in the Tyne whilst dredging, and are still in the old castle at Newcastle-on-Tyne.

The Venetians were among the first to use cannon on shipboard. In 1380 one of their vessels was taken at Sluies; on board was a master gunner, "divers greate gunnes, and a quantitie of powder." This last is recorded by the chronicler to have been worth more than all the rest.

MISCELLANEOUS EARLY ARMS.

Cannon of three and more barrels were made in the fifteenth century; a curious breech-loading cannon of this description is shown in the annexed illustration; a different method of arranging the three barrels is also illustrated.

The bore of the cannon was not always circular; an oval-bore cannon was made in Germany in 1625. A weapon of still greater elliptical bore is shown on the opposite page. This peculiarly shaped mortar was sometimes used to make breaches in barricades at close quarters, when it was charged to the muzzle, and bars of iron fired from it. It was also used for firing bar-shot.

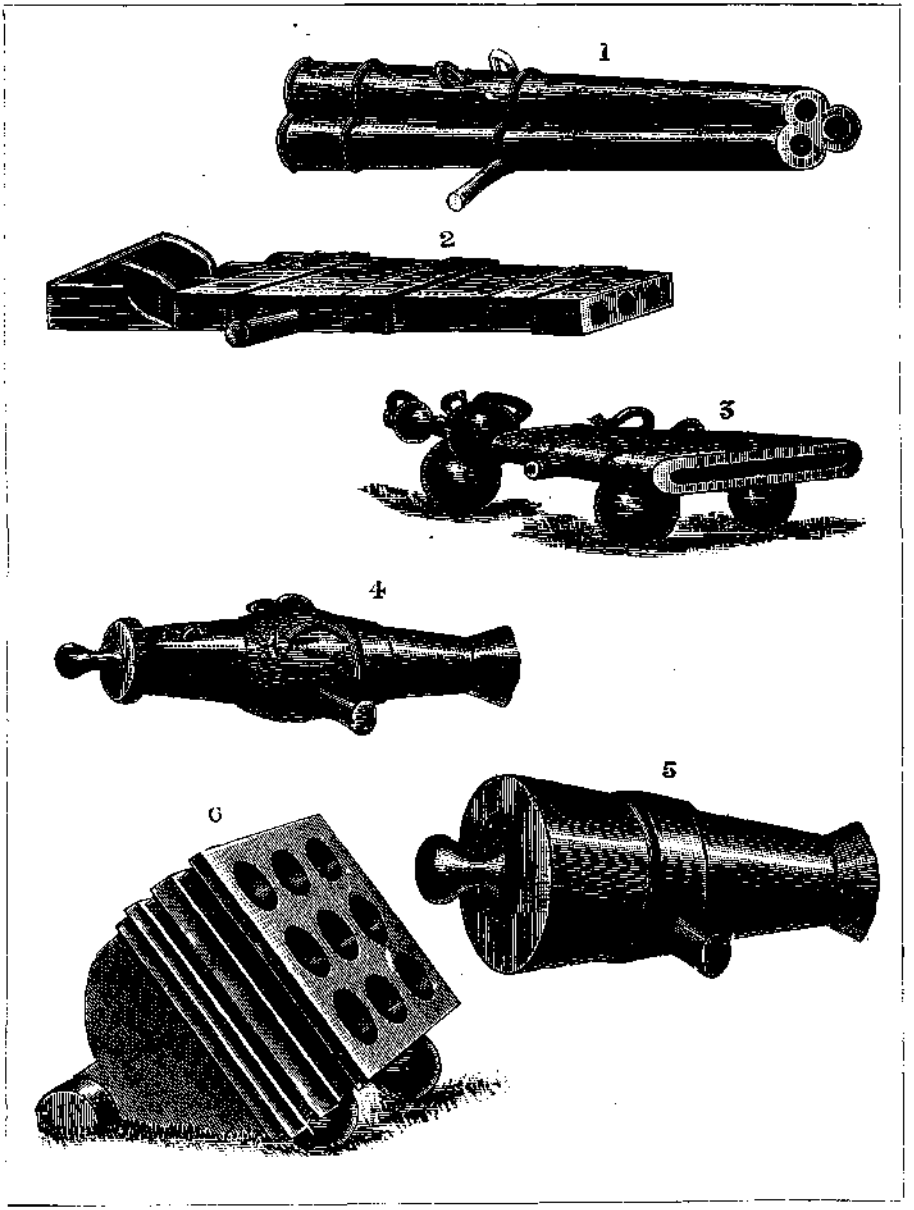


Wooden Cannon of Cochin China.

The petard was a peculiar arm used for affixing to doors or walls in order to effect a breach. It consisted of a short gun, or rather cannon, loaded to the muzzle, and fixed in a peculiar manner against the surface to be blown apart, so that when fired the door or wall should receive the shock, and not the petard. Their use has long been discontinued, bags of gunpowder hung against barricades answering the purpose just as well.

Various substitutes for metal have been used for constructing cannon and mortars. Leather was probably the most successful; it was often used by the Venetians, sometimes in conjunction with hempen rope, sometimes alone. A leather cannon was fired three times at King's Park, Edinburgh, in October, 1788. Cannon of paper, brought from Syria by the Crusaders, are preserved at Malta, and considered great curiosities. According to Nathaniel Nye, who wrote in 1640, an artificer of Bromsgrove, near Worcester, was very successful in making fire-arms of paper and leather, and they were recommended by Nye, as master gunner of Worcester, because of their lightness and strength.

Wooden cannon do not appear to have been at all common in Europe; several have been brought from China and the East, where they seem to have been in general use. The one illustrated is still in the Paris Museum, and, as shown, is

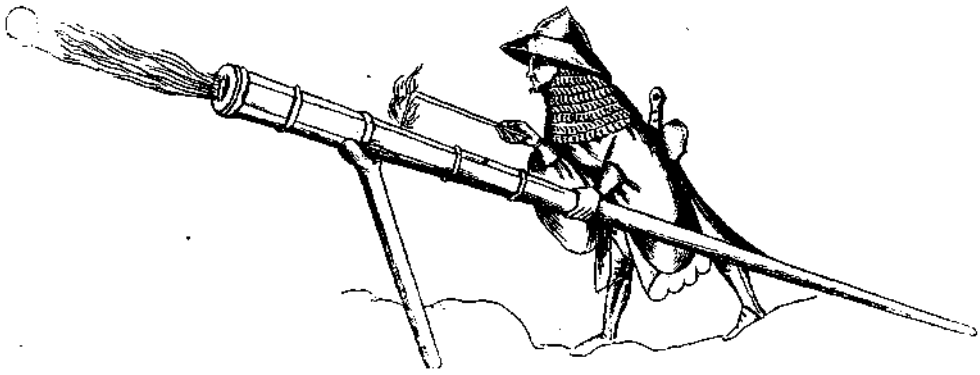


Old Cannon Mortars, etc., from the Tower of London.

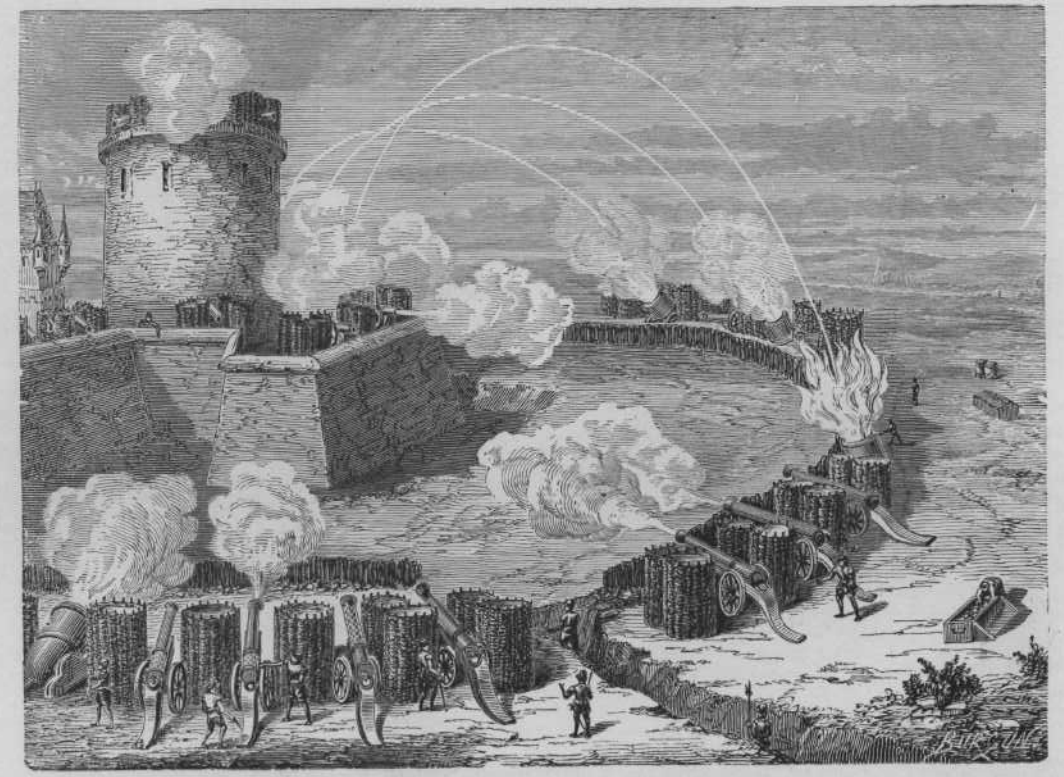
hooped with iron. It is about 8 feet long, and the bore is 6 inches in diameter. The wood used is of light colour, but very hard. The body of the cannon is in two pieces, each having a groove in its centre; the two pieces are laid together with the grooves coinciding with each other, and hooped together. The breech consists of a wooden plug, dovetailed into the two pieces forming the cannon, and is bound with one iron ring. The joint of the two pieces is shown in the engraving, and the relative size and shape of the interior of the cannon, the dovetail of the breech block, and the position and shape of the touch-hole, are shown by the dotted lines

In the museum at Zürich is a cannon made of a thin iron coil or tube surrounded by two pieces of grooved stones after the fashion of the wooden cannon above, but joined together with cement, the whole being covered with leather.

These remarks upon early cannon may be aptly concluded by an illustration from a painting of the early part of the sixteenth century, showing the manner of besieging at that period.



Soldier Firing Semi-portable Gun (from an early MS.).



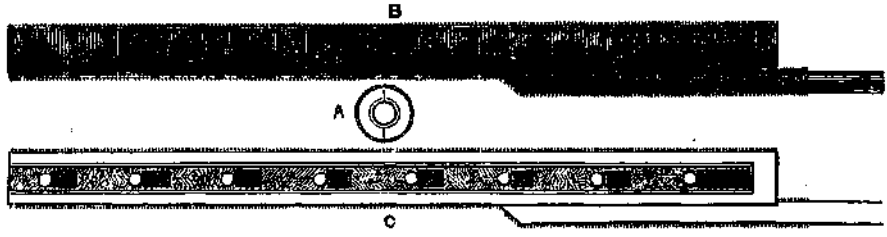
Besieging a Fortified Castle : Sixteenth Century.

CHAPTER IV.

EARLY HAND FIRE-ARMS.

CANNON AS HAND-GUNS.

No distinction can be drawn between the small cannon or "crash-guns" of the fourteenth century and the earliest hand fire-arms. A pyrotechnical piece developed into a variety of hand weapon, and used for military purposes—especially for causing disturbances among troops, frightening horses and stampeding cattle—was employed by Eastern nations and by the Arabs in Northern Africa. The following description of this weapon is from the "Dictionnaire Mobilier Français," and, according to that work, it was also used by incendiaries, pillagers, and outlaws. In the illustration B shows the exterior of the gun; A is an end elevation, and C a sectional view showing the construction. The gun consisted of an iron tube about six feet long, covered with two hollowed pieces of wood, and bound round with



Pyrotechnical Hand-weapon.

hair, hemp, hide, or other suitable substance. The charge was composed of, first, a bed of fine gunpowder, four fingers in thickness, then a bullet made of hempen stuff mixed with powder, wax, etc., then a layer of coarse powder, composed of powdered glass, Grecian wax, steel filings and saltpetre, then two fingers of fine powder and bullet alternately, until loaded to the muzzle; it will thus be seen that the weapon greatly resembled a *Roman candle* or *pump*, throwing successively burning wax and inflammable balls. The weapon was, of course, fired from the muzzle, and the whole tube bound upon a stick, to handle it during the discharge.

It is said that such weapons were in use amongst the Arabs during the fifteenth century.

The "hand-cannon," as first used by the French, Italians, and Netherlanders, consisted of a small bombarde (*bombardello*) affixed to a straight piece of wood, and fired from the shoulder by means of a match, as shown in the accompanying illustration. A slight modification of this weapon rendered it applicable for use upon horseback. Instead of being fastened to a stock, the bombarde was welded on to an iron rod about 30 inches long; the extremity of the rod was pierced, and a cord passed through, and thus suspended from the neck of the soldier.

Foot Soldier Firing Hand-cannon: Fourteenth Century.

The bombarde was supported by a forked rest projecting from the saddle-bow, and pointed by the left hand, the right serving to apply the fire to the touch-hole. Both illustrations are from the MS. of Marianus Jacobus, written in 1449.

The first account of hand-cannon being used in Germany was in 1381, when the town of Augsburg supplied thirty men armed with them to the contingent of the Suabian towns in their war against the South German nobles.

The exact construction of these early cannon is shown by the annexed illustration. The powder chamber was of smaller internal diameter than the bore of the gun, but externally larger; the mount was sometimes a staff forced into the ferrule at the base of the chamber; more often a spike from the breech of the gun was

driven into the staff. These cannon were known as *bastons-à-feu* or "fire-sticks," and were common in the Netherlands in the fifteenth and sixteenth centuries.

These fire-arms were sometimes so fashioned as to be capable of use as clubs or battle-axes. The club pistol shown is about two feet in length, the touch-hole is on the top and the pistol was held in one hand and fired by application of a slow-match

Cavalier Firing Petronel. (*After Marianus Jacobus.*)

from the other. The next figure represents a pistol battle-axe in the Dresden Museum; dotted lines show the position of the touch-hole. For use as a fire-arm the grip of the axe had to be reversed, and it was grasped near the head; later pistols had the axe-head fixed upon the muzzle end of the barrel. The two weapons here illustrated are both of fifteenth century manufacture.

The ordinary hand-culverin consisted of a small cannon affixed to a stock by iron bands, as represented. The barrel was of forged iron; the stock of rough

wood, nearly straight; the barrel being fastened to it by the five iron bands, and the two side bridles fastening the trunnion or swivel band to the butt. These culverins were of small bore (about ½ or ¾ inch), and were extensively used towards the close of the fifteenth century; for at the battle of Morat, in 1476, the Swiss army counted not less than 6,000 culveriners. The hand culverin required two

Early Hand-Guns, showing Methods of handling them, as illustrated in Contemporary MS.; and a Sectional View of Gun, showing its Construction.

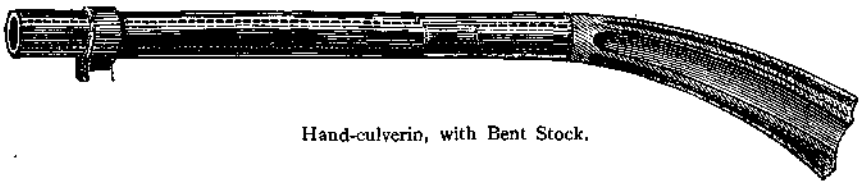
men to manipulate it. It was fired from a rest, sometimes forked (*fourquine*), and sharpened at its lower extremity to obtain a firm hold in the soil and served also as a ramrod. One man (the culveriner) levelled and held the weapon during discharge, whilst his companion (the *gougat*) applied the priming and the match, and assisted in loading and carrying the weapon. The culverin was improved at a later date by having the bore enlarged, the stock more bent, and affixed to the barrel by entering into a recess in its breech-end, as shown in the accompanying illustration

by the dotted lines. The internal bore of the barrel and the position of the touch-hole are also shown by the dotted lines. A forked rest was used with this

Iron Club Pistol of the Fifteenth Century.

Pistol Battle-axe.

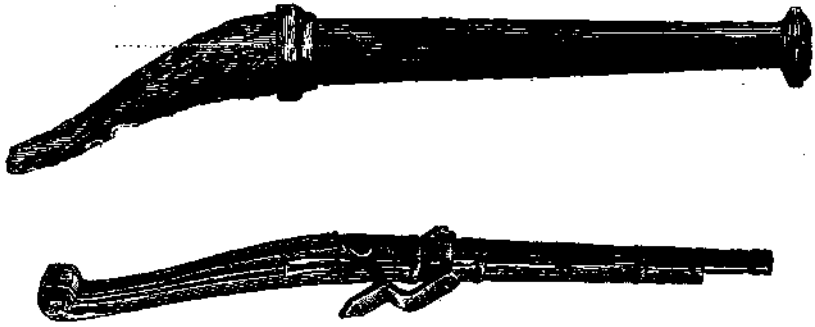
Early Culverin.



Hand-culverin, with Bent Stock.

culverin, and in some instances the stock was ornamented with grooves of various sizes. The culverin was afterwards improved by placing the touch-hole upon the side, with a flash-pan for the powder, as shown. The barrels were made of bronze, and cast in octagonal or hexagonal form; the stock was lengthened, fitting under

the arm, and shaped like the butts of modern punt-guns. Several good specimens of these early culverins are to be seen in the Musée des Invalides at Paris. The culverins varied greatly in their dimensions and weight; the smallest for horseback use, and similar to, or identical with, the pétrinal, were about 4 feet long, and weighed from 10 to 15 lbs.; the larger culverins were from 4 to 8 feet long, and weighed from 12 to 60 lbs. By the end of the fifteenth century hand-cannon were in use throughout Europe as military weapons. Charles VII. had a corps of horse-culverineers, and the hand-culveriners of Charles VIII. played an important part in Italy during his campaign in 1494. Hand-cannon were also used by the Emperor



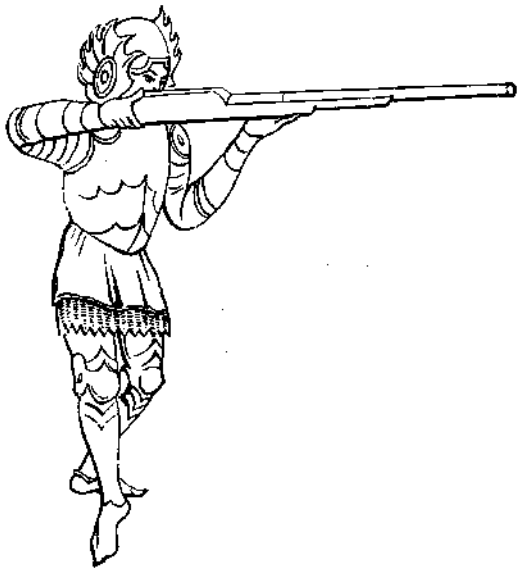
Culverins with side Flash-pans.

Sizgimund, who led 500 men armed with "rest-guns," in his Roman campaign in 1430, when they created a great sensation, although similar guns had been made at Padua as early as 1386. Hand-guns figured conspicuously in the Hussite wars, and at the siege of Lucca by the Florentines in 1431. All these early hand-guns were, however, roughly constructed, for their accuracy in hitting was as small as the trouble of loading was great, and their imperfections as numerous as those of the gunpowder with which they were fired, which was veritably powder, resembling dust —powder not being granulated till the sixteenth century.

The first English illustration of a hand-gun appears in the Royal MS. 18 E, fol. xxxiv., written in 1473. Reproduced is the illustration, which, however, has already appeared in "Hewitt's Ancient Arms and Armour." The drawing is not an explicit one; it fails to show the position of the touch-hole, or to explain in which way the gun was fired. As the bearer carries neither flask nor pouch, he must have been accompanied by an attendant, who carried the accessories and applied

German Gunners and Cross-bow Men of 1430.

the ignition to the arm. The position of the man is also very peculiar, and one not well calculated to withstand the recoil. The manner of grasping the gun is also original, and from the general appearance of the drawing it appears to represent a

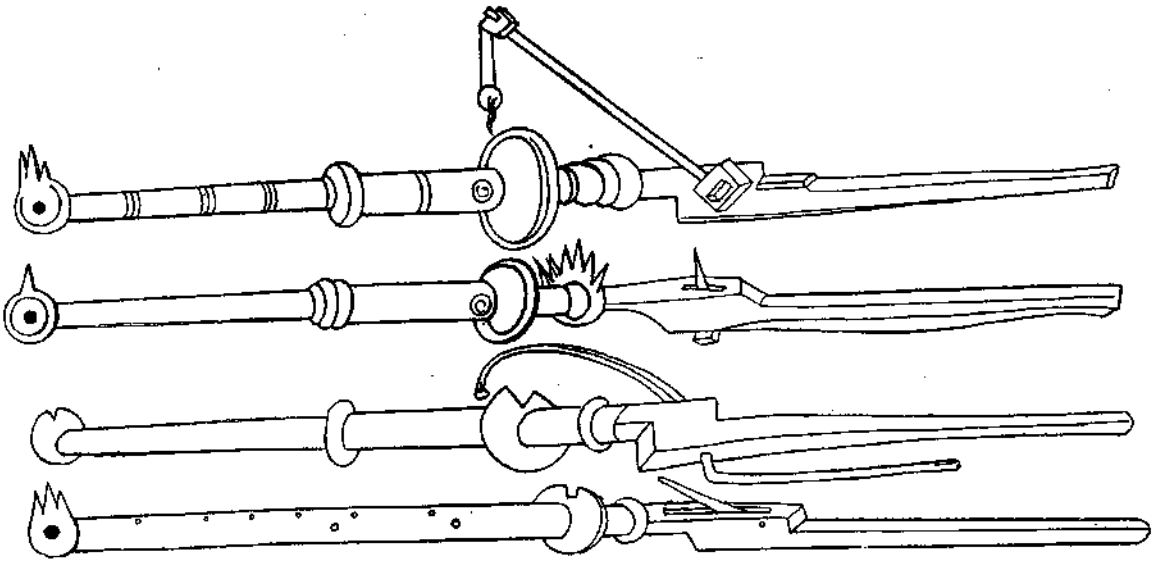


Soldier Firing Hand-gun: Fifteenth Century.

soldier shooting a weapon of precision at a dead mark. Much allowance must, of course, be made for the rude drawing of the time—a point still more emphasised in the following group, which is reproduced from a German MS. of 1430–40, now in Vienna.

THE MATCHLOCK.

The development of the matchlock is shown in the following illustrations, all taken from a German MSS. of 1460–80, now in the Royal University Library at Erlangen. The pointed protuberance at the muzzle is, of course, the sight, the corresponding jagged disc at the breech of the middle gun of the group may be a back-sight, or simply points upon which to fasten the prepared tow which served as a slow-match; more probably the former, since in the third figure the disc to

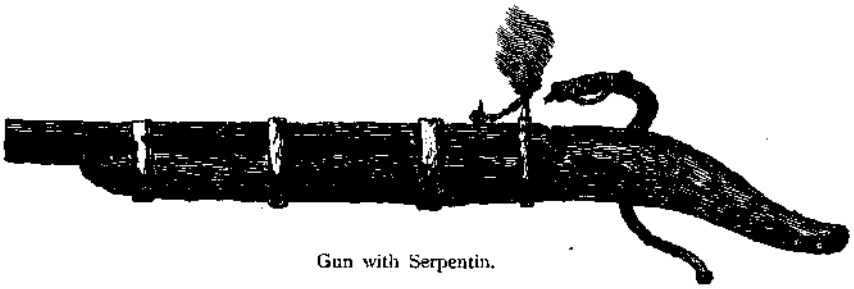


The Development of the "Matchlock."

protect the hand of the firer from being burnt by the powder in the flash-pan is undoubtedly notched in order to serve as a back-sight.

THE FIRST MATCHLOCKS.

The main feature of the invention consists of the "serpentin," or cock for holding the match. In later models the arrangement was as in the following illustration.



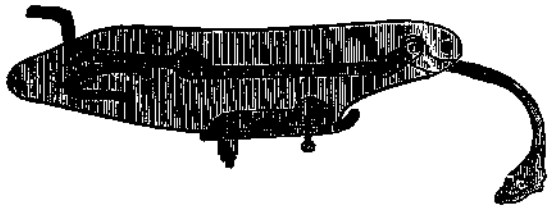
Gun with Serpentin.

The slow-match is kept burning in a holder on the top of the barrel; the flash-pan and touch-hole are at the side. The serpentin is hung upon a pivot passing through the stock and continued past the pivot, forming a lever for the hand. To discharge the piece the match in the serpentin is first brought into contact with the burning match on the barrel until ignited: then, by raising the lever and moving it to one side, the serpentin is brought into the priming in the touch-hole, and the gun discharged—though it is highly probable the first arquebuses did not carry the fire in a holder on the barrel, but only the match in the serpentin.

The advantages of the matchlock were at once appreciated, and its adoption was general. Its improvement was rapid; in great measure due to the adaptation of the releasing trigger mechanism of the cross-bow to the fire-arm.

In a few years it was found advantageous to place the serpentin the reverse way, and to provide a spring to hold the match—away from the touch-hole; pressure upon the lever caused the serpentin with the lighted match to fall into the flash-pan. This is the mechanism shown in the illustration of the lock. The

same general arrangement will be noticed in the matchlock fire-arms carried by the soldiers elsewhere illustrated in this chapter. Particularly the simple arquebus, as



Mechanism of the Matchlock.

used by the Spaniards in 1527, when they captured Francis I. at Pavia, had a trigger matchlock, to which mechanism the success of that battle has been attributed.

Spanish Arquebusier of the Sixteenth Century.

OPPOSITION TO THE USE OF FIRE-ARMS.

Guns upon their introduction, and more especially hand-guns, met with great opposition.

The French were perhaps the most bitter against them. One old French author says:—

"On ne faisoit point encore usage en France, en 1547, de cette arme terrible contre les hommes; les François s'en étoient bien servis en 1338, pour l'attaque de quelques châteaux mais ils rougissoient de l'employer contre leurs semblables. Les Anglais, moins humains, sans doute, nous devancèrent et s'en servirent à la célèbre bataille de Creçi, qui eut lieu entre ces troupes du Roi d'Angleterre, Edouard III., qui fut si méchant, si perfide, qui donna tant de fil à retordre à Philippe de Valois, et aux troupes de ce dernier; et ce fut en majeure partie à la frayeur et à la confusion qu' occasionnèrent les canons, dont les Anglois se servoient pour la première fois, qu'ils avoient postés sur une colline proche le village de Creçi, que les François derent leur route."

[Translation.]

"No use has yet been made in France, in 1547, of that terrible weapon against men. The French used it with good effect against some castles in 1338, but they would blush to employ it against their fellow-creatures. The English, less humane, without doubt outstripped us, and made use of some at the celebrated battle of Creçy, which took place against the troops of King Edward III. of England, who was so spiteful and treacherous that he plagued Philip de Valois and his troops to the last; and the greater part of the terror and confusion was occasioned by the cannon, which the English used for the first time, and had placed upon a knoll near the village of Creçy, and to which the French assign their defeat."

When the celebrated Montluc made his first appearance in the field under Francis I. fire-arms were less esteemed than the cross-bow, and the characteristic remark made by him in "*Michaud et Poujoulat*" clearly shows his opinion of these new weapons:—

"I must observe," says Montluc, "that the troops which I commanded consisted of cross-bow men only; since at that time there were in our nation no soldiers armed with guns. Only three or four days before, six Gascon arquebusiers, deserters, came over from the enemy's camp to our army, and these men I kept with me, as I had the good fortune on that day to be on duty at the gate of the town. One of these men was from the Montluc estates. I wonder, however, that it could have been the will of Providence that this unlucky instrument should have been invented! I myself still bear about me the marks that it has left, which even now cause me to suffer much weakness; and have seen brave and valiant men killed with it in such sad numbers, and it generally happened that they were struck down to the ground by those abominable bullets, which had been discharged by cowardly and base knaves, who would never have dared to have met true soldiers face to face and hand to hand. All this is very clearly one of those artifices which the devil employs to induce us human beings to kill one another."

Fire-arms were greatly dreaded by all classes, and Shakespeare humorously alludes to it in *King Henry IV.* :—

> "And that it was a great pity, so it was,
> That villainous saltpetre should be digg'd
> Out of the bowels of the harmless earth,
> Which many a good tall fellow had destroyed
> So cowardly; and, but for those vile guns,
> He would himself have been a soldier."
>
> *Henry IV.* act i. scene iii.

Most loudly did the armoured knights clamour against the use of fire-arms, for even their thick armour could not be made proof against the heavy bullets, and it was not a usual thing for a well-armoured knight to be killed. A good suit of armour would generally repel the blow of an arrow or quarrel; although the horses, not so fortunate, and driven mad by the rage and pain caused by the thrusts of the rough barbed missiles, would rear and throw their riders; then the doughty warriors would roll about for a time upon the earth, to retire with only a few bruises, and ready to engage in the tilting match another day. In several battles about this time not a single knight was slain; even when unhorsed, it was difficult to administer the *coup de grace* to the valiant cavalier, for the *misericorde*, or dagger of mercy, refused to penetrate the chinks of a closely jointed suit.

At the battle of Fournouë a number of Italian knights, being unhorsed, could only be killed after they and their armour had been broken up, like so many lobsters, with wood-cutters' axes. Well might James I. remark that defensive armour was a double protection, preventing the bearer from being injured or from injuring others.

Gunshot wounds in these early days were considered to be all but necessarily mortal, which may be accounted for by the unskilful surgery of the times. Some of the recipes for the cure of gunshot wounds were, however, much more likely to prove mortal than the wound itself. The following is one given, but the precise details are wanting:—Take of oil and wine equal parts, inject them into a living dog, well boil the animal; its flesh, together with the oil, wine, and other ingredients, form the application.

It was clear that the armour could never be so increased in strength as to withstand the missiles from field artillery, even if successful against the hand-guns. The gunners improved in marksmanship, and then weapons were more carefully made, so that they at length became formidable, and, as they were

Group of Harquebusiers. (*From the Treatise by Jacob de Gheyn.*)

numerous in every army by the middle of the sixteenth century, the heavily mailed knights bowed to the inevitable, and protective armour gradually decayed, after having been so increased in weight that the horses could barely sustain their burden.

THE HARQUEBUSIERS.

The harquebusier or culveriner—the man who carried and fired a hand-gun—was usually also conversant with its manufacture, sometimes was the actual maker of the weapon; hence the application of the name to gun-makers. The great difficulty with which he had to contend in the field of battle was obtaining fire with which to ignite his gun or, when armed with a matchlock, to keep the match aglow. The weapons were very heavy, most unwieldy, tiresome to load, and continually missing fire.

