From Snider-Enfield, to Martini-Henry, to the Magazine Lee-Metford: An Historical and Technical Overview of the Development of British Military Rifles from 1866 to 1895

A dissertation submitted in fulfilment of the requirements for:

AX501 - History MA by Research (Music Humanities and Media) FT

Thomas Heptinstall BA (Hons)

U1258695

September 2016

Word Count: 30603

Academic Tutors:

Reverend Paul Wilcock BEM, BA Hons, MA, PhD, FHEA, Director, Arms and Armour Research Institute

Peter Smithurst, Visiting Research Fellow, University of Huddersfield,

Curator Emeritus, Royal Armouries

Dr Steve Burt, Visiting Professor, University of Huddersfield

Acknowledgements:

This thesis would not have been possible without the help of the acknowledged experts that were kind enough to provide primary materials, published research, topic specific knowledge and advice that contributed to its development. This includes Ian Skennerton, who was kind enough to share a lifetime's work and offer to accommodate me on my travels. It also includes Peter Smithurst, Malcolm Cobb and Andrew Appleby who offered continued help that was invaluable my research. I would also like to credit York Army Museum and its staff for their assistance and the Royal Armouries staff at both the library and the National Firearms Centre for their support and expertise.

Copyright Statement:

Contents

List of Tables

An Introduction

In the period from 1866 to 1895, Britain was the leading world power whose Empire stretched from Canada to India to New Zealand. Although it was one of the first industrialised nations, other countries such as France and the United States were beginning to challenge its dominance, particularly in terms of technological change. The British Empire could only survive if it retained a dominant military position which meant supporting the most powerful army and navy in the world. To achieve this, it was essential that the weaponry carried by these armed forces was as technologically advanced as possible.

In the early 1860s, British and colonial armed forces numbered around 220,000 men.[1] Given the state of continuous expansion, many of these forces were engaged in a continuous cycle of colonial conflicts. They required the best equipment available and this was sourced from the Ordnance Department, which from 1855 onwards was part of the War Office, with a financial budget second only to that of Her Majesty's Treasury.[2] In 1866, this stood at £26,100,000, or thirty-nine percent of all government spending.[3] Standing alongside the regular army was a volunteer force, which in 1862 numbered 162,681 available men.[4] Throughout the latter half of the nineteenth century, this force was slowly absorbed into the Army in the form of reserves. These volunteer forces were required to fund and provide their own equipment, and so had a vested interest in acquiring the most modern arms available. By law these weapons had to be provided by the War Office, and so were also supplied by the Ordnance Department.

There was consequently a clear interest in procuring the finest rifles possible. To achieve this, special Ordnance Committees were assembled by the War Office. These Committees consisted of small teams of veteran officers, who were also firearms enthusiasts themselves. They were tasked with sourcing the best rifles they could find through a series of rifle trials. As the period from 1866 to 1895 coincided with a major technological

[1] This was quite small when compared to France with 400,000 men in 1860 or Russia with 1,132,000 men in 1864. Unlike most countries on the continent, the British army was not conscripted.
[2] N. Skentlebery, *Arrows to atom bombs: a history of the Ordnance Board* (London, 1975)
[3] B. Mitchell, *British Historical Statistics* (London, 2011)
[4] H. Cunningham, *The Volunteer Force: A Social and Political History 1859-1908*(London, 1975), p. 22

revolution and the development of mass production techniques, changes to small arms advanced at an unprecedented rate. In the early 1860s, military firearms were slow, single shot, muzzle-loading rifles (powder and shot were manually poured down and packed into the barrel of the rifle). Yet just thirty years later the British military had access to small-bore, magazine fed, rapid fire breech-loading rifles (loading the rifle by means of a cartridge in the breech). Due to these rapid changes, the Ordnance Committees were locked in an almost endless process of rifle trials, selecting the best competitors for use in British service. Across this period, these selections were the Snider-Enfield, the Martini-Henry and the Lee-Metford.

Despite such enormous effort by the War Office it is worth noting that rifles issued to the military in this era lagged behind those that were available on the commercial market. For example, in America in 1860, Benjamin Henry developed the Henry repeating rifle that was breech-loading, had self-contained cartridges and was also magazine fed.[5] Although ingenious in their design, rifles such as these were never fit for the general infantry as they were regarded as unsafe, unreliable or underpowered. Conversely, military rifles had to be durable, reliable, accurate, fast and powerful, and it was only from 1866 to 1895 that this became possible. This technological advancement in small arms will be charted in this thesis which will focus on the development of the Ordnance Committee's three selections: the Snider-Enfield of 1866, the Martini-Henry of 1874 and the Lee-Metford of 1888.

This analysis will be broken into three sections and will highlight why a new rifle was required for the British Army and how the relevant Committee went about selecting it. First, the selection process of each rifle is examined. This involves the rigorous trial process each rifle underwent. For example, when selecting the Snider-Enfield, forty-three rival designs were submitted which had to be processed.[6] In examining this Committee activity, it can be shown that the Snider-Enfield, Martini-Henry and Lee-Metford were all the most technologically advanced, financially viable and the best option available to the Committees at the time.

Each specific rifle will then be analysed from a technical aspect, in an assessment of how the Snider-Enfield, the Martini-Henry and the Lee-Metford would be operated by a soldier.

[5] D. Butler, *United States Firearms The First Century 1776-1875* (New York, 1971), p.229
[6] Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864 (12/10/1864)

These chapters also discuss how each rifle actually worked, by looking at the functions of each component part. In doing so, this will show how small arms were developed over time, with each new design implemented across the era being simpler to operate and capable of firing faster than its predecessor. Once issued, each individual rifle also underwent a constant process of improvement, either to remedy inherent flaws of the rifles or to improve them further. As this is part of how the rifles actually functioned, the development of each rifle will also be provided in the technical overview.

The final section of each chapter will then show how, once issued to the British Army, the Snider-Enfield, the Martini-Henry and the Lee-Metford actually performed on the battlefield. By analysing the role of the rifle in a range of scenarios, from small colonial conflicts, to huge theatres of battle, the historical impact of each rifle can be shown. The significance of each weapons system will also be proven as all three saw extended use once they had been officially replaced. In combining the original selection process of each rifle with the technical overview and impact on the battlefield, the historical importance of each rifle can ultimately be shown.

Methodology

This thesis is based on a wide range of primary and secondary sources. The first line of enquiry focused on the existing secondary literature available. Although there were extensive sources for rifles such as the Martini-Henry and the Lee-Metford, there was a paucity of material for the Snider-Enfield. The secondary literature on the topic was instigated by the historian Ian Skennerton in the late 1970's, with works such as '*A Treatise on the Snider, The British Soldier's Firearm 1866-c.1880*'.[7] Skennerton's work subsequently dominated the historiography on British military small arms for over thirty years. It is only in the past decade that the dynamic has changed, and new literature has been introduced, such as Martin Pegler's '*The Lee-Enfield Rifle'* in 2012.[8] Some works, like that of Stephen Manning's '*The Martini-Henry Rifle*' were published as late as 2013.[9] Others are yet to be published, such as Martin Cobb's upcoming book on the Snider-Enfield.

These publications all focus on one rifle of the period, and are excellent sources for detailed statistical information on each separate rifle. They provide an insight into where each rifle was used, what it was capable of and other statistical information such as the rifle's weight or size. They were therefore useful in forming a basic knowledge on the subject. In focusing on just one rifle, however, they all failed to assess the small arms development over the period as a whole. The only literature that achieves this, such as Christopher Roads' *'The British Soldier's Firearm, 1850-1864',* is based around a completely different period in time.[10] There was therefore a substantial gap in the historiography on the subject.

In order for the thesis to fill this gap, and present a detailed analysis of small arms development over time, it was crucial to meet the acknowledged experts in the field, in order to discuss how my research could build upon their work. As Ian Skennerton had been the principle historian on the subject, in December 2015 I travelled to the Gold Coast in

[7] I. Skennerton, *A Treatise on the Snider, The British Soldier's Firearm 1866-c.1880* (Margate, AU, 1977)
[8] M. Pegler, *The Lee-Enfield Rifle* (Oxford, 2012)
[9] S. Manning, *The Martini-Henry Rifle* (Oxford, 2013)
[10] C. Roads, *The British Soldier's Firearm, 1850-1864, from Smooth-Bore to Small-Bore* (London, 1964)

Queensland, Australia to discuss my thesis with him, and spent three weeks assessing how my research would develop. Other historians were then consulted upon my return to England, including Malcolm Cobb who wrote '*The Martini-Henry Notebook*' and is an expert on British and South African small arms.[11] Interviews were also conducted with the historian Andrew Appleby, who is currently writing the book '*Thomas Wilson his Patents, Arms and Ammunition*' and is acknowledged as an expert in nineteenth century small arms.[12]

These consultations proved to be incredibly useful. Through engaging with the experts in the field, or by consulting other secondary literature, I gained a great deal of factual information on the topic, as well as gaining access routes to previously unused primary documents. Through these discussions, another gap in the published research was beginning to present itself. Whilst some of these texts did look at how each rifle was chosen by each Committee, they did not ask why, or by whom, or provide a level of detail to ascertain why it was an important choice as part of the wider context. Changes and developments in the rifles had always been recorded, but the reasons behind these developments seemed to be missing.

Instead of simply stating that a change took place, as the secondary sources tend to do, the focus of the thesis developed to establish why it took place, for example, with the Martini-Henry, later models had a thumb rest added and a lengthened butt which is described in Skennerton's '*Treatise on the Martini*' series, but what is not explained is why the War Office needed to change it in the first place.[13] By going back to the primary source documents, such as troop reports on the Martini-Henry, it was found that this was done because young soldiers were injuring themselves when firing the rifle as its recoil was too great. Similarly, in the Martini-Henry trials Skennerton documents that Mr Westley Richards withdrew his rifle from the competition. When looking at the original reports as to why it happened, it was

[11] M. Cobb, *The Martini-Henry Notebook, The Life and Times of a Grand Old Rifle* (Gillette, New Jersey 2007)
[12] A. Appleby, Thomas Wilson, his Patents, Arms and Ammunition, Research Press, *Historical Breechloading Small Arms Association* (2008)
[13] B. Temple, I. Skennerton, *A Treatise on the British Military Martini, The Martini-Henry 1869-C1900* (London, UK, 1983)

found that Mr Westley Richards had actually had a disagreement with the Small Arms Committee, causing him to angrily back out of the competition.[14]

Returning to the primary sources to establish why developments actually took place in this manner forms a large part of the thesis. The first section of all three chapters deals with the trials process leading to the selection of a particular rifle, which is based almost entirely on primary documents, such as minutes, reports, tables and newspaper articles, which was accessed at the Royal Armouries archives and the Royal Armouries National Firearms Centre in Leeds. Once supplemented with the existing secondary literature, a detailed assessment of the trials process could be achieved. After finding out how a rifle was selected, and how it was operated, it was necessary to establish how it actually performed in the field. Again, whilst secondary sources provided some information relating to their use in various conflicts, it was only through primary research that soldiers' assessments of the rifles could be gained. As well as the Royal Armouries, this line of research required research trips to locations such as York Army Museum, to find previously unpublished documents such as soldier's diaries and military handbooks.

It is this large variety of original research that allows this thesis to provide a detailed insight into the process of development of British military small-arms from 1866 to 1895. The three chapters on the main rifles of the era, the Snider-Enfield, the Martini-Henry and the Lee-Metford combine to produce an original overview on the progression of British military small arms, that not only shows the significance of each separate rifle, but also the historical significance of their development at a time when Britain successfully retained its position as a dominant world power.

[14] Report on rifle selection for service, Special Committee on Breech-Loading rifles (11/02/1869)

Breech-Loaders for all:

The .577 Snider-Enfield Rifle

[15]

[15] I. Skennerton, *Snider Enfield and Snider Enfield Cavalry Carbine with Armourers tools*, the Bob Farris private firearms collection

The story of the Snider-Enfield has often been overlooked in British military history. After all, breech loading rifles had been in military service on the continent for decades with Prussian *Dreyse* and the French *Chassepot* rifles. Nor was the concept of converted rifles anything novel. Many other countries in the world were using converted muzzle-loaders, such as the French with the *Tabatiere* rifle and the Russians with the *Tula* rifle.[16] Prior to the British trials, the Snider had been rejected by the United States ordnance department, opting instead for conversion of their Springfield rifles, which caused Jacob Snider Jr and Eugene Schneider to take out their joint patent and look for markets in Europe instead.[17] Furthermore, the Snider-Enfield only officially served from 1866 to 1871 before it was made 'obsolete' by the Martini-Henry.

The following overview will change this perspective by means of a step-by-step analysis of the rifle to show why the Snider-Enfield was a historically significant rifle. The first step comes with the adoption of the Snider-Enfield. The decision to adopt a breech-loader into British military service was not taken lightly and, even after the decision had been made, it took almost two years to find a suitable rifle. The analysis of this adoption process is extremely important from a historical perspective, as every single modern rifle of the day came together in direct competition with one another. Of the forty eight different rifles that were submitted, none could compete with the Snider-Enfield, proving that it was the best rifle available to the British Army at the time.[18]

Many other aspects of the Snider-Enfield must be considered to prove it was much more than a 'stop-gap' rifle. A technical overview of the Snider-Enfield's design and manipulation is incredibly important when assessing this capability. Therefore, the design and operation of the rifle must be reviewed, alongside the various upgrades the rifle was given throughout its service life, to show how capable the rifle really was. Finally, an overview of the conflicts in which the Snider-Enfield was actually involved in will give weight to the fact that it was indeed a quality, first-class rifle. It was ultimately victorious over older muzzle-loaders in every single campaign and the Snider's introduction was demonstrably a huge technological advancement for the British Army.

---

[16] R. Pauly, *Firearms: The Life Story of a Technology* (London, 2004)
[17] I. Skennerton, *.577 Pattern 1853 Rifle Musket & Snider Enfield, Small Arms Identification Series* (Labrador, QLD, AU, 2005), p. 16
[18] M. Cobb, *Cinderella Snider* - Unpublished (21/02/2016)

The Snider-Enfield was much more than a quick 'stop-gap' solution and by the end of its official service life alone over 690,000 of them had been produced.[19] It had seen service in every single continent in the world and of the pitched battles it had been involved in, it had a 100 percent success rate. The Snider's excellent reputation should not be forgotten. In the words of Colonel Dixon of the Royal Artillery: 'Three years of use by the soldier have most satisfactorily established the character of this weapon - superior to any breech loading arms of any foreign army today.'[20]

[19] I. Skennerton, *.577 Snider-Enfield Rifles & Carbines, British Service Longarms 1866-c.1880* (Labrador, AU, 2003), p. 220

[20] Skennerton, .577 Snider-Enfield Rifles & Carbines, British Service Longarms 1866-c.1880, p. 220

Choosing the Snider-Enfield

> *This committee, composed of practical officers, unanimously report in favour of arming the infantry with breech loading rifles. The question must be dealt with in two ways - either by ascertaining the speediest and cheapest mode or by determining the most perfect arm to be used by the infantry. We must first adopt the readiest means for converting existing arms of service. Having thus armed the troops, we should proceed to enquire fully and deliberately what form of rifle would be most perfect.*

De Grey's official statement 11 July 1864[21]

The formal decision to adopt a universal breech-loader into British service in 1864 had not been made lightly. To re-equip the army would be an expensive venture, made worse by the fact that the Britain had produced over 1,500,000 pattern 1853 rifles that would become immediately obsolete. It was, however, an unavoidable decision. The Prussian army had utilised breech-loading *Dreyse* rifles incredibly successfully with their victory in Schleswig-Holstein just five months earlier. Worse still, the Emperor of France had already declared that his troops were to be equipped with breech-loaders as quickly as possible.[22] Britain had been considering breech-loading concepts for general infantry use since the late 1850s, but the two major developments on the continent sparked the arms race which ultimately led to the adoption of the Snider-Enfield.

The question can be raised as to why the Committee did not simply copy existing continental infantry rifles and remove the need to hold a competition. The answer is twofold. Firstly, cost was a major issue. To immediately switch to a brand new rifle would be far too expensive for the Committee. Secondly, the War Department had already reviewed and rejected existing breech-loaders, such as the *Dreyse* and the *Chassepot*. The *Dreyse* was found to be unsuitable for service because of its serious gas leakage issues.[23] The *Chassepot* was also scorned as it required a rubber seal which wore away after as little as thirty rounds,

[21] De Grey, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864 Official Statement (01/08/1864)
[22] De Grey, Ordnance Select Committee Report
[23] M. Cobb, The Martini and its Place in History: A Historical Perspective - Unpublished (02/02/2016)

which also led to gas leakage.[24] Christopher Roads demonstrates this problem perfectly in his BBC 2 documentary, *The Gun: Riflemen All*:

Figure 1. Burn damage on the thumb from firing the Chassepot. [25]

Developed simultaneously to the infantry rifles were smaller carbines, intended for cavalry use. The most technologically advanced of this genre of rifles was the American breech-loading *Spencer* carbine. The *Spencer* was a repeating rifle, as it stored extra ammunition in a tubular magazine in the butt. More importantly, it also made use of the newly developed self-contained metallic cartridge. The Committee were impressed with the Spencer as 'it did not require capping as there was a ring of fulminate in the copper cartridge.'[26] Unfortunately, the Spencer had too many drawbacks to be considered for general infantry use. Its main drawback was its inherent lack of power. This was because the Spencer rifles ammunition performed poorly at long range due to its low velocity.

In Britain, cavalry carbines still required the use of percussion caps, like the .58 *Sharps* carbine. The *Sharps* was an excellent choice for cavalry units. As De Witt Bailey notes, 'it can be loaded by the right hand, without removing it from the position of which it is usually carried at the side of the horse.'[27] Unfortunately, this rifle also had its drawbacks, such as issues with gas leakages. The amount of gas escaping at the breech was enough to damage the eyes of the user. This is again exemplified by Roads, who places a white handkerchief

[24] De Grey, 3rd Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1862
[25] C. Roads, *The Gun: Riflemen All*, BBC 2 1980'S Film Footage - 2 minutes 54 seconds
[26] De Grey, 1st Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864 (09/11/1859)
[27] De Witt Bailey, The Sharps In England, 1853-1881, *HSBA Journal*, Volume 2., p. 4

over the breech of the *Sharps* carbine and then fires it. The resultant fouling on the handkerchief is the result of just one shot, shown below.

Figure 2. Placing a white handkerchief over the Sharps Carbine's breech.[28]

Figure 3. Captured gas leakage after firing the Sharps Carbine.[29]

It is therefore not difficult to understand why the carbine wasn't considered suitable for general infantry use. Other cavalry issued capping breech loaders in British military service were also inherently unsuitable for infantry use. The British *Westley-Richards* carbine was also trialled but considered unsuitable. This was because the lubrication it required caused 'decomposition of the rifle which affects its performance.'[30]

As nothing suitable had been discovered, the following Committee meeting brought into question the need for the British army to even use breech-loaders at all. The multitude of

[28] Roads, *The Gun: Riflemen All* - 3 minutes 56 seconds
[29] Roads, *The Gun: Riflemen All* - 4 minutes 12 seconds
[30] 1st Meeting, Ordnance Select Committee Report (09/11/1859)

problems they presented were currently outweighing the positives. Furthermore, it was discovered that the Prussian army now carried up to 120 rounds of ammunition on their person, which was double the amount that the British soldier currently carried.[31] It was therefore decided that breech-loaders used too much ammunition to be practical arms. This is shown by committee member Major Young, who claimed that breech-loaders should never be used by the general infantry, as they present a temptation to fire away all of their ammunition, instead, they should be used only by 'trained men on special occasions'.[32]

Subsequent meetings by the Committee took place whenever a new breech-loader was produced, and were equally pessimistic. Wilson's rifle was shunned on 26th March 1861 because it required a piece of felt wad to stop any gases escaping the breech, which then had to be fired out by the following shot, which caused inaccuracy.[33] The Committee had some positive comments to make about the *Montgomery Storm* rifle, believing that its breech action had its merits. After prolonged testing however, this rifle too was dismissed because of its inherent accuracy problems. In April 1861 it was reported 'at 300 yards the Storm is very bad, at 500 it is very bad and at 800 it is positively wild.'[34] From this plethora of rejections, there didn't seem to be any real viable option for the British army's future breech-loader.

Hope was eventually found in one particular weapon system. On the 2nd August 1860 the Committee reported that they had 'observed a great merit possessed by one system at least - which is very different in character from the Storm's and in no way copies it. No encouragement should be received to the maker to mislead him as to the probability of the future adoption of his new arm.'[35] The rifle was that of Mr Jacob Snider. Major Young's Committee was so impressed that they were considered implementing the *Snider* rifle into service four years before they had even decided that a breech-loader was a requirement of the general infantry.

---

[31] De Grey, 2nd Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864
[32] Major Young, 2nd Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864
[33] Ordnance Select Committee Report, Wilson's Rifle Trials, Breech-Loading Small Arms 1859-1864 (26/03/1861)
[34] Ordnance Select Committee Report, Mont Storm's Rifle Trials, Breech-Loading Small Arms 1859-1864 (16/04/1861)
[35] Ordnance Select Committee Report, Snider's Rifle Trials, Breech-Loading Small Arms 1859-1864 (02/08/1860)

By 1864 it can therefore be shown that little had been achieved by the Committee in terms of finding a breech-loading rifle for the general infantry. Whilst the Committee had a broad overview on what existed elsewhere, nothing rugged or powerful enough for British service had been found. As events on the continent caused an increasing need for change, it was at this point that the Committee leader, De Grey, offered the question to the general public. Subsequently, on 23rd August 1864, the Secretary of State for War announced the desire to 'receive communications from gun-makers and others on the subject of the best means of converting the Enfield rifle into a breech-loader.'[36] The best way to inspire this innovation is undoubtedly by means of reward, and so the War Office introduced a competition to find a new breech-loading rifle for the infantry with a 'bounty' of £5000. The competition had two main prerequisites - that the arm does not 'exceed the cost of £1', and that the arm 'should not be inferior to that of an unaltered arm when shooting'.[37]

The response from British gun makers was outstanding. In just one month forty three rifles were received by the committee, and by mid-October a further four latecomers had been submitted.[38] Of these, nine were automatically chosen for testing and eleven were marked for reconsideration. The rest were collectively rejected. Unfortunately, the *Dixon* rifle was withdrawn by its designer, leaving eight rifles for initial testing.[39] As a rule, these eight rifles could be split into two distinct categories, those of the old system that still required percussion caps and those that had self-contained cartridges. The rifles which utilised self-contained cartridge were preferred by the Committee, as by dispensing with the percussion cap, the process of firing could be sped up. The selected rifles were outlined on the following table.

[36] J. St George, Director of Ordnance, Trials of Breech-Loading Small-Arms 1864-67, Ordnance Select Committee (23/08/1864)
[37] Muzzle Loaders Association of Great Britain (MLAGB), Transitional Rifles <http://www.enfield-snider.com/Transitional%20Rifles.htm> [Accessed: 12/11/2015]
[38] Ordnance Select Committee Report (12/10/1864)
[39] Ordnance Select Committee Report (12/10/1864)

Order of Preference	Rifle	Means of Ignition	Notable Features
1	*Montgomery Storm*	Percussion cap	Joint between barrel and chamber secured with an expanding thimble. Operates with a front hinge secured by a bolt.
2	*Shepards (b)*	Percussion cap	Percussion cap, long hammer to reach the nipple.
3	*Westley Richards*	Percussion cap	Same design as the carbine, utilises a hook at the end of the plunger for cartridge withdrawal.
4	*Wilsons*	Percussion cap	Barrel that opens at the top, uses a plunger on a bolt. The bolt is rubber sealed to prevent gas leakage.
5	*Greens*	Percussion cap	Noted from 1863 trials, uses a rotating plunger to secure breech.
6	*Snider*	Ignition in cartridge	New system. Very simple conversion that dispenses with percussion caps.
7	*Joslyn's*	Ignition in cartridge	First noted in 1861 trials. Hinged breech partially ejects empty cases.
8	*Shepards (a)*	Ignition in cartridge	First noted in 1864 trials, breech locks in the centre of the stock. Only original part retained is the barrel.

Table 1. Selected designs for further trial with attached notable features.[40]

Before testing the ability of the top eight rifles, the eleven rifles earmarked for reconsideration first had to be reviewed. It seems that this process was more of a search for problems rather than a search for the merits as a wide array of flaws were found with the reconsidered rifles. Of the eleven, the designs by *Adams*, *Clarks* and *Manceaux* were rejected as they were considered too complicated to operate. The designs submitted by *Goodman*, *Benjamin* and the two examples given by a *Colonel C.* were all rejected as they had parts liable to 'derangement and disjoinment'.[41] *Wentworth*, *Needham* and *Storer's* designs had various breech issues, such as problems with gas escaping and rust. Finally, *Matthew's* rifle was rejected simply because it was a 'worse version of the Westley

[40] Brig. General Lefroy, Royal Artillery, Snider-Enfield: Report of Ordnance Select Committee on Trials, The War Office (06/02/1865)

[41] Ordnance Select Committee Report, Systems Set Aside but Summarily Rejected, Breech-Loading Small Arms 1859-1864 (12/10/1864)

Richards.'[42] Unfortunately, this meant that of the not one rifle was selected to face the other eight in the trials competitions, which were set to commence as quickly as possible.

It was a matter of months, however, before the rifles actually arrived for testing. As the Committee announced, the delay of competitors in providing their rifles 'retarded the commencement of the trials', and it was only by 6th February 1865 that the first serious trials began.[43] Despite the late start, only seven of the eight selected rifles actually made it to Woolwich for testing because the Joslyn rifle never arrived in time. Joslyn was based at the Joslyn Firearms Company, which operated out of Stonington, Connecticut, in the United States.[44] This meant that once constructed, his rifles had to be shipped overseas. Unfortunately due to permit troubles in New York, his rifles could not leave the United States. The rifle therefore could not be considered in the trials.

Worse still for the Committee, of the seven rifles that actually arrived, only five were actually safe for operation. It was reported that when making the initial inspection of the all the received arms and their corresponding ammunition, the cartridges for both of the Shepards rifles literally fell apart when they were picked up. The rifles were immediately deemed too dangerous to load and so were 'abandoned before a single shot could be fired.'[45]

Due to these early eliminations, the Snider rifle was now the only competitor to utilise self-contained cartridges. As the contemporary magazine, *The Mechanic* described, 'Mr Snider now has it all his own way.'[46] Unfortunately for Snider, the ammunition he provided was not of required quality, which proved to be an issue as the trials progressed. It was decided that once better cartridges could be sourced, the Snider would be re-tested.[47] The Committee still decided to include the Snider in the trials with the other rifles to gain an idea of how it compared to them even with faulty ammunition.

[42] Ordnance Select Committee Report, Systems Set Aside but Summarily Rejected (12/10/1864)
[43] Snider-Enfield: Report of Ordnance Select Committee on Trials (06/02/1865)
[44] Joslyn 1864 Carbine <http://www.horsesoldier.com/products/firearms/carbines/4323> [Accessed: 11/10/2015]
[45] Snider-Enfield: Report of Ordnance Select Committee on Trials (06/02/1865)
[46] Converted Enfield Rifles, *The Mechanic's Magazine* (08/09/1865)
[47] Snider-Enfield: Report of Ordnance Select Committee on Trials (06/02/1865)

The first test was set to gauge which of the weapons systems could be operated the fastest. Each system was to fire twenty shots at a medium sized target at 100 yards. As the primary objective of the Committee was to find an improved rifle to the Pattern 1853 Enfield, an example of the current issue arm would also be trialled alongside the contenders.

Rifle	**Time taken to fire twenty shots at 100 yards (minutes and seconds)**
Green	2:26
Wilson	2:44
Snider	2:46
Storm	3:01
Westley Richards	3:29
Pattern 1853 Enfield	6:52

Table 2. Rifle speed tests (06/02/1865).[48]

The results for the first trial were as expected. All of the breech-loading arms fired twice as fast as their muzzle-loading competition. The Snider rifle was able to achieve a mid-table result despite its faulty ammunition. When the Snider was re-tested, with ammunition that was not faulty, it scored a time of just two minutes, rendering it faster than any other trials rifle.[49]

Rapidity of fire alone is irrelevant on the battlefield if absolutely nothing can be hit. The second trial therefore tested the accuracy of the selected rifles to which extremely disappointing results were found, shown in Table 3.

[48] Brig. General Lefroy, Royal Artillery, 1st Trial Results, Royal Artillery, Report of Ordnance Select Committee on Trials, The War Office (06/02/1865)
[49] Skennerton, .577 Snider-Enfield Rifles & Carbines, British Service Longarms 1866-c.1880

Rifle	Accuracy Deviation at 500 yards (feet)
Pattern 1853 Enfield	1.64
Westley Richards	1.81
Wilson	2.10
Storm	2.58
Green	3.59
Snider	5.00

Table 3. Rifle accuracy tests (06/02/1865).[50]

Disappointingly for the Committee, none of the rifles could beat the current service arm in terms of accuracy. As a general rule, the systems which could fire the fastest appeared to be the systems that were inherently the most inaccurate. That said, even the slower systems failed provide suitable results. The poor accuracy of the Snider was not solved until much later in the Committee's trials when its ammunition was modified by Colonel Boxer. This modification housed the ammunition in a cartridge made of two brass coils with a covering of white paper.[51] Once this change had been made, the Snider became capable of beating the Pattern 1853 Enfield in terms of accuracy at 500 yards, a feat no other rifle could accomplish. Table 4. Shows the results of the revised accuracy tests once Boxer's ammunition for the Snider rifle had been developed:

Rifle	Accuracy deviation at 500 yards (feet)
Snider	1.06
Pattern 1853 Enfield	1.57

Table 4. Accuracy tests on the Snider with revised ammunition. (Note the Pattern 1853 accuracy has changed due to different shooting conditions.)[52]

The accuracy of the Snider had been markedly improved. This does raise the point, however, that if the other weapon systems had received equal amounts of help from the War Office to perfect their rifle and ammunition, their systems too could also be dramatically improved. The Wilson rifle, for example, also had ammunition problems that were never

[50] Brig. General Lefroy, 2nd Trial Results, Royal Artillery, Report of Ordnance Select Committee on Trials, The War Office (06/02/1865)
[51] Brig. General Lefroy, Royal Artillery, Snider's Converted Enfield Rifles, 2nd Progress Report, Ordnance Committee (09/05/1866)
[52] Lefroy, Snider's Converted Enfield Rifles, 2nd Progress Report (09/05/1866)

solved before the trials process ended.[53] It must therefore be noted that these later accuracy trials were allowed for the Snider system only as a means of fixing its flaws. It had already been selected for the merits it possessed.

