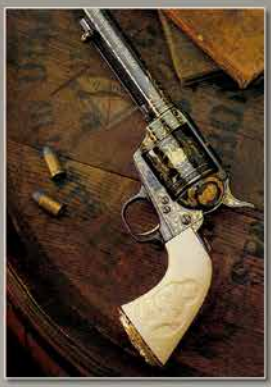
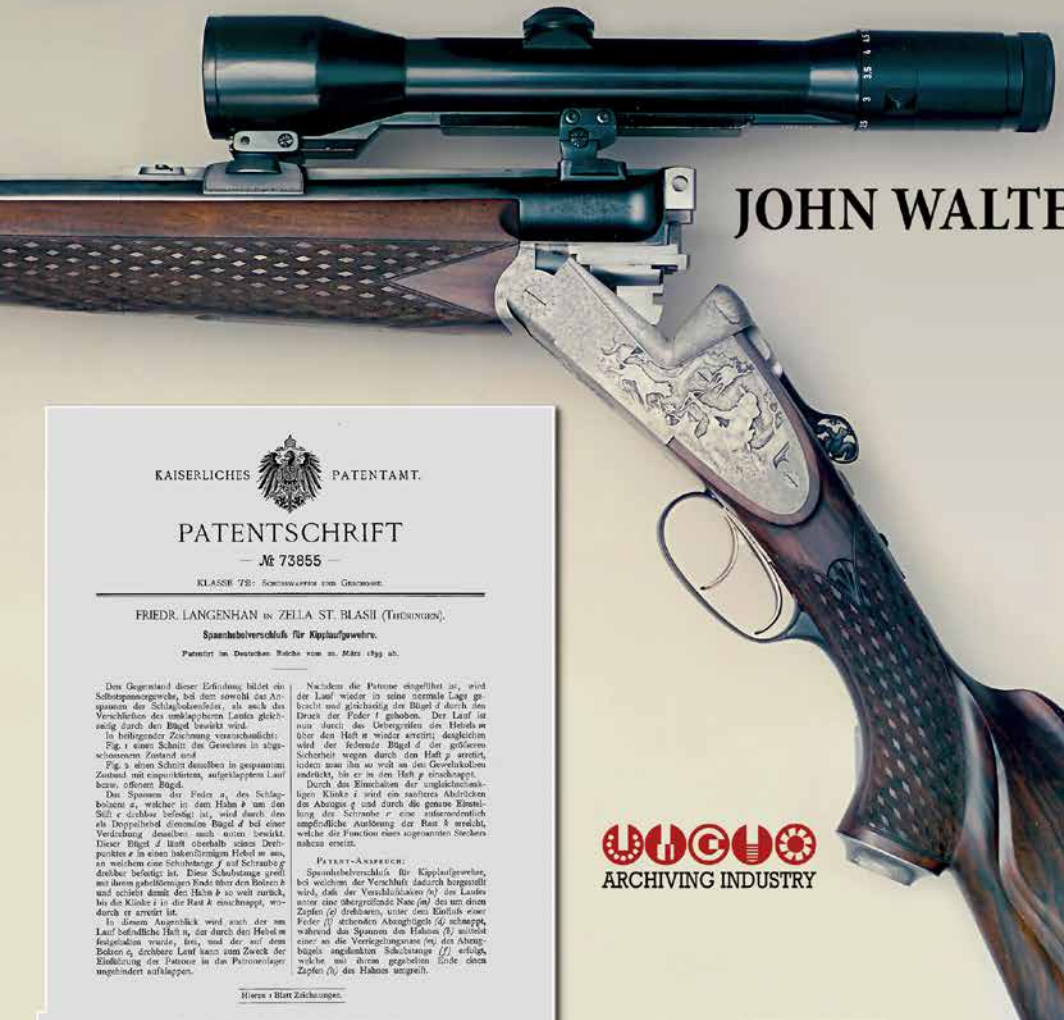



A CONCISE DICTIONARY OF

GUNS & GUNMAKERS

INVENTORS, PATENTEES, BRAND NAMES AND TRADEMARKS



JOHN WALTER

KAISERLICHES PATENTAMT.

PATENTSCHRIFT

— № 73855 —

KLASSE 72: Schusswaffen und Geschosse.

FRIEDR. LANGENHAN in ZELLA ST. BLASII (Thüringen).

Spannhebelverschluss für Kipplaufgewehre.

Patentirt im Deutschen Reiche vom 21. März 1893 ab.

Den Gegenstand dieser Erfindung bildet ein Selbstspannergewehr, bei dem sowohl das Anspannen der Schlagbolzenfeder, als auch das Verschließen des umklappbaren Laufes gleichzeitig durch den Bügel bewirkt wird.

In beifolgender Zeichnung veranschaulicht:

Fig. 1 einen Schnitt des Gewehres in abgeschossenem Zustand und

Fig. 2 einen Schnitt desselben in gespanntem Zustand mit eingerichtetem, aufgeklapptem Lauf bezw. offenem Bügel.

Das Spannen der Feder a_1 des Schlagbolzens a, welcher in dem Hahn b um den Stift c drehbar befestigt ist, wird durch den als Doppelhebel dienenden Bügel d bei einer Verdrehung desselben nach unten bewirkt. Dieser Bügel d trifft oberhalb seines Drehpunktes e in einen hakenförmigen Hebel m aus, an welchem eine Schubstange f auf Schraube g drehbar befestigt ist. Diese Schubstange greift mit ihrem gabelförmigen Ende über den Bolzen h und schiebt damit den Hahn b so weit zurück, bis die Klinke i in die Rast k einschnappt, wodurch er arretirt ist.

In diesem Augenblick wird auch der am Lauf befindliche Haft n, der durch den Hebel m festgehalten wurde, frei, und der auf dem Bolzen o_1 drehbare Lauf kann zum Zweck der Einführung der Patrone in das Patronenlager ungehindert aufklappen.

Nachdem die Patrone eingeführt ist, wird der Lauf wieder in seine normale Lage gebracht und gleichzeitig der Bügel d durch den Druck der Feder f gehoben. Der Lauf ist nun durch das Uebergreifen des Hebels m über den Haft n wieder arretirt; desgleichen wird der federnde Bügel d der größeren Sicherheit wegen durch den Haft p arretirt, indem man ihn so weit an den Gewehrkolben andrückt, bis er in den Haft p einschnappt.

Durch das Einschalten der ungleichschenkligen Klinke i wird ein sanftes Abdrücken des Abzuges q und durch die genaue Einstellung der Schraube r eine außerordentlich empfindliche Auslösung der Rast k erreicht, welche der Function eines sogenannten Stechers nahezu gleicht.

Patent-Anspruch:

Spannhebelverschluß für Kipplaufgewehre, bei welchem der Verschluß dadurch hergestellt wird, daß der Verschlußkasten (n) des Laufes unter einer übergreifende Nase (m) des um einen Zapfen (e) drehbaren, unter dem Einfluß einer Feder (f) stehenden Abzugbügels (d) schnappt, während das Spannen des Hahnes (b) mittelst einer an die Verriegelungsnase (m) des Abzugbügels angelenkten Schubstange (f) erfolgt, welche mit ihrem gegabelten Ende einen Zapfen (h) des Hahnes umgreift.

Hierzu 1 Blatt Zeichnungen.

ARCHIVING INDUSTRY


BULLET IMPACT

A CONCISE DICTIONARY OF GUNS AND GUNMAKERS

inventors, patentees, brand names and trademarks

JOHN WALTER

ARCHIVING INDUSTRY

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PRODUCED IN GREAT BRITAIN

CONTENTS

INTRODUCTION

Guns, gunmakers, trademarks, brand names, designers, patentees

This project had its roots partly in my habitual list-making, but also in the information accumulated from links which had been forged with enthusiasts throughout the world. The first result was 'Airguns A–Z', the directory-style listing that was serialised in the 'Airgun Scene' column of the British periodical *Guns Review* from 1984 into the early 1990s...without ever reaching 'Z'. The basic manuscript was then greatly expanded to include firearms and associated topics, reappearing in 2001 as *The Greenhill Dictionary of Guns and Gunmakers*, published simultaneously by Greenhill Books of London and Stackpole Books of Mechanicsburg. Several thousand books were sold, but a declaration of 'out of print' in 2006 brought progress a halt.

The 2001 book had sought to identify in a single volume as many brand names, trademarks and gunmakers' monograms as possible; to date the activities of individual manufacturers from changes of corporate structure or address; to provide brief details of selected individual guns; and, particularly, to direct the reader to sources of detailed information.

The project initially concentrated on the machine-made breechloader at the expense of the single shot cap-lock, which was largely due to my personal interests. However, even if the beginning of the modern era can be defined as the patenting of the first Colt revolver in 1836, cap-locks retained their importance for several decades; indeed, in remote areas of Africa, or even the most distant backwaters of the U.S.A., the scarcity of self-contained metal-case ammunition ensured the survival of the cap-lock rifle into the twentieth century.

The days of American gunmakers steeped in the traditions of eighteenth-century Long Rifle smiths, who could make each and every gun component, were numbered by the advent of the machine-made sporting gun; and, by the end of the nineteenth century, steadily improving distribution networks (railways, in particular) were taking the products of Remington, Sharps, Winchester, Colt, Smith & Wesson, Iver Johnson, Lefever, the Crescent Gun Company and uncounted others to the farthest corners of the U.S.A.

The output of the largest manufacturers, numbered in hundreds of thousands, finally undermined the need for individual craftsmanship. Consequently, the gunmakers working in the U.S.A. prior to 1880 were originally excluded from the dictionary unless I could prove a connection with multi-shot or breechloading firearms. The gunmaking fraternities in Europe, however, and especially in Britain, worked very differently from their North American counterparts prior to the First World War. Mass production was confined largely to military establishments, and to aggressive government supported private conglomerates such as Waffenfabrik Mauser AG or Österreichische Waffenfabriks-Gesellschaft, whose output was more military than sporting.

Art. 671

Art. 671. **Original-Mauser-Repetier-Pürschbüchse**

Ausführung Nr. 120 mit Stecher, 600 mm langem Halbachtkantlauf, Jagdvisier auf 100, 200 und 300 m, Gewicht ca. 3250 gr, Länge 1140 mm, in den gleichen Kalibern lieferbar wie Art. 670.

Art. 672. **Original-Mauser-Repetier-Pürschbüchse**

Ausführung Nr. 140 mit Stecher, 600 mm langem Ganzachtkantlauf, Jagdvisier auf 100, 200 und 300 m, Gewicht ca. 3250 gr, Länge 1140 mm, lieferbar in Kal. 7 mm, 8 mm (Patrone 8×60 mm), 9 mm, 9,3 und 10,75 mm.

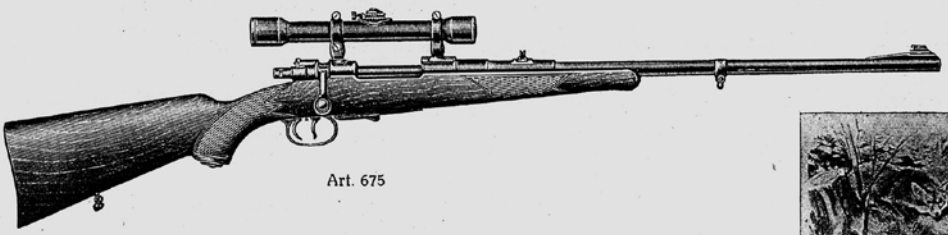
Art. 673. **Original-Mauser-Repetier-Pürschbüchse Modell K**

Ausführung Nr. 162 mit Stecher, 550 mm langem rundem Lauf, Jagdvisier auf 100, 200 und 300 m. Gewicht ca. 2700 gr, Länge 1075 mm, leichte, elegante Waffe, lieferbar in Kal. 6,5 mm und 8 mm.

Art. 674

Art. 674. **Original-Mauser-Repetier-Pürschstutzen, Modell M mit Ganzschaft**

Ausführung Nr. 270 mit Stecher, 500 mm langem rundem Lauf, Jagdvisier auf 100, 200 und 300 m, Gewicht ca. 3150 gr, Länge 1040 mm. Besonders elegante und handliche Waffe mit flachem Kammerhebel, Metallvorderschaftskappe und Ausbohrung für Putzstock im Kolben. Lieferbar in Kal. 6,5, 7, 8 (Patrone 8×60 mm) und 9 mm



Art. 675

Art. 675. **Original-Mauser-Repetier-Pürschbüchse**

Kaliber 7, 8, 9, 9,3 und 10,75 mm mit Stecher, 600 mm langem rundem Lauf, Jagdvisierung auf 100, 200, 300 m mit aufmontiertem Zielfernrohr (Marke nach Wahl des Bestellers).

Gewicht { mit Fernrohr ca. kg 3,75 / ohne „ ca. kg 3,25 } Länge der Büchse 114 cm.

Zeugnis: „ . . . Seit ca. 8 Jahren führe ich außer einer 9,3 mm Repetier-Pürschbüchse eine Original-MAUSER-Repetier-Pürschbüchse Kal. 7 mm mit Zielfernrohr neben anderen 5 Zielfernrohr-Büchsen. Diese 7 mm (am meisten geführte) Büchse ist von **derart präziser Schußleistung** und hervorragender Fernrohr-Montage, wie ich **noch nie etwas ähnliches in Händen hatte.** Mein Jäger führt sie seit 2 Jahren. Noch immer **erstklassige Schußleistung.** Nichts rührt sich. Sie ist die **Lieblingswaffe** des Genannten. Er hütet sie aber auch wie seinen Augapfel. Ich möchte nur jedem eine solche Büchse empfehlen, damit er dieselbe Freude mit ihr empfindet . . ." H. L., Wien, 9. II. 1930.

A page from a catalogue published by Waffen-Glaser of Zürich in 1933

The British had a particularly durable tradition of craftsmanship which had never been entirely subordinated to the machine. This could also be said of most other European gunmaking centres, until the unprecedented demands made by the First World War put a premium on quantity at the expense of quality.

The claims of nineteenth-century European gunmakers to inclusion have often been difficult to dismiss. Though many men bought components from specialist gun-lock makers or barrel riflers, assembly and finishing were still undertaken personally. Consequently, many provincial British gunmakers were originally included on the grounds that multi-shot handguns or breechloading sporting guns have been (or may still be) found with appropriate marks.

Directory entries were also biased towards Anglo-American affairs, paying less attention to the gunmakers operating in Brescia, Eibar, Ferlach, Liége, Saint-Étienne, Suhl or Weipert. However, an acknowledgment of the most important European makers was still be found.

Inventors and patentees were included wherever possible, though space limitations meant that priority usually had to be given to designs which were exploited commercially at the expense of 'paper projects' (interesting though these may have been).

Some designers achieved stupendous totals of citations, particularly in twentieth-century days when the 'catch all' patents of the 1860s had given way to the separate registry of each major component of a design. Andrew Burgess, among the most versatile of gun designers if by no means the most successful, was granted no fewer than 836 firearms-related patents in his career; John Browning (perhaps the greatest of the great) received about 950, mostly for automatic weapons. Yet, in September 1957, *The Gun Report* related a claim made by the otherwise overlooked Crawford Loomis—who spent most of his working life with Remington—to have held 'more assignable patents than any other gun designer'.

It is, of course, impossible to include every known brand name or trademark, or to summarise the career of every gunsmith and gun dealer. Writing in October 1970 in *Shooting Times & Country Magazine*, the late Gough Thomas claimed to have information about more than four thousand British gunmakers in his files; Gardner's *Small Arms Makers* itself contains nearly 400,000 words devoted to just one small part of the subject of guns and gunmaking; and studies of individual gunmakers may exceed a half-million words.

Some trademarks and brand names still defy interpretation, but a special effort has been made to unravel monograms, which, at their most complex, can seem bafflingly obscure. The principles under which these have been analysed are described in greater detail in the directory entries entitled 'Monograms', 'National markings' and 'Trademarks and brand names'.

When I began working on the guns and gunmakers project in the mid 1990s, I rashly sought an overall 'success rate' of fifty per cent: a reader should have one chance in two of finding what was sought. Once I began enlarging entries to include product-details, even in shorthand form, content grew so rapidly that a book once conceived as eighty thousand words exceeded 500,000 when my publisher, Lionel

Leventhal, finally called 'time'. To put this total in context, I estimate my published output to approach four million words, and my good friend Ian Hogg (1926–2002), author of more than 150 books, reckoned to have written at least nine million.

Consequently, though my dictionary seeks to be genuinely ecletic, some topics are inevitably represented in far greater detail than others. Seeking the brand name found on a Spanish 6.35mm Browning-type pocket pistol or an American 'Suicide Special' revolver will encounter greater success than a quest for descriptions of each of the hundreds of individual patents granted to Andrew Burgess or John Browning. And it will be easier to identify a shotgun-cartridge brand name than a military headstamp, at least until much more work has been done.

No guide to the worldwide gunmaking industry can hope to be truly comprehensive, but all projects reach the point where it is better to offer the benefits of incomplete research than wait decades until every last piece of information has been sifted. The arguments offered in 2001 seem to be as valid today even though, increasingly eager to trace the origins of the guns that had been current in 1836 (by implication, with earlier origins), I began to work back in time. The material offered here, therefore, still far from completion, reflects my progress.

But what of the changes that have been made in the last decade? One of the most obvious has been the rise of computer-based dissemination of knowledge by way of the internet, which, though not always entirely trustworthy, at least allows information to be constantly updated in a way in which a traditional book cannot. Among the most valuable websites are the many collectors' forums and those of the patent offices of Britain, Germany and the U.S.A., all of which offer on-line search facilities. Though British patents can currently be accessed only back to the 1880s and pre-1919 German patents can be found only if the patent number is known in advance, the U.S. site (*http://www.uspto.gov*) allows access to *all* the many millions of patents granted in the U.S.A. since 1836. Unfortunately, the marks on U.S.-made firearms give only the date of grant, and it is still sometimes necessary to search by name through—for example—Google Patents. This explains why I am endeavouring to convert the guns dictionary into electronic form.

This 'book' obviously contains information which has not been upgraded for more than a decade, and I hope that readers will be patient. The initial phase of the project is simply to convert printed pages to the electronic equivalent. Most of this is straightforward, if time-consuming and at times tedious! Parts of 'C' and all of 'H' and 'J' have been lost to disk-corruption, but optical character-recognition systems will allow the information to be recaptured in due course. Only then will a concerted attempt be made to upgrade individual entries ('phase two'), and, lastly, add some illustrations ('phase three').

Lastly, an explanation of content. Even before the original book was published, some expert readers—including Ian Hogg—complained that I had included too many airguns, offering the opinion that only firearms merited the description 'gun'. I still take the view that the term is actually a corruption of the Scandinavian female personal name 'Gunnhildr', in which *gunnr* meant 'war'. This may seem like a strange interpretation (others claim that 'gun' is a corruption of 'Engine'), yet the

C. F. LEFEVER.

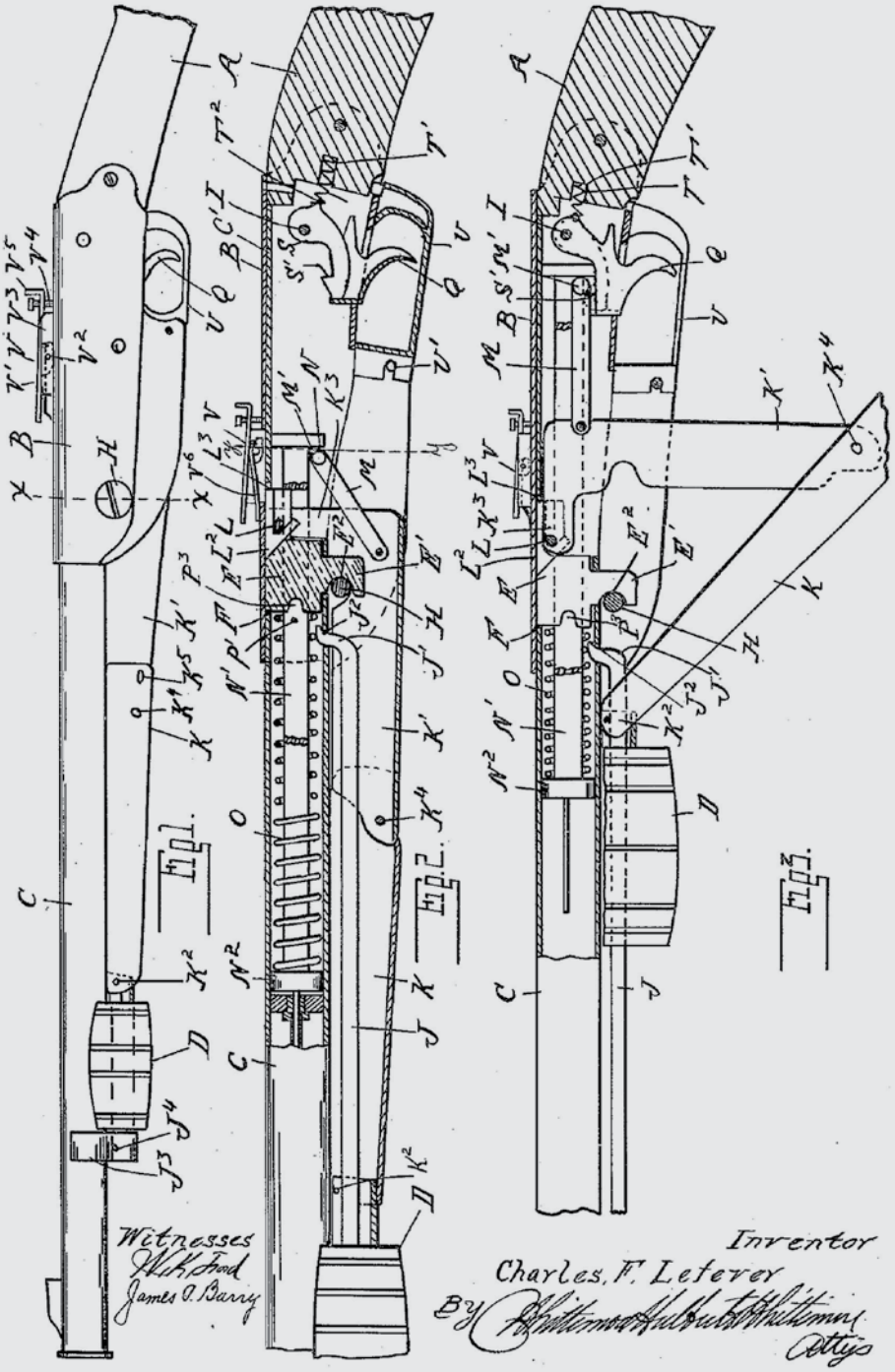
SPRING AIR GUN.

APPLICATION FILED JUNE 21, 1913.

1,136,470.

Patented Apr. 20, 1915.

3 SHEETS—SHEET 1.



Witnesses
H. K. Ford
James A. Barry

Inventor
Charles F. Lefever
By Whittemore, Hubbard & Whittemore
Attys

Oxford English Dictionary notes that what was most probably a large siege engine was given the byname *Gonnhylde Gnoste*, "Gunnhilda['s] Spark", in plainsong dating from the time of the English king Edward II (reigned 1307–27), and also that 'gun' was applied sufficiently loosely in mediæval times to allow the English writer Geoffrey Chaucer (*c*. 1344–1400) to link the term with the missiles thrown by a trebuchet.

Of course, this definition could be taken to extremes: if a 'gun' is accepted to be something capable of discharging any missile, pop-guns and water-pistols could be legitimately included. A line has to be drawn somewhere and so, with an occasional exception (where a cork-firer, for example, is derived from or the inspiration for an airgun), 'guns' of this type are excluded. But it should be remarked that the work of many firearms inventors transcended one particular genre. They included Charles Frederick ('Fred') Lefever, whose many patented designs included shotguns, pop-guns, water pistols, and BB Guns of the type pictured opposite…the incredibly successful pump-action Daisy No. 25.

Another contentious issue has been the inclusion of accessories. Owing to their significance, and sometimes also their indispensability, I have included sections on ammunition, bayonets, sights, sub-calibre inserts (*Einsteckläufe*) if they seem to be sufficiently important.

The 2001 book was originally to have opened with a history of 'the gun', but this was dropped by my publisher when the project threatened to spiral out of control. Some of the material has been retrieved from an old floppy disk, and the removal of page-length constraints now allows it to be reinstated. The chapter is incomplete in its present form, of course, as work had originally stopped at the First World War and text thereafter is still very sketchy. However, this shortcoming was not deemed to be significant enough to prevent publication. We have even been able to add some illustrations!

Comments about the dictionary project can always be sent to my e-address [*johndouglaswalter@gmail.com*], but please hold back complaints about omissions until all the 'first-stage' files has been uploaded!

John Walter, 2015

An illustration from Jakob de Gheyn's *Wapenhandelinghe van Roers, Musquetten ende Spiessen*, published in the Netherlands in 1608 merely ten years before the start of the Thirty Years War. Even though the first wheel-locks had appeared fifty years earlier, they were still regarded as the expensive toys of the aristocracy; consequently, the two soldiers are still carrying matchlocks, a linstock and an array of cartridge holders (right), and a powder flask and hanks of slow-match.

THE RISE OF THE GUN

From the earliest times to the twenty-first century

The origins of the military firearm stretch back to the fourteenth century (perhaps even slightly earlier), but not until technology improved did it become a viable weapon. The first guns were exceptionally clumsy, even after a 'tiller'—the forerunner of a stock—had been added to what had previously been an unsupported barrel, once made by hammer-welding short strips of iron onto a mandrel that could subsequently be drilled out to provide a 'bore'. Later guns were cast in a single piece, allowing them to be stronger and less likely to burst by unwinding along an inadequately welded seam.

Many small guns have been retrieved from the ruins of castles and fortifications, dating as early as the fourteenth century, but most of these were simply diminutions of the tiller-gun. They usually have sockets in the breech-end of the tube, and the smallness of their bore suggests that they were simply the playthings of the nobility, or perhaps the sons of the nobility. There is no evidence that they were made in quantity. Indeed, guns of all types were in short supply prior to 1400. It is hard to believe that they would have had much offensive threat, as the bores were very small and the capacity for the poor-quality gunpowder of the day was extremely limited.

The idea of a one-hand gun remained in limbo until the invention of the ➔wheel-lock, attributed to a variety of men—including Leonardo da Vinci—but almost certainly a product of the south German clock-making industry at the beginning of the 1500s (a claim that it dates back to the 1440s is not generally accepted). The clockmakers were amongst the most skilled of the earliest mechanical engineers, used to working accurately in small scale. To function efficiently, clocks needed to combine skill in design and great precision in the cutting of gears. It was a small step from a clock to the 'clockwork' mechanism of the wheel-lock, in which a small chain (often of only three or five links) connected a spring with a rotating wheel.

To work the lock, a small key was used to 'span' the mechanism by winding the chain against the pressure of the spring onto a spindle fixed in the wheel. The other major part of the action was a piece of iron pyrites held in the jaws of a 'cock' that could be rotated until held against the serrated rim of the wheel by a small spring.

Pressure on the trigger or 'tricker' released the captive wheel, which was spun by the action of the spring pulling on the chain. Sparks generated from the contact of the pyrites and the serrated edge of the wheel cascaded into a pan of fine-grain priming powder and, after an infinitesimal delay, the main charge of gunpowder in the chamber also ignited.

The advent of the wheel-lock had two important effects. It not only freed the firearm from the first, but essentially primitive method of ignition, the lighted match or tow, but also removed the need for two-hand use by providing a self-contained mechanism that worked automatically once released. In addition, by

involving the highly-skilled clockmakers, it ensured that the status of gunmakers was rapidly elevated to the status that was jealously guarded for generation after generation. The recognition of gunmakers' guilds and the steadily increasing output allowed the small firearm to find military use, and the increase in use created an environment in which innovations-not always universally praised-could be promoted.

The wheel-lock was an efficient mechanism, but had several weaknesses judged from a military standpoint. Production was limited by the need of skilled craftsmen and costs were correspondingly high, even though considerable numbers of plain-looking guns were made for military service; the pyrites was comparatively weak, often disintegrating after a few shots had been fired; and the employment of a separate key or 'spanner' to wind the spindle was undesirable in combat. Something better was needed; something that could be used time and time again with a minimum of motion and a certainty of repetition.

The answer was the 'flinted lock', made in several forms. There has been much debate about the origins of these locks, and the differences between them. The most popular forms are the Spanish →miquelet, the Dutch/German →Snaphance, and the →French lock or 'flintlock'. Though the principal difference between the snaphance and the French lock is often said to be the combination of the steel and pan cover in one component, it seems that the first French Locks, introduced early in the seventeenth century (allegedly by the French gunmaker Marin le Bougeoys, *Arquebusier du Roi*), also had separate pan covers.

The true difference will be found in the design of the sear, which works vertically to engage notches or 'bents' in the tumbler attached to the cock spindle. In the snaphance, the sear works laterally; in addition, notably in the miquelet, the nose of the sear projects through the lock plate to release the tail of the cock when the trigger is pressed.

The French lock gradually attained a position of supremacy by the end of the seventeenth century, which lasted until the advent of the percussion cap more than a hundred years later. The principle of the lock was simple: a specially shaped or 'knapped' flint, held in the jaws of a rotating cock, was brought into contact with a rapidly-moving roughened surface so that a shower of sparks was diverted into a panful of priming powder.

A true French-style flintlock, therefore, had the steel and the pan cover formed as a single part, and a sear that moved vertically to intercept a tumbler fixed to the axis-pin of the cock after it had passed through the lock plate. The dog lock, particularly favoured in England, was simply a flintlock with a large safety catch or 'dog' on the outside tail of the lock plate to intercept the tail of the cock.

The flintlock offered no real economy of size compared with the preceding wheel-lock, but had the merits of simplicity and durability. The flint was much harder than pyrites, and gave more consistent ignition; and, excepting the relationship between the striking point of the flint on the steel, the parts of the flintlock were comparatively easy to make and easy to regulate. The ease with which the new lock could be made boosted production to a point where armies could

The wheel-lock was the earliest major improvement in firearms technology. Conceived in the first half of the sixteenth century, its creation was due to clockmakers working in soutthern Germany and Bohemia. Many guns, like this 13-bore pyrotechnic pictol of *c*. 1580, made in Nürnberg and once in the Amalric collection until sold at auction in 2006, were richly decorated to reflect the rank of their aristocratic purchasers.

issue firearms universally, at the expense of the bow and the pike. The guns were simple and sturdy, though often initially large, long-barrelled and cumbersome; as the years passed, however, even the regulation military weapons became more compact and better to handle.