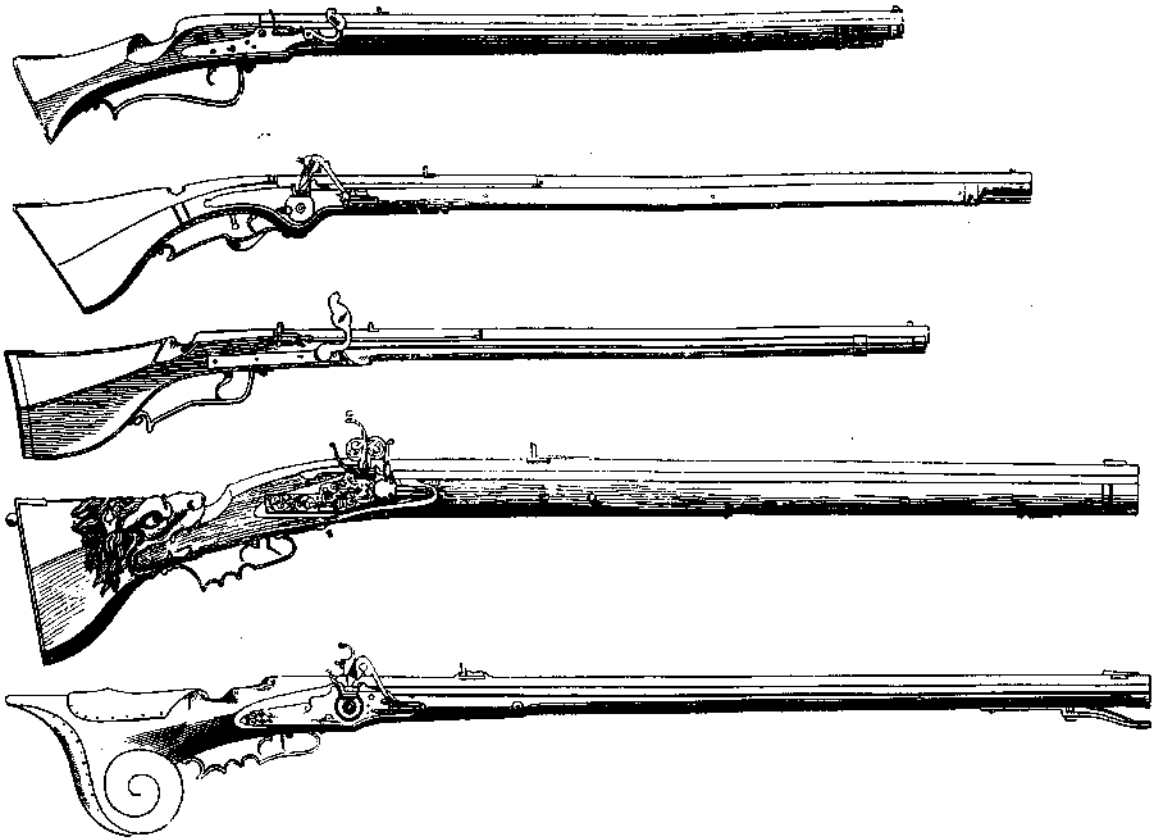
Having discharged their weapons, a body of culveriners would be for the time defenceless. To remedy this, the culveriner was supplied with a sword, or the rest was converted into a defensive weapon, by adjoining a dagger, which was released by a spring. Such rests received the name of swines, or Swedish feathers.

The sword was too much for the early culveriner, for he had already too many encumbrances. Grose says that "he had, in addition to the unwieldy weapon itself, his coarse powder, for loading, in a flask; his fine powder, for priming, in a touch-box; his bullets in a leather bag, with strings to draw to get at them; whilst in his hand were his musket-rest and his burning match."

The French culveriners, too, generally carried their lighted fuse at the girdle, until about firing, when it was wound round the right arm. With all these encumbrances, it is not surprising to find that the bow was for many years considered a superior weapon.

The culveriner was generally accompanied by an attendant, called a "varlet" or *gougat*, to carry the rests and keep the fire going—a difficult matter in a shower of rain, unless, as was once the custom, the matches were carried in the hat. History states that great difficulty in retaining the fire was experienced by the English musketeers in the battle of Dunbar (1650), which was fought during a dense fog, and a heavy fall of rain took place the night previous, to which the troops were exposed.

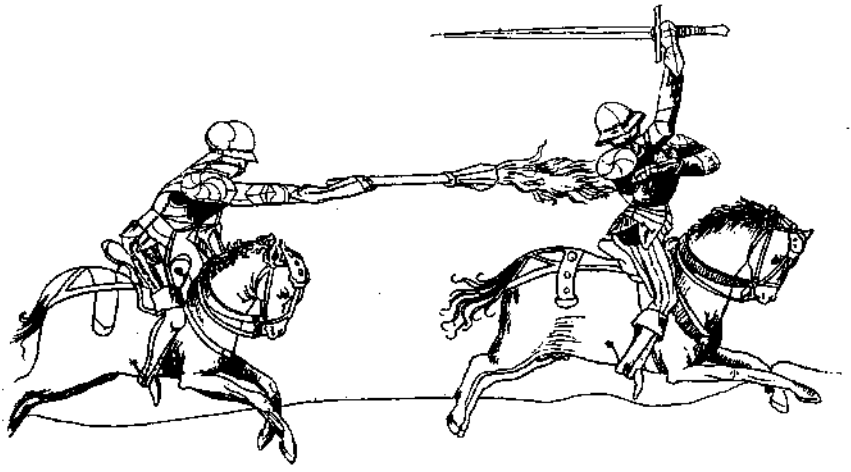
An extract from an old military work will give some idea of the powder, matches, and arms of the sixteenth and early seventeenth centuries. It is from the "Military Fireworks," by Kabel, published in 1619. The author says :—



Early Arquebuses, illustrating the Development of the Gun-stock.

"One of the greatest helpes consist in the pouther and match. For a souldier must ever buy his pouther sharpe in taste, well incorporate with saltpetre, and not full of coal-dust (raw charcoal). Let him accustome to drie his powder, if he can, in the sunne, just sprinkling it over with *aqua vitæ* or strong claret wine. Let him make his tutch powder, being finely sarsed and sifted, with quick-pale, which is to be bought at the powder-maker's or apothecarie's; and let his match be boyled in ashes-lie and powder, that it may bothe burn well and carry a long coale, and that will not falle off with touch of his finger. This preparation will at first touch, give fire, and procure a violent, speedy, and thundering discharge. Some use brimstone, finely powdered, in their touch powder, but that furs and stops up your breech and tutchole.

"The bullet of a souldier's piece must be of a just bignesse with the mouth of the same, so that, falling in smoothly, it drive down and close up the mouth of the powder. If the stock of his piece be crooked, he ought to place the end just before the right papp; if long and straight, as the Spaniards use them, then upon the point of his right shoulder, using a stately upright



Horseman using Hand-cannon.

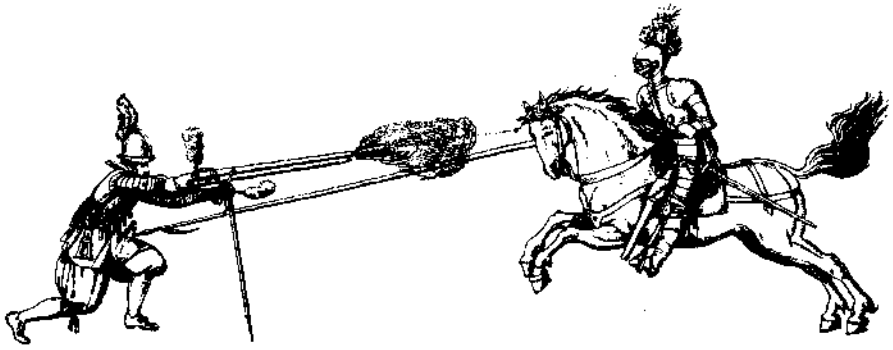
pace in discharge. The musquet is to be used in all respects like the harqabuse, save that in respect it carries a double bullet, and is much more weightie. The souldier useth a staffe breaste high, in the one end a pike to pitch on the ground, and in the other an iron forke to rest his piece upon, and a hole a little beneath the same in the staffe, whereunto he doth adde a string, which tied and wrapped about his wrest, yealdes him commodity to train his forke or staffe after him, whilst he in skirmish doth charge his musquet afresh with powder and bullet."

The difference between the musket and arquebus is here defined. At a later period, the light for igniting the matches was carried by a slow-burning fuse

contained in a metal case perforated with small holes to afford egress for the smoke.

The Holy-Water Sprinkle.

These fire-holders were usually attached to the girdle. All the early fire-arms were so slow to load that as late as the battle of Kuisyingen, in 1636, the slowest soldiers



Gun *v.* Lance. (*From a Sixteenth Century German Treatise on Military Exercises.*)

managed to fire seven shots only during eight hours; and in 1638, at Wittenmergen, the musketeers of the Duke of Weimar shot seven times only during the action that lasted from noon to eight o'clock in the evening.

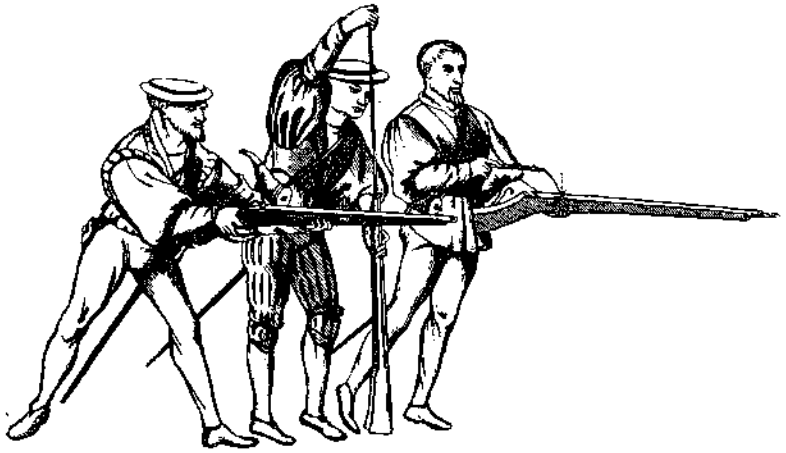
German Shooter, 1545.

METHODS OF USING EARLY FIRE-ARMS.

The object of the early gunner was to frighten; guns were made expressly for the purpose of the report caused by firing them —"crakys of war" they were termed—and, indeed, this appears to have been the most valuable and satisfactory performance of the early guns; for Montaigne wrote in 1585, when numerous improvements had been made, that

"the effect of fire-arms, apart from the shock caused by the report, to which one does not easily get accustomed," was so insignificant that he hoped they would be discarded.

To add to the terror of the knights, and for unexpected use at close quarters, a variety of peculiar fire-arms were produced. The repeating arm was advantageous when the enemy, having seen the gun discharged, came boldly up and was fired



Methods of Shooting in the Sixteenth Century.

upon again and again at very close range. So the pistol battle-axes and clubs already described were a species of secret or surprise weapon. The "Holy Water Sprinkle," a fire arm much favoured by the English of the early sixteenth century, consisted of a strong mace, the head of which was formed by four or more barrels joined and arranged in the same manner as the chamber of a modern revolver, and having upon the outside one or more spike-studded collars. There was usually but one flash-pan having connection with all the barrels; the powder was placed in and fired by a match from the hand.

For use on horseback the fire-arm appears to have been considered as supplementary to lance and sword until the middle of the sixteenth century. Old drawings show that it was of secondary importance. Books of military exercises instruct the gunner how to use his weapons to best advantage against infantry, but the fact that the fire-arms could be used by cavalry as an offensive weapon against foot soldiers was not soon discovered.

The German cavalry called Ritters were the first to use the pistol with signal success. At the battle of Renty, fought in 1544, they charged the French in squadrons fifteen to twenty ranks deep, and halted immediately on coming

South German Harquebusiers, 1500–10.

within range, each rank firing in turn and wheeling to the right or left, falling in again at the rear and reloading the pistols. The manœuvre, called "caracole," was entirely new, and was at once adopted in the French army; and occasioned lances to be gradually but surely replaced by pistols.

The methods of holding the gun whilst firing were as various as the weapons used. From the annexed illustration it will be seen that many shots were made with the butt of the gun against the hips or against the breastbone. Short guns appear to have been held against the cheek, and, as already shown, the earliest hand-cannon were fired whilst the butt rested upon the shoulder—a method confirmed by the shape of gun stocks of very much later date.

METHODS OF SHOOTING IN SIXTEENTH CENTURY.

The group of shooters is from a picture by M. Ferelen, and is dated 1533; the shooter kneeling is from a wood-cut of 1545. It was usual to shoot with both eyes open at this date, but from a drawing of 1500–10 in the Munich State Library the habit of closing one eye was also practised; this drawing is here reproduced, and shows the intention of the shooter unmistakably.

THE WHEEL-LOCK.

To obviate the difficulty of retaining fire in the matchlock, it was sought in Germany, early in the sixteenth century, to fix a flint and steel to the side of the gun, the powder in the flash-pan serving the purpose of the tinder in the box of the domestic strike-fires. In the Dresden Museum the "Monk's Gun," as it is called,

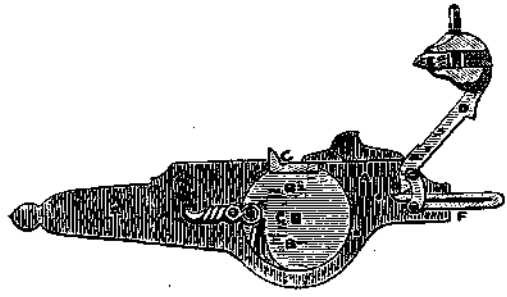
The "Monk's Gun," 1510-15.

is still preserved, and, as will be seen by the illustration, the friction necessary to the production of the sparks is obtained by drawing out and pushing in the roughened steel, or file, against the flake of flint which presses down upon it near the flash-hole. The pyrites are held in the jaws of the serpentin so shaped as to form a strong spring upon the side of the weapon; there is a guard underneath to assist the hand whilst gripping the pistol. The ring at the breech is attached to a bar of steel with a serrated edge against which the pyrites press: the touch-hole is immediately in front of this pyrite; by drawing the ring sharply the serrated edges move past the pyrites, and the required stream of sparks is thus obtained and the priming ignited.

The wheel-lock proper was invented in 1515 at Nuremburg, and its mechanism was entirely different to anything constructed up to that date. Its parts were a grooved steel wheel with serrated edge, which worked partly in the flash-pan, and was connected to the lock-plate by means of chain and strong spring, after the fashion of a watch-drum. The spring power was stored by winding the wheel up with a key or "spanner." In front of the pan a catch was placed, moved by a strong spring, and holding a pyrite with its jaws. When ready for firing, the wheel was wound up, the flash-pan lid pushed back, and the pyrites held in the cock allowed to come in contact with the wheel. By pressure on the trigger a stop-pin was drawn back out of the wheel, and the latter, turning round its pivot at a considerable speed, produced sparks by the friction against the pyrites, and thus ignited the priming.

The improvements in the application of the flint for the purpose of igniting fire-arms were made by Kehfuss, of Nuremburg, in 1517, further improvements of note being made in 1573 and 1632 at Nuremburg, and in Venice about 1584.

The next illustration shows the mechanism of the ordinary German wheel-lock; AA, is the lock-plate; BB, the wheel-drum; C, the axle; D, the serpentin holding



The German Wheel-lock.

the pyrite, E, and kept pressing against the edge of the wheel, B, in the flash-pan, G, by means of the spring, F. The scear and scear-spring are arranged upon the opposite side of the plate. At first the scear simply withdrew from a notch in the wheel, but later, various complicated mechanisms were affixed; but they are not of sufficient utility to require a description. The scear was acted upon by a trigger in the usual way.

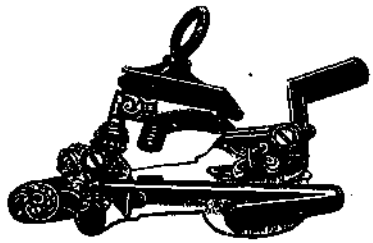
The wheel-lock gun was most expensive to manufacture, and was therefore confined in a great measure to sporting purposes and for use upon horseback, where it offered great advantages over the clumsy, but far less expensive, matchlock

arquebus. With the introduction of the wheel-lock the fire-arm came into more general use for sporting purposes: with the old-fashioned culverins, or hand-cannon game could only be shot upon rare opportunities, or by waiting *caché* until the unwary animals passed the sportsman, and it was altogether impossible to take a fine aim; with the wheel-lock a steady aim could be obtained; the guns were made lighter, and leaden bullets used.

The use of fire-arms for sporting and other purposes became so general towards the middle of the sixteenth century that a prohibition appeared in the State Papers of the Elector Augustus of Saxony, dated the 10th October, 1555, and in it the following passage occurs:—"Whereas the carrying of fire-arms in our dominions has become so general that not only travellers, but peasants and shepherds, are found to use them."

THE FLINT-LOCK GUN.

In the flint-lock the hammer, or *cover plate* to the *flash-pan*, is knocked backwards by the blow of the flint screwed in the jaws of the *cock*, and uncovers the



Spanish Flint-lock.

priming in the flash-pan, which is ignited by the sparks caused by the flint coming into contact with the steel face of the hammer.

The most reliable accounts state the flint-lock to have been of Spanish origin, and invented early in the seventeenth century, and prior to 1630. Immediately upon its introduction it was styled the Lock à la Miquelet, and so named, it is said, from a Spanish regiment composed of marauders (Miquelitos) of the Pyrenees; in which case the account of its invention will correspond somewhat with that given by Grose and other English writers, who state the flint-lock to have been of Dutch origin, and first used by robbers, or rather poultry stealers (*snaaphans*), who, it is said, invented the flint-lock from a study of the wheel-lock, the use of the matchlock exposing them, on their marauding expeditions, to great

inconvenience from the light of the priming-match showing their position, and they being unable to provide themselves with wheel-locks on account of their heavy cost. The flint-lock was called after them the Snaphaunce, under which name it certainly was known for many years in the Netherlands. Soon after their introduction the flint-lock guns were called fusils, from the flints (*fucile*), by a very common abuse of language, which consists in giving to an entire object a name taken from one of its parts. The flint-lock is so well known that it is almost unnecessary to describe its mechanism.

Many years elapsed before the lock assumed even the shape and arrangement generally known, but it consisted of a mainspring upon the outside of the lock-plate that answered also for the hammer-spring, and had no swivel; the scear and the piece of metal answering to what afterwards became the tumblers were fixed upon the inside of the lock-plate. The illustration represents an early Spanish flint-lock taken from a gun in the royal collection at Dresden, and which, from the ornamentation upon it, appears to be intended for a sporting weapon.

The flint-lock was not readily adopted either in England or France. In the latter country the generals of Louis XIII. raised numerous objections to its use, saying—as was indeed true—that the sparks caused by the flint striking the hammer were not always sufficient to fire the charge, the stream of sparks going on either side of the pan, and failing to enter it. To remedy this fault *musket* fusils were constructed, which consisted of guns having a combination of both the flint and the matchlock.

In the year 1653, by an ordinance of Louis XIV., soldiers were forbidden to use flint-lock guns, and by another, later in the same year, the use of these guns by soldiers was made a crime punishable with death. They were introduced into England in the reign of William III., and from that time gradually increased in favour till they became the general weapons of this country. They remained in use in the British army until 1840, flint guns being manufactured in Birmingham for the English Government as late as 1842.

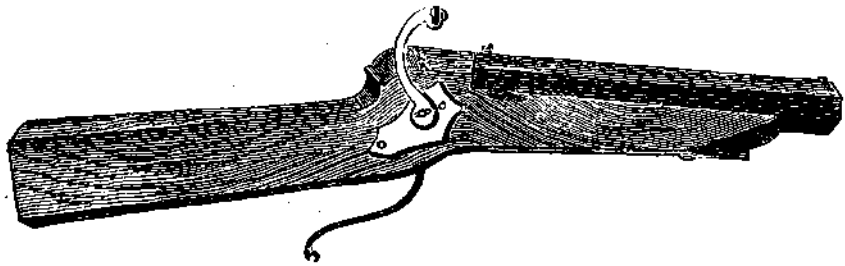
EARLY SPORTING FIRE-ARMS.

As a sporting weapon, the gun dates from the invention of the wheel-lock; before that period the long-bow in England and the cross-bow on the Continent were the usual weapons of the chase. In the fifteenth century fire-arms were used for sporting purposes in Italy, Spain, Germany, and to a lesser extent in France. In Great Britain little use appears to have been made of them for game-shooting

until the latter half of the seventeeth century, and at that time the arms used for the purpose were entirely of foreign make.

The large, long, heavy hand-cannon used for military purposes were quite unsuited to the chase, but from certain references in mediæval manuscripts it appears that they were occasionally so used. The earliest gun at all suited to purposes of sport is the short matchlock here shown; but it may have been intended to serve primarily as a weapon of defence.

The invention of rifling at Nuremberg in the fifteenth century leading to the production of arms giving greater accuracy, and the invention of the wheel-lock



German Matchlock Gun.

permitting fire-arms to be used for stalking, for which the matchlock with its ever-burning torch could not be used, led to the acceptance of fire-arms by sportsmen. These arms, being evidently expensive and highly valued, have been so well preserved that numerous specimens still exist. Some few well deserve fuller description than space permits, but the illustrations will doubtless convey a better idea of their finish than would any verbal enumeration of their dimensions and construction.

EARLY GERMAN SPORTING FIRE-ARMS.

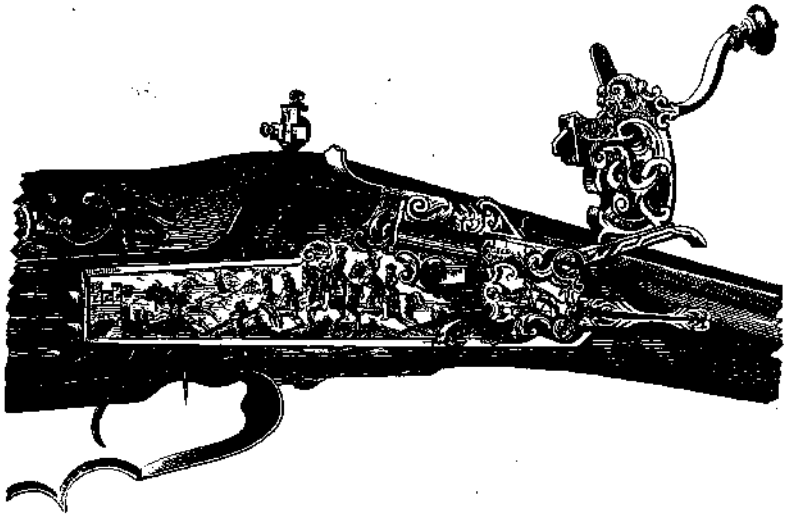
The first weapon illustrated is a German rifle of the first half of the seventeenth century. This beautiful weapon is one of several equally valuable found in the Birmingham collection. It is a wheel-lock musket, of which the serpentin resembles the head of a griffin. The stock is richly carved with scroll designs, and the engraving upon the weapon, especially that of the lock-plate, is worthy of the highest commendation, representing a hunting party in chase of a stag. The barrel bears the stamp and name of the maker, I. Georg Dax in Munchen.

The wheel is inside the lock-plate, and the pressing of the trigger causes the

flash-pan (*couvré bassinet*) to slide back ; a safety-bolt is also attached to this gun, which is actuated by a small pointed stud descending from the stock immediately in front of the trigger. A bead-sight is affixed upon the muzzle, and a back wind-gauge peep-elevating sight is placed upon the stock in front of the grip. This sight is exactly similar in construction to the one used during the first half of the present century by the late Mr. J. Purdey and other English gun-makers.

The next arm illustrated is of a similar type and character, but the workmanship is of better quality. The stock is inlaid with ivory and ebony in fanciful designs.

The engraving upon the lock-plate represents an army encamped. It is of a



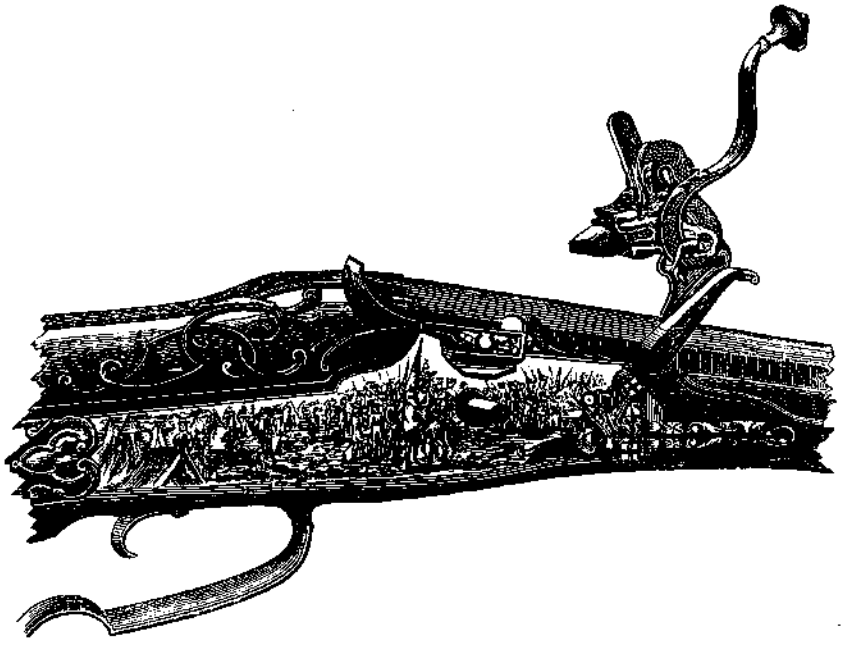
Ornamental German Wheel-lock Musquetoon.

little later date than the preceding gun. The barrel is rifled, and the weapon appears to be of German manufacture, and probably was made about the end of the seventeenth century.

The next to be illustrated are four "handbüchse," taken promiscuously from a case in the Dresden Museum. The upper one is a German rifle, the wheel-lock and hammer artfully concealed by the stag; the back sight is silver, the stock artistically inlaid with sporting and scroll designs, of a shape prevalent in Germany in the seventeenth and early eighteenth centuries.

The next is a wheel-lock sporting carbine, the well-curved stock being profusely

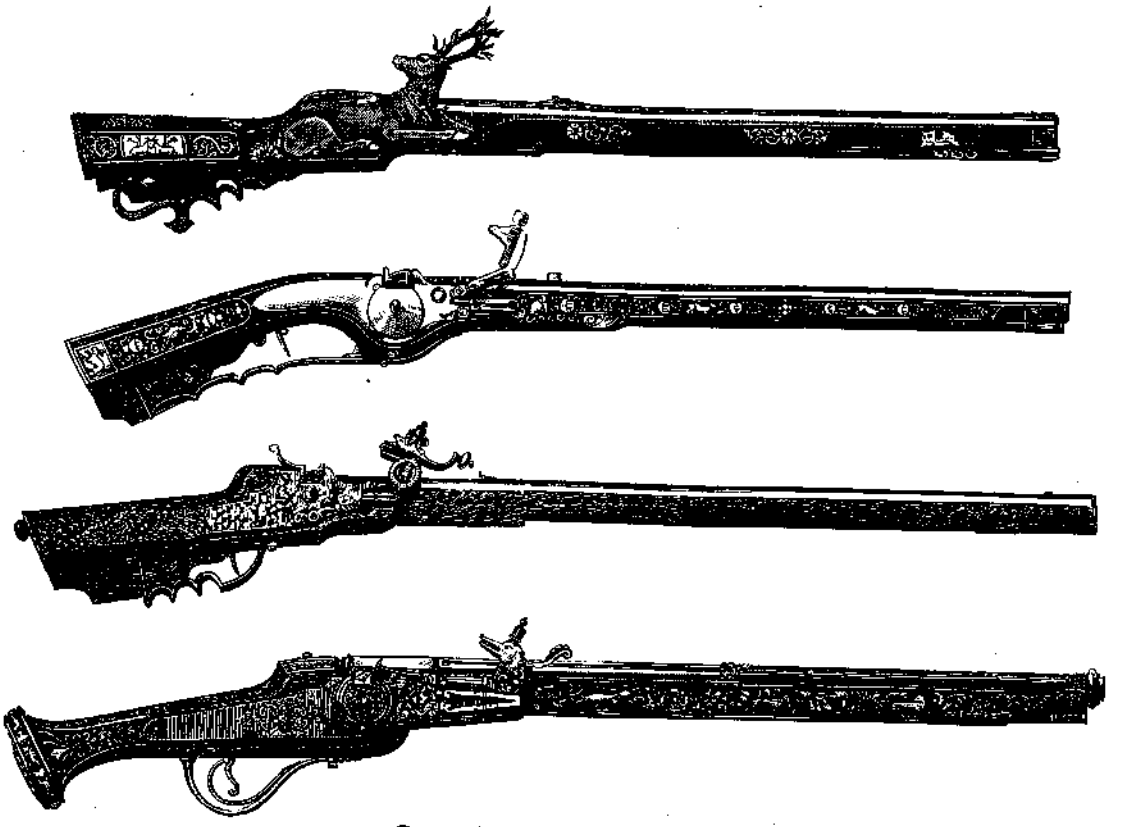
ornamented by silver and ivory inlaying. The third rifle has the stock wholly of buck-horn, and doubtless was so constructed by way of novelty. It, as well as the two preceding, is of Saxon make. Saxon pistols, too, of same date and style, are in the Museum; the stock of one, some 18 inches in length, being carved from one horn, and without a join—a rare sample of man's ingenuity. It would be tedious to enumerate the various materials of which gun-stocks have been constructed. Woods of almost every known kind, steel, iron, copper, silver, whalebone, ivory, leather, paper,



Ornamental Musket: Seventeenth Century.

and even straw, have each in their turn been used for the purpose of stocking. A remarkable weapon—the stock composed of many-coloured plaited straws—is in the Dresden Museum. The weight of the arm—a ball gun, the barrel 34 inches long—is barely 6½ pounds; the effect of the brightly-dyed straws is pleasing, and the numerous plaits are fixed and the stock made rigid by a strong glue.

The last arm figuring in the illustration is an early South German wheel-lock, the stock and lock both presenting ornamentation of a superior kind and worthy of



Decorated German Arms—1600-1700.

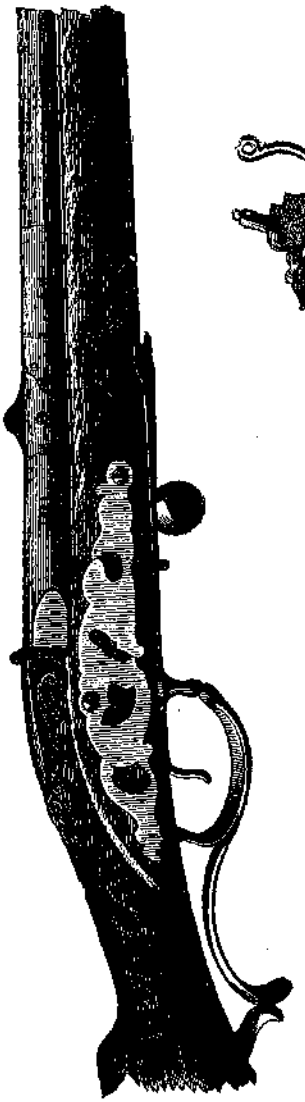
emulation, the stock of the shape common in Italy as late as the early part of last century, and to this day the favourite of several Eastern peoples.