A key trial made by the Committee was that of reliability, as a military arm is useless if it cannot withstand the strains of constant military use. The reliability trials therefore examined the probability that each rifle will misfire, as well as how strong and durable it was when beaten about. In order to test the probability of a misfire, 270 rounds were fired consecutively from each rifle, and the amounts of stoppages were recorded, shown below.

Rifle	Misfires After 270 Rounds
Green	0
Storm	0
Westley Richards	1
Wilson	1
Pattern 1853 Enfield	1
Snider	8

Table 5. Stoppages after 270 rounds of ammunition.[54]

Once again, the Snider finished with terrible results. As the trend shows, this problem was attributed entirely to the ammunition. Further testing of the Snider by Brigadier General Lefroy took place and 5500 rounds were fired with only one misfire, thus redeeming the Snider.[55]

A rifle needs to be strong and durable to survive general infantry use. To test this the rifles were exposed to the elements; they were dropped, submerged in water, covered in dirt and sand and left in the rain. It was during this testing that the stocks of both the Wilson's and Green's rifles were found to break, rendering them useless. Combined with their relatively poor performances in the earlier accuracy tests, both of these systems failed to be recommended for use.[56]

[53] Excellent and Extremely Rare Wilson's Patent Rifle <https://www.collegehillarsenal.com/shop/product.php?productid=1186> [Accessed 11/09/2015]
[54] Lefroy, Snider's Converted Enfield Rifles, 2nd Progress Report (09/05/1866)
[55] Lefroy, Snider's Converted Enfield Rifles, 2nd Progress Report (09/05/1866)
[56] Brig. General Lefroy, Royal Artillery, Second Ordinance Select Committee Report, Ordnance Committee (14/03/1865), p. 13

On top of its poor initial results in the trials, it was found that when the older Pattern 1853s were converted to Snider's system, their barrels became damaged in the manufacture process due to being 'raised to a red heat.'[57] As the main purpose of the original competition was for a quick solution to be found, this left just two viable systems for selection: The Westley Richards and the Storm rifle. Each one had identifiable advantages; The Westley Richards had beaten the other rifles in the original accuracy competitions, 'giving superior figures in accuracy all the way out to 800 yards.'[58] On the other hand, the Storm rifle was a cheaper option as its ammunition was interchangeable with the older pattern 1853 Enfields. Overall, however, the Storm possessed the most advantages. It could be fired faster than the Westley Richards and was much more reliable. It was on this basis that the Storm rifle was chosen as the 1864 competition winner. An initial order for 3000 Montgomery Storm rifles was placed in early 1865.[59]

The Montgomery Storm system was a relatively simple conversion of the Pattern 53 Enfield rifle. The breech was cut away at the top, with a chamber attached to a hinge at the front. The inner layer of the chamber, called the thimble, expanded upon firing, sealing the breech and preventing gas escape. The cartridge was inserted into the chamber facing the user, and flipped over to reattach the chamber to the breech. Like the Pattern 53 Enfield, it still relied on percussion caps as a means of igniting the cartridge. The cartridge was made of a thin layer of animal skin, which would be burnt away by the ignited cap, thus igniting the powder. The main distinguishing feature from the original Enfield was the visible hinge between the cock and the foresight, as shown below with the sealed Pattern Montgomery Storm.

[57] Lefroy, Second Ordinance Select Committee Report (14/03/1865), p. 14
[58] Lefroy, Second Ordinance Select Committee Report (14/03/1865), p. 14
[59] Cobb, The Martini and its Place in History: A Historical Perspective

Figure 4. Sealed Pattern Montgomery Storm rifle.[60]

In their rush to find a winner for their prize competition, the Ordnance Select Committee failed to realise that the rifle was riddled with fundamental flaws. For a start, the nature of the rotating chamber confused soldiers when first presented with the rifle. As they forgot to load the skin cartridges backwards, the rifle inevitably misfired.[61] Once the breech is opened, as shown in figure 5, the cartridge is inserted facing the user, as shown in the armourer's drawing in figure 6.

[60] Mont-Storm Rifle with seal visible, Britain, Rifle, Sealed Pattern .577 Montgomery Storm Breech Loading Rifle (1860), Royal Armouries National Firearms Centre Gunhall [Photo taken 09/08/16]
[61] Cobb, The Martini and its Place in History: A Historical Perspective

Figure 5. Sealed Pattern Montgomery Storm rifle with open breech.[62]

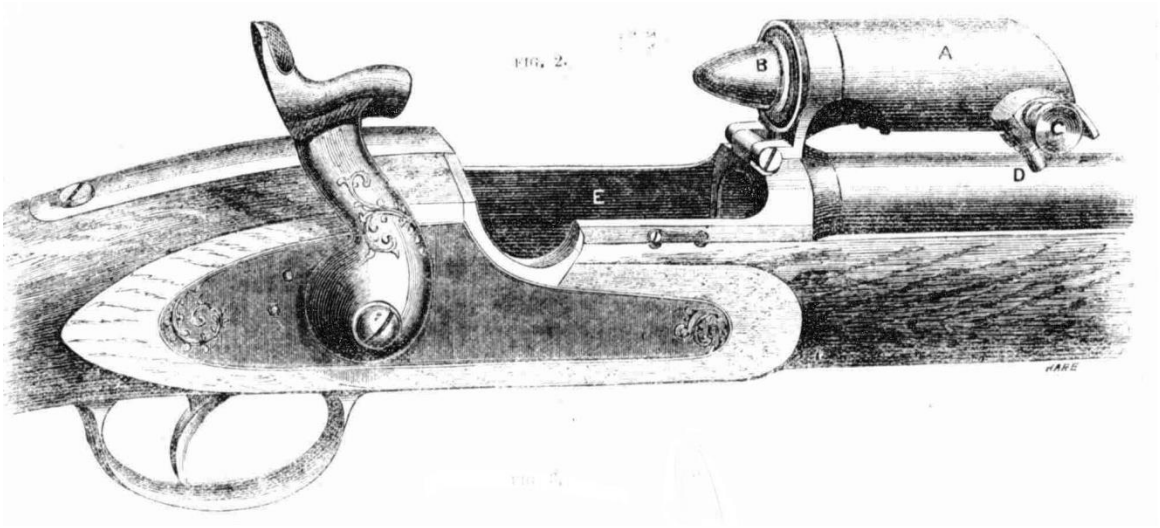


Figure 6. Armourer's drawing of a Montgomery Storm rifle. Note how the nose of the round protrudes towards the user.[63]

[62] Mont-Storm rifle with open breech, Britain, Rifle, Sealed Pattern .577 Montgomery Storm Breech Loading Rifle (1860), Royal Armouries National Firearms Centre Gunhall [Photo taken 09/08/16]
[63] Mont-Storm diagram with open breech, Mont Storm's Breech Loading Rifle, *Illustrated Times* (23/08/1862)

Once loaded, the chamber would be swung shut and the ammunition would sit the correct way around, shown below.

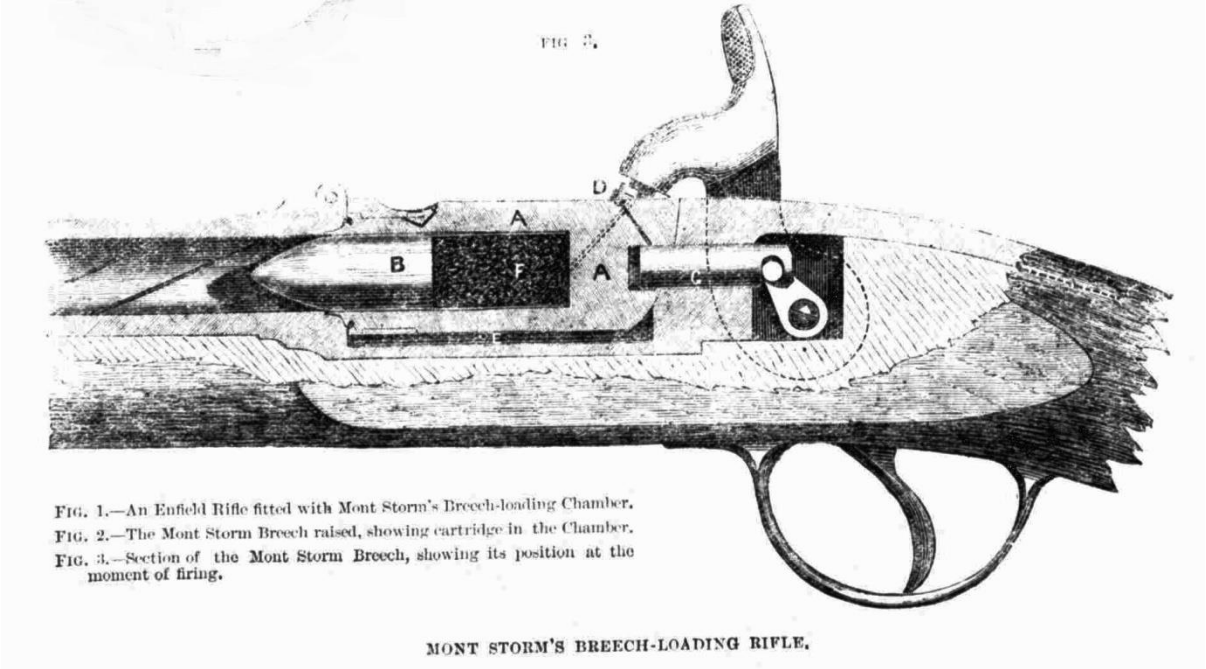


Figure 7. Armourer's drawing of a Montgomery Storm rifle, loaded, but un-cocked.[64]

Whilst this problem could indeed be ironed out by means of rigorous training, the rifle did have more serious problems which related to its ammunition. By utilising animal skin, the ammunition became very expensive and difficult to source; it was impossible to stock enough ammunition for the first 3000 rifle contract alone.[65] Worse still, the fact that the Montgomery Storm required percussion caps was considered a major flaw. Committee member Major General Hay shows this in his reports, announcing that 'it is not justified to propose the Montgomery Storm for conversions despite its leading of the trials. This is entirely due to the external percussion cap.'[66] The Committee ideally wanted a rifle that contained its own ignition in its ammunition, and so it was decided that only 2000 of the proposed 3000 Montgomery Storm rifles would actually be converted until better system

[64] Mont-Storm rifle internals diagram, Mont Storm's Breech Loading Rifle, Illustrated Times (23/08/1862)
[65] Roads, *The Gun: Riflemen All* - 4 minutes 39 seconds
[66] Maj. General Hay, Second Ordinance Select Committee Report, Ordnance Committee (14/03/1865), p. 14

could be sourced.[67] It was due to these flaws that the Montgomery Storm rifle had such a short service life.

The question could be raised as to why the Mont Storm was chosen in the first place if the Committee knew that it was unsuitable for service issue. Ultimately, it had been chosen as a temporary measure as there was some scepticism over the advantages of self-contained cartridges. The biggest fear was that if one was to ignite accidentally in stores, the entire store could be liable to explosion. It was also thought that poor weather conditions could damage the cartridges causing a misfire. Colonel Dixon presented this problem during the early Committee meetings, stating that these 'cartridges were both dangerous and susceptible to weather damage if stored incorrectly.'[68] These concerns seemed justified with the early problems with Snider's ammunition. After the implementation of the Mont Storm however, the War Office had officially revoked these concerns, and were instead advertising these kind of cartridges as the '*sine quâ no*n' of acceptability.[69] This was excellent news for Snider: his system was the only trials rifle that utilised self contained ammunition. It was therefore decided that the Snider rifle would replace the Montgomery Storm.

Upon hearing this news, Snider's reaction was one of joy, proclaiming, 'This is excellent news! They have given in at last!'[70] The only task left for Snider was to design a successful cartridge that performed better than the one in the Committee's trials. Snider first tried to use a thin brass plate wrapped in paper or calico to provide a solid cartridge case. Due to constant monetary problems, all he could produce was 'rough and clumsy.'[71] The task fell towards Colonel Boxer of the War Office, who had 'all the machinery and resources of Woolwich' at his disposal.[72] After perfecting a cartridge, named the 'Boxer cartridge', the Snider was re-trialled. Included in these final trials were stress tests where the barrel was fired so continuously it became hot enough to 'char the stock and turn water into steam.'[73] It was found that manipulation of the rifle was very simple and that after 1000 firing rounds without cleaning, the Snider's 'accuracy and facility of loading' remained exactly the same.

[67] Converted Enfield Rifles, *The Mechanic's Magazine* (08/09/1865)
[68] De Grey, 2nd Meeting, Breech-Loading Small Arms 1859-1864
[69] J Scoffern, Jacob Snider's death, *Belgravia: A London Magazine*, Volume. 1, p. 184
[70] Scoffern, Jacob Snider's death, Belgravia, p. 184
[71] Scoffern, Jacob Snider's death, Belgravia, p. 184
[72] Scoffern, Jacob Snider's death, Belgravia: A London Magazine, p. 184
[73] Lefroy, Snider's Converted Enfield Rifles, 2nd Progress Report (09/05/1866)

On the 23rd May 1866, the Ordnance Select Committee officially recommended the adoption of the Snider as a result of this re-trial.[74] The Duke of Cambridge and Commander in Chief of the British army concurred on 5th July and by August, contracts had been established and an order for the sealed pattern Snider produced.[75] Unfortunately for Jacob Snider, it quickly became apparent that he would not be paid for the pending adoption of his rifle, despite the original competition offering the £5000 bounty. His patent had no legal force against the crown, and so the joy of having his weapon selected for use was quickly shattered. Any payments for his invention would have to come by means of a bounty. The War Office solicitor, Mr. Clode, refused to offer Snider a bounty for his design because he believed Snider's rifle 'could still prove to be a failure,' as had been the case with the Montgomery Storm.[76] Instead, a paltry £1000 was granted in September 1866 and Snider was cast away by the War Office. Of this money, every last penny was immediately given to his creditors to satisfy many of the debts gained by obtaining parts for his rifles and ammunition.[77] Snider, already stuck down by illness, could only react with impotent rage; 'People here are either china or crockery. I am crockery, of the yellow clay. A nobody, an adventurer; the pledged honour of England take no heed of me. Damn the china that is the War people, the mean beggars! Let me write my book, I will shame them to their shoes the mean beggars!'[78]

Nevertheless, the Snider rifle was officially adopted on 18th September 1866. In the list of changes this was marked as 'Change 1327, Musket Rifled, Enfield, Pattern 53 Converted to a breech-loader on Snider's principle (Pattern I). Proposed by Mr Jacob Snider Jr.' [79] The base version, first accepted for service, weighed nine pounds four ounces.[80] Thus, the Snider-Enfield Mk I was born and conversion of the old muzzle-loaders would commence immediately. For many, there was a great deal of scepticism over whether or not the best

[74] The Snider Enfield <http://www.britishempire.co.uk/forces/armyarmaments/rifles/sniderhistory.htm> [Accessed 13/09/2015]
[75] The Snider Enfield <http://www.britishempire.co.uk/forces/armyarmaments/rifles/sniderhistory.htm>
[76] C. Purdon, Jacob Snider's Action & E.M. Boxer's Cartridge: The Snider-Enfield Rifle, *Historical Arms Series*, Number. 24 (Bloomfield, Canada, 1990), p. 25
[77] Purdon, Jacob Snider's Action & E.M. Boxer's Cartridge, Historical Arms Series No .24, p. 25
[78] Scoffern, Jacob Snider's death, Belgravia, p. 184
[79] I. Skennerton, List of Changes in British War Material in Relation to Edged Weapons, Firearms and Associated Ammunition and Accoutrements, Volume I, 1860-1886 (1979), p. 39
[80] Brig. General Lefroy, Royal Artillery, Snider's Converted Enfield Rifles, 1st Progress Report, Ordnance Committee (20/04/1866)

rifle had been found. After all, what was meant to be a quick cheap upgrade had taken the best part of two years to complete. The Committee's indecisiveness was shown with the *fait accompli* of the Mont Storm, and their ultimate decision to adopt the Snider was tainted by the mistreatment of its inventor.

The question of whether the Ordnance Select Committee was successful or not in choosing the Snider-Enfield would only be answered with time. For the moment, the pressure of modernising the infantry with an effective breech-loading conversion of the old Enfield arms had been completed and a stop-gap measure had been ultimately lifted. This was no means the end of the road for the Ordnance Select Committee, as only the first of their two tasks had been completed and the purpose built breech-loader was yet to be found.

A technical overview of the Snider-Enfield

> The application of a needle moving at an oblique angle, as described, or piston to pierce or percuss the fulminate contained in the cartridge; as herein set forth, as applicable to the transformation of all firearms heretofore made upon various systems in use ignited by an ordinary cap or nipple.

J. Snider describing his patented principle.[81]

Jacob Snider's rifle was so successful militarily because it was reliable, robust, and most importantly, simple to use. Of all the rifles described in the competition trials to find the first official breech loader for general infantry use, the Snider retained the most features of the old, Pattern 1853 Enfield. It also removed the smallest amount of wood from the stock, making it a very strong rifle.[82] To understand why the Snider was such a technical leap forward, an assessment must be made of its manufacture and internal workings. Furthermore, the rifle was subject to a huge amount of development, from Mk I and II converted Enfields, to the Mk III systems that were made from scratch. As well as the official infantry rifles, the Snider was also used for cavalry and artillery carbines.

Across all the different variants of Snider-Enfield, from carbine to long rifle, the basic breech loading principle remained the same. A small part of the breech end of the barrel and its surrounding stock was removed and replaced by a chamber to house the new breech block. This was known as the 'shoe', which was screwed onto the rifle's barrel after the rear portion had been cut away. The shoe carries a breech block that is attached via a hinge on the right, allowing the breech block to swing open and shut. Before opening the breech, the rifle had to be put onto half cock, demonstrated below.

[81]Skennerton, .577 Snider-Enfield Rifles & Carbines, British Service Longarms 1866-c.1880, p. 22
[82] G. Pfeiffer, The Snider Rifle (2009) <oldbritishguns.com/the-snider-rifle> [Accessed: 15/09/2015]

Figures 1. and 2. Putting the Snider Rifle onto half cock. [83][84]

The next step was to open the breech. On the original rifles, the breech would simply flip open. After 1869, a locking latch was introduced to help secure the breech block.[85] This would be opened by pressing a left mounted lever with the thumb and forefinger and pulling to the right, thus opening the breech. A cartridge would then be inserted.

Figure 3. Charging the Snider-Enfield Rifle.[86]

[83] The Mk III Snider-Enfield: An Introduction (21/02/2016) <https://www.youtube.com/watch?v=DJ-f11hM4Sk> [Accessed: 22/02/2016]
[84] The Mk III Snider-Enfield: An Introduction
[85] List of Changes in British War Material, change number 1759 (13/01/1869)
[86] The Mk III Snider-Enfield: An Introduction

The block would then be swung shut, in doing so automatically locking the breech block into the shoe. The rifle would then be put onto full cock.

Figure 4. Putting the Snider-Enfield onto full cock.[87]

The user would then aim at his target and fire the rifle. To fire, the trigger was pulled, releasing the external hammer causing it to fly forward, hitting the striker at speed. In an ordinary Pattern 1853 Enfield this would ignite a cap; however, on the Snider it hits a long pin that runs through this entire breech block. Snider described this pin as 'passing obliquely through from the nipple to the centre of the front of the block.'[88] This pin, known as the firing pin, would pierce the cap in the base of the cartridge. A surrounding spring would then restore it to its original position. Thus the force of the pin would cause the cartridge to ignite, projecting the bullet through the barrel.

Once the cartridge has been discharged, the breech block is once again opened by compressing the lever and swinging the hinge to the right. A useful innovation in the Snider rifle is the cartridge extractor, which is attached to the hinge on the shoe. By pulling the breech block backwards towards the user with the thumb and forefinger, the rim of the cartridge moves backwards a portion, removing it, but not ejecting it, from the chamber.

[87] The Mk III Snider-Enfield: An Introduction

[88] I. Skennerton, *A Treatise on the Snider, The British Soldier's Firearm 1866-c.1880* (Margate, AU, 1977), p. 56

Figure 5. Ejecting the spent cartridge.[89]

The user then releases the breech block, which is driven back to its original position by another spring on the hinge itself. At this point the cartridge is only partially ejected, so must be either pulled, shaken, or flipped out of the rifle by the user. Officially, this had to be done by rotating the rifle to the right. Proficient users could achieve upwards of ten rounds per minute by firing in this manner, which was three times faster than the muzzle-loaders of a now obsolete era.

Figure 6. Ejecting the spent cartridge from a Snider-Enfield.[90]

Although a lengthy process compared to modern standards, this method was much faster and easier than loading the Pattern 53 Enfield, requiring much fewer steps. Some of the Enfield's key features were retained however. The barrel was exactly the same, using early Enfield rifling, causing the Snider to become known as the Snider-Enfield rifle. The most notable feature was the external percussion lock, making the Snider the last British infantry rifle to utilise an external lock. The lock itself was undoubtedly the most complex part of the

[89] The Mk III Snider-Enfield: An Introduction
[90] The Mk III Snider-Enfield: An Introduction

rifle, requiring the most parts and the most complex construction methods. Whilst all troops were expected to know how to operate the rifle, only armourers would know how to dismantle, fix and rebuild the Enfield lock. Figure 7. shows a labelled drawing of all the components that went into the lock's working parts.

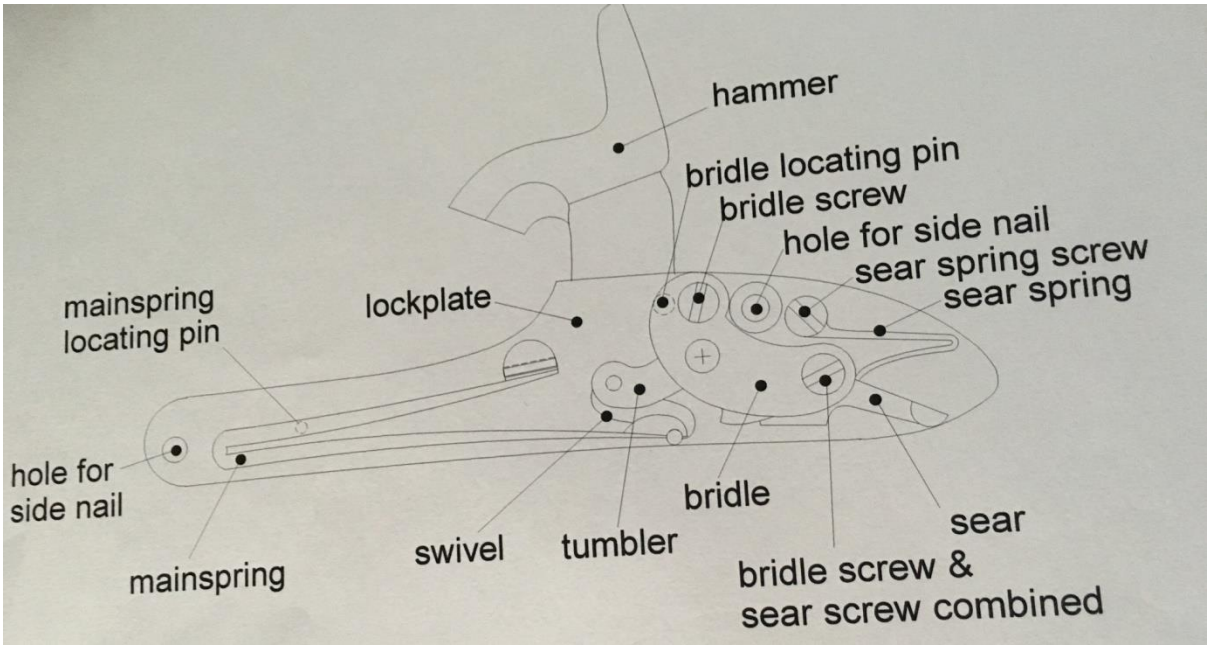


Figure 7. Enfield Percussion lock with nomenclature.[91]

The Snider's lock was almost identical to the lock of the Pattern 1853 Enfield, with the only difference being the hammer's function; instead of striking a percussion cap, it now drove a firing pin. When the rifle is uncocked, this hammer sits vertically on the rifle and there is no pressure on any of the internal springs.

[91] P. Smithurst, *The Pattern 1853 Enfield Rifle* (Oxford, 2011), p. 13

Figure 8. A Mk III Snider-Enfield percussion lock in an uncocked position..[92]

Like the Pattern 1853 Enfield, the Snider-Enfield had the capability to be held in a half-cock position. Originally, half-cock was designed to allow the user to prime the pan in flintlock mechanisms, or to stop the hammer resting on the cap in the percussion system it derives from. In the Snider, the position was used more as a safety precaution. By being held at half-cock, the chances of accidental premature fire were reduced as there was no pressure on the firing pin. (Although this was always a possibility if the sear was damaged, hence the term 'going off at half cock'). To put the rifle onto half cock, the hammer was drawn backwards. This compressed the mainspring a fraction, pushing the tumbler upwards via the stirrup on the left, causing the tumbler to rotate clockwise. As it rotated, the sear would slide along its curved edge and fall neatly into the first of two notches, named 'bents' cut into the tumbler. These bents stop the spring pressure from rotating the tumbler and releasing the hammer, shown below in a simplified depiction of the tumbler's function.

[92] I. Skennerton, Snider-Enfield 'b-Lock uncocked', Snider-Enfield Picture collection (16/12/2015)

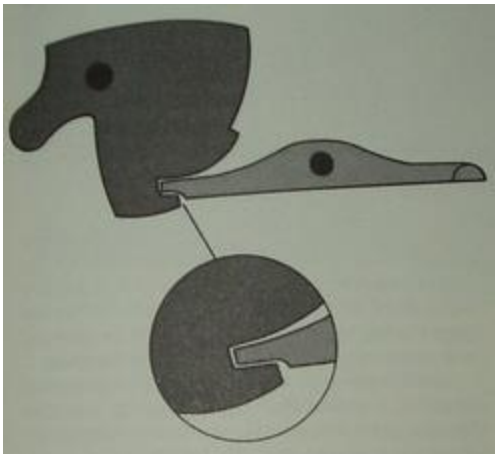


Figure 9. Sear slotted into a tumbler on the first notch, or half-cock position.[93]

A sear spring is required in order to force the sear to engage with the bents in the tumbler in this manner. The resultant half-cock configuration can be shown below.

Figure 10. A Mk III Snider-Enfield percussion lock in a half cock position.[94]

When the cartridge is loaded into the rifle, and the breech is closed, the hammer is drawn back to full cock before firing. This action is merely an extension of the half-cock procedure, except much more pressure is put onto the mainspring and the sear falls into a second, much smaller notch on the tumbler.

[93] Visual description of how sears and tumblers function <http://britishmilitariaforums.yuku.com/topic/16487/My-577-Snider-will-fire-at-HalfCock?page=1#.Vv_QVKQrJnQ> [Accessed: 22/09/2015]

[94] I. Skennerton, Snider-Enfield 'b-Lock full cocked',Snider-Enfield Picture collection (16/12/2015)

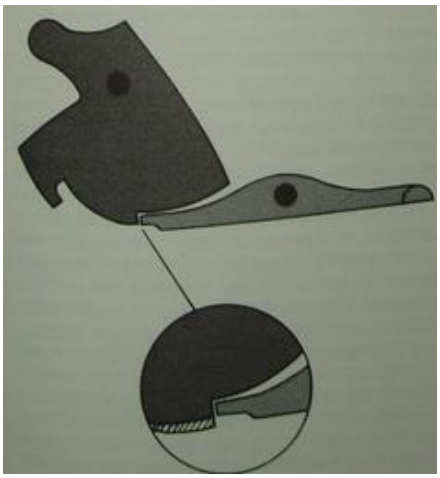


Figure 11. Sear falling into a tumbler at full cock position.[95]

This second bent is much smaller, and so the sear spring again functions to hold the sear in place. Once in place, the lock is now fully cocked.

Figure 12. Mk III Snider-Enfield lock at full cock.[96]

All that is left to do for the user is pull the trigger. The trigger engages with the sear, and so when the trigger is pulled, the sear is released. This releases the pressure on the mainspring,

[95] Visual description of how sears and tumblers function

[96] I. Skennerton, Snider-Enfield 'b-Lock half-cocked', Snider-Enfield Picture collection (16/12/2015)

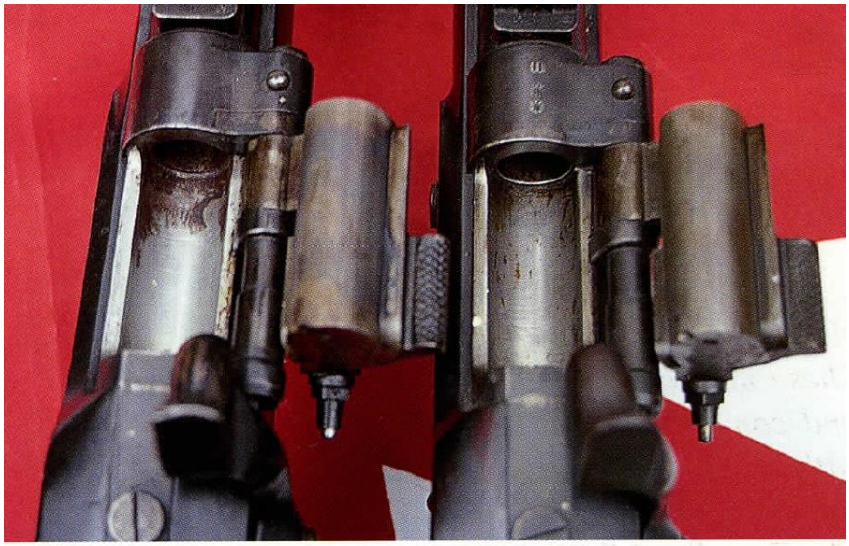
as it pulls down on the tumbler, simultaneously causing the hammer to fly forward with enough force to drive the firing pin forward to ignite the cartridge's primer.