The pre-eminence of the flintlock endured for more than two hundred years, until the realisation that the explosive properties of a group of chemical compounds known as the fulminates could be harnessed to provide a self-contained ignition system. Credited to Scottish clergyman Alexander ➛Forsyth (though the potential use of fulminates as an igniter had been predicted by the Frenchman Claude-Louis Berthollet as early as 1786), the original percussion-ignition lock was patented in England in 1807.

Known as the 'scent bottle', it relied on a rotating reservoir to deposit a small amount of fulminate powder alongside a touch-hole, where it could be struck and ignited by the hammer. The fulminate lock was difficult to make, and prone to suffer the effects of corrosion. Experience rapidly showed that improvements could be made, however, and the effect it had on the sporting-gun market persuaded many enterprising gunmakers to produce alternatives: pill-locks, tube-locks, and a variety of other proprietary designs. These were soon all swept away by the cap, a pellet of mercuric fulminate contained within a small envelope-initially of board, later of tin and then copper, shellacked to be waterproof.

The genesis of the cap has always been in some doubt, though the consensus is to give the honour to John Shaw even though his claims are vigorously contested in France in particular. The ➛percussion cap was the greatest step forward in firearms technology since the introduction of the flintlock. Though the mechanics of the cap-lock differed from the flintlock only in the substitution of a nipple for the pan and steel, the means of ignition was far more efficient. Tests undertaken by the French army in the 1830s suggested that the certainty of ignition improved by a factor of six once the cap had replaced the flint. Though this superiority was disputed by diehards, it was to be demonstrated graphically on the battlefield.

One of the most important factors in the development of the military weapon was the introduction of breech-loading, largely unheralded in its first, often primitive forms. Though the rudiments of breech-loading can be seen in some of the earliest guns, in which separate cylindrical breech chambers were retained by a wedge, ineffectual breech seals were a perpetual problem. The gas-leaks were so bad, in fact, that the universal acceptance of breech-loading was delayed until the nineteenth century.

A popular early method of achieving a higher density of fire was simply to load powder charges, bullets and wads alternately into a single barrel, and then attempt to fire each charge sequentially. This involved an often-unappreciated risk: unless the wads sealed the system properly, these guns were prone to fire all the shots at once and could even explode. Superimposing loads was soon seen to be risky-as well as inefficient-and the next step was to group several single-shot barrels together around a central axis. This led indirectly to the revolver, though the multi-barrel block proved to be long-lived.

This English-made two-barrel flintlock pistol dates from about 1680. The barrels rotate around a horizontal pivot, the so-called 'turnover' or 'Wender' principle, requiring two pans and two steels. *Christian Cranmer collection*.

Neither the rotary barrel cluster nor a barrel-block restricted weight or size, the best compromise being a single-barrelled gun either with multiple breech-chambers (the revolver) or some kind of magazine. An important early step towards the perfection of the magazine rifle was the work of the seventeenth-century Danish gunsmith Peter ➔Kalthoff, which had a laterally moving breech-chamber system, actuated by radial movement of the trigger guard, which transferred powders and balls from the butt magazines, and the breech (much copied) offered by the Florentine gunsmith Michele ➔Lorenzoni, which consisted of a large vertical disc with peripheral chambers designed to transfer balls and powder from the magazines into the butt to the chamber by means of a large radial charging lever. Unsuccessful attempts were still being made to devise an efficient powder-and-ball repeater as late as 1840; early single-shot breechloaders initially encountered much more success.

Typical of these was the British ➔Ferguson rifle, with a rapid-pitch thread which, when turned by the trigger-guard, dropped the plug to give access to the breech. This could then be loaded with a tight-fitting ball, wadding and a suitable powder charge, and the plug wound back to seal the breech. In March 1777, Ferguson set sail for North America with a special unit of riflemen; unfortunately, despite early successes, there were too few Ferguson rifles to make much impact on contemporary warfare. Ferguson was seriously wounded at Brandywine Hill, his men being assimilated in the regular infantry, and was later killed on King's Mountain in 1780; the rifle died with him.

Later British efforts centred on an adaptation of the ➔Crespi breech-loading system, which had been extensively (but unsuccessfully) tested by the Austrian army in 1770-9. Made by Durs Egg, with Hennem's Screwless Lock, more than thirty of these chamber-loaders were tested in 1784-8 in several differing forms. The opinions were substantially that the rifled versions performed best and that the spear bayonet was not advisable. However, the Board of Ordnance expressed concern that the breech would leak badly when the chamber mouths began to wear—as had happened with the Austrian guns—and the project was abandoned. Unlocking was achieved by pivoting the chamber lever until it was parallel to the barrel axis, disengaging it from its retaining slot and permitting the chamber to be tipped upwards to receive a cartridge. A later modification, patented by the gunsmith Sartorius *c*. 1800, solved some of the leakage tendencies by using an interrupted screw to lock the sliding chamber into the breech.

Other unsuccessful British breech-loaders included Egg's pattern of c.1788, in which a stout pin running down through the action could be removed to set an automatic safety and allow the chamber to be withdrawn backwards. James Wilkes' submission in 1801, based on the Baker flintlock rifle, featured a detachable link-retained screwed plug on the left side of the breech—hardly innovative—while Hulme's rifle of 1807 had a vertical disc-type breech block actuated by a lever on the left side of the barrel.

Another old idea was to load more than one charge in a single barrel, as the 'Roman Candle' or *Espignole* had originated in mediaeval times. The difficulties

of igniting individual charges were well known: most of the earliest guns were designed to fire the entire barrel-load of projectiles sequentially, without attempting to stop the process until the last charge had been fired. Some are even known in which a series of charges, loaded from the breech, were fired sequentially by igniting the front one conventionally (usually with a flintlock) and then allowing each successive shot to be fired with the assistance of a fuse running back through all the projectiles and charges. The recoil of the gun must have been excessive, and the strength of the breech mechanism may not always have been great enough to ensure the firer's safety. Comparatively few of these weapons survive.

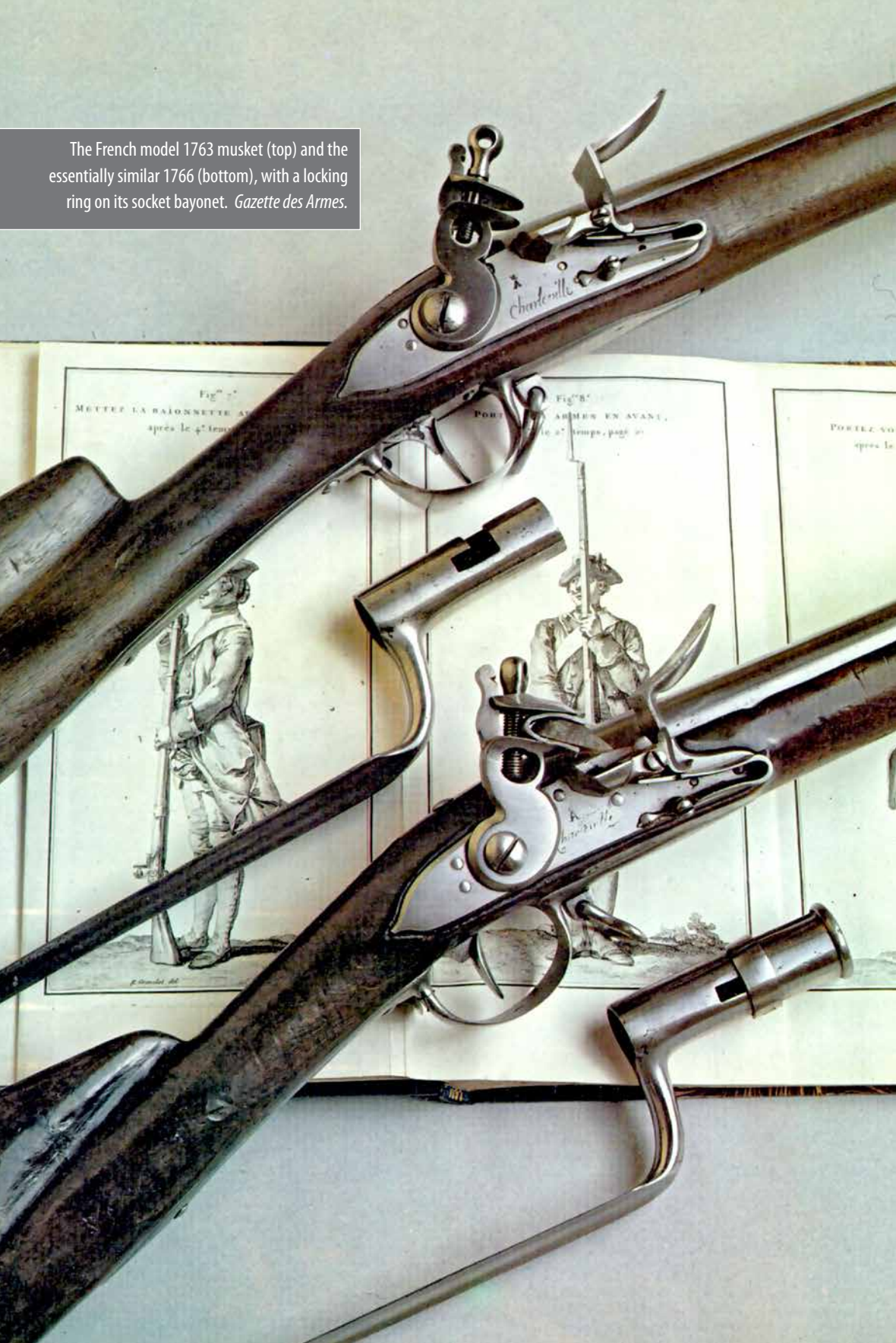
Attempts were made by many inventors to provide sliding locks and a series of touch-holes, each protected by a pivoting cover. A patent of this general class was granted in England in 1780 (no. 12700) to a surgeon, John Aitken, who proposed multiple touch-holes and 'intermedia or colfings'—wads of leather or suitable substitute—to separate each charge.

Better known was the work of Joseph ➔Belton of Philadelphia, who petitioned the U.S. Congress to test his gun and had been authorised to make a hundred eight-shot muskets on 3rd May 1777. There is no evidence that these guns were made, as Belton eventually departed for London. There the Master General of Ordnance granted his gun an official trial, which was undertaken at Woolwich on 28th July 1784. This particular Belton gun was a musket with a detachable 11-inch chamber holding seven charges, operated by two triggers.

Though the Woolwich exhibition had failed to attract the interest of the army, Belton entered into partnership with the London gunmaker William ➔Jover and approached the Commissioners of the East India Company with his plans. The submission was welcomed, as the multiple charges were believed to give cavalrymen a great advantage in skirmishes where they were greatly outnumbered. The Company subsequently paid Jover & Belton £2292.8s.0d for muskets and, presumably, some pistols. Howard L. Blackmore, *British Military Firearms 1650–1850*, p. 249, records that one surviving EIC musket dated 1786 also bears the number '124'. This and the payment, a large sum in its day, both suggest that substantial quantities were involved. However, very few examples are known to survive.

Multiple-charge guns were predictably far too long, clumsy, and prone to chain-firing unless the seals between each successive charge/projectile combination were exceptionally good. Superimposed loads, therefore, were another evolutionary dead-end even though attempts were made from time to time to increase firepower by combining turnover barrels and superimposed charges.

By the 1830s, within a decade of its introduction, the cap-lock had become sturdy, effectual, and had a misfire rate one-sixth that of the flintlock. Yet progress in firearms technology was still firmly obstructed by the negligible improvement in ammunition. Consequently, it became a matter of importance to find a way of improving the performance of the standard muskets without drastically changing them. The importance of rifling had been established for some time, and the first attempts to improve the grip between the projectile and the bore had consisted of wrapping the former in a patch. This complicated logistics, slowed loading and led



The French model 1763 musket (top) and the essentially similar 1766 (bottom), with a locking ring on its socket bayonet. *Gazette des Armes.*

to a higher than acceptable proportion of misfires. The patched ball was replaced by the belted ball, the raised ribs being inserted in the deep wide grooves before the bullet was rammed into the barrel. This system was credited to Captain ➛Berners of the Royal Brunswick Army. However, the British ➛Brunswick Rifle of 1837 was little improved from the Baker apart from its ignition: it was still slow-firing, and accurate only to a little over 200 yards.

The belted ball and its near-relation, the ribbed slug, was an improvement on the patched ball; but it still required care in ensuring the belts mated satisfactorily with the rifling. The goal then became a projectile that could be dropped down the barrel with ease, yet which would expand to fill the rifling on firing. The first attempts involved dropping a slightly sub-calibre projectile down the bore, relying on gravity to distort the malleable lead sufficiently to fill the bore when the projectile struck a ring in the breech. This was an old idea, dating back to the Frenchman ➛Deschamps (1718) and briefly revived by the Gardner Nail-breech and Nock Ring-breech in Britain (1796–9). Unfortunately, the high incidence of cleaning rods catching on the ring caused the British to abandon the idea in 1813. When it reappeared in the 1830s in France, a sturdy ramrod and, perhaps, a small mallet sufficed to upset the projectile sides into the rifling. The Delvigne chamber breech was then superseded by the ➛Thouvenin pillar system (*à Tige*) in which the projectile was expanded over a rod protruding centrally from the breech-face.

Neither system was ideal, owing to the deformation of the projectile, but was sufficiently advantageous to improve shooting. This was clearly evident in a French trial in which pillar-breech rifles and standard infantry muskets were fired at ranges varying from 200 to 1,000 paces. At the shortest range, a behatted soldier-size target measuring 2 metres high and a half-metre broad was hit 30 per cent of the time by the musket and 62 per cent by the rifle; at the 500-pace target (2 metres square) the figures were 5 and 52 per cent respectively; beyond this, however, the musket ceased to have value while the rifle recorded 42 per cent on the 800-pace target (2 metres high, 4 metres broad) and even 23 per cent at the longest range (target 2 metres high, 6 metres broad).

The next stage was the invention of a self-expanding bullet, utilising the power of the propelling gases to force the comparatively malleable lead bullet into the rifling. This improved accuracy still further, as the bullet no longer needed to be struck onto a pillar. This significant breakthrough is generally credited to the Frenchman Claude-Étienne ➛Minié though Norton and Greener in Britain both claimed to have pre-empted him. Minié's hollow-base bullet could be dropped down the bore with minimal effort, its comparatively thin base-walls being expanded into the rifling by the violent ignition of the main propellant charge: the system worked surprisingly well, and was greatly improved by the discovery that a plug set in the base facilitated expansion. The British used a boxwood plug, but other armies used iron or tin.

Great strides being made in machine-tool design and mass-production techniques permitted the expanding bullet to be issued to British line infantry in time for the Crimean War (1853–6) and, typified by the British P/53 Enfield and U.S.

M1855 Springfield, had become widespread by the commencement of the U.S. Civil War in 1861. Rifle-muskets could shoot with surprising accuracy at distances of up to 1,000 yards. Tests undertaken with the standard British P/53 'Enfield' infantry rifle-musket returned a mean radius of 2.24 feet at 500 yards, 4.11 feet at 800 yards and 8.04 feet at 1100 yards. And though the P/53 was among the best of the weapons of its type, the small-bore cap locks were capable of even finer shooting: the British .451-calibre Whitworth, with its special mechanically fitting projectile, recorded the staggering mean radius of only 4.1 inches at 500 yards (a figure some modern rifles would be hard pressed to beat) and 4.62 feet at 1400 yards, a distance at which the P/53 had shot so wildly that shooting had ceased to be recorded during the 1857 trials. At 100 yards, the Whitworth bullet penetrated 33 half-inch elm planks compared with only twelve for the P/53. It was, however, notoriously difficult to keep clear of propellant fouling; in a fouled state, the Whitworth's shooting was not only on a par with the Enfield's, but excessive force was required to force the projectile down the bore.

With the widespread issue of rifle-muskets throughout European armies, as well as in the U.S.A., battle tactics could be finally be divorced from stereotyped geometry. Oddly, the Crimean War, the opening stages of the U.S. Civil War and even the Seven Weeks War (at least from the Austrian viewpoint) showed no appreciation of this.

The distribution of an effectual weapon of any sort throughout an entire standing army presented a difficult problem for most governments, particularly for the great colonialist countries such as Britain and France which had to find vast numbers of guns. It is a popular fallacy, particularly in Britain, that an industrial revolution occurred with such startling rapidity that cottage industries struggling to make articles by the tens or hundreds transformed overnight into conglomerates capable of making items by the million. In most industries, this was simply not true; in the firearms industry, the gradual move towards full interchangeability of parts took at least a hundred years.

Progress varied from country to country, depending on need and, to a large extent, the availability of two principal commodities: capital and labour. The U.S. firearms industry presents the best example of rapid growth, progressing from the cottage industry base of the 1820s to an ability to satisfy the needs of the Civil War within forty years. In Britain, conversely, the transition never really took place at all: the gun trade in 1900 was as primitive as it had been in 1800, excepting the very few true mass producers. Of these the Royal Small Arms Factory at →Enfield only began to mass-produce in the mid-1850s, using a fair proportion of American-made machine tools, BSA was not founded until 1861 and companies such as Vickers, Sons & Maxim did not attain prominence until the end of the century.

Much of the credit is due to American entrepreneurs such as Eli Whitney, Eliphalet Remington and Samuel Colt, who each made tremendous contributions to the science of mass production. The importance of the differences in approach between the U.S.A. and Britain may be gained from the experience of BSA, which contracted to alter twenty thousand Egyptian Remington rifles from rim- to

centre-fire in the early 1870s; the BSA assembly room is on record as registering disbelief to a man when it was discovered that the guns could be stripped, the parts piled indiscriminately and then reassembled into working guns with almost no handwork. Usually, the gunsmiths' 'crib boxes' were full of parts that had to be juggled until one was found to fit'. Lest it be thought that the British workmanship was bad—it was, in fact, usually very good—the difference was that Britain was small country with a comparatively large population; the U.S.A. was the reverse, with vast under-populated tracts and a shortage of labour in all but some of the north-eastern states. Consequently, the British tended towards labour-intensive production whereas the Americans had almost no option but to mechanise.

By the early 1800s, metallic cartridges began to appear. At first, many took the form of detachable chambers in which separate powder and ball could be loaded in a manner redolent of the old chamber-loading cannon of the fourteenth century. Chief among the early inventors was the Swiss Samuel ➔Pauly, who spent much of his time working in Paris and London. In 1812, Pauly received a French patent for a breech-loading gun which fired a special cardboard cartridge with a thick metal base into which priming compound was set. The difference between this and the earlier chamber-loading principle was largely that the Pauly cartridges were to be discarded after firing. The Pauly rifle generally embodied a hinged breech-block with a long lever extending backwards along the top of the wrist of the butt; to open the gun, the lever was simply lifted upwards to expose the breech, which withdrew the breech plunger, a cartridge inserted and the action closed. Some guns cocked automatically, others had external hammers; a few even embodied a strange form of hot-air ignition.

The French were particularly active; early cartridges included the centre-fire Galy-Cazalat pattern of 1826, French Patent 3355, which contained its powder charge in the leather or parchment case with the fulminate in a central pocket; ➔Pottet's metal-based paper cartridge of 1829 (3930) with priming pockets in the centre of its base; and ➔Robert's 'primed shell of fusible alloy' of 1831 (8061); Houillier's first crude pinfire (Patent no. 1936 of 1846); and ➔Lefaucheux's detachable copper-base/copper tube or metal head/paper tube pinfire (4839 of 1850). The development of the pinfire has been dated back to the late 1820s, but no such design could be found in the French patent specifications—though a number of the designs of this period had flash-tubes in which the genesis of the pinfire is obvious.

Few of these early attempts to produce self-contained ammunition had much military value, largely because they were either too delicate or insufficiently powerful. A 16mm-calibre Robert-type musket, stocked in government musket fashion, was tested extensively by the Comité de l'Artillerie but the final report, submitted in February 1833, was unenthusiastic: though easy to load, the breech was prone to fouling and red hot cartridge debris occasionally ignited a new cartridge before the trigger could be pressed. The gun had a concealed underhammer, cocked as the breech was opened by the long ring-tipped lever running—as Pauly's had done—back down the wrist of the butt. A special indicator protruded ahead of the trigger guard to show that the mechanism was cocked. When the trigger was

pressed, the hammer flew upwards and ignited the cartridge by crushing the primer tube projecting from its base; this was a different and quite inferior system to Robert's 1831 patent, giving countless premature ignitions during loading on trial. Ironically, no sooner had the authorities rejected the Robert musket than its sporting version received a gold medal at the 1834 Paris Exposition!

Next came the ➛Lefaucheux rifle, patented in 1827, whose dropping barrel was controlled by a radial lever beneath the breech ahead of the trigger guard. The reinforced paper combustible cartridge, fired by a conventional external back-action cap-lock, could not prevent gas leakage and the gun was rejected. It later became a very successful sporting gun, particularly when adapted for pin- and then centre-fire metallic-case ammunition.

The French authorities in this period were quite happy to test guns, but very reluctant to recommend anything unusual. Among the early casualties of this attitude were the Leroy rifle, tested at Vincennes and Douai in 1831–3 but rejected as too complicated and too weakly made; a centre-hammer gun developed by the arsenal at Charleville in 1831–2, with a tipping breech system adapted from the *Fusil de Rempart Mle. 1831*; and the 1835-vintage pivoting barrel 17.1mm-calibre Le Page, unsuccessfully considered by Vincennes as a cavalry carbine. All of these fired combustible cartridges with varying degrees of efficiency.

The only breech-loader to be introduced to French service in this period was the Mle. 1831 rampart gun, whose 47-inch barrel made muzzle loading impossible. This 21.8mm-calibre rifle featured a tipping chamber-type breech, a combustible cartridge, and a conventional back-action sidehammer cap-lock. It fired a 640-grain ball with up to 285 grains of black powder. The Mle. 1831 measured 66½ inches overall and weighed about 19 pounds without its pivot.

Though the French experimented with trials rifles submitted by Plastow (Châtellerault), Minié, Charleville arsenal and Descoutoures in 1846–53, nothing came of any of them. They had a vertical sliding breech-block, a laterally pivoting barrel, a side-hinged block and a vertical disc breech respectively; all fired combustible ammunition, and, consequently, had no effect on the modern military rifle. In 1853–4, however, a trial seems to have taken place to develop a suitable firearm for the Corps de Cent Gardes, the imperial bodyguard, to whom show was of more consideration than efficiency; yet Napoelon III seems to have demanded a breech-loader for such an elite squadron. Carbines by Gastinne-Renette, Ghaye and Arcelin (Châtellerault) appeared, plus an odd design submitted by the perfector of the Mle. 1831 rampart gun, Capitaine d'Artillerie Treuille de Beaulieu (1809–86, later a general).

The 13mm-calibre ➛Gastinne-Renette carbine featured a barrel that turned on a vertical axis; the Belgian ➛Ghaye had a barrel that slid forward as the trigger-guard lever was depressed; while the ➛Arcelin musketoon had an interrupted-screw lock. Each was passed over in favour of the extraordinary ➛Treuille de Beaulieu system, strange even by French ordnance standards as it fired a unique cartridge with a long upward-projecting extractor pin and a rearward projecting primer tube.

Dating from about 1850, this two-barrelled cap-lock sporting rifle by Manton was found in Nepal. It is believed to have been taken back by Jang Bahadur, the first Nepalese premier to visit Britain, and later found its way into the hands of his uncle Ranodip Singh. *Marcus Ray collection.*

While the military authorities in Europe dithered over the adoption of improved weapons, the American mechanic John ➛Hall had successfully produced a breech-loading flintlock rifle. Eight years work had culminated in the adoption of the system by the U.S. Army in 1819, though only in small quantities and only for special purposes. The essence of the Hall breech was a removable chamber, carrying the lock, which could be detached for loading. Though this permitted a tighter-fitting bullet, and enhanced accuracy, it did so at the expense of considerable gas leakage around the imperfectly made seat between the chamber and the bore. The Hall system advanced through a number of designs—rifle models of 1826 and 1836, carbines of 1833 and 1836—but was never entirely satisfactory, despite the change to percussion ignition after 1836 and notwithstanding the improvements made in the basic action by Henry ➛North in 1840. The most praiseworthy feature of the Hall rifle was the speed with which it could be fired, tests in 1826 showing that for each of its hundred shots the standard flintlock rifle could only fire 43 and the musket merely 37.

On the debit side, considerable powder charges were needed in the Hall compared with the standard muzzle-loaders even though power was appreciably less. Trials undertaken at West Point in 1837 discovered that penetration in oak (at a range of 100 yards) was one inch for the muzzle-loading musket, 0.93 inches for the muzzle-loading rifle and only 0.34 inches for the percussion-ignition Hall. A later trial showed that the muzzle velocities of the Hall-North Carbine was only 1240 feet per second compared with 1687 for the ➛Jenks, which fired the same 70-grain charge and had a barrel of approximately comparable length. Though some Hall and Hall-North guns remained serviceable until the Civil War, they had long since been declared obsolescent.

The principal challenger to the Hall system in U.S. service initially came from the ➛Colt Revolver Rifles, a few of which were acquired for service during the Second Seminole War in Florida. However, the advantages of the eight-shot Colt-Patersons were soon seen to be outweighed by their delicate lockwork and a distressing tendency to chain-fire. The single-shot carbine patented by William ➛Jenks in the U.S.A. in May 1838 (no. 747) soon proved to be much more effectual than either the Hall or the Colt; a hundred experimental flintlock guns were acquired in 1839, but most were subsequently converted to percussion. Trials with the 1st Dragoons in 1841 confirmed the Jenks' potential, and an endurance test at Fort Adam ceased only when the nipple split after 14,813 shots had been fired with no obvious problems. In 1845, a Board of Officers meeting at Washington Arsenal on behalf of the army and navy, recommended that the Jenks Carbine be adopted; unfortunately, military opinion had so hardened as a result of the poor service history of the Halls that nothing further was done even though some Jenks' Carbines were converted to the ➛Merrill cartridge system in the late 1850s.

The cap-lock Jenks has a very distinctive sidehammer (which earned it the sobriquet 'Mule Ear') and a toggle-type breech system actuated by an elongated breech-cover pivoted at the back of the action. When the lever is raised, the lock is broken and the breech-block withdrawn from the chamber to permit reloading.

The mechanism sealed very well, though the actuating lever, which covered the breech, would probably have tended to deflect any such blast down and away from the firer's face.

The failure of Jenks' Carbine opened the way for the dropping-block pattern patented by Christian ➛Sharps in September 1848 (no. 5763). The essence of the Sharps system was a block that slid vertically in a substantial receiver, the combustible cartridge being ignited by a conventional sidehammer and a percussion cap. The initial test, undertaken in 1850, was judged to be highly satisfactory; but later trials in 1851–3 showed that the early Sharps carbines leaked gas alarmingly. Attempts had been made to provide a platinum bush on the face of the breech-block, but, though durable, this minimized rather than prevented leakage. In 1853, the ➛Conant gas-seal was fitted in the bush aperture where, it was hoped, gas would expand the seal against the breech and prevent any leaks. The first such seals were improvements, but not until the modified pattern of 1859 was the problem finally solved; by 1860, however, the Marine Corps was able to confirm that 'all the earlier troubles encountered' with Sharps Carbine had been corrected. Though only 5540 guns had been acquired prior to 1861, no fewer than 89,653 were officially purchased by the Federal government during the Civil War.

Trials of the 1853-model Sharps' Carbine in 1854 showed that accuracy was poor; despite being optimistically sighted for 800 yards, 25 shots at an 8-feet square target at 200 yards resulted in one 24 shots returning a mean vertical dispersion of nearly 24 inches and a horizontal dispersion of almost eight. However, penetration of 7.3 inches of pine at 30 yards showed that the Sharps was appreciably more powerful than the Hall or the Jenks.

In Prussia, Johann Niklaus ➛Dreyse (1787–1867), once apprenticed to Pauly, made the first of his needle-fire pistols in association with Kaufmann Collenbusch after returning to Sömmerda in 1824. After patenting a percussion cap, Dreyse turned to the problems of successfully firing a self-contained paper-cased cartridge, the first of his designs being patented in 1828. During the early 1830s, Dreyse & Collenbush produced some pistols in which the internal firing needle was cocked by a backward-pointing crank-lever on the right side of the breech.

The earliest guns were muzzle-loaders but, by *c*. 1834, a variant of the crank-cocking system had been developed in which the crank spindle was elongated and hollowed to receive a short self-contained cartridge loaded through an aperture on top of the barrel. Pistols and rifles were made on this system, though the comparatively small size of the loading chamber restricted the efficacy of longarms of this type; certainly, they had no military application. Though pistols on this system were made for some years, a bolt-action needle gun had been submitted to the Prussian War Ministry in 1836. Its mechanism consisted of a simple sliding bolt containing the needle, its spring and a locking catch. The massive square base of the bolt handle locked on a special bridge in the receiver. To fire these guns, it was necessary to press down on the locking catch and then pull the catch and needle together backwards until they locked; the bolt handle was then turned to the left through about 30 degrees and the entire bolt drawn rearward to expose

The metallic cartridge was a leap in firearms technology. This pin-fire shotgun by Purdey dates from the 1860s.

the chamber. A cartridge is then inserted in the chamber, pushed home with the thumb, the bolt closed and rotated to the right to lock the action. The closing stroke cocked the needle and the gun was ready to fire. A total of 155 experimental *Zündnadelgewehre* were purchased for large-scale troop trials in 1839 and the 'Leichte Percussions-Gewehr M 1841'—deliberately named to hide the fact that it was a needle-fire breechloader—was formally adopted on 4th December 1840.