These arms show that not only was the strength of the gun studied, but attention also directed towards symmetry and artistic embellishment. Specimens of German ornamentation have already been shown and remarked upon; but to make even more clear the talent and knowledge of these industrious artisans two other illustrations are appended, wood-cuts that have taxed the skill of the best engravers to produce. In these weapons the artists have given free play to their fancy both in shaping and ornamenting their stocks. The utile limbs, especially the trigger and its guard, exist in the cruder forms—a curved bit of wire or a bent metal ribbon serve as limbs which, in later days, have exercised the fancy of the leading gun-smiths of Europe: the shaping of triggers and guard being now esteemed as of almost equal importance as the lay and shape of stock.

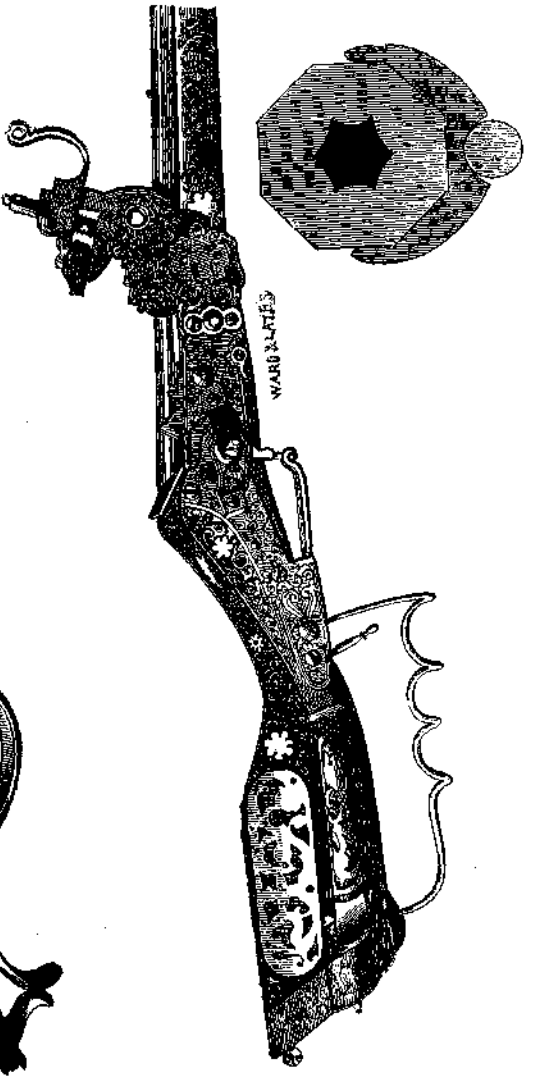
In "*Die Moderne Gewehr Fabrication*," by F. Brandeis, the following short history of gun ornamentation is given:—"In the earlier times Mythology furnished the best subjects for the embellishment of weapons, and of fire-arms more particularly. The goddess of the chase, Diana, for a sporting gun; Vulcan, the fire-god, for a fire-lock; Vesta, as tutelar goddess of smiths, for a percussion gun; whilst Venus, Mars, and Neptune supplied other needful and very ingenious allegories. Ancient stories also furnished the Middle Ages with ample designs for both chiselling and engraving the gun. Thus it was the fashion to ornament the lock-plate with dragons, serpents, tigers, griffins, and leopards, and finally with devils, pigmies, and other comical and unbeautiful figures. Afterwards, and certainly for a long time, were devils and gods wholly ignored, and the ornamentation confined to representations of sporting scenes and game with various foliage, and scroll-work combinations, which style originated in Paris and gradually extended over Europe."

EARLY ITALIAN SPORTING FIRE-ARMS.

The Italian gun-smiths surpassed the Germans in the elegance of their forged and chiselled barrels, and generally in the design of the fire-arms they made. Their work is more particularly noticed in connection with pistols, of which the specimens extant are more numerous than those of guns or rifles. Of the two specimens illustrated here the first represents a beautiful example of a Venetian rifle of the sixteenth century. It has a wheel-lock in which the whole of the mechanism is arranged upon the exterior of the lock-plate, and may be easily understood by a



Flint-lock Hammerless Gun.



Venetian Rifle.

reference to the engraving. The butt is of a peculiar shape, and has a box-trap covered with a sliding wooden lid. The guard is of an original pattern, but the trigger, the plainest feature in the gun, consists of simply a straight piece of wire. The stock, which is of walnut, is inlaid with gold, mosaic, filigree, and mother-of-pearl, and is probably as fine a sample of ornamentation as any extant. The barrel is beautifully damascened and inlaid. It is bell-nosed upon the outside. The bore of the rifle, which is hexagonal, is very small, five-sixteenths of an inch. An end view of the muzzle is also given, and shows the enormous thickness at that part. The grooves are straight, but in other respects the bore is similar to the Whitworth.

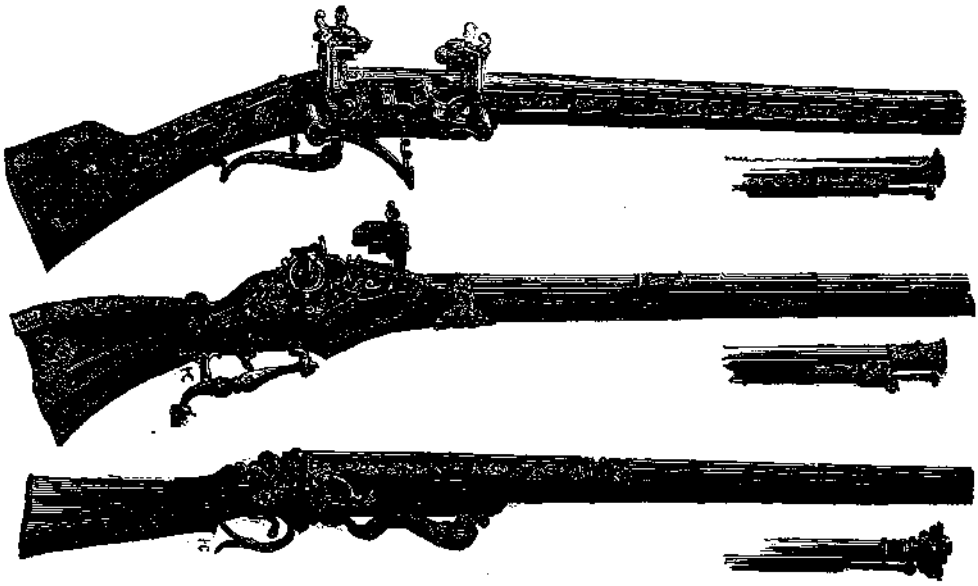
The other illustration represents an early hammerless gun. The body of this weapon is of brass chiselled. The hammer is fixed upon a hinge, and kept in position over the flash-pan by means of a spring; the flash-pan is at the base of the barrel in the body. The flint is fixed upon a rod working in the body, and actuated by a spiral spring. To cock the gun the flint is drawn back by means of the knob underneath the barrel, which is affixed to the rod in the body. There is a notch in the rod into which a scear engages. When the gun is cocked, and the hammer placed in its position, the gun presents no protuberances whatever, but is to all intents a hammerless gun. Even at this early date the advantages of having no complicated mechanism or ever-entangling hooks upon the exterior appear to have been well appreciated, for in the Continental museums are preserved several high-class specimens of guns so constructed.

In the Paris Museum there are two, one differing in no respect from the one illustrated, but better made; the other is a breech-loader of Portuguese manufacture, and bears the inscription "Fabrica-real, Lisboa, anno 1779." It is a breech-loader, all the mechanism being covered by a semicircular hinged lid. The mode of igniting the charge is by a flint and spiral spring, as already described. The barrel is fixed to the stock, the charge being ignited by the manipulation of the breech-plug.

EARLY FRENCH SPORTING FIRE-ARMS.

The French gun-makers of St. Etienne claim for their town that it is the oldest centre of the fire-arms industry. They do not appear to have made more than the barrels of the finest sporting arms, and these even were sometimes made in Paris. The production of fire-arms by the artists of Paris reached its zenith about the middle of the seventeenth century. The annexed illustrations represent French

arms in the Paris Museum. In the middle figure will be found an example of the excessive ornamentation produced by carving in relief, the deeply sunk hollows interspersed amongst the raised work having anything but a pleasing effect. In the figure representing a musquetoon with a double wheel-lock the ornamentation consists of inlaying the stock with metals, mother-of-pearl, and ivory. The devices



French Arms in the Musée des Invalides, Paris.

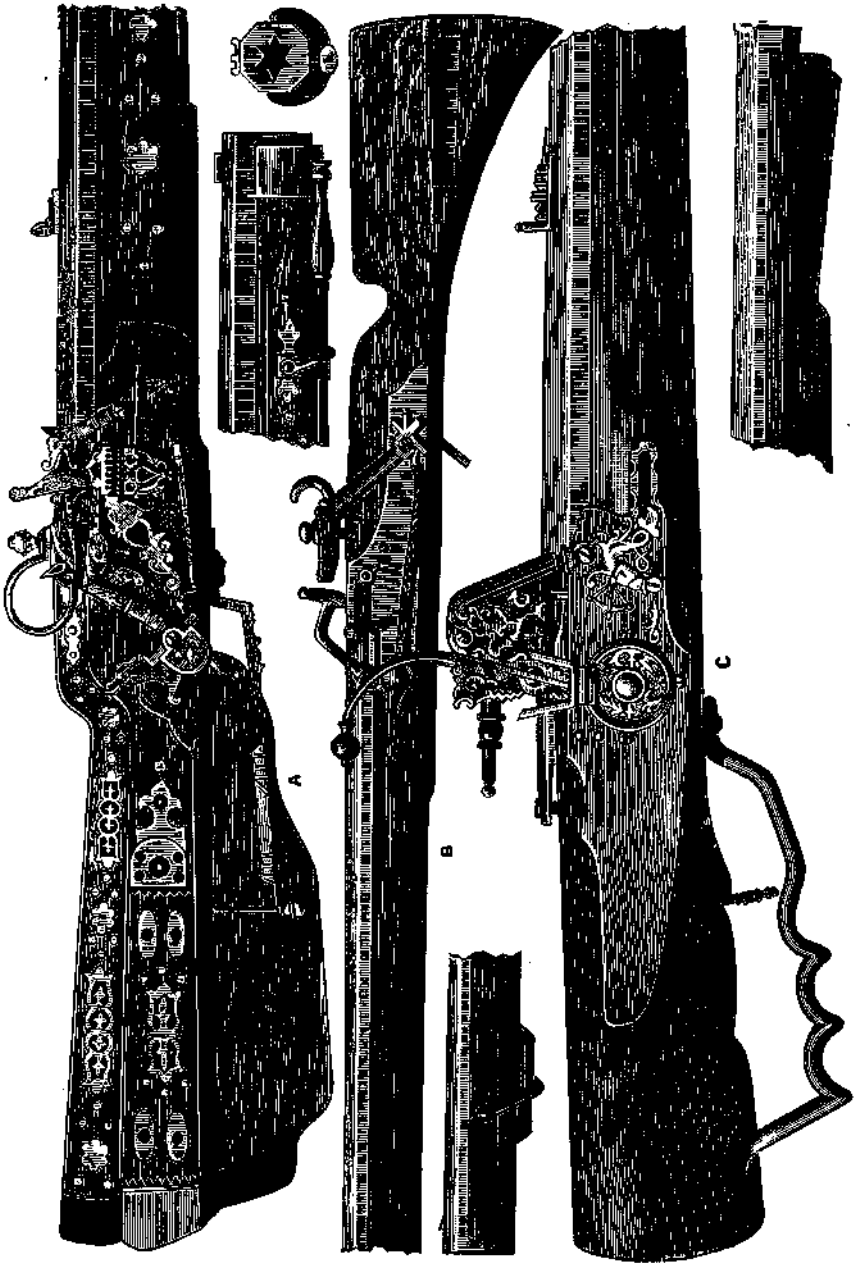
consist of an odd medley of human figures, animals, foliage and scroll, but the general effect is much more pleasing than that shown in the preceding. The last figure represents a matchlock musket that formerly belonged to the celebrated Cardinal Richelieu, and this curiously shaped and remarkable weapon is best described in the expressive words used by M. L'Haridon in the catalogue of the Museum :—"The barrel cut and squared towards the base, chased and gilt, exhibits three oval medallions, representing in relief warriors in ancient armour. The sight is formed of two rams' heads coupled together. The upper part of the barrel, formed like a fluted column, supports a capital in which are introduced four

caryatides in full relief. The lock, decorated throughout with chasing on gold, has a head of Medusa in high relief. Beneath the gun-stock, which is of cherry-wood, is a boldly sculptured figure of a dolphin. Above—where the barrel joins the stock—is a beautiful mask of a man's face surmounted by a shell; and on the shoulder-plate of the butt may be seen the three chevrons with a cardinal's hat, the armorial insignia of Cardinal Richelieu."

EARLY RUSSIAN GUNS.

In Russia the gun-maker's art—as most arts—was scarcely practised until the day of Peter the Great. This enterprising monarch so developed the resources of Moscow's arsenal that it not only turned out serviceable weapons for the troops, but arms of passing beauty and richness for the Tsar and his nobles. Of the former many samples are extant, relics of Poltava and the siege of Troitska, when the monks defended their monastery by using these Muscovian flint-locks. Of the latter several are carefully guarded in the Kremlin, and a sample of these is here shown. Its profuse ornament forbids detailed enumeration; ivory, mother-of-pearl, gold, stones, and stained wood are lavishly bespattered over stock and barrel alike. The lock is a clever piece of Russian fretwork, and a queerly cut inscription states that the gun was built for the Tsar Alexis Michaelovski in 1654. This arm has no less than three band-swivels, and all on the front part of the stock. The shape of the barrel is shown in elevation, as are also the back and foresights, which are of gold. B is an ordinary old Russian flint-lock, and guns very similar may still be bought as usable commodities in the rag markets of Moscow, or the annual fairs at Nijni and Irbite; C represents a more elaborate weapon of Muscovian make—a Russian wheel-lock rifle—it is built after the German style, but lacks any shape in the butt.

Arms with locks on the principle shown in A, but with an octagonal stock slightly bent, are still largely in use amongst the Tartars, and are common enough at Oranienburg, Russia being far behind Western countries in this respect. Nevertheless, the arms museums of Russia are without equal for completeness and diverse systems both of cannon and small-arms. The Kremlin at Moscow, the Monastery of Troitska, the Museum at Tula, and the royal collections of St. Petersburg and the Zarskoe Seloe, contain more devices in arms mechanisms than would seem conceivable. They have never been properly catalogued, though a certain arrangement has been followed. The St. Petersburg collections are rich in combined arms and revolving and repeating guns and cannon, all of which, however, appear to have a greater antiquity than they in reality possess.

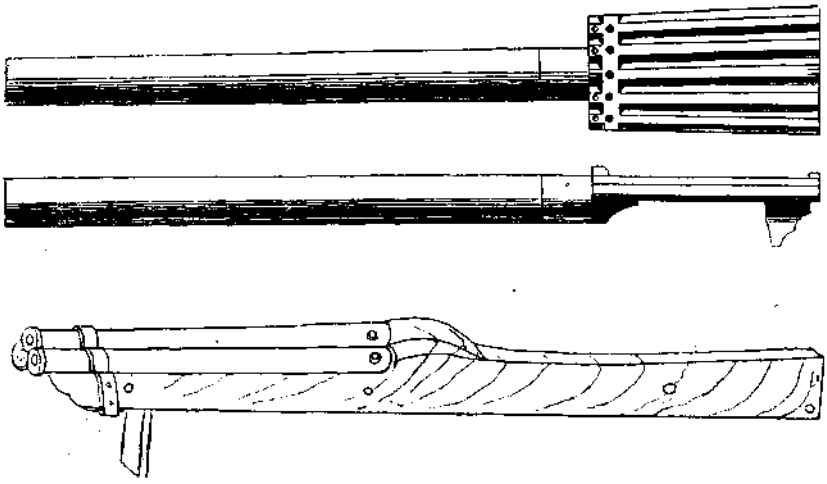


Arms made in Moscow Arsenal.

EARLY REPEATING ARMS.

The hand-gun to fire more than one shot at different times appears to have been contemporary with the introduction of fire-arms into Europe; or, at any rate, was in use at the same period as the *orgues des bombardes* already described.

The first specimens were simply three- or more barrelled hand-cannon—the author has never seen a two-barrelled specimen—and of these two varieties are



Multi-barrelled Hand-cannon.

shown in the adjoining illustration. The three-barrelled weapon has a wooden stock, and was intended for use from ramparts. Its date is about 1500, and the original drawing is preserved in the Munich State Library. The same MS. shows similar arms with four and with six barrels, all with barrels side by side, and one with three barrels, two of which are side by side, the third superposed between hem.

The five-barrelled gun shown is of about the same date; the barrels, instead of being forged are all cast in one mould, and are of bronze. The foresight on the middle barrel has a corresponding back-sight immediately behind the touch-hole of that barrel, but this is likely to escape notice in the drawing. The same principle of construction for the same class of weapon was long continued. In the French

French Wall Piece.

The Repeating Matchlock Rifle.

museums are many specimens of flint-lock guns so made, of which the one illustrated is typical.

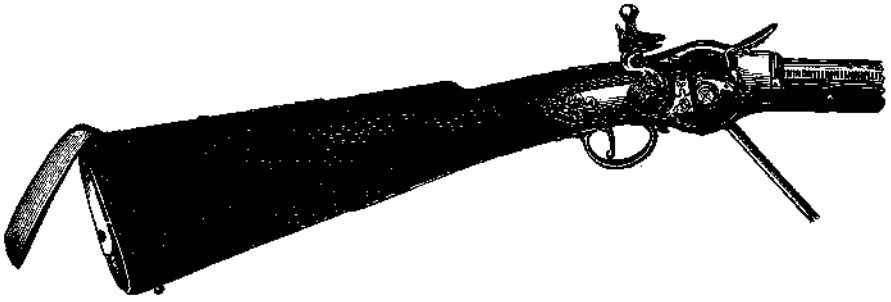
There are many guns preserved in the museums with double match, wheel, or flint locks, in the barrels of which two, three, and sometimes more charges are inserted in the same barrel, one upon the top of the other, and fired in succession.

The guns in which two charges are placed have generally two separate locks or touch-holes, but those capable of firing more charges have usually a mechanical arrangement similar to that shown in the annexed illustration; which represents a matchlock arquebus capable of receiving and firing eight charges in the same barrel without reloading. It will be seen that there are eight flash-pans, each protected by a hinged cover. The serpentin travels on a notched rack, and is brought into contact with the priming of each pan in succession, and fired by pressing a corresponding trigger. In loading the gun, each charge is separated from the other by two well-fitting leather wads or washers; but the use of such a weapon, if always loaded to its full extent, would be exceedingly dangerous. They were not in general use at any time either as military or as sporting weapons. The advantages of the repeating principle thus appear to have been observed at an early date, and the inventive genius of the gun-maker would have been equal to producing weapons of the desired type if only the skill and tools of the workman had allowed of a perfect mechanically-fitting joint being obtained.

EARLY MAGAZINE FIRE-ARMS.

The first magazine gun is of comparatively modern date, manufactured undoubtedly in the first years of the seventeenth century at the earliest. The one illustrated is of Italian make, and is in the Birmingham Museum, but most public collections include one or more specimens. In this weapon the powder for priming and for charging the piece is contained loose in separate chambers in the butt, and inserted by raising the heel-plate. These chambers communicate with a revolving cylinder at the breech-end of the barrel, the axis of which is at right angles to that of the barrels. On the under-side of the revolving cylinder is a small aperture, in which the bullet is placed; the cylinder is then turned by the lever on the left side almost a complete turn. This movement cuts off and deposits in their respective places the proper charge of powder and the priming, closes the pan, and cocks the lock. It is, however, necessary whilst so loading the arm, to depress the muzzle, in order that the powder in the stock may fall into the rotating cylinder. This weapon bears the name of the maker, "Antonio Constantine," but unfortunately the date is wanting. It may readily be conceived that, unless the revolving cylinder is

accurately fitted, the danger of using such a weapon must be great, the powder in the butt (sufficient for six charges) only being separated from the barrel by the revolving cylinder, which also acts as a false breech for the barrel; indeed, the late W. Greener states that a pistol of similar construction blew up whilst being experimented with. A weapon of like construction to the above is in the Paris Museum; but the bullets, instead of having to be inserted each time by the hand, are contained in a recess under the breech-end of the barrel, and forced into the cylinder by a spiral spring.



Italian Magazine Gun.

In another specimen there are two tubes in the stock for the powder, and it is forty shot, instead of six, as in the one shown; the lever forms the trigger guard, and by being moved to the right loads and also cocks the weapon.

The makers of these weapons appear to have been foreign without exception, and chiefly to have issued from Amsterdam, Hanover, and Liège. The peculiar complication of the various mechanisms, and the general inutility of the weapons themselves, render a detailed description of little value to the inventor or the general reader; but the connoisseur will find several varieties in the Paris Museum; these are comprehensively described in the valuable catalogue of the collection.

EARLY REVOLVING GUNS.

Revolving cannon—some of large calibre—are described in mediæval manuscripts, but these bear little resemblance to that type of arm which has become known throughout the civilised world by the name of revolver.

Before the introduction of the flint-lock various revolving matchlock guns were in use. The earliest description is an arquebus with four chambers, a specimen

of which is to be seen in the Tower collection, and is supposed to have belonged to King Henry VIII. It appears to be of the first half of the sixteenth century. The barrel is 2 feet 9 inches long, and the chamber $7\frac{1}{2}$ inches, bore about half an inch. There is a separate flash-pan for each chamber, covered with a sliding lid, and they are moved in succession underneath the serpentin. An end view of the chambers is also given. The barrel is fastened to the spindle, and strengthened by a rod fastened to its top, with the other extremity fixed to the butt of the gun. The lock

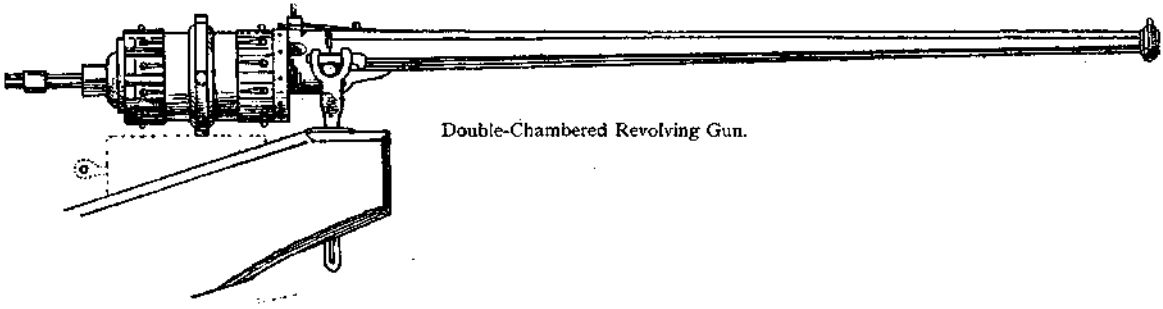
Revolving Arquebus in the Tower of London.

mechanism is exceedingly simple, consisting of a serpentin pivoted in the stock, and extended below and behind the pivot to form a trigger. By pressing up the trigger the serpentin falls into the flash-pan, the weight of the trigger serving to bring it back into its place. Several similar weapons of a later date of French and German manufacture are to be found in the Paris Museum. In one a spring is attached to the barrel which engages in a stop in the chamber immediately it is in the proper position for firing. The chambers in all cases are moved round by hand. One has eight, and another three, and the rest have five chambers.

In one arquebus of the middle of the seventeenth century the fire is communicated to the chambers by one flash-pan only, which requires repriming after each discharge.

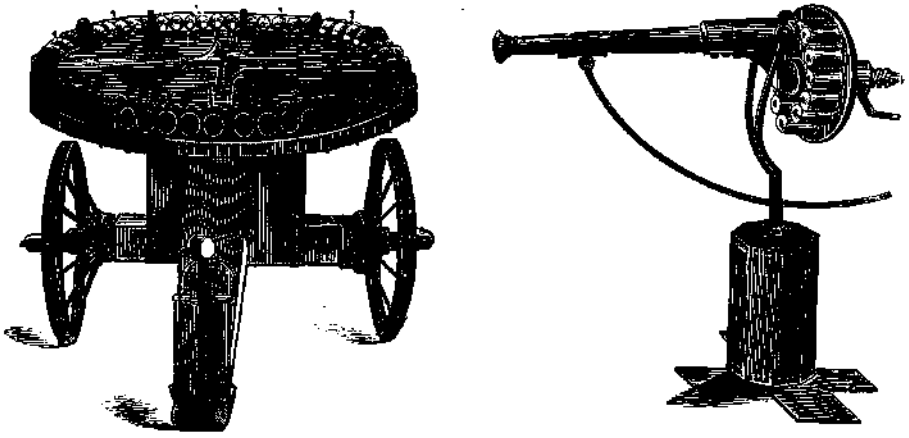
In the Paris Museum a three-chambered wheel-lock revolving gun is preserved. There is but one flash-pan, and the chambers are moved round by the hand after each discharge, and are kept in position at the time of firing by a spring button placed upon the tail-piece of the barrel. The date of these weapons is about the latter end of the seventeenth century. A six-chambered *flint-lock* pistol of the first half of the eighteenth century is also to be found in the same museum. The mechanism is similar to that of the preceding weapon, but it is self-priming, the magazine being fixed to the hammer or striking-piece, and, upon being closed after each

discharge, deposits the priming in the flash-pan. The stock is finely carved, and ornamented with copper and filigree work. The lock bears the name "A. Leotien."



Double-Chambered Revolving Gun.

The German double-chambered revolving gun illustrated is probably unique in principle. In addition to the increased speed in firing which would result from the

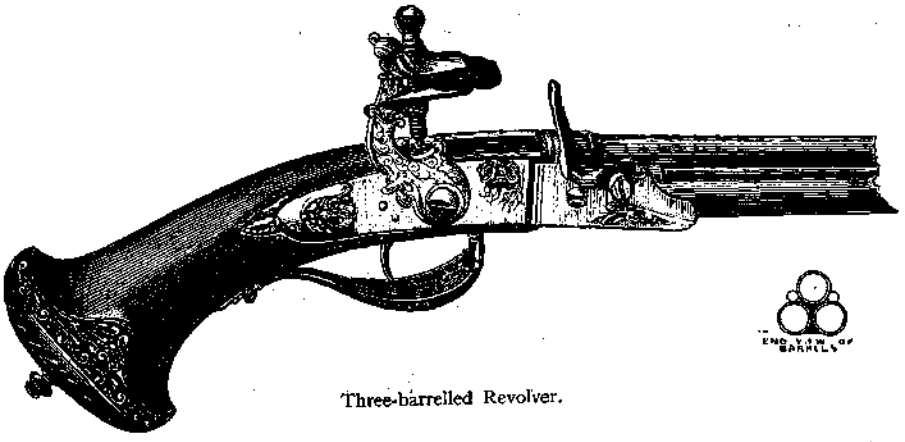


Revolving Arms, Russian.

ten chambers, the chambers, by being made long enough to contain two charges, one in front of the other, and fired by separate touch-holes, allowed two shots to be fired in very quick succession. As the touch-holes were not covered, it was

necessary to prime afresh each time the chamber was partly revolved. The first rotating gun with touch-holes and flash-pans covered by a sliding lid was made about 1570; the gun shown was probably made at the end of the sixteenth century, and certainly prior to 1650.

In Russia revolving arms of the kind long since discarded in Western Europe were used in the present century. The close likeness of the short-barrelled gun to



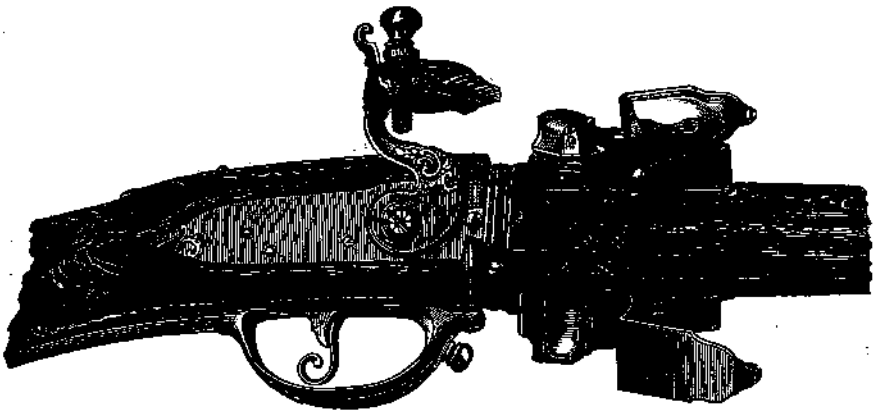
Three-barrelled Revolver.

the weapons described by Valturius in the fifteenth century, and already referred to, will be at once noticed. The other revolving gun resembles the German weapon above described; but some of these Russian guns were made at so late a date as to be provided with nipples for ignition by means of the well-known percussion cap of the present period.

In the Birmingham Museum there is an Italian three-barrelled flint pistol of the latter end of the seventeenth century. In this pistol, the three barrels turn round upon one common axis, and are brought opposite the flash-pan by the hand. The barrels are arranged as shown in the muzzle elevation, which also shows the position of the wooden ramrod.