In terms of technological development, the Snider-Enfield's lock design was very intricate and required a great knowledge of precision engineering. Conversely, the lock was also incredibly easy to operate and repair. Unfortunately for the Snider, the rifle represented the end of an era, as this was the last British rifle to utilise an external lock.

The means of operating the Snider remained the same throughout its service life, but, like the majority of British small arms, it underwent several key modifications. All rifles up to Mk III were conversions of older rifles, whilst after Mk III the rifles were constructed from scratch. The first of these changes was something of an embarrassment for the War Office, occurring just three months after the Snider had been introduced into service. There were growing concerns about the Snider's breechblock being blown open, due to a combination of poorly designed ammunition and breech locking mechanism. There is a reason that there are no records of this happening, as it would appear that the War Office attempted to suppress this rather significant problem. Historian Ian Skennerton makes reference to some official correspondence regarding the issue: 'As regards Canada, the Committee think it would be best to say nothing about the defect of ammunition, but at the earliest possible period to send out new ammunition and withdraw what is there, at the same time altering the breech recesses to form Mk I*. As regards Ireland, the same course should be pursued.' [97]

The problem must have been much greater than the War Office would care to admit. To initiate ammunition recalls and rifle adjustments was a major undertaking, given that by this point over 14,000 rifles had been produced. The remedy for the rifles, however, was somewhat minor. The only things changed were the rim profiles at the start of the chamber. Instead of being rounded, they became squared. By squaring the edges of the chamber, there was less chance of gas escaping from the base of the cartridges. This also served to aid cartridge extraction after firing.

[97] I. Skennerton, The Mk I* Snider Short Rifle Cover up, *Historical Arms Series*



*Mk I Snider at left, Mk II** at right. Note different rim profile for the cartridge, round (left) and squared (right)*

Figure 13. Comparison of Mk I Snider with later versions.[98]

This change was applied on 11th December 1866 as a 'slight alteration to the breech mechanisms in the form of a squared countersink'.[99] All existing rifles were known as Mk Is, but once they had their breeches altered they were re-stamped as Mk I*s. Newly converted rifles now had to have this 'squared countersink' so were automatically stamped as Mk II*s. To confuse matters further, there were recurrent problems with ammunition extraction as cartridges failed to extract from the rifle. In 1867, The Inspector General of Musketry, Hay, complained that 'the rifle constantly fouled and jammed.'[100] This problem had already been registered by the War Office, as on 11th December 1866 some rifles already had the 'shape and dimensions of the extractor' modified.[101] Rifles updated in this way were stamped Mk II**, however, not all subsequent rifles built were made to this mark.

The only changes to the converted rifles from this point onwards were in ammunition. By 1869, all suitable muzzle loaders in stores marked for conversion had been used up. Even stores of rifles that were not Pattern 1853 Enfields had been converted to the Snider principle (such as the Lancaster rifles), numbering some 290,000 rifles by the end of

[98] Skennerton, The Mk I* Snider Short Rifle Cover up
[99] Skennerton, List of Changes in British War Material, Volume I, p. 39
[100] J. Peel, Army Sneider Breech Loading System - Copy of Reports by Inspector General of Musketry C. Hay (19/02/1867)
[101] Skennerton, List of Changes in British War Material, Volume I, p. 39

production.[102] As no more rifles could be converted, new rifles were subsequently made at Enfield. Apart from being brand new rifles, they differed from the older marks with two main features.

The first feature is that they were built from steel instead of iron: earning the Snider rifle the accolade of being the first steel rifle in British infantry service.[103] The second change was a locking bolt attached to the breech block. This was because even after the initial modifications, reports to the War Office were still coming in about gas escapes. In his reports of 1867, Inspector General Hay was horrified to find 'an escape of gas amongst other rifle problems.'[104] To remedy this, the breeches became fixed in place when closed with a new locking latch designed by Edward Bond of the London Small Arms Company in the form of a bolted breech. To operate, it had to be pressed inwards to release the latch.

Figure 14. An overview of the Snider's breech development. Note the locking latch on the Mk III to the right.[105]

This new purpose built Snider-Enfield arrived in service officially on 13th January 1869 as the Mk III.[106] Other modifications included a more squared-off hammer, as the former Pattern 53's hammer was slightly recessed so as not to prevent pieces of percussion cap

[102] Skennerton, *.577 Snider-Enfield Rifles & Carbines, British Service Longarms 1866-c.1880*, p. 221
[103] Apart from being stronger, steel was also more resistant to corrosion, increasing the rifle's service life.
[104] Peel, Army Sneider Breech Loading System (19/02/1867)
[105] I. Skennerton, Snider-Enfield 'IMG_0642', Snider-Enfield Picture collection (16/12/2015)
[106] Skennerton, List of Changes in British War Material in Relation to Edged Weapons, Volume I, p. 39

from flying off once struck. More metal was also added underneath the shoe for strength. The armourers drawing below shows the Mk III.

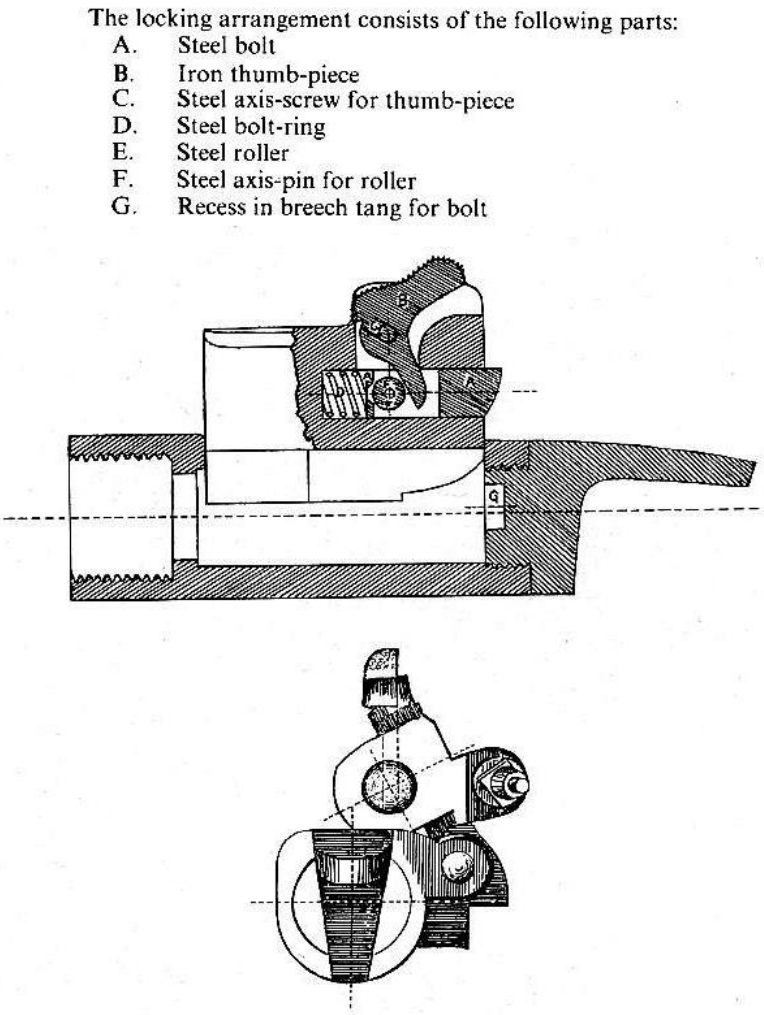


Figure 15. Armourer's drawing of the Snider-Enfield Mk III.[107]

This final development of the Snider ensured its success as a British military rifle; it far surpassed its original intended purpose. Snider-Enfields were first designed purely as a conversion, to modernise the army to the standards of the continent whilst a purpose-built breech-loader could be discovered. Instead, the Mk III shows that they were so good that they were worth building from scratch; a true testament to the rifle's quality.

The technical overview of the Snider-Enfield therefore shows that the rifle was extremely important historically for two key reasons. Firstly, the speed at which the arm could be fired outclassed any rifle the general infantry had fielded before it, and the ease of operation is entirely due to Jacob Snider's design. The second key factor is the mechanics of the rifle. The

[107] The Snider-Enfield Mk III, armourer's drawing, The War Office (January, 1869)

Snider-Enfield represented a complex piece of technology of the era; from the design of the lock, to the means of ignition via a firing pin. It was the first ever general infantry rifle to use a self-contained cartridge. The combination of these factors ultimately resulted in an arm that was perfectly suited to military service, causing Colonel Dixon of the War Office to remark: 'Three Years of use by the soldier have most satisfactorily established the character of this weapon - superior to any breech-loading arms of any foreign army.'[108]

[108] Skennerton, *.577 Snider-Enfield Rifles & Carbines, British Service Longarms 1866-c.1880*, p. 220

The Snider in battle

> Colonel Cameron also watched intently, gauging the range and speed of movement of the enemy. He was an experienced soldier who knew his business and he wanted the first blast of musketry to be a devastating one, so that although the Snider was effective at 500 yards he waited resolutely. When the approaching line was some 250 yards away he judged the time ripe. In a clear, unhurried voice, he gave the order to fire. Three hundred blue barrels came up together and three hundred hammers clicked back to full cock. The first burst of fire ran down the line with a noise like a great tearing of canvas and a wide gap appeared abruptly in the centre of the Abyssinian line as the storm of fire hit it. The British were firing independently and by the time the more deliberate shots had fired their first rounds the quicker were ready with their second.

Extract taken from George Alfred Henty's '*The March to Magdala'*.[109]

Just as its inventor was cast away and forgotten, the Snider-Enfield is something of a forgotten weapon of the nineteenth century. Its use in battle is, for the most part, poorly recorded. Whilst its successor, the Martini-Henry became an icon of the British Army in popular culture due to its part in films such as 'Zulu' and 'Zulu Dawn', the Snider-Enfield holds no such fame, and has subsequently been cast aside. In-fact, it is recorded as merely a stop-gap; something temporary to be thrown away as quickly as possible.[110] In reality, however, the Snider was much more than a temporary solution. Although poorly documented, it played its role in battles across the British Empire. Furthermore, it saw continued use well past its official service life all over the globe. Moreover, the fact that Snider-Enfields reappeared in the hands of British soldiers even as late as World War One demonstrated that it vastly outlived its perceived 'stop-gap' role. It can be therefore be argued that the Snider-Enfield is a vastly underrated technological development in both British history and military history as a whole.

The first major British use of the Snider rifle was at the Battle of Arogi during the Abyssinian campaign of 1868. This saw a pitched battle between the *4th Kings Own Regiment* - numbering over 300 rifles against a mass of up to 7000 Abyssinian warriors. The Abyssinians charged *en masse* and the effectiveness of the Snider became all too apparent, shocking

[109] G. Henty, *The March to Magdala* (London, 1868)
[110] Cobb, Cinderella Snider

both sides. The Abyssinian warriors had expected pauses between each volley so that they could advance, but the speed of operation of the Snider meant that there was none. The result was a massacre. For the British troops, they too were used to volley fire and so for the first time the British army's eyes had been opened to the true power of the breechloader.

Outside of the general infantry, the Snider rifle was used most extensively by the Canadian army. Sniders were first requested to quell a Fenian uprising in 1866; however, the first rifles only arrived for use in 1867.[111] On the 25th May 1870 the Snider rifle was involved in two entirely unique scenarios in two different Canadian provinces. The first was the 'Wolseley expedition', which was part of the wider Red River campaign. As United States Colonists attempted to expand into Canadian territory, the British led a Canadian army in the campaign to remove the colonists. As during the Wolseley expedition the colonists were armed with muzzle-loaders, whilst Wolseley's unit possessed Snider-Enfield rifles, the result was a decisive victory for the Canadians. [112]

On the same day, the battle of Eccles Hill was fought in Huntingdon, Quebec. The Fenian brotherhood had launched a raid into Canadian territory, which was easily fought off by Canadian militiamen and their Snider-Enfields.

[111] The Snider Enfield <http://www.britishempire.co.uk/forces/armyarmaments/rifles/sniderhistory.htm>
[112] M. Cobb, Online interview with Malcolm Cobb regarding Snider and Martini Rifles and their use (23/02/2016)

Figure 2. Canadian militiamen armed with two-band sergeants Snider-Enfields posing with a dead Fenian.[113]

Even after the official adoption of the Martini-Henry rifle in 1871, the era of the Snider-Enfield endured. In the 1873 to 1874 Ashanti campaigns, the short two-band Snider-Enfield loaded with buckshot was the preferred arm of many soldiers, as for jungle fighting at ranges of often less than fifty metres it was a perfect weapon.[114] British colonies were also armed with Snider-Enfields once the general infantry had received their Martini-Henrys. This extended the service life of the Snider still further, a result of which was its continued use on the North-West frontier against the Burmese from 1885 right through into the 1890s.

As the Martini-Henry carbine was not introduced until 1877 for cavalry and artillery use the Snider remained in service with the British Army even longer still. In the 1879 Zulu wars, British Cavalry were still using Snider rifles, so much so that after the defeat at Kambula, more Sniders were recovered by the Zulus than Martinis.[115] The final official recorded use of the Snider on the battlefield is during the Transvaal wars of 1880-1881, when forts in Pretoria were surrounded by the Boers. In a desperate attempt to increase British firepower the Snider-Enfield was issued to town guards.[116] The Snider's final official distribution to

[113] Battle of Echoes Hill <http://britishmilitariaforums.yuku.com/topic/11886/Canadian-Soldiers-w-Snider-Enfields-Photo#.Vwe6raQrJnR> [Accessed: 25/09/2015]
[114] Cobb, Online interview with Malcolm Cobb
[115] Cobb, Online interview with Malcolm Cobb
[116] Cobb, Online interview with Malcolm Cobb

British forces was a full eighteen years later in 1899 when it was still being issued as personal protection for wagon drivers.[117]

This was not the end for the Snider. It was the primary arm of one of Japan's most significant military events, the Satsuma rebellion. In 1877, Snider-Enfield rifles, sold out of service by the British, were the primary arm of the Imperial Japanese Army. Interestingly, they were also the primary firearm of the Satsuma rebels, the last of the famous Samurai who revolted against this Imperial army. The Imperial army numbered around 90,000, of which upwards of 45,000 were armed with Snider rifles, with around 63,000,000 rounds of ammunition available to use in battle. In comparison, the Samurai rebels numbered around 30,000 and were armed with both Snider and Pattern 1853 Enfield rifles, with just 3,000,000 rounds of ammunition.[118] It was ultimately this imbalance of numbers that led to the Samurai's defeat.

During the conflict the Imperial army fired on average 322,150 rounds of small arms munitions every single day. So much smoke was generated that in some cases units engaged fire at distances of less than ten yards.[119] In comparison, at the midpoint of the campaign, the Samurai withdrew their Snider rifles, being forced to use the less efficient Pattern 1853s to slow down their ammunition expenditure to prevent them from running out.[120] If nothing else, these figures alone demonstrate how powerful the Snider-Enfield could be, and how much more efficient an arm it was when compared to the muzzle loaders that came before it.

[117] Cobb, Cinderella Snider
[118] J. Buck, The Satsuma Rebellion of 1877, from Kagoshima through the siege of Kumanoto castle, *Monumenta Nipponica*, Volume. 28, Number. 4 (1973), p. 430
[119] Buck, The Satsuma Rebellion of 1877, p. 440
[120] Buck, The Satsuma Rebellion of 1877, p. 443

Figure 3. Artists rendition of Imperial Troops at the battle of Tabaruzaka. Note the great clouds of smoke limiting visibility.[121]

The oldest guns used by the British forces in World War One were Snider-Enfields. As many first class arms as possible were in use at the front, little was left for training purposes. As historian Richard Gajda describes, 'they were much better than marching with broomsticks.'[122] This means that technically, Snider-Enfields did not serve the British Army as a short stop-gap rifle for five years until the introduction of the Martini-Henry...they were actually used by the British for over forty-eight years! Film footage even exists of British soldiers using Snider rifles during inspection under the watchful eye of Lord Kitchener.

[121] Battle of Tabaruzaka <https://rekishinihon.com/2014/06/07/battle-of-tabaruzaka/> [Accessed: 26/09/2015]
[122] R. Gajda, The Use of Blackpowder Cartridge Rifles, Carbines and Handguns in WWI, Film footage, 34 Minutes 0 Seconds

Figure 4. Lord Kitchener inspecting home guard units of the British Army c.1914. Note the combination of rifles visible, including Lee-Metfords, Martini-Henrys and Snider-Enfields.[123]

Figure 5. Enlargement a veteran home guard soldier carrying his Snider-Enfield.[124]

In British military service the Snider-Enfield therefore vastly exceeded expectations. Its first use at Arogi proved its devastating effects. Its continued use even after its official service life

[123] Home Guard inspection by Lord Kitchener c.1914, BBC Film footage, <http://www.bbc.co.uk/iplayer/episode/p01nprmc/Britains_Great_War_War_Comes_to_Britain/>, 28 Minutes 0 Seconds

[124] Home Guard inspection by Lord Kitchener c.1914, 28 Minutes 0 Seconds

ended proved that the rifle was much more than a temporary solution. The rifle appeared in the hands of volunteers over for forty years after it had been declared obsolete. It was also used extensively outside of the British Empire and Commonwealth nations such as Japan, Nepal, Denmark, Holland, Montenegro, Serbia, Turkey and Egypt.[125] Belgium and the United States even manufactured their own copies of the rifle.[126] The Snider-Enfield is therefore a vastly underrated weapons system which deserves more credit than it has been given in terms both arms and technological development, as well as the wider world of military history.

[125] Skennerton, *.577 Pattern 1853 Rifle Muskets & Snider Enfield*, p.19
[126] Skennerton, *.577 Pattern 1853 Rifle Muskets & Snider Enfield*, p.19

Conclusions

Sergeant's Two-Band Snider rifle and Snider carbine, courtesy of Ian Skennerton.[127]

Many people think of the Snider-Enfield as something 'not quite right that was offloaded as quickly as possible by the troops.'[128] This overview has challenged that assumption, by demonstrating the quality of the rifle. From its original selection in the 1866 breech-loading 'competition' to its manufacture, operation and modifications, the development of its ammunition and ultimately its performance in the field.

In the prize 'competition', the Snider was ultimately victorious. During the trials, it proved its worth as a cheap and easy conversion of the Pattern 1853 Enfield, leading to its formal adoption on 23rd May 1866.[129] Its successes during War Office trials were continued through into 1867, where in an effort to upgrade the rifle of the general infantry to a 'purpose built breechloader', the Snider-Enfield finished on top of its competition.[130] This proves that the Snider-Enfield was indeed the best choice of rifle available to the War Office.

The technical overview of the Snider-Enfield also proves that it was an adept military rifle. It was simple and quick to operate and could fire twenty rounds in little over two and a half

[127] I. Skennerton, Snider Sergeant's rifle and Snider Carbine "Dscn6645bc", Snider-Enfield Picture collection (16/12/2015)
[128] Cobb, Cinderella Snider
[129] The Snider Enfield <http://www.britishempire.co.uk/forces/armyarmaments/rifles/sniderhistory.htm>
[130] Cobb, Cinderella Snider

minutes.[131] Any flaws found in the rifles operation were quickly ironed out with the later Marks, such as the addition of a locking latch for the Mk III's. Its historical significance lays in the fact that it is the first general infantry rifle of the British army to use self-contained ammunition. Furthermore, it can be shown that the problems did not lie with the rifle itself, rather, it's early forms of ammunition.[132] This is demonstrated by the fact that when the Snider rifle was re-trialled, it produced much better results. This again emphasises the quality of Jacob Snider's original design.

Finally, the use of the Snider-Enfield in British and indeed global military service provides the strongest evidence to show that the rifle was much more than a 'stop-gap' measure, and is therefore much more historically significant than previously assumed. Officially, it served for a five years as a service weapon. In reality, however, it found almost half a century of military use in various forms.

[131] Snider Enfield Information <http://www.enfield-snider.com/.htm>
[132] J. Hulla, Report of the Shooting of the Snider Breech-Loading long rifle with the No.3 pattern cartridges, bullet weighing 480 grains, *Journal of the Society of Arts*, Volume .15, Number. 755 (10/05/1867), p. 401

The search for the 'Perfect Arm':

The .450/577 Martini-Henry Rifle

[133]

[133] J. Sammon, The Martini-Henry Rifle and the Greatest Discovery of Antique Firearms Ever, <http://www.guns.com/2012/01/31/the-martini-henry-rifle-and-the-greatest-discovery-of-antique-firearms-ever/> (31/01/2012) [Accessed 22/05/2016]

Whilst the Snider-Enfield rifle has often been overlooked in British military history, its successor, the Martini-Henry rifle, has been idolized. The rifle stands as a symbol of British imperialism and has been made famous in recent years by movies such as 'Zulu'. Officially, the rifle served the British army as a first class rifle from 1871-1888, and as a second class rifle for a further fifty years, showing it to be an important weapon of the British army. Yet does the Martini-Henry actually deserve to be revered over its predecessor the Snider-Enfield? On a global scale, it was something of an anomaly. On the continent, nations were beginning to turn towards bolt-action mechanisms.[134] In America, repeating arms were growing in popularity, yet were rejected in Britain as being too underpowered.[135] In fact, the only other nation outside of British influence to officially adopt a similar rifle to the Martini-Henry was Turkey, who bought in total 600,000 Peabody-Martini's.[136] Some historians, such as David Westwood, even claim that the Martini-Henry was 'not up to scratch' and that 'all that the rifle achieved for Britain was to 'bridge the gap between converted muzzle-loaders and bolt-actions.'[137]

The following technical overview of the Martini-Henry will analyse both historical standpoints of the rifle via a step by step review of the rifle, and show that the rifle was neither the stop-gap that Westwood describes, nor the perfect arm that its recent adulation suggests. Instead, it will show that over time and with frequent altercation, the rifle ultimately grew into the icon it is today. By analysing the rifle through the same process as the Snider-Enfield, it can be compared directly to its predecessor. The first step will therefore analyse the trials, tests that ultimately produced the Martini-Henry. The complexity of this process goes some way to showing just how good the arm had to be to survive selection, showing it to be historically significant, as well as showing the rifle's early flaws.

A technical overview will then analyse how the rifle was operated and how it functioned internally. This, when compared to the Snider-Enfield will show that the Martini-Henry was in fact an improvement in almost every way. It was cheaper, more accurate, more powerful and could even fire faster. Following this, an analysis of the rifle's development over time

[134] The .43 Mauser Model 1871 for example was now being used by the Prussian Army.
[135] Roads, The Gun: Riflemen All, 9 minutes 13 seconds
[136] Gajda, The Use of Blackpowder Cartridge Rifles, Carbines and Handguns in WWI, 27 Minutes 0 Seconds
[137] D. Westwood, *Rifles: An Illustrated History of Their Impact* (Santa Barbara, CA, 2005), pp. 60-61

will be made. This will show how the flaws of the rifle were eventually ironed out over time. As the contemporary newspaper *The Saturday Review of Politics, Literature, Science and Art* described: We are forever being told it will break down, to which it goes on to not break down.'[138] Finally, an analysis of how the Martini-Henry was used on the battlefield will evidence arguments for both the critics of the weapon and its supporters, by highlighting its strengths and weaknesses whilst in service.

Ultimately, it will be shown that the Martini-Henry was indeed an important rifle that to an extent deserves the adoration it receives today. Despite its faults, it was a definite leap forward in small arms technology when compared to the Snider-Enfield, evidenced and epitomized by battles such as Rorke's Drift. The Martini-Henry justifiably earned its respect. In the words of Rudyard Kipling; 'When 'arf of your bullets fly wide in the ditch, don't call your Martini a cross-eyed bitch. She's human as you are, you treat her as sich. An 'she'll fight for the young British soldier.'[139]

[138] The Martini-Henry Rifle, *The Saturday Review of Politics, Literature, Science and Art* (December 1870) Volume. 790, Number. 30, p. 778

[139] R. Kipling, The Young British Soldier c.1889-1891 <http://www.kiplingsociety.co.uk/poems_youngbrit.htm> [Accessed 20/05/2016]

The search for a perfect arm: the '*Faux Pas'* of the Sub-Select Committee

> *We invite all Gunmakers and Others to submit proposals for breech-loading rifles, either repeating or not repeating, which may replace the present service rifles in future manufacture.*

War Office invitation to the public to provide a new breech-loading arm in 1864.[140]

Ever since the decision to adopt a breech-loader into military service with the War Office's declaration in August 1864, Britain had been meticulously hunting for a 'perfect arm' that could compete with the modern breech-loading systems appearing across Europe. The first task for the War Office was to find a quick breech-loading conversion for their current Pattern 1853 service rifles. Despite taking much longer than anticipated, this was completed with the introduction of the Snider-Enfield in 1866. The second task was to find an entirely new breech-loading system to truly modernise the British Army. This task began with the official opening of the trials competition on 22nd October 1866.[141]

The competition gave strict prerequisites for the submitted designs to adhere to. They could not exceed nine pounds five ounces, or be longer than fifty one inches. They had to be capable of firing at least twelve rounds per minute and also be extremely accurate: at 300 yards they could not have more than a six inch shot deviation and at 500 they could have no more than twelve.[142] A prize of £300 would be given to any competitors that passed the first trial in order to to fund the production of six experimental rifles. On top of this, £1000 would be given to the best arm if selected for military use, or £600 would be given to the

[140] The War Office, 1865 Invitation for new breech-loading arms (22/09/1865)
[141] The Martini-Henry Rifle, *The Engineer* (12/03/1869), p. 181
[142] Reports on Breech-Loading Arms by a Special Sub-Committee of the Ordnance Select Committee (1868)

best arm failing this. Further prizes were offered for the best cartridge submission, worth £400 and the best magazine or repeating arm, worth £300.[143]

By 21st March 1867, the Committee reported that in response to this competition; no less than 104 rifles had been submitted for testing. The Committee had categorised the rifle submissions into two sections. The first section, 'Class I' contained thirty-seven rifles, and was made up of rifles that passed the entry criteria. The sixty-seven that did not meet the requirements were placed into 'Class II' - these were ineligible to win the top prizes, but would be examined to discover any merits.[144] No magazine arms were actually submitted to the Committee, despite the competition being open to them. The War Office therefore decided to test several prominent magazine arms, including the *Ball and Lamson*, *Henry repeating rifle* and *Spencer Carbines*.

Once the categories had been established, initial testing began. As they had the potential to become the next arm of the infantry, Class I rifles were tested first. Twenty-one of the thirty-seven in the category were eliminated before they had even been fired. After firing just twenty rounds from each of the remainder, a further seven were eliminated. All of these rejections were due to undesirability or suspect safety, leaving just nine competitors. On March 21st 1867 these finalists were recommended, with each maker rewarded £300 for their efforts. This reward was designed to be spent on the production of six rifles for further testing to be carried out at Woolwich at a later date. The finalists were as follows: The *Albini-Braendlin*, the *Burton* rifles number one and number two, the *Fosbery*, the *Henry* (designed by Alexander Henry and not the cavalry carbine), the *Joslyn*, the *Martini*, the *Peabody* and finally the *Remington*.[145]

The Class II arms were examined July 1867 and underwent a similar process. In the time it had taken to begin this testing, however, another sixteen arms had been submitted, meaning that eighty-three arms were processed. Within these trials, a poignant event occurred which would alter the Committee's perceptions for the foreseeable future. When firing one of the four bolt-action *Carter and Edwards* submissions, Sir Henry John Halford, leader of the Lancaster volunteer movement and prized competition shooter, lost his

[143] Reports on Breech-Loading Arms by a Special Sub-Committee of the Ordnance Select Committee
[144] Captain Lieutenant-Colonel Fletcher, Committee Report (21/03/1867)
[145] Captain Lieutenant-Colonel Fletcher, Committee Report (21/03/1867)

thumb. The accident happened when a cartridge to ignited prematurely as the bolt was being closed.[146] This had been the ultimate fear of the sceptics of bolt-action rifles, ever since the *Dreyse* needle rifle had been tested almost two decades ago. Nevertheless, some bolt-action rifles did make it through selection. The selected rifles from the Class II category were as follows: The *Berdan*, *Carter and Edwards No.3*, *Fosbery No. 4*, *Greve and Dowling No.4*, *Hammond*, *Needham*, *Poultney*, *Westley Richards No. 1*, *Westley Richards No. 3b*. (The *Sharp* and *Wilson* rifle were later added following subsequent submissions.) As these rifles were in Class II, they were not eligible for any prizes. They would, however, be examined in the future for the merits of their breech mechanisms.

During these Class II trials, rifle named the *Soper* was tested. It did not merit further selection because it was considered 'too complicated' and contained too many parts. But in two independent tests, the Soper was recorded as firing sixty rounds per minute; a huge feat for a single-loading arm.[147] This rapidity of small arms in the British Army was only beaten once self-loading arms were introduced in the 1950s. The Soper is therefore a prime example of why the Class II trials were undertaken, as the War Office could gauge the capability of all manner of firearms as a means of comparison.

For the Class I arms that complied to competition regulations, trials did not commence until 28th November 1867. The delay was due to the fact that Mr Burton had to produce twelve rifles instead of six, given that he had two designs in the finals.[148] Furthermore, the Martini rifles, in their journey from Switzerland, were detained in a French customs house. Once the rifles had arrived, daily trials were undertaken where factors such as accuracy, rapidity, recoil, reliability and trajectory were taken into account. The first tests for the finalists were those of accuracy. Four of the six rifles of each contender fired twenty rounds at targets of distances set at 300, 500, 800 and 1000 yards, with the current service arm, a Snider-Enfield being included for comparison. Table 1. Shows the first test at the short 300 yard distance, with the rifles being placed in order of merit:

[146] C. Roads, *The Gun: Riflemen All*, BBC 2 1980'S Film Footage - 6 minutes 22 seconds
[147] C. Roads, *The Gun: Riflemen All*, BBC 2 1980'S Film Footage - 7 minutes 17 seconds
[148] Captain Lieutenant-Colonel Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition in Accordance with the terms of the War Office Advertisement of 22/10/1866 (12/02/1868)

Weapons System	Mean deviation of the four rifles tested in feet at 300 yards
Burton No. 2	0.63
Albini and Braendlin	0.69
Burton No. 1	0.76
Henry	0.85
Martini	1.16
Fosbery	1.23
Remington	1.58
Peabody	1.67
Joslyn	1.74
Snider Naval (For Comparison)	0.75

Table 1. Accuracy at 300 yards, Special Sub-Committee of the Ordnance Select Committee report.[149]

These results disappointed the Sub-Committee. The 1866 competition prerequisites stated that the rifles could not deviate more than half a foot at 300 yards. No rifle even came close to these figures. Worse still, the Fosbery, Remington, Peabody and Joslyn rifles deviated by more than a foot, which was the maximum deviation allowed for the larger 500 yard trial. Disappointed with the results, the Sub-Committee therefore disqualified the bottom four from further accuracy trials. The next trial, at 500 yards only included five competition rifles, as shown below in Table 2.