Attempts to keep the Dreyse system secret were abandoned in 1855, when the Leichte Percussions-Gewehre were renamed 'Zündnadelgewehr M 1841'; by this time, however, guns had been sent for trials in Britain in 1849, where despite a high rate of fire and acceptable accuracy they had proved difficult to operate when hot or fouled. Others had been issued for active service in Baden, Dresden and Schleswig-Holstein in 1849.

By 1850, the 1841-pattern Dreyse was being carried by all the fusilier battalions of the Gardekorps and three of the army corps; two grenadier battalions; the Garde-Reserve regiments; and fusiliers of the first 32 line infantry regiments. Many of the guns were still serving in the Germano–Danish War of 1864 and the Austro–German or Seven Weeks War of 1866. These are described in greater detail below. However, they all embodied the standard Dreyse action and fired the standard oviform ball seated in a papier-mâché sabot in a stiff paper cartridge. The principal problem afflicting the early Dreyse guns was that, because the periphery of the bolt-head and the mouth of the chamber were rarely concentric.

Prussia was not at that time regarded as a leading industrial power, and the guns are an adequate reflection of the comparatively poor manufacturing standards. The problem was particularly bad on the 1849-pattern *Zündnadelbüchse*, in which the conical bolt-face slid inside the chamber mouth in attempt to shorten the clumsy action of the standard infantry rifle; however, unlike the standard M 1841, where the cone was on the chamber, this permitted gas to leak directly back into the firer's face. Not surprisingly, the 'seat-breech' was less successful than the standard cone pattern, and the 1849 rifle remained unique apart from the two later carbines of 1855 and 1857.

Though the much-vaunted success story of the Dreyse in the Seven Weeks War is said to have inspired the French, the Italians and one or two of the smaller German states to adopt comparable designs, work in France had actually started some years previously. In 1858, Antoine Alphonse ➛Chassepot had submitted a modified infantry musket in which an interrupted-screw bolt gave access to the breech. Mindful of the problems of gas leaking from the metal-to-metal surfaces of the breech, Chassepot included an indiarubber 'obturating washer' between the bolt head and the body. The pressure generated in the chamber when the gun was fired forced back on the bolt-head and squeezed the washer outward until it sealed against the chamber walls to prevent blow-past.

It is believed that Chassepot had adapted his ideas from an earlier experimental ➛Manceaux-Viellard cavalry carbine, tested in 1856, which had a different type of bolt system in which a leather washer between the bolt-head and the body was intended to achieve a similar seal. The Manceaux breech was also tested in Britain

in the late 1850s, performing well during the shooting trials, but was doomed by the excessive complexity of its wired cartridge.

The French were well aware of the values of small calibres, even for black-powder guns, and had experimented with a series of such guns: the British .451 Whitworth, the 10.4mm-calibre Swiss Stutzen and a 12mm Minié rifle. Observing the lessons of the brief struggle between Austro–Prussian and Danish forces in 1864, the French also saw merit in the Dreyse breech design. Though the 11.5mm-calibre muzzle-loading *Carabine de la Commission de Vincennes* was nearly adopted in 1865, commonsense prevailed and work switched to the experimental Chassepots. The previous cap-lock was replaced by an internal needle unit, the cartridge modified so that it contained its own igniter, and encouraging trials were undertaken in 1864–5.

Testing dragged on until the growing bellicosity of Prussia, together with the signing of a non-aggression pact between Prussian and Italy in April 1866, forced a final decision to be taken. Consequently, all competing designs were discarded except for the experimental Chassepot, a Chassepot with Plumerel's improvements, and the Favé rifle. The Plumerel adaptation consisted of a leather boot on the bolt-head into which the cartridge was inserted, the intention being that stronger non-combustible cartridges could be fired. These would need to be extracted manually from the leather boot before the next one could be loaded. On trials, this predictably proved to be very unsatisfactory and the standard Chassepot was preferred. Invented by the aide-de-camp to Napoléon III, General ➛Favé's rifle was a Dreyse-type bolt-action with an interrupted screw lock. It fired a cartridge with a leather base and a paper body, an extractor being provided to pull the remnants of the base out of the chamber after firing. Its trials were spoiled by accidents which, together with the poorly made cartridges, caused what may have been a promising gun in other circumstances to be withdrawn.

The sudden and somewhat unexpected defeat of the Austrians in the Seven Weeks War caused the French to redouble efforts to perfect the needle-rifle, the 11mm-calibre *Fusil Chassepot des essais du Camp de Chalons* passing trials well enough in the summer of 1866 to be adopted on 30th August as the "Fusil d'Infanterie Mle. 1866" after a few minor alterations were made. By the time of the Franco–Prussian War, therefore, the French had a needle-rifle of their own. But the self-contained combustible cartridge proved to be incapable of further development.

The first revolving-cylinder Colts were longarms, made in Hartford in 1832 and then in Baltimore. British Patent 6909 was granted on 22nd October 1835, to be followed by comparable U.S. no. 136 on 25th January 1836, each claiming advantages such as ease of loading and rapidity of fire by connecting the hammer and cylinder-rotating pawl. In 1835, Colt founded the ➛Patent Arms Manufacturing Company in Paterson, New Jersey, to make revolver-rifles—initially rejected by the U.S. Army in 1837—alongside the first concealed-trigger ➛Paterson Revolvers. About 180 No.5 Holster Pistols were acquired by the government of the independent State of Texas in 1839–41, where, though now often associated with the 'Texas Navy', they were issued to the Texas Rangers. However, an incident between the Texan

and Mexican navies in 1843 provided the inspiration for the maritime battle-scene rolled into the cylinder peripheries of many later Colts.

The Patent Arms Manufacturing Company went into liquidation in 1842. However, admitting Texas into the Union (1846) caused friction between the U.S.A. and Mexico, and an army commanded by General Zachary Taylor was despatched to the Mexican border. Taylor's men included Samuel H. Walker, who had experienced Paterson Colts during the Seminole Wars. Walker was sent north not only to recruit more volunteers, but also obtain more firearms. He sought out Colt, to whom the patents had reverted, and the two men successfully refined the Paterson Colt into a more battle-worthy weapon. A thousand-gun government contract was negotiated in January 1847, the guns being made in the Whitneyville, Connecticut, factory of Eli ➛Whitney.

Though the cumbersome 1847-vintage six-shot ➛Walker Colts measured more than 15 inches overall and weighed in excess of 4.5 pounds, their efficacy soon brought an additional order on whose strength Colt founded his own manufactory in Hartford, Connecticut, in 1848. Here, Colt developed the first of the Model 1848 or ➛Dragoon Revolvers. These initially embodied some old Whitney-made parts, but improvements were soon made: the second model featured pins between the nipples, a roller on the hammer and a leaf-type mainspring, while the Third Model had an improved back sight and a provision for a shoulder stock. Between 1849 and 1855, the U.S. Army purchased thousands of Dragoon revolvers.

The greatly improved Navy Colt M1851, otherwise known as the Old Model Belt Pistol, measured 13 inches overall and weighed only 2¼ pounds. Its 'navy' association came simply from .36-calibre and the naval scene rolled into the cylinder; more of the guns actually saw land service during the American Civil War than had maritime connexions!

By the mid 1850s, therefore, the cap-lock revolver was well established in the U.S.A. and was gradually spreading to Europe. Colt was particularly keen to establish a foothold in the British military market, and even opened a factory in Pimlico, London, in 1854 as a result of the successful exhibition of his revolvers at the Great Exhibition in 1851. However, the British already had a revolver—the ➛Adams, which was to plague Colt for many years. Patented in Britain in February 1851, this had superior features: its calibre was greater and the solid frame was stronger than Colt's open-top pattern. The Adams also had a double-action trigger, rather than requiring thumb cocking for every shot.

The Board of Ordnance subsequently acquired guns for trials and concluded that the Colt was preferable, but the competition was close-run and sufficient doubt remained to permit Adams to claim victory. The advent of the Crimean War forced the British authorities to acquire about 23,560 Navy Colts (March 1854–August 1855), and many others were purchased privately. But combat experience soon showed that the .36-calibre bullet was a poor man-stopper, and opinion swung back to the 38-bore (.500) and 54-bore (.442) Adams. By 1855, the Adams had been fitted with Rigby's and Kerr's patent rammers. Finally, improved lockwork patented by Lieutenant Frederick Beaumont of the Royal Engineers in February 1855 was

adopted; the improvements persuaded the Board of Ordnance to replace the Colt, and 19,123 Beaumont-Adams revolvers were acquired between October 1855 and the end of 1860.

THE AMERICAN CIVIL WAR

While European authorities dallied with capping breech-loaders and needle-guns, attempts were being made to perfect the metal case cartridge. Though much of the early experimentation was French, the result was the ➔pin-fire—one of those dead-end developments which seem to promise much, but have no lasting significance in firearms design. The first step towards the modern military weapon was taken by Samuel ➔Morse, who presented a breech-loading carbine to the U.S. Army in 1857. Though Morse's cartridge was ineffectual and developed little real power, it had an internal primer and could genuinely be called self-contained.

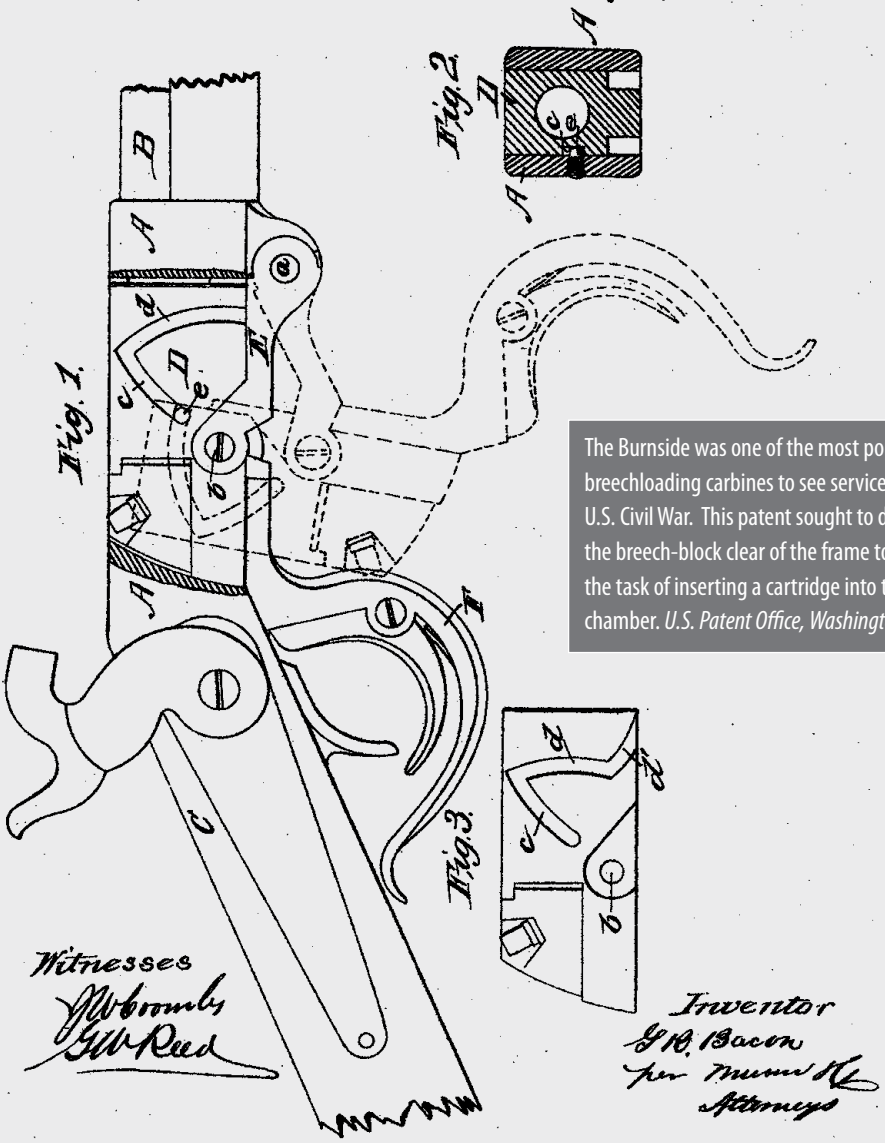
At this juncture in firearms history, there were two principal avenues of research where metal-case cartridges were concerned: one which believed that the cartridge, as in the Morse rifle and the Dreyse needle-gun, should carry its own primer and another reliant on standard external cap-locks. While the Morse underwent its trials and tribulations, the U.S. armed forces experimented with the Burnside and Maynard Carbines in 1858–9. The former was patented in March 1856 (no. 14491) by Ambrose ➔Burnside, subsequently a renowned if erratic army commander during the Civil War. The action is basically a dropping block controlled by a trigger-guard lever, the unique tapered copper cartridge case being inserted backwards into the block through the top of the frame. As the action is closed, the protruding bullet is seated in the chamber-mouth. Ignition is by a conventional cap-lock.

The original Burnside carbines, made by the Bristol Firearms Company of Bristol, Rhode Island, had a separate breech-lock lever beneath the hammer and appear to have lacked a fore-end. However, the near-success of the Burnside system after the 1857–8 trials, in which it was given the grudging compliment of being 'the best of the imperfect' systems submitted, evaporated in the absence of government orders. Burnside was declared bankrupt, his patents and the assets of the Bristol Firearm Company being sold. The carbine was subsequently revived by the controllers of the patents, who, reorganised as the 'Burnside Rifle Company', made many Burnside Carbines for the Federal Government during the Civil War. Later guns have the breech-locking lever on the trigger guard. Of the Bristol-type Burnsides, 200 were purchased in April 1856 and 709 in September 1858. Tested at the Washington Navy Yard in 1859, the Burnside fired 500 shots without misfiring, though 30 of the 470 aimed-fire shots missed the 8-feet square target at 500 yards. Penetration at 30 yards proved to be 6.15 inches of pine.

Patented in the U.S.A. by Edward ➔Maynard in May 1856 ('Cartridges', no. 15141) and December 1859 ('Breech-loading Firearms', no. 26364), the Maynard Carbine was an unconventional dropping-barrel gun locked by an underlever;

G. R. BACON.
BREECH LOADING FIREARM.

No. 39,270. Patented July 21, 1863.



The Burnside was one of the most popular breechloading carbines to see service in the U.S. Civil War. This patent sought to drop the breech-block clear of the frame to ease the task of inserting a cartridge into the chamber. *U.S. Patent Office, Washington DC.*

unlike the perfected Burnside, it had no fore-end. The guns were made by the Massachusetts Arms Company and fired a conventional-looking copper-case cartridge with a flash-hole in the base. Like Burnside's, the Maynard design used a cap lock. It featured a centrally-hung rather than external sidehammer.

An 1859-vintage test of the Maynard rifle suggested that it was more accurate than the Burnside, probably on account of a more consistent bullet-seating system, and all 250 shots at 500 yards hit the regulation target. At 1300 yards, fourteen shots out of 43 hit and penetrated the one-inch thick 10×30-feet target; 562 shots had been fired without cleaning or misfiring, the maximum rate of fire being twelve per minute. Some of the cartridge cases had proved to be capable of firing a hundred times or more without noticeably deteriorating.

In 1860, Major Colston reported to the Commissioners of Virginia Armory that, of the four carbines with which he had had experience, the paper-cartridge firing ➔Smith loaded easily when clean but became so foul after sixty shots that it could not be loaded at all; the somewhat similar ➔Merrill had proved solid and gas-tight even after 100 shots; the Burnside shot admirably, with no evidence of fouling; and the Maynard, which Colston regarded as very powerful, shot the best of the special cartridges. However, he also recorded that he would not recommend any gun that did not take a conventional paper-case cartridge, owing to the difficulty of re-loading a Burnside or Maynard Carbine if none of the special cartridges was available.

The Civil War provided a proving ground for almost all the leading European rifle muskets, but also proved that poorly-trained men—apt to panic in the heat and noise of battle—were apt to ram charge after charge into their rifle-muskets as a result of an unheard misfire. One gun recovered from the battlefield at Gettysburg is said to have been loaded no less than 23 times. However, if the war did much to destroy the reputation of the rifle-musket, it was also the single greatest testimony to the efficacy of the breech-loading rifle and metallic-case cartridge. These vital advances in technology were not always recognized at the time, largely because the guns tended to use unique cartridges of widely differing calibre (complicating logistics unacceptably), often with suspect ignition and poor-quality propellant. But the lessons were clear to those who were astute enough to heed them.

In the decade preceding the war, small numbers of ➔Volcanic firearms had sold commercially. Their origins lay in patents granted to Walter ➔Hunt of New York in 1848–9 to protect an unpractical repeating rifle and the 'Volition Ball'—a bullet which, anticipating the rocket cartridges of the twentieth century, contained its own propellant and igniter. Despite improvements made by the gunsmith Lewis ➔Jennings, the entire project was then sold to Courtlandt Palmer for $100,000. Palmer contracted for 5,000 Jennings-type rifles with Robbins & Lawrence, but the modified rifle was a failure. By 1854, however, Horace ➔Smith and Daniel ➔Wesson had patented an improved cartridge and a magazine pistol, and production of the latter—plus an occasional carbine—began immediately in Norwich, Connecticut. Unhappily, the guns were comparatively expensive, low-powered and inaccurate, and the fulminate powder was very corrosive. In 1855, the partners sold out to

the ➛Volcanic Arms Company of New Haven, Connecticut; Wesson was retained as works superintendent while Smith left, disillusioned. The original fulminate propellant was abandoned after spontaneous ignition blew off the magazine too frequently, and was replaced by a charger of weaker but more stable black powder.

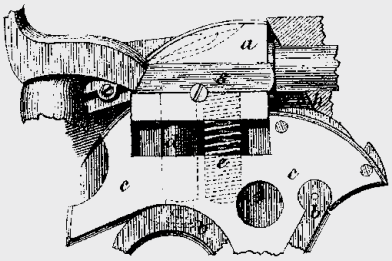
The efficiency of the lever action and tube magazine of the Volcanic system was masked by the eccentricities of its ammunition, despite the impressive (if customarily fraudulent) testimonials produced by its manufacturers to support their claims. However, after the Volcanic Arms Company had been declared insolvent, its assets were acquired by a shirt-maker called Oliver ➛Winchester. The substitution of a rimfire cartridge derived from patents granted to Smith & Wesson in the 1850s allowed the greatly improved ➛Henry Rifle to be patented in October 1860 (no. 30446). The lever-action Henry subsequently developed into the Winchester Model 1866, but had been perfected sufficiently to see service in the Civil War, 1731 being purchased by the Federal government in 1863–5 and perhaps nine thousand others selling privately. The Henry was comparatively delicate for a service weapon and as low powered as all comparable large-calibre rimfires, but was singularly fast-firing. Tests undertaken in Switzerland with an 1866-model Winchester, which fired the same ammunition as the Henry, indicated that even an untrained rifleman could achieve 21 unaimed shots each minute; accuracy was such that mean radii of 4 and 24 inches were returned at distances of 300 and 1200 paces respectively.

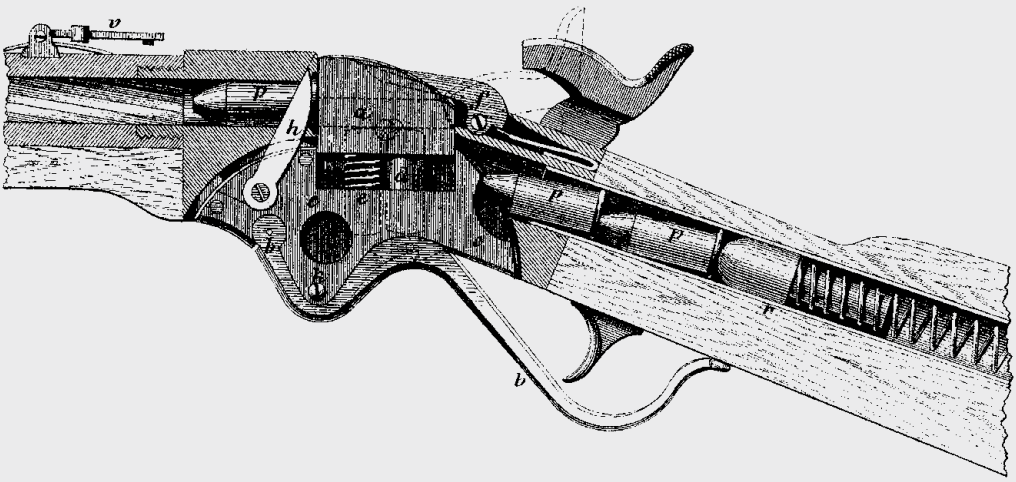
Statistically, though, the Henry rifle was to play an insignificant part in the Civil War; its reputation was to be established, retrospectively, by the improved Winchesters as they 'tamed the West'. The Spencer repeater had a much greater effect on hostilities. Patented by Christopher M. ➛Spencer in March 1860 (U.S. no. 27393), the rimfire gun had been successfully tested in Washington Navy Yard in 1861. Apart from an inherent weakness in the extractor, which was substituted by an improved version eventually patented in July 1862 (U.S. no. 36062), the rifle performed flawlessly; an order was subsequently secured from the U.S. Navy for 700 guns and 70,000 rounds of ammunition on 22nd June 1861, and the first shipments were made in 1862.

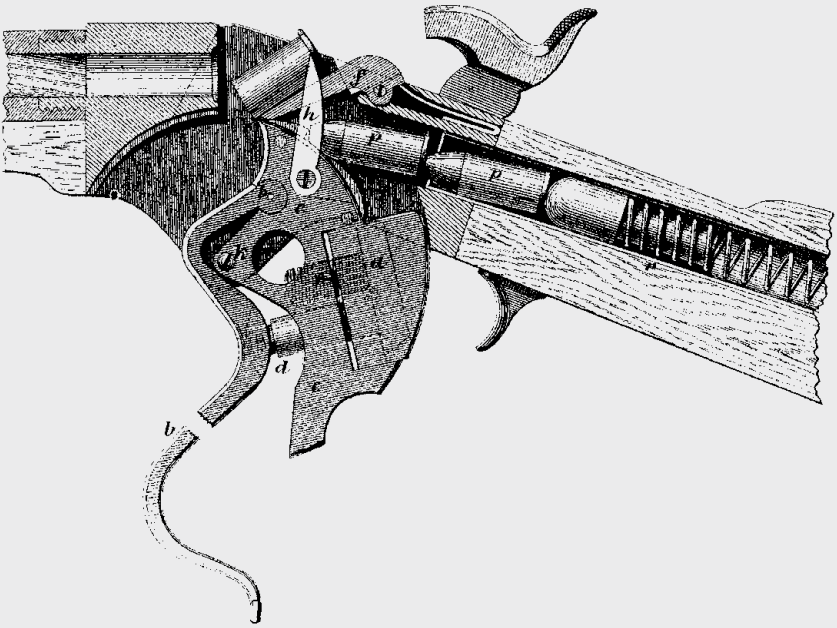
The principal advantages the Spencer possessed over the Henry were robust construction and a larger bullet—.56-calibre weighing 362 grains, compared with .44 and 216 grains. The powder charges were 34 and 25 grains respectively when tested by the Navy in 1862. Muzzle velocity has been estimated at 900 feet per second for the Spencer and 1125 feet per second for the Henry cartridges, giving the former a forty per cent advantage in muzzle energy.

Unfortunately, the Army Chief of Ordnance, Brigadier-General James Ripley, a notorious conservative, refused to countenance issue of Spencers for military service; it took the intercession of President Lincoln personally before Ripley would concede. The first government-order guns began to reach the troops in the winter of 1862, though many had already been purchased privately. The earliest authenticated use of a Spencer is generally agreed to have been by Sergeant Francis Lombard of the 1st Massachusetts Volunteer Cavalry in the Antietam campaign in

Made in large quantities during the U.S. Civil War, the Spencer breechloader (a carbine or a rifle) had a tube magazine in the butt. Though the action was unsuited to long-case cartridges and had a short period in vogue, Spencers enabled Federal soldiers to repel attacks by Confederate units outnumbering them manyfold.







October 1862. The first 'government guns' were issued in time for the campaigns of June/July 1863, as many as 3500 helping to stem the Confederate advance at the first Battle of Gettysburg on 1st July; by the end of the war, 106,667 had been ordered by the Federal government, though it has been estimated that only twelve thousand rifles and about fifty thousand of the handy 39-inch long 8½-pound carbines had reached the troops. The guns were made by the Spencer Repeating Arms Company and also by the Burnside Rifle Company, to whom Spencer sub-contracted 35,000 guns in June 1864 (30,496 of which were delivered by the end of 1865).

The Spencer featured a dropping- or radial-block action, actuated by a trigger-guard lever. When the lever was opened, the block dropped, the extractor pulled the spent case out of the chamber and the elector threw it out of the gun; as the lever closed, the tip of the breech-block picked up the rim of the first cartridge in the tubular magazine running up through the butt and fed it into the chamber. Though the external sidehammer still had to be cocked manually, the Spencer could be fired very rapidly. And its utility was greatly increased by the introduction of Blakeslee's Cartridge Box (patented in November 1864), which held ten seven-round loading tubes in a wooden block. Reloading was then simply a matter of opening the butt-trap, withdrawing the magazine spring and cartridge elevator, and simply dropping the cartridges straight out of the tinned sheet-metal Blakeslee loader into the butt. Replacing the magazine spring returned the carbine to working order: the whole cycle took a matter of seconds.

No wonder that Confederate cavalrymen, who faced Spencer-armed Federals with little but a muzzle-loading cap-lock, referred to the repeater as 'that damn Yankee invention you could load on Sunday and shoot all week'. Its fire-rate was generally reckoned at fourteen rounds per minute, without the benefit of the Blakeslee quickloader, compared with 10–12 for the single-shot Sharps' Carbine, eight for the Colt Revolver Rifle (which was uniquely time consuming to load), and only three for the rifle-musket. Loading the Spencer took about fifteen seconds; this could be cut to merely five seconds with the assistance of the quickloader, allowing 25 unaimed rounds to be fired per minute. The only problems with the Spencer were that the cartridges could be loaded backwards, a potentially dangerous state of affairs that could lead to premature explosions, and that the rapid fire-rate could expend ammunition more quickly than quartermasters could supply it!

Interestingly, there is not one authenticated incident where Confederates managed to overcome Spencer-armed Federals, despite occasions when the latter were outnumbered by as many as ten-to-one. However, even as late as 1865 the repeaters were still regarded scornfully by high-ranking regular officers accustomed to single-shot muskets. The breech-loaders were generally purchased by elite irregulars, militia and cavalry such as Berdan's Sharp Shooters and the Butler Brigade.

Despite suffering teething troubles, the metallic-cartridge guns had much to offer. The certainty of ignition was infinitely better than the cap-lock, a short-barrelled Burnside carbine tested at the Washington Navy Yard in 1859, for

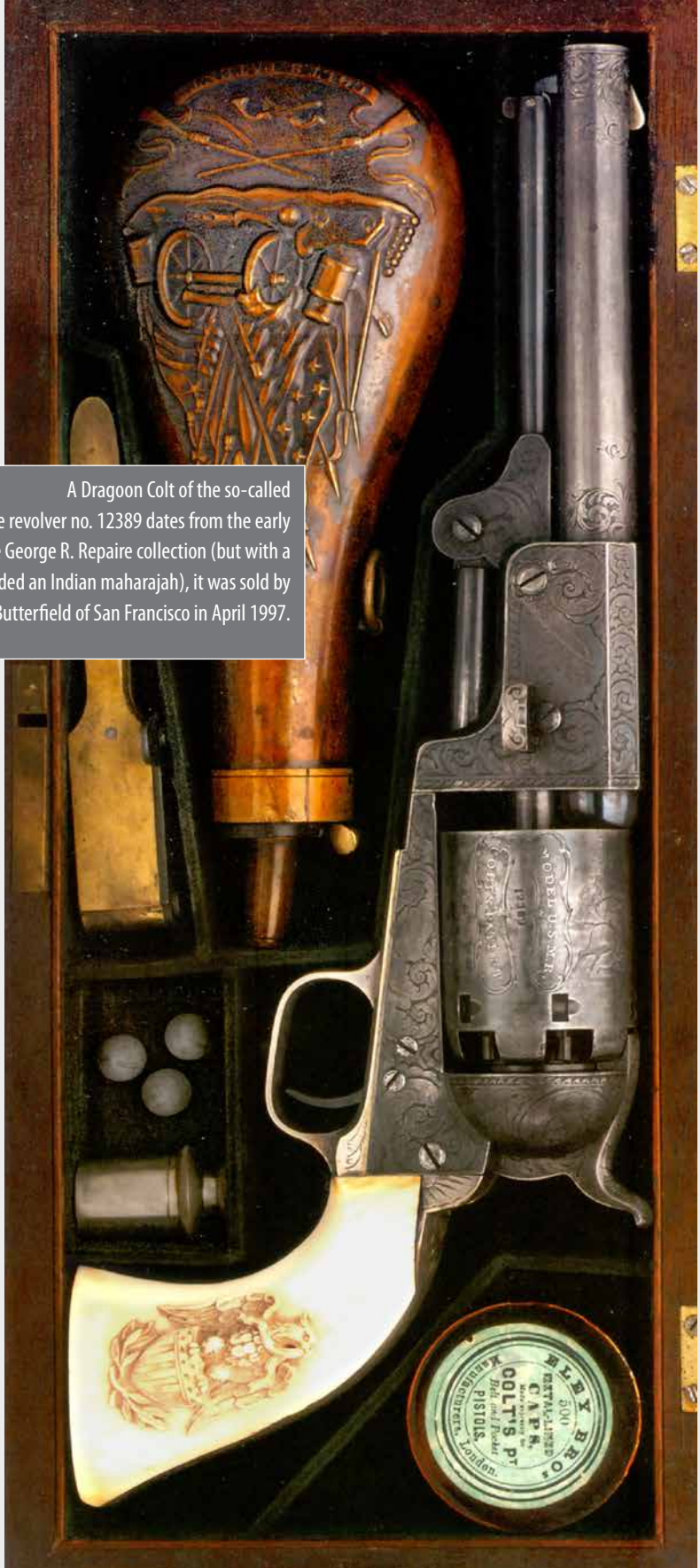
example, firing 500 shots without a single misfire. The accuracy of the best guns was also impressive, a Spencer carbine returning a mean horizontal deviation of 13 inches at 300 yards and 16.8 inches at 500 yards—roughly half the size of groups achieved with an Enfield rifle-musket at comparable distances. Unfortunately, the early cartridges were heavy enough to restrict how many a man could carry. As the Spencer rifle, with a Blakeslee Quickloader system, could easily fire twenty aimed shots a minute, six or seven times the rate of a rifle musket, it was soon reduced to the status of a sophisticated club once ammunition ran out. In desperation, or away from lines of communication and supply (where skirmishers and snipers were often to be found), ammunition could always be made for a muzzle-loading cap-lock rifle. Ironically, though many breech-loading guns had been purchased officially, the U.S. Board of Ordnance and Fortification subsequently chose a slow-firing 'trapdoor' conversion system for their rifle-muskets, condemning their troops to poor extraction for more than two decades.