The pistol is well made, and by an ingenious contrivance the hammer or striking-plate closes whilst in the act of cocking. The spring catch for retaining the barrels in position at the moment of firing is released by pressing the trigger with the cock down. The pistol is neatly ornamented and mounted in chiselled

steel, which, together with the shape of the stock, seems to indicate that it is of Italian manufacture. In the same museum there is also a revolving gun having two barrels, rotating upon a common axis, and each having its own flash-pan and hammer. One lock, cock and trigger, however, serves to discharge both barrels, they being turned in succession until opposite the cock and in the proper position for firing, in which position they are retained by a small spring bolt, moved by a stud fixed and working upon the fore-part of the trigger bow. This gun has a gold

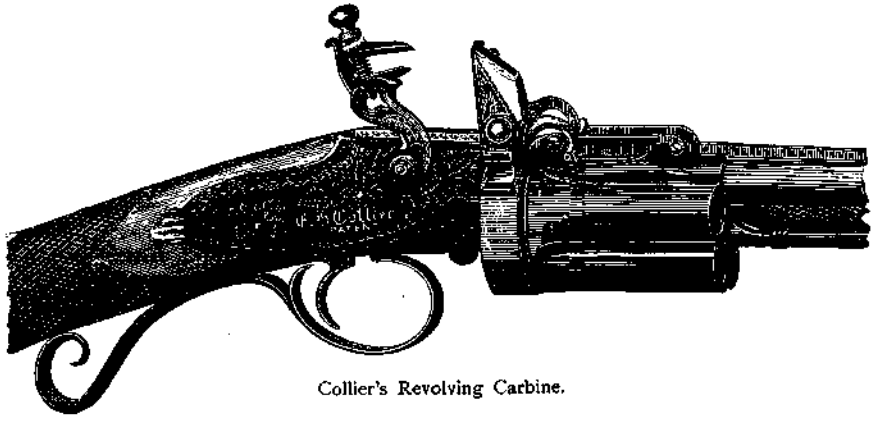


Double Revolving Gun.

stamp upon the barrels, a fine scroll trigger, and the stock is beautifully finished and carved. From the shape and ornamentation of the gun the date of its manufacture can be fixed as early in the eighteenth century; it is probably of Milanese origin. Several weapons of similar construction are to be found amongst the various Continental collections, both private and public. In the Paris Museum there is a similar gun, but with four barrels, and two locks and triggers.

Revolving carbines were made upon the same principle, or with slight modifications, during the latter part of the eighteenth century, and various specimens are preserved in different English and Continental museums. About 1810 a revolving carbine of unique description was manufactured in England by E. H. Collier. It will be seen by the engraving that the lock is placed nearly in the centre of the stock, the flash-pan and hammer upon the strap which connects the top of the barrel with the butt of the pistol, the touch-hole passing through the strap and into the chambers in an oblique direction. The breech is formed as a

cap to the chambers, and in which their breech-ends revolve. This cap, by being always in contact with the outside of the chamber, prevents any escape of powder at the touch-holes. The chambers are revolved by the hand, but before turning they must be drawn backward about one-eighth of an inch, the chambers being slightly enlarged at their mouths, and fitting over the taper breech-end of the barrel; this ensures the axis of the chamber being true with that of the barrel during the discharge. The chambers are forced over the tapered barrel by a flat spiral spring working upon the centre pivot, and are held up to their position at the



Collier's Revolving Carbine.

moment of discharge by a small horizontal sliding bolt or lever, actuated by the trigger immediately it is pulled to fire the weapon. The arm is well made apparently, the only weak part being the lever holding the chamber up to the barrel during the discharge, which is too small to withstand the constant wear and strain of firing. The weapon represented has two barrels, interchangeable, one a rifle and the other a shot barrel: both are about 24-bore, and 28 inches in length. Weapons of similar construction by the same maker are preserved in various museums, and this system appears to be the last of note before the introduction of percussion weapons. In fact, a few years later specimens of this same weapon with self-priming mechanism for percussion ignition are to be found.

COMBINED FIRE-ARMS.

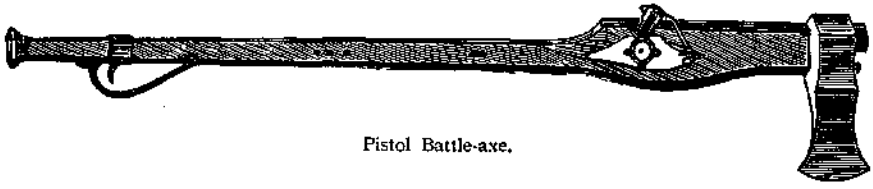
As already stated, it was usual when fire-arms were first introduced to combine with the fire-arm some other warlike weapon. These combined arms are most

varied, and appear to have been made in large numbers. That the idea of combining a fire-arm with a lethal weapon possesses many attractions to persons of inventive genius, if not proved by the many examples of such arms still extant, is exemplified by its persistent reiteration in the records of the Patent Office, whence a patent for a combined dagger and pistol has just been issued, and by the recent advocacy of a pistol-lance as the most suitable German cavalry weapon.

The fire-arm with axe is the commonest of the combinations and the one most widely spread; for the battle-axe here shown is almost identical with the one already described and illustrated, which was made in Europe in the fifteenth

Modern Hindoo Battle-axe.

century. The particulars of this battle-axe have been furnished by E. A. Elliott, Esq., to whose courtesy the author is indebted for the illustration. The axe was taken from the Santals, one of the hill-tribes of India. The thickness of metal at muzzle is only one-fifth inch, and the weight 1 lb.; its length over all is 16½ inches, of which the pistol-barrel takes 8½ inches. A primitive type of combined axe and pistol is shown in the next illustration. This arm is of German manufacture. The barrel is 6 inches long and is well concealed by the head of the axe and the handle, nearly 2 feet 6 inches long. The weapon is fired by a wheel-lock, and the



Pistol Battle-axe.

trigger is fixed near the extremity of the handle furthest from the lock. This weapon was probably intended for horseback use, and manufactured at the commencement of the seventeenth century. The pistol battle-axes on the plate are of a later date and of a higher class workmanship: all are from the Dresden

German Battle-axes in the Dresden Museum.

collection, which is particularly rich in arms of this kind and of this period—perhaps no better collection of wheel-lock arms has yet been brought together.

The combination of pistol with dagger is by no means rare, and several specimens are in the Birmingham collection; the two illustrated show the chief principles employed in effecting the combination. In the earliest, the barrel is in the centre of the blade, a muzzle stopper being removed whilst loading and

Wheel-lock Dagger-Pistol.

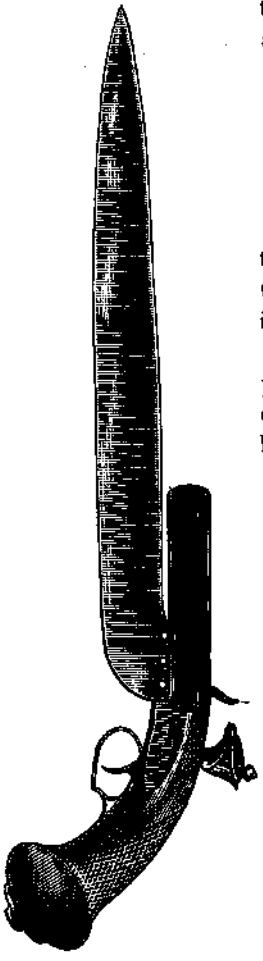
shooting the weapon. The muzzle stopper, upon being replaced, forms the point of the dagger. The pistol has a beautiful wheel-lock and an ingenious safety-bolt, working upon the left side of the handle; the lock is discharged by pressing a small stud on the handle. The whole pistol is of steel, artistically ornamented, and the mechanism neatly and cleverly arranged, as may be seen upon reference to the illustration; the barrel is of Damascus iron.

The other of these curious weapons represented has the barrel, about 4 inches in

Dagger-Pistol, Seventeenth Century.

length, along the side of the dagger blade and is discharged by pressing a small trigger in the handle of the weapon. The lock is a modification of the common flint-lock, the cock, hammer, and trigger-guard forming the cross of the dagger. Similar weapons with pistol on each side of blade are preserved in the same collection.

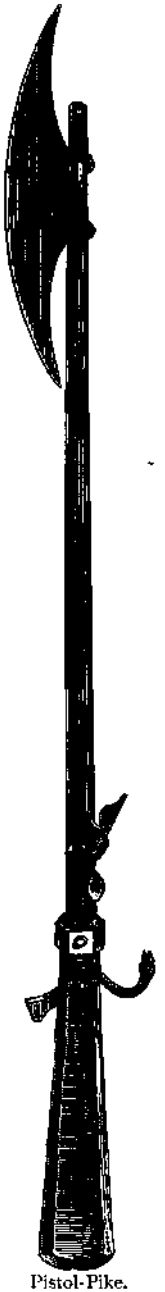
Another and still later form of the same weapon is also shown; in this last type it will be observed that of the two weapons combined in one the pistol is the superior, and the dagger blade subordinated to its requirements; whilst in the earlier models the blade was of first importance, and the fire-arm but subsidiary thereto.



German Pistol-Dagger: Eighteenth Century.

Sword-pistols of various forms are found in most collections, the best, possibly, being that in the Berlin Museum. In the Paris Museum there is, combined with a 20-inch damascened sword blade—curved somewhat like that of a sabre—a short wheel-lock arquebus, the barrel of which forms the backbone of the sword; the lock is placed upon the cross-hilt, and the gun is discharged by pressing a small stud in the handle.

Pistol-pikes are not uncommon; a musket-pike, like the one shown, is more rare. This is of the first half of the sixteenth century, and the blade affixed to its muzzle is available for both thrusting and hacking. In the Tower collection there is a "thief-taker" with the usual pike-staff and two pistol-barrels, one on each side, projecting at an angle of 45°, about midway on the staff. The trigger is near the lower end of the staff, and is connected by a rod with the lockwork, which is arranged near the breech ends of the pistol-barrels. A combination of gun and cross-bow was by no means uncommon in Germany, and various combinations of fire-arms with other weapons are occasionally met with, but they were not made in sufficient quantities to become general, which, indeed, would have defeated the object they were constructed for; and although they will always be regarded as great curiosities, the subject is not of sufficient importance as to render further details of any practical utility.



Pistol-Pike.

CONCEALED ARMS.

Before the introduction of fire-arms, concealed arms for projecting missiles were extremely rare, but in the Museum of Arms at Birmingham there is a small curious cross-bow of the early part of the fifteenth century intended so to be used. It is about 10 inches in length, and constructed wholly of iron; the bow is double and set by a fast-travelling screw; it is released by a small stud, which acts in the same manner as the triggers of a large arbalist. This singular weapon, when not armed lies in a sufficiently small compass to be easily concealed in the folds of a cloak or tunic. Its range cannot have been very great, and it was probably constructed to serve the ends of some private assassin. With the introduction of portable fire-arms, concealed weapons became more numerous; the surprise occasioned by the sudden discharge of a volley of unknown weapons caused more consternation and confusion than could have been gained by the actual killing or wounding power of the weapons themselves.

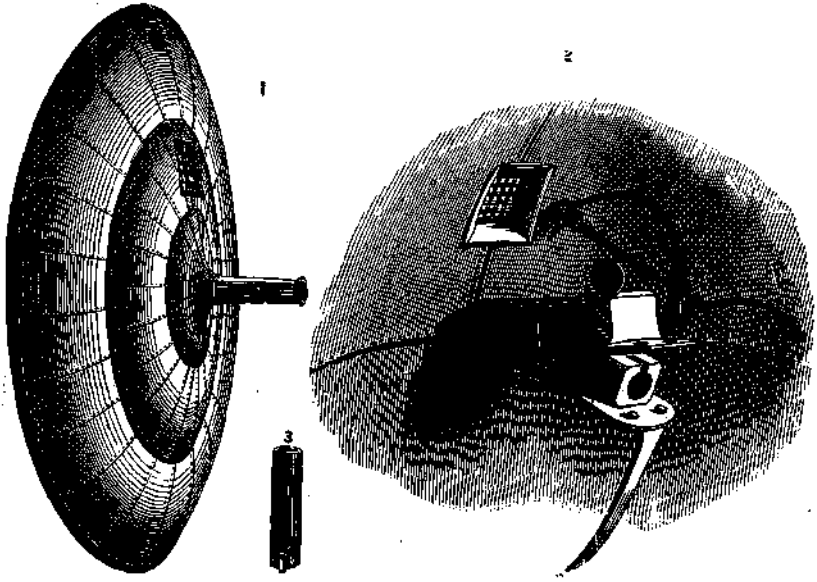
A purse, or sporran, of peculiar construction is preserved in the Museum of Edinburgh. It consists of an ingenious combination of the ordinary Highland sporran with a small flint-lock pistol hidden in the interior of the purse; by turning a succession of metal studs and buttons, when closing the purse, the trigger of the pistol is brought into connection with the clasp, so that anyone unacquainted with the mechanical arrangement endeavouring to open the purse would cause the pistol to fire, with the possibility of wounding the intermeddler, or at any rate of considerably startling him, and perhaps causing him to relinquish the purse entirely as a remarkably "uncanny" article. The connection between the clasp of the sporran and the pistol-trigger is broken by reversing the action of the mountings, but which would appear bewildering to any person unaware of their purport. The date of this sporran is placed about the seventeenth century, but Sir Walter Scott, in "Rob Roy," makes his hero the possessor of a similar sporran; the idea it is said, having originated upon Sir Walter Scott seeing the above weapon in the Museum during a visit. The following extract from "Rob Roy" gives a good description of this purse:—

"A tall, strong mountaineer, who seemed to act as Macgregor's lieutenant, brought from some place of safety a large leathern pouch, such as Highlanders of rank wear before them when in full dress, made of the skin of the sea-otter, richly garnished with silver ornaments and studs.

"'I advise no man to attempt opening this sporran till he has my secret,' said Rob Roy; and then twisting one button in one direction, and another in another, pulling one stud upward and pressing another downward, the mouth of the purse, which was bound with massive silver plate, opened and gave admittance to his hand. He made me remark, as if to break short the subject on which Baillie Jarvie had spoken, that a small steel pistol was concealed within the

purse, the trigger of which was connected with the mounting, and made part of the machinery; so that the weapon would certainly be discharged, and in all probability its contents lodged in the person of anyone who, being unacquainted with the secret, should tamper with the lock which secured his treasure. 'This,' said he, touching the pistol, 'is the keeper of my privy purse.'"

A weapon of unique character is the pistol-shield preserved in the Tower. It is known that these were made in the reign of Henry VIII., and twenty-one specimens, all identical, still remain. They are circular in form, and have a breech-loading, matchlock pistol fixed in or near the centre; the system adopted for loading



Obverse. Reverse.

Pistol-Shield.

consists of a block hinged upon each side of the barrel: it is raised up for the insertion of a loaded thimble or steel chamber. The match was affixed to a serpentin attached to a rod stapled to the interior of the shield, which was depressed by the hand into the flash-pan upon the top to ignite the charge. The mechanism will be more readily understood by a reference to the illustration which shows the breech of the barrel. 1 is the exterior view of the shield; and 3, the steel thimble or chamber. According to Hentzner, who noticed these shield-pistols during his visit to England in 1598, each pistol possessed four movable thimbles or chambers for loading and inserting in the barrel. There is a small barred aperture near

the top of each shield through which an aim may be taken, and being bullet-proof, they afford ample protection to the shooter from the missiles of his adversaries. These shields are enumerated in the inventory of King Edward VI. as target-shields with guns, and this, combined with their shape and size, should betoken that they were made about the first half of the sixteenth century.

Another species of concealed arm is a whip-pistol, of which there is a fine

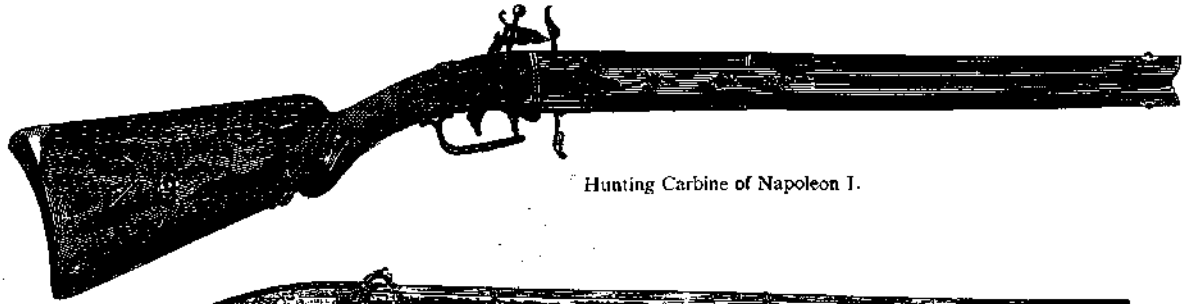
Brigand's Whip-Pistol.

specimen in the Birmingham Museum, having formerly belonged to a notorious Neapolitan brigand. The barrel is concealed in the whip stock, and runs its whole length, about 12 inches. The lock, a small flint and hammer one, is concealed by the ornamental tassels or fringe in front of the handle; it has a secret trigger.

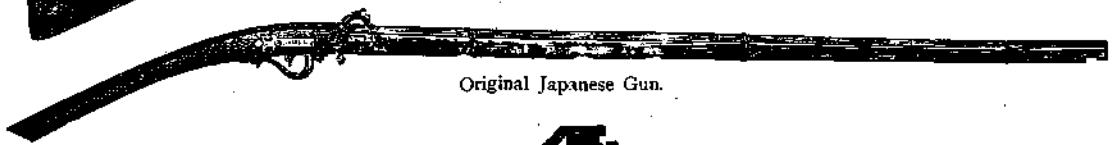
The use of such weapons, however, was not confined to brigands and outlaws, for during the seventeenth and eighteenth centuries the postillions of the French mail coaches travelling south of Lyons were all supplied with similar whip-pistols, specimens of which are preserved in the Paris Museum.

CURIOUS AND NOTABLE FIRE-ARMS.

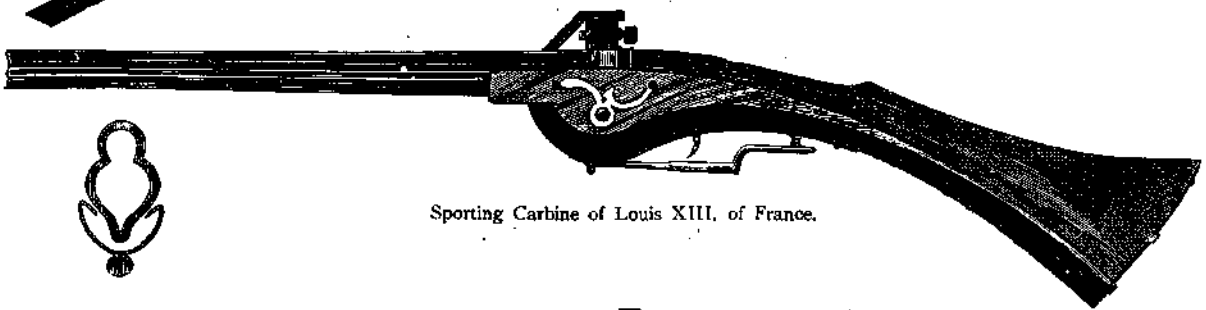
The early gun-makers, when constructing guns for notable personages, frequently tried to produce weapons quite different to the ordinary type; for instance, the



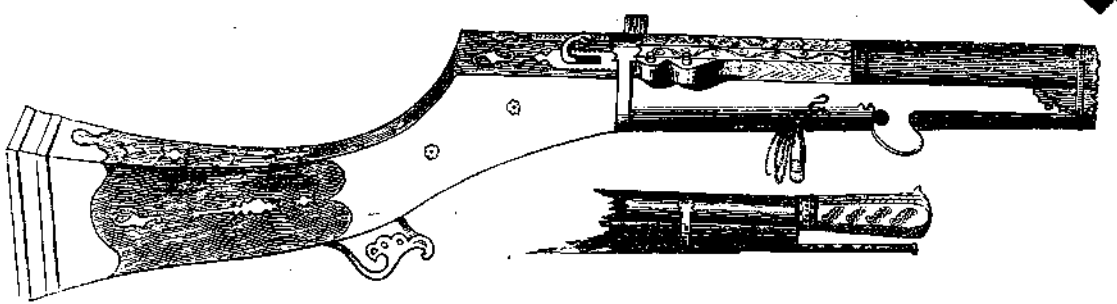
Hunting Carbine of Napoleon I.



Original Japanese Gun.



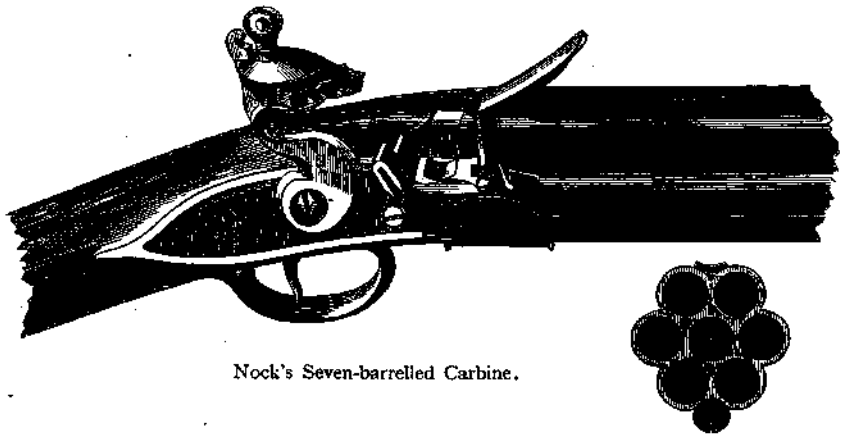
Sporting Carbine of Louis XIII. of France.



Indian Musket presented to H.R.H. the Prince of Wales.

peculiarly shaped barrel of the hunting carbine of Louis XIII. As shown in the illustration, the barrel is apparently composed of irregular tubes joined together. The object of so forming the barrel—which form is intended to represent the *fleur-de-lys* of France—was meant as a delicate flattery to Louis. The bore is about ¾-inch from groove to groove, and the length of barrel about 4 feet 6 inches.

Several extraordinary weapons were made for the first Napoleon. The one



Nock's Seven-barrelled Carbine.

illustrated is a poly-grooved sporting carbine, double-barrelled, the barrels revolving on a common centre, and each carrying its own flash-pan and hammer. The shape of the butt is peculiar, and the ornamentation only ordinary. The barrel is considerably shorter than that of the carbine of Louis XIII., although heavier; the bore is about ⅞-inch.

The Indian musket is the weapon presented to the Prince of Wales by an Indian Rajah; a very fine specimen of Eastern workmanship, heavily jewelled and highly decorated. This gun has been exhibited in most of the art galleries of the United Kingdom, and may be taken as fairly representing the Eastern sportsman's idea of what a gun should be.

The Chinese and Japanese—more particularly the latter—are now manufacturing fire-arms resembling the models purchased in Europe. An original weapon is illustrated for comparison with early European fire-arms. The similarity may be taken either as convincing proof that fire-arms originated in the East or as further

Ornamented Saxon Daggs.

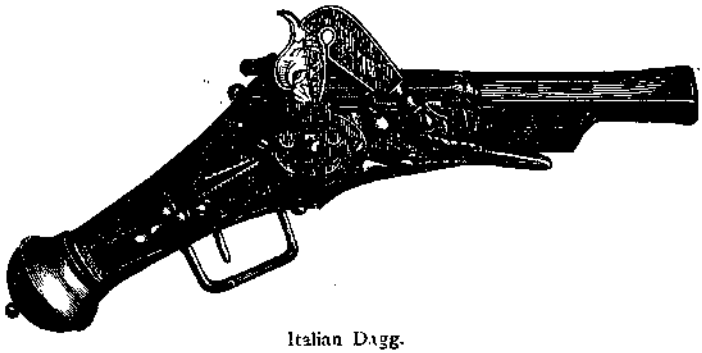
evidence of the fact that most ideas are common to the human race, and not to any particular nation.

Many people may be surprised that so recently as 1807 J. Nock, the renowned London gun-maker, made for the British Government a shoulder gun of the same principle as the multi-barrelled cannon of the fourteenth century. It consisted, as shown, of seven round barrels brazed together, and fired from the same touch-hole, all the barrels being fired, practically simultaneously, but actually in very rapid succession. The bore is 20, length of barrels 28 inches; the weapon is very heavy and unwieldy. It is fitted with sights and top-ribs, but the barrels are not rifled.

PISTOLS.

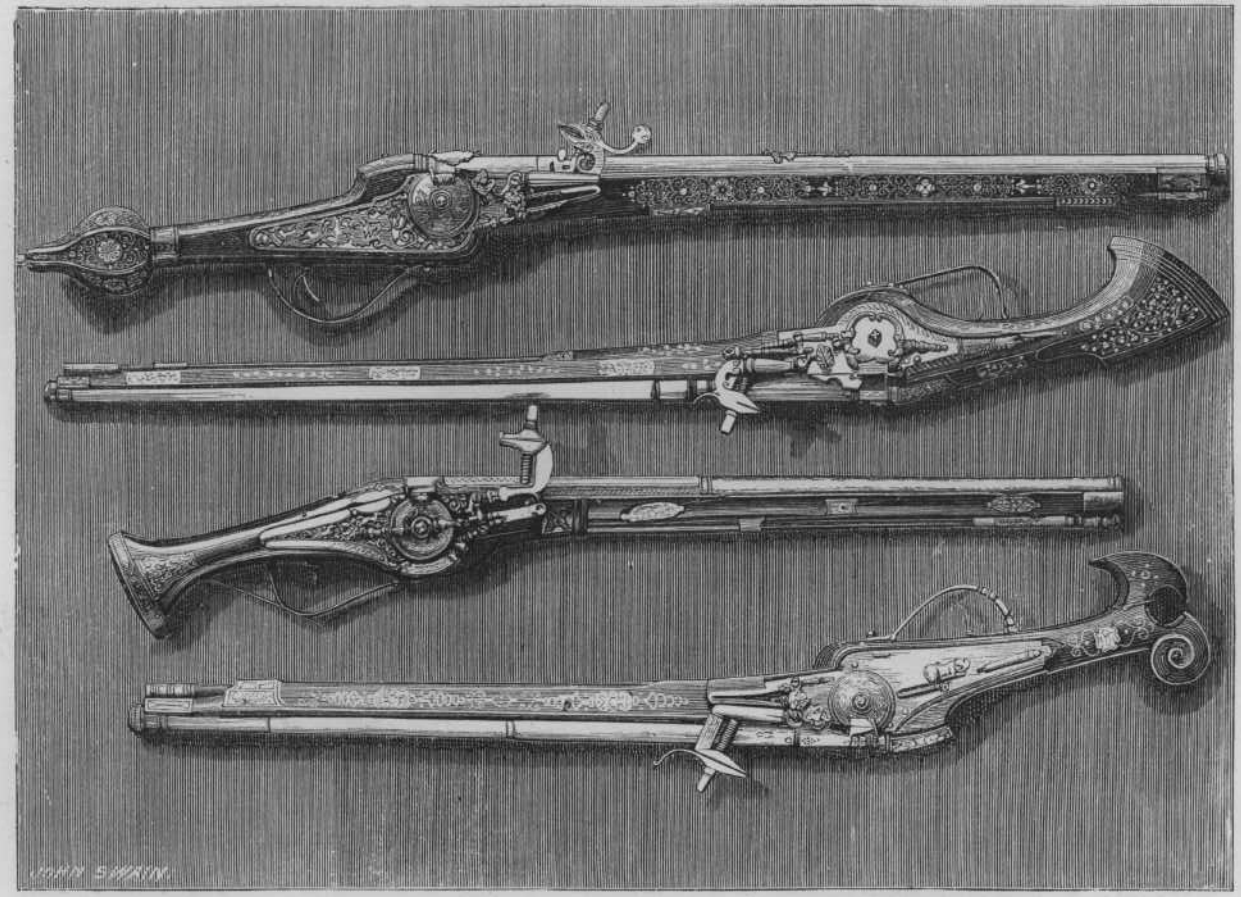
Pistols, as distinct from the smallest of hand-cannon, are understood to have been made for the first time at Pistoia, Italy, from which town they receive their name. Caminelleo Vitelli is the accredited inventor, and he flourished in 1540.

As at first manufactured, the true pistols had short barrels and heavy, clumsy butts, nearly at right angles with the barrel, and surmounted by enormous balls or



Italian Dagg.

caps. In a short time, however, the pattern changed, the butts being lengthened out, and almost in a line with the barrels. To all these early pistols the wheel-lock was the most applicable, and consequently the greater portion of the pistols of the sixteenth and seventeenth centuries are found so fitted. Short, heavy pistols, called "daggs," were in common use about the middle of the seventeenth century. In some cases the butts were of ivory, bone, or hard wood, in others of iron or metal. There were various patterns in use, but the one illustrated will convey an idea of



Old Saxon Pistols.

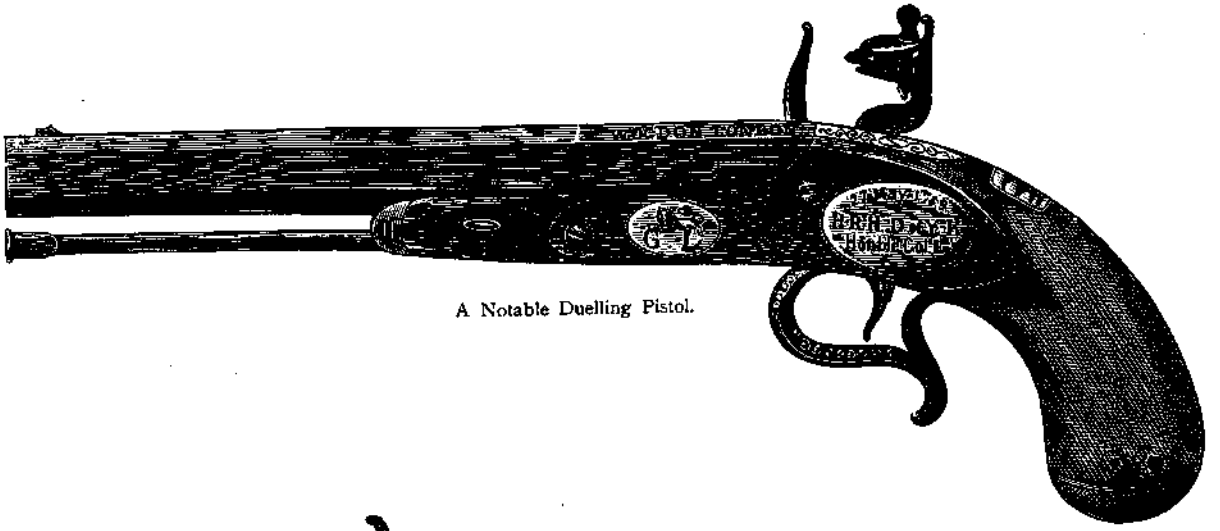
the general appearance of this weapon; a chiselled Italian dagg manufactured by one of the Comminazzo family about 1650. The barrel is slightly bell-nosed, about eight inches in length, and 14-bore. There is also a safety-bolt affixed on the right-hand side of the weapon, which is entirely of metal.

The wheel-lock pistols of German manufacture were used also for military purposes by the Ritters; these, with their balled stocks, so well known to frequenters of arms museums, were apparently built for Grafs and Dukes, and ornamented so profusely that photography alone can adequately reproduce the beauty of their intricate details. For chiselling, carving, and *schnittwerke* they cannot be surpassed: the designs are originally conceived and admirably executed. The interior work is likewise good, especially that of the smiths, but the finish would now be considered rough.