Weapons System	Mean deviation of the four rifles tested in feet at 500 yards
Burton No. 2	1.27
Henry	1.41
Burton No. 1	1.52
Albini and Braendlin	1.53
Martini	2.01
Snider Naval (For Comparison)	1.37

Table 2. Accuracy at 500 yards, Special Sub-Committee of the Ordnance Select Committee report.[150]

Once again, not one of the weapons systems complied with the standards set in the competition. Embarrassingly, some of the results were even lower than the rifles trialled in 1865, where the *Pattern 1853 Enfield*, the *Westley Richards* and the *Snider* all scoring

[149] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)
[150] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)

higher. The standard was equally poor out to 800 yards, where only one system, the Henry rifle, managed to qualify. As shooting had been so poor, only the Henry and the Burton No. 2 were tested at 1000 yards. Neither rifle performed well enough at this range.

The only merits found during the accuracy trials were observed during the firing of the Henry rifle at 1000 yards. As testing was made during a British winter, the weather across the entire trial was described as 'frequently windy and unfavourable for shooting.'[151] It was found that this wind carried bullets fired from rifles such as the Snider and Burton No. 2 as much as fifty feet to the right. In comparison, they noted that the bullets fired from the *Henry* at this range would only be blown twenty feet. This was due to the *Henry* rifle's smaller bore and large charge of powder, giving the bullet a much higher energy and average velocity.

It was also observed by the Committee that bullets fired from the Henry rifle had a much flatter trajectory than bullets fired from rifles such as the Snider, due to its smaller calibre. (The Henry rifle was .45 in calibre compared to the .577 of the Snider). These observations meant that the small bore rifles were advantageous at shorter ranges due to their trajectory, but also at longer ranges due to their bullet's velocity, evidenced below.

[151] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)

Weapons System	Mean angle of bullet trajectory compared to a straight line path when firing at 300 yards in arc minutes
Burton No. 2	220'
Albini and Braendlin	51'
Burton No. 1	130'
Henry	56'
Martini	51'
Fosbery	59'
Remington	53'
Peabody	34'
Joslyn	59'
Snider Naval (For Comparison)	70'

Table 3. Mean Elevation of trials rifles firing at 300 yards, Special Sub-Committee of the Ordnance Select Committee report.[152]

Casting aside the poor accuracy of each of the contenders, the Sub-Committee carried on with the trials process regardless. In a rather more successful test, trials for rapidity were undertaken for each rifle, with the competition standard requiring a score of at least fourteen rounds per minute. To test this, the time taken to fire twenty rounds from each contender was recorded. This was then repeated with another firer to find an average, and then converted into rounds fired per minute, as shown below.

Weapons System	Calculated number of rounds per minute
Peabody	16
Henry	16
Fosbery	14
Albini and Braendlin	14
Burton No. 1	13
Burton No. 2	11
Joslyn	10
Snider Naval (For Comparison)	14

Table 4. Rapidity test of trials rifles, Special Sub-Committee of the Ordnance Select Committee report.[153]

[152] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)
[153] Sergeant Mcanlis, R.A, and Private Crofts, Rapidity Tests, Special Sub-Committee (12/02/1868)

Unfortunately, two weapons systems were omitted from these trials. The Martini was removed from this test as its cartridges repeatedly exploded at the base, causing such an escape of gas as to render the rifles unsafe. The Remington, on the other hand, was trialled, but as its cartridges repeatedly broke causing delays which rendered its rate of fire 'worthless'.[154] Nevertheless, in terms of rapidity at least, the majority of rifles were successful.

Similar successes were found during exposure tests, made by pouring sand over every rifle and then attempting to fire them. In this trial, every single rifle passed, except the Martini.[155] Further exposure tests were made by submerging the rifles in water and then leaving them exposed to the winter weather for two weeks. Again, the results for this test were mostly positive. The only flaws discovered were in the Joslyn and Martini rifles. The Joslyn was found to be cracked at the tang, and the Martini had become plagued with a multitude of problems such as having a broken extractor and being clogged with rust.[156] Despite the Joslyn and Martini's issues, the majority of trials rifles were generally good at withstanding the elements.

Unfortunately for the Sub-Committee, the success of the exposure trials was very short lived. Amongst the final tests made were the increased charges and damaged cartridges test.[157] In the latter of these tests, cartridges were soaked in water or split partly open, to simulate what conditions they could be exposed to in the field. During these trials, the cartridges for the Remington, the Burton No.1 and the Joslyn rifle all burst, automatically rendering them unsafe. It was also found during the damaged cartridge tests that the current service arm, the Snider-Enfield, had its breech block blown open repeatedly. Therefore, as a direct result of these trials, a locking latch was added to the Snider-Enfield in early 1869.[158]

Moreover, it was found when increasing the charge of the Henry ammunition, that the cartridges provided by Alexander Henry did not conform to competition standards due to

[154] Mcanlis, Crofts, Rapidity Tests (12/02/1868)
[155] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)
[156] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)
[157] This was made almost as a security measure, so that if faulty ammunition with a greater charge was ever issued by mistake, the Committee could be sure that the rifles would not explode as a result.
[158] Skennerton, List of Changes in British War Material, Volume I, p. 39

the secret addition of extra lubrication.[159] Rather embarrassingly, this therefore meant that the Henry rifle had only been successful in previous trials because it had an unfair advantage over all the others.

On 10th February 1868, due to the repeated failure of the trials rifles, the competition was temporarily abandoned.[160] The flaws of the trials rifles made it impossible for the Committee to make a selection for military service. Not one rifle was accurate enough for military use. Half of the rifles had too high a trajectory to be militarily efficient. The rifles became dangerous if their ammunition was faulty, and often burst in the hands of the user. The early rifle trials were therefore a complete disaster for the Ordnance Select Committee, so much so that the top prize of £1000 was not given to any contender. Instead, they declared the Henry rifle the 'winner', with Captain Lieutenant-Colonel Fletcher stating: Henry won the trials so should be issued the best breech mechanism award of £600. The present service arm performed well enough to prove it as a sufficient military weapon.[161]

The competition therefore inadvertently paid homage to the Snider rifle and its capabilities as a military arm. But it also showed the Committee that the current market for military arms was not satisfactory. To devise an arm to meet their standard, they had to create their own composite rifle, and so the question of sourcing a new arm was taken back to the drawing board.

[159] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)
[160] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)
[161] Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for Competition (12/02/1868)

Back to the drawing board: the Martini-Henry is born

Figure 1. Volunteer shooting event on Wimbledon common.[162]

Across the decade 1860-1870, firearms technology was advancing at such a rate that no single committee could hope to find the best arm. The greatest embodiment of this development can be shown through the volunteer movement that swept Britain at this time, encompassing such firearms personalities as Alexander Henry, William Ellis Metford and Sir Joseph Whitworth.

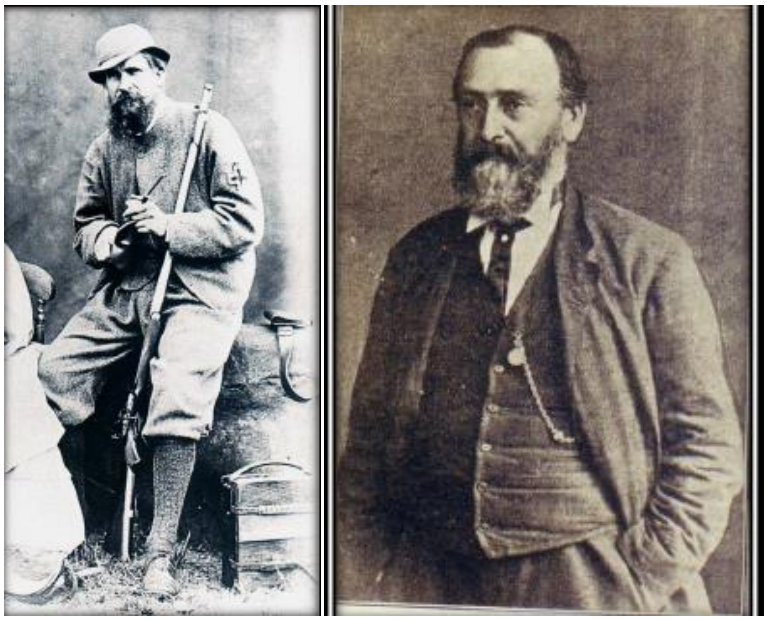
The volunteer movement in Britain mainly came as a reactionary response to Napoleon III's expansionist policies in France.[163] As a matter of fact, the push factors that resulted in the War Office's call for modernisation in the military in 1864, were the exact same push factors that increased civilian interest in rifles and shooting events.[164] The key figures of this

[162] Cobb, The Martini and its Place in History: A Historical Perspective
[163] Cobb, The Martini and its Place in History: A Historical Perspective
[164] A similar upsurge took place at the end of the eighteenth century as a result of the French Revolution.

volunteer movement were not satisfied with the .577 Enfield's produced by the government, believing them to be 'gas pipes'.[165] Instead, they strove to find new innovations and improvements.

The greatest proponent to exemplify advancements in breech-loading rifles across the decade was undoubtedly Alexander Henry of Edinburgh. His first major accomplishment in firearms was his famous patented seven groove rifling.[166] This rifling was so shallow that the bullet was gripped by the entire circumference of the barrel, which allowed for much greater accuracy. By 17th April 1865 he had designed his patented falling block action, that won the £600 special committee prize in 1878. Henry became such a respected gun maker, that in 1870, the Prince of Wales requested a private audience with him on a visit to Scotland.[167]

In an era when breech-loading rifle designs were still being pioneered, muzzle-loading rifle designs were now being perfected. The strongest example of this perfection of arms can be shown by the joint efforts of Sir Henry Halford and William Ellis Metford, pictured below.



Figures 2. and 3. Sir Henry Halford (left) and William Ellis Metford (right).[168]

[165] Cobb, The Martini and its Place in History: A Historical Perspective
[166] D. Dallas, In the Gunroom, Alexander Henry, Triumph and Tragedy, *Holts Auctioneers on Fine and Modern Antique Guns* (10/12/2015), p. 148
[167] Dallas, In the Gunroom, Alexander Henry, Triumph and Tragedy, p. 147
[168] Cobb, The Martini and its Place in History: A Historical Perspective

In 1865, the British National Rifle Association held a competition for rifle shooting at 2000 yards, which was double the range of any War Office Committee tests. The only two competitors were Halford and Metford.[169] The competition was a draw, with both competitors scoring eight hits out of twenty-five shots at a twenty-four by twelve feet target.[170] The following year there were five competitors, four using Metford's rifle and a fifth using a Murcott rifle, that was withdrawn as it failed to hit the target.[171] In terms of range and accuracy, this clearly shows that Metford had perfected his designs for muzzle-loading rifles. By the third year, the competitions at this range were discontinued, 'in view of the subject being taken up by the War Office.'[172] No longer concerned with ultra-long range rifles, Metford then developed his own 'reduced-bore' rifling, with shallow grooves and a bore diameter .461.[173] This proved to be so accurate that the design was copied by gun makers such as Rigby and the Royal Small Arms Factory at Enfield.

These 'reduced-bore' muzzle-loading rifles subsequently stole the show at every single competition shoot conducted by the volunteer movement. The most notable of these was the .451 muzzle-loading Whitworth rifle, designed by Sir Joseph Whitworth. He had been employed by the War Office to produce a more accurate arm than the current service Enfields. With the assistance of Mr Westley Richards and his patented octagonal rifling, Whitworth designed his famous hexagonal designs.[174] This prompted the War Office to compare the current issue breech-loader, the Snider, with the more accurate muzzle-loading arms. The results show just how accurate these civilian weapons systems actually were:

[169] Both competitors were using a fifteen pound rifle with telescopic sights attached that was designed by Metford and manufactured in Bristol by George Gibbs.
[170] The Telescopic Rifles, *Western Daily Press* (29/05/1865)
[171] The Telescopic Rifles, *Western Daily Press*
[172] D. Minshall, Metford's 2000 Yard Rifle, Long Range Rifle Fire, *Research Press* <http://www.researchpress.co.uk/index.php/longrange/148-metford-2000> [Accessed 30/01/2016]
[173] Cobb, The Martini and its Place in History: A Historical Perspective
[174] Cobb, The Martini and its Place in History: A Historical Perspective

Rifle Tested	Mean Deviation at 500 yards (inches)
Pattern 1853 Enfield	12.95
Snider-Enfield	12.02
Whitworth	10.05
Westley-Richards	9.65

Table 1. Snider-Enfield comparison trials with contemporary muzzle-loaders.[175]

The volunteer movement's rifles had now ultimately shown the War Office what could be achieved in terms of accuracy, a standard which no rifle in the Sub-Committee's previous trials could match. The solution, decided upon on the 11th February 1869, was that the 'perfect arm' could only be achieved if it was a composite arm.[176] The rifling would be considered in a completely separate trial to the breech. As the volunteer's competitions at Wimbledon had shown, they decided that a .45 solid bullet would be preferable. The bullet weight was set at 480 grains with an eighty-five grain charge.[177] Thus, the revised trials commenced.

As accuracy had been the greatest embarrassment of the earlier trials, the 'perfect arm's' rifling was to be decided upon first, with a pool of muzzle-loading rifles already renowned for their accuracy being trialled. As the Henry rifle had won the £600 offered from the previous competition, the Henry breech would be attached to each rifle. The chosen systems were those of *Messrs*, *Henry*, *Lancaster*, *Metford*, *Rigby*, *Westley-Richards*, *Whitworth* and *Enfield*, with requests being sent to each gun maker to produce two rifles with Henry breeches attached.[178] Unfortunately, Mr. Metford declined participation in the trial, and other rifles were absent from the trials. Testing was made with each rifle at the standard distances of 300, 500, 800 and 1000 yards, with the shortest two ranges being shown in Table 2. The longer two ranges are then shown in Table 3.:

[175] Report on Small Arm Experiments, Woolwich, Royal Laboratory (17/09/1867)
[176] Report of a Special Committee on Breech-Loading Rifles: Together with Minutes of Evidence (11/02/1869)
[177] Special Committee on Breech-Loading Rifles: Together with Minutes of Evidence (11/02/1869)
[178] Committee on Breech-Loading Rifles: Together with Minutes of Evidence (11/02/1869)

Weapons System Tested	Deviation in feet at 300 yards (first rifle)	Deviation in feet at 300 yards (second rifle)	Deviation in feet at 500 yards (first rifle)	Deviation in feet at 500 yards (second rifle)
Enfield	0.62	0.61	1.27	1.03
Henry	0.62	0.68	1.06	0.90
Lancaster	-	-	1.08	-
Rigby	-	-	2.34	-
Westley-Richards	-	-	1.39	-
Whitworth	0.54	0.63	1.07	1.09
Snider .5 inch bore	0.59	0.63	1.02	1.16

Table 2. Accuracy trials at 300 and 500 yards. (Note that '-' indicates the shooting was deemed 'too inaccurate'.)[179]

Weapons System Tested	Deviation in feet at 800 yards (first rifle)	Deviation in feet at 800 yards (second rifle)	Deviation in feet at 1000 yards (first rifle)	Deviation in feet at 1000 yards (second rifle)
Enfield	2.47	2.94	3.93	4.74
Henry	2.39	2.30	2.65	2.59
Lancaster	-	-	-	-
Rigby	-	-	-	-
Westley-Richards	-	-	-	-
Whitworth	2.91	-	-	-
Snider .5 inch bore	2.46	-	-	-

Table 3. Accuracy trials at 800 and 1000 yards. (Note that '-' indicates the shooting was deemed 'too inaccurate'.)[180]

During these trials, the rifles had to comply with the regulation .45 ammunition decided upon previously by the Committee. Upon seeing the poor results produced by his rifle, Mr. Westley Richards claimed that it was impossible for his rifles to get any accuracy from the ammunition provided and ultimately withdrew his rifle in disgust.[181] Not that this altered events in any way. From the results it was obvious that the Henry rifle was the resounding winner of the accuracy competition. On top of its impressive accuracy, it was found that the Henry rifle also had the flattest trajectory and had no fouling issues during shooting.[182] On

[179] Report of a Special Committee on Breech-Loading Rifles: Accuracy trials (11/02/1869)
[180] Accuracy trials (11/02/1869)
[181] Special Committee on Breech-Loading Rifles: Together with Minutes of Evidence (11/02/1869)
[182] Trials of Barrels in Respect to Accuracy, Trajectory, Penetration, War Office Report (11/02/1869)

this basis, the Henry barrel was selected for use for the future 'perfect arm', and the Sub-Committee had finally made progress.

Now that the cartridge had been decided upon, and the rifling had been chosen, all that was left to do was to find a suitable breech action for the new composite arm. Due to the fact that a further forty-five new rifles had been submitted to the War Office since the 1868 trials, the Sub-Committee decided to start the competition afresh. After preliminary trials, the majority of the submissions were quickly eliminated. The remainder were then divided into two sub-groups based upon their actions: the bolt group and the block group, shown in Table 4.

Block type breech-loaders chosen by the Committee	**Bolt-action type breech-loaders chosen by the Committee**
Berdan	Bacon
Henry	Carter and Edwards
Martini	Kerr
Money-Walker	Wilson
Westley Richards (falling block)	
Westley Richards (elevating block)	

Table 4. 1869 Breech competition finalists.[183]

The rifles were then sent back to the gun makers to be modified to fit the regulation .45 service ammunition. Once all the rifles were returned, in depth testing began. It was evident from the start that although they had been selected as finalists, the bolt-action rifles never stood a chance as the next service arm as Sir Henry Halford's previous accident with a Carter and Edwards rifle was still fresh in the Committee's minds.[184] Indeed, their fears were met with reality when the Wilson rifle's breech was blown back when being fired by Lord Spencer.[185] Despite this being an isolated incident, with all the other bolt-action rifles fairing well in the tests, it was enough to reject the entire category of rifles due to potential safety issues.

The following testing of the block type rifles replicated the earlier tests of 1868. During exposure tests, the Berdan, the Money-Walker and the Westley Richards (elevating block)

[183] Report on rifle selection for service, Special Committee on Breech-Loading rifles (11/02/1869)
[184] Report on rifle selection for service (11/02/1869)
[185] The Martini-Henry Rifle, *The Engineer*,p. 181

rifle all quickly failed. This left the only the Martini, the Henry and the Westley Richards (falling block) rifles for consideration. After testing these rifles for accuracy, it was found that the Westley Richards did not perform as well as the other two. Mr Westley Richards claimed he could fix the shortfalls of his rifle, but was denied the opportunity.[186] In frustration, the Westley Richards (falling block) rifle was thus withdrawn from the competition, with Mr Westley Richards claiming 'the committee have already made up their minds.'[187]

For the final two rifles, the decision boiled down to issues of cost and manufacture as both had performed equally well in the most recent trials. The Henry rifle required forty nine separate parts, whilst the Martini required just twenty seven. This made production of the Martini much cheaper. This, combined with the fact that the Martini cocked upon opening the breech, whilst the Henry required a separate motion, ultimately swung the Committee in favour of the Martini breech.[188] This decision now meant that the composite arm had been completed. The Martini breech would be attached to a Henry rifled barrel and would fire the regulation .45 ammunition. Thus, the Martini-Henry was born.

This final choice was immediately met with a great deal of furore, as the public believed the competition had been rigged in favour of the Martini. This was because whilst the other gun makers had to modify their rifles themselves to fit the Committee's criteria, the Martini had been sent to the Royal Small Arms Factory at Enfield for modification.[189] At Enfield, the design had been refined with many small features of the rifle being altered and improved, such as the addition of a cocking indicator and a safety bolt, as well as having the sights modified.[190] There was a logic behind the Martini being improved by the War Office. Mr. Martini was from Switzerland, and so communications between Martini and the War Office were often slow and delayed. This issue became exacerbated by the fact that in earlier competitions, Martini rifles and components had been held up in customs offices. To

[186] Westley Richards proposed adding a special lubrication to the cartridge .45 cartridge, but was rebuffed as the other trials rifles did not need this cartridge alteration.
[187] Report on rifle selection for service (11/02/1869)
[188] The Martini-Henry Rifle, *The Engineer*, p. 181
[189] Special Committee on Breech-Loading Rifles: Together with Minutes of Evidence (11/02/1869)
[190] The Martini-Henry Rifle, The Engineer, p. 181

prevent delays, the Martini was to be altered at Enfield.[191] It was therefore practicality, not bias, that prompted the decision.

Nevertheless, criticisms about bias continued, especially in the British press. Mr Wilson, writing to *The Engineer*, attempted to expose this bias after his rifle had been rejected from the competition: 'The Snider and the Martini have had their accidents; it is monstrously unfair to brandish about the mishap of the Wilson without detailing the serious accident which very recently occurred with the Martini... It is a scandalous injustice not to demerit the Martini, especially after the accident occurred after two years of tinkering by the Royal Laboratory.'[192] It must be noted, however, that Mr. Wilson's comments came as a response to the degradation of his rifle in a previous edition of *The Engineer*, not as an official complaint against the Committee.

Further criticisms about the Martini-Henry were also sensationalised by the British press. *The Times,* for example, claimed that the Martini 'misfired and failed to extract cartridges' at a spectacular rate.[193] In its claims, it failed to state that, the rate of misfires and extraction problems with the Martini were below the averages of other rifles the reporter had tested.[194] *The Times* newspaper also posed the question: 'If the Martini-Henry is so good, why do no other nations adopt it?'[195] It must be noted, however, that no two nations on the continent were using the same arm at this point.[196]

The public criticism of the Martini-Henry rifle was definitely not unfounded; the rifle was riddled with problems. So much so, that despite being selected by the Committee in 1869, it was not officially adopted as the arm of the British infantry until 1874. During this time, the Mk I rifles went through three slightly different patterns as part of an almost endless cycle of troop trials, negative feedback, attempted improvement and then further trial. For the most part, troop feedback showed two problems. Firstly, that of recoil. The 'kick' from the Martini-Henry was so great that it often injured the user. The second problem was that of

[191] Special Committee on Breech-Loading Rifles: Together with Minutes of Evidence (11/02/1869)
[192] The Martini-Henry rifle, Wilson's letter and readers comments, *The Engineer* (26/03/1869), p. 222
[193] The Martini and its Critics, *The Pall Mall Budget* (28/08/1874), p. 13
[194] The Martini and its Critics, *The Pall Mall Budget*, p. 13
[195] The Martini and its Critics, *The Pall Mall Budget*, p. 13
[196] The Martini and its Critics, *The Pall Mall Budget*, p. 13

faulty component parts, such as the rifle's tumbler and striker, which broke and rendered the rifle inoperable.

Regarding the recoil, the pressure from the large cartridge in the Martini-Henry caused its recoil to be much larger than that of the Snider. Reports from officers and troops alike indicated that this was far too great. Sergeant Major Davies, for example, commented that 'in regards to questions of recoil, it is go grave as to affect general shooting.' He also reported that he 'does not think men like the new arm better than the Snider in this regard.'[197] From the perspective of the troops, the recoil was a problem as men were injuring themselves whilst operating the rifle: 'The recoil funks the young soldiers - several have bruised cheeks and fingers.'[198] In response to the barrage of complaints, the Royal Laboratory added a thumb rest on the rifle, in order to aid the soldier's grip. The recoil was also worse with rifles with shorter butts (a feature of the original Martini-Henry was the choice between a long or shorter butt stock), and so it was recommended that the butts were to be lengthened an inch.[199] When soliders continued to complain after these changes, the overriding response from the War Office changed to one of 'troops will get used to it.'

Perhaps more pressing was the Martini-Henry's component breakages and faulty parts. For example, after problems of breakages after troops trials in 1871, the War Office introduced a new pattern strengthened striker with a reconfigured block to accept the a better striker.[200] Troops at the Cambridge Barracks at Woolwich were given these rifles in 1873 to test the new strikers. The reports they responded with were damning as they simply stated that 'strikers still break.'[201] The War Office believed that by improving the manufacture of each component part, this issue could be eradicated. Experience in the hands of the troops, however, would prove the exact opposite. Even after the rifles official adoption, troop reports almost unanimously highlighted component issues shown below in Table 5.

---

[197] Sergeant Major Davies in, Ayde, Director of Artillery and Stores, Minutes of Conference held at the War Office (24/10/1873)
[198] Lieutenant Newman in, Ayde, Director of Artillery and Stores, Minutes of Conference held at the War Office (24/10/1873)
[199] J. Ayde, Director of Artillery and Stores, Minutes of Conference held at the War Office (24/10/1873)
[200] Martini-Henry Mk I 1st and 2nd Pattern Rifle <http://www.martinihenry.org/index.php?route=product/product&path=61_59&product_id=50> [Accessed 15/05/2016]
[201] Report on Martini-Henry troop trials, Cambridge Barracks, Woolwich S.E. (27/08/1873)

Report Number	Regiment	Response
1	*1st Regiment Edinburgh*	Arm generally approved: Lowness of trajectory, accuracy and celerity of fire are all great advantages. Many locks (Birmingham arms) too highly tempered. Strikers are liable to fracture. All rifles under sighted.
2	*2nd Battalion 5th Regiment Jersey*	Excellent arm even in bad weather. Difficulties in extraction - probably due to inexperience. Rifles are under sighted.
4	*Depôts 64th and 98th Glasgow*	Much preferred to the Snider but of our rifles five strikers and two tumblers broke. All under sighted.

Table 5. Initial troop responses after firing ten rounds from the Martini-Henry rifle.[202]

Despite its critics, whether it was from rival gun-makers, the press, the public or even the soldiers who had to use it, the Martini-Henry was introduced into official service on 17th July 1874. It was the composite product of one of the most complex processes of implementation ever undertaken by the British government, and whether the public liked it or not, it would officially the serve the British army for years to come. Its weaknesses were obvious from the offset. Over time, however, the Martini-Henry would show its strengths and justify its implementation as a service arm of the British Army.

[202] Précis of Reports from regiments on the special firing of ten rounds from the Martini Henry, *Special Army Circular* (26/11/1874)

A technical overview of the Martini-Henry

> The bore of the barrel, the turn of the Rifling and the weight of the Projectile, gave results in accuracy, trajectory, and penetration, and rapidity of fire that could not be surpassed. The necessary movements for loading and firing were reduced to a minimum; from seventeen to eighteen shots per minute could be fired, and a good aim taken. The principle of the falling block in the breech action, which was a previous American invention, was the best arrangement for the purpose of closing the breech, and has the great advantage of being completely enclosed in the iron box which contains the lock arrangement, both when the breech is opened for loading, and when closed for firing.

An overview of the merits of the Martini-Henry arm.[203]

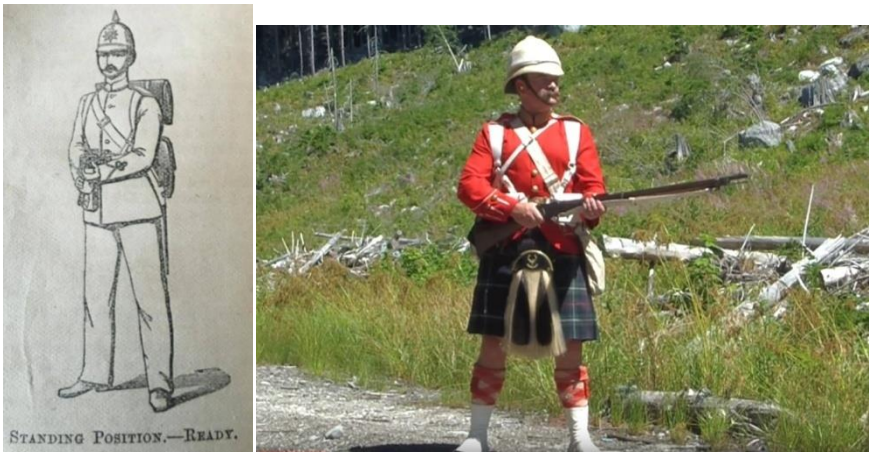
Despite its shaky reception into British military service, the Martini-Henry was highly successful as a military arm. It improved on the Snider-Enfield in almost every single respect. It was more powerful, it had a flatter trajectory, it could fire faster and it had a greater range. To evaluate this improvement, it is necessary to assess how the Martini-Henry was operated and how it worked internally. Like the Snider-Enfield, the Martini-Henry was subject to many pattern changes and improvements in its lifetime, from the early Mk I versions through to the later Mk IV. There were also many different varients of Martini-Henrys, such as cavalry carbines. Unlike the Snider, however, some Martinis were subject to caliber changes, such as the experimental .402 and the later .303. These adaptations show just how efficient a military arm the Martini-Henry ultimately became, as it constantly adapted to keep up with small arms developments across the latter part of the nineteenth century.

Regardless of its designated mark, all Martini-Henrys were operated in the same manner. Like the Snider-Enfield, it was only capable of being a 'single-loader', that is, one round had to be loaded, fired and ejected manually before a fresh round could be inserted. The key

[203] W. Marshall, *The Comparative Merits of the Martini Rifle and the Westley-Richards Rifle and Ammunition* (London, 1870), pp. 3-4

improvement over the Snider-Enfield by means of operation was its simplicity. This can be shown across the analysis of the Martini-Henry's operation.

When firing from a standing position, the first step for the British soldier when operating a rifle is to move into the 'ready' position. This ensures a stable base with which to fire from, and is shown below.



Figures 2. and 3., The soldier moves his left foot ten inches, placing the feet at right angles. The weapon is raised parrallel to the ground.[204] [205]

Once the soldier is in position, the rifle can then be loaded. This was to be done by 'placing the thumb inside the loop of the lever and opening the breech with a strong downward pressure.'[206] This motion not only opens the breech of the rifle to allow loading, but it also cocks the rifle. Compared to the Snider-Enfield with its external hammer, this allows the soldier to effectively skip the process of half cocking and fully cocking the rifle, shown below.