The Civil War also saw widespread use of snipers, chosen from the ranks of professional hunters and skilled target-shooters. These men were truly elitist, eschewing military discipline and selecting any weapon they liked. Favourites included the heavy Wesson bench rifles, some of which weighed more than twenty pounds, and the British-made Whitworth rifle musket. Many were even fitted with primitive telescope sights in the quest for extra accuracy. Though the Whitworth was beset by fouling problems, and supplies of its distinctive mechanically-fitting hexagonal projectile were few and far between, British official tests indicated that mean radii as small as 12 inches could be obtained at 800 yards; even at 1100 yards, 30 inches could be bettered.

The Civil War also saw unprecedented use not only of handguns in general, but also of revolvers in particular. The 1860 or army model Colt was the most popular revolver purchased by the Federal government, 129,730 being acquired together with 17,010 additional .36-calibre Navy Models. Though Colts accounted for 39 per cent of the total government acquisition in 1861–6, this was only fractionally greater than purchases of Remingtons (35 per cent).

The .44-calibre single-action six shot Remington Beals Army Revolver—made by E. ➔Remington & Sons of Ilion, New York, to Fordyce ➔Beals' U.S. Patent 21478 of September 1858—was a sturdy solid-frame design with Beals' Patent Rammer, a brass trigger guard, an octagonal barrel and a small web beneath the rammer shaft. Unlike the later Remington army revolvers, the attaching threads are not visible where the barrel abouts the cylinder face. The six-shot single-action .44 guns measure 13.8 inches overall, with an 8-inch five-groove barrel, and weigh 46 ounces empty. Only a couple of thousand were made (together with about 15,000 of the smaller .36-calibre navy revolvers) before being superseded by the Model 1861 Army Revolver.

The comparative lack of success of the Beals-pattern army revolver prompted Remington to substitute a rammer patented by William Elliot in December 1861 (U.S. Patent 33932). This supposedly permitted the cylinder axis pin to be withdrawn without releasing the rammer catch, but the cylinder catch sometimes



A Dragoon Colt of the so-called 'Third Model', highly ornate revolver no. 12389 dates from the early 1850s. Once part of the George R. Repaire collection (but with a provenance that included an Indian maharajah), it was sold by auctioneers Butterfield & Butterfield of San Francisco in April 1997.

slid forward on firing and jammed the mechanism. Excepting the rammer, the 1861-model was practically indistinguishable from the Beals type. Virtually all the 19,000 .44 M1861 Army Revolvers were purchased by the Federal Government, survivors displaying inspectors' initials in a cartouche on the outer surface of the left grip. About 7500 smaller .36-calibre navy revolvers were made in the same number sequence.

The inefficiency of the Elliott Rammer forced the substitution of a new design patented by Samuel Remington in March 1863. The most obvious features of the New Models were the safety notches between the nipples and the exposed attachment threads visible where the barrel abutted the cylinder face. The army revolvers had brass trigger guards, were about 13.75 inches overall, had five-groove eight-inch barrels, and weighed about 46 ounces. In addition to the regular marks, 'NEW MODEL' will be found on the octagonal barrel. The walnut grips usually bear cartouched army inspectors' marks such as 'BH', 'GP' or 'OWA'. From 1863 until 30th June 1866, Remington supplied the Federal government with 125,314 .44-calibre guns, practically the entire production run. Generally comparable to the 1860 army Colt, even if somewhat poorer-made, the Remington cost only $13.02 against $17.70 for its rival. There were also about 23,000 .36-calibre but otherwise similar Remington Navy Revolvers.

The rather odd-looking Starr revolvers accounted for only some thirteen per cent of official purchases during the American Civil War. Based on patents granted to ➔Ebenezer Townsend Starr in 1858, the original double-action revolver had elicited impressive testimonials from government trials. The Federal government bought small quantities of the .36-calibre version and then a larger number of the .44 pattern; however, as the Civil War dragged on, a simplified .44-calibre single-action appeared to accelerate production. Total procurement in the period between New Year's Day 1861 and 30th June 1866 amounted to 47,952.

The cap-lock revolver patented by Henry ➔North on 17th June 1856 ('revolving firearm', U.S. no. 15144) was made by Edward ➔Savage and then Savage & North of Middletown, Connecticut, until an improved version was patented jointly on 18th January 1859 (no. 22566) and 15th May 1860 (no. 28331). Both patents were assigned to the ➔Savage Revolving Fire-Arms Company. The first guns had an extraordinary ring-tipped actuating lever, which protruded from the frame below the trigger; a spur-like protector ahead of the operating lever gave the appearance of the number '8', a term by which these cap-locks are now generally classified.

Made in several patterns, the clumsy .36-calibre six-shot revolvers were about 14 inches long, had seven-inch barrels and weighed 56oz. The U.S. Navy ordered three hundred of them in July 1858, and a 500-gun army order soon followed. Deliveries were painfully slow; the navy contract was not fulfilled until the end of 1860. A very few 'fourth-model' guns, with a flat iron frame and an improved 1860-patent cylinder adjustor, were made in 1860–1, but total production of 'figure 8' Savages scarcely exceeded two thousand. The North & Savage guns were clumsy, but incorporated some advanced features. Pulling back on the operating lever revolved the hammer and cocked the hammer; releasing it allowed a wedge to press

the cylinder forward until the chamfered chamber mouth rode over the end of the barrel—sealing the mechanism far more effectually against the escape of gas than in rival designs.

The improved 1859-patent revolver, made by the Savage Revolving Fire-Arms Company, shared the general lines of its predecessor. However, the butt-spur was greatly reduced and the trigger guard extended back to the base of the butt. The first sales of the new .36-calibre 'navy' gun were made to the Federal government in August 1861, seven hundred for the navy and two hundred for the army. However, these had been acquired through retailers and Savage had had little success negotiating directly with the Ordnance Department. A 5000-gun contract was signed in September 1861, but cancelled early in October owing to wrangling over payment of monies to an intermediary. However, a second contract was negotiated in mid-October, the last of five thousand guns being delivered by March 1862. The Federal government ultimately purchased more than 11,000 Savage Navy Revolvers from 1st January 1861 until 30th June 1866, apparently on behalf of the U.S. Navy.

The six-shot .36 'heart guard' Savage & North-system revolvers were no less clumsy than their predecessors, but shared the effectual gas-seal system and indexed their cylinders much more precisely than their contemporaries. They were sturdy and durable, though many inexperienced firers attempted to pull the ring-lever and the trigger together; the lever had to be pulled to rotate the cylinder and cock the hammer *before* the trigger was pressed.

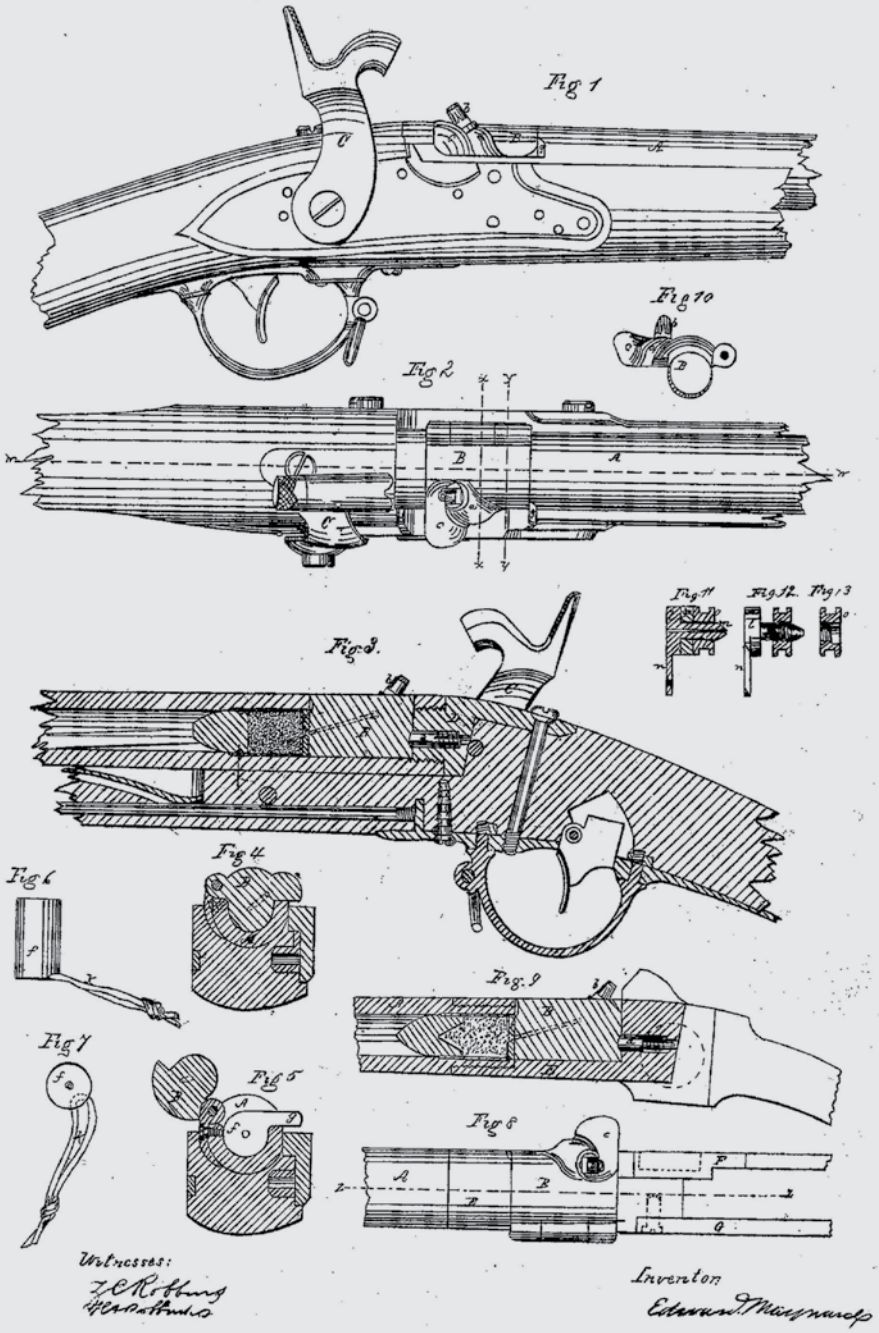
The original ➔Whitney revolvers were inspired by the success of the Walker-pattern Colt; they were, however, inferior designs. The perfected .36 Whitney appeared after copies of the Colt Navy had been made and was to prove one of the more popular revolvers to see service during the war. Safety notches appeared between each pair of nipples shortly after production got underway, while a modified cylinder-periphery maritime scene and a rammer-locking wedge were substituted for the previous spring-loaded ball midway through the production run...towards the end of which the trigger guard was enlarged and the rifling changed from seven to five-groove. Made in the Whitney factory in New Haven, Connecticut, the standard single-action six-shot Whitney 'Navy' revolver measured 13.1 inches overall, had a 7.6-inch barrel and weighed about 41 ounces. Federal purchases amounted to 11,214 for the army, 5726 for the navy and 792 for the New Jersey State Militia during the Civil War, though others were purchased privately from total production approaching 33,000. According to the *Statement of ordnance and ordnance stores purchased by the Ordnance Department from January 1, 1861, to June 30, 1866*, the Whitneys cost the Federal treasury $136,690.39.

Only about 2,500 .44-calibre army revolvers were made by C.B. Hoard's Armory of Watertown, New York, to the design of Austin ➔Freeman of Binghampton, New York State. Freeman's U.S. Patent 37,091 was granted in December 1862 to protect a unique cylinder axis pin/locking catch assembly, which could be pulled forward to disengage the frame and permit the entire cylinder to be taken out of the left side of the frame. The earliest guns have a removable side-plate; later examples have solid frames with fixed pivot-screws for the hammer and trigger. On 8th May

E. MAYNARD.

Breech-Loading Fire-Arm.

No. 30,537 Patented Oct. 30, 1860.



The Civil War in the U.S.A. coincided with the first attempts to convert rifle-muskets into breech-loaders. This 1860-vintage Edward Maynard design, with a radial block, was typical.

1864, Hoard received a Federal government contract for five thousand revolvers, but none were ever accepted and the contract was re-issued to Rogers & Spencer (q.v.). Six-shot .44-calibre single action Freeman revolvers have a very distinctive angular frame and an equally characteristic 'hump back' wooden grip. They were 12.5 inches overall, weighed 45 ounces and had 7½-inch barrels with six-groove rifling.

Charles S. ➔Pettengill of New Haven, Connecticut, received his first revolver patent in July 1856. As the trigger was pulled, a top-mounted cam revolved the cylinder through the combination lever and placed the mainspring under tension. When the cylinder had been indexed, the trigger-cam disengaged the sear from the hammer and the gun fired. Made by Rogers & Spencer of Willowvale, New York State, the Pettengills also embodied the combined mainspring and combination lever patented by Thomas Austin in October 1858 (U.S. no. 21730) and were finally simplified through a patent granted to Edward Raymond and Charles Robitaille in July 1858. Rogers & Spencer obtained a Federal contract for 5,000 'Army Caliber' (.44) Pettengills on 6th December 1861. These guns were simply enlargements of the .34-calibre 'navy' model, but so many problems ensued that the U.S. Army refused to accept any guns from the first batch.

After modifications had been made to prevent fouling jamming the cylinder axis-pin, and the trigger patented by Henry Rogers in November 1862 had been substituted for the original cam type, the Ordnance Department grudgingly accepted 2,001 modified revolvers delivered between 20th October 1862 and 17th January 1863 at a cost of $40,287.10. The odd-looking Pettengill cannot be mistaken for a Colt, Remington, Starr or Whitney, as its cylinder is an axial extension of the grip/frame unit. It measures about 14 inches overall, has a 7½-inch six-groove barrel, and weighed about 48 ounces unladen. The double-action-only trigger often exhibits a fearsome pull that discouraged accurate shooting.

A total of 1100 of the revolver patented by Benjamin ➔Joslyn of Worcester, Massachusetts, in May 1858, were acquired by the Federal government during the Civil War at a cost of $24,793. The principal claim to novelty was a 'spring clutch' and ratchet cylinder-rotating mechanism. The .44-calibre five-shot solid frame single-action Joslyn has an externally-mounted sidehammer, the nose of which is cranked to clear the cylinder axis pin entering from the rear of the frame. The guns have a conventional three-piece rammer, measure 14.4 inches overall, have five-groove 8-inch octagonal barrels and weigh about 49 ounces unladen. Their first manufacturer—W.C. Freeman of Worcester, Massachusetts—contracted with the Chief of Ordnance on 28th August 1861 to provide five hundred revolvers at the high cost of $25 apiece. These had plate-type butt caps retained by two screws.

Freeman claimed he subsequently refused to deliver an 'unserviceable design' to the U.S. Army, but the first contract was terminated by the Federal government owing to non-delivery. Freeman's subsequent offer of revolvers was declined partly because the asking price was too high and partly because 225 Joslyns had been purchased from Bruff, Brother & Seaver of New York in the winter of 1861. Many of the unsold guns subsequently passed to the Ohio state militia at the end of

1861. The Freeman-made Joslyns usually display 'B.F. JOSLYN WORCESTER MASS.' together with the patent date. However, Joslyn subsequently made about 2500 additional 'Stonington'-marked guns. The first of these had iron rather than brass trigger guards and lacked the butt-caps. After about 1400 had been made, the Freeman-type butt cap reappeared. Of the Stonington Joslyns, about 875 were delivered to the Federal government in 1861–2, approximately five hundred were acquired by the Federal navy in 1862 (these have an anchor on the butt-strap or under the barrel) and 675 more went in 1862 to—but were promptly rejected by—the 5th Ohio Militia Cavalry.

The archaic appearance of the ➔Butterfield revolver, another Civil War oddity, belies the date of manufacture. The principal novelty is that a tube of disc primers can be inserted ahead of the trigger guard; patented by Jesse Butterfield in 1855 (U.S. no. 12124), this feeds primers one-by-one above the nipple each time the external hammer was cocked. Butterfield believed that he had accepted a contract for 2280 .41-calibre Army Model revolvers placed on behalf of the Ira Harris Guard of the 5th New York Cavalry, but the Ordnance authorities cancelled the contract on 24th June 1862. Probably no more than seven hundred guns had been completed by Krider & Co. of Philadelphia, many subsequently finding their way to the Confederacy. The five-shot single action Butterfield Army Model was about 13.8 inches overall, had a seven-grooved 7.1-inch barrel and weighed about 41 ounces.

The success of cap-lock revolvers persuaded many companies to copy many of the best-known, particularly the Colts. A selection of Whitney-like guns is also known, generally marked as the products of W.W. ➔Marston, The Phoenix Armory, or the ➔Union or ➔Western Arms Companies. It has been suggested that these were made on machinery sold by Whitney once the latter's revolvers had been perfected, but the differences in frame design make this unlikely; it has also been theorised that Whitney supplied ready-engraved cylinders to Marston, which seems possible. The nipple recesses on the Union and Western guns are squared rather than rounded, though this could be explained by Whitney supplying unfinished parts. Among the imports were nearly thirteen thousand Lefaucheux pinfires, plus a few British Beaumont-Adams, French Raphaels, and Perrins with their distinctive thick-rimmed rimfire cartridges.

The Confederate States of America had a much poorer arms industry than the Federals, most resources being concentrated north of the Mason–Dixon Line. However, modified Dragoon or Navy Colts were made by the Augusta Machine Works, the Columbus Fire Arms Co.; ➔Dance Bros. & Park; L. Tucker & Co., its successor ➔Tucker, Sherrard & Co., and then Clark Sherrard & Company. None of these made more than a few hundred. However, ➔Griswold & Gunnison of Griswoldville, Georgia, made three thousand; and ➔Leech & Rigdon, Leech & Co., and Rigdon, Ansley & Co. made about 1500 in Columbus, Greensboro and Augusta. ➔Spiller & Burr of Atlanta and, later, Macon, Georgia, made about 1500 Whitney copies in 1863–4. At the other extreme, about twenty brass-framed Remington-Beals type revolvers were made by farmer Alfred Kapp of Sisterdale, Texas. The revolver patented by Alexandre Le ➔Mat of New Orleans in October 1856, was

also popular with Confederate officers. The standard Civil War pattern—made in France and Britain—substitutes a .67-calibre shot barrel for the cylinder-axis pin and have a selector mounted on the hammer-nose, but a metallic-cartridge version was patented in 1869 by Le Mat's son, François Alexandre.

A desire to perfect a gun capable of defeating an entire attacking force was by no means unique to recent firearms history; indeed, it had its roots in the Orgelgeschutz or *Ribaldequin* of the fifteenth century. These primitive multi-barrel guns were made in many sizes—the largest had three banks of barrels and was some twenty feet high— but the limitations of the gunpowder of the day reduced their efficacy considerably unless range was very short. And if the ribaldequin got close enough to the enemy to deliver its message effectively, the attackers often simply outflanked the comparatively immobile field-pieces. The barrels, therefore, were removed from the carriages, placed on separate wood stocks and issued to individual marksmen who could make best use of the firepower. In this way began the story of the modern rifle.

The advent of the rifle-musket in the middle of the nineteenth century brought a great increase in range and hitting power. But this was still achieved at the expense of considerable numbers of men; gradually, inventors' thoughts returned to the possibilities of replacing these men in a single 'battery gun'. Apart from eccentricities such as the Perkins Steam Gun of 1843, in its way an awesome weapon but a particularly unpractical one, the first of the modern volley-guns was the ➛Mitrailleuse. Credit for the rediscovery of the ancient ribauldequin is generally given to a Belgian artilleryman named Fafschamps, but his gun was refined for production by Josef Montigny and Louis Chistophe; made in Montigny's factory in Fontaine l'Évêque, near Liége, the 37-barrel Montigny Mitrailleuse was extensively employed in Belgian strongpoints.

These multi-shot weapons were not regarded with much enthusiasm by contemporary army commanders, most of whom had served much earlier in the century and regarded such devices as unsporting. However, when the American Civil War began, the attitudes of the field commanders differed greatly from their European colleagues. This was partly due to the employment of large numbers of volunteers, whose commanders were often politicians or leaders of commerce rather than career soldiers, and to the unique capacity of even the U.S.A. of the 1860s to produce hundreds of thousands of machine-made arms.

Precisely who invented the ➛Union Repeating Gun is no longer clear. Though it was patented in Britain in 1866 by Wilson Ager, an inventor of agricultural machinery, no comparable protection was sought in the U.S.A. and a lawsuit contesting the rights to the gun was fought in New York in 1861 between Edward Nugent and William Palmer. Advertised as 'An Army in Six Feet Square', the Union Repeating Gun was successfully demonstrated before President Lincoln on 16th October 1861; Lincoln promptly sanctioned the purchase of all ten of the available guns, the first recorded purchase of a 'battery gun' by the Federal army. Fifty were purchased in 1861, plus two by each of Generals Fremont and Butler in 1861–2. The Union Repeating Gun may also have been the first rapid-firing gun to be used in the

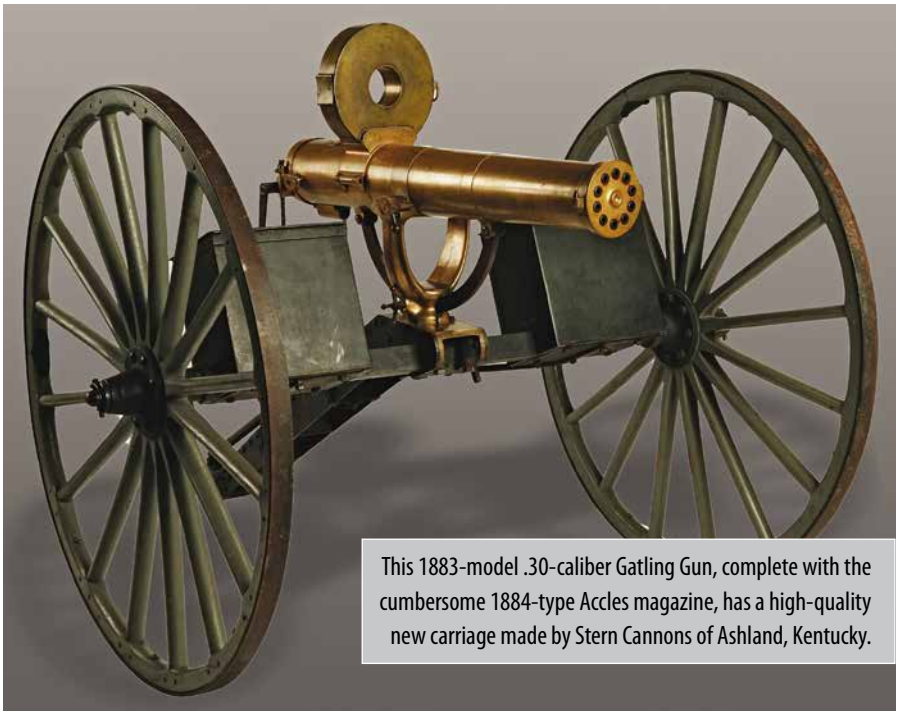
war. The dispute hangs on a contested attribution of the use of Union Repeaters at along the Potomac at Middleburg, Virginia, by the 28th Pennsylvania Volunteer Infantry on 29th March 1862. However, Colonel John Geary subsequently returned the guns as 'ineffectual and unsafe to the operators' and the story relies heavily on unsupportable hearsay; the claim for the large-calibre Confederate ➛Williams Gun, which was incontrovertibly used in the early Summer of 1862, seems the stronger. The first demonstrable use of Ager's gun took place at the Battle of Gaines Mills in June 1862, some five weeks after the first authenticated use of the Williams Gun.

The Union Repeating Gun fired the standard .58-calibre combustible paper cartridges from special capped-cylinders fed into the distinctive hopper on top of the breech, which gave it the sobriquet 'Coffee Mill Gun'. As the breech-handle was cranked, each cylinder was fed into the breech, fired, extracted and dropped down through the action into a receiving tray from which it could be retrieved and reloaded. When clean and in good order, the gun could attain a cyclic rate of about 120 shots per minute; unfortunately, ignition of the cartridges was suspect and some ignited only after they had been ejected. The breech was also difficult to close when the gun heated up or became foul.

The battery gun patented by William ➛Billingshurst and Joseph Requa of Rochester, New York, in September 1861 (U.S. no. 36488) was the first to use self-contained metallic cartridges, 25 of which could be loaded on a flexible metallic strip. A train of priming powder was then laid in a trough behind the breech, to be ignited by a conventional cap-lock on the side of the breech. The flash from this could reach the propellant in the cartridges through basal holes. The Billingshurt-Requa gun first saw action at Charleston, South Carolina, in 1863; however, it was susceptible to misfiring if there was moisture in the atmosphere and was often relegated to covered strongpoints. So many of these protected bridges and river crossings that the Billingshurst-Requa became known as the 'Bridge Gun'. Curiously, the U.S. Navy, which could have been expected to take damp-induced misfiring very seriously, formed an appreciably better opinion of the gun than the U.S. army!

The work of Ezra ➛Ripley of Troy, New York, and patented in October 1861 (U.S. no. 33544), the Ripley Battery Gun bore an external affinity with the later—and more successful—Gatling, though its barrels were fixed and it operated more in the manner of the Montigny Mitrailleuse. The detachable breech-block was loaded with standard .58-calibre combustible cartridges, which could be fired singly or as a volley by judiciously turning the crank-handle attached to the cascabel. The Ripley Gun was light and handy, but was poorly promoted and doomed from the outset.

Many interesting machine-guns were tested by the Federal and Confederate authorities, but few encountered success: the Mayall Revolver Cannon, patented in October 1860, ignited its combustible cartridges electrically, but its cyclic rate proved to be a mere twelve shots per minute and the army regarded it as a positive danger to its crew; the .50-calibre Raphael Gun, a slide-fed side-loader, was found to be too inaccurate when tested at Frankford Arsenal in August 1862; and the Douglas and Corry volley guns were too late to see service.



This 1883-model .30-caliber Gatling Gun, complete with the cumbersome 1884-type Accles magazine, has a high-quality new carriage made by Stern Cannons of Ashland, Kentucky.

The first Gatling Gun was patented by Richard Jordan ➔Gatling in November 1862 (U.S. no. 36836). A .58-calibre mechanical repeater, this fired standard combustible cartridges inserted in integrally-capped carriers—not unlike the Union Repeating Gun, though Gatling always denied this source of inspiration. The concept of a multiple-barrel cluster had been introduced by the DeBrame Revolver Cannon (patented in the U.S.A. in December 1861), but Gatling's was the earliest gun of its class to prove effectual. It achieved an impressive fire-rate by firing six times for each turn of the barrel cluster, though only the uppermost barrel fired. The earliest Gatlings were, however, far from the success that is usually assumed. They leaked gas severely and the method of wedging the cartridge-carriers into the breech made the crank handle difficult to turn.

By the middle of the war, the Gatling had been re-designed for .58-calibre copper-case cartridges carried in separate cylindrical inserts. Aligning the chambers and the barrel still proved problematical, so the breech-throats were tapered to handle any slight misalignment. Unfortunately, the accuracy of the pre-1865 guns was still very poor.

In 1862, Gatling demonstrated one of his guns before Governor Oliver Morton of Indiana, who was so impressed that he wrote to the Assistant Secretary of War recommending the new gun for official trials. Coupled with an effective Press campaign, and headlines like 'Two Hundred Shots a Minute' or 'A Substitute for Troops', the Gatling Gun was soon in the public eye. The first six were made by

Miles H. Greenwood & Co. in the Eagle Iron Works, Cincinnati, Ohio, but were destroyed by fire before they could be completed—allegedly due to Confederate saboteurs, lending spurious credence to unfounded allegations that Gatling's sympathies lay with his 'native South'.

With the backing of McWhinney & Rindge, another thirteen guns were subsequently made by the Cincinnati Type Foundry Company and an optimistic approach was made to the Federal army. Unfortunately, Rindge and Gatling crossed the path of Brevet Brigadier-General James Ripley, 'Old Fogey Ripley', the near septuganerian Chief of Ordnance who was apt to confide that his 'ideal weapon' was a flintlock musket. It seems that one Gatling was sold to the U.S. Navy, where trials were successfully undertaken in July 1863, while the remaining twelve guns were purchased by Major-General Benjamin F. Butler ('Beast Butler'), a political appointee in command of the Massachusetts Volunteer. There are, however, few reports of these guns seeing action.

Butler is known to have tested them in somewhat bizarre circumstances—against Confederates during an unofficial truce!—but his purchases of ammunition were insufficient for sustained firing and it seems probable that the Gatlings were relegated to point-defence. They rate no mention in Butler's autobiography. Similarly, it has yet to be proved that the gun purchased by Admiral David Porter ever saw action with his Mississippi squadron. Possibly the most interesting purchase of Gatlings during the war was of the three that defended the Times Building during the New York Draft Riots of July 1863. But even these did not have to fire a shot...

The first Federal army trial occurred in January 1865, when a four-barrel .58-calibre gun weighing 426 pounds on its wheeled carriage passed an impressive test at Washington Arsenal. A barrel had burst during the trials, but the lockpiece had simply been removed and the gun continued as a three-barrel. The success of the Gatling in these trials persuaded General Alexander Dyer, the Chief of Ordnance in succession to Ripley (who had been forcibly retired two years previously) to request development of 1-inch calibre gun that could take the place of the standard 12-pounder field gun for flank defence.