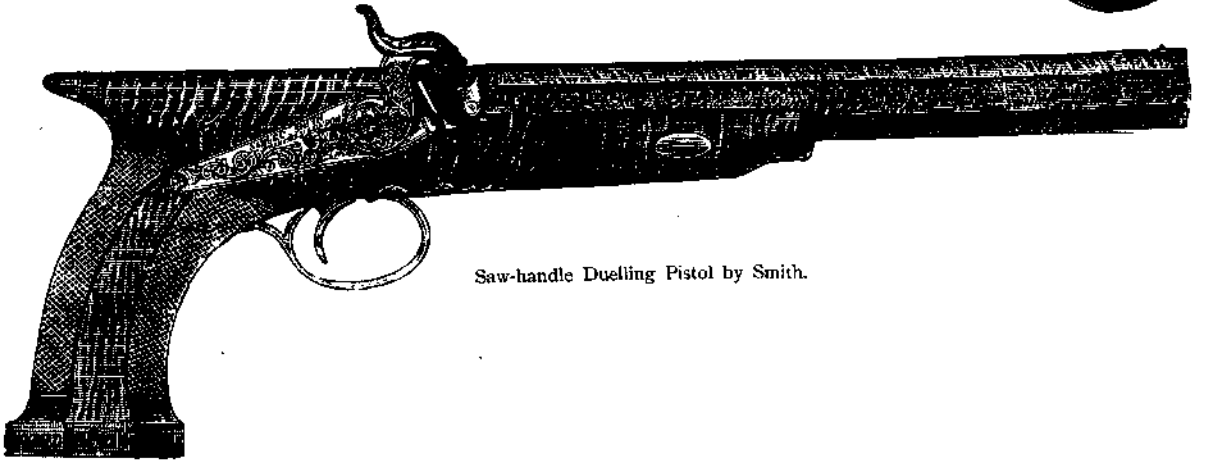
Duelling, when and wherever in vogue, has caused the production of weapons most accurately made and reliable at twenty paces, good specimens of the gun-makers' craft at their date of manufacture. The pattern of pistol seldom varied, and for exterior appearance and handling the duelling pistol of to-day is the same as that of last century. The specimen here shown, a very good one of its class, was recently in the author's hands. It has figured in several memorable contests, the better-known encounter being that between His Royal Highness the Duke of York and the Honourable Colonel Lennox in 1789. The little meeting took place on Wimbledon Common, and His Royal Highness, who did not fire, lost a curl by his adversary's shot. The accuracy of this pistol is equal to that of more modern ones, the same principle of a heavy bullet and a small charge of powder being employed.

Pistols with metal hafts were common in the seventeenth and eighteenth centuries; some very beautiful specimens were made in Edinburgh, Highlanders preferring them to those of the ordinary type, as, with the blue metallic stock and silver mountings, they matched better the ornaments of the Highland costume.

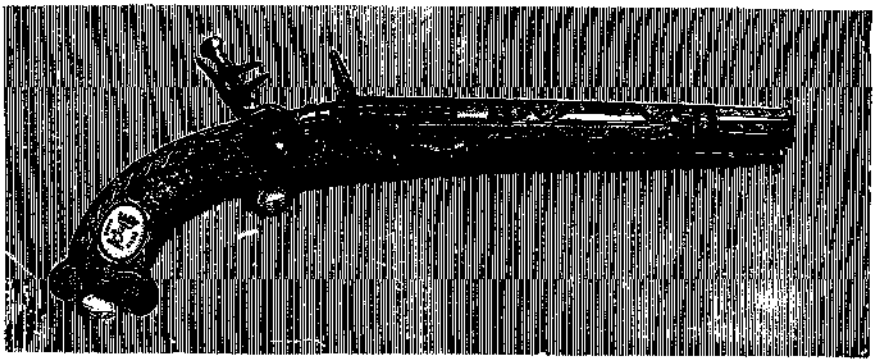
In the double pistol with barrels under and over, the trigger mechanism is the chief peculiarity, as it serves to discharge both locks. The trigger is pivoted vertically; an inclined plane on the right tumbler forces the trigger under the left scear, when the right tumbler has been let down; on the tumbler being raised, a spring forces the trigger beneath the right scear. It is necessary to remove the pressure of the finger upon the trigger before the second barrel can be discharged, in the same manner as with a double-action revolver, but the pistol trigger does not require so much travel. This method of constructing guns is advocated in a German book on gun-making.



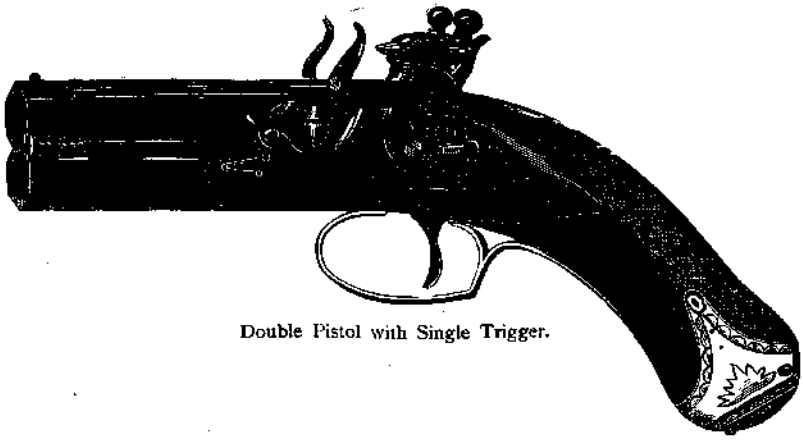
A Notable Duelling Pistol.



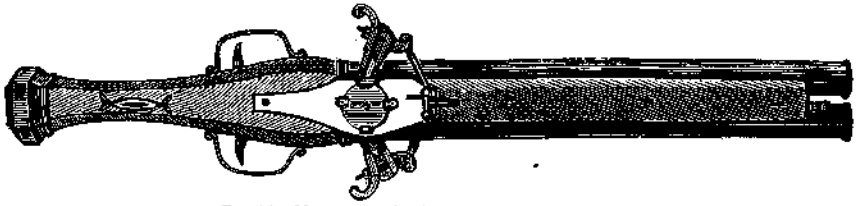
Saw-handle Duelling Pistol by Smith.



Highland Pistol.



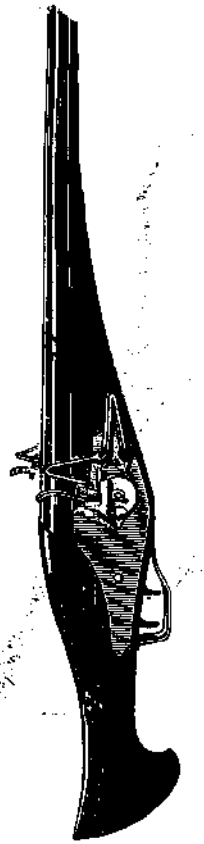
Double Pistol with Single Trigger.



Double Horse-pistol of the Sixteenth Century.

EARLY DOUBLE-BARRELLED GUNS.

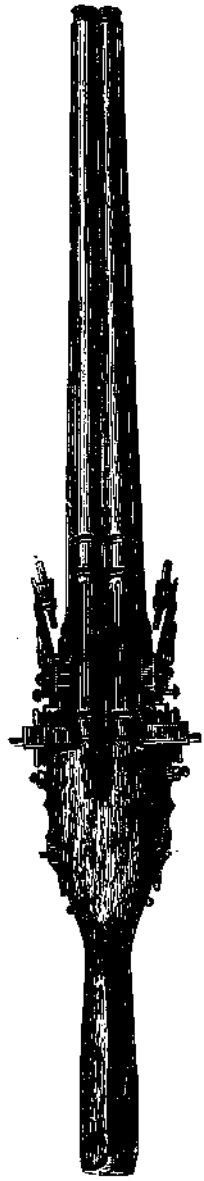
It is surprising how few specimens of early double-barrelled guns are known. It seems that when fire-arms were first introduced, although the multiplication of cannon upon one carriage, shaft, or stand was commonly resorted to, two barrels were seldom, if ever, employed. For this the author can offer no adequate explanation. The first successful double-guns were built with the barrels over and under, and not side by side, and certainly not until after the introduction of the wheel-lock into Italy. The first inventor of this double gun appears to be one Giuliano Bossi, of Rome, who in 1616 wrote describing the qualities and advantages of the double arms of his design.



Double Pistol of the Seventeenth Century.

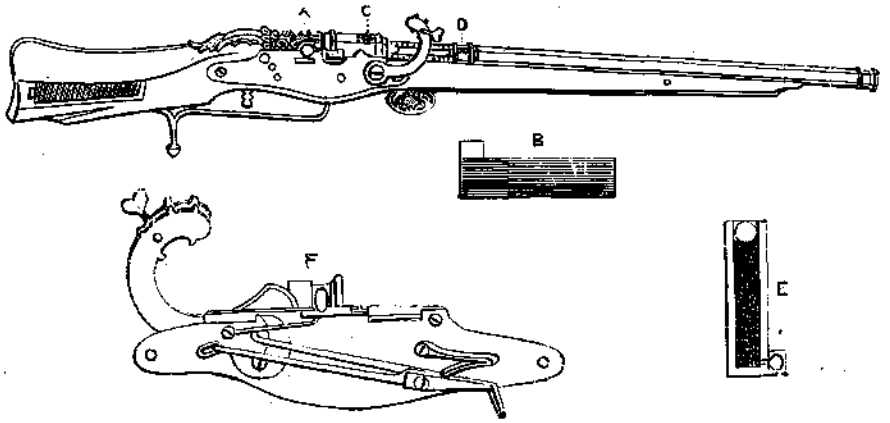
The pistol illustrated fully explains itself, as the weapon was so formed as to shoot with either barrel uppermost, and was only the crude idea of a double-barrel fire-arm. Towards the middle of the sixteenth century, wheel-lock carbines with two barrels, one over the other, were made in Germany. The barrels turned upon a common axis, and were fired by a separate or common lock, as already illustrated : this was the invention of Bossi.

In the Tower of London there is preserved an early double fire-arm of the commencement of the seventeenth century. It is a long double pistol, in which the barrels are placed side by side. It is an early specimen of the wheel-lock, and the shape of the stock or handle is remarkable. The weapon appears to have been intended for sporting purposes. It



Italian Double Gun.

is ornamented with brass, and has barrels about eighteen inches in length. These two weapons are clumsily made, and unwieldy; not so, however, is the pretty little Italian arquebus next illustrated. This handy little weapon appears to have been manufactured for solely sporting purposes, and is undoubtedly one of the earliest double sporting guns with the barrels side by side. It is a wheel-lock arquebus of about the middle of the seventeenth century. It is beautifully ornamented with chiselled copper mountings: the barrels are nicely finished, both at the breech and muzzles, and the flash-pans are also of copper. The barrels are about twenty-two inches long and half-inch bore, but the name of the maker is wanting. A similar gun, but of a considerably later date, is preserved in the Paris Museum, and bears the name of Berch.



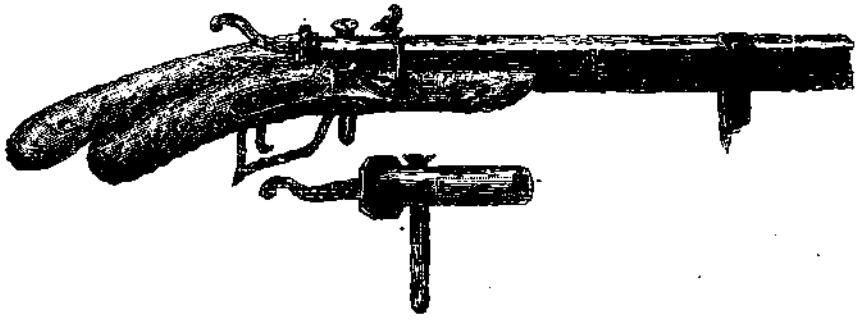
Breech-loading Arquebus of King Henry VIII.

Double shot-guns do not appear to have been in general use until the present century. In 1784 they were so new that Dr. Aikins deemed it worth while to write and publish a description of them. Joseph Manton is thought to have been the first man to unite the barrels with a rib; but the success of the double gun was more directly due to the lighter weight which better material and higher class workmanship made possible.

EARLY BREECH-LOADERS.

One of the earliest breech-loading hand-guns is to be found in the Tower of London, in the specimen cherished as the hunting arquebus of Henry VIII. The annexed illustration represents this curious weapon. It is a matchlock arquebus,

and bears the letters "H. R." and the date 1537. The system of loading is similar to the Snider breech-action. The breech-block is, however, hinged on the left side, and opens from the right to left. The charge is put in a small steel thimble or chamber, which has a false flash-pan and touch-hole in one side that fits into the flash-pan upon being placed in the chamber. The shape and comparative size of the movable chamber is shown in the engraving at B, and in section at E. A is the breech-block, C the Royal arms, D the King's initials, and F shows the mechanism of the lock. It will be seen that a rod actuating a lever to the flash-pan cover is affixed to the scear, so that upon the scear being raised the cover slides from over the flash-pan. This weapon is probably of French manufacture. The armourer's



Early German Breech-loader.

mark is a *fleur-de-lys* surmounted by the letters "W. H." It has also stamped on the breech a crowned rose supported by two lions. The barrel is fluted and about 3 ft. 6 in. in length.

Another breech-loading arquebus was in common use in Germany during the earlier half of the sixteenth century. In this gun, represented with its movable chamber, the barrel is enlarged to take a steel thimble and breech-block in one; the thimble having an elongated tail or handle to allow of its being easily moved in or out of the chamber. The thimble is retained in the barrel during the discharge by a cotter pin passing through the barrel, the base of the thimble, and the stock, firmly wedging the whole together, and similar to the German breech-loading cannon shown on page 37.

Henry IV. of France is said to have invented a similar breech-loader, with which some of the French troops were armed during his reign.

The next distinct type of breech-loading arm was of French invention and

made about the middle of the seventeenth century; it was called the "*Amusette du Maréchal de Saxe.*" It was usually made as a wall-piece, but a few were also manufactured as carbines for use by the dragoons. By turning the trigger-guard the breech-plug was caused to open, the block consisting of a cylindrical plug. The charge was placed in loose, cartridges not being employed by the French at that time. It was soon discarded, on account of the great danger in manipulating the weapon, for the friction was so great that the gun frequently went off before the breech-plug was returned to its place.

Early Breech-loading Flint-lock Pistol.

During the seventeenth and eighteenth centuries breech-loading arms were very numerous and of greatly diversified mechanisms; it will therefore be in the compass of this work to describe and illustrate a few of them only. Wheel-lock arquebuses on the drop-down system were manufactured in the second half of the sixteenth century, but in most of these early arms breech-plugs and fixed barrels

were employed. In many instances the charge is placed in the breech-block, and not in the barrel itself.

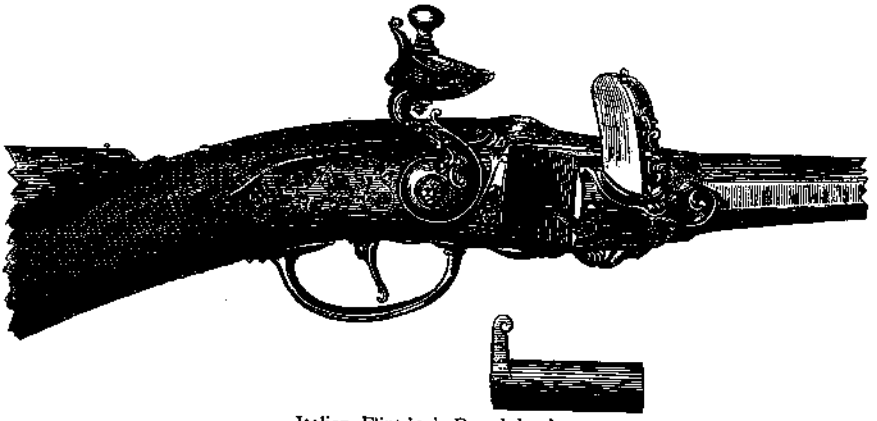
For sporting weapons breech-loaders of curious forms have been made, and generally on the drop-down system. It was not until after the introduction of the flint-lock that any inventions now valuable were produced. Amongst these early arms the one on the drop-down plan, as shown, is most worthy of detailed description.

It is a very long-barrelled pistol, probably of Italian manufacture about the middle of the sixteenth century. The barrel drops on a hinged joint, to allow of the insertion of the charge in a movable steel chamber. It is retained in its position for firing by a catch on the top of the false breech, and actuated by a spring trigger in front of the lock trigger. The similarity that this weapon bears to the breech-action of that introduced by the late J. H. Walsh, Esq., has been noted by some of the readers of the *Field*, who commented upon the hinged joint and the barrel falling at right angles to the stock, which peculiarities were supposed to have belonged to Mr. Walsh's gun only. A gun similar to this one is preserved in the Edinburgh Museum, except that the barrel is retained in position by a sliding bolt, and not by a spring catch.

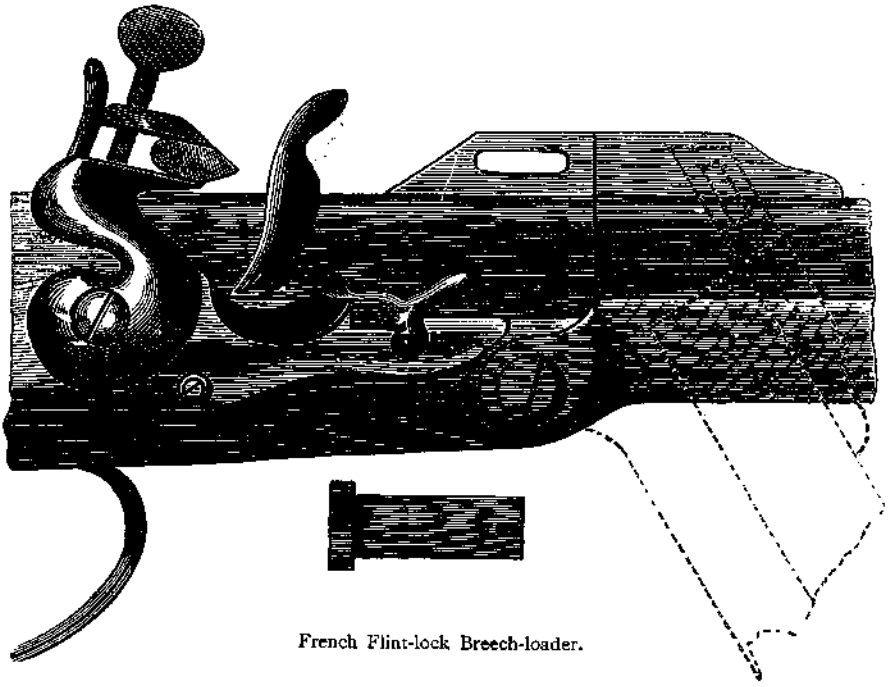
Such guns—in which the barrels drop at right angles to the stock—are not rare. There are several in the Continental collections, and some are illustrated in various parts of this treatise. One, which possesses also an extended top rib and top cross-bolt which is moved by the hand, is shown here. This gun—which appears to have been considerably used—is still sound and in working order. Both the fastenings—the hook and the hinge—being placed behind the joint, have kept the breech close and firm. No cartridge was used in this gun, but the charge was inserted in the rigid breech-end of the barrel, and not in the movable fore-part. The top cross-bolt is shown detached (half-size), and the position of the barrel when open is indicated by the dotted lines.

The next figure illustrates an Italian flint-lock gun, the mechanism of which is the best made of any the author has noticed amongst the arms of the seventeenth century. It is by the celebrated Aqua Fresca à Borgia, and bears the date of 1694.

By pressing the guard a catch under the barrel is released, and, the barrel being pivoted vertically, a lateral motion may be given to the barrel, which swings open horizontally, as shown in the illustration. The charge, contained in a steel tube, may then be introduced, and the barrel returned to its position. By a system of wheels the gun primes itself, the powder being placed in the magazine affixed to the hammer. The butt is hollowed to contain bullet-mould, and the whole weapon is nicely finished, the mountings being of chiselled steel.



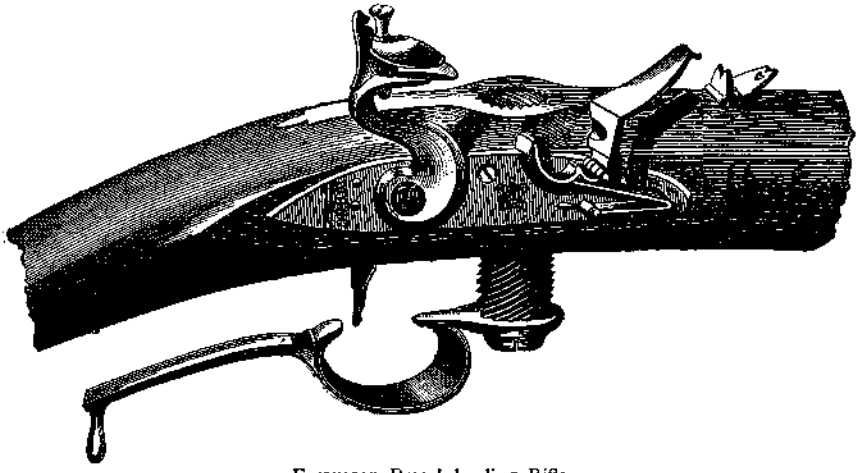
Italian Flint-lock Breech-loader.



French Flint-lock Breech-loader.

During the eighteenth century breech-loading flint-guns were made in which the barrel or barrels revolved on a common axis, as shown on page 85, a space being cut from the side of the arm to allow of the insertion of the cartridges. In single-barrelled weapons the barrel was usually pivoted on a centre considerably below the axis of the barrel, so that upon the barrel being turned over to the right or left it was thrown clear of the stock. The barrel was kept in position for firing by means of a spring stud or catch entering into the barrel from the false breech.

A breech-loading carbine, known as the Fergusson rifle, was used in the American War of Independence, and is here illustrated. It is the first breech-loading carbine ever used by a regularly organised British corps, and is the

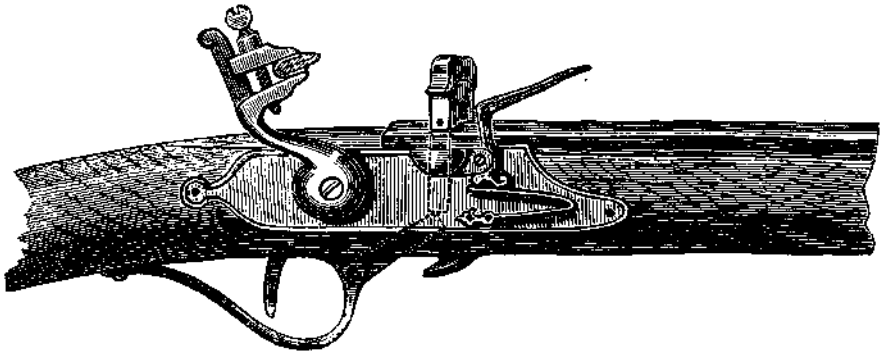


Fergusson Breech-loading Rifle.

invention of Patrick Fergusson, Major, 2nd Batt. 71st Regt. Highlanders, who constructed it some time previous to 1776. It is a flint-lock, and sighted from 100 to 500 yards. The breech mechanism consists of a three- to twelve-thread vertical screw plug, passing through the breech-end of the barrel. This screw plug is attached to the trigger-guard, which, when turned, sinks the screw plug, leaving an aperture in the top of the barrel for the insertion of the cartridge or charge. The screw is then raised by replacing the guard, and the aperture leading to the barrel chamber thereby closed.

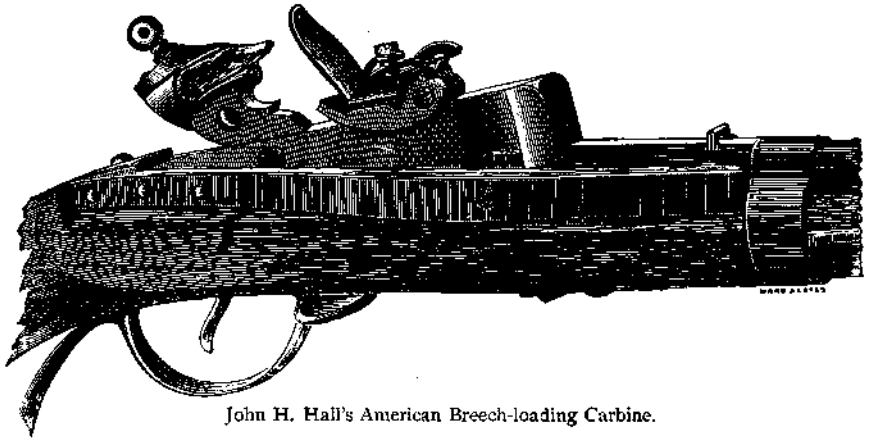
Another type of breech-loader is that of Mr. Theiss, of Nuremburg. In this

arm the stock is hollowed immediately behind the breech of the barrel to admit of the charge being introduced, the barrel being closed by a vertically sliding breech-block, actuated by a button attached to a lever under the barrel in front of the guard. When pushed upwards by the button, a hole in the breech-block is in a



The Theiss Breech-loading Gun.

line with the axis of the barrel. Through this aperture the cartridge is pushed into the chamber of the barrel, which is closed by knocking down the breech-block.

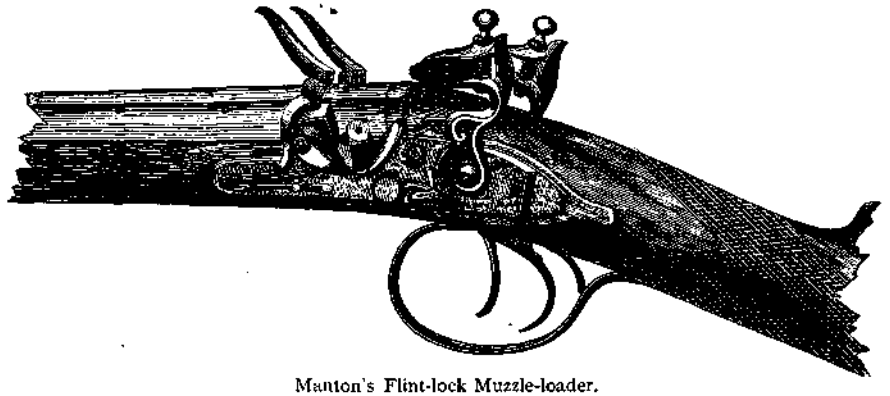


John H. Hall's American Breech-loading Carbine.

The weapon is a flint-lock, and was manufactured in Germany about 1804, but was discontinued owing to the large escape of gas at the breech.

Another type of flint-lock breech-loading arm is next illustrated. It was the invention of an American, who afterwards made arms on the interchangeable system for the United States Government. In this arm the breech-block itself is loaded, the flash-pan, hammer, and cock all being arranged in or upon the movable block. After loading, the block is depressed and kept in position for firing by a spring catch working under the barrel; the block is hinged similarly to that of the Martini, but moves upwards instead of downwards.

This action may be considered a fair sample of that generally employed in old wall-pieces, though the modifications are so numerous that only a cursory notice of them would fill a volume. As muzzle-loaders, wall-pieces, on account of



Manton's Flint-lock Muzzle-loader.

the length of their barrels, were most difficult to load, so that more breech-loading wall-pieces than early breech-loading small-arms were made. In some cases cartridges were used which were placed in the barrel itself or in the breech-block. Rigid barrels and movable blocks appear to have been the principle on which most of them were constructed.

The highest development of the flint-lock was not applied to breech-loaders, nor yet to military muzzle-loaders, but is found only in the best fowling-pieces, particularly those made by Joseph Manton early in the present century. The illustration is of a typical weapon, and represents a Manton double-gun with the patent gravitating stops on the outside of the lock-plate. They fell, by their own weight, whenever the gun was in a perpendicular position, and locked the hammers automatically, securing them whilst the gun was being loaded and the charges rammed down.

CHAPTER V.

THE PERCUSSION SYSTEM.

HISTORICAL NOTE ON FULMINATES.

The main appreciable difference between ordinary explosive and a fulminate consists in the amount of percussion required to produce explosion and the difference in the rapidity of the explosion. Ordinary black gunpowder and some nitro-compounds may be ignited by percussion between steel or other metal faces, but the explosion so produced is not appreciably more rapid or violent than if ignition is produced by the simple application of fire. A fulminate, on the contrary, is most readily ignited by percussion, and so exploded exerts greater force in less time than if fired by other means. The qualities of the fulminates and various mixtures used in connection with fire-arms are briefly enumerated in the chapter on "Modern Explosives;" here an attempt is made to show how certain of them came to be employed for igniting the powder charges in fire-arms, and in what way the fulminate has been applied to the purpose.

Chlorate of potash is probably the best known fulminate; mixed with powdered glass, it is one of the most sensitive detonating mixtures used in connection with fire-arms. Used as a substitute for the nitrate of potash in gunpowder, or as an additional ingredient, it changes the product into fulminating powder—a much more violent and dangerous explosive, and an unstable one. In England no *mixture* containing chlorate of potash and sulphur is now allowed to be manufactured, although the Patent Office continues to afford protection to numerous explosive mixtures into the composition of which these ingredients enter. Many accidents have occurred in the last and during the present century with gunpowders so made —notably in 1788 to Berthollet, the famous French chemist. Other percussion powders are derived from the fulminates of mercury, silver, gold, platinum, etc.

The first researches for these powders appear to have been made by Peter Bolduc, a Frenchman, at a date anterior to 1700. In the reports of the Royal Academy of Sciences from 1712 to 1714 notices are given of the experiments of Nicholas Lemery in the same direction Nothing of great importance appears to have been arrived at by either of these personages, but in 1774 Bayen, chief army

physician to Louis XV., discovered *fulminate of mercury*, and made known its explosive properties; but there was no idea, even at that time, of applying fulminates in any way whatever to fire-arms; indeed, it was not until after the discoveries of Fourcroy in 1785, of Vauquelin in 1787, and of Berthollet in 1788, that an attempt was made to provide a substitute for saltpetre in gunpowder by the use of chlorate of potash.

Berthollet, the famous chemist and experimentalist, essayed in vain to effect this; and, after two successive explosions—cruel evidences of the terrible force of the new salts—he desisted, although not entirely relinquishing his researches, as he studied the fulminates, and discovered *fulminate of silver*. Immediately this fulminate became known, endeavours were made to use it in pyrotechnical displays, and after a few trials it was applied to fire-arms, but did not answer effectually; its extreme sensitiveness, and the great care required in handling and using it, rendered it most unsuitable for pyrotechnical purposes.

Scientific persons then endeavoured to combine with the fulminate of silver other combustible ingredients that would render it less sensitive, such as a mixture of chlorate of silver and sulphur, iodate of potass with sulphur, ammoniates of gold, platinum, silver, etc.

In 1800 an Englishman named Howard, after a study of the experiments of Vauquelin and Fourcroy, essayed to manufacture a fulminate composed of fulminate of mercury and saltpetre. This powder was extremely sensitive, possessed all the requisite qualities of a priming powder, and was for years known as Howard's powder.