[204] The War Office, *Rifle Exercises & Musketry Instruction 1879,* Her Majesty's Stationary Office (London, 1879), p. 94
[205] The Mk I Martini Henry: Rifle Exercises C.1879/1881, Britishmuzzleloaders (25/08/2015) <https://www.youtube.com/watch?v=RPNc5IAwp6g> [Accessed: 14/05/2016] 1 Minute 41 Seconds
[206] Rifle Exercises & Musketry Instruction 1879, p. 96

Figure 5. The soldier in the ready position with an un-cocked rifle. Notice that the cocking indicator sits vertically.[207]

Figure 6. The breech is opened and the rifle is cocked. The cocking indicator clearly shows this as it has rotated forty-five degrees.[208]

Then, using the forefinger and thumb, a cartridge is inserted into the chamber with the right hand, ensuring it is 'well home' by pressing it with the thumb.[209] Once inserted, the breech is closed by placing the fingers under the lever, resting the thumb on top of the rifle's butt and squeezing the lever shut, shown below. This ensures that the thumb doesn't get trapped inside the lever.

[207] The MK I Martini Henry: Introduction, Britishmuzzleloaders (20/08/2014) <https://www.youtube.com/watch?v=DiT6Bzz2SP> [Accessed 15/05/2016] 2 Minutes 51 Seconds
[208] The MK I Martini Henry: Introduction, Britishmuzzleloaders, 2 Minutes 52 Seconds
[209] Rifle Exercises & Musketry Instruction 1879, p. 96

Figure 7. The cartridge is loaded into the chamber.[210]

Figure 8. The lever is brought back up. Note the means of closing is different to that of opening the breech.[211]

The next step was to adjust the sights on the rifle accordingly. The Rifle Exercises handbook suggests that the officer should always name the distance required, however, often troops judged the distance independently. The troops would have a good idea of gauging distance from their musketry training shown in the drawing below.

[210] The MK I Martini Henry: Introduction, Britishmuzzleloaders, 2 Minutes 54 Seconds
[211] The MK I Martini Henry: Introduction, Britishmuzzleloaders, 3 Minutes 0 Seconds

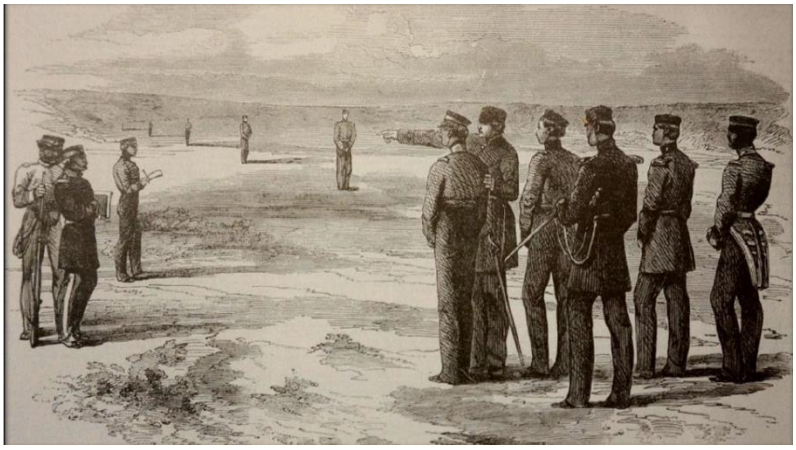


Figure 9. British soldiers during musketry training, learning how to gauge distances, published in the *Illustrated London News*.[212]

Figure 10. The soldier sets his backsight to the desired range.[213]

The rifle would now be ready for firing. Upon the command 'present' the rifle is 'brought sharply into the hollow of the right shoulder, pressing it to the shoulder with the left hand; at the same instant the left elbow is brought nearly under the rifle and the right elbow square to it.'[214] The forefinger is placed on the trigger, without pressing it. The left eye is also to be closed and the right fixed on the muzzle.

[212] Cobb, The Martini and its Place in History: A Historical Perspective
[213] The Mk I Martini Henry: Rifle Exercises C.1879/1881, Britishmuzzleloaders, 2 Minutes 50 Seconds
[214] Rifle Exercises & Musketry Instruction 1879, p. 97

Figure 11. The soldier places the rifle in the ready position, creating a stable shooting platform for himself.[215]

When firing the rifle, the soldier would start with a lowered muzzle and raise it to fix the sights on the target. As the trigger is pulled, breathing is to be restricted and every part of the soldier must remain in the 'present' position. Once the rifle had been fired, the spent cartridge would be ejected by pulling sharply on the lever.

Figure 11. The cartridge is ejected automatically as the breech is opened.[216]

Figure 12. The reality of the cartridge ejection. It was not uncommon for Martini-Henrys to eject quite weakly. In this case, the cartridge must be removed by hand.[217]

[215] The Mk I Martini Henry: Rifle Exercises C.1879/1881, Britishmuzzleloaders, 3 Minutes 5 Seconds
[216] The MK I Martini Henry: Introduction, Britishmuzzleloaders, 3 Minutes 8 Seconds

Once the soldier had fired all the rounds required and the final cartridge was ejected, this would leave a cocked rifle with an open breech. This was closed by 'pressing the trigger firmly without touching the lever' to de-cock the rifle and ease the springs.[218]

This firing process may look more complex than that of the Snider-Enfield, but in reality, it was much quicker and simpler to perform. In the early rifle trials, the Martini-Henry outperformed the Snider-Enfield on speed of operation by an average two shots per minute, even before ergonomic additions such as the thumb rest and extended lever were added by the War Office. It was this simplified process that made the Martini-Henry one of the simplest breech-loading rifles of the era.

This simplicity could also be shown in the manufacture of the Martini-Henry, as it had less components than the Snider-Enfield, having thirty parts to the Snider's thirty nine.[219] This meant that its internal workings were relatively simple, compared to the intricate external lock of the Snider-Enfield. The rifle's designer, Friederich Von Martini stated that: 'This arm unites great simplicity of construction with ease of repair, it is very durable, and little liable to damage even in the most awkward hands.'[220] The original patent for this simple Martini action can be shown below in the configuration that was used in the 1868 trials.

[217] The MK I Martini Henry: Introduction, Britishmuzzleloaders, 5 Minutes 36 Seconds
[218] Rifle Exercises & Musketry Instruction 1879, p. 98
[219] B. Temple, I. Skennerton, *A Treatise on the British Military Martini, The Martini-Henry 1869-C1900* (London, UK, 1983), p. 33
[220] Friederich Von Martini to Clinton Edgcumbe Brooman, Commissioner of Patents (22/07/1868)

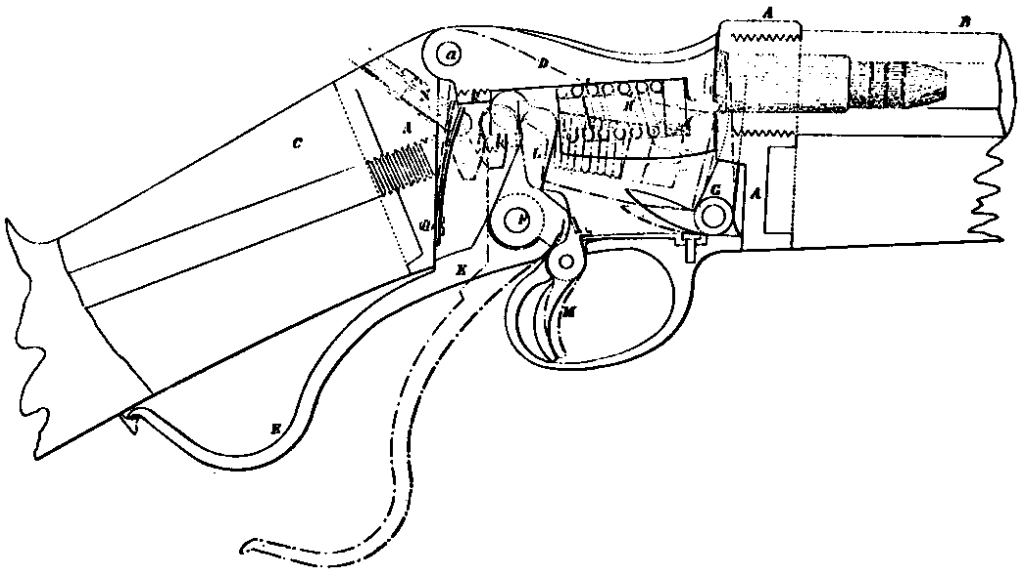


Figure 13. Friederich Von Martini's original British patent.[221]

The workings of this original action were repeatedly modified by the War Office throughout the trials. Despite this, the basic operation of the Martini-Henry remained the same. For example, the components in the armourer's drawings for the Martini-Henry in 1897 were still very similar to this original, with the most obvious changes being the lengthened extractor and the altered shape of the body.

[221] Friederich Von Martini to Clinton Edgcumbe Brooman (22/07/1868)

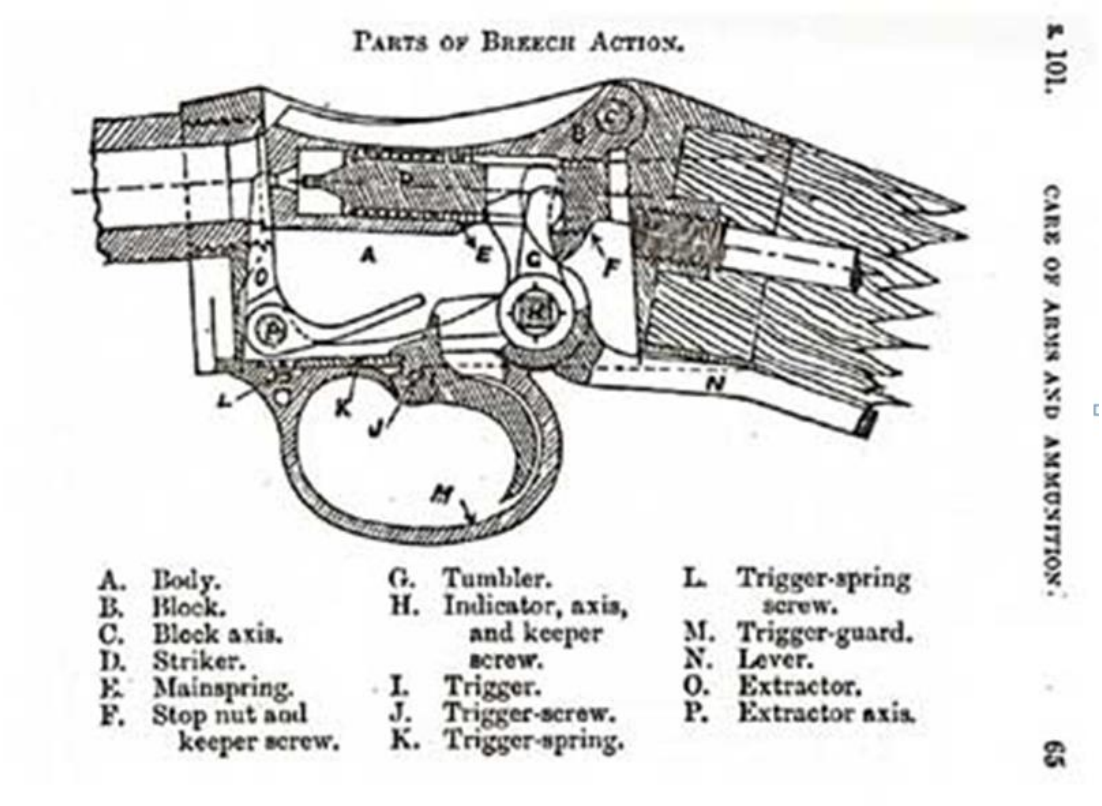


Figure 14. Armourer's drawing of the Martini-Henry action (when closed and un-cocked).[222]

The functions of the different components to the rifle are as follows. The long metal bolt in the wooden stock secured the breech tightly to the stock. The block contained inside the breech drops down by means of a hinge towards the back of the breech. The top of this block is slightly hollowed to assist in inserting cartridges into the chamber. Officially, this groove was described as 'a hollow which corresponds with the aperture in the barrel when it is in position for the cartridge to be placed in it.'[223] Inside this block is the firing mechanism, which comprises of a metal striker attached to a helical spring. When firing, the tip of this striker passes through a hole in the block to ignite the cartridge.

To cock the rifle, the external lever is pushed downwards. The block subsequently drops using a tooth-gear mechanism, thus allowing a cartridge to be loaded into the chamber, shown below.

[222] New South Wales Military Forces, *Handbook for the Martini-Henry Rifle* (1897), p. 65
[223] Friederich Von Martini to Clinton Edgcumbe Brooman (22/07/1868)

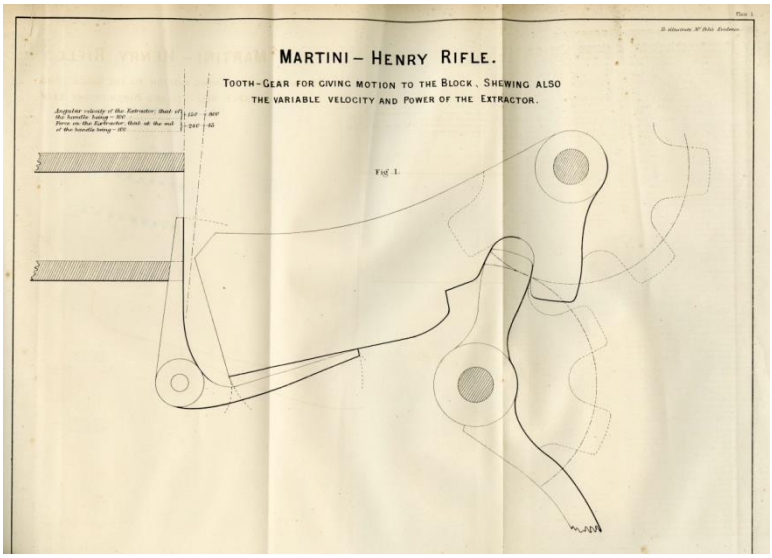


Figure 15. Armourer's drawing of the Martini-Henry falling block mechanism.[224]

At the same time, the lever that causes the block to 'fall' revolves the tumbler, which in turn pulls back the spring inside the block. As the lever is fully extended, the tumbler rotates far enough to rest in a bent, which holds it and the spring in place, shown below.

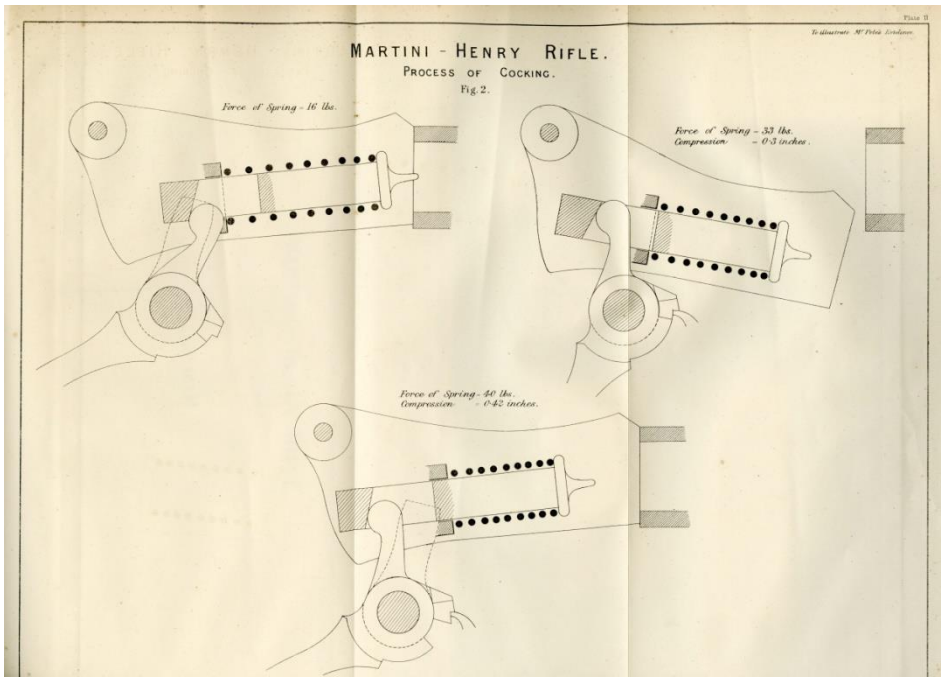


Figure 16. Armourer's drawing of a Martini rifle as it is cocked. Note how the tumbler sits in a notch, shown in the second and third images.[225]

[224] Martini Block action, Notes on The Martini-Henry Rifle, Royal Armouries Archives, Courtesy of Chris Streek [03/05/2016]
[225] Process of cocking, Notes on The Martini-Henry Rifle, Royal Armouries Archives, Courtesy of Chris Streek [03/05/2016]

Once the lever is closed, the notch ensures tumbler remains in its original position. Closing the lever also pushes the breech block back upwards. The only thing holding the block in place is the lever itself. As Martini described; 'The moveable breech during the discharge is maintained in place by the lever only, and the short arm is so disposed that it is impossible for the block to be displaced by the force of the explosion.'[226]

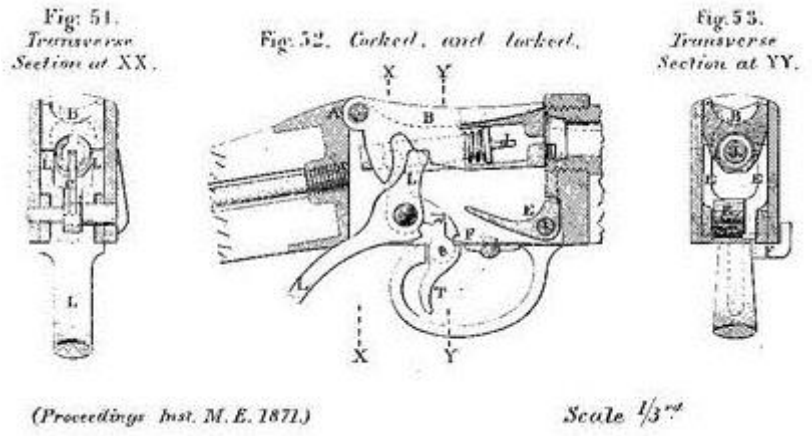


Figure 17. The Martini when it is cocked and the lever is closed.[227]

When the rifle is fired, the trigger is compressed. This rotates the trigger sear, to which the notch holding the tumbler in place is attached. This causes the tumbler to rotate at speed and releases the spring in the firing mechanism, causing the striker to fly forward with enough speed to ignite the cartridge. The Martini-Henry at the point of ignition can be shown in Armour's drawing below.

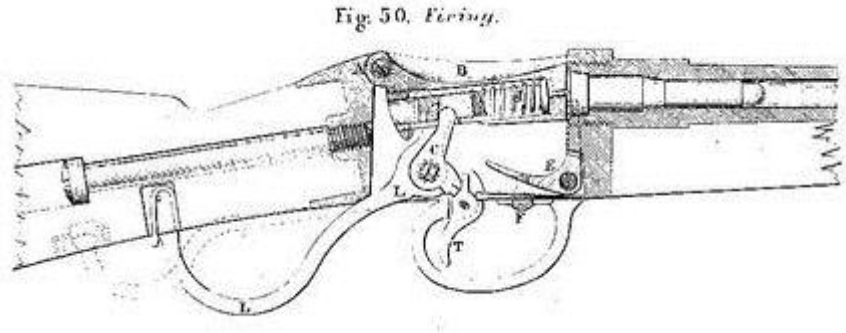


Figure 18. A Martini at the point of ignition. The striker and the tumbler have both shifted prominently towards the chamber.[228]

[226] Friederich Von Martini to Clinton Edgcumbe Brooman (22/07/1868)
[227] Cocking the Martini, Breech-Loading Rifles, 1868-1871 Trials Rifles Armourer's Drawings, War Office (1871)
[228] Firing the Martini, Breech-Loading Rifles, 1868-1871 Trials Rifles Armourer's Drawings, War Office (1871)

To extract the spent cartridge, two vertical arms are built into the sides of the barrel that grip the rim of the cartridge. Upon opening the lever, a bent arm (shown by the letter *E* in figure 18.) is pushed downwards. This rotates the vertical arms of the extractor, thus removing the cartridge from the chamber.[229]

Although appearing quite complex, it must be noted that this rifle could be fired almost twenty times a minute. As it contained so few parts, it could also easily be repaired by an armourer. It does not mean to say that the Martini-Henry was 'perfect' from the offset. Like the Snider, the Martini-Henry was subject to a great deal of improvement across its life in service due to small flaws in the original designs that came in the form of different Marks. Dealing with the Martini-Henry rifle alone, (omitting the carbine version), there were four official marks across its life in service. To complicate matters, further variants existed, such as the experimental Enfield Martini in .402 calibre and the Martini-Metford chambered for .303 ammunition. A prototype of the first Martini-Henry rifle issued to troops, the Mk I, can is shown below.

Figure 19. Martini-Henry, sample arm for production c.1875.[230]

The Martini-Henry Mk I had also been subject to constant change, moving through three distinct patterns, the first of which even requiring its own 'long' ammunition.[231] Despite the Mk I consisting of three different patterns, inherent problems still existed, such as

[229] Friederich Von Martini to Clinton Edgcumbe Brooman (22/07/1868)
[230] Britain, Rifle .577/450 Martini-Henry Mk I Sample Arm, G&B LTD Leeds c.1875, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[231] In this case, the different patterns were simply different versions of the same Mark as minor improvements were made.

component issues. The change from Martini-Henry Mk I to Mk II sought to fix the faulty components; it was fitted with a new tumbler, trigger and trigger guard. The extractor was also altered so that it was parallel throughout. Finally, the sights were also changed to fix the problem of rifles being under sighted.[232] The Mk II designation was officially implemented on 25th April 1877, shown below.

Figure 20. A Martini-Henry Mk II rifle.[233]

As the Martini-Henry carbine was in development simultaneously with the rifle, its parts became minutely different. The alteration from the Martini-Henry Mk II to Mk III was therefore implemented to standardise its components to that of the carbine, thus making the components interchangeable. It therefore had a smaller striker, and had its screws altered.[234] If one of these components broke on the rifle, it could in theory be repaired by parts built for the carbine. Martini-Henrys Mk IIIs were also fitted with a block that had a wider fore-end to increase stability when firing, and the cocking indicator was also made smaller. These changes were appeared in the list of changes on 22nd August 1879.[235] The sealed pattern Mk III can be shown below, with the smaller cocking indicator being the most visible difference to its predecessors.

[232] List of Changes in British War Material, change no. 3193
[233] Britain, Rifle .577/450 Martini-Henry Mk II, NAA co. 1880, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
List of Changes in British War Material, change no. 3998
[235] List of Changes in British War Material, change no. 3998

Figure 21. Sealed Pattern Martini-Henry Mk III.[236]

In the interim period before the Martini-Henry Mk IV, experiments were made into 'the production of a new improved rifle' based on the Martini-Henry.[237] It was necessitated by the fact that other countries were now using superior arms. In 1880, the War Office found during testing at Dungeness that the American designed *Berdan* rifle used by the Russians was superior to the Martini-Henry.[238] It would have perhaps been wiser for the War Office to look into developing a new arm, capable of holding a magazine, given that several other nations were now using magazine arms, such as the Swiss with the *Vetterli* rifle. Nevertheless, the result of these experiments saw many changes made to the Martini-Henry. As well as altering the sights, it was also fitted with a new reduced .402 barrel and utilised a new ratchet rifling system.[239] In reducing the bore, the muzzle velocity could be raised from 1315 feet per second to 1570, thus increasing the rifle's power.[240] In 1886, attempts were made at adding 'quickloaders' to the rifles in an attempt to increase the speed of loading. These could, for a 'nimble man' shave four or five seconds off firing twenty rounds compared to the older Mk III Martini-Henry.[241] On 13th May 1886, a pattern '*B*' Enfield-Martini was introduced, with a longer lever to aid extraction. This version featured

[236] Britain, Rifle .577/450 Martini-Henry Mk III Sealed Pattern 1879, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[237] R. McMahon, The .402 Enfield-Martini, from Cinderella to Pumpkin, Rifles at Random, *International Arms and Militaria Collector No. 25* (Labrador, AU, 2006), p. 30
[238] K. Jones, D. Welch, *A Cultural History of Firearms in the Age of Empire* (Farnham, 2013), p. 243
[239] The New Martini-Enfield Rifle*, Saturday Review of Politics, Literature, Science and Art*, Volume. 57 (16/02/1884), p. 208
[240] The New Martini-Enfield Rifle, *Saturday Review of Politics, Literature, Science and Art*, p. 208
[241] The New Martini-Enfield Rifle, *Saturday Review of Politics, Literature, Science and Art*, p. 209

ultra-long range volley sights, which was to be a key characteristic of subsequent infantry rifles such as the magazine Lee-Metford. This new Enfield-Martini meant that in theory, the British now possessed rifle that was 'superior in every way to other nations', that is, in accuracy, velocity and speed of operation.[242]

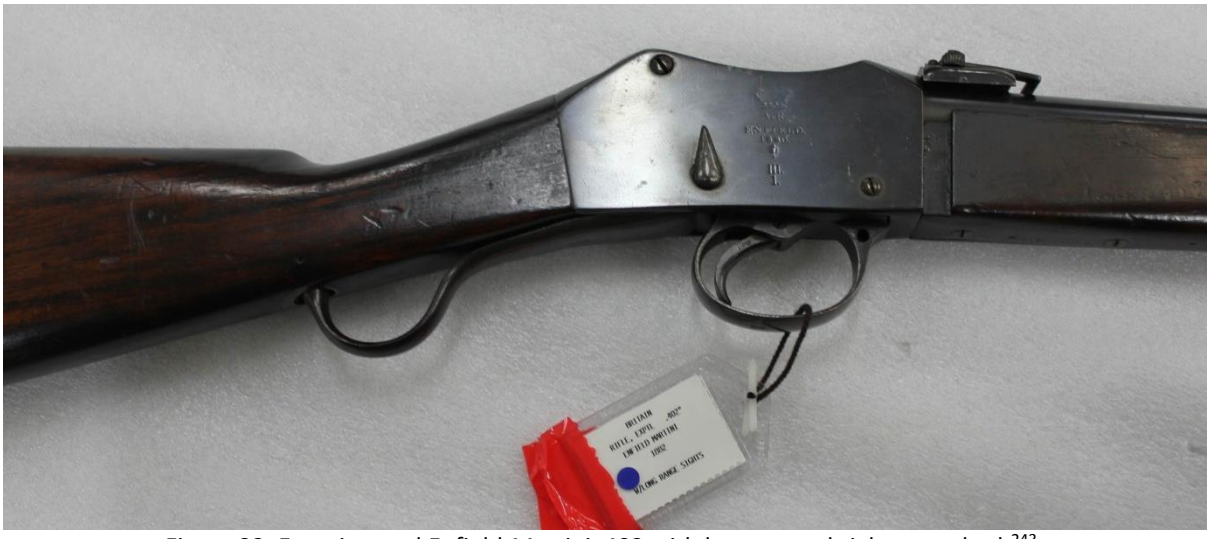


Figure 22. Experimental Enfield-Martini .402 with long ranged sights attached.[243]

In practise, this 'improvement' brought with it more problems than its introduction solved, the most prominent of which was logistical. In 1886 the British army possessed 600,000 Martini-Henrys in stores alone, not counting those rifles held in service. Alongside these, they had 45,000,000 rounds of .450/577 Martini-Henry ammunition. The Gatling-Gardner machine gun ammunition in service at the time was also not interchangeable with Martini-Henry rifles.[244] Furthermore, the decision to adopt the .303 cartridge in later years sealed the fate of the Enfield-Martini. The variety of calibres posed too much of a logistical nightmare for the Enfield-Martini to ever be a practical choice. For that reason, the experiment of the Enfield-Martini rifle was abolished, ultimately leaving 64,634 Enfield-Martinis in store.[245]

[242] McMahon, The .402 Enfield-Martini, from Cinderella to Pumpkin, Rifles at Random, p. 30
[243] Britain, Rifle .402 Enfield-Martini W/Long Range Sights 1882, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[244] Enfield Martini .402" Mk1 Rifle Pattern A <http://www.martinihenry.org/index.php?route=product/product&path=61_59&product_id=78>
[245] McMahon, The .402 Enfield-Martini, from Cinderella to Pumpkin, Rifles at Random, p. 32

To solve these logistical problems, the Martini-Henry was restored to a .450/577 rifle, with the Mk IV being introduced into service on 15th September 1887.[246] Of the Mk IV's, the first pattern, '*A*'s, were simply converted Enfield-Martini rifles. The safety catch and the quick-loader were removed and the rifle was re-bored with the traditional Henry rifling at the Sparkbrook factory.[247] Pattern '*B*' Mk IVs were also converted Enfield-Martinis, however, these variants had been converted from the pattern '*B*' rifles described above. The final pattern, '*C*' rifles, were those that were made entirely from scratch.

Like its immediate predecessor, the Enfield-Martini, the Martini-Henry Mk IV differed drastically compared to the earlier Marks. These differences were the result of bitter experience in battle. Reports from the frontiers of the Empire showed that the Martini-Henry was plagued with problems. These issues had of course been inherent in the rifle from the offset, but refusal deal with them left the rifle fundamentally flawed. On 16th January 1882, for example, the Secretary of State for War, Hugh Childers, ruled out re-examining the breech-system because of its flaws 'unless in case of urgent necessity.'[248] This decision proved to be disastrous. Reports from the Sudan found that in conflicts such as in Tofrek in 1885 between twenty five and fifty percent of the Martini-Henrys used jammed in action, causing the Dervish enemies to penetrate the British formations.[249] The majority of these problems based upon the rifle's extractor. The extractors on Martini-Henry rifles were very weak, an issue that had been raised by troops throughout rifle's selection process.