This gun was developed successfully, the first being made by the ➔Cooper Fire Arms Manufacturing Company in Philadelphia before work eventually passed to Colt. Cooper also made the last of the early .58-calibre guns. The story of the 1-inch Gatlings is outside the scope of this book; it suffices to say that the first trials were spectacularly successful, persuading General Winfield Hancock to order twelve for his army corps on the spot, and production continued until the mid 1870s. On 24th August 1866, General Dyer sanctioned a hundred-gun Gatling Gun contract. Made by ➔Colt's Patent Fire Arms Manufacturing Company, with which the Gatling Gun Company had contracted following the failure of Cooper to make guns that were sufficiently durable, these were delivered in 1867. Fifty were 1-inch calibre, the remainder chambering the .50 centre-fire service cartridge.

By 1870, successful trials had been undertaken in many countries and the negotiation of contracts with Russia (1868) and Turkey (1870) assured Gatling's

fortune. Guns had been sold to France, Prussia and Japan by this time, and a production licence granted to Sir W.G. Armstrong & Co. Ltd in Britain. Some idea of the performance of these early guns is necessary to appreciate why they were so successful in the decade after the end of the American Civil War—and why, indeed, they were able to co-exist with the truly automatic machine-gun well into the twentieth century. At a test in Karlsruhe, Baden, in 1869, one .50-calibre ten-barrel Gatling was pitted against a hundred picked men armed with needle-rifles. Firing for a minute at eight hundred paces, the Gatling fired 246 shots and obtained 216 hits. The riflemen managed a mere 196 hits from 721 shots in circumstances that favoured them. Hostile fire would undoubtedly have degraded their performance appreciably, but would have made very little difference to the Gatling.

British trials undertaken at Shoeburyness in the summer of 1870, in which .42, .65 and 1-inch Gatlings were pitted against breech- and muzzle-loading field guns, the Montigny Mitrailleuse, and a selection of infantry rifles showed that while the Gatling and Mitrailleuse performed similarly on static targets, the former obtained more hits by virtue of its easier manipulation. At 300 yards, for example, the Gatling had obtained 369 hits out of 616 shots in two minutes, compared with an impressive 171 out of only 185 for the Mitrailleuse; at 1400 yards, the figures had been 104 from 545 and 68 from 296 respectively. The most realistic trial, however, saw each of the guns firing at individual man-size dummies placed to represent a column 'retiring in loose order'. At 300 yards the Gatling scored twice as many hits as the Mitrailleuse; at 950 yards, the Gatling obtained 177 hits compared with only nine for the Mitrailleuse, whose inflexibility proved its Achilles' heel.

It took little imagination to picture the effect Gatling Guns could have on massed ranks, but the lesson was, curiously, applied only in Colonial Wars: very successfully at the battle of Tel el-Kebir in the Sudan in 1882, against the Zulus, or in some of the 'wars' undertaken by the U.S. Army with native Americans. Oddly, a myth arose that no European army would suffer against the Gatling Gun in the way that 'undisciplined savages' had done, as European officers would surely not send serried ranks into action against machine-guns. The myth was to be so costly in the Somme or Passechendaele forty years later.

THE SEVEN WEEKS WAR

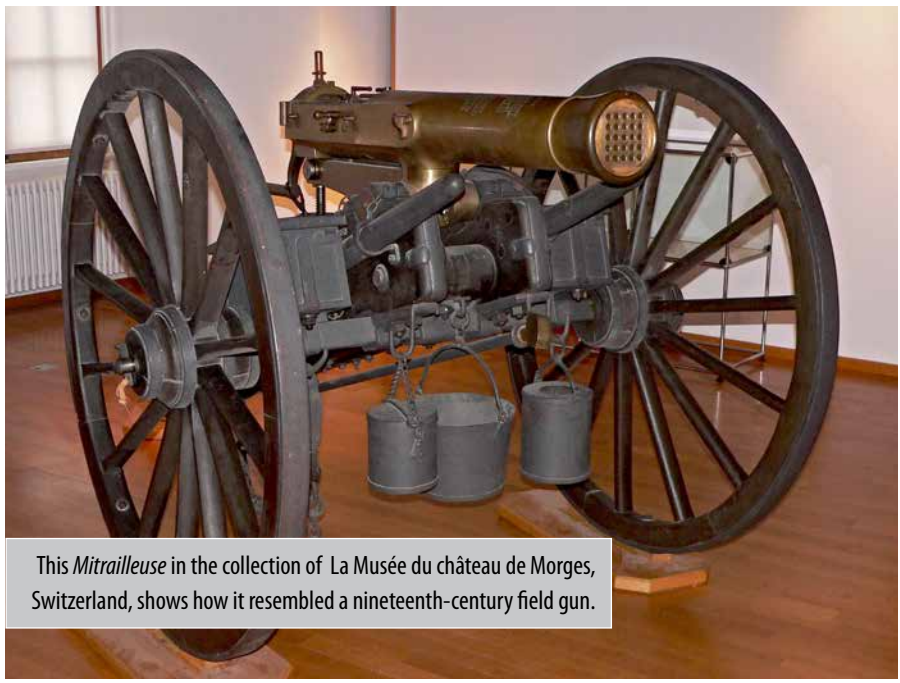
During this brief conflict, the Prussians had comprehensively outshot the vaunted Austrian army armed with conventional Lorenz rifle-muskets. The Prussians had armed with the comparatively crude ➔Dreyse bolt-action needle gun. The breech leaked gas, and the high, looping trajectory of the slow-moving bullet undeniably contributed range-gauging problems; the Prussian inventor had even buried the percussion igniter immediately behind the bullet, forcing the firing needle to run through the charge before reaching the cap. When the cap fired the main charge, the needle speedily corroded in the heat of combustion. Prussian soldiers even carried spare needles, noted the experts. But these 'experts' failed to appreciate

that the bolt system facilitated loading, particularly when the firer was prone or behind cover: factors that contributed greatly both to Prussian success and a lower than expected casualty rate.

FRANCO–PRUSSIAN AND NINETEENTH-CENTURY COLONIAL WARS

The resentment simmering between France and the steadily-uniting German states boiled over when, after some cunning political manoeuvring by Bismarck, hostilities began in the summer of 1870. Most uncommitted European observers expected the French to crush Prussian alliance, and it was widely believed that the southern German states—such as Bavarian and Baden—would probably be won over to the French side. But it was not to be: the war was a crushing victory for the Germans, and hastened the fall of Napoléon III.

The course of the war had been greatly helped by the poor quality of many French troops and by the inertia of their leaders. The principal weapons of the Franco-Prussian War were the ➔Dreyse needle-rifles carried by the Prussians and the Württembergers, and the ➔Werder and ➔Lindner-transformed rifle muskets of the Bavarians. Reporting to his government in 1869, Colonel Baron Stoffel (according to his *Rapports Militaires Ecrits de Berlin, 1866–70*, 1871) estimated that the troops of the North German Confederation could muster 1.5 million rifles and 140,000 carbines.



This *Mitrailleuse* in the collection of La Musée du château de Morges, Switzerland, shows how it resembled a nineteenth-century field gun.

On 15th July 1870, the Prussians had a total of 1,097,260 needle guns of all types (including 448,510 M1841 and 434,567 M1862 infantry rifles, 101,886 M1860 fusilier rifles, and 29,896 M1865 Jäger rifles). There were also 54,172 M1857 carbines in the hands of the cavalry. Against these, according to a survey taken on 1st July 1870, the French could field 1,037,555 Mle. 1866 Chassepot needle-rifles, 342,115 'à Tabatière' conversions of earlier muskets, and 1,989,401 smooth-bores of various types. There were also several hundred de Reffye *Mitrailleuses* in the French army: the vaunted 'secret weapon' which, the French believed, would drive the Prussian riflemen from the field.

By the end of the war, however, the Mitrailleuse had been crushed by the effectiveness of the German field artillery, which had also negated much of the advantage the Chassepot held over the improved Dreyse rifles. Casualties had been high: German losses amounted to 46,589 dead (killed, died of wounds, and missing presumed dead) and 127,867 wounded, while the French casualties were assessed as 119,805 dead and 143,066 wounded. In addition, at least nineteen thousand Frenchmen had died in captivity. Illness had also incapacitated many of the fighting men, the inclement winter of 1870–71 laying low no fewer than 84,000 men of the invading German armies in December 1870—fully ten per cent of their strength. It has been estimated that 328,000 Frenchmen 'fell ill' during the war.

Analysing the casualties showed that 93 per cent of the German casualties had been due to small-arms fire, while only five per cent had been due to artillery. On the French side the figures showed a marked difference—70 and 25 per cent respectively. Though the French continued to make Chassepots at a prodigious rate (about 122,000 new guns were made between 17th September 1870 and 22nd February 1871), the Germans had captured a fantastic 665,327 of these needle-guns during the fighting, together with a half-million assorted breech- and muzzle-loaders. As a result of the deteriorating supply situation, therefore, the French, desperate for weapons, had obtained about 1.5 million guns from Europe and the U.S.A. in 1870–71…in no fewer than ninety differing models. Most of these were acquired on behalf of the *Comité de la Défense Nationale*, and issued to the Gardes Mobiles and irregulars, but some nonetheless found their way to front-line troops. Guns such as Remington Rolling Blocks and Peabody dropping-block rifles were infinitely superior to the Chassepot and greatly valued by individual recipients, though lack of ammunition hindered their effectiveness on a broader scale. The same was true of the handful of Gatling Guns acquired in 1870, which offered far better performance than the cumbersome de Reffye Mitrailleuse.

The accuracy, general handiness and fire-rate of the Prussian needle guns (*Zündnadelgewehre*) was claimed as an important factor in the Seven Weeks and Franco–Prussian Wars even by some of the most respected historians of the twentieth century, who overlooked the value of the Prussian field artillery in 1870–71. Though the Dreyse rifle played an important role in the Seven Weeks War, when it had been pitted against conventional rifle-muskets, its ineffectiveness was more remarkable in the Franco–Prussian War than its advantages. The Dreyse shot very erratically at ranges greater than about eight hundred paces, which was roughly

The infantry weapons of the Franco-Prussian War were simiilar: needle-guns by Dreyse (Prussian) and Chassepot (French). However, only the latter could be converted to fire metallic cartridges.

the maximum effective range of its curious oviform projectile. Most sources suggest that the needle gun was more accurate than the Bavarian rifle-musket at all ranges below 800 paces, but that most 'second generation' breech-loaders were considerably more accurate than the Dreyse. In the Austro–Prussian War, most Prussians carried needle guns while the Austrians were at a disadvantage with their Lorenz rifle-muskets at anything other than long range: a style of combat which was very rarely favoured in Europe at the time.

In the Franco–Prussian War, however, the French had their own needle rifle. The success of the Dreyse had persuaded the French to adopt a variant firing a smaller bullet (11.43mm diameter) at a higher initial velocity to give a flatter trajectory. The *Fusil d'Infanterie Mle. 1866* (better known after its inventor, Antoine Alphonse Chassepot) would have been an improvement on the Dreyse had not the French, in their wisdom, used an indiarubber obturating washer to seal the breech. After a few shots, the heat of combustion destroyed the elasticity of the washer and the breech seal failed; the all-metal cone-seal Dreyse would continue to work, despite its occasional back-blast.

Needle guns were doomed by the inefficiency of their ammunition and had no lasting effect on firearms history, apart from adding further testimony to the potential of the bolt-action. The fire-rate of even the earliest Dreyse breech-loaders, notwithstanding that the firing needle had to be retracted before the bolt could be opened, was considerably greater than the contemporary muzzle-loading rifle-muskets. Compared with the guns that had preceded them, needle rifles were acceptably accurate even if loaded rapidly (provided careful aim was taken); the theoretically better accuracy of rifle-muskets usually deteriorated with speed, as speed meant forgetting to tamp the cartridge down properly with the ramrod, spilling some of the powder charge or fumbling the cap onto the nipple.

Howard Blackmore, writing in *British Military Firearms, 1650–1850*, records that firing ten rounds of muzzle-loading ammunition in 3½ minutes was regarded as a reasonable performance. The Bavarians regarded the average rate of fire for the Werder rifle to be ten rounds per minute 'from the pocket', or 14–15 for an experienced firer. There were reports of as many as 24 rounds per minute being fired; and, even in the 1869 trials, groups of 36 shots were fired in a little over two minutes (the best was 2 minutes 6 seconds) with such accuracy that they all hit a 9×4-foot target at 200 paces.

The vertices of projectile trajectories are very important in a military context, because a flat bullet-path minimised the effect of range-gauging errors. The *Zündnadelgewehre*, owing to their low muzzle velocity, were inferior to the standard rifle-muskets in this respect; they were also vastly inferior to the French Chassepot, which compared favourably with the contemporary metallic-cartridge rifles—for example, the Mauser, the Werder or the Martini-Henry. Nineteenth-century sources quote differing ways of assessing the flatness of trajectory, though most were based on calculations of the 'safe' zones for infantry and cavalrymen in each bullet path. These naturally varied according to distance, and whether the marksman was standing, kneeling or prone.

The French Chasspot was as effective at 900 metres as the Dreyse (with its high looping trajectory) was at 600; and that the 'third generation', the small-bore breech-loaders represented by the Gewehr 88 →*Reichsgewehr*, were as effective at 1200 metres as the Dreyse was at half that distance. Indeed, the original Dreyse, the *Infanteriegewehr M1841*, compared very unfavourably with the French Mle. 59 carbine…a typical short-barrel muzzle-loader. The maximum height of the Dreyse bullet above the bore, when firing at 600 metres, was a staggering 9.95 metres (more than 30 feet) compared with only about 7.8 metres for the French Mle. 59.

In addition, the maximum range of the standard M1862 Dreyse infantry rifle, only 1500 metres, compared badly with 2250 metres for the Bavarian Podewils-Gewehr rifle-musket, 2500 for the Mle. 66 Chassepot, and about 2900 metres for the Mauser M1871. Even in the Seven Weeks War, this had allowed the Austrian troops to open fire at much longer ranges than the Prussians; the difference was simply that the latter, with their breech-loaders, could make better use of cover. In the Franco–Prussian War, with both sides using needle guns, this Prussian advantage was negated.

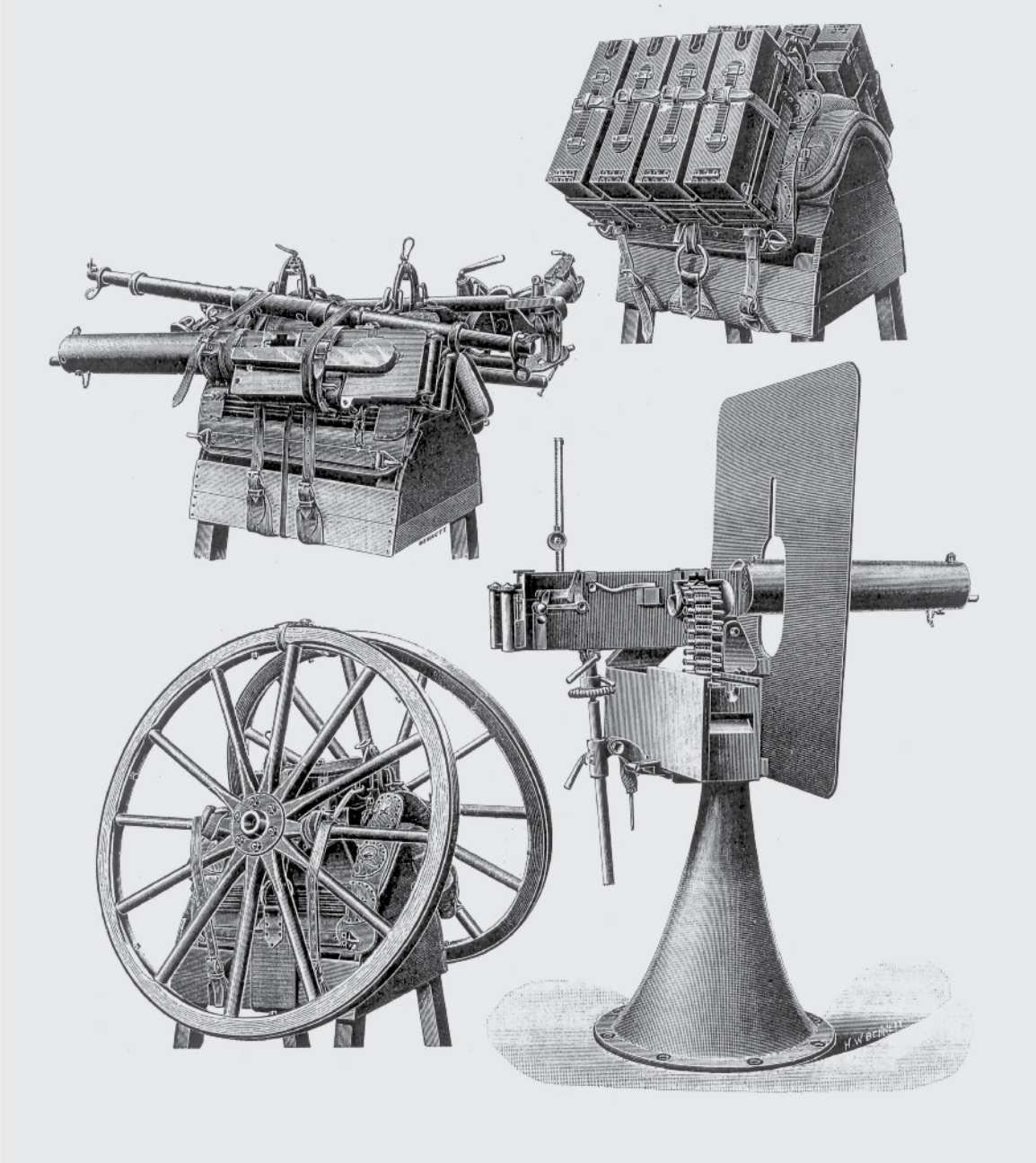
By the time of the Franco–Prussian War, the single-shot breech-loader was well established and most armies had replaced their rifle-musket conversions. Little Switzerland had even adopted the 10.4mm Vetterli bolt-action repeating rifle in August 1869 and the way ahead was plainly signalled. The Vetterli infantry rifle had a twelve-shot tube magazine under the barrel and could carry a thirteenth on the cartridge elevator. Though long and heavy, it conferred a considerable advantage on the Swiss infantryman. No real attempt was made to provide an 'elite' version of the Vetterli, though the *Repetierstutzer*, introduced in 1871, had a special set-trigger in the tradition of the Austro–Prussian Jägerbüchsen.

The Battle of Plevna (Pleven) during the Russo-Turkish War of 1877–8 showed not only that the single-shot breech-loader was doomed, but also that outnumbered (but well-protected) riflemen could still defeat infantry and cavalry advancing across open ground. During the first skirmishes on 20th July 1877, the six-thousand strong Russian vanguard attempted to storm well dug-in Turkish defenders in what was then accepted as a routine, if usually costly part of contemporary warfare. Attackers, armed with single-shot 10.6mm-calibre Berdan bolt-action rifles would be pitted against defenders firing block-action Peabody-Martini rifles of similar efficacy. Things went according to plan until the Russians were within 300 yards of the Turkish positions; the defenders put down their Peabodies and picked up lever-action Winchester repeaters. Within minutes the Russians had been routed; and a second assault, mustering thirty thousand men, suffered similarly. No fewer than 95,000 Russians tried again on 11/12th September, but were repulsed at a cost of twenty thousand Russians and 6200 Turks. Plevna remains the classic nineteenth-century demonstration of the superiority of the breech-loader.

The fighting for Plevna was contemporaneous with British campaigns in Africa and on the North-West Frontier, where the need for firearms suited to a wide range of climatic conditions was emphasised. Colonial powers often discovered that guns which worked perfectly on home service fell short of perfection abroad. The

The armies of the colonising nations—principally Britain and France in the second half of the nineteenth century—were often confronted by huge native armies with very little fear of death. Though breech-loading rifles and the first machine guns could cause terrible slaughter, even technology would fail if ammunition ran short.

The earliest machine-guns were so heavy that they were often seen as a form of light artillery. They could be accompanied by heavy mounts, including pedestals for static use, and by a range of accessories which could take several mules to move. These engravings of a Maxim are taken from the British periodical *Engineering* of March 1891.



Martini-Henry was no exception, encountering such severe extraction troubles in the heat, sand and dust of Suakin and Tel-el-Kebr that problems could no longer be suppressed. After an outcry in the Press, and a government inquiry, blame was laid on the .450-inch coiled-case cartridge that unwound under the African sun, leaving the separate case-head to be torn away by the extractor as the breech was opened. By the 1880s, with the adoption of an assortment of magazine breech-loaders, some of which offered the virtues of reduced calibre, the Eurpoean scene was in disarray. In 1887, however, the French had introduced the first serviceable small-calibre military rifle, firing an 8mm cartridge loaded with smokeless 'Poudre B'. The *Fusil d'Infanterie Mle. 1886*, better known as the ➛Lebel, had an under-barrel tube magazine. This could be a source of danger, as premature ignition could be caused by slamming the butt too hard on the ground—allowing the nose of the cartridges to smash into the primer of the round ahead of them.

Yet though the Lebel rifle offered no real advance on contemporary 11mm clip-loaded ➛Mannlichers, its cartridge represented a huge advance in efficiency. No less lethal than the big black-powder patterns it replaced, it performed far better at long ranges and was so much lighter that many more cartridges to be carried for a given weight. Where the French led, everyone was to follow.

The Spanish–American War (1898) and the Second South African or Boer War (1899–1901) both showed that the vaunted firearms of the major powers were lacking in efficiency. The U.S. Army found the Krag-Jørgensen to be very inaccurate, a problem which was eventually traced to poorly-made barrels and inefficient bedding, while the British were comprehensively outshot in South Africa by Mauser-carrying Boers. The Boers, it is true, were experienced fieldsmen and had a great advantage over the ill-led Britons; and their commando tactics so influenced the development of irregular warfare that the British, in particular, were to make good use of the lessons forty years later.

THE FIRST WORLD WAR

By the time of the First World War (1914–18), revisions had been made to the bolt-action rifles used by Britain and the United States of America. The British had created the 'Rifle, Short, Magazine ➛Lee-Enfield' or SMLE simply by chopping five inches off the barrel of the Long Lee-Enfield, revising the sights and fitting guides enabling the contents of two five-round chargers ('stripper clips' in U.S. parlance) to be fed into the magazine; the U.S. Army had simply replaced the Krag with a modified Mauser known colloquially as the ➛Springfield.

The SMLE was particularly vulnerable to criticism from the target-shooting fraternity, particularly after the politically-inspired adoption of the ➛Ross rifle in Canada. The Canadian Army had previously taken nothing but the standard British rifles and so the change in procurement was keenly felt. The Ross was everything the SMLE was not: long, very accurate and thus revered by target shooters. Agitation was such that the British War Office even promoted an experimental

modified Mauser, the '0.276in Rifle Pattern 1913' (P/13), to deflect criticism from the National Rifle Association, the gun trade and even its own experts. By August 1914, the SMLE, it had been decided, would be replaced with a gun based on the P/13. However, war caused the plans to be changed; not only was production of the SMLE accelerated, but the P/14—a modification of the P/13 chambering the rimmed .303in cartridge—was also ordered into production. The contrast between the short and handy SMLE and the long, cumbersome Ross Mark III and P/14 highlights another recurrent theme in military weapon design. In the pursuit of maximum effectiveness—the combination of reliability and 'killing power'—compromises must be made. The target shooters' ideal is rarely suitable for mass distribution to untrained men, and new or 'revolutionary' weapons rarely reach service status without protracted development.

During the opening phases of the First World War, the time-proven SMLE handled unusually well in the hands of troops trained in rapid-fire and the British Expeditionary Force held back numerically superior Germans during the Battle of Mons. Each Tommy, the Germans believed, had a machine-gun. Rapid fire had not been taught to the partially conscripted German armies, and they were caught very much by surprise by disciplined regulars.

Quite apart from the potentially lethal chance of reassembling the bolt without the lock-piece, the vaunted Ross ultimately proved a disaster in the mud of the Western Front—just as British trials has suggested it would be. Surviving Ross rifles were withdrawn from the dispirited Canadian troops in 1916 and replaced by the SMLE Mk III. Some remained in the hands of snipers, however, who appreciated their shooting qualities and could clean them as and when necessary out of the line. Before the war was over, though, most of the Rosses had been replaced by the P/14: heavy and unwieldy but with a stronger bolt system than the SMLE. Consequently, the P/14 proved especially popular with the British snipers.

Many senior British Army officers initially regarded sniping as 'Bad Form': ungentlemanly, and therefore not to be pursued by any civilised power. However, once the First World War had stretched past 1915 with no immediate end in sight, the British, having had a change of heart, found themselves impossibly short of suitable rifles. Commandeered Mannlicher, Mauser and Ross sporting rifles, as well as Long Lee-Enfields, received a curious selection of commercial optical sights until sufficient supplies of P/14 and the otherwise tempramental Canadian Ross Mark III had been assured. The P/14 usually received 4× Aldis optical sights; the Ross was issued with American-made 6× Warner & Swazey Telescopic Musket Sight of 1908 or 1913. Though the performance of the Warner & Swazey sights was surprisingly poor, they nonetheless came as a revelation to shooters used only to open sights. The Germans were better equipped, fitting selected (but otherwise standard) Gewehre 98 with excellent Zeiss, Goertz and Ajack optical sights. German snipers were elitist, and lessons learned from their activities promoted the sniper to a value that is appreciated today.

The First World War brought the first increase in elite forces in several decades. This was partly due to the increasingly stagnated nature of the trench war, which

The First World War was remarkable for the way in which tradition and technology attempted to co-exist. These four German artillerymen have a Mauser short rifle and an anachronistic sabre.

The German Maxim, the MG. 08, was the scourge of Allied attackers during the First World War. The upper picture shows a posed trenchscape; the lower, an MG. 08 retrieved from Turkey in the 1990s.

promoted sniping, and the success of the machine-gun. The crews of the German ➔Maxim and British ➔Vickers guns rightly judged themselves as elite units, though the subsequent issue of lightened guns to infantry machine-gun companies removed some of the gloss. By 1918, machine-guns had appeared on tripod mounts to provide sustained fire, on light bipods for close-quarter infantry support, as 'machine rifles', and in the air. The machine-gun had truly arrived. Water-cooled Maxim and Vickers machine-guns exacted a dreadful toll on the Western Front. However, these guns were very heavy—the standard German *Maschinengewehr-Gerät 08 (System Maxim)* weighed 62kg, 132lb—and required a crew of several men to manage them.

The emerging pattern of trench warfare soon indicated that while heavy machine-guns were excellent for static use, built into strongpoints in the defence system, lighter guns were needed to support the troops during advances across no man's land and into the ground commanded by the opponents' machine-guns. The Germans simply lightened the MG.08, producing the MG.08/15, but this was still water-cooled, clumsy, weighed 18kg (40lb) without the coolant, and was usually serviced by four men.

Strangely, the Germans all but ignored the air-cooled ➔Bergmann machine-gun, weighing a little under 29lb without its small tripod, and restricted the efficient ➔Parabellum to aerial use. The young Erwin Rommel, famous for his role in a later war, commanded a Württemberg mountain unit on the Italian Front during this period. Among the guns especially favoured by his unit was the ➔Madsen light machine-gun, purchased in Denmark, which provided an effective combination of mobility and firepower some years ahead of its time. With their top-mounted magazines, these Madsens proved to be far better machine-rifles than the MG.08/15, and were greatly prized.

At the outset of war, the British had acquired small numbers of light machine-guns developed by an American, Colonel Isaac ➔Lewis, but made by BSA. Though the Lewis was very prone to jamming, owing to its spring-operated pan magazine and rimmed cartridge, it weighed only 26lb and could be carried in the manner of a large rifle. Despite its weaknesses, six Lewis Guns could be made for each Vickers Gun and were to provide indispensable infantry support.

In 1915, the French adopted a light machine-gun (a *Fusil Mitrailleur*, 'automatic rifle') known as the CSRG or ➔Chauchat. Despite poor performance, the Chauchat was well suited to the French technique of firing from the hip while advancing. Converted for the powerful U.S. .30–06 round, whereafter it performed even worse than the original, the Chauchat was adopted to alleviate shortages of machine weapons when the U.S. Army entered the First World War.

The failure of the Chauchat in U.S. Army service inspired John ➔Browning to develop the Browning Automatic Rifle ('BAR'), now often considered to be the true prototype assault rifle. The BAR was large, weighing about 16lb in its original guise, but light enough to be used from the shoulder by the specially selected men to whom the rifles were issued. A twenty-round detachable box magazine, protruding beneath the receiver, provided more than adequate firepower in 1918.

Though manufacturing problems occurred with the early BAR—hardly surprising, considering the haste in which it had been readied for service—the rifle was well liked. In the post-war period, however, its role was scrutinised, a bipod was added (increasing weight by more than two pounds), and the BAR became more of a light machine-gun than a true automatic rifle. Lacking a quick-change barrel, the modified Browning Automatic Rifle was tried and found wanting against guns such as the Madsen, the Czech ZB vz/26 and the Bren, though derivations were made in Belgium, Sweden, Poland and elsewhere during the 1930s.

During the First World War, the Germans and Austro-Hungarians evolved the concept of *Sturmtruppen* ('storm troops'): heavily armed raiding parties which relied on little more than their firearms and grenades. Close-quarter fighting promoted the use of trench daggers, clubs and sharpened spades, but one of the solutions to the problem of providing additional close-range firepower was found by the Germans in the long so-called 'Artillery Luger' (*lang Pistole M.1908*) paired with a 32-round drum magazine. These semi-automatic pistols were scarcely ideal, as the magazines jammed too easily and projected clumsily below the gun-butt, but they encouraged unconventional developments. In 1918, therefore, the first true submachine-gun appeared. The ➔Bergmann MP.18,I retained the cumbersome drum magazine associated with the long-barrelled Parabellums, but could fire automatically at 600 rounds per minute. Though perhaps less than fifty thousand had been made prior to the Armistice, the MP.18.I was to have an impact disproportionate to its numbers.