The most notable invention in connection with the application of fulminates to fire-arms was then discovered. According to the Patent Office Records, the Rev. Alexander John Forsyth, LL.D., a Scotch clergyman, and for fifty-two years minister of Belhelvie, Aberdeenshire, is the person to whom the honour of inventing the percussion system is awarded; his letters patent, dated April 11th, 1807, describe the *application* of the detonating principle for exploding gunpowder in fire-arms, etc. Various modes of applying the same to ordnance are shown. The validity of this patent was disputed in the case of "Forsyth *v.* Reveiere," tried in the King's Bench, June 4th, 1819, in which it transpired that other persons had privately used a similar invention before the date of the patent—which, however, was established; the judge (Abbot, L.C.J.) ruling that if several persons simultaneously discover the same thing, the party first communicating it to the public is the legal inventor, and entitled to the protection of letters patent. When Lord Moira was Master-General of Ordnance (1806) Mr. Forsyth, at his request, carried

out some experiments in the Tower of London, with a view to the application of the detonating system to existing arms; but the experiments did not culminate in the immediate adoption of the invention, and, after a few months, Mr. Forsyth returned to Belhelvie and resumed his pastoral duties, not further engaging with gunnery. His inactivity with respect to his clever invention led to his patent being evaded by many persons. The fulminating mixtures he made use of are thus described in the specification of his patent:—

"I do make use of some one of the compounds of combustible matter, such as sulphur or sulphur and charcoal, with an oxymuriatic salt; for example, the salt formed of dephlogisticated marine acid and potash (oxymuriatic of potassium), or of fulminating metallic compounds, as fulminate of mercury or of common gunpowder, mixed in due quantity with any of the aforementioned substances, or with an oxymuriatic salt as aforesaid."

With regard to the manner of ignition the specification reads:—

"Instead of permitting the touch-hole, or vent, of the species of artillery, fire-arms, mines, etc., to communicate with the open air, and instead of giving fire by a lighted match, or flint or steel, or by any other matter in a state of actual combustion, applied to a priming in an open pan, I do so close the touch-hole or vent by means of a plug or sliding-piece so as to exclude the open air, and to prevent any sensible escape of the blast, or explosive gas or vapour, outwards, or from the priming or charge; and, as much as it is possible, to force the said priming to go in the direction of the charge, and to set fire to the same, and not to be wasted in the open air."

The charge was fired by a plunger working in a hole having communication with the charge, at the bottom of which a small quantity of the detonating mixture had been previously placed. The rod was struck by a cock, or, in artillery, by means of a hammer.

The success of the principle was soon observed, notwithstanding the clumsy and often inefficient inventions which were adopted in order to apply it to existing types of guns. Nor can the value of the invention be too highly appreciated, since to it is due the modern method of igniting powder charges in all small-arms.

DETONATORS AND THE COPPER CAP.

The mechanical means by which Forsyth's system of ignition was utilised were very numerous; a few only need be mentioned. The original patent specified a magazine turning on a roller or tube screwed into the breech of the gun; the fulminating powder was deposited in the roller, the magazine was restored to its position, and the cock struck on a pin with a spiral spring attached, which pin reached and ignited the powder. Various improvements were made by those

engaged by the patentee to produce for him; the gun-makers also adopted the principle, whilst varying the mechanism by which it was applied, and when the patent had been in use some years many makers had their own particular mechanisms licensed by the patentee.

In 1808 a Genevan gun-maker named Pauly, practising in Paris, invented a percussion breech-loading gun, in which a fulminating paper cap was affixed to the breech of the cartridge. Upon pulling a trigger, a needle pierced the cap, and thus ignited the charge. It was from this gun that the Lefaucheux breech-loader was subsequently developed.

In 1812 this same Pauly invented a percussion gun, in which the hammer,

The Westley Richards Detonating Gun.

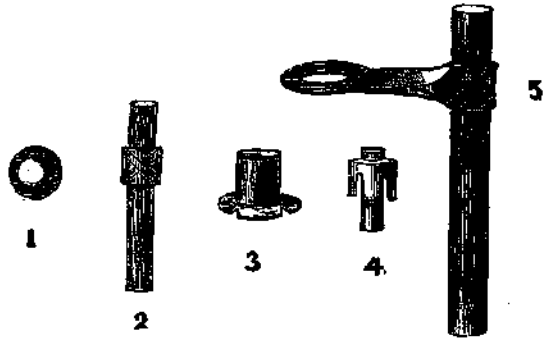
cock, and flash-pan were dispensed with, all being replaced by a small piston, actuated by a spiral spring, striking a nipple upon which a few grains of fulminate were placed.

Numerous inventions between 1807 and 1825 relate to self-priming guns, and the systems are greatly varied; sometimes the fulminate was enveloped in paper or metallic covers, and in others the powder was simply rolled into small pills or pellets. In 1821 Westley Richards invented a percussion gun which ignited with either the simple detonating powder, the paper caps, the pellets, or the balls.

The cock strikes into the flash-pan, which is covered with a pivoted lid actuated by a spring. The falling of the hammer causes the cover to move from over the pan by its breast pressing against an extremity of a pivoted lever, whose other

extremity is connected with and actuates the pan-cover. The touch- or communication-hole is situated in the bottom of the pan, and enters the barrel in an oblique direction. A small peg is screwed through the cock-nose so that the point of the peg falls into the centre of the pan, which is concave, and thus renders the percussion more certain.

Many similar systems were used and patented between 1812 and 1825. The chief systems were those of Egg, Wilkinson, Lancaster, Lang, and Westley Richards. The accompanying illustration shows a few of the numerous detonators; many others existed but a very short time, and were not extensively used. No. 1 represents the paper cap, the fulminate being placed between two small pieces of paper. No. 2 is a priming-tube, the one end being inserted in the touch-hole and the other



Detonators.

struck by the cock. No. 3 is a musket percussion-cap. No. 4 is the Westley Richards primer. This consisted of a priming-tube with flanges affixed to it. The tube was inserted in the nipple, the flanges preventing it being driven in altogether when struck by the cock. No. 5 is a friction-tube, as used for firing cannon. It is placed in the touch-hole and by pulling a string attached to the ring in the cross-arm the required friction to ignite the fulminate within the tube is obtained.

The copper cap was the latest and best form of percussion ignition. Many persons claim to have invented it; among them the gun-makers Egg and Manton. Wilkinson states that Egg purchased it of Roantree, a gun-maker of Barnard Castle, but that it was actually first used in 1814 by a Mr. Joshua Shaw, of Philadelphia, who, at that time, put the fulminate in a steel cap, which, after use, he kept for the purpose of repriming. The next year he employed a pewter cap, which he threw

away after using, and in 1816 used a similar cap of copper, exactly as used on percussion muzzle-loaders forty years later.

Colonel Hawker says respecting it:—

"The copper cap is now in general use all over the world, and therefore many gun-makers attempt to claim its invention as their own. I do not mean to say that I was the inventor of it—probably not; but this I must beg leave to state:—When Joe (Manton) first brought out his detonator in Davies Street, he made the most perfect gun I ever saw; and doubting whether such another could be got, I set my wits to work in order to simplify the invention. At last the plan of a perforated nipple, and the detonating powder in the crown of a small cap, occurred to me. I made a drawing of it, and took it to Joe. After having explained it, he said he would show me something in a few weeks' time, when, lo and behold! there was a rough gun altered to precisely my own plan—his factotum, poor old Asell, informing me that the whole job was done from my drawing. Thus Joe, who led the fashion for all the world, sent out a few copper-cap guns, and I know with some degree of reluctance. The trade, finding he had then deviated from his own patent, adopted this plan, and it proved to answer so well that we now see it in general circulation."

Joseph Manton's "Tube" Detonating Gun.

The reason for Manton's reluctance appears to be that he wished to push his own patent tube-gun. In this a metal primer was placed in the touch-hole and held there by a spring catch, and exploded by the blow of the cock on the *side* of the tube—the fired tube being blown out of the gun by the force of the explosion.

The late W. Greener used tinned iron caps. Another plan deserving mention was that of Baron Heurteloup, who, discovering that a fulminating powder enclosed in a tube of soft metal could be cut through without ignition yet detonated if struck by a blunt instrument, designed a self-priming gun in which a long tube of detonating powder was contained in the stock and moved forward into position by each

fall of the hammer; the fall also cutting off the fragment of tube required and then instantly detonating it by continuing its blow.

The detonating mixtures used in copper caps and the methods of manufacture are described in the chapter on "Explosives."

THE PERCUSSION MUZZLE-LOADER.

The percussion principle of ignition was applied to muzzle- and to breech-loading guns. It succeeded first with the muzzle-loader, and it was to this principle that the English gunmakers confined their attention. Percussion guns were not quickly accepted as military weapons; the British Government was very slow to adopt the principle, and at first many sportsmen would not use the copper-cap gun. Old sportsmen chiefly adhered to the flint-lock; notably that great authority, Colonel P. Hawker. When first made, it was a common fault to overload the cap; an error which resulted in numerous accidents and serious injuries to sportsmen. The metal of the cap was not always of the best quality, was often too thin, and had a dangerous way of flying into fragments and scattering in all directions when exploded. There was also an idea prevalent that the flint gun shot stronger; a wrong conclusion was formed, but it took years to reverse it in the public judgment.

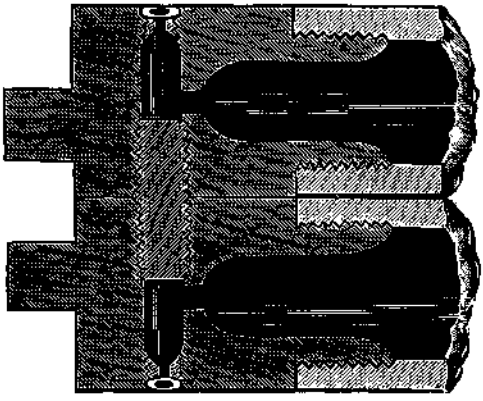
The ignition given to the charge is certainly more rapid, and there is not the violent escape of gas at the nipple as there is at the touch-hole of a *flint gun*. The penetration and recoil are therefore proportionately increased. Colonel Hawker made several trials between flint and detonating guns, the results showing the advantage of the flint system. He thus addressed Joe Manton after this trial:—

"From the result of very many experiments, Colonel Hawker is of opinion that for neat shooting in the field or covert, and also for killing, single shots at wildfowl rapidly flying, and particularly by night, there is not a question in favour of the detonating system, as its trifling inferiority to the flint gun is tenfold repaid by the wonderful accuracy it gives in so readily obeying the eye. But in firing a heavy charge among a large flock of birds the flint has the decided advantage.

"Moreover, the sudden and additional recoil of a detonator with the full charge for duck-gun is apt, if the shooter be not careful, to strike the hand back and give him a severe blow on the nose."

With the flint-lock in a heavy shower of rain, or a continuous drizzle, it was a matter of impossibility to keep the priming-powder dry. With detonating paper caps and pellets the same difficulties were experienced, and it was not until the introduction of the copper cap that the percussion gun could be considered in every way superior to the flint, although the tube detonating gun of Westley

Richards, already described, had considerable vogue, and was in use for many years. The extreme quickness of fulminate powder, the combustion of which is so rapid that its unchecked flame may pass through gunpowder without igniting it, brought into general requisition various forms of nipple and the patent breech. The latter was invented by Nock in 1787, with the object of getting a front ignition of the powder charge. Prior to that date barrels had been made with a plain hut or breech-plug, screwed in the end; by hollowing out this plug so that part at least of the charge of powder should be behind the touch-hole, Nock expected to obtain stronger shooting and avoid the blowing out of the grains of powder by the explosion of the rear part of the charge. Sporting guns in those days were of small bore—24 or less—and the Nock patent breech was advantageous. With the

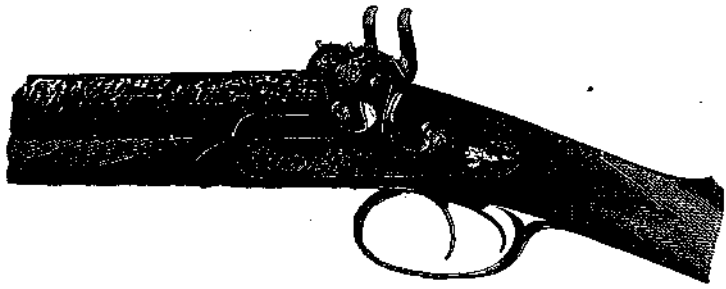


Nock's Patent Breech.

early percussion guns there were often misfires, owing to the extreme quickness of the fulminate used. Sometimes, too, the charge was started up the barrel by the detonator before the powder charge ignited. Much was gained by improvements in the fulminate employed, and by diminishing the quantity used. Still more by altering the position of the nipple and contracting the flash-hole, so that the flames of the cap impinged at that point, and this brief check caused greater heat to be generated and secured the immediate firing of the charge. The touch-hole removed from the side and then placed upon the top of the breech-plug was a great improvement, so far as the performance of the gun was concerned, and, in time, the shape and arrangement of nipple, breech and break-off were altered, until in 1850 the muzzle-loading percussion gun was a truly elegant weapon. No one did more

towards effecting this development of type than the late W. Greener; a facsimile of one of his latest pattern guns is here reproduced, and it may be said, with truth, that it accurately represents the highest form of muzzle-loading sporting shot gun.

To facilitate the manipulation of the percussion muzzle-loader various mechanisms were subsequently added to the lock mechanism. For instance, guns have been fitted with an ingenious arrangement for automatically conveying caps from a magazine and placing them in position *upon* the nipple by the motion of raising the hammer to full cock. In the event of a cap missing fire it was necessary only to raise the hammer again and pull the trigger. The invention obviated the troublesome fumbling with small caps, but even an invention so ingenious could not maintain the popularity of the muzzle-loading principle.



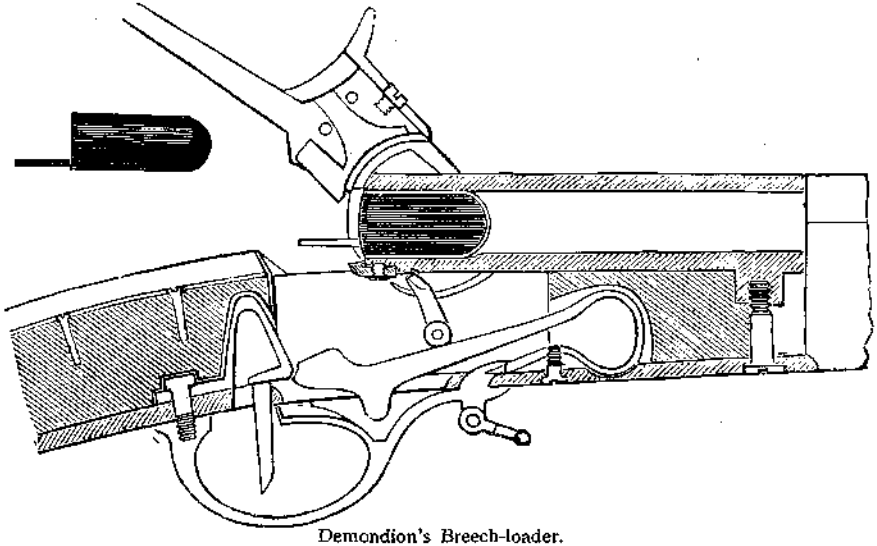
W. Greener's Double Muzzle-loader: 1858.

THE PERCUSSION BREECH-LOADER.

The percussion method of ignition was early applied to breech-loaders; in some the fulminating powder was attached, more or less effectually, to a paper cartridge case; in others it was placed in the gun in the shape of powder, pellet, paper cap, or tube; in others, later, the copper cap was used, it being found that its flash was strong enough to pierce the paper of the cartridge and ignite the charge.

A breech-loader consisting of a hinged breech-block, pulled upward from the breech end of the barrels by a hand-lever, was invented early in the century by Robert, a gun-maker of Paris, and had a certain local popularity. Pauly, to whom reference has already been made, invented several, including one on the drop-down principle from which the Lefaucheux gun was developed. Potet, Bastin Lepage, and other Parisian and Continental makers had breech-loading mechanisms for sporting guns.

In 1831 M. Demondion patented the breech-loading percussion gun illustrated. In this arm the breech-block is raised for loading by means of a lever attached to it, and lying along the top of the grip when in position; the act of raising the breech-block depresses the mainspring hammer, situated beneath the barrel, until it



Demondion's Breech-loader.

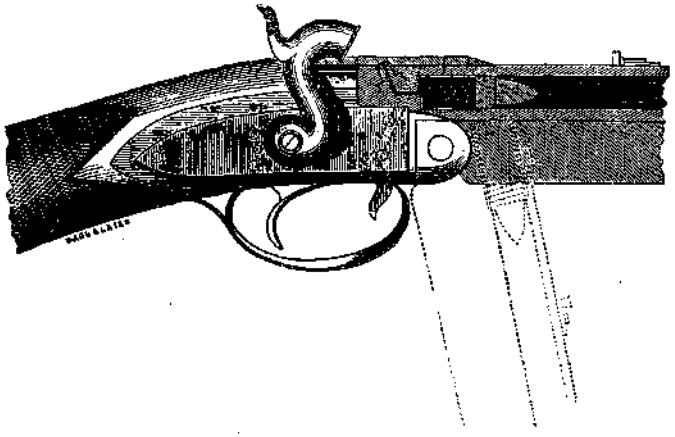
engages with the spring trigger, in shape similar to a door-catch. The cartridge has a small percussion tube projecting from the base, against which the flattened end of the mainspring strikes to discharge the gun, the base of the breech-block acting as an anvil on which to strike the tube.

The lock mechanism will easily be understood by referring to the illustration, and the cartridge case was self-consuming, so that no extractor was needed. This arm is one of the first in which cartridges containing their own ignition were used.

GILBERT SMITH'S AMERICAN RIFLE.

In this arm the barrel drops for the insertion of the cartridge, which is of india-rubber, with a perforated cardboard base. The barrel breaks off in the middle of the chamber, and falls at nearly right angles to the stock, as shown by the dotted lines. The cartridge being flexible, it readily accommodates itself to the fixed portion of the chamber, and, the base being perforated, an ordinary cap is sufficient

to ignite the charge. This weapon was brought over to England about 1838, and submitted to the British Government; but the escape of gas at the joint—which it was thought would be avoided by having the breach in the centre of the cartridge—was sufficient to condemn it. This gun is fastened at the top by means of a



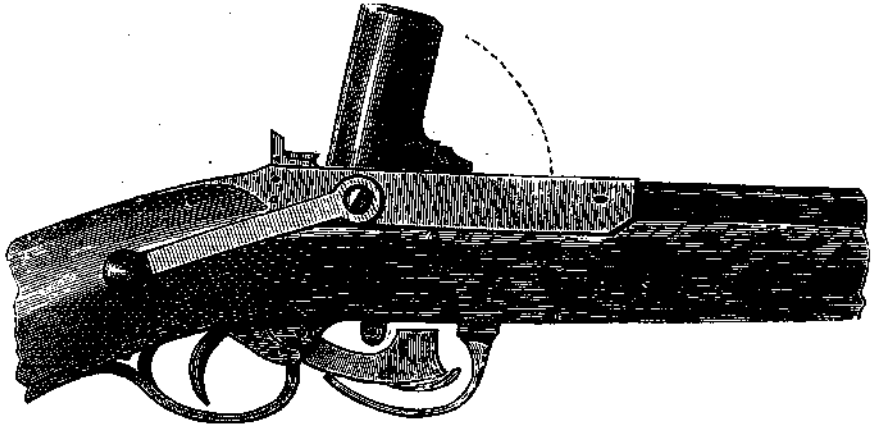
Gilbert Smith's American Carbine.

horizontally sliding bar actuated by a small trigger-lever in front of the lock-trigger, the whole action being very similar in mechanism to that of the French flint-lock drop-down breech-loader described and illustrated in the chapter on "Early Breech-loading Mechanisms."

THE NORWEGIAN CARBINE.

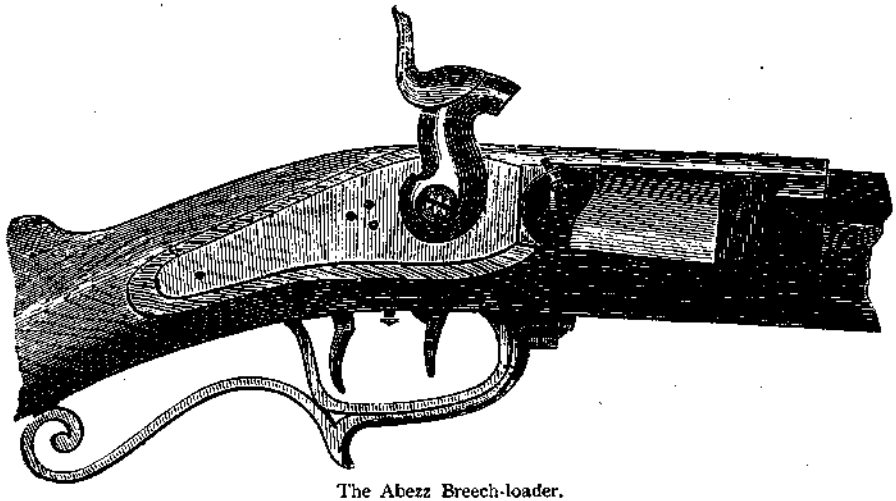
A large number of the percussion breech-loaders were designed for military arms. No arm of the kind was generally adopted for use by the British, and their use has been so long discontinued that the author has not deemed it advisable to include any in the chapters devoted to military rifles. A few of the most inclusive type are therefore shown here. The first to be illustrated is the Norwegian military arm of 1842. The action is different from any yet described, the hollow breech-block being pivoted upon a strong pin, and worked by a side-lever which works upon an eccentric affixed to it. By depressing the lever the breech-block is withdrawn from the barrel and raised, as shown in the illustration, and the cock situated beneath the barrel must be depressed to force it into full-cock. The charge is placed in the

breech-block, and the cap placed on the nipple, which when returned to its proper position for firing, is in a vertical position, projecting from underneath the barrel.



Norwegian Carbine: 1842 Model.

The mainspring is fixed to the fore-part of the stock, and works along the back of the cock. There is a small stud projecting from the breech-block as a safeguard



The Abezz Breech-loader.

against the premature ignition of the cap. It must be moved from position by the hand before firing.

The sight is placed on the break-off immediately behind the base of the breech-block. The weapon is about 500 bore, and rifled with six grooves.

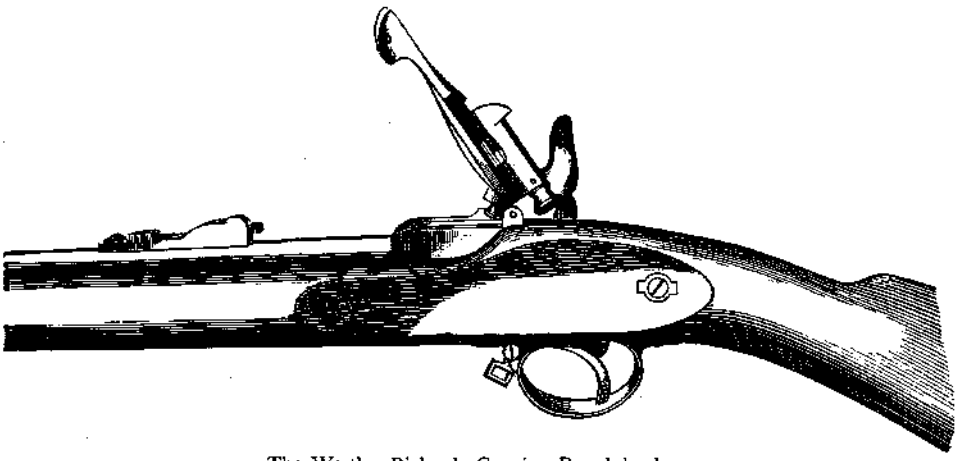
In 1851 Karl d'Abezz, of Zürich, invented the percussion breech-loading carbine next illustrated. This gun is loaded in the breech-block, which is capable of moving horizontally in a frame connecting the barrel with the stock. The movement is communicated to the breech-block by an eccentric pivot actuated by a quarter-turn of the lever under the guard. A forward motion is given to the block by the eccentric pivot when returning it to its place, so as to insert the projecting neck on the breech-block into the barrel itself.

Thus the greater portion of the strain was sustained by the eccentric pivot attached to the lever. The lever moved to the left to open the gun-block, and an ordinary cap, cartridge, and lock were employed.

The Calesher and Terry Capping Carbine, introduced in 1853, was one of the most generally succesful arms of this type. The action was on the bolt principle, the shoe being closed by a plug held up to the breech by an intercepted screw. To open the gun a locking piece was raised, and when at right angles to the barrel it formed a handle by which to turn and withdraw the breech-plug. The paper cartridge was inserted through a hole in the side of the shoe; the plug thrust forward, the lever-handle turned down, and when in its place, pressed quite home along the shoe, it covered the hole by which the cartridge was inserted.

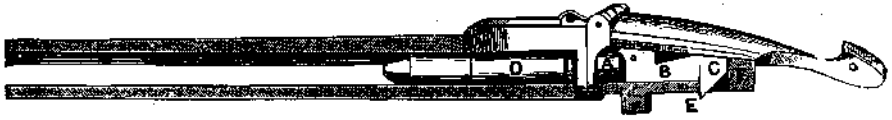
WESTLEY RICHARDS CAPPING BREECH-LOADER.

This was adopted as a cavalry arm in 1861. The principle resembles several which preceded it. The breech-bolt slides to and fro on a flap hinged above the breech end of the barrel; this flap is raised to admit the cartridge D, and, in closing the movable head A to the breech-bolt, pressed forward by its rear extremity C pressing against the back of the breech-shoe or standing breech, F forces the cartridge into the chamber of the barrel and wedges the bolt securely between the face of the barrel and the standing breech. The bolt A together with the breech-block is withdrawn from the barrel, an opening by the catch C engaging the bottom of the breech-shoe E. As a 52- or ·450-bore, the arm is still used in South Africa, where for many years it was most popular. It was fired by the ordinary military cap and nipple, the flash passing through the paper of the cartridge case and so igniting



The Westley Richards Capping Breech-loader.

the charge; the arm could be converted to a muzzle-loader by inserting a metal plug and a couple of wads. The wad at the base of the cartridge by its expansion practically stops escape of gas at breech, and the wad is pushed forward by the next cartridge inserted and shot out in front of the bullet.



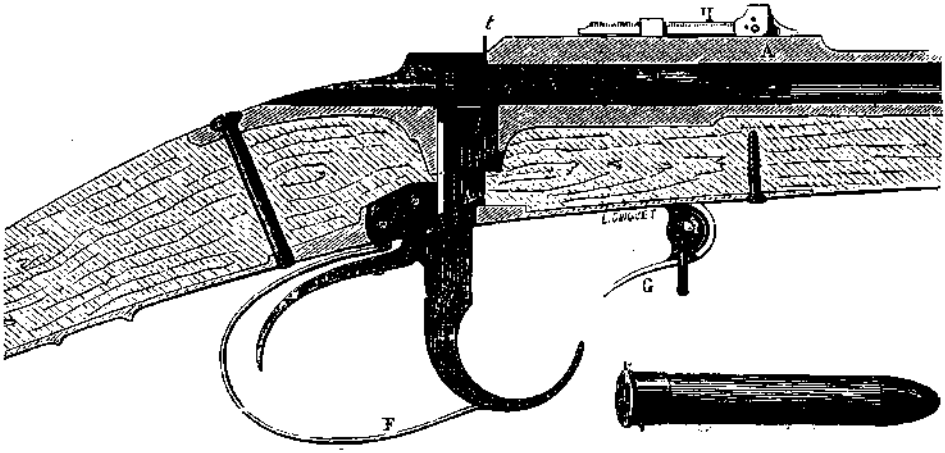
Mechanism of the Capping Carbine.

THE FRENCH *MOUSQUETON*.

The "*Mousqueton des Cent Gardes*" was invented in France shortly afterwards; its mechanism and cartridge is the next illustrated. The pin A for the cap is placed under the base of the cartridge, and projects barely $\frac{1}{8}$-inch. The long pin, F, on the top of the case is to withdraw it from the chamber after discharge. The stock is hollowed behind the breech to allow of the cartridge being pushed into the barrel A. The breech-block B carries a small stud *b*, which strikes the cap of the cartridge C when the gun is fired. Affixed to the block B is a scear D, forming part of the trigger-guard, the other part being composed of the scear and trigger-spring F, one

end acting upon the trigger E, and the other causing the breech-block D to fly upwards with sufficient velocity to close the breech of the barrel and detonate the cartridge cap; G is a swivel and guard, to prevent the finger coming under the scear tail. The manipulation of this arm is said to have been both difficult and dangerous.

Of the other breech-actions invented at this period, some were adaptable to the improved form of breech-loading cartridge, and in the new form are better known; a few may be still in use, but the majority have fallen into desuetude. With the single exception of the Westley Richards Capping Carbine, the percussion breech-



Early French Military Breech-loader.

loader may be pronounced to have failed. It united the disadvantages of ignition on the outside: requiring the fixing of a cap in addition to the manipulations of the breech mechanism necessary to loading, and the raising of the cock for firing, it is not surprising that it was quickly superseded as a weapon of war, and as a sporting arm was never able to compete with arms firing cartridges containing their own means of ignition. In but few instances, and in but few points, was the percussion breech-loader preferred to the muzzle-loader.

CHAPTER VI.

MODERN SHOT GUNS.

HISTORY OF THE BREECH-LOADING SYSTEM.

THE modern sporting breech-loader may be said to have originated with the invention of the cartridge case containing its own ignition; though the breech-loading mechanism of the gun antedated the cartridge by many years, being, in fact, a slow but continuous development of the earliest type of breech-loader already described. The cartridge—that is to say, a charge of powder and bullet in a paper envelope—dates from 1586, and, on the authority of Capo Bianco, such articles were in general use in Europe at the close of the sixteenth century. They were used ordinarily with muzzle-loaders, the base being ripped or bitten off by the soldier before placing in the barrel. At the same time, many attempts were made to use cartridges in breech-loaders. As stated in the section on Ancient Arms, some of these cartridge cases were strong and heavy, and were made of metal; it was not until the detonating cap came into use that the paper cartridge was made to answer well in breech-loading arms. These cases were consumed or were blown out of the barrel; they were not extracted and refilled as were the heavy metal ones in use with wheel, flint, and even matchlock breech-loaders. The flash of the copper cap was sufficient to penetrate the thin paper of the cartridge case and fire the charge; as instanced in the Westley Richards capping carbine already described. Sometimes, as in Demondion's breech-loader, the case contained its own ignition—a detonating pellet or other primer, projecting from the case at or near its base. Bastin Lepage, of Paris, produced a cartridge case, about 1840, in which a copper cap, enclosing its anvil, projected from the base of the cartridge; he claimed that by doing away with the nipple there was no escape of gas at the breech, for he not only did away with the nipple, but provided a stout wad, which, affixed to the base of the cartridge, served the double purpose of supporting the cap and anvil which projected beyond it, but also, by expanding, sealed the breech at the moment of discharge. Presumably there were difficulties in the extraction of the unconsumed remnant of the cartridge and cap, and the idea seems to have been originally intended as applicable chiefly to very small bores and to pistols. Houiller, another

Paris gunsmith, in 1847 patented the pin-fire cartridge as now used. Instead of putting the nipple and cap, or their equivalent, projecting from the base of the cartridge case, he placed the detonating cap, or a detonating pellet, or primer, within wads at the base of the cartridge, and allowed the anvil only to project beyond. As another method, he specified the rim-fire cartridge, and a variety of the central-fire case; in these, as in the pin fire, the cap or priming mixture was in the wad base of the cartridge case, and the whole was covered by a thin metal capsule, as at present used.