As solid drawn cartridges were now being issued for the Martini-Henry, the need to alter the extractor subsequently became paramount. The Mk IV sought to finally fix any extraction issues, by strengthening the extractor and making it half an inch longer.[250] Like the Enfield-Martini, the Mk IV possessed a lever that was three inches longer. In mechanical terms, the further away from the fulcrum (or pivot point) you apply the effort, the greater the resultant force becomes on the load. For the Mk IV, this meant more force would be exerted on the extractor when the lever is pushed downwards, increasing the chance the cartridge would

[246] Martini Henry .450" Mk1V Pattern A <http://www.martinihenry.org/index.php?route=product/product&path=61_59&product_id=97> [Accessed 15/05/2016]
[247] Martini Henry .450" Mk1V Pattern A <http://www.martinihenry.org/index.php?route=product/product&path=61_59&product_id=97>
[248] Jones, Welch, *A Cultural History of Firearms in the Age of Empire*, p. 243
[249] Jones, Welch, *A Cultural History of Firearms in the Age of Empire*, p. 243
[250] List of Changes in British War Material, change no. 5603

eject successfully. Due to complaints that the rifle was too heavy, the rifle body was reduced and the butt stock was narrowed, thus decreasing the overall weight of the arm.[251] The resultant Mk IV finally eradicated the inherent issues of the Martini-Henry.

Figure 23. Martini-Henry Mk IV.[252]

The final versions of the Martini-Henry came in the form of fitting new barrels to the rifles to fit later .303 ammunition. This would help the British Army logistically, as fewer types of service ammunition were needed. The first of these rifles were the Martini-Henry Mk V and Mk VI, officially known as the Martini-Metford Mk I (sealed on 30th July 1889) and Mk II (sealed on 12th March 1890) respectively.[253] These rifles used the Metford rifling that came standard to the Magazine Rifle, .303. Of the two, the Mk I's were either conversions of old Mk III Martini-Henrys, or newly built variants made at Birmingham Small Arms company and the Mk II's were conversions of Mk II Martini-Henrys. These rifles saw limited use in the British army however, as only very few were issued to forces in places like Jamaica and Zululand.[254]

As cordite was phased into use with the magazine rifles, causing them to switch to a more robust Enfield rifling, converted Martini-Henrys followed suit in what was to be their final service alterations. These, confusingly named Martini-Enfields Mk I and II were issued on

[251] List of Changes in British War Material, change no. 5603
[252] Britain, Rifle Martini-Henry Mk IV, 1887, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[253] Martini-Henry Rifle MkVI (Martini Metford MkII) <http://www.martinihenry.org/index.php?route=product/product&path=61_59&product_id=57> [Accessed 15/05/2016]
[254] Martini-Henry Rifle Mk VI (Martini Metford MkII) <http://www.martinihenry.org/index.php?route=product/product&path=61_59&product_id=57>

5th February 1896 and 11th February 1896.[255] Like the Metford rifled variants, the Martini-Enfields were simply re-barrelled Martini-Henrys. Unlike the Metford variants, these rifles saw a much higher level of service and production, with 48,000 Mk Is and 10,000 Mk II's being produced for use in commonwealth countries.

On this basis, it can be shown that although built around a simple and robust design, it took an incredibly long time for the Martini-Henry to be truly fit for service. By the time it resembled the 'perfect arm' that the War Office originally envisioned when advertising the rifle trials, development of the Magazine Rifle .303 was already well underway. The value of the Martini-Henry can be shown in that even after the Magazine Rifle .303 became standard issue, it was constantly being adapted, ensuring that it retained its significance well into the 1890's.

[255] Martini-Enfield Rifle Mk II <http://www.martinihenry.org/index.php?route=product/product&path=61_59&product_id=60> [Accessed 15/05/2016]

A symbol of imperialism: the Martini-Henry in battle

Figure 1. The Defence of Rorke's drift.[256]

'The Colt Peacemaker may have been regarded to have 'tamed the west', but it was the Martini-Henry that maintained order around the globe.'[257] In popular culture, when the vast majority of people think of the British Empire, they envisage a redcoat soldier clutching his trusty Martini-Henry. But is the Martini-Henry worthy of this accolade? The rifle was not without its flaws. In terms of technological development, it did not represent a state of the art design, as the 'lead was firmly held in the hands of the Europeans.'[258] The key reason for the legacy of the Martini-Henry is colonial expansion. From the era of the Snider-Enfield in 1866 to the end of the Martini-Henry's service life with in 1888, the British Empire had grown hugely, as territory was gained across Africa, Indonesia and the Middle East.

[256] J. Askew, The Defence of Rorke's Drift, Help for Heroes Charity Commission (2011) <http://www.yessy.com/jasonaskew/zulu.html?i=29786> [Accessed 03/02/2016]
[257] P. Suciu, The Versatile Martini-Henry Rifle Was a Mainstay of the British Army During Queen Victoria's Numerous 'Little' Wars, *Military Heritage Magazine* (August 2005)
[258] Westwood, *Rifles: An Illustrated History of Their Impact*, p. 59

The number of conflicts that the British Empire was involved in directly correlated to the amount of territory they possessed. This ensured that the Martini-Henry would be used in far more conflicts than the Snider-Enfield. Some of the key conflicts where the Martini-Henry was used will be analysed to show its effectiveness, from lesser known campaigns in Malaysia to its iconic role in the Zulu campaigns, and its swan song appearances in both World Wars.

The first deployment of the Martini-Henry was during the Perak campaign in Northern Malaysia from 1875 to 1876.[259] The 80th Staffordshire Regiment and the 3rd Royal East Kent regiment were sent to the region from postings in India and Hong Kong to restore order after the British Administrator James W. W. Birch was murdered. The Perak campaign was based around armoured flotillas that traversed the Perak river to neutralise the hostile Malay forces. The campaign ended when the rebel leaders were captured and hanged.[260] These flotillas can be shown below.

Figure 4. General Colbourne's armoured flotilla in pursuit of rebel ex Sultan Ismail.[261]

The first serious conflict that involved the Martini-Henry was in Africa in 1878 in the 9th Cape Frontier War. 450 British troops fought against almost 4000 Gcaleka warriors. On 7th February 1878 at Centane, the Gcaleka troops charged the British position. Whilst they succeeded in coming within 100 yards of the British line, the fast accurate fire of the Martini-Henry caused them to retreat, resulting in 500 Gcaleka dead and not one British

[259] S. Manning, *The Martini-Henry Rifle* (Oxford, 2013), p. 32
[260] R. Zuljan, The Perak War 1875-76 (2016)
<https://www.onwar.com/aced/chrono/c1800s/yr75/fperak1875.htm> [Accessed 20/05/2016]
[261] The Perak War Dispatches, *The Illustrated London News* (26/02/1876)

soldier killed.[262] The commander, Sir Cunningham remarked that 'at no time has the power of the Martini-Henry been so conspicuously shown.'[263] Against forces of natives, the Martini-Henry truly was proving to be worthy of the reputation it holds today.

The early success story of the Martini-Henry against native forces continued in places such as Afghanistan in 1880. Accounts like those at the battle of Mazina show the power of the Martini-Henry: 'effective volley fire by both marksmen and companies was achieved at 400 yards on the left and 700 yards on the right. The enemy made a stand but the way was ultimately cleared with the bayonet. They lost heavily to just two of our own killed.'[264] Battles such as these clearly exemplify the power of the Martini-Henry.

As the Martini-Henry's experience in battle grew, however, faults began to be reported. As historian David Welch shows, 'campaigns in the Sudan brought sufficient complaint. Martini-Henry's jammed in Tamai in 1884, Abu Khea in 1885 and Tofrek in 1885 (in the latter as many as half of the British rifles jammed.)'[265] In this light, doubt is cast over the true abilities of the rifle. A case study must be therefore be made to examine whether the rifle is at fault in these instances, or whether external factors contributed to its effectiveness.

As a case study, conflict across modern day South Africa from 1878 to 1881 with the Anglo-Zulu War (1878-1879) and the First Transvaal War (1880-1881) highlight both the qualities and failings of the Martini-Henry in battle. Despite both ending disastrously for British forces, it can be shown that the rifle was not to blame, rather, it was the incompetence of British leadership that led to disaster. Conversely, it can actually be shown that the Martini-Henry often saved the British when on the brink of defeat.

The Anglo-Zulu War, although ending in victory for the British, was far too costly be considered a success: 'It took 17,000 troops at a cost of £5,230,328 to defeat the Zulus who were unsophisticated and could put no more than 29,000 men in the field. Seventy-six officers, 1007 soldiers and 600 black auxiliaries were killed.'[266] The British expected the conflict to be similar to that of battles such as Centane. Once the British forces moved into

[262] Manning, *The Martini-Henry Rifle*, p. 32
[263] Manning, *The Martini-Henry Rifle*, p. 33
[264] Captain H. O'Donnell, *Historical records of the 14th Regiment, now the Prince of Wales' own (West Yorkshire Regiment) from its formation in 1685 to 1892* (Devonport, 1920), p. 229
[265] Jones, Welch, *A Cultural History of Firearms in the Age of Empire*, p. 244
[266] J. Laband, Lord Chelmsford's Zululand Campaign 1878-1879, *Army Records Society* (1994)

Zululand to engage the enemy, no defensive positions were made, with the British commander Lord Chelmsford believing they would 'take a week to make.'[267] At Isandlwana on 22nd January 1879, a 4000 man strong Zulu force succeeded in outmanoeuvring and massacring the British forces stationed there, whilst the main British force was away searching for the Zulu army. The disaster, that resulted caused over 1300 deaths on the British side, cannot be blamed on the Martini-Henry rifle. Most of the fighting occurred in hand to hand combat, and the power of the rifle could not be brought to bear upon the Zulus.

Interestingly, two of the key battles in which the Martini-Henry was deployed occurred on the same day. Simultaneously to Islandlwana came the Battle of Rorke's Drift. The successful defence of the small British contingent at Rorke's drift saw around 150 British troops repel an army of 3000 Zulu warriors, losing just seventeen of their own and killing over 350.[268] In this instance, the film 'Zulu' categorically places the Martini-Henry as the reason for victory, as Stanley Baker (playing the role of British commander Lt. John Chard), states 'victory wasn't merely a miracle, but rather a short chamber, Boxer-Henry, .45 calibre miracle.'[269] Whilst this statement was in all probability never actually made by Lt. Chard, it was not far from the truth. Private Caleb Wood, for example, praises the Martini-Henry in his memoir of the battle: "The pain of my burned fingers and aching shoulder was proof indeed that I was still alive. I instinctively dropped the lever under the breech of my rifle, cursing the boiling oil that seeped from the super heated walnut. I slid another heavy boxer round into the chamber and steeled myself for the final, inevitable, last few minutes of my life. But the Zulu's host who had attacked again and again were to come no more."[270] In the early stages, volley fire at range from Martini-Henrys repelled the first waves of attack, whilst sustained fire in the latter stages at close range helped prevent the defences from being breached.[271] In this example, the Martini-Henry is therefore worthy of its reputation today.

[267] F. Colenso, *History of the Zulu War and its Origin* (London, 1880), p. 294
[268] Colenso, *History of the Zulu War and its Origin*, p. 304
[269] Suciu, The Versatile Martini-Henry Rifle Was a Mainstay of the British Army During Queen Victoria's Numerous 'Little' Wars
[270] C. Wood, Account of Rorke's Drift, *Nottingham Daily Express* (23/07/1914)
[271] A. Greaves, *Rorke's Drift* (London, 2002), p. 230

Figure 5. 'Defending the Biscuit Box Wall'[272]

The Martini-Henry was therefore perfectly suited for fighting against natives armed with muzzle-loading rifles or close combat weaponry. But what if the conflict was against well-armed troops that utilized field tactics rather than simply charging *en masse*? This was the case in the Transvaal War of 1880-1881 which resulted in a loss for the British. Across a series of skirmishes, the British forces lost over 400 soldiers, compared to the Boer's forty-one.[273] In this campaign, many problems were reported with the Martini-Henry. The rifle often overheated, limiting its rate of fire to a mere six rounds per minute and reducing its accuracy.[274] The high British losses cannot be attributed to these flaws, however, as the Boers were using similar weapons systems and did not experience any issues. As volunteer militiamen, the Boers were only armed with what they could afford, and so carried a variety of weapons systems that included Martini-Henrys, Snider-Enfields and Westley-Richards rifles, as shown below.[275]

[272] 'Defending the Biscuit Box Wall' Battle of Rorke's Drift <http://www.britishbattles.com/zulu-war/rorkes-drift.htm> [Accessed 30/05/2016]
[273] G. Duxbury, *David and Goliath: The First War of Independence, 1880–1881* (Johannesburg, South Africa, 1981)
[274] J. Laband, *The Transvaal Rebellion: The First Boer War, 1880-1881* (New York, NY, 2005), p. 29
[275] Laband, The Transvaal Rebellion: The First Boer War, p. 17

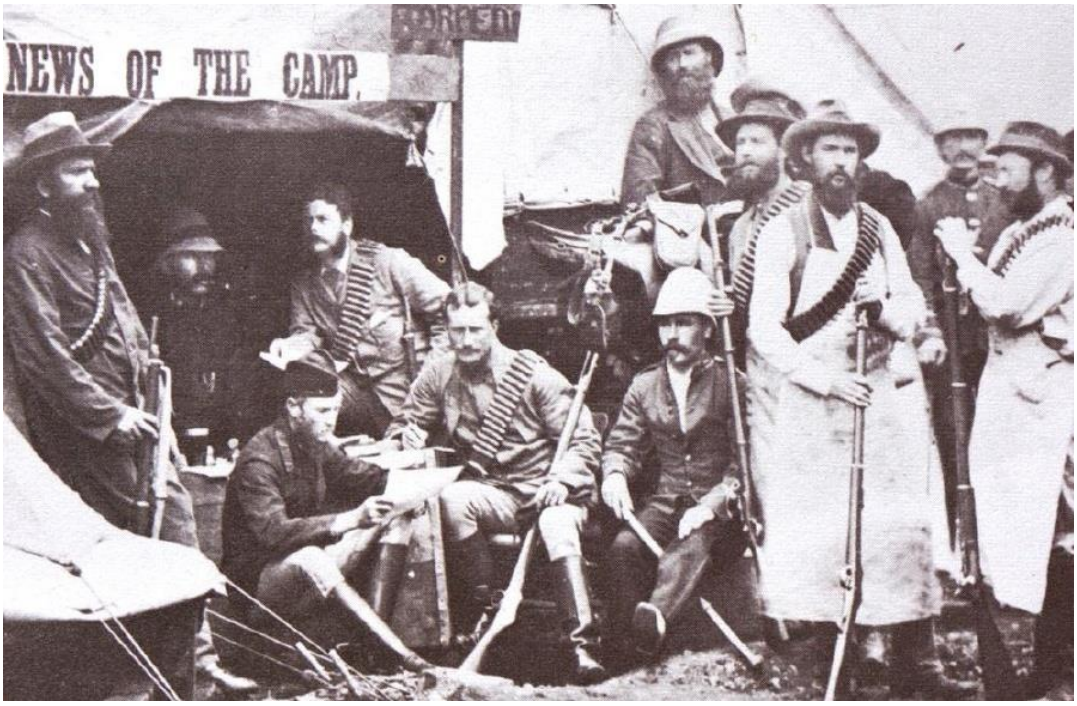


Figure 6. Boer commandoes at the siege of Pretoria.[276]

In this instance the high casualty rate was due to the poor British leadership. The British were utilising conventional military tactics, whilst the Boers presented a more modern approach. Whilst the British preferred to stand in lines and volley fire, the Boers favoured concealed positions, sniping as if hunting.

Overall, the Martini-Henry does indeed deserve the status that modern military historians attribute to it. It allowed the British army to win multiple conflicts in which they were almost always outnumbered, and it prevented more serious defeats in the conflicts that were not successful. Furthermore, like the Snider-Enfield, the Martini-Henry saw continued use even after it had been made a second-class arm by the coming bolt action rifles. For example, it served alongside the Snider-Enfield in the Home Guard during the First World War. [277]

Unlike the Snider-Enfield, the Martini-Henry also saw service with the Home Guard in the Second World War. At the Lithgow factory in Australia new models were constructed into the 1950s, and examples are still being recovered in modern day conflict areas such as Afghanistan, as shown below.

[276] Cobb, The Martini and its Place in History: A Historical Perspective
[277] Home Guard inspection by Lord Kitchener c.1914, BBC Film footage, 28 Minutes 0 Seconds

Figure 8. Note Martini-Henrys and Martini-Henry carbines amongst the weaponry.[278]

On this basis, the Martini-Henry is truly worthy of the reputation it gained that was hard earned in countless conflicts across the globe.

[278] I. Hogg, Afghan fighters at prayer shortly after Soviet invasion of Afghanistan, 1979, *Janes Guns* (1996)

Conclusions

Figure 1. BSA 1876 re-barrelled to .303 at Enfield in 1900 on a BSA military bicycle.[279]

The Martini-Henry as a rifle has been subjected to a continuous flow of both criticism and praise by military historians. To some, the Martini-Henry is nothing more than a rifle built 'to bridge the gap between converted muzzle-loaders and bolt-actions.'[280] To others, the rifle represents the embodiment of the British Empire. From this overview, it can be shown that the Martini-Henry is worthy of the latter view.

The complex process of trials that resulted in the adoption of the Martini-Henry shows that these divisions existed from the offset of the rifle's implementation. For example, the press originally branded the Martini-Henry as the result of War Office bias and incompetence. Conversely, after proving its worth as a rifle, the overriding opinion grew that the War Office

[279] 1876 BSA Martini-Henry Rifle <http://www.oldbike.eu/museum/guns/1876-bsa-martini-henry-rifle/> [Accessed 27/05/2016]
[280] Westwood, *Rifles: An Illustrated History of Their Impact*, p. 61

was indeed successful in developing a competent arm. As the Manchester Guardian proclaimed, the rifle was 'the most perfect in every respect that has yet to be invented.'[281]

The design and operation of the Martini-Henry also proved that the rifle deserved its reputation. Even though it was a single-loader it was simpler and faster than its predecessor, the Snider-Enfield. Its design was no major revolution in the development of firearms, and was quickly obsolesced by other European nations. Nevertheless, it 'soldiered on regardless.'[282] The Martini-Henry did have its issues, but these were steadily resolved in later marks of the rifle, ensuring that the Martini-Henry could be developed into an incredibly successful weapon.

Finally, the extent to which the Martini-Henry was used in British service gives testament to how important a military arm it actually was. The range of conflicts it was successfully involved in occurred in almost every single British colony around the world, 'from the deserts of Egypt, to the rainforests of Africa.'[283] The case study of South African conflicts shows that despite encountering some issues with the rifle, the Martini-Henry still served the British forces well. The extended service life of the Martini-Henry evidences this, with its continued use into the twentieth century.. Indeed, in the words of Suciu, 'the Martini-Henry is the embodiment of the Victorian, last of the line, English through-and-through persona.'[284]

[281] M. Delmard, The Martini-Henry Rifle, *The Manchester Guardian* (22/02/1875)
[282] N. F. Magazine Fed Martinis (25/02/2015) <www.thefirearmblog.com> [Accessed 15/10/2015]
[283] D. Lewis, *Martini-Henry .450 Rifles & Carbines* (Latham, NY, 1996), p. 6
[284] Suciu, The Versatile Martini-Henry Rifle was a Mainstay of the British Army During Queen Victoria's Numerous 'Little' Wars

Transitioning into modernity:

the Magazine Rifle, .303

 [285]

[285] G. James, Britain's Black-Powder .303, The Lee-Metford, *Guns Digest* (09/02/2015)

> Men fall to the shrill whisper of a bullet, the sound of which has not time to reach their ears, fired by an invisible foe at great distance. There death is merely the *quod erat demonstrandum* of mathematical and mechanical proposition.

War correspondent George Lynch on the capabilities of the Lee-Metford.[286]

The adoption of the .303 magazine Lee-Metford in British military history is little known, especially when compared to its progeny, the Lee-Enfield. On a global scale, its adoption into British service in 1888 was by no means unique. In the late 1880s every single world power adopted a small bore, bolt-action repeating rifle: The 1886 French *Lebel*, the German *Mauser*, the Japanese *Type 22*, the American *Krag-Jørgensen* and even the Russian 1891 *Mosin-Nagant*.[287] James Paris Lee's original bolt action design too, was almost a decade old by the time the British adopted his rifle, having been rejected by both British and United States governments simultaneously in its original 1879 format.[288] Furthermore, the rifle was troubled with endurance problems due to the corrosive effects of a new explosive named cordite, that caused it to be replaced by the Lee-Enfield in 1895.

Despite these factors, the Lee-Metford was indeed an extremely important rifle for the British army. It represented a leap forward in firearms technology that was so great that the officers of the day could not adapt to the new tactics it allowed. In the view of historians Temple and Skennerton, 'the advent of the magazine rifle was to render all single-shot rifles obsolete. Even 'quick-loading' systems were abandoned almost as soon as they achieved operational status.'[289] Its direct descendant, the Lee-Enfield, served the British army well into the late 1980s, and the box magazine in general is now standard feature on many modern firearms.

The importance of the arm can first be shown through the rifle's selection process. Like the Snider-Enfield and Martini-Henry, the Lee-Metford rifle came as a result of a rigorous trials

[286] G. Lynch, *The Dance of Death: Impressions of a War Correspondent 1899-1902* (London, 1902)
[287] James, Britain's Black-Powder .303, The Lee-Metford
[288] S. Small, A Decision Deferred: The Bolt-Action Rifle and The U.S. Army (1870-1892), *Small Arms Review* (September, 2013)
[289] B. Temple, I. Skennerton, *A Treatise on the British Military Martini, the .40 & .303 Martinis 1880-c1920* (London, 1989), p. 338

process.[290] By assessing how the rifle was operated, first by the soldier using it and then how its internal parts functioned, a clearer picture can then be gauged of just how advanced the rifle actually was from both engineering and historical perspectives.

The Lee-Metford rifle needed to be tested in service to resolve any issues that it may have possessed. An overview of how the Lee-Metford developed from the *Rifle, Magazine .303* through to the *Rifle, Magazine, Lee-Metford, Mark II** will therefore identify how any issues were found how they were resolved. Despite having a very short official service life, the Lee-Metford played a role in a large number of conflicts. An overview of some of these key conflicts will also serve to present the view that the Lee-Metford was incredibly important historically, as its effectiveness came to a fore on battlefields across the Empire.

The Lee-Metford was indeed a significant part of British military history. It presented an arm with the potential to revolutionise the battlefield. In its later forms, it was more accurate, more reliable, quicker and even theoretically more powerful that any of its predecessors.[291] Ultimately, the Lee-Metford represented a small-arms revolution in Britain, and was part of the much wider small arms revolution across the globe.

[290] Shooting a Lee-Metford at 400 yards (12/06/2015)
[291] A. Mallock, Vibrations in Rifle Barrels, *Proceedings of the Royal Society of London*, Volume. 68 (1901)

Keeping up with the continent: Adopting magazine arms into the Infantry

> We must now accept as fact that every European power has either adopted a magazine rifle, or is about to do so. The Germans with the converted "Mauser", the French with the "Normale", even the Austrians with the "Schuloff" and the "Mannlicher". It falls upon the committee to devote their labours to determine which system is best adapted for our services.

Instructions to the committee of Small Arms 18th February 1887.[292]

Magazine arms were not a new concept when introduced to the British infantry in 1888. Repeating Henry rifles, designed in 1860, had been used in the American civil war. In Switzerland, tubular magazine rifles were issued to the general infantry as early as 1869 with the *Vetterli* rifle.[293] The War Office themselves had even publicly offered prize money for innovative magazine arms in their breech-loading competition of 1866. This shows that the War Office were obviously aware of the continuous development of magazine arms. So what caused such a delay to their adoption? In the view of the historian Webster, the adoption of magazine arms lagged behind other commercial markets based on three main principles; 'ruggedness, simplicity and reliability.'[294] In other words, the flaws of the early magazine arms outweighed their merits.

By the mid 1870s, however, viable magazine fed arms were slowly being filtered into service across the globe and were proving their preponderance. The *Winchester* rifle in the Russo-Turkish war served as an example of their devastating capabilities from 1877-1878.[295] At the same time, and being developed almost simultaneously to magazine arms, early machine guns such as the *Nordenfelt* (designed in 1873) and the *Gatling* gun (first designed in 1862,

[292] H. Northcote, Instructions to Committee of Small Arms (18/02/1887)
[293] D. Webster, *Military Bolt Action Rifles 1841-1918* (Alexandria Bay, NY, USA, 1993), p. xii
[294] Webster, *Military Bolt Action Rifles 1841-1918*, p. ix
[295] R. Beachey, The Arms Trade in East Africa in the Late Nineteenth Century, *Journal of African History*, Volume. 3, Number. 3 (1962)

but first used by the British in battle in 1879) were making their first appearances on the battlefield.[296] As the War Office believed that magazine arms fell into the category of 'systems of machine guns' rather than that of small arms, on 23rd October 1879, the War Office's Machine Gun Committee, led by Vice Admiral Boys were tasked with the question of finding a viable magazine rifle for the infantry.[297]

By 23rd December 1880, Boys' Committee reported that they had trialled the prominent magazine arms of the day, including the *Kropatschek*, *Hotchkiss*, *Winchester*, *Lee*, *Gardner*, *Green, Mauser* and *Vetterli*.[298] Interestingly, the iconic Winchester rifle, which had served the Turks so well in the Russo-Turkish war, was found to be incredibly dangerous during these trials. As it possessed a tubular magazine, the rifle is loaded via sliding cartridges into the magazine 'bullet-to-base'. During the trials this process was done too fast which caused the cartridges to explode in the magazine, thus seriously injuring the user.[299] All tubular magazine rifles were subsequently regarded as too dangerous, and were automatically rejected from all future trials.

The only rifles the Committee thought held any merit were the German *Mauser*, the *Lee* and the *Green*, and recommended them to the Colonel Fletcher's small arms Committee for trial. Unfortunately, these three systems were all bolt-action rifles, which, owing to Sir Henry Halford's accident during the Martini-Henry trials, was enough for the rifles to be rejected before testing even began.[300] The final nail in the coffin was the fact that the British Secretary of State did not see the need for a new rifle at this time, believing instead that the Martini-Henry should be further developed.[301] Despite their ever-growing prevalence overseas, the British Army's view to adopt a magazine arm was summarily deferred.

Across the Atlantic ocean, a similar decision regarding the *Lee* rifle was made by the United States Army. When trialling bolt action rifles to replace the iconic trapdoor *Springfield* in 1881, Lee accidentally made a dimensions error in his design drawings. This resulted in a

[296] B. Robson, *The Road to Kabul: The Second Afghan War 1878-1881* (Stroud, 2007)
[297] Colonel Slade, Trials of Magazine Rifles in England from 1879, A Memorandum, The War Office (07/02/1887)
[298] Slade, Trials of Magazine Rifles in England from 1879 (07/02/1887)
[299] Slade, Trials of Magazine Rifles in England from 1879 (07/02/1887)
[300] Report on rifle selection for service (11/02/1869)
[301] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto, The War Office (20/04/1888)

locking lug failure, causing the rifle to be rejected by the United States Ordnance Department.[302] It took another decade for the United States Army to adopt a magazine rifle, in which they chose the *Krag-Jørgensen* on 15th September 1892.[303] The Lee rifle was, however, adopted by the navy in 1895. The rejection of the early magazine systems by both the British and the Americans show that magazine systems were not ready for general infantry use.

Despite their initial rejection, the benefits of magazine arms were far too compelling to be ignored for long. By 1882, the Royal Navy requested trials into magazine arms be re-opened so as not to be superseded in technology by other forces. In the same year, the Intelligence Department at the War Office presented information to the government on the increasing use of magazine arms by foreign powers, instantly making the War Office anxious to develop a new, modern rifle.[304] As a result, a brand new committee on small arms was established, led by Lieutenant Colonel Phillip Smith of the Grenadier guards to establish a suitable magazine rifle for issue to the Royal Navy.

Smith's small arms committee received thirty-one magazine rifles and seven quick loading rifles for testing, which were trialled from 1882 until 31st October 1883.[305] Conducted in a similar manner to Boys' Committee in 1880, all forms of tubular magazine were rejected, many, such as the Mauser, without being tested.[306] In fact, all quick loading rifles were rejected and only three magazine rifles survived Smith's committee's first trial. The first two, the *Owen Jones* and the *Lee* qualified for continued trial, whilst the third, the *Bethel Burton* was allowed to submit an improved version for testing on a later date. The Lee too would undergo 'improvement', by attaching an Alexander Henry barrel to ensure it could fire Gatling ammunition.[307] Table 1. shows the three rifles that merited further consideration, with supporting images below.

[302] Small, A Decision Deferred: The Bolt-Action Rifle and The U.S. Army (1870-1892)
[303] Small, A Decision Deferred: The Bolt-Action Rifle and The U.S. Army (1870-1892)
[304] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)
[305] Slade, Trials of Magazine Rifles in England from 1879 (07/02/1887)
[306] I. Skennerton, *The British Service Lee: The Lee-Metford and Lee-Enfield Rifles & Carbines* (Australia, 1982), p. 6
[307] Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, 1st Progress Report (31/10/1883)

Arm	Nature of Action	Nature of Magazine	Result of Trial	Remarks
Owen Jones Magazine Rifle	Hinged block	Hopper magazine	Stood all tests	Still under trial
Lee Magazine Rifle	Bolt	Detachable under action	Stood all tests	Still under trial
Bethel Burton Magazine Rifle	Bolt	Side hopper	Extraction and ejection unsatisfactory; elevating spoon broke during firing.	Improved action proposed, but not yet submitted. Rejected.