THE GREAT PEACE

The period after 1919 was intended to be one of peace, and very little firearms development reached fruition. Most of the efforts were devoted to perfecting machine-guns and large-calibre cannon, but the U.S. Army took the opportunity—after trials lasting more than a decade—to introduce the 'Rifle, Caliber 0.30, M1', better known as the ➔Garand after its inventor. The Garand was the first self-loading rifle to achieve universal issue, though this had not been completed by the time the U.S. Army entered the Second World War in December 1941 and many units went to war armed with the bolt-action Springfield.

The Garand was another of the many designs that attracted considerable criticism, failing the standard British dust and mud tests, but which war was to prove to confer a considerable advantage on its firers. The worst feature of the rifle was its idiosyncratic clip-loaded magazine, which prevented the action being loaded with loose rounds; and the magazine capacity (a mere eight) was also subsequently regarded as too small. In terms of rate of fire and, most importantly, ease and comfort of firing, the Garand was a vast improvement on its bolt-action predecessors: the considerable physical effort expended on manipulating the bolt-action rifles was avoided, minimising fatigue, muscle tremors, increases in blood pressure and consequent deterioration of accuracy.

In the early 1930s, the rise of Germany panicked many European countries into developing new light machine-guns. In this period, the tactical employment of machine-guns was dissected, to be analysed over and over again even though most armies remained convinced by pre-1918 dogma: heavy support guns, generally water-cooled, reinforced by box-fed light guns for close-quarter fire support when mobility was pre-requisite. By 1939, Britain had the Vickers and the ➔Bren Gun, while Russia had the Maxim and the light, pan-fed ➔Degtyarev. The French, going a stage farther, had adopted the box-fed *Fusil Mitrailleur Mle. 1924/29* ('Châtellerault') for widespread issue, and a curious drum-fed MAC 31 for static use in the Maginot Line and aircraft. Once again, war was to provide conditions under which peacetime developments were to be judged, and not all of them would be successful.

THE SECOND WORLD WAR

Considerable experimentation between the wars had improved the quality of small-arms almost universally, but had had little effect on the design of the weapons of the rank and file. Thus, the initial Wehrmacht successes during the early campaigns of the Second World War owed more to mechanisation—the Panzers, particularly—and the perfection of aerial dive-bombing against lightly defended positions.

Apart from the adoption of the Garand by the U.S. Army in 1936, which had excited controversy, the Allies had achieved little; the British Army had the new, highly efficient Bren Gun, but the infantry rifle was still the bolt-action 'Rifle, Short, Magazine Lee-Enfield' in a form little changed from 1918. Only the Russians had much to show for the experiments with automatic rifles that had obsessed most European armies in the 1930s: the majority view was exemplified by the British, who still regarded them as wasteful of ammunition and lacking in durability.

The Red Army had tried the ➔Simonov-designed AVS in Manchuria, where Japanese incursions had been comprehensively rebuffed, but such a lightweight rifle—a little under 9lb empty—was too flimsy to sustain automatic fire with the standard 7.62mm cartridge, quite apart from the maltreatment associated with service conditions. Throughout firearms history, this has been a recurrent theme: promising designs have often failed merely because they were insufficiently strong. Surviving Simonovs were expended in Finland during the Winter War, the complicated, rather fragile guns being superseded in 1938 (after protracted trials) by the ➔Tokarev-designed SVT.

Adopted in February 1939, the pre-production SVT shared some of the weaknesses of the Simonov. Procurement was soon suspended while an improved AVS was tested, but Simonov was less acceptable politically than Tokarev and the first true SVT rifle was assembled in July 1939. Experience in the Winter War revealed so many weaknesses that the SVT38 was withdrawn again, to reappear in April 1940 as the 'SVT40'. Huge quantities of Tokarevs were made (more than a million in 1941 alone), but series production was bedevilled by constant problems.

Bitter first-hand experience in the Winter War against the Finns, in 1939/40, had taught the Russians the value of well-trained snipers. Among the thorns in their flesh was Simo Hähyä, a farmer who had won many pre-war marksmanship trophies. Attached to a unit on the Karelia Front, Häyhä, firing an open-sighted Model 1928 rifle (a Finnish Mosin-Nagant), killed more than five hundred Russian soldiers in fifteen weeks.

As a result of experiences in Finland, the Russians selected the most accurate Tokarev rifles for snipers' use, fitting them with telescope sights, but the SNT40 proved appreciably less reliable than the solid Mosin-Nagant bolt-action 1891/30 pattern. The latter was ordered back into production in 1942 and remained the standard Eastern Bloc sniping rifle until 1963. The best of the Russian snipers preferred the 1891/30 to the semi-automatic for reasons that are as relevant today as they had been in 1941: the manually-operated rifle was more reliable, less prone to structural failure and had no mechanical noise in the action. This was particularly important if silence was essential, as the ejection/reloading cycle of the SNT was accompanied by considerable clatter.

Despite the troubles originating from the disruption of manufacture after the German invasion of Russia in June 1941, the Tokarev was by no means a total failure. Provided it was kept reasonably clean—a stricture still applying to most automatic weapons—it functioned satisfactorily enough in the hands of good-quality troops such as the Russian marines. Poor equipment would not have been tolerated by the Soviet snipers, who were rightly respected by their opponents and extracted a terrible price for the German invasion.

Snipers also made their presence felt in the Pacific, where the Japanese not only became past-masters in the art of concealment but also had a degree of fanaticism sufficient to persist long after most Western marksmen would have prudently withdrawn. The lessons were not lost on the Americans, while, even at Arnhem, the Germans feared British snipers largely because the latter were taught to aim only at the head if the circumstances permitted.

At the commencement of the war, the Germans, despite their spectacular successes, were lacking in advanced small-arms. The standard infantry weapon was the strong, acceptably accurate but somewhat cumbersome Mauser-type bolt-action Kar. 98k, 45.6in overall, weighing 8.85lb and taking five 7.9mm rounds in an internal magazine. The rifle was supplemented by a comparatively new air-cooled medium machine-gun, the MG. 34, developed clandestinely in Switzerland in the early 1930s and adopted after experiments in Hungary and elsewhere. The belt-fed MG. 34 was appreciably lighter than most of its predecessors, very well made and efficient under normal conditions…though, when the Germans became bogged down in Russia and the Western Desert, demonstrating a notable tendency to jam, its excellent manufacturing standards and minimal tolerances proving an unexpected Achilles' Heel.

While the MG. 34 jammed, the archaic-looking Degtyarev light machine-gun, so crude by German standards, proved extremely reliable under adverse conditions. That impeccable quality did not guarantee efficiency was not lost on

Fighting a large-scale war made unprecedented demands on weapons-manufacturing capacity. Production of these Mk III* Lee-Enfield ('No. 1 Mk III*') rifles and their No. 4 successors ran into millions during the world wars.

the Germans, however, and has had a lasting effect on firearms development. The German armies also had MP. 38 and MP. 40 ('➔Schmeisser'), submachine-guns to provide a good volume of fire at the expense of chambering a pistol cartridge with limited effective range.

The Germans used their automatic weapons to good effect in the early campaigns, including the daring capture of Fort Eben Emael in Belgium in May 1940. However, the impetus for the development of special forces was soon to swing to Britain, desperately facing up to the threat posed by German troops in the Pas de Calais and haunted by the bitter memories of the near-debacle at Dunkirk.

THE POST-WAR ERA

No sooner had Germany capitulated in 1945 than Allied weapons experts seized their chance to interrogate their opponents. Secretly, many Anglo-American specialists were prepared to admit that there was much to learn. In addition to the FG. 42 and the MP. 43/StG. 44 series, not forgetting the incomplete StG. 45 project and the highly-rated MG. 45V light machine-gun, there were countless interesting projects to examine.

The Russians had been first to act. They have claimed that their experiments with 'intermediate' cartridges began before the Second World War, which is undeniably true. However, these appear to have concerned pistol-type cartridges, and the inference is that the Simonov and other carbines were directly comparable with the U.S. .30 Carbine M1 rather than the MP. 43. Too many modern writers have swallowed Soviet propaganda that they had outguessed the Germans!

The MP. 43 had shown the Russians that their policy of mass attack, then based around the crudely effective PPSh-41 submachine-gun, would be improved greatly by an assault rifle. Shortly before the war ended, the Russians had produced an adaptation of the German 7.9mm Kurz cartridge known as the Model 43, but had been unable to develop an effective gun. The trials had, however, produced the promising gas-operated Simonov and ➔Kalashnikov prototypes. Both were ordered into limited production, probably with a view to undertaking mass trials in the manner popularised by the Germans. Simonov's SKS entered service in 1945; Kalashnikov's more radical AK appeared two years later.

The first trials showed that the Kalashnikov required more development, and the more conventional SKS was ordered into mass production. Though discontinued in Russia about 1952, it proved to be so popular elsewhere that work continued in the People's Republic of China and other satellites for many years. Once the AK-47 had been perfected, however, the Soviet Army retained the SKS only for ceremonial duties.

The gas-operated AK, locked by a turning bolt, fires its M43 intermediate cartridge—with a 122-grain bullet—at about 2460 ft/sec. It is acceptably accurate and, particularly when fitted with the perfected compensator, surprisingly stable in automatic fire. Since its inception sixty years ago, however, changes have been

The rigours of combat often reveal flaws in the design of weaponry which may not be evident in trials or peacetime service. Even the M1 Garand (shown here in a modernised form), generally regarded as an outstanding success, struggled to gain acceptance in the U.S. Army of the late 1930s. *Courtesy of Springfield Armory, Inc.*

made: the improved AKM, introduced in 1958, was much lighter, and subsequent reductions in calibre (to 5.45mm) have flattened the looping trajectory of the original 7.62mm cartridge. The Kalashnikov remains most people's concept of an assault rifle. In excess of seventy million have been made in several countries, receiving so much media exposure in the hands of guerrillas, urban terrorists and 'freedom fighters' that its silhouette is easily recognisable.

The original AK was a short and rather clumsy gun, comparatively heavy at 10.5lb laden, but its efficiency belied its crude construction. The Kalashnikov is simply the latest in a long line of small-arms embodying the post-1917 Russian philosophy that nuances of construction or finish are irrelevant, assuming that the guns work efficiently and are sufficiently robust for service.

Though the Russians were quick to follow the German lead, the remaining Allies were much more sceptical. Once again, the old problem of maximum effective range took precedence. Though analysis of the German 7.9mm Kurz cartridge, the MP. 43 and the other experimental *Sturmgewehre* showed their merits, the U.S. Army, particularly, refused to countenance cartridges whose maximum effective engagement range was only 400–500 metres.

Immediately after the war, using a mixture of German, Polish emigré and indigenous research, the British produced EM-1 (➔Thorpe) and EM-2 (➔Janson) rifles around a special .280in cartridge, firing a 140-grain bullet at a muzzle velocity of 2535ft/sec: less powerful than the U.S. 30-06, it was true, but better than the lighter German 7.9mm Kurz. The roller-locked EM-1 had soon been discontinued in favour of the EM-2, which had a modified Kjellman flap-lock, and the British government optimistically entered the EM-2 in the NATO trials of 1951–2. The new rifle had several obvious advantages: its 'bull-pup' design, with the magazine behind the pistol grip, permitted a standard-length barrel in an otherwise compact design. Minor, but by no means insoluble problems appeared during the trials—the guns were not particularly accurate, and had an assortment of teething troubles—but the U.S. Army was so opposed to the EM-2 that the project foundered amidst recriminations and allegations of deliberate bias. Even though some later EM-2 rifles chambered the 7.62mm T65 (the precursor of the 7.62×51mm NATO) and even the bigger U.S. .30-06, the design disappeared into history.

The U.S. Army adopted the *Rifle M14*, little more than an updated Garand, most remaining NATO powers taking variants of the FN-designed *Fusil Automatique Leger* ('FAL'). The British accepted the Belgian gun in the interests of standardisation, production of the slightly modified 'Rifle 7.62mm L1A1' beginning in the Royal Small Arms Factory and at BSA Guns Ltd in 1956.

The Korean War of 1950–3 was fought on comparatively conventional lines, with the small-arms that had served since the Second World War. In addition, most of the special forces that performed so well prior to 1945 had been stood down or disbanded. After Korea, however, a perceptible change in warfare occurred. Gone was the classic large-scale confrontation between major powers; instead, the fragmentation of the great colonial empires promoted the 'freedom fighter'—a guerrilla, often but not inevitably communist-motivated, determined to overthrow

the existing order and then impose his ideology to bring order from the resultant chaos. Nowhere was this more obvious than in poor countries where no attempt had been made to educate the indigenous population, or where national borders had been drawn with no regard for tribal demarcation.

Though small-scale 'traditional wars' arose in the Middle East and the Indo-Pakistan sub-continent, the involvement of the Great Powers has been comparatively limited; most of the conflicts have been between opposing guerrillas, guerrillas and local authorities, or guerrillas and supposedly powerful Western nations.

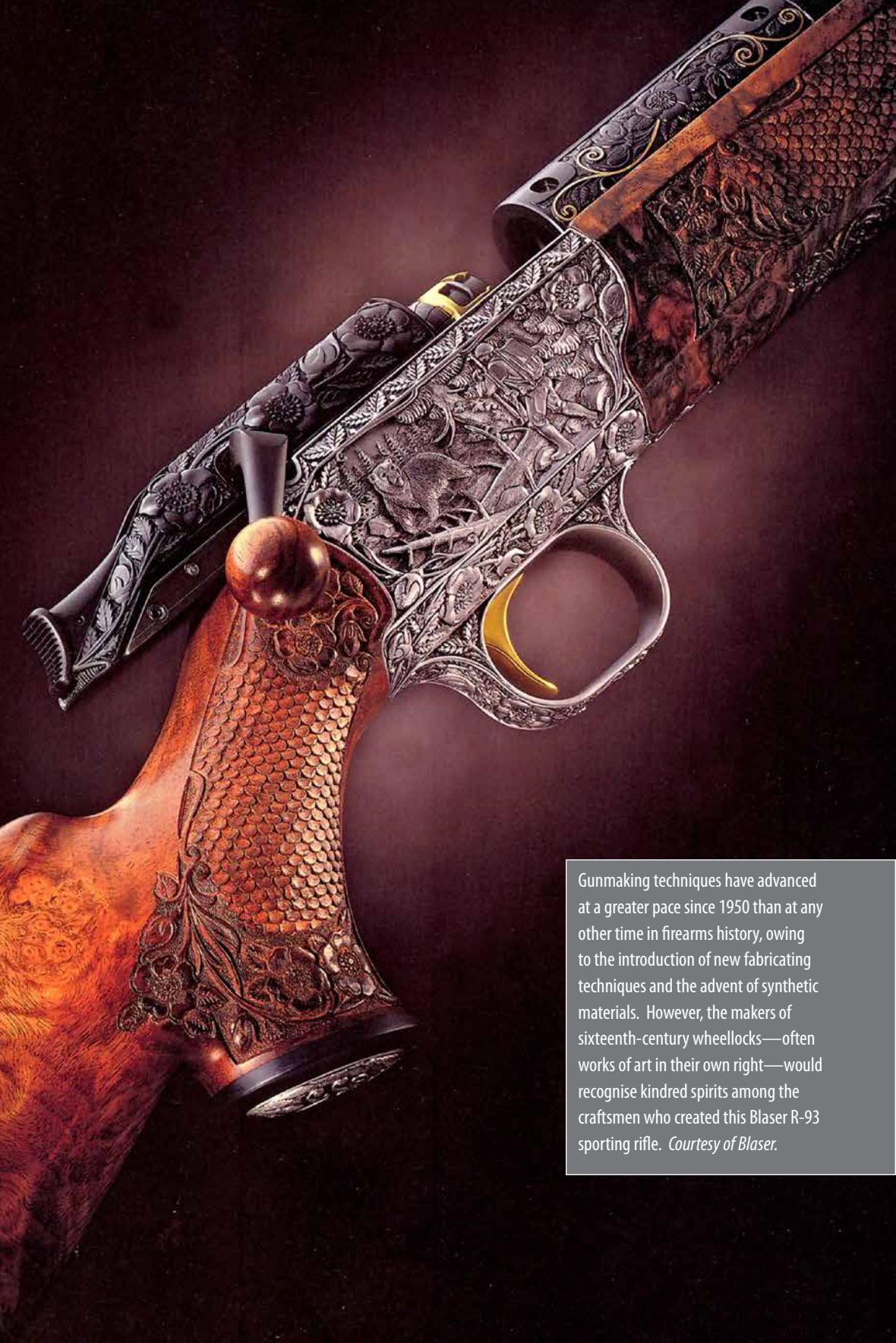
One outcome of the change in warfare has been the erosion of traditional industrial supremacy, which is rarely capable of alone defeating guerrillas who can carry the sympathy of the people with them. Confrontations between the French and the Viet Minh in the First Indo-China War (1946–54), for example, showed that Western strategists often underestimated their comparatively weakly armed opponents, hastening in the ignominious French withdrawal from Indo-China. Many of the lessons were lost on the Americans, whose embroilment in Vietnam (1961–73) never wholly subdued the Viet Cong in fighting that could be brutal and bloody in the extreme.

For all the millions of tons of bombs, defoliant chemicals, shells and small-arms ammunition expended during the conflict (and the loss of over fifty thousand American lives), the communists eventually gained not only Vietnam, but also neighbouring Cambodia. Nor could the Portuguese halt nationalism in Angola or Mozambique; and the Belgians were panicked into withdrawing from the Congo. Experience in the Yemen, Central America and Afghanistan makes the point over and over again: guerrillas are rarely conclusively defeated solely by the non-nuclear military might of even the most powerful industrialised nations (whose politicians are rightly wary of all-out war).

Among the few qualified successes in a catalogue of misfortune are the British exploits in Malaya (1948–60) and the rebuttal of Indonesian infiltration in Borneo (1963–6), where emphasis was put on fighting irregulars on their own terms—but with all the sophisticated back-up available to a modern soldier. Yet the brutality of parts of these campaigns would not be acceptable in today's liberalised society.

The increase of fighting such as encountered in Malaya and Borneo gradually changed attitudes to small-arms. During the 1950s, most NATO-aligned armies had adopted the comparatively cumbersome FN rifle, the FAL, which weighed about 11lb loaded and measured 44in overall. Despite its undoubted power, impeccable reputation and suitability for long-range fire, the FAL was no more appropriate for jungle warfare than the equally large and powerful U.S. Rifle M14.

During the early Vietnam campaigns, the U.S. Army—such a strong advocate of power in the trials that had caused the demise of the British EM-2 rifle in the early 1950s—suddenly decided to seek a smaller gun firing a lighter, handier cartridge. As the wood of the M14 stocks rotted in the tropics, the new gun was also to feature a synthetic butt and fore-end. After protracted testing, the ➔Armalite rifle, designed by Eugene ➔Stoner, became the 'Rifle M16'. Built around the commercial .222in Remington sporting rifle cartridge, which had proved itself against thin-



Gunmaking techniques have advanced at a greater pace since 1950 than at any other time in firearms history, owing to the introduction of new fabricating techniques and the advent of synthetic materials. However, the makers of sixteenth-century wheellocks—often works of art in their own right—would recognise kindred spirits among the craftsmen who created this Blaser R-93 sporting rifle. *Courtesy of Blaser.*

skinned game, the M16 represented a great reduction in rifle weight and allowed an individual soldier to carry more of the lightweight cartridges (182 grains compared with 396 for the standard Cartridge, .30, Ball M2). The finalised M16, together with its loaded thirty-round magazine weighed a mere 8.7lb!

The M16/M16A1 series has been purchased for Limited Theatre use by the British Army, and was particularly popular in Borneo. The worst problem has concerned the American 5.56mm M193 bullet which, though undeniably very destructive at short range, is not especially effective beyond 400 metres and is readily deflected by branches and obstructions. The European compromise is a heavier slower-moving bullet (the SS109) and a faster rifling twist to improve stability. However, though this improves carrying properties appreciably, lethality is reduced compared with the M193.

After an inauspicious beginning, experience in Vietnam ultimately showed that the intermediate cartridge and (ultimately) the small-diameter bullet were suitable for combat use, indirectly confirming the advocacy of the Germans during the Second World War and the Russians thereafter. However, most of the 'traditional' wars contested by highly industrialized nations have nonetheless featured full-power cartridges. These have included the conflict between Iraq and Iran, the brief confrontation between Britain and Argentina in the South Atlantic in 1982, the Gulf War, and the war in Iraq.

Ironically, the British and Argentinian armies were armed similarly in 1982: both, for example, used FN-designed infantry rifles, general-purpose machine-guns and pistols. The principal difference lay in the light machine-guns, where the British Bren proved more serviceable than the Argentine heavy-barrelled FAL, and in support weapons. The open treeless expanse of the Falkland Islands proved to be more suited to the traditional concepts of infantry confrontation than, for example, the tropical jungles and sub-tropical rain forests of Malaya, Vietnam or Borneo. The fighting also reflected a more traditional role…

ORGANISATION AND TERMINOLOGY

And a note on sources of additional information

The dictionary has been organised on as logical an alphabetical basis as can be compatible with its goals, although punctuation, ampersands and some word breaks have been ignored. In addition, some businesses and many brand names (especially on shotgun ammunition) have always considered a prefatory 'The' as part of their title; these have been listed as 'Arms & Ammunition Company Ltd [The]' to minimise confusion.

Company names may cause problems if they are listed as 'Smith, James, & Sons Ltd', which could be a partnership of 'Smith' and 'James', or a business that had been started originally by a sole trader called 'James Smith' and subsequently expanded to include his sons. The style 'James Smith & Company' has been preferred here, even though it appears to disrupt alphabetical progression. The basis of classification, therefore, is effectively:

Smith
Smith [&] Company
Smith [&] Son
A.A. Smith
A.A. Smith [&] Company
A.A. Smith [&] Son
A.B. Smith
Smith [&] Brown
Smith Carbine
Smith Pistol
Smith Rifle
Smith, White [&] Company

Cross-references are indicated in several ways. Most simply say 'see Garand'. It is obvious in these cases that the keyword is 'Sharps' or 'Garand'. Where this is not so obvious, particularly as there is great scope for confusion in corporate names, the key word is either prefixed by the '↠' symbol or underlined (e.g., 'James Paris ↠Lee', 'Lee-Enfield').

Particular care is necessary with monograms, which can be difficult to decipher, but the problems are summarised in the relevant directory entry, and the most confusing examples have been listed under every combination of their individual letters! Brand names and trademarks have been listed wherever possible, but numerical designations have been ignored anywhere other than in the section devoted to an individual manufacturer. Thus details of the Remington Model 700 bolt-action rifle will be found in '↠Remington, rifles, bolt-action', but not under 'Model'. Numerical designations do not always appear on guns, and those that

do are often easily identified by referring to sources of information listed in the individual directory entries.

Some of the best-known ammunition makers are also included, alongside many headstamp codes. However, only the surface of this complex subject has been scratched. Proof marks may be identified from letters accompanying them, and the first attempts have been made to explain the abbreviations used by military formations (e.g, '→German military unit marks'). However, inspectors' marks have been largely ignored, with the exception of American examples; U.S. government inspectors customarily applied marks that can date other wise anonymous items.

TERMINOLOGY AND CORPORATE STRUCTURE

The introduction of limited liability, where the risks taken by promoters were restricted in law, brought a series of new abbreviations. Limited partnerships were formed by a general partner, who accepted complete liability, and a number of sleeping partners whose risk was limited only to their capital investment—but only if they took no part in running the business. These operations were known as *Société en commandit* in France, frequently abbreviated to 'S.N.C.'; as *Società in accomandita* ('S.I.A.') In Italy; and as *Kommanditgesellschaft* ('KG') in Germany.

True limited-liability operations in Britain were distinguished by 'Ltd' or 'Company Ltd', although, from 1977 onward, public companies have been identified as 'PLC' (public limited company). Similar businesses in the Netherlands are *naamloze vennootschap* ('NV'), and are *Aktiebolag* ('AB') in Sweden; Danish and Norwegian equivalents are usually identified as 'AS' or 'A/S'.

Public companies in France and Belgium are classed as *Société anonyme* ('SA'), the latter often gaining the additional qualification 'Belge' ('SAB'); comparable terms include *Società per azioni* ('SPA', SpA') in Italy, and *Aktiengesellschaft* ('AG') in Germany. Private companies, each formed in accordance with its own national rules, include *Société à responsabilité limitée* ('SARL', 's.a.r.l.') in France, *Gesellschaft mit beschränkter Haftung* ('GmbH') in Germany, and *Società a responsabilita limitata* ('SRL', 's.r.l.') in Italy. Any French company described as *Société Mixte* ('SM') is a partnership of private individuals and government agencies.

Additional information may appear in the form of 'Brothers' (often rendered simply as 'Bros.') and equivalents such as *Fratelli* ('F.lli', Italy), *Frères* (France and Belgium) and *Gebrüder* (Germany). Among the variants of 'Son' are *Sohn* (plural 'Söhne', German), *Zoon* (plural 'Zonen', Dutch), *fils* (French and Belgian), *Figlio* (plural 'Figli', Italian) and *Hijo* (plural 'Hijos', Spanish). Abbreviations for 'Proprietor', often itself listed simply as 'Prop.', include *Inhaber* ('owner' in German, *Inhaberin* if female). *Witwe* (German) and *Veuve* (French) both mean 'widow'.

The spelling of 'Liége' was altered officially to 'Liège' in 1946, reflecting changes in local pronunciation. The older form is preferred throughout the dictionary, as the greater part of coverage dates prior to 1945; however, 'Liégeois' and 'Liégeoise' (both still in use) are unaffected.

SOURCES OF INFORMATION

References to sources of additional information have been provided in many entries. Further details will be found in the 'Bibliography'.

General studies. *Firearms Past & Present* by Jaroslav Lugs, which has been published in Czech (1955), German (1962) and English (Grenville Publishing, London, 1973) is an underrated source of information, particularly as it takes a different perspective to the customary Anglo-American viewpoints. It also has an excellent bibliography.

Gunmakers. Among the studies of individual gunmakers are Johan Støckel's immense *Haandskydevaabens Bedømmelse* (Copenhagen, Denmark, second edition, 1962), reprinted in 1992 by Journal-Verlag Schwend of Schwäbisch Hall as *Der Neue Støckel*, with a third volume contributed by Eugen Heer. Although rarely intruding into the 'modern era', it is indispensable. Colonel Robert E. Gardner's *Small Arms Makers* (Bonanza Books, New York, 1963), understandably biased toward U.S. topics, was a pioneering and greatly underrated study which represented nearly fifty years of research. Its coverage may be inconsistent and occasionally very frustrating, with comparatively little attention paid to individual products, but these are minor flaws. Cataloguing British gunmaking has benefited greatly from the scholarly work of the late Howard Blackmore, whose *A Dictionary of London Gunmakers 1350–1850* (Phaidon–Christies, London, 1997) and 1999-vintage supplement are invaluable—particularly when supported by *English Gunmakers* ('The Birmingham and Provincial Gun Trade in the 18th and 19th century') by D.W. Bailey and D.A. Nie (Arms & Armour Press, London, 1978). The latter desperately needs reprinting in an enlarged and revised form. *Boothroyd's Revised Dictionary of British Gunmakers* (published privately, 1997), by Geoffrey Boothroyd and his daughter Susan, is another invaluable source of information.

John A. Belton's *Canadian Gunsmiths from 1608* (Museum Restoration Service, Bloomfield, 1992) is helpful, while Claude Gaier's *Five Centuries of Liege Gunmaking* (Éditions du Perron, 1996) is as attractive as its scholarship is excellent. *Le Qui est Qui de l'Armurerie Liégeoise* by Guy Gadisseur and Michel Druart (Éditions du Pécari [Atlantica], Biarritz, 2005) provides an indispensable directory of Liégeois gunsmiths. A similar role for the French gunmaking industry is fulfilled by the two-volume study *Le "Qui est qui" de l'arme en France de 1350 à 1970*, compiled by Jean-Jacques Buigné on the basis of initial research by Pierre Jarlier (Éditions du Portail, La Tour du Pin, 2001); and Yves Cadiou's *Grands Noms de l'Armurerie* (Crepin-Leblond, Paris, 1999) can help to refine detail.

Company histories. With the exception of an occasional sponsored, self-promotional or commemorative review (e.g., *F.N., 1889–1964* and the fiftieth anniversary history of DWM), and reprinted catalogues that give snapshots of individual activities, comparatively little information is available regarding any

These attractive, brightly-coloured cutaway drawings of the Heckler & Koch P7 (PSP) semi-automatic pistol appeared in a promotional brochure dating from November 1982. They are typical of the high-quality illustrations commissioned by large-scale manufacturers.

A rarely -seen leaflet advertising the P1 (P38), P5 and PP, dating from a time when Walther was celebrating its centenary.

but the best-known makers. Colt and Winchester are served almost to saturation, whereas the activities of Sauer and Savage (to name but two) have hardly received mention. Individually-sponsored studies of most lesser manufacturers, which are often excellent in themselves, merely highlight the difficulty of balancing manufacturing history with the details sought by individual collectors.

Excellent examples of the 'one company' studies are Lieutenant Colonel William S. Brophy's *Marlin Firearms* (Stackpole Books, Harrisburg, 1989), which delves into its subject in meticulous detail, and Harold F. Williamson's *Winchester. The Gun that Won the West* (A.S. Barnes, South Brunswick, 1962), which accepts that the history of a gunmaker is not simply that of the guns. Ellsworth S. Grant, in *The Colt Armory* (Mowbray Publishing, Lincoln, 1995), goes behind the scenes to show not only how the guns were made, but also how the manufactory operated.