Some fifteen years previous to this Lefaucheux, a gunsmith of Paris, had improved the Pauly system of breech-loading. The Pauly mechanism was not unlike the Gilbert Smith American rifle, but resembled in other points some of the still earlier breech-loaders. Lefaucheux specified a hinge joint at greater distance from the breech, and the holding down of the barrels at the breech, where they rested upon the prolonged portion of the fore-part of the standing breech, by an interrupted screw. The screw had only one thread, and was practically identical with the double-grip mechanism, later to be described. Later, he still further simplified this grip by doing away with one-half of the half-thread of the interrupted screw, and thus a projection on the head of the lever engaging with a corresponding notch in the lump affixed to the barrels for the purpose of hinging them to the standing breech, became the best known type of Lefaucheux gun. The Houiller pin-fire cartridge was quickly accepted by both Lefaucheux and Lepage, and in a short time its use became general.

The pin-fire cartridge and the modern breech-loader, even in this form, were not the outcome of any one great invention, but resulted from one improvement after another, each later form differing but slightly from the one which immediately preceded it. By the modification and combination of details a principle of breech-loading was gradually evolved, and although that principle has never since been departed from with success, the breech-loading gun, in all its minor details, has been radically changed. The chief alterations have been in the breech-action and the lock mechanism, and it is by tracing these changes that the best idea of the ... elopment of the modern gun is to be obtained, and it is by describing them th... the history of the gun will be unfolded.

The essential feature of the modern principle of breech-loading is the prevention of all escape of gas at the breech when the gun is fired by the employment of an expansive cartridge case containing its own means of ignition. In the earlier breech-loaders there was an escape of gas through the joints of the breech mechanism, however well fitted, because the metal expanded at the moment of firing and the

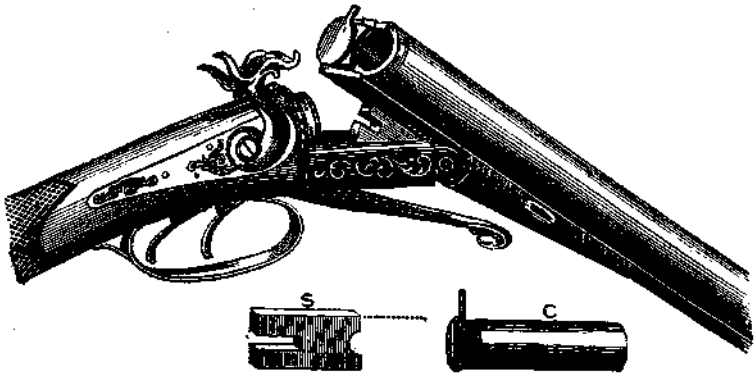
cartridges were formed of a consumable case, or the load was put in a strong non-expansive breech-plug. In those arms in which the ignition was by cap, or other flash from the outside of the barrel, there was, of course, always a considerable escape back through the vent, or touch-hole, in addition. In the earliest efficient modern cartridge case—the pin-fire—the cap, or detonator, is placed within the case; an anvil, or striking-pin, projects through the rim of the case, and, when struck by the hammer, explodes the priming and ignites the charge of powder. The thin, weak shell is then expanded, by the force of the explosion, until it fits perfectly in the barrel, bears hard against the standing breech, closes tightly round the striking-pin, and thus forms a complete and efficient gas check. Further, the cartridge case is a fresh lining to the breech, every shot, forming, as it were, a second breech, which relieves the permanent breech of much wear and prevents its corrosion.

Probably no invention connected with fire-arms has wrought such changes in the principle of gun construction as the invention of the expansive cartridge case. It has been used for every description of small fire-arm, and has been applied with success even to cannon. It has completely revolutionised the art of gun-making, and has called into being a new and now important industry—that of cartridge manufacture.

Modern sportsmen can hardly realise the immense advantages possessed by the breech-loader over the best of muzzle-loading guns. There is no danger when loading; no possibility of the ramrod being shot through the hand, or of caps flying into the eye; no nipples to foul; no powder-flask and shot-pouch to carry, no caps to fumble with; and no need to tear paper into wadding. There is stronger shooting, for there is no escape of gas through the nipple hole, and because the powder is unimpaired by the fouling which, with the muzzle-loader, used to be forced down upon the charge by the wadding; the breech-loading gun is much more quickly and easily manipulated; and, greatest gain of all, it can be instantly unloaded—an operation which with the muzzle-loader was not only tedious, but fraught with considerable danger even when most carefully performed. The breech-loading principle was of even greater advantage when applied to rifled ar. , admitting of a perfectly-fitting bullet without the necessity of driving it with a mr :t into the bore, obviating windage and ensuring greater accuracy, as is fully stated in the chapter on the history of "Rifles." The whole of the advantages were not immediately apparent, for the original type of gun and cartridge had both to be greatly improved upon before some of the benefits of the breech-loading system were realised, but the principle involved is of too great importance to be easily overrated.

THE LEFAUCHEUX BREECH-LOADER.

The breech action of the Lefaucheux gun is a crude mechanism. Through a lump fastened beneath the barrels a pin passes, and on this pin the barrels turn. A slot is cut at the opposite end of the lump, and in this slot a projection upon the vertical pivot of the action lever grips to hold the breech end of the barrels close down to the bed of the breech-action body. The "grip" is required only to hold the barrels in position; the hinge-pin has to keep the breech ends of the barrels firmly up to the standing breech and prevent the barrels from moving forward when the gun is fired. The face of the standing breech, against which the base of the cartridge presses, has to bear the force of the explosion. The thickness of the breech, and the strength of the metal of which it is made, are supposed to be sufficient to enable it to maintain its position; actually, when the gun is fired, the



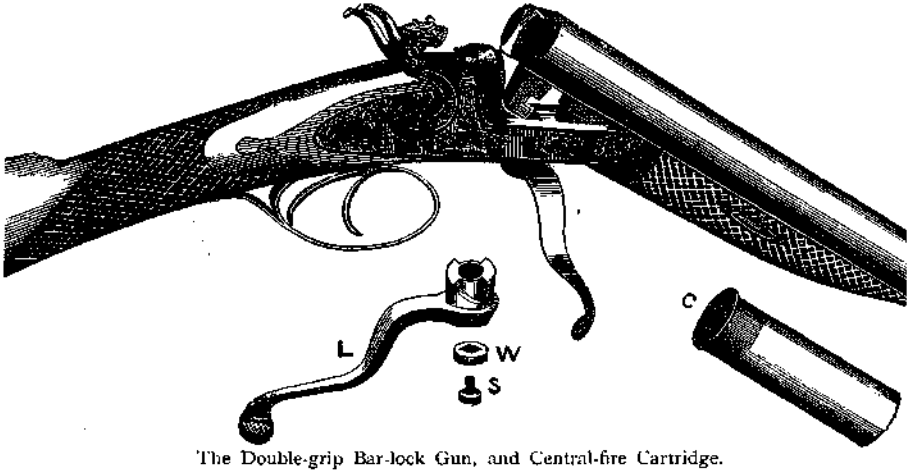
The Original Lefaucheux Breech-loader: 1836.

force of the explosion causes the standing breech to spring back and the joint to gape. A like result is produced by wear, and can be produced at any time by forcing in a very tight cartridge and using the power of the lever to screw down the barrels to their place. This lever, when "home," lies parallel with the barrels and extends to the extremity of the fore-end; which, originally, was not detachable, but formed the hinge on which the barrel lumps were hooked, and to which the barrels were secured by a fore-end bolt. In other patterns the lump is hooked on to the joint-pin as shown in the illustration. Large numbers of pin-fire guns, closely resembling the original model, are still made in Belgium and France. The

first cartridges were without rims, and the gun had no extractor, the fired cases being withdrawn by the striking-pin. The great fault of the gun is the weakness of the breech action and the clumsy and inefficient method of securing the barrels thereto; defects which English gun-makers were quick to observe and remedy.

THE DOUBLE-GRIP BREECH MECHANISM

This gun—the invention of a Birmingham gun-maker—is substantially the same mechanism as the original Lefaucheux. It differs in the lever, which fits over the bow of the trigger-guard, instead of along the fore-end beneath the barrels, and has two grips, engaging, each with its own particular slot, in the double lump. An inclined plane on the cylindrical head of the lever works against the barrel lump, and forces the breech ends of the barrels upward, when the lever is turned from the trigger-guard. When it is returned to its place the two flanges on the cylindrical head of the lever enter the notches on the barrel lump, and draw down the barrels, securing them firmly to the breech-action body. The lever, L, is held in position by the screw, S, and washer, W, to a pivot passing through the head of the



The Double-grip Bar-lock Gun, and Central-fire Cartridge.

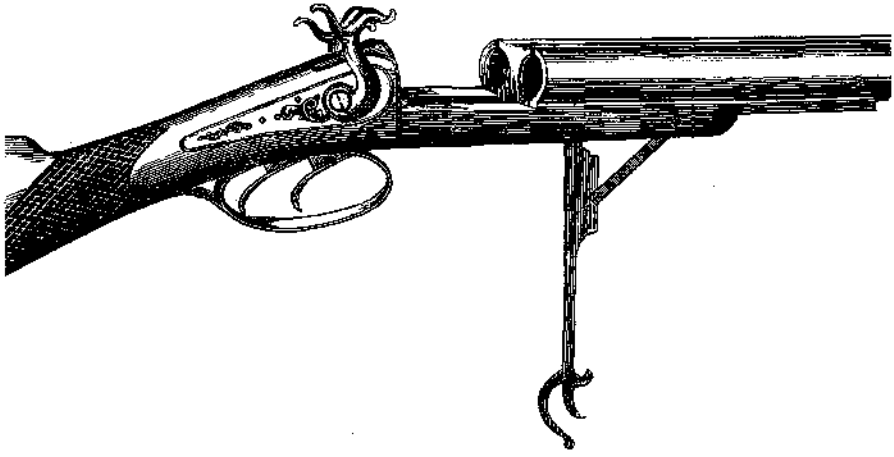
lever, the pivot being solid with the action body; a stop on the washer allows the lever to travel one quarter of a circle only. A modified form was made in which the lever was returned by a spring; the idea being to convert the mechanism to that of a snap-action gun. This double-grip lever mechanism is very simple; all

the parts are strong, and, with back-action locks, it is a form of breech action which but for the time required to manipulate might still find favour with sportsmen.

From the fact that the screw-like grip with its long lever is capable of binding down the barrels very tightly to the breech-action body it is sometimes inferred that the double-grip is a stronger form of breech mechanism than some snap mechanisms which will not work automatically when the action is foul or a too thick rimmed cartridge case is put in the chamber. As will subsequently be shown, this inference is wrong, since the strain exerted by the force of the explosion is in a line with the axis of the barrels; to support this strain the double grip affords no power whatever. The work it actually does requires no particular strength; for the barrels may be held to the bed of the breech-action body by the thumb and fore-finger, even though a full charge be fired.

THE SLIDING BARREL BREECH MECHANISM.

In Bastin Lepage's breech-loader the barrels are not hinged, but slide to and fro on the fore-part of the stock. They are actuated by a lever linked to the



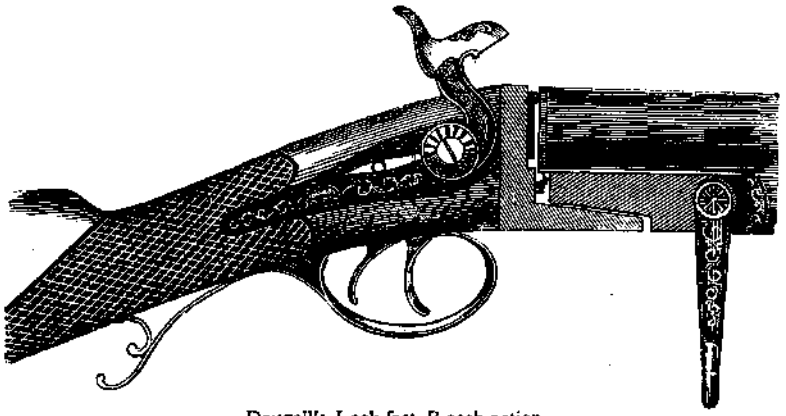
The Bastin Lepage Breech-loader.

fore-end, moving forward just sufficiently to receive the cartridge. A catch upon the lever bolts, or wedges, the barrels against the face of the standing breech when the lever is returned to its place, but this was found to be insufficient, and, the plan being proved faulty in other ways, the mechanism fell into disuse

COMBINED SLIDING AND HINGED BREECH MECHANISM.

The sliding barrel of the Bastin and the hinged barrel of the Lefaucheux are combined in the Dougall lock-fast breech mechanism. The hinge-pin is eccentric, and is turned by the lever attached to it. The barrels not only turn upon this hinge-pin, but are moved by it in a line parallel with their axis sufficiently far to clear, and engage with, projecting discs upon the face of the standing breech.

To open the barrels for loading, the lever is depressed; this turns the eccentric hinge-pin, and moves the barrels forward about one-eighth of an inch, when the breech ends are clear of the discs and the barrels drop, as in the ordinary



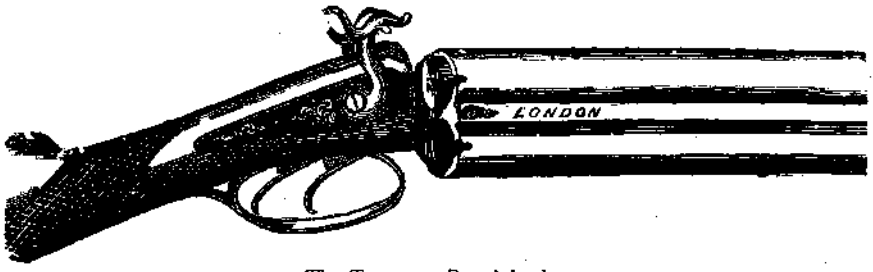
Dougall's Lock-fast Breech-action.

Lefaucheux gun. When the cartridges have been inserted the barrels are brought up and held in position until the lever is turned, and the barrels forced back by the eccentric until the discs on the face of the standing breech enter the chambers behind the cartridges and prevent the barrels from turning on the hinge-pin.

These discs were advocated as a remedy for side motion of the barrels when the breech mechanism became worn. Now two wings or side clips projecting, one on each side, from the face of the standing breech are extolled as effecting the same purpose. It is surprising that first-class gun-makers should continue to make these unsightly protuberances, which are useless for any purpose for which, presumably, they have been designed. A well-fitting top extension is a safer and more sightly remedy for a fault which ought not to exist, and one that will rarely, if ever, be found in a soundly made gun constructed on any reliable system.

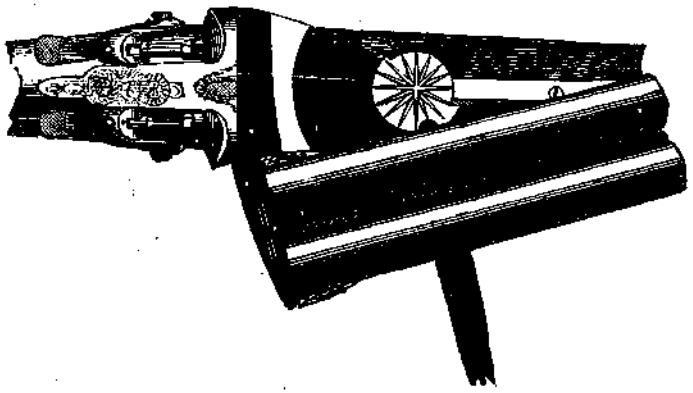
THE TURN-OVER BREECH MECHANISM.

Another form of breech mechanism tried repeatedly without success is the turn-over action. In this the barrels are secured to the standing breech by a screw-pin entering the barrel lump just below the extreme breech-ends. This screw-pin is



The Turn-over Breech-loader.

the pivot on which the barrels turn for loading. By turning the barrels to the right the breech-ends will be exposed sufficiently to admit of the cartridges being inserted. They are then returned to the firing position, and secured there by a bolt entering



Jeffries' Side-motion Breech-loader.

the rib. The turn-over is the simplest of all the principles of breech-loading described, but it has not been generally employed; it is suitable only for the pin-fire cartridge, and in the event of the case bursting or the action jamming from

other causes there is very little leverage obtainable for forcing the gun open. It requires also back-action locks, to which there are several objections.

THE SIDE-MOTION BREECH MECHANISM.

Of the side-motion breech mechanisms the best known is that invented by Mr. Jeffries, of Norwich, about 1862. The barrels are turned on a vertical pivot by a lever pivoted vertically under the breech-action body, and having a projection fixed eccentrically upon the turning head of the lever, which projection engages with a slot in the barrels and moves them.

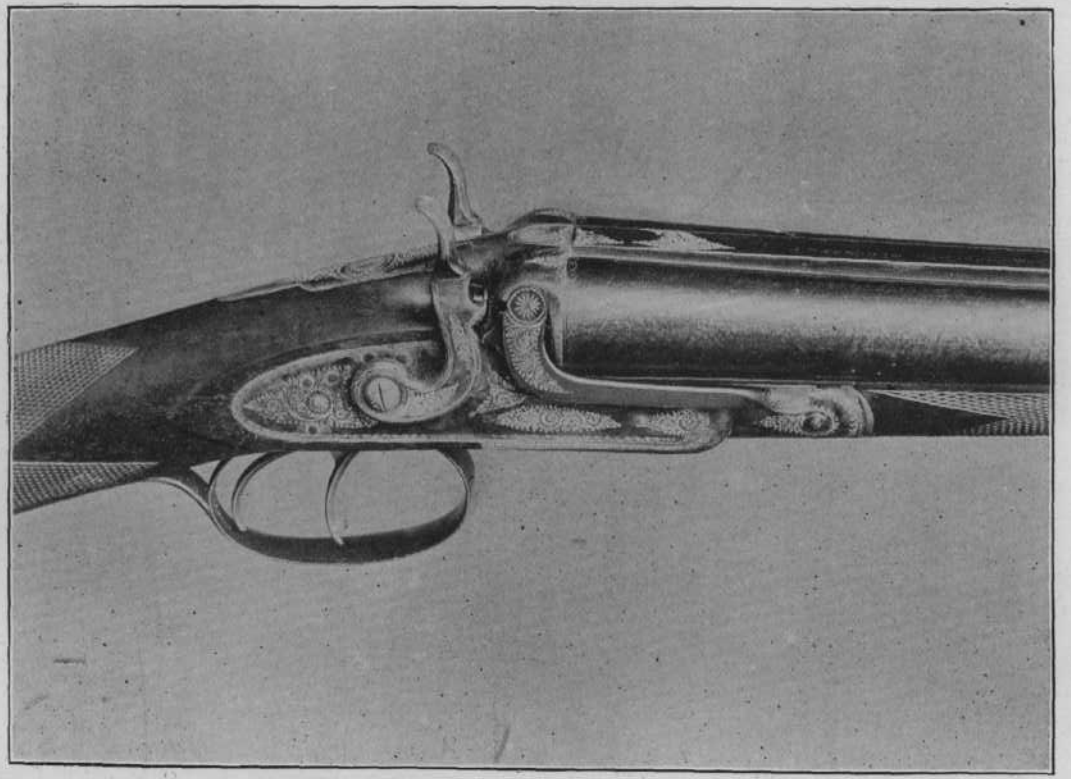
This plan of breech-loading is probably the next best to the "drop-down" or Lefaucheux principle for sporting guns; but its inventor, after making it for many years, finally abandoned it; and the Fox gun, constructed upon the same principle, but dispensing with the lever, was strenuously pushed in the United States without greater success. Gun-makers, and sportsmen seem agreed that the drop-down principle has greater advantages and is the most convenient for all sporting purposes.

THE SELF HALF-COCKING MECHANISM.

With the pin-fire cartridge it is necessary, after firing the gun, to raise the hammers to half-cock before the breech action can be opened. In order to effect

W. W. Greener's Self Half-cocking Gun, and First Top Bolt Breech-action.

this half-cocking of the locks automatically the author produced in 1864 a snap-action breech mechanism which presented several novel features.



Needham's Snap-action Mechanism.

It was one of the first guns on the drop-down principle in which the barrels were bolted to the top of the standing breech. This locking-bolt works in the top of the standing breech, between the hammers and in a line with the barrels, with which it engages by entering a slot immediately below the top rib. The lever placed over the trigger-guard turned the pin which served as its pivot, and upon this pin were two arms which raised the hammers to half-cock before the action bolt was withdrawn, and the barrels left free to open. This breech mechanism, simple and fragile as it may appear, withstood a great amount of hard work, especially upon the large-bore rifles used in India, and is here illustrated for comparison with later mechanisms, which demonstrate the great improvement made in gun construction since this mechanism was introduced.

NEEDHAM'S SIDE-LEVER BREECH MECHANISM.

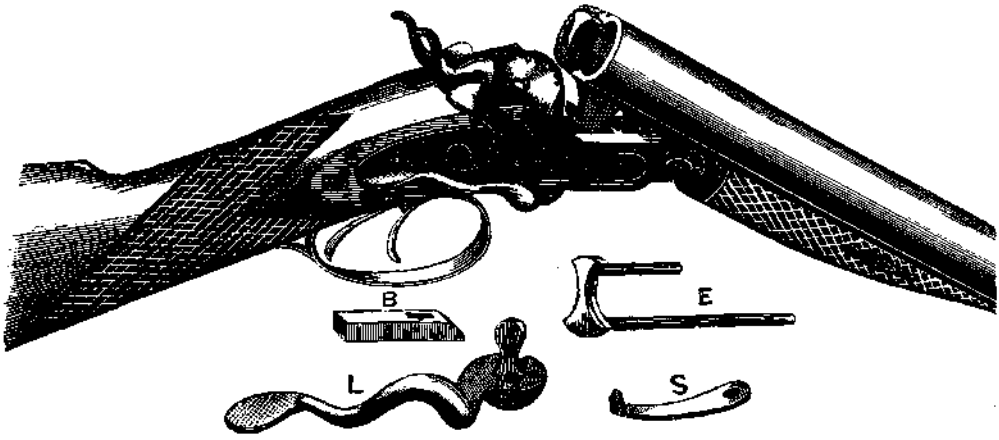
Like the foregoing, the Needham side-lever breech action has for its first object the self half-cocking of the locks by depressing the lever for opening the gun. This gun is noteworthy on other accounts; it was the first modern breech mechanism on the snap-action principle, and it was the first of which an illustrated advertisement appeared in a newspaper. The advertisement appeared in the *Field* in 1862, shortly after the introduction of the gun.

The mechanism proved to be a good one; some of the guns constructed on this system have seen much hard work and are still in use, whilst the snap-action principle is that now generally employed by gun-makers for all sporting guns. The locking-bolt, or holding-down bolt, which secures the barrels upon the breech-action body, is forced into the slots by a spring when the gun is closed, instead of requiring the lever to be moved by hand.

THE SIDE-LEVER BREECH MECHANISM.

One of the earliest snap breech actions is the side-lever, which for a long time remained the favourite of American sportsmen and some London gun-makers. The lever is bent round from underneath the breech-action body so as to lie on the lock-plate; its thumb-piece conveniently placed immediately behind the hammer. The lever, L, is pivoted beneath the barrels; an arm continued upwards engages in a slot in a steel holding-down bolt, B, working to and fro in a slot in the breech-action body, being forced forward by a spring, S, and moved backward by depressing the lever. The spring is sometimes fixed in the breech-action body, forward of the

lever, and is uncovered; it should be placed on the trigger-plate and connected to the lever by an **S**-swivel. Such guns work more pleasantly especially if the holding-down bolt is kept constantly pressing against the back of the fore-lug of the barrel lump, and allows the gun to be closed without appreciable snap or jerk. The principal objection to the side-lever is, that in some circumstances the position of the lever renders it difficult to raise the left-hand hammer to full-cock—an objection which was well met by placing the lever on the left side of the gun.



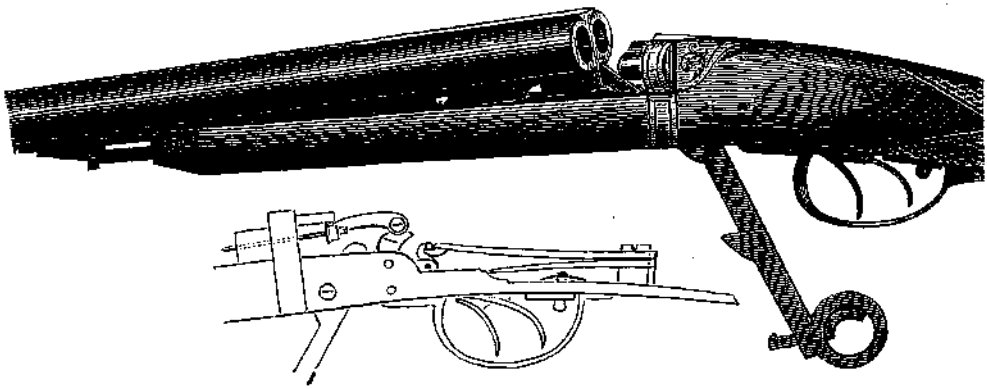
Side-lever Breech-loader with Bar, or Front-action, Locks

THE CENTRAL-FIRE SYSTEM.

The early central-fire guns were used with consumable cartridge cases, and the difficulty to be overcome was the escape of gas at the breech joint at the time of firing. In 1838 Dreyse, of Sommerda, produced a central-fire gun of this type. A modification of it was adopted by the Prussian army in 1842, and became famous as the "needle gun," the breech mechanism being a combination of the sliding and drop-down principles.

To open the Dreyse gun the lever is depressed; by this motion the barrels are forced forward, clear of the discs, and allowed to rise beyond the level of the standing breech. The lever has an arm extended upwards beyond the point which engages with the tumblers, and cocks the locks by forcing the hammers back, as

shown. The gun was without outside hammers, and the chief drawback to its use was the fouling of the lock mechanism, but more particularly the needles, which had

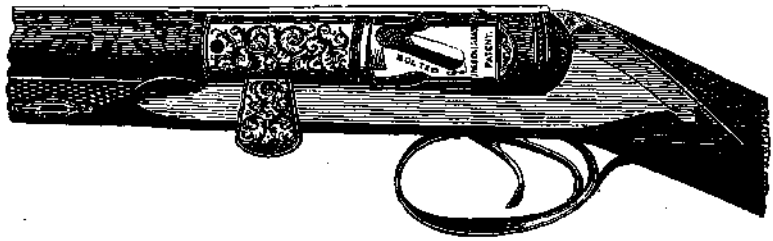


Dreyse's Gun.

to pierce the soft cartridge case and force through the powder charge to strike the cap, which was fixed to the wad separating the powder from the load of shot.

NEEDHAM'S NEEDLE GUNS.

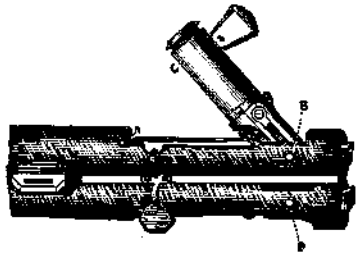
A somewhat similar cartridge, but having the cap at the base, was used in the central-fire gun introduced by Needham about 1850. The gun is of a very different



Needham's Central-fire Needle Gun.

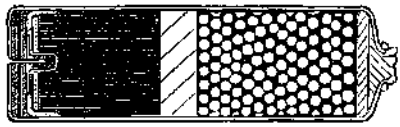
type, having barrels fixed to the stock like those of a muzzle-loader and in double-guns, a separate action for each barrel. The only well-known gun at all resembling

it in principle is the almost forgotten Bacon breech-loader or some hybrid weapon like the double-barrelled Remington. This gun is loaded by turning the finger-picce toward the top of the barrel, and pulling outward the "action" or breech-block pivoted vertically upon the pin, B; the cartridge is inserted in the recess left vacant by the "action" and pushed into the barrel, the breech-block is then returned to its place, locked there by depressing the finger-piece, and is ready for firing, the lock contained



Mechanism of Needham's Needle Gun.

in the "action" having been automatically cocked by the turning up of the finger-piece. The cartridge consists of two cardboard wads for the base (as shown), the cylinder of ordinary cartridge paper, and the cap is placed on the inner side of the two wads, its cup towards the base. The striking-needle passes through the outer envelope of



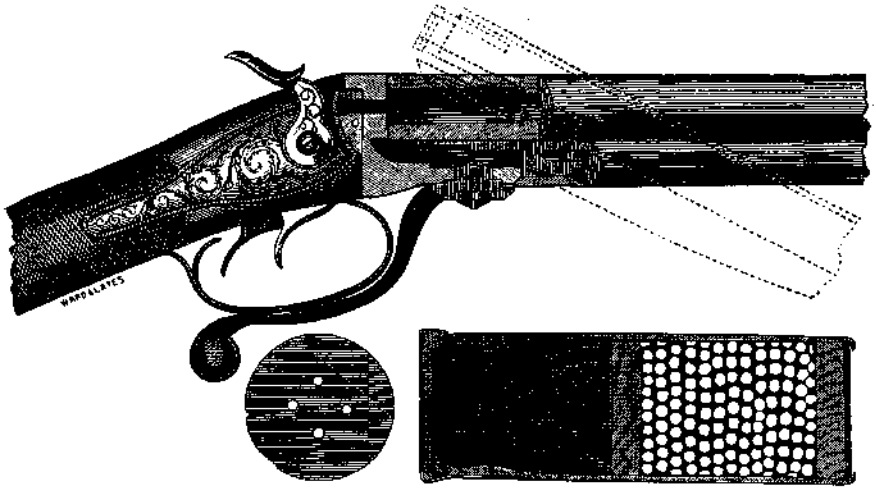
Needham's Central-fire Cartridge.

the cartridge and through holes pierced in the wad forming the base, and strikes into the cap. The base is stiffened by a zinc washer or cap, and the case is not extracted after firing, but the base, pushed forward by the next cartridge inserted, acts as a top-wad. The gun had considerable success, but was soon superseded by higher developments of the central-fire system.