Table 1. Smith's Committee finalists.[308]

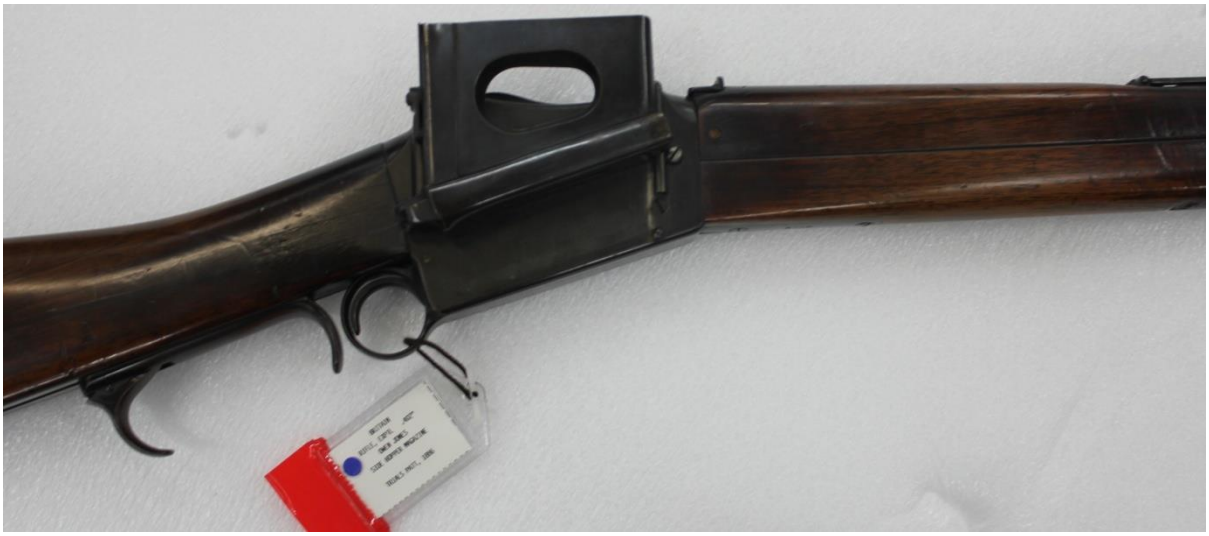


Figure 1. The Owen Jones trials rifle with .402 Enfield barrel.[309]

Figure 2. The Improved Lee in .45 Gatling calibre.[310]

[308] Skennerton, The British Service Lee: The Lee-Metford and Lee-Enfield Rifles & Carbines, p. 6
[309] Britain, Experimental Rifle, Owen Jones .402 with side hopper magazine, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Figure 3. The Bethel Burton with .45 barrel.[311]

At this early stage it was clear that Smith's committee, the Royal Navy and even the Director of Artillery all favoured the Owen Jones rifle. In their first report of proceedings, Smith noted that 'no rifle possesses sufficient merit to render extended trials - Only the Owen Jones possesses any serious merit.'[312] This view remained prevalent once the 'improved' Bethel Burton and Lee rifles had been manufactured for testing. On 19th June 1884 it was found that both were inferior to the Owen Jones rifle, but were to remain in trials as their 'magazines were sufficient for consideration.'[313]

By the 31st July the following year, the 'improved' Bethel Burton had proved to be unsatisfactory. The Lee too was considered a poor option as it had a detachable magazine, which the Committee were worried would get lost. By November, it had also been deduced that it would be impossible to convert the existing Martini-Henry into a magazine arm.[314] For that reason, after reviewing the merits of the rifle, the committee recommended the Owen Jones be produced for service trials on 11th November 1885.[315]

The War Office's Director of Artillery attempted to take out a contract at the Royal Small Arms Factory at Enfield to provide the Royal Navy with 5000 Owen Jones rifles. In a strange

---

[310] Britain, Experimental Rifle, .45GG" Improved Lee Trials Pattern with detachable box magazine, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[311] Britain, Experimental Rifle, .45 Bethel Burton with side hopper magazine, 1883, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[312] Smith, 1st Progress Report (31/10/1883)
[313] Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, 2nd Progress Report (17/06/1884)
[314] Temple, Skennerton, A Treatise on the British Military Martini, The .40 & .303 Martinis 1880-c1920, p. 344
[315] Slade, Trials of Magazine Rifles in England from 1879, A Memorandum, The War Office (07/02/1887),p. 11

turn of events, the factory's superintendent refused, as he claimed that no rifles could be made in time based upon their complexity.[316] The superintendent of the factory at Enfield clearly doubted the Committee's recommendations. After all, the trials process had only ever tested one rifle at a time; to throw caution to the wind and build 5000 would be, in his view, a dangerous move. In refusing the contract, he could absolve himself from the blame if the Owen Jones rifles failed. Instead, he preferred the Lee as it was cheaper to produce and easier to repair, and so suggested trialling both rifles in small numbers.[317]

The failure to establish a contract for the Owen Jones rifle prevented it from ever being produced in volume or issued to troops. Upon re-evaluation of the Owen Jones, Smith's suddenly discovered it to be unfit for service. When compared to the 'improved' Lee, it was found that the Lee was much simpler, it jammed less frequently, could have its parts replaced easier, that the detachable magazine was in fact an advantage and it had a much more powerful extractor.[318] The Committee then rescinded the recommendation of the Owen Jones rifle.[319]

In the time it had taken to process the first trials rifles, a seventeen new designs had been received by the War Office, such as the *Schulhof* and the *Morris*.[320] A new Committee, this time led by Sir Evelyn Wood, deemed the *Schulhof* too complicated and rejected the *Morris* as it suffered from permanent excrescence.[321] Once again, every rifle bar the Lee was rejected. Given its success in these latest trials, the Lee bolt was finally recommended for adoption and manufacture on 7th February 1887.[322] The only question that remained was whether it would be fitted with the corresponding Lee magazine, or the Burton magazine, as the Burton magazine had shown merit in earlier trials. As a result just two rifles remained in the trials process, both with the Lee bolt and a unique magazine design.

[316] Slade, Trials of Magazine Rifles in England from 1879, A Memorandum (07/02/1887)
[317] Slade, Trials of Magazine Rifles in England from 1879, A Memorandum (07/02/1887)
[318] Slade, Trials of Magazine Rifles in England from 1879, A Memorandum (07/02/1887)
[319] Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890 3rd Progress Report (19/10/1887)
[320] Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, Final Report, Appendix B (19/10/1887)
[321] Field Marshall Sir Evelyn Wood, Committee on Special Small Arms (07/02/1887)
[322] Wood, Committee on Special Small Arms (07/02/1887)

Feature	*Lee Burton*	*Improved Lee*
Length	4 feet 2 inches	4 feet 3 1/2 inches
Empty Weight	10 1/4 lbs	10 lbs
Barrel	30 inches	32 inches
Grooves	7	5
Twist	1 turn in 15 inches	1 turn in 20 inches
Calibre	.402	.433
Charge	85 grains	87 grains
Bullet Weight	384 grains	375 grains
Magazine Type	Side gravity fed magazine, raised to feed, lowered to safe. Can be used as a single loader when safe. Holds five cartridges.	Detachable magazine underneath the action. Holds five cartridges.

Table 2. Trials rifle contenders 1887.[323]

As the experimental Enfield-Martini was still in development in its new .402 calibre, both of the remaining trials rifles were re-barrelled to match on 18th February 1887. As the rifles were now identical in all but the magazine system, it was deemed that the troops themselves should have their say in which one they preferred. Therefore, once re-barrelled, both weapon systems were sent for the first troop trials aboard the H.M.S. Excellent. In a rare show of British military unanimity, it was found that the Lee magazine was superior to the Burton.[324] The two contenders can be shown below.

[323] Lee Burton and Improved Lee: Memorandum relating to Magazine rifles issued for trial in 1887, The War Office (1887)

[324] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)

Figure 4. The 'Enfield Lee' rifle in .402 calibre.[325]

Figure 5. The Lee Burton rifle, also in .402 calibre.[326]

After five years of trials, a rifle had finally been selected for service, until developments on the continent drew the entire process to a halt. A Swiss *Rubin* rifle, chambered for 'small-bore' .298 ammunition, was brought into the War Office the 2nd December 1886. Under trial, it was found that this rifle could beat the Enfield-Martini of 1886 in every aspect including range, penetration and capability to inflict injury. This instantly placed all .402 rifles into a state of obsolescence.[327] Furthermore, the invention of smokeless powder, used in the ammunition for the French *Lebel* rifles in 1886 stood to make any new rifle introduced into service immediately obsolete.

[325] Britain, Experimental Rifle, .402 Enfield Lee trials pattern, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[326] Britain, Experimental Rifle, .402 Lee Burton trials pattern, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[327] Smith, 3rd Progress Report (Enfield, 19/10/1887)

In response, it was decided that if the Lee was to be adopted into military service, it had to be equipped with a .3 inch calibre barrel. This smaller bore would give the rifle the range and penetrating properties of the *Rubin*. It was also decided that the risk of adopting a nitro compound was far too great, with black powder being preferred pending further nitro trials.[328] Several different small bore rifles were therefore quickly tested by the committee and compared to the Enfield-Martini. This included the 'new' Enfield rifling and that of William Ellis Metford. The testing, conducted in June 1887 found that Metford's rifling was the best, as shown in Table 3.

Form of rifling used	**Mean deviation after fifteen shots at 1000 yards in inches**
'New' Enfield	25.3
Metford	23.5

Table 3. Comparison of small bore rifling trials results 8th June 1887.[329]

As Metford's rifling proved to be the most accurate, a 'specimen rifle' was built to compile the developments of the varying trials. It utilised a Lee bolt and a Lee magazine, Metford's rifling and a .303 cartridge designed by Major Rubin of Switzerland. This rifle was then trialled until 21st September 1887, where it was found to be highly satisfactory.[330]

[328] Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890 4th Report (11/01/1889)
[329] Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, Final Report, Appendix A (08/06/1887)
[330] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)

Figure 6. Rifle, Experimental, .303 Lee Metford built for troop trials.[331]

A preliminary group of 350 specimen rifles and fifty carbines were then constructed at Enfield to be distributed to troops for service trials, to commence on the 28th December 1887.[332] These trials immediately produced highly satisfactory results. For example, the South Lancashire Regiment reported that: 'The rifle is as handy as the Martini-Henry, men even state that it is more comfortable. Filling the magazine took just fifteen seconds. The dial sights worked well even out to 1600 yards. It is greater than the Martini-Henry in rapidity, accuracy (at all ranges), extraction, cleaning and recoil.'[333]

As is to be expected with prototypes many of the troops reported problems with the specimen rifles, including breakages, misfires and gas leakages.[334] To remedy this, several quick alterations were made to the specimen rifle. The bolt and action body were strengthened to prevent breakages or gas leakage and the bolt key was abolished.[335] Once these fixes had been applied, a pattern was sealed at Enfield on 1st November 1888.[336] As production started, the rifle appeared in the List of Changes on 22nd December 1888, as the Rifle, Magazine (Mk I).[337]

[331] Britain, Experimental Rifle, .303" Lee Metford Troop Trials rifle, chambered for the Rubin Cartridge, 1887, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[332] Smith, 4th Report (11/01/1889)
[333] South Lancashire Regiment Specimen rifle report , Magazine Rifles Committee on Small Arms 1883-1890 (11/01/1889)
[334] South Lancashire Regiment Specimen rifle report (11/01/1889)
[335] Smith, 4th Report (11/01/1889)
[336] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)
[337] List of Changes in British War Material, change no. 5877

Thus, the British Army had finally adopted a magazine rifle into general service. This by no means meant that the Martini-Henry became redundant. In 1888 Captain Harston of the Royal Grenadiers, Toronto, approached the War office with a successful conversion of the Martini-Henry to a magazine rifle. His idea was that of a spring-loaded magazine which mechanically fed rounds into the rifle's breech.[338] In doing so, Harston claimed that he would be 'making an essential and large saving to the country by converting Martini-Henrys to repeaters.'[339]

Figure 7. The Harston converted Martini-Henry Rifle.[340]

Although built around an extraordinary mechanism, the rifle was rejected by the War Office. When compared to the Rifle, Magazine Mk I, it was overly complex and difficult to manufacture. For that reason, in response to Harston, the War Office stated that: 'Your invention, although ingenious, is not one which could, with advantage be brought into Her Majesty's service.'[341] The adoption of the rifle, Magazine Mk I was now complete. The British Army would now possess a small-bore, magazine rifle that would revolutionise the power of the general infantry as they knew it.

[338] Nathanial F., Magazine Fed Martinis (25/02/2015)
[339] Captain Harston to the War Office, Letter No. 34 (04/10/1888), Correspondence between War Office and Captain C. Harston 1886-1889
[340] Britain, Experimental Rifle, Martini-Henry, Harston conversion, 1888, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]
[341] War Office to Captain Harston, Letter No. 45 (22/11/1888), Correspondence between War Office and Captain C. Harston 1886-1889

A technical overview of ‘The Rifle, Magazine, .303’

> On the Persian frontier from Cochannes to Bashala there was very wild country with no apparent signs of lawful government, or indeed, anything much until Mount Ararat where three empires meet. On this road, my eleven-shot sporting Lee-Metford attracted the most covetous envy, one rich chief offering me untold gold and several good Russian rifles in exchange for it. I was not waylaid as I expected to be after my refusal to part with it - I was denied all excitement of attack wherever I passed through this country with it.

Colonel Massey describing the value of his trusty magazine rifle.[342]

The introduction of the magazine rifle into British service in 1888 was to be the first step towards a revolution in British infantry tactics, as it considerably increased the capabilities of the infantry. In order to assess the impact of this revolution in small arms technology, it is necessary to see the different ways that the rifle could be operated, as well as how it works internally. Following this, a technical overview of the rifle's development across various improvements can then show that, once perfected, the Lee-Metford was one of the finest rifles ever to be adopted by the British Army.

Regardless of its official nomenclature, all British .303 magazine rifles were operated in a similar manner by means of its bolt-action mechanism. The Lee-Metford could be used as a repeating rifle or a single-loader depending on the circumstances. The firing exercise below is an example of when single shots are to be fired, so as to provide a comparison between the magazine rifle and its single-loading predecessors. To use the Lee-Metford as a single-loader, a magazine cut-off was applied, which was a small sheet of metal that simply

[342] Colonel P. Massy, Exploration in Asiatic Turkey, 1896 to 1903, *The Geographical Journal*, Volume. 26, Number. 3 (September 1905)

blocked the magazine off from the chamber of the rifle. When rapid fire was needed, this was simply removed by pulling on the lip located on the right.

Figure 22. Magazine cut-off applied, the Robert W. Farris Collection.[343]

Figure 23. Magazine cut-off removed to facilitate rapid fire, the Robert W. Farris Collection.[344]

The commands given for individual fire when using the rifle, Magazine .303 were extremely similar to those given to soldiers using the Martini-Henry. The first stage, moving into the 'ready' position, was exactly the same, as shown below.

[343] Ian Skennerton, Magazine cut off applied, The Robert W. Farris Collection IMG_0136rbd
[344] Ian Skennerton, Open Magazine cut off, The Robert W. Farris Collection IMG_0145bcd

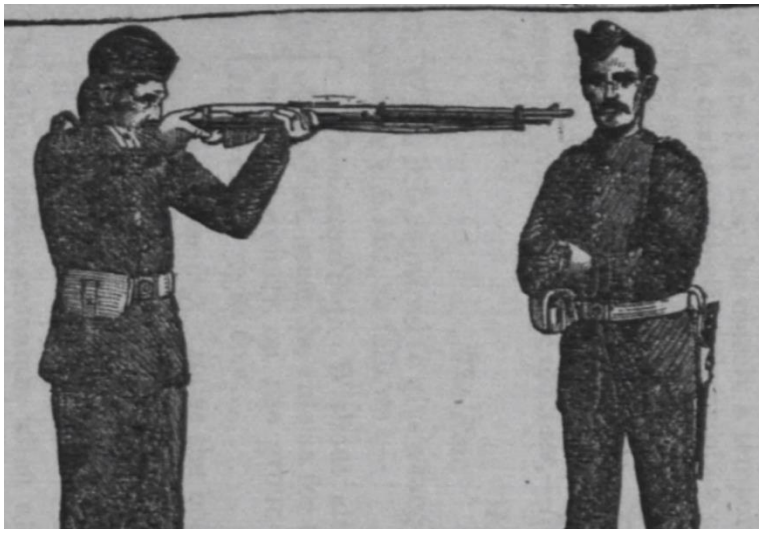


Figure 1. The 'ready' position shown on the right and the 'present' position shown on the left.[345]

In order to charge the rifle as a single-loader, on the command 'two', with his right hand, the soldier would pinch the bolt between his forefinger and thumb, raise it, and draw it backwards to its full length, opening the bolt.

Figure 3. Opening the bolt.[346]

A cartridge was then taken from the pouch and inserted into the chamber. The bolt was then closed rapidly, using the palm of the soldier's right hand. It is this action that actually cocks the rifle.

[345] The War Office, *Rifle and Carbine Exercises, Manual Exercise, Firing Exercise, Bayonet Exercise, Firing Exercise for Webley Pistol and Instructions for Cleaning Arms*, Her Majesty's Stationary Office (London, 1898)
[346] The Mk I Lee Metford: The Firing Exercise, *Britishmuzzleloaders* (09/04/2016) <https://www.youtube.com/watch?v=SlBdVXrhFSk> [Accessed 10/04/2016], 5 Minutes 26 Seconds

Figure 4. The cartridge is inserted into the chamber.[347]

The sights were then set to the required distance. For conventional shooting, this involved simply moving the back-sight to the required range.

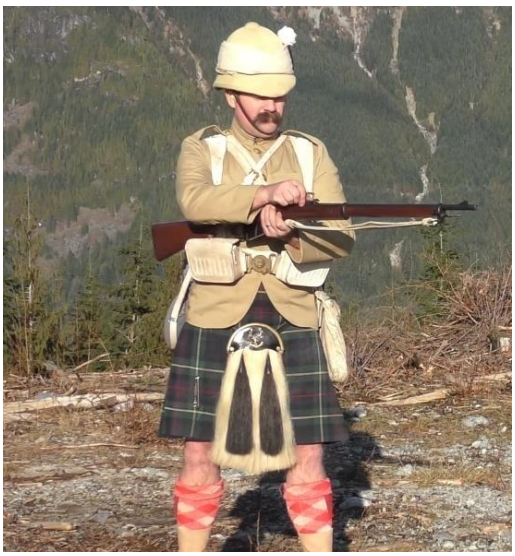


Figure 5. Setting the sights to the desired range.[348]

For conventional fire, there were three main 'zones'; long-range zones, from 800 to 1500 yards, medium-range zones from 800 to 500 yards and the 'decisive' zone that was anything less than 500 yards. Usually, independent fire commenced within 200 yards of the enemy.[349]

The Lee-Metford also utilised ultra-long range sights, which had first been developed on the Enfield-Martini in 1886. These sights consisted of a frontal dial sight and a flip up aperture sight at the back end of the rifle. These allowed the soldier to sight his rifle up to 2800 yards.

[347] The Mk I Lee Metford: The Firing Exercise, 6 Minutes 36 Seconds
[348] The Mk I Lee Metford: The Firing Exercise, 5 Minutes 34 Seconds
[349] Captain W. James, Handbook of Tactics, *Gale & Polden's Military Series* (Aldershot, 1895), p. 206

Firing in ranks, this would allow the a unit to act as a mobile artillery piece, suppressing enemy forces at extreme ranges.

Figure 6. The rotating dial sight ranged to 2800 yards.[350]

Figure 7. The flip up rear aperture sight[351]

When aligned, the rifle would be held at an obscure angle, as if aiming at the sky. At this range, the soldier would not be able to see his target. The idea was that soldiers would fire in ranks, creating a beaten zone that approaching forces had to traverse through. The sight picture can be seen below.

[350] The Mk I Lee Metford: The Firing Exercise, 15 Minutes 0 Seconds
[351] The Mk I Lee Metford: The Firing Exercise, 15 Minutes 12 Seconds

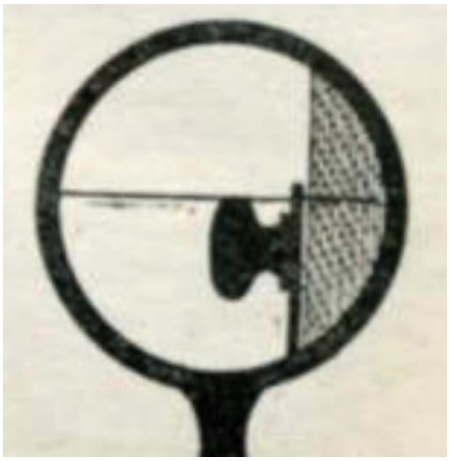


Figure 8. The volley sight picture.[352]

To some, the concept of shooting out to 2800 yards with a black powder rifle designed in 1888 is ridiculous, given the fact that the longest confirmed sniper kill to date, achieved by Corporal Craig Harrison in 2009 stands at 2474 metres (2706 yards) with a L115A3 sniper rifle.[353] There is evidence to show that volley firing at ultra long range was actually used successfully. In the Second Boer War, at the Battle of Escourt in 1899, volleys delivered at 2900 yards by the Dublin fusilier's succeeded in 'clearing the Boers from the town, to which several were killed or wounded.'[354] Contemporary books on tactics even stated that 'even at 3000 yards marching in fours is dangerous.'[355]

To fire the rifle, on the order 'present', the arm was brought to the firing position. The soldier would then aim at his target and fire on command by pulling the trigger.

[352] *Rifle and Carbine Exercises, Manual Exercise, Firing Exercise, Bayonet Exercise, Firing Exercise for Webley Pistol and Instructions for Cleaning Arms* (London, 1898)
[353] Guiness World Records, Longest Confirmed Sniper Kill <http://www.guinnessworldrecords.com/world-records/longest-confirmed-sniper-kill> [Accessed 25/06/2016]
[354] B. Burleigh, *The Natal Campaign, Estcourt, 21st November 1899* (London, 1900)
[355] Major C. Callwell, *Tactics of To-Day* (London, 1900)

Figure 9. The stance used for the 'Present' and 'Fire' commands.[356]

After firing, step two would be repeated, opening the bolt. By doing so the cartridge would be simultaneously ejected. If no more shots were required, the command 'unload' was given. The soldier would rapidly open and close the bolt to eject the cartridge, before then pulling the trigger to ease the springs. If firing from the magazine, the process was the same, except the magazine would be removed by pressing the magazine release catch and held in the left hand as the cartridges were unloaded.[357]

The operation of the Lee-Metford was therefore very simple. Despite the simplicity of operation, the actual construction of the Lee-Metford was quite complex based on the fact that it was so much more technologically advanced than its predecessors. In fact, it was so complex that required over double the components of the Martini-Henry.[358] As there are so many working parts, this overview will assess the Lee-Metford's bolt separately to the magazine.

When firing, the bolt must first be manipulated in such a manner as to cock the rifle. The main components that make up the this bolt are as follows:

[356] The Mk I Lee Metford: The Firing Exercise, 5 Minutes 40 Seconds
[357] *Rifle and Carbine Exercises, Manual Exercise, Firing Exercise, Bayonet Exercise, Firing Exercise for Webley Pistol and Instructions for Cleaning Arms* (London, 1898)
[358] Director General of Ordnance Factories, Report on Specimen magazine rifles 1888 (20/04/1888)

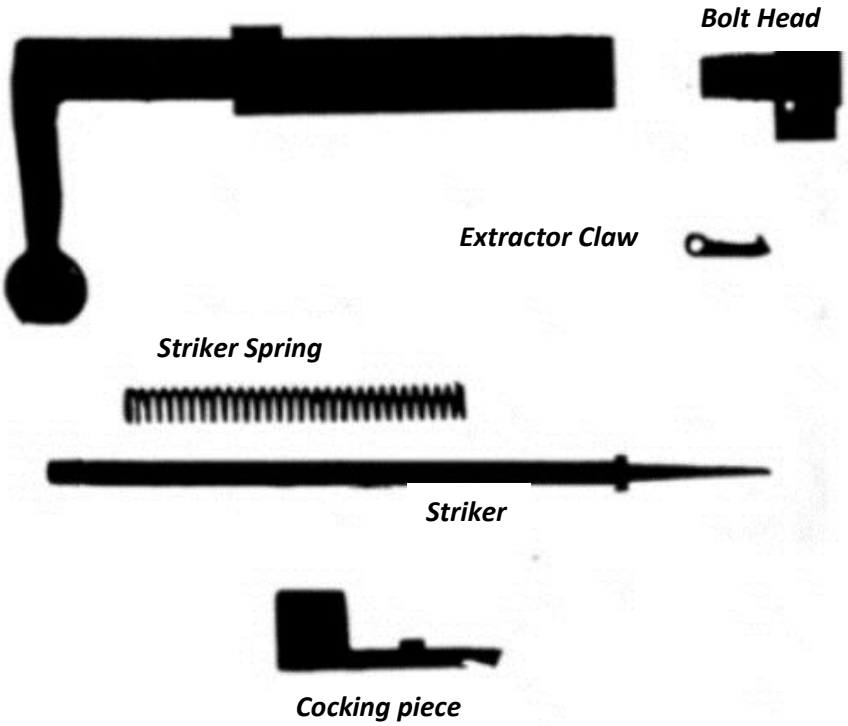


Figure 11. Bolt components for a 'Lee' bolt.[359]

A hollow tube with a cocking handle attached to the rear makes up the chassis of the bolt. Attached to the end of this is the bolt head. Its angular shape provides locking lugs that lock the bolt place for firing. Attached to this is the extractor claw, which simply grips the rim of the cartridge base. When the bolt is pulled backwards, the cartridge is pulled out of the rifle. Inside the bolt is the striker. This is the component that punches forward to ignite the cartridge. This has a spring coiled around it and a cocking piece attached to the rear, that sits below the bolt. The bolt assembly can be shown below.

[359] Royal Small Arms Factory, *Enfield Enforcer 7.62mm Sniper Rifle Handbook* (Middlesex 1968)

Figure 12. Skeletonised Lee-Enfield showing the open bolt, with the visible cocking piece to the left.[360]

When loading the rifle, the bolt is opened and a cartridge is placed in the chamber. The bolt is then closed by pushing the cocking handle forwards. Whilst the bolt assembly travels forward, the cocking piece, which sits below the bolt, catches on the sear preventing it from travelling forward with the rest of the bolt. This causes the striker spring to become compressed. The cocking handle is then rotated downwards; locking the bolt head's lugs into place and cams the bolt. Now that the rifle is cocked, the trigger assembly becomes necessary in order to fire the rifle.

[360] Ian Skennerton, Skeletonised Lee-Enfield, The Robert W. Farris Collection IMG_1277bc

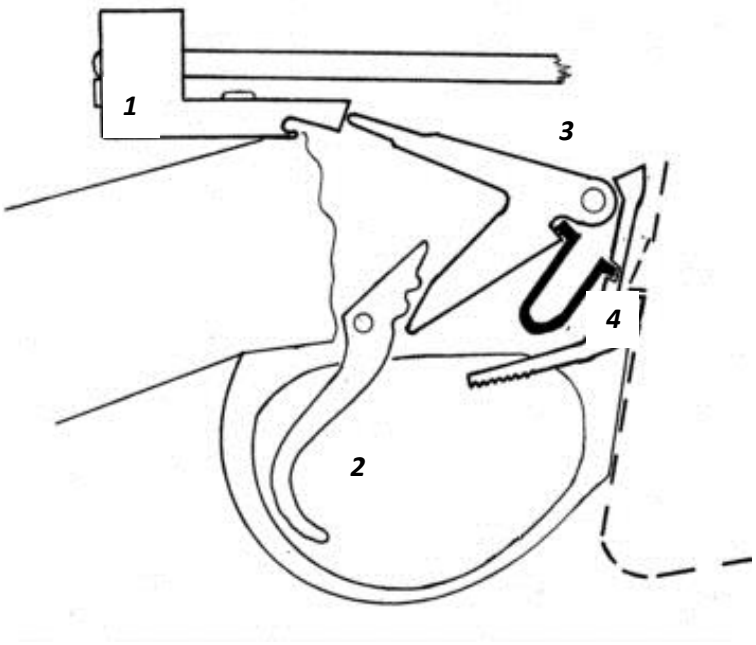


Figure 13. 'Lee' trigger assembly components:

1. Cocking Piece

2. Trigger

3. Sear

4. Sear spring [361]

As the user compresses the trigger (***2***), a downward pressure is inserted onto the sear (***3***). The trigger has two visible protrusions on it. When compressed, the lowest bump engages the sear first. As it compressed further, the second protrusion engages the sear. As the trigger is pulled past the second protrusion it undergoes its full length of travel. This rotates the nose of the sear clean off the cocking piece (***1***). The pressure of the compressed striker spring then forces this piece forward at speed. As it is attached to the striker, the striker also moves forward rapidly, with enough force to ignite the primer of the cartridge in the chamber. This process can be shown below.

[361] Royal Small Arms Factory, *Enfield Enforcer 7.62mm Sniper Rifle Handbook*

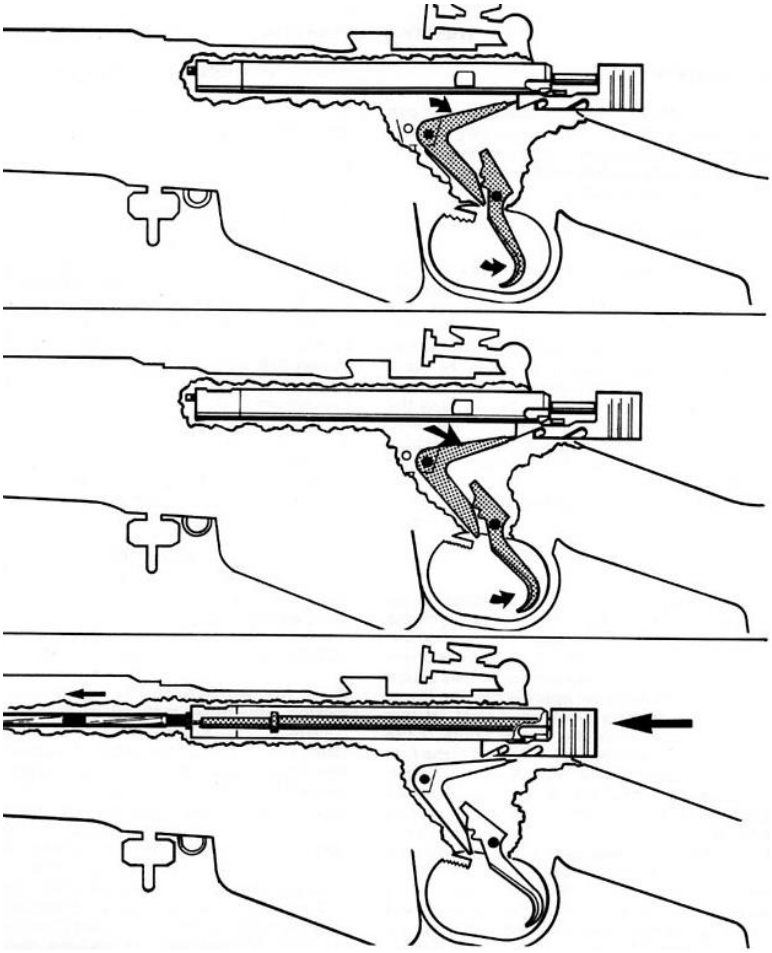


Figure 14. The firing process of a Lee bolt-action rifle (drawings shown use a No.7 Lee-Enfield).[362]

Once the rifle has been fired, the extractor claw will remove the spent cartridge as the bolt is reopened, completing the process.