Firearms. So many books deal with individual topics that it is impossible to recommend more than a few. Particularly useful, however, have been the all-enveloping *Small Arms of the World* (Stackpole Books, Harrisburg, eleventh edition, 1977), compiled by W.H.B. Smith, Joseph E. Smith and Edward C. Ezell; *The Greenhill Military Small Arms Data Book*, by Ian V. Hogg (1999); and *Military Small Arms of the World* (Krause Publications, Iola, seventh edition, 2000) by Ian Hogg and Colonel John S. Weeks. *The Handgun*, by Geoffrey Boothroyd (Cassell, London, 1976), and *Handguns of the World*, by Edward C. Ezell (Stackpole Books, Harrisburg, 1981), presented detailed overviews, whereas *Pistols of the World* by Ian V. Hogg, John S. Weeks and John Walter (DBI, Inc., Northfield, fourth edition, 2004), and *Rifles of the World* by John Walter (Krause Publications, Iola, third edition, 2006) took a directory approach. Detailed gun-by-gun listings, such as the *Gun Trader's Guide* (John E. Traister, ed., Stoeger Publishing Company, South Hackensack) and S.P. Fjestad's *The Blue Book of Used Gun Values* (Blue Book Publications, Inc., Minneapolis), are published annually in the U.S.A. Although these can subordinate history to observational details, they represent invaluable sources of information.

Airguns. There is still no reliable history of this particular subject, despite steadily growing interest. W.H.B. Smith's *Gas, Air and Spring Guns of the World* (1957) is out of date, and John Walter's *The Airgun Book* (the third edition of 1984 was the most historically orientated) has been out of print for many years. The later editions of Dennis Hiller's *Air Rifles* and *Air Pistols* (published privately in Britain) had much to offer, but the most comprehensive survey is currently *The Blue Book of Airguns* by Robert Beeman and John Allen (Blue Book Publications, Inc, Minneapolis, eighth edition, 2010).

Ammunition. There are several excellent sources of information concerning the history and identification of ammunition, not least being the work of Jakob H. Brandt and Horst H. Hamann in *Identifizierung von Handfeuer-Waffen Munition* (Journal-Verlag Schwend, Schwäbisch Hall, 1971–3). I am concerned mainly with recording aids to identification; thus works such as *The Cartridge Guide* by Ian Hogg

(Arms & Armour Press. London, 1982) are invaluable. I would also like to single out *Collecting Shotgun Cartridges*, by Ken Rutterford (Stanley Paul, London, 1987) for particular praise; although this would benefit from critical review, the book offers a tremendous amount of information.

KEY CROSS-REFERENCES

The entries below have been extracted from the main directory, partly because of frequent references and partly because it will be some time before the entire project has been uploaded in even its most basic form.

Cyphers, Imperial and Royal

Although the small-arms of many armies bear national markings, others are easier to identify by the markings applied by their kings, queens and emperors. Some of these were elaborate monograms; others were simply small crowned Roman letters.

Bavaria. The kings Leopold II (1864–86), Otto (1886–1913) and Ludwig III (1913–18) used a crowned cursive 'L' or a crowned 'O'.

Belgium. Kings Leopold II (1865–1909), Albert (1909–34), Leopold III (1934–50) and Baudoin (1950 to date) used the letters 'L', 'A', 'L' and 'B' respectively. The 'L' and 'A' marks are customarily cursive, whereas the 'B' is usually a Roman letter—often hatched horizontally in its largest sizes.

Britain. Prior to the accession of Queen Elizabeth II ('E. II R.') in 1952, only three cyphers had been used since the 1830s: 'V.R.' (Victoria Regina) by Queen Victoria between 1837 and 1901; 'E.R.' (Edwardius Rex) by Edward VII, 1901–10, and Edward VIII (1936 only); and 'G.R.' by George V (1910–36) and George VI (1936–52). Date determines which is appropriate. The marks on small-arms consisted simply of crowns above Roman letters, although each monarch also had a cursive cypher that could take a very different form from the simple version. While cursive forms often graced the hilts of swords, uniforms and accoutrements, they have never been reported on firearms.

Bulgaria. Prince Ferdinand I (Tsar from 1913) used a crowned 'F' from 1887 until superseded by Boris III (1918–43). Simeon II reigned from 1943 until 1946, but was deposed by pro-Communist forces before attaining his majority.

Germany. The cyphers of Kaisers Wilhelm I (1871–88) and Wilhelm II (1888–1918) took the form of an imperial or squared-top crown above 'W'; it is thought that the 'F' of Kaiser Friedrich III, who reigned for a few months in 1888, may never have been applied to small-arms. Imperial cyphers were used only on the weapons of the navy and colonial protection forces; the armies of Prussia, Bavaria, Saxony and Württemberg continued to apply their own royal cyphers.

Netherlands. King Willem III (reigned 1849–1890) was succeeded by three queens—Wilhelmina (1890–1948), Juliana (1948–80) and Beatrix (1980 to

A promotional leaflet published by Beretta U.S.A to highlight the adoption of the Beretta 92 ('M9') pistol by the U.S. armed forces.

date). Cyphers customarily take the form of a crowned 'W', 'J' or 'B'. In their larger applications. over the chambers of Mannlicher rifles or on the slides of FN-Browning pistols, for example. the letters were customarily outlined and hatched horizontally. Smaller versions, on the Parabellum pistols or edged weapons. were often simply small cursive letters beneath crowns.

Norway. The cyphers of King Haakon VII (1905–57) and King Olaf V (1957 to date) may be found on Krag- Jørgensen rifles and other military stores. They take the form of 'H' with '7' on the crossbar or 'V' within 'O' respectively.

Portugal. King Luis I (1861–89) used a crowned 'L I^{O}'; Carlos I (1889–1908) preferred an elaborate crowned 'CI' monogram, often found above the chambers of Mauser-Vergueiro rifles; and Manuel II, deposed in the revolution of 1910, adopted a large crowned 'M' with a small '2' looped around the point. 'M2' marks will be found on 7.65mm army-type Parabellum pistols.

Prussia. King Friedrich Wilhelm IV used a crowned 'FW' mark. This was superseded by a simple 'W' when Wilhelm I gained the throne. The King of Prussia became Kaiser of Germany in 1871, reigning as 'Wilhelm I' until 1888. He and his grandson, Wilhelm II (1888–1918) used crowned 'W' cyphers. There is no evidence that the mark of Friedrich III (1888)—presumably a crowned 'F'—was ever applied to small-arms.

Romania. Carol I (1881–1914) used an addorsed 'CC' monogram on behalf of himself and his consort, Charlotte of Luxembourg. Customarily encircled beneath a crown within a wreath of laurel, it will be found on machine-guns. Ferdinand (1914–27) is believed to have used a crowned 'F'; Míhaí I (1927–30 and 1940–7) adopted an elaborate monogram consisting of four crowned letters 'M' joining at their bases in the form of a cross. Carol II (1931–40) perpetuated the 'CC' monogram of his nineteenth-century predecessor.

Saxony. The cyphers of Kings Albert (reigned 1873–1902), Georg (1902–4) and Friedrich August III (1904–18) took the form of cursive 'AR', 'GR' and 'FA' beneath crowns.

Sweden. A black-letter 'C' beneath a crown appeared on many firearms made by the state ordnance factory is Eskilstuna, Carl Gustafs Stads Gevärsfaktori. This, however, should not be classed as a monogram, even though many Swedish kings have been named appropriately—e.g. Gustav V (1907–50) and Carl XVI Gustaf (1950–73). Oskar II reigned from 1872–1907, during the period in which many Mauser rilles were made.

Württemberg. Small-arms were marked simply with a crown over a Roman 'W', as King Wilhelm (1891–1918) shared his name with the Kaiser. However, a fraktur 'W' is commonly encountered on swords, uniforms and accoutrements , and may yet be reported on firearms.

Monograms

The penchant for these methods of marking dates back to the nineteenth century, the origins perhaps lying in the successful development of methods of moulding

rubber. These were particularly popular fittings on pre-1914 revolvers, the first perhaps originating in the 1880s. Unfortunately, the mould-makers were keen to show their skills in handling the tinest design-detail, resulting in technically highly impressive but often almost totally illegible results. This is particularly true of concentric or superimposed lettering, though linear designs are often (but not always) significantly easier to read.

There are three basic types of monogram: superimposed, with the letters on top of each other or intercutting; concentric, when they take a circle-within-circle form; and linear, where the letters, though conjoined, are in a sequence that can be read as a continuous string. However, the characteristics can be blurred by superimposing only a few of the letters. This makes it difficult to decipher monograms—letter forms may be too distorted, or the dominant letter difficult to determine—and they have been listed in the dictionary under each of the most obvious permutations. A mark that apparently reads 'ABC', therefore, could be listed under 'ACB', 'BAC', 'BCA', 'CAB' or 'CBA' and it may be necessary to try several possible sequences before an answer can be found. A monogram containing five letters of equal significance has 120 permutations, so attempts have been made (helped by the subordination of 'CO.' or 'Co.', for 'Company') to the name to assess dominant letter(s) in each trademark in an effort to keep entries to a minimum.

National Markings

The absence of countries or states from this list indicates either that they applied no marks which could be classified as 'national', or, alternatively, that no reliable information has been obtained. Arms have often been changed when crowns have changed hands, when republics have superseded monarchies, or with the addition (alternatively, loss) of provinces and colonies; consequently, the notes that follow are merely as guidelines. In addition, restrictions of space have often forced the die-engravers to simplify or even omit details. ➛'Cyphers, imperial and royal'.

Argentina. Found on stores ranging from Maxim machine-guns and Mauser rifles to Ballester-Molina pistols, bayonets and accoutrements, the national Arms consisted of an oval shield containing two hands clasping a Phrygian or 'Liberty' Cap on a pole within a wreath of laurel, generally surmounted by a sunburst (Sol de Mayo). Inscriptions will be in Spanish, and may be accompanied by 'E–A' or EJERCITO ARGENTINO.

Australia. No readily identifiable national marks have been used, other than 'D' or 'DD' ('Department of Defence') and the marks applied by individual states—e.g., 'W.A.' for Western Australia or 'TAS.' for Tasmania. Many state-marks were applied before the 1900 confederation.

Austria. Some post-1945 guns will bear a displayed eagle mark, often accompanied by 'BH' (Bundesheer, 'state army'). The Austrian eagle has a single head topped by a mural (or 'civic') crown, and a breast shield charged with a single horizontal

bar. One talon holds a hammer, while the other clasps a sickle; broken shackles signify release from oppression.

Austria-Hungary. No national marks were applied, though the double-headed Habsburg eagle was used as a military proof mark.

Bavaria. National markings were rarely used on small-arms, though the shield of the state Arms—a distinctive 'lozengy' pattern—is perpetuated in the mark applied by the München proof house. See also 'Cyphers, imperial and royal'.

Belgium. No specific national marks have been identified. See also 'ABL', 'GB' and also 'Cyphers, imperial and royal'.

Bolivia. The arms consist of a shield bearing a depiction of Potosi mountain in a landscape, with a breadfruit tree, a llama and a wheatsheaf, within a circlet containing the name of the country and nine stars. The Arms are customarily surmounted by an enwreathed condor and backed by a trophy of two crossed cannon, four bayonetted rifles, and three pairs of national flags. One cannon-mouth holds a Phyrgian Cap; the other contains an axe. The marks may be found beneath EJERCITO DE BOLIVIA ('Bolivian army'); inscriptions will be in Spanish.

Brazil. Customarily accompanied prior to 1968 by ESTADOS UNIDOS DO BRASIL (or simply 'E.U. do Brasil'), the crest consists of a large five point prismatic star impaled on a sword, point uppermost. A constellation of five stars, the Southern Cross, lies within a circlet of small stars on the centre of the prismatic star; the circlet originally contained twenty stars representing the original provinces, but the total was increased to 21 in 1960, to 22 in 1962, to 23 in 1977, to 24 in 1981 and finally to 27 in 1989. Marks found on weapons ranging from Mauser rifles to Madsen submachin-guns and FN FAL rifles customarily have twenty-star circlets. The device is generally contained within a wreath of laurel and coffee leaves, and may be placed on a stylised sunburst, particularly on post-1930 guns. The legend ESTADOS UNIDOS DO BRASIL and 15 DO NOVEMBRE DE 1889 (the date of the formation of the Brazilian republic) may be found on a scroll. Property marks may take the form of the letter 'B', for 'Brazil', usually within a circle or an encircled six-point star. Inscriptions will be in Portuguese, highlighted by a preference for 'Berlim' (Berlin); EXERCITO BRASILEIRO ('Brazilian army') has also been widely used.

Britain. No national marks have been used, though the 'BO' of the Board of Ordnance (prior to 1855) and the 'WD' of the War Department (post-1855) will be found with the Broad Arrow. See also 'Cyphers, imperial and royal'.

Bulgaria. The Arms comprised a lion rampant on a shield, sometimes, especially on older guns, superimposed on a pavilion and supported by two lance-bearing lions. This was replaced early in the twentieth century by a rampant lion on a shield beneath a crown supported on two batons, found on Parabellum pistols and Maxim machine-guns supplied shortly before the First Balkan War began. From 1947 onward, the lion appeared on a demi-cogwheel within a wreath of wheat ears separated at their tips by a five-point star. A small version of the Bulgarian lion has been used as a military proof- or property mark.

Canada. Small-arms used during the period of British domination, including Ross rifles, bore a Broad Arrow within 'C'. Modern military stores may instead bear a stylised maple leaf.

Chile. Encountered above the chambers of 7mm Mauser rifles or on the slides of 9mm Steyr-Hahn pistols, the Chilean Arms consist of a five-point prismatic star on a shield halved horizontally, with a crest of three rhea feathers, supported by a crowned Huemal (Andean deer) and a crowned condor. They will usually be found on a mound strewn with laurel, particularly when impressed into butts; stock-marks may be accompanied by 'M.F.' in a rectangular cartouche, sometimes placed above the date of manufacture or reconstruction. Some guns display a chamber mark consisting of crossed slung Mauser carbines, CHILE and ORDEN Y PATRIA; others have an unidentified stock roundel that seems to consist of 'C', 'I', 'A' and 'E', with the first and last letters dominant. Inscriptions will be in Spanish.

China. Marks in Chinese characters are usually distinctive, but can easily be confused with Japanese. Guns made in the principal Chinese arsenal in Hanyang will be marked with a double interlocking diamond logo, which, particularly on guns made in the 1930s, may be combined into a flattened octagonal border enclosing the designation. Others may have a stylised cogwheel enclosing a bow-and-arrow, the significance of which is still not known; and others may show a stylised disc-like sun with twelve short pointed rays, adopted in 1928 but customarily used merely as a property or proof mark on military stores.

Colombia. Customarily surmounted by a condor with shackles in its beak and a scroll bearing LIBERTAD Y ORDEN, the Arms consist of a pomegranate and two cornucopiae above a Phrygian Cap on a spear-head, and a representation of the Isthmus of Panama separating a sailing ship on the Caribbean Sea from a similar ship on the Pacific Ocean. The shield was customarily placed on two pairs of flags and backed by a sunburst within an oval border, though guns supplied by Českosolvenská Zbrojovka after *c*. 1930 lacked the sunburst and border and had REPÚBLICA DE COLOMBIA added beneath the Arms. Others displayed EJERCITO DE COLOMBIA ('Colombian army'), whereas Mauser rifles supplied in the 1950s by Fabrique Nationale used COLOMBIA and FUERZAS MILITARES ('Military forces'). Inscriptions will be in Spanish.

Costa Rica. The Arms consist of a shield bearing seven stars above the three volcanoes (representing the Isthmus of Panama) separating sailing ships on the Pacific ocean and Caribbean Sea, the latter being accompanied by a sun rising over the horizon. Marks will be in Spanish.

Croatia. Marks applied during the German occupation during the Second World War featured the traditional chequered shield beneath the letter 'U' within an eight-looped rope border. This denoted the Uštaze, a right-wing Catholic militia raised by Ante Pavelic.

Cuba. Found on firearms ranging from Remington-Lee rifles to the FN FAL, the Arms used from 1902 until 1958 consisted of a shield divided into three. The top bears a key superimposed on land- and seascape representing the Gulf of

Mexico; the lower portions contain five diagonal bars and a Royal Palm in a stylised pastoral scene. A single supporter in the form of a fasces topped with a Phyrgian Cap lies behind the shield, which may be enreathed in oak and laurel. Inscriptions will be in Spanish.

Czechoslovakia. Guns will sometimes bear the crowned two-tailed Lion of Bohemia, charged prior to 1960 with a breast shield (for Slovakia) bearing a double-armed cross on a base of three mountains. They may also be marked 'ČSK' for *Československa* ('Czechoslovakia'). The confederation, something of an articial creation, split in 1997 into the Czech Republic and Slovakia.

Denmark. National markings were rarely used on firearms. See also 'Cyphers, imperial and royal'.

Dominican Republic. The Arms consist of a plain cross on a shield, charged with six national flags, a Cross of Christ and an open Bible. The shield may be enwreathed in palm- and laurel leaves. Marks will be in Spanish.

Ecuador. The Arms consisted of an oval shield or cartouche displaying a landscape (featuring the volcano Chimborazo) rising, beneath a shining sun set on a band bearing the March–June zodiacal signs. A steamer rides off the mouth of the Rio Guyas. Surmounted by a condor, the device is backed by two paired flags and a wreath of palm and laurel, and will usually also feature a fasces at its base. Marks will be in Spanish.

Egypt. A country with a troubled history, this has rarely applied distinctive marks to its guns. However, the Eagle of Saladin was used in 1952–8 and from 1984 to date, and a stylised Hawk of Quraish during the Federation of Arab Republics (1972–7). The Egyptian army marks customarily had breast shields divided vertically into three. Marks will be in Arabic.

El Salvador. Rifles will bear a triangular seascape with five volcanoes beneath a rainbow and a staff supporting an enrayed Phrygian Cap, which may be encircled by the date of independence 15 DE SET. DE 1821. This is usually backed by five national flags and may be enwreathed in laurel.

Estonia. The Arms comprised three lions passant guardant on a plain shield. It is not known to have been used on small-arms.

Ethiopia. Guns used in Ethiopia may bear the Lion of Judah, apparently a property mark, and a mark consisting of the imperial crown above an Amharic inscription and a stylised lion's-head mask within a wreath of laurel (?). Others are said to bear the cypher of Haile Selassie within a wreath of a grapevine and a wheat-ear.

Finland. Small-arms used in Finland rarely bear national markings, though 'S.A.' and 'Sk.Y' marks (qq.v.) are common. A few guns have been reported bearing a fylfot, or swastika, with its arms pointing to the left (cf., the marks used in Germany during the Third Reich pointed to the right), but so have some modern Chinese firearms and the attribution is unclear.

France. National insignia has rarely, if ever appeared on modern military small-arms. However, 'R.F.' for République Française ('French Republic') has been reported on the grips of Unique and other handguns.

Germany. Though imperial cyphers and displayed-eagle military proof marks were used prior to 1918, no national marks were applied with the exception of DEUTSCHES REICH ('German Empire') on captured guns or *Beutegewehre*. Guns made during the Third Reich may bear an assortment of marks based on the displayed-eagle state emblem, but these were customarily used simply as proof and inspectors' marks. The swastika or *Hakenkreuz* was rarely used, excepting in marks applied by some of the paramilitary formations.

Greece. These firearms may bear the National Arms, comprising a cross on a horizontally-barred shield enwreathed in laurel. Marks will be in Greek.

Guatemala. Guns often bore a quetzal bird perched on a scroll reading LIBERTAD DE 15 DE SET. DE 1821 (Liberation day, 15th September 1821), with two bayonetted rifles crossed above two crossed sabres within a wreath of laurel tied with a riband recording the national motto (?). Marks will be in Spanish.

Haiti. The National Arms consisted of a trophy of anchors, swords, flags, drums, rifles, cannon and cannon balls in front of an Emperor Palm, superimposed (or topped by) on a Phrygian Cap on a vertical staff. Marks will be in Spanish. 32. Honduras. Last revised in 1935, the national Arms consists of a triangle with five flames (now a sun?), flanked by two towers, in front of a Mayan pyramid rising from the sea. Topped by a quiver of arrows and two cornucopiae, this was set inside a border bearing the date of independence (15th September 1821). Marks will be in Spanish.

Hungary. Part of Austria-Hungary (q.v.) until 1918. Hungarian firearms made in 1918–43 will occasionally bear a shield, halved vertically. One half contains seven bars; the other has a double-armed cross, encircled by a coronet, on a triple-step base or (particularly in later examples) a grassed mound. The mark is customarily surmounted by St Stephen's Crown, which is topped by a distinctive bent cross. Hungarian small-arms produced since the Communists came to power in 1948 (e.g., Tokarev 48M pistols) may display a crest of a crossed hammer and sword within a circlet of wheat-ears.

India. Part of the British Empire until 1947, the Indian authorities applied marks in the form of 'I' beneath a Broad Arrow to their military stores. Post-independence weapons will display the cap of the Pillar of Sarnath, created by the Buddhist emperor Asoka (by whose name it is often known). Only three of the pillar-cap lions are visible.

Indonesia. The national emblem, the Garuda, a mythical half-human bird, may be found on Beretta-made Garand rifles and a range of machine-guns. Other firearms will bear a large five-point star, from the Presidential flag. See also 'TNI'.

Iran. Some guns will bear the mark of the imperial dynasty, which consisted of a scimitar-wielding lion backed by a rising sun. This customarily appears beneath a Pahlavi crown within a wreath of oak and laurel leaves. See also 'Persia'.

Iraq. Some guns—Lee-Enfield rifles, for example—will bear a mark comprising an Arabic character (appearing as a reversed angular 'S') within a triangle. More modern weapons may display what appears to be a monogram comprising

'A' and an inverted '2', which is said to be an Arabic abbreviation used by the Republican Guard.

Ireland (Eire). No national markings.

Israel. The six-point *Magen David* ('Star of David') appears in the Defence Force badge, accompanied by a sword, an olive branch and a scroll bearing the national motto. Marks will be in Hebrew.

Italy. The Arms of Savoy were used by the Kingdom of Italy until 1946, but rarely if ever appeared on weapons. They consisted of a shield bearing a St George's Cross within a plain border. A bundled Fasces, however, may be found on firearms made during the supremacy of Benito Mussolini (1922–43).

Japan. An imperial Mon in the form of a stylised chrysanthemum was used on small-arms.

Korea. The emblem of a circular yin-yang and four Kwae trigrams representing the four seasons (or the elements of creation) may have been used.

Laos. Guns may be marked with an emblem depicting three elephants beneath a parasol.

Latvia. The Arms consisted of a shield charged with a rising half-sun above a lion and a griffin in separate quarters.

Liberia. A shield bearing a star above eleven vertical bars may have been used. Marks will be in English.

Lithuania. The Shield of Arms consisted of a sword-wielding knight mounted on a rearing horse, his own shield being charged with a Patriarchal Cross. However, a highly stylised crown may be found on small-arms.

Luxembourg. The Arms consisted of a crowned lion rampant on a horizontally-barred shield, originally with an inescutcheon in the form of a small shield bearing the Netherlands lion (q.v.) on a billeted ground. The term 'Letzebourg' may be used instead of 'Luxembourg'.

Manchuria (Manchukuo). This short-lived republic, formed in the 1930s under Japanese control, does not seem to have used any identifiable national marks other than the cross-and-concentric-circle attributed to Mukden arsenal.

Mexico. A distinctive mark of an eagle with a snake in its beak, perched on a cactus on an island in a lake, has been used on military firearms for many years. The device is usually enwreathed in oak and laurel. Marks on guns imported into Mexico generally take the form of an heraldic displayed eagle, and often also bear REPÚBLICA MEXICANA; indigenous products use a less formal mark, more traditionally Aztec, accompanied by FÁBRICA NACIONAL DE ARMAS – MEXICO D.F. Weapons used by Mexican insurgents may bear a Phyrgian Cap on a sunburst, accompanied by 'R' and 'M' or 'R de M'. Inscriptions will be in Spanish.

Netherlands. Rarely encountered on firearms, the National Arms bear a rampant lion (clutching a sword and a sheaf of arrows) on a plain ground strewn with gold billets. See also 'Cyphers, imperial and royal'.

New Zealand. Part of the British Empire and Commonwealth, the New Zealand authorities often marked their service weapons with 'N' and 'Z' , separated by a Broad Arrow.

Nicaragua. The National Arms comprised five volcanoes and an enrayed Phrygian Cap, on a staff rising out of a seascape beneath a rainbow.

Norway. A mark of a crowned lion bearing the Axe of St Olav has been widely used. See also 'Cyphers, imperial and royal'.

Orange Free State. This short-lived republic simply used 'O.V.S.' on its small-arms.

Paraguay. The principal mark found on Mauser rifles and FN-Browning pistols consisted of a five-point prismatic star (*Estrella de Mayo*) on a stylised sunburst, generally within a wreath of palm- and olive leaves—though laurel alone seems to have been used on most guns. An oval border and also sometimes REPÚBLICA DEL PARAGUAY will also often appear. Inscriptions will be in Spanish.

Persia. See 'Iran'.

Peru. The National Arms consisted of a shield divided into three, with a llama and a chichona tree (each in an upper compartment) above a cornucopia. The shield was usually placed on two pairs of national flags, surmounted by a sunburst and (alternatively, or) wreath of laurel, surrounded by a wreath of palm- and olive leaves. Guns may also be marked REPÚBLICA PERUANA or REPÚBLICA DEL PERU.

Philippines. Guns may be marked 'R.O.P.' ('Republic of the Philippines').

Poland. Part of Russia until the Revolution of 1917. Guns may bear a crowned single-headed displayed eagle, often accompanied by 'R' and 'P' for *Reszpublika Polska* ('Polish Republic') or 'F.B.', 'RADOM' (q.v.), and the date; 'FB' within a triangle may also be found.

Portugal. Small-arms may bear a version of the National Arms, which comprised a shield within a shield, containing five small shields each charged with five discs; seven castles (the 'Bordure of Castile') lay around the outer edge of the large shield, the whole being placed on an Armillary Sphere and surrounded by an unusually naturalistic 'spray-wreath' of laurel leaves. See also 'Cyphers, imperial and royal'.

Prussia. The displayed-eagle national mark was customarily confined to proof marks. See also 'Cyphers, imperial and royal'.

Romania. A large crown was used on many pre-1918 small-arms, customarily above the designation (e.g., 'ARMA MD. 1892'). ➔ 'Cyphers, imperial and royal'.

Russia (Tsarist, pre-1917). The double-headed imperial eagle was widely used in proof and property marks. It can be distinguished by its double crowned heads, beneath a single large crown symbolising the unity of the many provinces. It should bear a breast shield showing St George slaying the Dragon (taken from the Arms of Moscow), an encircling collar of the Order of St Andrew, and four small shields on each wing bearing the Arms of major cities and provices of the Empire. However, most small-arms marks are too small to show these in detail. Inscriptions will be in Cyrillic (shared only by Bulgaria, Serbia and Yugoslavia prior to 1948).

Saudi Arabia. The National Arms consists of crossed scimitars beneath a palm tree, though the current flag bears only a single Sword of Abd al-Aziz (straight-bladed since 1981) beneath the *shahada*—an expression of the creed of Islam in Arabic script.

Saxony. No national markings. See also 'Cyphers, imperial and royal'.

Serbia. Found on Mauser rifles, amongst other guns, the pre-1918 Arms consisted of a pavilion containing a double-headed eagle on a shield, with an inescutcheon or 'breast shield' bearing a cross with a decorative striking-steel in each quarter.

Siam. The *Chakra* mark was widely used on Siamese military stores. Originally used in Indian to describe a spinning wheel, 'Chakra' came to signify a war-quoit with a series of flame-like blades issuing from a circle. The largest examples, particularly those used prior to the 1920s, sometimes contained lines radiating from the top centre of the inner ring; later examples usually have concentric-circle interiors.

Slovakian Republic. Formed by the German authorities during the Second World War, the armed forces of this short-lived territory marked small-arms with a Patriarchal Cross atop three mounds.

South Africa. Part of the British Empire and Commonwealth until 1960, South African weapons of this period were marked 'U' (for 'Union of South Africa'), often containing a Broad Arrow.

Spain. The National Arms have been revised many times, but, owing to the need for compact marks, those used on small-arms have almost always taken a standardised simplified form. The marks found on stores ranging from Mauser rifles to Astra pistols comprise a crowned shield quartered with a castle (for Castile), a lion (Leon), vertical bars (Aragon) and a 'wheel of chains' (Navarra). An inescutcheon bore three fleurs-de-lis for the House of Borbon on a plain ground, but a small compartment at the shield-tip, which should have contained the pomegranate of Granada, was customarily voided owing to lack of space. Spanish-made Mausers often omitted the Arms, instead bearing a crown over FÁBRICA DE ARMAS, OVIEDO and the date. The so-called Falangist guns, made during the Spanish Civil War of 1936–9, often by Industrias de Guerra de Cataluña, were marked with a crossed fasces and a sword. Modern small-arms may bear revised Arms, lacking the inescutcheon, placed on the displayed Black Eagle of the Holy Roman Empire with a Nimbus and a scroll charged with UNA GRANDE LIBRE around its head. Distinctive badges of a ribanded yoke and a sheaf of arrows are placed to the right and left of the eagle's tail respectively. Some guns may be marked LA CORUÑA; others will bear the modern Spanish air force mark, an encircled displayed eagle beneath a crown, superimposed on stylised wings.

Sweden. Many older small-arms—Mauser rifles, for example—bear a crowned black-letter 'C', the mark of Carl Gustavs Stads Gevärsfaktori, the state-owned gunmaking plant. Modern weapons may display property marks in the form of three ultra-simple stylised crowns.

Switzerland. Swiss Schmidt-Rubin rifles, Schmidt revolvers and Parabellum pistols may display a cross (*Schweizerkreuz* or *Croix Helvetique*) on a sunburst or, usually post-1909, on a vertically-barred shield. Small crosses may serve as proof- or inspectors' marks, the latter customarily including an indentifying letter.

Syria. Small-arms issued since the 1960s may bear the Hawk of Quraish with a breast shield divided vertically into three. Virtually identical with the marks used by Egypt (see above) in the days of the Federaton of Arab States (1972–7), Syrian examples could be distinguished by two small five-point stars on the centre bar of the shield. Inscriptions will be in Arabic.

Thailand. See 'Siam'.

Transvaal. This short-lived republic marked its military stores with 'Z.A.R.' (Zuid Afrikaansche Republiek, 'South African Republic').