THE LANCASTER CENTRAL-FIRE SYSTEM.

This system was introduced by the late Mr. Lancaster in 1852. It differed from the needle guns in the construction both of breech mechanism and the form

of the cartridge used. The barrels, like those of the Dreyse gun, slide forward before turning on the hinge-pin; the forward motion is conveyed by means of an eccentric on the head of the vertically pivoted under-lever. A projection of the under-lump engaging below the standing breech takes the place of the disc for holding down the barrels. The cartridge case is not consumed, but is withdrawn



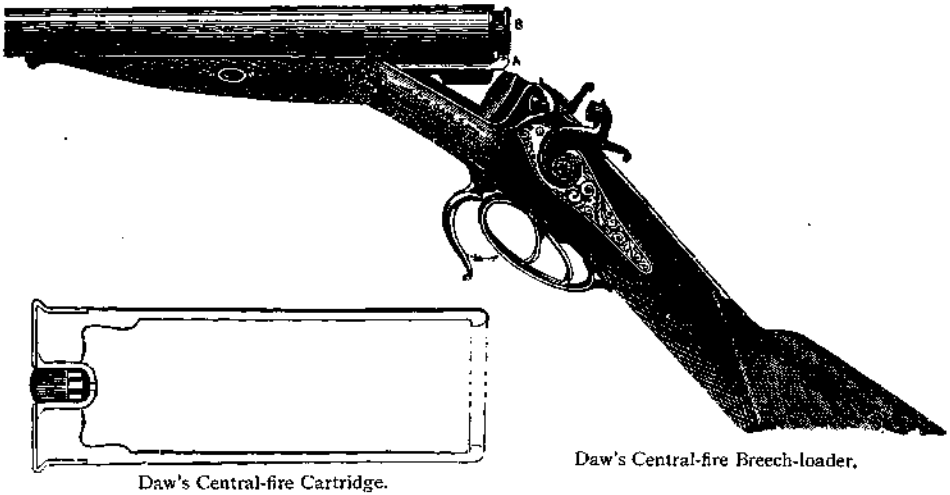
The Lancaster Central-fire Breech-loader and Cartridge.

by an extractor after firing. It differs from later central-fire cases in the mode of effecting the ignition of the charge. At the base of the cartridge case is a copper disc perforated with four holes; on the disc the detonating mixture is spread. The whole of the base is then covered with a copper capsule, which is then in the centre, and there receives the blow from a striking-pin having a flattened head. It is stouter at the edge, where it is somewhat wider than the diameter of the cartridge, and forms a slight rim by which it is withdrawn. It will be noticed that the gun differs but slightly from the ordinary central-fire gun in general use since 1860—so much so, in fact, that in some languages the term "system Lancaster" is a synonym for central-fire breech-loader.

THE DAW CENTRAL-FIRE SYSTEM.

The central-fire cartridge, practically as now in use, was introduced into this country in 1861 by Mr. Daw. It is said to have been the invention of M. Pottet,

of Paris, and was improved upon by a M. Schneider, and gave rise to considerable litigation with reference to patent rights. Mr. Daw, who controlled the English patents, was defeated by Messrs Eley Bros., owing, it is understood, to the fact that the patent had not been kept in force in France, where the invention was originally protected. Mr. Daw was the only exhibitor of central-fire guns and cartridges at



Daw's Central-fire Cartridge.

Daw's Central-fire Breech-loader.

the International Exhibition in 1862; the system with which his name is intimately connected is shown here. The bottom lever withdraws the holding-down bolt; the cartridge is of the modern type, the cap detonated by a striker passing from the outside of the standing breech to the inner face; and, after firing, the cartridge case is withdrawn in the ordinary way by a sliding extractor fitted to the breech ends of the barrels.

SOME ADVANTAGES OF THE CENTRAL-FIRE PRINCIPLE.

The pin-fire cartridge, however well made, is found to occasionally permit an escape of gas at the pin-hole. Especially is this the case when the breech ends of the barrels become worn, or the chamber is so large as not to properly support the case, thus allowing too great expansion. The cartridges are not so handy to carry, on account of the projecting pin, as the central-fire. The central-fire gun has no

pin-hole in the barrels to admit wet, nor is it needful to note that the cartridges are put in the right side uppermost. The central-fire gun is much more rapidly loaded; the extraction is automatically performed, and its advantages are so apparent that it is surprising the system encountered any serious opposition when first introduced. The chief objection raised by sportsmen was that the gun did not show at a glance whether or not it was loaded. Gun-makers, therefore, fitted indicators, or small pins, which protruded through the action when a cartridge case, fired or unfired, was in the chamber; experience proved them to be unnecessary. Eighteen or more years later the same objection was advanced against hammerless guns. They, too, have been fitted with indicators to show when the gun is cocked, whilst one maker provides a small window in each lock-plate, so that the shooter may, when he desires, inspect the mechanism and ascertain which barrel has been fired. With the facility for opening and closing the gun modern snap-actions afford, the best and simplest way is to open the gun and look at the cartridge. Everyone should observe the rule of treating a gun as loaded—accidents would then be rare. There cannot now be the slightest excuse for leaving a breech-loader with a cartridge in it, and doing so should be considered a grave offence. One of the great advantages possessed by the breech-loader is that it can be so readily loaded and unloaded; so that if only a little trouble be taken accidents with loaded guns would be rare indeed.

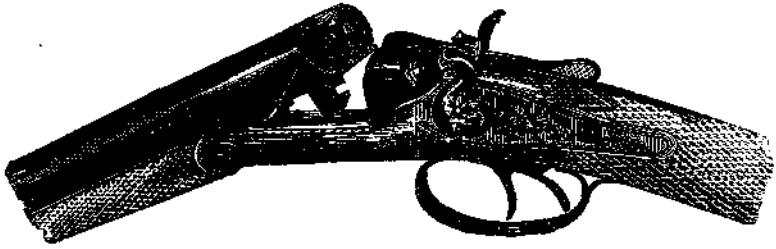
TOP-LEVER ACTIONS AND OTHERS.

There are two distinct types of top-lever mechanisms; in one the lever swings upon a horizontal pivot on the standing breech, and is either raised or is depressed to withdraw the holding-down bolt and open the gun. This type is not generally used. In the other the lever turns upon a vertical pivot, and actuates various mechanisms, used to bolt the breech-action body and the barrels together.

The first top-lever mechanism is said to be that of a Birmingham gunsmith named Matthews. His production was a crude one, but the principle was improved upon and adopted; a better form of it was introduced by Westley Richards about 1860, and was applied to pin-fire guns. The chief advantages of the breech-action lever being placed upon the top of the gun are: first, it is possible to carry the gun in any position without catching or displacing the lever; second, the shooter can at once detect whether or not the action is securely fastened, the position of the lever being noticeable as the gun is raised to the shoulder for firing; third, it is easier to manipulate than any other, and, length for length, allows of greater leverage than if placed elsewhere; the power the manipulator

has to control the lever fixed in this position is very great, it being possible with even a short top-lever to raise both locks to full-cock as well as withdraw the holding-down bolts and overcome the weight of the spring which drives them home. Another advantage is that the hand, after firing the gun, can work the lever without losing its grip of the stock.

A variety of bolts have been used with the top-lever, the most common being the double holding-down bolt shown in the illustrations of the "Top-lever Gun with Back-action Locks." Single, treble, and even quadruple grip-bolts have been made. The double bolt is preferable, as the single bolt, being short, is liable to spring—a contingency provided against in the double bolt by giving it a longer bearing surface; this also causes the gun to close more evenly. The treble-bite bolt cuts away so much metal from the under lump and the action



Top-lever Gun with Back-action Locks.

under the barrels as to weaken them, and is of less service than a well-fitted double bolt.

In addition to the levers already described, the holding-down bolts have been actuated by other devices, or by modifications of one or other of the levers noticed. A favourite at one time was the "Purdey," a short lever in front of the trigger-guard, the bow of which was pierced to allow the thumb to reach the lever and force it forward. Other levers in this position, instead of being pushed forward, or from the gun, to open the mechanism, were pressed towards it—a plan favoured by "Stonehenge," and still in use on a modern French gun, and but recently discarded by a well-known firm of manufacturers in America. In some cases the lever, instead of being moved by thumb or finger, is worked by the hand, as in the "comb-lever," which extends from the breech to the comb of the gun-stock, and is depressed to withdraw the holding-down bolts.

LOCKS AND MINOR MECHANISMS.

In the lock of the muzzle-loader it was important that the hammer should continue to press upon the cap until after the gun had been fired. To a lesser extent this was advisable with the pin-fire gun, but, as shown, gun-makers tried to devise efficient mechanism to automatically raise the hammers to half-cock as the lever drew back the holding-down bolts. With the central-fire gun it was of still greater importance that the hammers should be at half-cock before opening the gun, and also that the strikers should not project beyond the face of the standing breech; if they do so, by snapping the gun up sharply, it is possible to discharge the cartridge prematurely.

Comb-lever Treble-grip Gun.

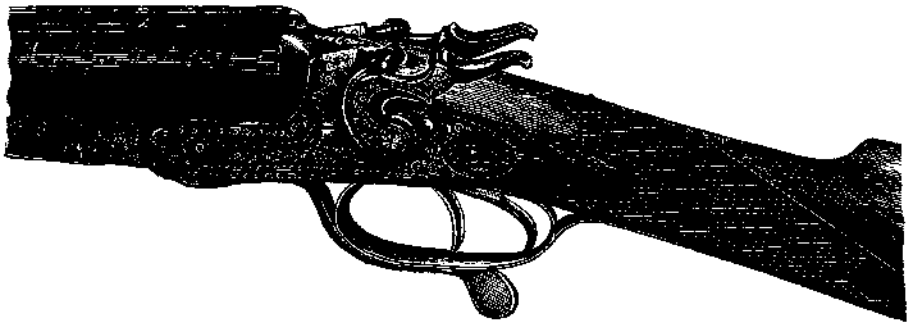
Prior, therefore, to the central-fire system, the main difference existing in ordinary gun-locks was the arrangement of the work upon the lock-plates. If the mainspring is placed behind the tumbler, the lock is a back-work lock; if it is placed before the tumbler, it is "front-action" or "bar." With the muzzle-loader one was as good as another, the preference being given to the bar-lock on the score of appearance.

With the breech-loader the case is not the same; for the bar-lock more metal has to be cut away from the breech-action body, where it is badly needed. With back-action locks this metal is left, but the stock is weakened at the point where it is most liable to fracture. The sportsmen of Cape Colony, most particularly, object to the back-action lock, for, subjecting their guns to much rough usage, the stocks are often broken unless very strong in the grip and furnished with front-action locks.

About 1866, the rebounding lock was introduced, and was further improved in 1869. In this lock the mainspring, by a species of overdraft, reacts upon the

tumbler, and automatically raises it to half-cock, as will be found fully detailed in that part of this book treating of Gun-making.

Other inventions of minor importance have in their time served a useful purpose and led to valuable improvements in the sporting gun. For instance, the springless striker, which obviated much jamming in guns with nipples; the patent "striker" invented by the author, which was carried from the base of the cartridge by a stud on the hammer engaging with a projection on the head of the striker; the through lump, which, with "circle jointing," removed much of the strain from the hinge-pin



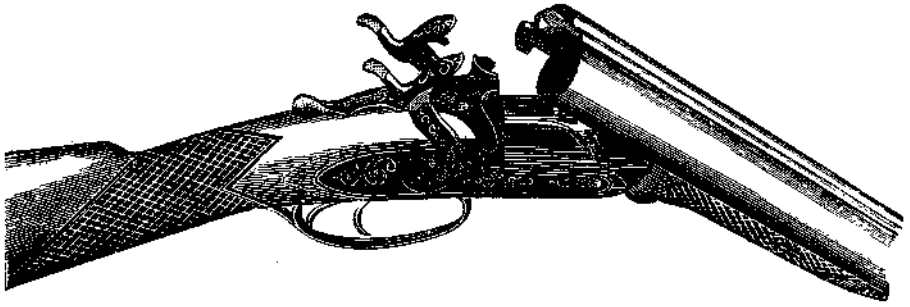
Greener's Patent Self-acting Striker Gun.

at the moment of firing, and has lengthened the life of the gun. The spring fore-end fastener has saved sportsmen time and trouble; the one-legged extractor (first used by the author) obviated the weakening of the barrel at a point where faulty workmanship is fraught with peril, and permits of the barrels being left sound and whole. Details respecting some other minor inventions will be given later; attention is drawn to these now in order to make clear to the reader that the modern gun has been gradually perfected: one piece of mechanism here, a useless limb discarded there, metal added in one place, wood diminished in another, but on the whole tending towards simpler mechanism, although designed for harder work, and to perform mechanically what originally the shooter had to do less effectually by his own effort.

THE WESTLEY RICHARDS' BREECH-LOADER.

This gun is one of the first, if not the first, of the top breech-bolt mechanisms, and was patented in 1862. In addition to the lump underneath the barrels, upon

which they turn, there is a lump projecting from the breech ends at the top of the barrels. This lump is of dovetail shape and has a hook; the projection fits into a correspondingly shaped slot in the top of the standing breech, and is secured there by a holding-down bolt sliding to and fro in the line of the barrels. This bolt is



Westley Richards' Patent Breech-loader.

pushed forward by a spring behind it, and is withdrawn by pressing the lever lying between the hammers to the right. The object of this particular arrangement is to prevent the standing breech from springing back at the moment of firing, and was undoubtedly a step in the right direction. In 1865 the author invented a top cross-bolt, which passed through an extension of the top rib, thus wedging the barrels to the standing breech. Both of these mechanisms were suitable for pin- and central-fire guns; indeed, many of the Westley Richards' guns, by an ingenious arrangement of the strikers and hammers, were made to answer equally well for firing pin- and central-fire cartridges.

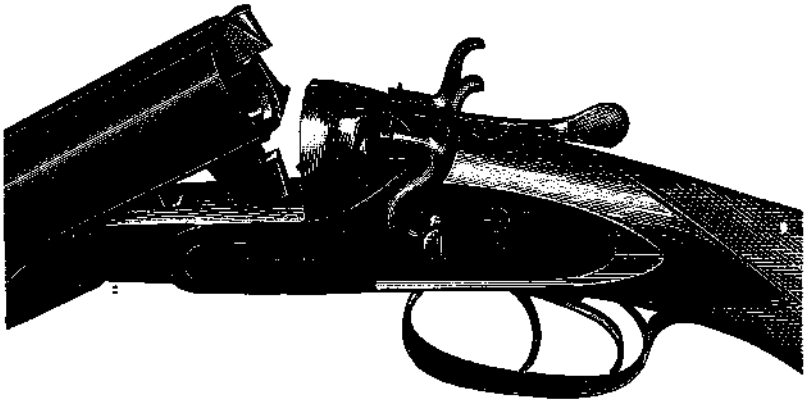
THE DOLL'S-HEAD GUN.

In this breech mechanism the barrels have an extension of the top rib—or a separate steel lump equal thereto—which extension is let into a correspondingly shaped hole in the top of the standing breech.

The belief is that this head keeps the standing breech from springing back at the moment of discharge, and consequently increases the solidity of the weapon. It has been demonstrated that unless the "doll's-head" is bolted fast to the standing breech by a strong grip, either on the top-lever or an efficient separate bolt, it gives little or no appreciable increase of strength.

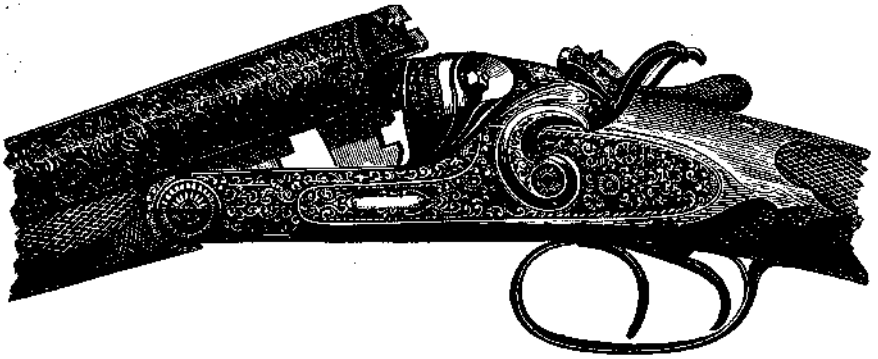
TREBLE-GRIP GUNS.

When, in addition to the usual double holding-down bolt, a gun is furnished with a bolt, engaging with the extension of the top rib, it is called a treble-grip gun. The ordinary doll's-head gun is sometimes so styled, but wrongly so. The crude



The Doll's-head Gun, with Bar Locks.

idea of the ordinary treble-grip gun would seem to have originated from a combination of the well-known Westley Richards' top-grip breech action with the



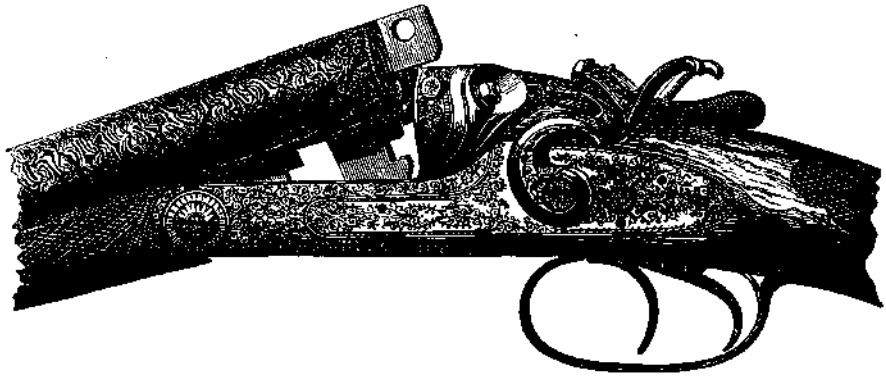
The Treble-grip Gun.

double holding-down bolt; but, strange to say, this is almost the last form the treble-grip gun has taken. The well-known and very much superior treble

wedge-fast gun—to be described —preceded it, as did many others of considerable worth. The third grip may be a prolongation of the top lever, a small bolt actuated by it, or a fancifully shaped and named head engaging with slots or V-grooves in the projecting rib. The treble-grip gun illustrated is one of the simplest and best of the many forms now common. The third grip is a plain bearing of a prolongation of the top lever upon the projecting rib, and, if well fitted, it not only materially lessens the strain upon the under bolts, but also keeps the projecting rib, which is dovetailed into the standing breech, up to its work

THE TREBLE WEDGE-FAST MECHANISM.

This is decidedly the most popular breech mechanism. It may be said to have originated with W. W. Greener's cross-bolt gun of 1865, but was not perfected until 1873, when the top cross-bolt was united with the double holding-down bolt, and a mechanism evolved which effectually, and by the simplest means, locked barrels



W. W. Greener's Patent Treble Wedge-fast Gun.

and breech-action body together with a treble wedge. It consists of a steel projection from the top rib, which fits into a slot in the standing breech. A round steel bolt, actuated by an arm of the top lever, works transversely in the standing breech, and passes through the steel projection, binding the top of the barrels securely to the breech, so that any gaping or wear at the joint is impossible. Nothing more simple nor so efficient can be imagined. This top bolt is in itself fully equal to the strain of firing heavy charges, but in connection with the double

holding-down bolt it works smoothly, and forms the strongest mechanical contrivance applicable to guns on the drop-down principle.

The mechanism is equally applicable to front- and back-action locks, and is made on both plans, and is also applied to various hammerless guns. This gun is more expensive to produce than treble-grip guns, and, if well made, it is certainly without any equal for strength or beauty. So far from adding to the weight of the gun, it diminishes it, for guns made on this principle, being stronger, may be built lighter.

In 1874, an editorial notice of this gun appeared in the *Field*, from which the following is extracted :—

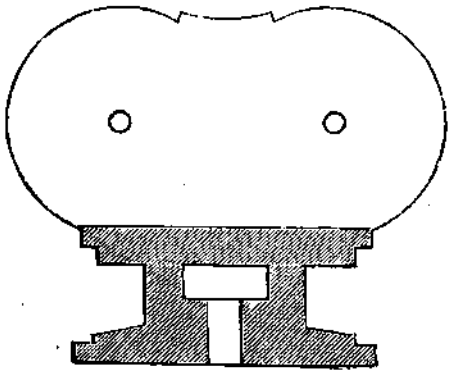
"We have previously noticed the guns of Mr. W. W. Greener, of St. Mary's Works, Birmingham, the strength of which, at the time of our former notice, mainly rested in the cross-bolt, which is driven into the projecting rib, as shown in the annexed diagrams. The present guns vary only in the levers by which this cross-bolt and the additional double-grip are moved, and in the locks employed. Having always contended for the advantages accruing from this top connection between the barrels and the false breech (which Mr. W. W. Greener's action possesses in common with that of Mr. Westley Richards), we need not refer to it further than to remark that the double-grip now employed forms, with the cross-bolt, the strongest development of the Lefaucheux action with which we are acquainted."

Many gun-makers, jealous of the great success this gun achieved, brought out numerous imitations of the system, but to avoid the patent were obliged to omit particular points on which the main strength and efficiency of the invention depended. Most of these would-be treble wedge-fast guns have well-sounding names—"giant grip-fast," "treble lock-fast," "climax grip," etc., all mechanisms inferior to the original of which they are a weak copy. Since it is now open to every gun-maker to build a treble wedge-fast cross-bolt gun as he likes, the chief fault made is the weakness of the parts constituting the mechanism; in some the extension of the top rib is but a sham, and the top fastening but an apology for a bolt.

In order to demonstrate the advantage of a secure top fastening it is necessary to point out the weakest part of the breech action. The accompanying illustration shows in section an ordinary 12-gauge breech-action body (actual size), the bar-locks and furniture being removed. It is cut through at that point where the greatest strain is exerted, the junction of the standing breech with the end of the breech-action body. The metal shaded is all that there is to withstand the great strain of continued firing with heavy charges.

To remedy this fault gun-makers sometimes leave more metal in the breech-action

body between the barrels and the locks, which requires also more metal to be left where it can be of no use, and not only spoils the appearance of the gun, but adds considerably to its dead weight. By using back-action locks a stronger breech-action body results, but to these locks many objections are raised. The best, easiest, and simplest way is to affix an efficient bolt uniting the top of the standing breech and the upper portion of the barrels. None is so strong and thorough as the Greener cross-bolt, which has been proved by actual experiment to add enormously to the safety and wear of a gun. Occasionally the barrels part from the stock when there is no top connection between barrels and standing breech: the author has known it occur with a back-action double-bolt gun, the breech-action breaking through completely.



Section of Bar-lock Breech-action.

The experiments detailed below were made by the editor of the *Field* immediately at the close of the Explosives Trial of 1878, from the report of which the extract is taken.

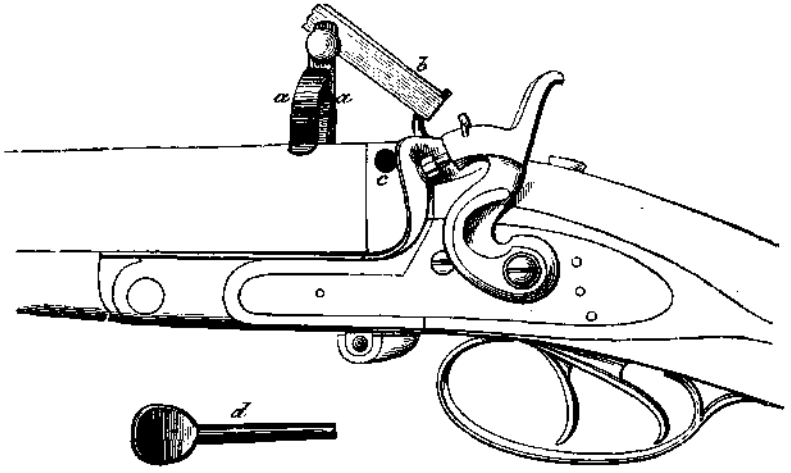
"THE BREAKING STRAIN OF POWDERS ON GUN ACTIONS, ETC.

"Among our various remarks referring to the then proposed trial of explosives, etc., we stated that we intended to show the superior strength of the top connection between the barrels and break-off of hinged breech-loading guns over the bolt at the base. Mr. Greener's action happening to combine these two bolts in such a way as to allow of their separate use, we had a 10-bore so constructed by him that the top cross-bolt (*d*) could be readily removed from its hole (*c*) or applied at will. This allowed of one barrel being first fired with the bolt in position, and then, after removing the bolt, firing the other. To this action we had a little apparatus fixed, as shown in the accompanying engraving.

"By this arrangement a piece of silver paper can be strained between the hook (*b*) on the break-off and the screw-clip (*a a*) attached to the barrels, so that when any separation takes place during an explosion, the paper breaks. To prevent the possibility of any doubt as to this being caused by the jar of the explosion, both barrels are loaded equally, after which one is fired with the bolt in, and then, supposing no breakage occurs, the bolt is removed and the other barrel discharged.

"Experimenting in this way, we found that in Mr. Greener's action no breakage occurred, either with the bolt in or out, using any charge of powder which the cartridge case could be

made to hold, until we charged it with sixty grains of the 'Blissett'* sample of Schultze powder, considerably compressed, a thin felt wad, and two ounces of shot, when the discharge of the first barrel (with the bolt in) produced no effect on the paper, but on removing the bolt the second discharge broke it up completely. Repeating this experiment, the same result again occurred, which we considered conclusive as to this powder. After this we confined our experiments to the Schultze of 1877-8, that of 1878-9 used at the recent trial, and Nos. 3 and 6



Experimental Breech-action.

of Curtiss and Harvey's black powder, as follows: the shot in each case being 2 oz. No. 6 introduced from the muzzle after charging the cartridge case with powder and an ordinary felt wad. In each case the bolt was in position with the firing of the first barrel, and was removed afterwards; but with the bolt in position the paper remained intact up to the last.

	Powder.	Result.
1.	5 drachms Curtiss and Harvey No. 6	No breakage.
2.	,, ,, ,, No. 3	Ditto.
3.	55 grains Schultze 1877-8	Ditto.
4.	,, ,, 1878-9	Ditto.
5.	6 drachms Curtiss and Harvey No. 3	No breakage.
7.	65 grains Schultze 1877-8	Ditto.
8.	,, ,, 1878-9	Slight breakage.

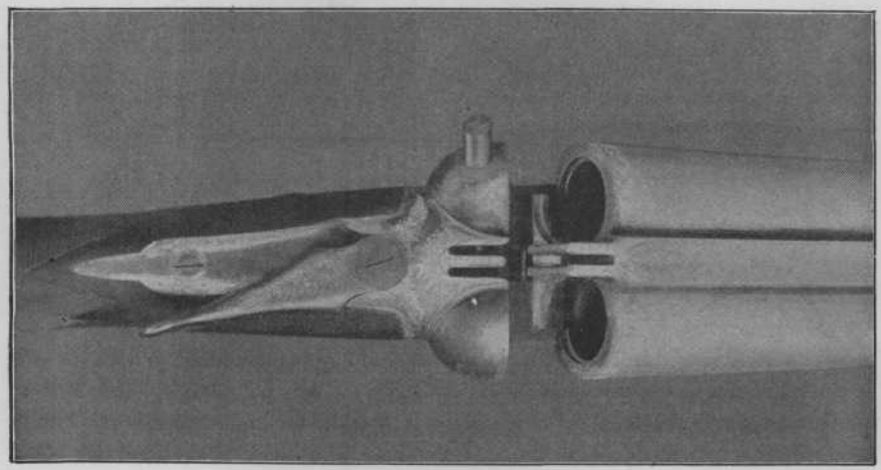
* This was a special issue of powder made to the order of Mr. Blissett for use in pigeon guns. It was used in guns having ordinary breech-actions and light barrels, and the results were so disastrous that this make of powder has not been again issued above the normal strength.

	Powder.	Result.
9.	7 drachms Curtiss and Harvey No. 3	Slight breakage.
10.	75 grains Schultze 1877-8	Complete breakage.
	,, ,, 1878-9	Ditto.

"In the last case there was not only complete breakage of paper, but such a permanent opening of the breech of the gun as to stop the experiment."

Had the cross-bolt been kept in during the whole trial, it is evident no breakage of the paper could have occurred. This shows conclusively the great strength and advantage of the top connection.

Mr. J. H. Walsh, in his work on the "Modern Sportsman's Gun and Rifle," Vol. I., writes in flattering terms of this action, whose advantages he was one of the



Greener's Improved Wedge-fast Grip.

first to demonstrate, and even contemporary gun-makers now acknowledge its merits, for the patent has expired, and in many districts it is very difficult to sell a gun not possessing the Greener cross-bolt. Such guns are therefore made, both in Birmingham and on the Continent, by manufacturers who cater for the wholesale market. Unfortunately, many of these guns are far from fulfilling requirements, as the cross-bolt demands accurate workmanship and very carefully fitting if it is to bear its proper share of the work in holding action and barrels together. The treble

wedge-fast cross-bolt gun is far superior in strength and lasting power to the double-grip action. A double 4-bore and a double 8-bore were made on this, the top cross-bolt, principle in 1874, for the late Mr. G. P. Sanderson, superintendent of the Government Elephant Keddahs, Decca. They were in continual use by him until his death, firing 2-oz. bullets with 12 drams and 4-oz. bullets with 16 drams of powder, "hundreds of times," and, to quote Mr. Sanderson, "the breech-actions are as sound and close as when they left the factory nearly ten years ago." These rifles are still doing excellent service.

For large-bore guns and rifles it has been found desirable to provide still greater gripping power at the top; for this purpose the cross-bolt mechanism has been modified by doubling the extension; the one cross-bolt passing through both prolongations of the top lump. An increased bearing surface has also been obtained by enlarging the extension at its furthest extremity, the cross-bolt engaging with it just in front of the dovetail or doll's-head. This form of the mechanism is by no means clumsy upon guns of large bore, but the ordinary form is all sufficient for those of usual calibre, and using full sporting charges of ordinary explosives. The special form renders even the largest shoulder gun absolutely unbreakable with the heaviest charges which can be fired, and ensures free working of the mechanism even when nitro-explosives giving greatly increased pressures are employed.

Instead of a round cross-bolt, a square bolt is used by some makers, but the form has no advantage, and its use is detrimental, as the extension of the top rib is weakened more by a square hole than by a round one of the same area. Breech actions in which the extensions have been too light for the work required of them have shown weakness first between the hole and the junction of the extension with the breech ends of the barrels, but the tendency to break there is lessened by having the hole round. With a sharp angle, as needed for a square bolt, the extension needs to be much thicker and broader to give equal strength, and this makes the action clumsy, as it also widens the slot-way which the cross-bolt has to bridge; the bolt, too, must be made larger to give equal strength, since the bearings supporting it are farther asunder. Added to these disadvantages is the extra trouble of fitting a square bolt accurately.