Turkey. Some Turkish guns will bear a Toughra, customarily placed above the chamber of Mauser rifles, which is basically a calligraphic version of the sultan's cypher. Others may be marked with a star-and-crescent, with a 'TC' monogram (*Türkiye Cümhuriyeti*, 'Republic of Turkey'), or with an 'AS.FA' mark representing the military factory or *Askeri Fabrika* in Ankara. Marks will be in Arabic prior to 1926, and then customarily in Roman lettering.

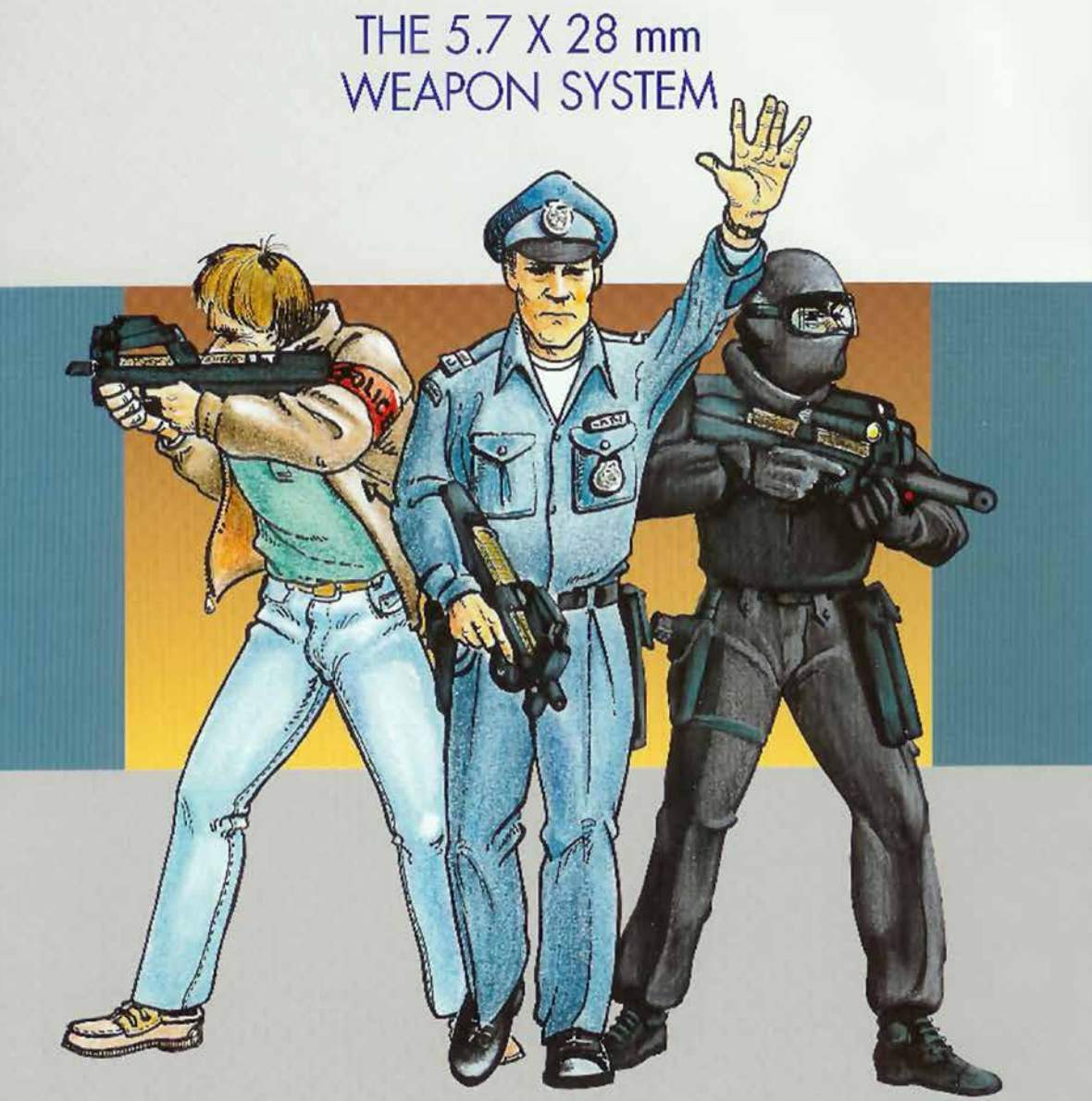
Uruguay, also known as 'Republica Oriental del Uruguay' ('R.O.U.') or simply 'Republica Oriental' ('R.O.'). The Arms consist of a laurel-enwreathed quartered oval beneath a rising sun, bearing the Scales of Justice, the 'Cerro' citadel of Montevideo, a horse and a bull. The marks are customarily accompanied by a date, and, on later examples, by R.O.U. EJERCITO NACIONAL ('National army of the Oriental Republic of Uruguay'). Inscriptions will be in Spanish.

United States of America. Military stores are simply marked 'U.S.', or U.S. PROPERTY. A few guns—the 'American Luger', for example—may bear marks in the form of a displayed Bald Eagle with arrows and thunderbolts in its talons.

USSR. Small-arms made prior to the fragmentation of the Soviet Union in 1991 will bear a hammer-and-sickle mark. See also 'C.C.C.P.'

Venezuela. The Arms consist of a shield divided into three, with a wheatsheaf and a trophy of flags and sabres above a white horse. The mark is surmounted by two cornucopiae and may be surrounded by a wreath of coffee and palm leaves (sugar cane?). A riband bearing the dates of independence and federation of the Estados Unidos de Venezuela ('EE.UU. Venezuela'), 19th April 1816 and 20th February 1889 respectively, binds the limbs of the wreath. Some modern firearms will also be marked FUERZAS ARMADAS DE VENEZUELA ('Venezuelan armes forces').

Yugoslavia. The Kingdom of Serbs, Croats and Slovenes, formed after the First World War, initially used marks based on those of Serbia (q.v.). The shield bore a crowned double-headed eagle with an inescutcheon or 'breast shield' divided with two compartments above a third. Used on ZB machine-guns, Mauser rifles and FN-Browning pistols, these honoured the Arms of the three principal consitituents of the federation. Post-1948 guns may bear the State Emblem of six torches forming a single flame within a circlet of wheat-ears; some may also be marked 'S.F.R.J.'—'Socialist Federal Republic of Jugoslavia'. Pre-revolutionary marks will often be in Cyrillic; later examples are in Roman lettering. 'BTZ' signifies *Voino Tekhniki Zavod*, the state ordnance factory in Kraguyevac; other guns may display PREDUZEČE (q.v.) in Cyrillic or Roman.



This cartoon-like promotional leaflet was offered in the 1990s by FN Herstal to advertise the new small-calibre Personal Weapon System. This almost jocular genre is rarely used to promote firearms, which are usually deemed to be too 'serious' to facilitate such a light-hearted approach.

Author's collection

NATO Standard Numbers ('NSN')

Applied by the North Atlantic Treaty Alliance ('NATO'), this system was based on the U.S. Federal Stock Numbers (FSN), introduced as part of an Act of Congress in 1952 to assist governmental stock control, which extended to virtually any article of military value. A typical FSN consisted of a four-digit prefix, the Federal Supply Code (FSC), and a seven-digit serial number. In September 1974, a two-digit National Codification Bureau (NCB) component was added to identify the originating country and the NSN was formed.

All NSNs have thirteen digits, customarily separated into groups of four, two and seven. In addition to a general '11', which simply refers to NATO itself, identifiers for individual NATO members include '00', '01' and '06' for the U.S.A.; '12', Germany; '13', Belgium; '14', France; '15', Italy; '17', Netherlands; '21', Canada; '22', Denmark; '23', Greece; '24', Iceland; '25', Norway; '26', Portugal; '27', Turkey; '28', Luxembourg; '33', Spain; and '99' for Britain. The system has been expanded intermittently to include non-NATO members, '30' signifying Japan, for example, and '66' for Australia. The marks will sometimes be found on small-arms. For example, a British 7.62mm L8A1 armoured-vehicle machine-gun, an indigenous variant of the FN MAG, will be marked on the left side of the receiver with the designation MACHINE GUN 7.62MM TK L8A1 over the manufacturer's code (RSAF Enfield), the date (1965) and serial number—UE 65 A282—above the NSN.

The NSN group contains the '1005' prefix common to all guns and small-arms of 30mm calibre and below; the code for Britain, '99'; and an arbitrary stock-number '960–6851'. The codes will also be found on much more mundane items: the 'Cloth coated bayonet frog, polyurethane on textured nylon, IRR' bears '8465–99–011–2306'. Though most of the marks may be read without difficulty, some will include the country of manufacture instead of the country of use. Consequently, the Belgian-made MAG machine-guns used by the British Army (7.62mm L7A1) exhibit '13' in the NSN instead of '99'.

Patents

The precise origins of 'Letters Patent' are still often contested. In Britain, they originally allowed a Monarch to confer the privileges on favourites that were 'patent': open to public scrutiny, so that the honours or services due to the beneficiary would be provided on request. Gradually, however, the system evolved more into a method of honouring merchants who introduced new manufactories, techniques or inventions by granting them a period of unchallengeable exploitation.

The first patent of this type to be granted (by Henry VI in 1449) allowed a stained-glass maker, a Fleming immigrant named John of Utynam, a twenty-year monopoly on a manufacturing process unknown in England, but only about sixty monopolies had been the subject of Letters Patent prior to the death in 1603 of Elizabeth I.

By 1610, the granting process was being regularly abused; some requests were mistakenly rejected on the grounds that the 'trade was already being pursued' and the acceptance of others owed more to favouritism or to patronage than real merit. Public outcry and judicial criticism prevailed, however, and the system of grants was radically overhauled.

The new system was operated by the judiciary for more than two hundred years without governmental interference, though a change made *c*. 1713, in the reign of Queen Anne, established that a petitioner had 'by an instrument in writing [to] describe and ascertain the nature of the invention and the manner in which it is to be performed'. The first application to be accompanied by a written specification was made in 1718 by James Puckle, to protect a primitive form of machine-gun, but the grants of protection were still often contested.

Many changes have been made over the years to national and international patent law, and the original English intention of petitioning the king by way of Lords Chancellor soon gave way to applications made directly to officials appointed by the Crown to receive, assess and grant protection. Another major change was made to the British patent system shortly after the Great Exhibition had been opened in London in 1851. Prior to the last day of September 1852, English and Scottish patents were numbered in separate series. With effect from 1st October 1852, however, the implementation of the Patent Law Amendment Act combined the disparate series; numbers were reduced to '1' and a simple progression occurred until, on 1st January 1853, the series re-started at '1'.

A new Patent Office was created in a Master of Chancery's office in Southampton Buildings, London WC, where, much extended, it remains to this day. A trademark registry was created in 1875, applying marks from 1st January 1877 onward; and the Patents, Designs and Trade Marks Act of 1883 not only transferred responsibility from the 'Commissioner of Patents' to a Comptroller General of Patents appointed by the Board of Trade, but also appointed the first Examiners. An Act of Parliament passed in 1902 finally ensured that investigation, albeit limited, was to be made into claims of novelty before patents could be granted.

The 1852-type grant system continued until 30th December 1915; from 1st January 1916, a new series began at '100001' to run on, supposedly sequentially, without regard to calendar years. The Patent Act 1977 then made an important change, as applications made after 1st July 1978 were numbered from 2000000 upward. However, processing claims made on or prior to 30th June 1978, often slowed by investigation (and litigation), ensured that the old numbering system survived into the present century. Numbers that had stood at about 1525000 on 1st July 1978 were approaching 1610000 by 1st September 2000.

A mark PATENT 12345 on an artefact of British origin, therefore, can have several interpretations: (1) Registry in England (or, theoretically Scotland) prior to 30th September 1852, the last remnant of a cumulative non-specific system begun in the eighteenth century. (2) Registry in any of the years between 1853 and 1915 in which more than 12,345 patents had been granted. In this case, but not infallibly, the marks will be found as PATENT 12345/67—the 12,345th of 1867—and

the year date should be included (e.g., '12345/67' or '12345/1867') in cataloguing information. Few if any pre-1915 individual years exceeded thirty thousand grants. (3) In accordance with any agreement by which a particular patent (which may or may not be accompanied by its annual identifier) has been licensed to a manufacturer, common in cases where the inventor lacked suitable finance or production facilities. Thus the mark PATENT 12345 would be the 12,345th item to have been made in accordance with the licensing agreement, and, therefore, would not refer directly to the protecting legislation.

Obviously, patent no. 12345 cannot have been registered in the finalised cumulative series, on or after 1st January 1916, as this began at 100001: grant no. 123456 dates from 1919.

The British system was well-organised, but this was not always true of other countries; Spain, for example, had a much more flexible 'patent' system which could incorporate the registry of trademarks. Yet practically all European countries with the exception of Austria and Austria-Hungary, which issued *Privilegium* numbered in annual-cycle sequences, relied on simple cumulative numbering series from which the earliest date of an item may be deduced with comparatively little difficulty.

The U.S. patent system owed its inception to an Act, signed on 1st April 1790, which recognised the rights of men to profit from their inventions. A board comprising the Secretary of State, the Secretary of War and the Attorney General—or their nominees—was empowered to issue patents to endure no more than fourteen years on presentation of specifications, drawings and models. In 1793, however, the Patent Board was abolished in favour of a fee-based registration system based not on novelty or utility, but instead on the raising of revenue. Finally, on Independence Day, 1836, a new Patent Act repaired much of the damage that had been done by the ineffectual grant system, and a system of investigating claims against 'prior art' appeared.

On 15th December 1836, unfortunately, the Patent Office lodged in Blodgett's Hotel, Washington DC, was destroyed by fire together with more than seven thousand irreplaceable patent models, nine thousand drawings, and the entire application/grant records.

The continuous nature of U.S. patents, even though they began again at '1' after the implementation of the new Patent Act on 13th July 1836, ensured that numbers had reached 6981 by 1st January 1850; 640167 by 1st January 1900; 2492944 by 1st January 1950; and 6009555 by 1st January 2000. One particularly helpful feature of marks applied in accordance with U.S. Patents (though they rarely include the actual number) is the legal requirement to state the day, month and year of grant. This is so unlike regulations governing the exploitation of protection in other countries that it can provide an immediate clue to nationality.

The U.S. Patent Office has also sparingly re-issued patents, numbering them separately from 1838 onward. Numbers representing this sequence will occasionally be found, and, unless accompanied by proper identification, can be perplexing. Marks such as REISSUE or simply 'RE$^{D'}$ can be helpful. Reissue numbers

stood at merely 158 on 1st January 1850; at 11798 on 1st January 1900; at 23186 on 1st January 1950; and at 36479 on the first day of 2000.

The German system, which was implemented in 1877, six years after the foundation of the German Empire or *Deutsches Reich*, also runs sequentially. Patents granted by the German Federal Republic (1945–91) follow on from those granted during the Kaiserzeit (1871–1918), the Weimar Republic (1919–33) and the Third Reich (1933–45). The sequence has been continued since the reunification of Germany. However, a satisfactory individual year-date/patent number correlation has yet to be compiled. A few typical examples give an idea of the numerical progression: no. 1192 (7th August 1877), 28109 (4th November 1883), 65225 (16th February 1892), 105620 (20th December 1898), 256606 (22nd November 1911), 578765 (7th November 1930), 824160 (4th July 1950) and 1553964 (July 1966).

The duration of patents, customarily enshrined in law, can also be useful. Pre-1852 English patents were granted, with significant exceptions, to run fourteen years from the application of the seal of the Lord Chancellor's office; the 1852 Act, though retaining the fourteen-year maximum, backdated protection to the date of application to ensure that infringement could not occur between the first submission and the final grant. Additional provisions included fee-supported renewal of patents after three and then seven years, and the submission of a Provisional Specification with the patent application.

Items made in the few months between initial submissions and the final grant will display marks such as 'P. P.', 'P. Pt.', 'P. Pat.' or 'Prov. Pat.'

Patents listed on industrial items often prove to have been granted to someone other than the manufacturer. This became increasingly common in the era of mass-production, where fewer inventors had the opportunity to produce and then market their ideas.

Many licensed them to well-established manufacturers, obscuring the origins of particular items, and others were employed by large and well-established businesses which viewed the work of employees as their own. For example, Waffenfabrik Mauser & Co., a world-renowned supplier of military rifles by 1914, secured the lasting reputation of its surviving 'founding father' Paul Mauser by filing all patents in his name. It is doubtful if Mauser personally undertook design work after about 1890, but involvement of others, with one well-documented exception, is now impossible to prove. Another problem can be provided by the British 'Communicated' patents, which often bear the name of a British patent agent working on behalf of an inventor domiciled overseas.

Prior to 1859, the identity of the inventor was seldom revealed; it then became a statutory requirement. Yet many spelling mistakes were still made in British records—particularly foreign names—and there have been lapses of geography. Other problems may arise from the transfer of patented designs by licence, which often allowed differing manufacturers to make the same items at the same time. It was common to find notes such as 'the proprietor of British Patent 12345/06, for improvements in the manufacturer of the widget, seeks interest from patents wishing to benefit from his invention…' in periodicals such as *The Engineer* or

Engineering. And a major flaw in the use of patent information to date items can sometimes be seen in the retention of marks, often for historical reasons, long after the patents themselves have elapsed.

Trademarks

The marks granted to protect the rights of manufacturers and distributors (and to assure purchasers of merchantable quality) provide some of the best ways of identifying guns, ammunition and accessories if they can be read effectively.

Trademarks have their origins in the masons' marks of the Middle Ages and in the marks applied by Guild members thereafter, which helped to differentiate the work of individuals in an era where literacy was an exception instead of the general rule. Where firearms are concerned, trademarks (excepting in the form of initials) are rarely found prior to the American Civil War of 1861–5, but then become increasingly common.

This was entirely due to the perfection in the 1870s of a moulding process that allowed gutta-percha to be used to make grips for handguns. The facility with which this material could receive a design led to a proliferation of decoration, and to the embodiment of marks and monograms in the basic designs. The complexity was limited only by the skills of the mould-maker, which were often exceptionally high. Dog's heads, birds, flowers, impressive scrolls and delicate chequering were just some of the many designs that each manufacturer guarded jealously—and their rivals just as eagerly copied. Consequently, though it is usually easy to link a design with a particular manufacturer, grips commissioned by distributors could grace a variety of inexpensive rimfire revolvers with differing origins.

Trademark acts have been passed in most European countries, though registry in Germany did not begin until 1874, Britain followed in 1877, and many Spanish marks were originally registered as patents. In the U.S.A., uniquely, 'first use' of a mark often guarantees legal protection; prior to the Lanham Act of 1946, which made important changes, registration conferred only minor additional advantages.

The first international agreement protecting 'Industrial Property' was signed in Paris in 1883, the 'Paris Convention' thereafter being modified many times until, by the time of the meeting in Lisbon in 1958, more than eighty countries had subscribed. The Arrangement for the International Registration of Trademarks was signed in Madrid in 1891. Though some international consensus exists, however, intra-national views vary appreciably.

Protection for marks in Germany, prior to 1945 at least, was usually granted for ten years; at the end of the period, therefore, unless the renewal was prompt, anyone was free to register the same mark. There are a few cases where gun-related marks have changed hands three times or more. And some countries, notably the U.S.A. (and Britain, to a lesser extent), deem protection to have ended once a name is classed as generic.

Trademarks found on firearms may be divided into several categories. The easiest to identify are those accompanied by a name: the well-known Mauser

and Walther 'banners', for example. Next comes the group accompanied by abbreviations, and then marks composed of →monograms (interlocking initials). Marks consisting of an illustration and an abbreviation are usually easy to read, and can be identified if the abbreviations can be linked with a specific manufacturer. However, this is still impossible in the case of some marks; in others, a range of possibilities may exist.

Monograms range from simple and easily read, customarily true of more recent designs, to complex and confusing in the case of many nineteenth-century patterns. This is usually due to the zeal with which pre-1900 lettering was decorated: tendrils, floriation and hatching often makes the letter-forms difficult to detect. Brandnames are customarily easily read, and as easily identified. However, very little research amongst brand-name registries—tedious, but potentially very useful—has yet been undertaken within the gun-collecting fraternity and, consequently, many names are still difficult to date precisely.

Key to Trademarks

1. Abercrombie & Fitch Company (U.S.A.)
2 and 3. Accuracy International Ltd (Britain).
4. Air Arms Ltd (Britain).
5. Air Match SrL (Italy).
6, 7 and 8. J.G. →Anschütz Germania Waffenfabrik AG, and successors (Germany).
9 and 10. Norica Arms Company (Arizmendi, Spain).
11. Astra–Unceta y Cia (Spain).
12. Auto-Ordnance Corporation (U.S.A.).
13. Azanza y Arizabalaga (Spain).
14. Izhevsk arms factory (USSR).
15 and 16. Fritz →Barthelmes–FB Rekord (Germany).
17. C. y T. Bascaran, Cometa (Spain).
18 and 19. Bayerische Sportwaffenfabrik (Germany).
20. Beeman Precision Guns, Inc. (U.S.A.).
21 and 22. Vincenzo Bernardelli & Co/ SNC (Italy).
23. Benelli Armi SpA (Italy).
24–27. Pietro Beretta SpA (Italy).
28. Berlin-Suhler-Werke (Germany).
29. Armas Bersa SA (Argentina).
30. Bildstein, Mommer & Co. (Germany).
31–36. Birmingham Small Arms Co. Ltd and BSA Guns Ltd (Britain).
37. Bolte & Anschütz (Germany).
38. Browning Arms Company (U.S.A.).
39. California Industrial Company, CALICO (U.S.A.).
40–42. Česká Zbrojovka AS(Czechoslovakia).
43 and 44. Charter Arms, Inc. (U.S.A.)
45–48. Colt's Patent Firearms Mfg Co. and Colt Industries (U.S.A.). Mark no. 47 is that of the Colt Custom Gun Shop.
49. Dae Woo Heavy Industries, Small-arms Division (South Korea).
50. Daisy Mfg Co. (U.S.A.).
51. Dansk Industri Syndikat AS 'Madsen' (Denmark).
52. Deutsche Waffen- u. Munitionsfabriken and Berlin–Karlsruher Industrie Werke (Germany).
53 and 54. G.C. Dornheim, Gecado (Germany).
55 and 56. Echave y Arizmendi (Spain).
57. Star–Bonifacio →Echeverria SA (Spain).
58. Edgar Bros. Ltd (Britain).
59–62. Eidgenössische Waffenfabrik, Bern (Switzerland).
63. Imperial Metal Industries/IMI, →Eley Division (Britain).


A&F
1.
accuracy
INTERNATIONAL
2.
AI
3.
AIR ARMS
4.
AIR MATCH
5.
JGA
6.
JGA
7.
ANSCHÜTZ
8.
NORICA
9.
NAC
10.
ASTRA
11.
Thompson
12.
13.
"Baikal"
14.
FB Record
15.
FB Record
16.
17.
BSF
18.
BAVARIA
19.
PRECISION
Beeman
AIRGUNS
20.
VBG
21.
VB
22.
23.
24.
25.
26.
DB
27.
BSW
28.
BERSA
INDUSTRIA ARGENTINA
29.
BIMOCO
30.
BSA
31.
32.
TRADE MARK
33.
34.
35.
BSA
OF ENGLAND
36.
B
B&A
37.
38.
CALICO
39.
40.
41.
42.
CHARTER
ARMS
43.
CHARTER ARMS
44.
45.
COLT
46.
47.
100 YEARS OF COLT CRAFTSMANSHIP
COLT
150
48.
49.
Daisy
50.
51.
DWM
52.
GECADO
53.
GECADO
54.
EYA
55.
EA
56.
STAR
TRADE MARK
57.
58.
WF
59.
WF
60.
61.
62.
ELEY
ELEY
63.
el gamo
64.
gamo
65.
ENSIGN
ARMS COMPANY
66.
ERMA
67.
ERMA
68.
FAIR
69.
FAS
70.
BROWNING
71.
72.
FIE
73.
74.
F&W
75.
76.
Franchi
77.

64 and 65. Industrias El Gamo (Spain).
66. Ensign Arms Company (Britain).
67 and 68. Erma-Werke (Germany).
69. Fabbrica d'Armi Italiana →Rizzini &C., FAIR (Italy).
70. Fabbrica Armi Sportive, →FAS (Italy).
71 and 72. →Fabrique Nationale d'Armes de Guerre/FN Herstal SA (Belgium)
73. FIE Corporation (U.S.A.).
74. Guilio Fiocchi &C./Fiocchi Munizione SpA (Italy).
75. Forehand & Wadsworth Arms Company (U.S.A.).
76–8. Luigi Franchi SpA (Italy).
79–81. A.L. Frank, ALFA (Germany).
82. Armi Renato →Gamba (Italy).
83. General Electric Company (U.S.A., found on Vulcan Miniguns).
84 and 85. Gustav Genschow & Co. AG, GECO (Germany, also used by Dynamit Nobel).
86. Gerstenberger & Eberwein, Em-Ge Sportgerätewerk (Germany).
87 and 88. Grünig & Elmiger (Switzerland).
89. Gustloff-Werke (Germany).
90 and 91. Haendler & Natermann GmbH (Germany).
92. C.G. Haenel , Waffen- & Fahrradfabrik (Germany).
93. Hämmerli AG (Switzerland).
94–100. Harrington & Richardson Arms Company (U.S.A.).
101. Friedr. Wilh. Heym GmbH & Co. (Germany).
102. Hopkins & Allen Arms Conmpany (U.S.A.).
103. Husqvarna Våpenfabriks (Sweden).
104. Israeli Military Industries (Israel).
105 and 106. Italguns SpA (Italy).
107–9. Iver Johnson's Arms & Cycle Works (U.S.A.).
110. Armas →Juaristi (Spain).
111 and 112. Albrecht Kind, AKAH (Germany).
113. Kriegskorte & Co., KRICO (Germany).
114. H. Krieghoff GmbH & Co. (Germany, post-war).
115. Friedrich Langenhan (Germany).
116. Von Lengerke & Detmold (U.S.A.).
117 and 118. Łucznik Predom (Poland).
119. Marlin Fire Arms Company (U.S.A.).
120–22. Waffenfabrik →Mauser AG/Mauser-Werke AG/Mauser Jagdwaffen (Germany).
123. Mayer & Söhne (Germany).
124 and 125. Mayer & Grammelspacher, Dianawerk (Germany).
126. Merkuria (Czechoslovakia).
127. Milbro Ltd (Britain).
128. Mondiale–Modesto →Molgora (Italy).
129. Moritz & Gerstenberger/Gerstenberger & Eberwein (Germany).
130. National Arms & Ammunition Co. Ltd (Britain).
131. National Rifle Association (U.S.A., found on commemorative guns).
132. National Rifle Company (India).
133. Navy Arms Company (U.S.A.).
134. Nederlansch Wapen- en Munitiefabriek (the Netherlands).
135. Gotthilf von Nordheim, VONO (Germany).
136. China North Industries Corporation (People's Republic of China).
137. Omnipol (Czechoslovakia).
138. Österreichische Werk-Anstalt (Austria).
139. Bernhard Paatz (Germany).
140. Parker-Hale Ltd (Britain).
141 and 142. Friedrich Pickert, ARMINIUS (Germany).
143 and 144. Anciens Établissements →Pieper (Belgium).
145. Karl Arndt Reck GmbH (Germany).
146. Reising Arms Company (U.S.A.).
147 and 148. Relum Ltd (Britain).
149. Remington Arms[–United Metallic Cartridge] Company (U.S.A.).
150. Replica Arms (U.S.A.).
151 and 152. Rheinisch-Westfälische Sprengstoff AG, RWS (now used by Dynamit Nobel, Germany).
153. Rheinische Metallwaaren- & Munitionsfabrik/Rheinmetall-Borsig AG/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Rheinmetall GmbH (Germany).
154. Rhöner Sportwaffenfabrik GmbH (Germany).
155. Röhm GmbH (Germany).
156. Amadeo Rossi SA (Brazil).
157 and 158. Pulverfabriken →Rottweil (Dynamit Nobel, Germany).
159. Thomas E. Ryan (U.S.A.).
160. Saco Defense, Inc. (U.S.A.).
161. Empresa Nacional de Industrias Militares 'Santa Barbara' SA, →CETME (Spain).
162–6. J.P. Sauer & Sohn GmbH & Co. (Germany).
167 and 168. Savage Arms Company (U.S.A.).
169–71. Herbert Schmidt (Germany).
172. Sheridan Products, Inc. (U.S.A.).
173. Schweizerische Industrie-Gesellschaft/SIG (Switzerland).
174. SIG-Sauer (Switzerland/Germany).
175 and 176. Simson & Co. (Germany).
177. Kovo AS (?), SLAVIA (Czechoslovakia).
178. Springfield Armory, Inc. (U.S.A.).
179. Stenda-Werke (Germany).
180. Sterling Armament & Co. Ltd (Britain).
181. Steyr-Mannlicher GmbH (Austria).
182. Stoeger Industries (U.S.A.).
183–5. Sturm, Ruger & Co. (U.S.A.).
186. VEB Fahrzeug- & Waffenfabrik 'Ernst →Thälmann' (Germany [DDR]).
187. Thompson/Center Arms (U.S.A.).
188–90. Oy →Tikkakoski Ab (Finland).
191 and 192. Tula Arms Factory (USSR).
193. Aldo Uberti & C SNC (Italy).
194. Manufacture d'Arms des Pyrénées Françaises →'Unique' (France).
195. Viking Arms Company (Britain).
196 and 197. Koma-Werke/→Voetter & Co., Schwarzwalder Jagd- & Sportwaffenfabrik, VOERE (Germany)
198. Carl Walther Waffenfabrik/Carl Walter Sportwaffenfabrik GmbH (Germany).
199. Lothar Walther (Germany).
200–5. P. Webley & Sons/Webley & Scott (Britain).
206–8. Hermann Weihrauch KG (Germany).
209. Dan Wesson Arms Company (U.S.A.).
210 and 211. Westinger & Altenburger, →FEINWERKBAU (Germany).
212. Wilsker & Co. (Germany).
213 and 214. Winchester Repeating Arms Company (U.S.A.).
215. Zieh- und Stanzwerke →Schedetal AG (Germany).
216. Antonio Zoli & C. SNC (Italy).