Working simultaneously to the bolt was the detachable box magazine. On the Lee rifle, this was housed under the receiver body in a 'Z' shaped spring.[363] The design can be seen in Lee's original patent, where the magazine assembly is clearly visible:

[362] Canadian Forces Technical Order, *Rifle, Caliber .22, No.7 Mk I*, National Defence HQ (Ottawa, CA, 14/09/1984)
[363] M. Pegler, *The Lee-Enfield Rifle* (Oxford, 2012), p. 8

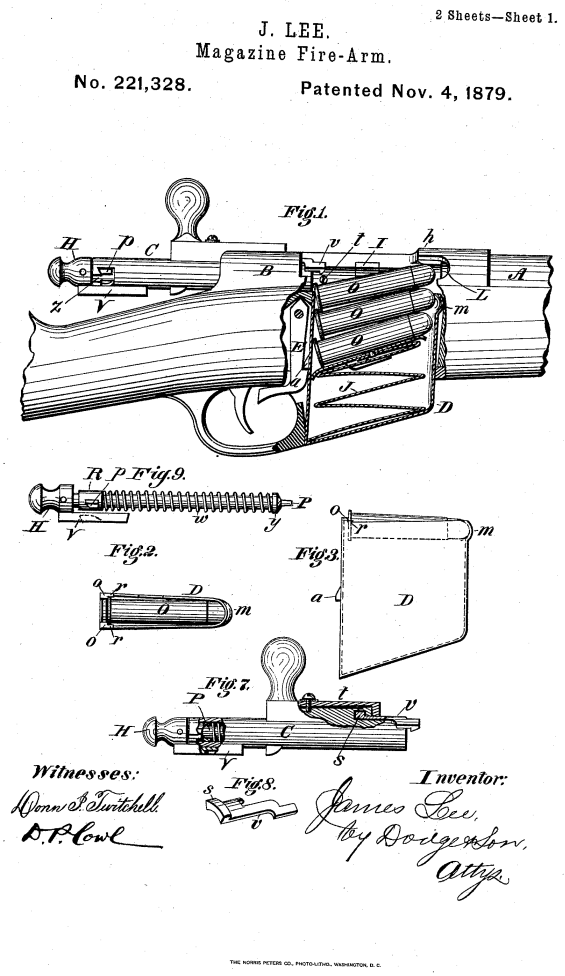


Figure 15. Lee's magazine rifle patent, first submitted in 1878.[364]

To charge the magazine, cartridges were pushed in against the force of the magazines spring. When the bolt was opened, the uppermost cartridge would be pushed upwards by the 'Z' shaped spring forcing it to protrude from the magazine. Small lips on the magazine prevented the cartridge from springing out. The historian Petrillo describes how this functions alongside the bolt: 'As it is closed, the forward motion of the bolt sweeps the protruding top cartridge off the magazine and into the chamber. Once the cartridge is ejected, the bolt travels back over the magazine and the process is repeated.'[365]

After perfecting the design of the box magazine, Lee then designed a means of securing the magazine to the rifle itself, whilst also being able to easily remove it: ' The box may be held

[364] J. Lee, Patent No. 221,328, James Paris Lee's Detachable Box Magazine Rifle Patent, United States Patent Office (New York, 04/11/1879)
[365] A. Petrillo, *British Service Rifles and Carbines 1888-1900* (Latham, NY, 1994)

fast by any suitable means; but a very simple plan is to have a spring catch secured in the stock or receiver. With this arrangement it is only necessary to shove the box into the opening, and it is at once secured ready for operation. To detach it, it is only necessary to draw back the catch and pull out the box.' [366]

Like its predecessors, the Lee-Metford underwent a series of modifications throughout its service life. The manner to which these changes came about, however, was markedly different. For example, with rifles such as the Martini-Henry, modifications were made out of bitter necessity, often following battles where the rifle had failed. With the Lee-Metford, the War Office sought to avoid these issues. Anticipating teething problems with the new arm, it was arranged that all of the rifles should undergo inspection by 'viewers'.[367] These issues could therefore be dealt with collectively, instead of making multiple piecemeal changes. These could then be fixed in one major overhaul with a Mk II arm that required no further alteration.[368] Unfortunately for the War Office, there were many more problems with the rifle than they expected, and so by the end of its service life, six official variants had been produced.

An intriguing idea for the future development of the Lee-Metford was also proposed in 1888, but was never adopted. The idea, submitted by a Mr Satterlee, was the electric primer. A battery for the primer would be placed in the butt of the rifle, and when the trigger was pressed a high voltage charge would electrically ignite the primer. This idea was considered too dangerous and too expensive.[369] What makes this idea significant is the fact that the American arms company, Remington, attempted to introduce the exact same mechanism in their *R700* series of rifles in the year 2000, 112 years after Mr Satterlee's original idea. Unfortunately, even in today the idea is still deemed far too expensive to ever be practical.[370]

Innovative thought aside, the first official 'change' for the Lee-Metford saw no actual difference to the structure of the rifle, rather, on 3rd October 1890, the issue of spare

[366] J. Lee, Patent No. 221,328, James Paris Lee's Detachable Box Magazine Rifle
[367] These were regular officers that were also employed by the War Office with the task of highlighting any issues that occurred with the rifles.
[368] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)
[369] Committee on Small-Arms Progress Report, the Rifle, Magazine Mk I, The War Office (1889)
[370] C. Dunn, Electric Cartridge Primers: Gone but not lamented, *The Truth About Guns* (19/12/2013)

magazines was discontinued in an effort to reduce the rifle's cost.[371] Similarly, the second official 'change' was in nomenclature only, where the rifle was dubbed the Magazine, Lee Metford Mark I.[372] This original Lee-Metford can be shown below.

Figure 16. The Rifle, Magazine, Lee Metford Mark I.[373]

By this stage, the first of the 'viewer's' reports had been received by the War Office, which showed that of the first 7402 rifles introduced into service, 851 rifles were already reported as beyond an armourer's power to repair due to bulging, rusting and unavailability of parts.[374]

In November 1890, *The Times* newspaper released an article which damned the production of the Lee-Metford. It made a comprehensive list of any conceivable problem, real or imaginary, claiming that: '(The) Mark I has serious defects which we are expected to believe that (The) Mark II be perfection. The defects in the rifle are inherent. The new Mark would have to differ so substantially as to be a new rifle. This nation can of course afford the millions required for modification: but not for a faulty arm.'[375]

In order to save face, on 25th November, former Small Arms Committee Chairman P. Smith published a report to defend the Lee-Metford. He claimed that the rifle's cost would be reduced and that it had become favourable to the committee only after extensive trials.[376] Committee member Sir Evelyn Wood also made his remarks on *The Times* article public. He

[371] List of Changes In British War Material, change no. 6235
[372] List of Changes In British War Material, change no. 6476
[373] .303 Magazine Lee-Metford Mark I with wire breaker (Enfield, 1889), Serial No. 5329, Tag no. 18, The Robert W. Farris Long arm Collection (December 2015)
[374] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)
[375] 'The Magazine Rifle', *The Times* (12/11/1890)
[376] Major General Smith, Report on 'The Times' article of 12th November (25/11/1890)

attempted to dispute the claims that *The Times* had made, such as the bolt closing itself if firing downhill, and also noted that 'if the future changes made make it a different rifle, then surely the same can be said for the different versions of the Martini-Henry.'[377] To the public eye, it would therefore seem like *The Times* were merely being melodramatic.

In reality, however, the article published by *the Times* was closer to the truth than the War Office were willing to accept. The official response given by Smith had actually been heavily 'revised' by the Secretary of State. For example, in his draft copy, the line 'experience has proved that the rifle may in fact fall to pieces under stress of ordinary work' was etched out in red ink. Curiously, also etched out was an admission of the 'flaws of the Martini-Henry in the Sudan.'[378]

Nevertheless, the entire point of this 'wearing in period' of the rifle was to establish its flaws, so that the War Office could remedy them. Alongside the viewers reports, they had also been accumulating their own data on potential issues with the rifle, shown below.

Number of Rounds Fired (* Indicating a new barrel)	Result
7350	Striker damaged
7628	Recoil stud of bolt broken
16050	Barrels too worn
15493*	Extractor broke
16843*	Bolt shield broke

Table 1. Magazine Lee-Metford Mark I testing to establish service life, 1890.[379]

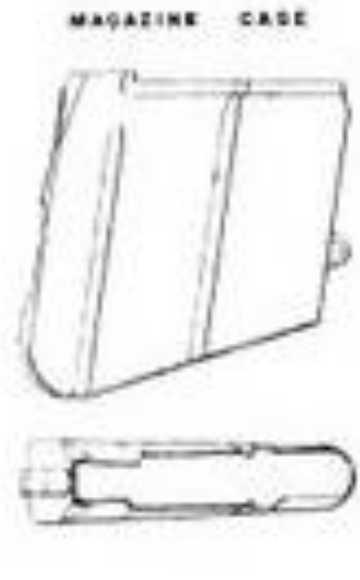
The Rifle, Magazine, Lee Metford Mark I* was introduced into service on 19th January 1892.[380] It sought to modify existing Mark I rifles to absolve them of the problems found. As was expected, it encompassed many changes. It omitted the safety catch, cleared the rifle's body to the rear, modified the hand guard, added a disc for regimental markings, reduced the dial sights to 2900 yards and altered the butt so the oil stopper wouldn't leak all over

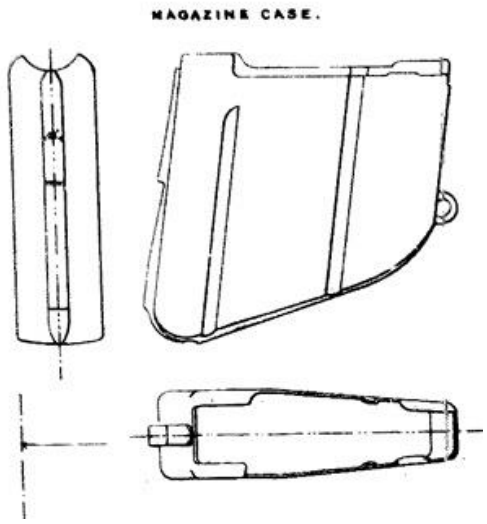
[377] Lieutenant General Sir Evelyn Wood, Remarks to 'The Times' Article to Henry S. Dodd, Staff Armourer-Serjeant of the Ordnance State Depot (1890)
[378] Major General Smith, Confidential Report on Times Article, Revised by Secretary of State (14/11/1890)
[379] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)
[380] List of Changes In British War Material, change no. 6760

the user.[381] The striker spring was also strengthened, sights were altered, and the magazine spring was revised to facilitate faster loading.[382] The resultant rifle is shown below.

Figure 17. The Rifle, Magazine, Lee Metford Mark I*.[383]

Eleven days later on 30th January 1892, the Rifle, Magazine, Lee Metford Mark II was introduced into service for all newly built rifles. As well as encompassing all the alterations of the Mark I*, the Mark II had a lightened barrel and modified magazine.[384] The magazine was no longer single stacked, but was now a double column magazine. Instead of having 'Z' shaped springs it had a stronger 'C' shaped spring that could be charged much faster, and could hold ten cartridges rather than eight.





[381] List of Changes In British War Material, change no. 6760
[382] List of Changes In British War Material, change no. 6760
[383] .303 Magazine Lee-Metford Mark I*(Enfield, 1892), Serial No. 3286 S, Tag no. 21, The Robert W. Farris Long arm Collection (December 2015)
[384] List of Changes In British War Material, change no. 7404

Figures 18. and 19. Comparison between the old Mk I magazine on the left and Mk II magazine on the right.[385,386]

The finger grooves on the hand guard were also omitted, as were the brass regimental disc plates in another bid to reduce cost. Production costs therefore dropped from £5 16 shillings to just £5.[387] The Mark II rifle is illustrated in detail below.

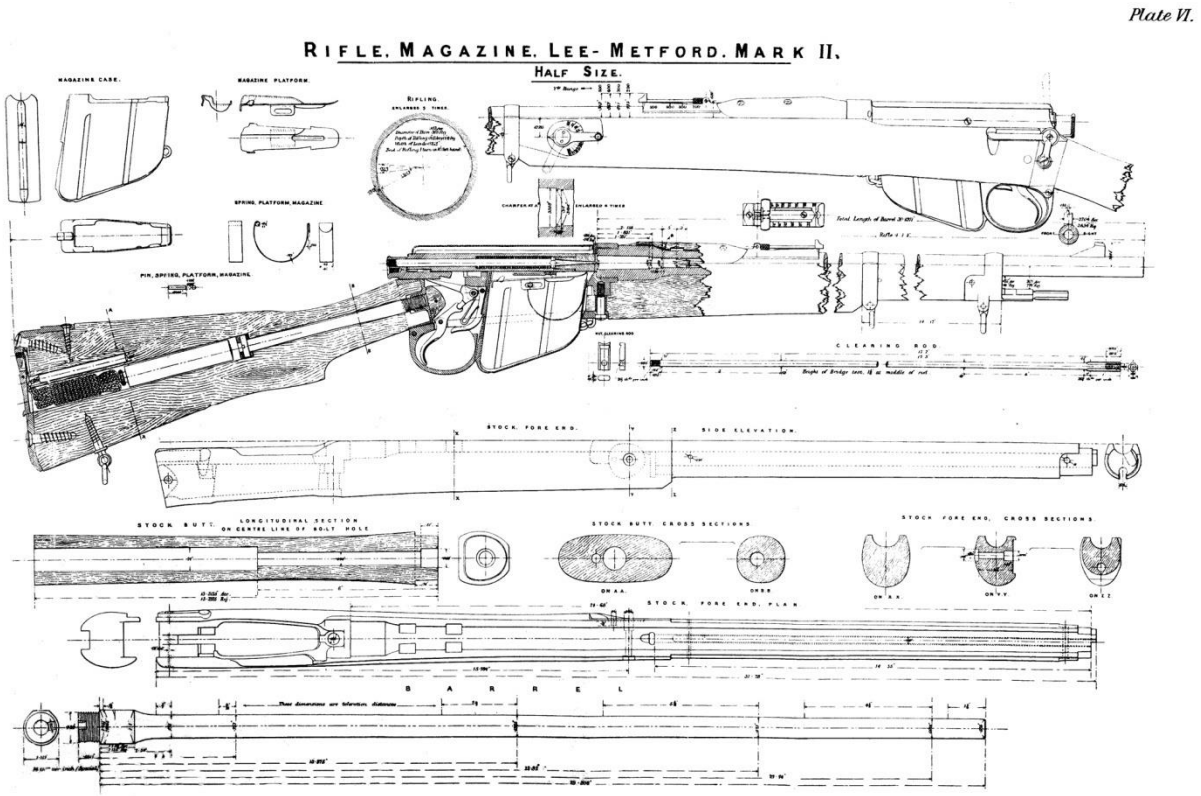


Figure 20. Armourer's drawing of the Mark II rifle.[388]

Figure 21. The Rifle, Magazine, Lee Metford Mark II.[389]

[385] Mk I* Magazine, Lee-Metford Armourer's instructions, The War Office (1892)
[386] Mk II Magazine, Lee-Metford Armourer's instructions, The War Office (1897)
[387] Pegler, *The Lee-Enfield Rifle*, p. 16
[388] Rifle, Magazine, Lee-Metford Mk II, Small Arms Instructions for Armourers, The War Office (London, 1897)

This great overhaul was to prove extremely successful. Following the changes, the War Office stated that some rifles could now 'withstand up to 60,000 rounds of black powder ammunition and still be uninjured.'[390] Reliability issues using black powder ammunition had been all but solved. In 1895, however, the change to a Mark II* was made that re-added the safety catch and slightly lengthened the bolt assembly, as part of a minor update.[391]

The growing use of cordite ammunition was slowly becoming an issue for the Lee-Metford, as it was a great deal more powerful than black powder. As Metford rifling was extremely shallow, the greater forces in the barrel produced by cordite effectively stripped the rifling, wearing the barrels away and rendering them unserviceable. Testing by the India Office found that after an average of just 4200 rounds, the rifles were becoming useless.[392] In a bid to prolong the service life of the Lee-Metford, a new, deeper rifling was produced. This, known as Enfield rifling, was introduced on 11th November 1895. As the rifle no longer possessed its Metford rifling, the 'new' arm was given the official nomenclature of the Rifle, Magazine, Lee-Enfield, Mark I.[393]

The final change implemented to Lee-Metford rifles was the conversion to charger loading in 1907 for some rifles. It is a strange concept that although the rifle had a detachable magazine, soldiers never actually used interchangeable magazines. The historian Erenfeict raises this anomaly: 'Why the British Army even wanted magazines nobody knows because extra magazines were *never* given to the rank and file Tommy.'[394] This is made even stranger by the ease at which the magazine could be removed and replaced, shown by Colonel Slade at Woolwich in 1887 who claimed that the Lee rifle's magazine could be replaced 'even quicker than loading a single Martini-Henry cartridge', which allowed him to fire off his full magazine in just seven seconds.[395] Why then was the issue of spare magazines discontinued,

---

[389] .303 Magazine Lee-Metford Mark II (Sparkbrook, 1893), Serial No. 18597, Tag no. 23, The Robert W. Farris Long arm Collection, Image Courtesy of Ian Skennerton (December 2015)
[390] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)
[391] List of Changes In British War Material, changes made on 22 April 1895
[392] D of A Minutes, Small Arms Extracts 1895-1898, Destructive Effects of Cordite, The War Office (1895)
[393] List of Changes In British War Material, change no. 8117
[394] L. Erenfeict, The Magazines, *Small Arms Review* (October 2005)
[395] Colonel Slade, Lectures on Magazine Rifles, First Lecture (Woolwich, 1887)

with troops being forced to turn in all their spare magazines just three years later, in October 1890?[396]

The problem was that of increased ammunition expenditure. For example, in Königgrätz during the Austro-Prussian war in 1866, Prussian soldiers expended just twelve rounds per man. Yet by 1888 Colonel Slade anticipated that with magazine arms, as many as 200 rounds of ammunition per man would be required per conflict.[397] To carry this much ammunition in spare magazines would very difficult in terms of weight. It would also be far too expensive to produce magazines to house all this ammunition when the rifle alone already cost over £5 to manufacture, which was double that of a Martini-Henry.[398] In fact, magazines for the Lee-Metford were considered so valuable that originally they were physically chained to the rifle so that they could never be lost or dropped.

In an effort to cut costs, charger-loading was eventually introduced. Instead of carrying spare magazines, ammunition was held in a small metal clip, and pushed vertically into the magazine well.[399] The conversion process to facilitate charger-loading was relatively simple: A metal bridge was connected across the rifle in an arch shape, with a cut away to accommodate the charger clip. [400] This gave a solid platform for the clip to rest in as the ammunition was loaded into the magazine. An early form of charger-loading was used on the Lee Metford as early as 1902.[401] It was only by 1907 that it was introduced officially, and was not implemented with many units until as late as 1909.[402] As a result, charger-loading was the final development of the Lee Metford.

[396] Skennerton, List of Changes in British War Material, Volume II 1886-1900
[397] Colonel Slade, Lectures on Magazine Rifles, Second Lecture (Woolwich, 1887)
[398] Skennerton, List of Changes in British War, Volume II 1886-1900
[399] This concept was copied from existing designs such as the Mauser model 1895 that came fitted for charger loading as standard.
[400] S. Mowbray, *Bolt Action Military Rifles of the World* (Woonsocket, RI, 2009), p. 146
[401] Knott, South Africa's National Museum of Military History
[402] Mowbray, Bolt Action Military Rifles of the World, p. 147

Figure 24. Loading dummy rounds by means of a charger.[403]

The Lee Metford remained in official service until 1926.[404] The War Office's plan to make one grandiose overhaul was not entirely successful, as many changes were still required. Despite this, once upgraded, the Lee Metford rifle become immensely popular. It formed the basis for the Lee Enfield family of rifles to develop from, which would serve the British Army until the 1980's. It was simple to use, quick to fire and extremely accurate, which ensure that the rifle is extremely significant from both a technological and a historical perspective.

[403]Ian Skennerton, Charger loading, The Robert W. Farris Collection, IMG_0355bcd
[404] ISkennerton, *The Lee-Enfield Story*, p. 74

A revolution unnoticed: The Lee-Metford in battle

Figure 1. A Maxim gun detachment in British Colonial India in 1898.[405]

Whilst its predecessor, the Martini-Henry, was idolised for its role in colonial conflicts, the Lee-Metford rifle has been somewhat overlooked. If people have ever heard of the Lee-Metford, typically they know it as the forefather of the Lee-Enfield, not as the revolutionary small-bore, magazine fed rifle that it actually was. There are three key reasons the Lee-Metford never gained the fame it deserved. The first is due to its longevity. In 1895, less than seven years after its official adoption, the Lee-Metford was replaced by the Lee-Enfield.[406] When Lee-Metfords were upgraded or taken into repair, they too were fitted with Enfield barrels.[407] The second issue was based on problems found with the rifle. This is shown by the historian Pegler, who claimed that 'difficulties in loading, barrel wear and awkward magazine access led to further experimentation, and suspicion.'[408] The final factor was not to do with the rifle itself, rather, the ability of officers to adapt to the tactics that

[405] British Maxim Gun Detachment. Chiteral Campaign. 1898. National Army Museum Copy (Printed 11/08/2012)
[406] List of Changes In British War Material, change no. 8117
[407] The War Office, *Magazine Rifles in the Service, .303 Small Arms Armourer's Handbook* (1917)
[408] Pegler, *The Lee-Enfield Rifle*, p. 16

the magazine rifle made available. Even contemporary journals noted that 'the masters of the art of war admit their inability to cope with modern invention.'[409]

Despite these three factors impacting negatively on the rifle, it nevertheless experienced a huge amount of service in its short time in the British army. Even when officially replaced, the Lee-Metford continued to see a great deal of use in British territories, and was even brought back to life in limited numbers as a converted automatic rifle. Several key examples of the Lee-Metford in battle will be outlined below, from both small and large-scale colonial conflicts, through to the Second Boer War. Finally its military use once superseded by its Lee-Enfield counterpart will be shown.

Like the Martini-Henry, the number of small campaigns across the globe that the Lee-Metford was involved in was substantial. An example of just one of these many small wars was the *Battle of Taku forts* during the Boxer Rebellion in 1900. A coalition named the 'Eight-Nation alliance', numbering thirty five officers and 869 men besieged several forts defended by over 2000 Chinese soldiers.[410] The *Battle of Taku forts* was undertaken in order to gain a military foothold in Northern China. The British contingent came in the form of a detachment of marines from the H.M.S. Alacrity and led by Commander C. G. Cradock. A section of these marines can be shown below, carrying Lee-Metford Mk II rifles.

[409] E. Atkinson, The Brutality of War, *The Advocate of Peace*, Volume. 63, Number. 9 (September 1901)
[410] R. Edgerton, *Warriors of the Rising Sun: A History of the Japanese Military* (London, 1997), p. 73

Figure 2. British Marines from H.M.S. Alacrity c.1900.[411]

After an artillery bombardment from the alliance's ships on 16th June 1900, the allied brigade advanced to the attack. By four thirty a.m. on 17th June, the allies began to capture the forts on the north side of the river. The British and Japanese led the attack, with the Japanese commander being the first to scale the forts parapet.[412] The siege was entirely successful as it achieved its aims and the Taku forts were taken, with all bar two being dismantled. The allies lost 172 soldiers, with the number of Chinese losses being unknown.[413]

As well as serving in small colonial conflicts, the Lee-Metford was used huge set-piece colonial battles, such as that at Omdurman in 1898. In this conflict, on 2nd September 1898 a force of 8200 British and 17,600 colonial troops under the command of Lord Kitchener, armed with Maxim machine guns and Lee-Metford rifles fought against 60,000 '*Dervishes*' fighting under the banner of the Sudanese Kalifa, Abdullahi. In the view of a young Winston Churchill, these Dervishes were armed with weapons that 'resemble a twelfth century

[411] British Marines c.1900 <http://www.forgottenweapons.com/wp-content/uploads/2015/10/Lee-Metfor-Alacrity-China.jpg> [Accessed: 10/07/2016]
[412] The Service history of the Surprise Class Fleet, The Alacrity <http://www.battleships-cruisers.co.uk/surprise_class.htm#HMS Alacrity> [Accessed: 10/07/2016]
[413] Edgerton, *Warriors of the Rising Sun*, p. 73

crusader army'.[414] Although they did possess upwards of 15,000 firearms, they were often primitive and poorly maintained. The Dervishes charged against the British on 2nd September after being heavily shelled throughout the night.

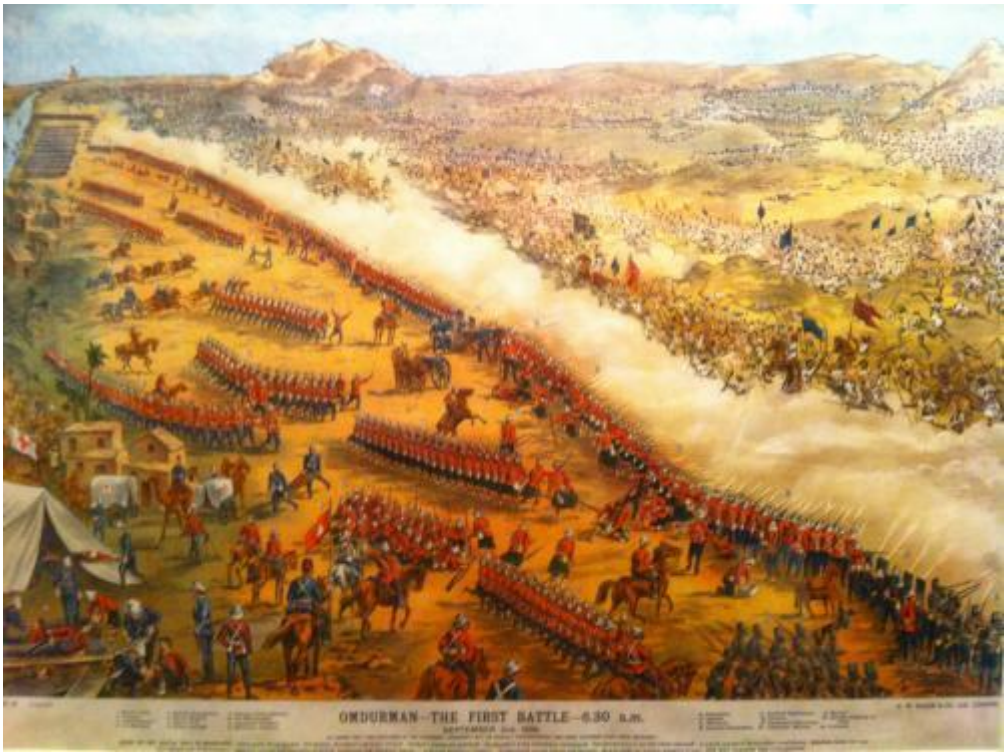


Figure 3. The Battle of Omdurman.[415]

The true might of the Lee-Metford finally came to a fore. Combined with the power of Maxim machine guns, the battle lasted only five hours. 11,000 Dervishes were killed and a further 16,000 were wounded. In comparison, British and Egyptian losses numbered only 500.[416] It is in instances like this where the power of the magazine rifle can truly be shown, proving it to be a revolutionary rifle. When it was introduced into service in 1888, the War Office even stated that 'the disaster at Isandlwana would have been a victory if our troops were in possession of these magazine rifles.'[417]

But what would happen if the tables were turned, and instead of facing large forces of poorly equipped tribesmen, the British army faced a highly professional body of troops with

[414] D. Shonfield, Battle of Omdurman, *History Today*, Volume. 48, Issue. 9 (September, 1998)
[415] A. Fides, The Battle of Omdurman, against the Kalifa and the Ansar, 2nd September 1898 (Print made 28/02/2014) [Accessed: 10/07/2016]
[416] Shonfield, Battle of Omdurman
[417] Memorandum on Magazine and Small-Bore Rifles, The War Office (1888)

access to equally modern magazine arms? This was indeed the case in the Second Boer War from 11th October 1899 until 31st May 1902.

The Boer was something of a master of the art of late nineteenth century warfare. They had spent their entire existence in combat in various forms.[418] As well as being experienced, they were well equipped. In this period, the Mauser magazine rifle was considered the predominant bolt-action design across the globe, as over 900,000 had been produced between 1886 and 1889.[419] The Boer president, Kruger, had ordered 70,000 of the latest 1895 variant of these Mausers, of which around 55,000 were delivered.[420] They also had access to Vickers-Maxim machine guns, which they used to great effect at great ranges.[421] Even those Boers without access to the most modern small-arms of the day took their own rifles with them. This included arms such as the Martini-Henry, to which the Boers owned over 30,000 rifles.[422]

These factors ensured that the Second Boer War was disastrous for the British army. Although ending in British victory, around 6000 British soldiers died in battle, whilst around 7000 Boers were killed. As both sides had access to modern weaponry, the War was fought across scales that were previously unimaginable. For example, one soldier commented on how he came under fire from the Boers at 2000 yards. He claimed that 'the bullets were falling like hailstones. My right pouch was hit, cutting it in half. The force of the shot knocked me flat.'[423] In one conflict, the Boers set up a Maxim-Vickers gun at 1800 yards to find the range of the British soldiers. Once the range was found 'musketry fire became very effective and eleven British soldiers were killed.'[424] In that particular battle, each British soldier expended 300 rounds of ammunition and their machine gun expended 7500 rounds.[425]

---

[418] H. Bolco, *The Fighting Boers, Foreign and Commonwealth Office Collection* (1900), p. 438
[419] Webster, Military Bolt Action Rifles 1841-1918, p. 42
[420] P. Scarlata, The Model 1893/95 “Boer Model” Mauser, *The Shooting Times* (September 2010)
[421] *Extract from Digest of Service of the 2nd Battallion Prince of Wales own West Yorkshire regiment in South Africa, from 20th October 1899 to 4th August 1902* (York, 1903), p. 4
[422] R. Knott, South Africa's National Museum of Military History, *Small Arms Review* (January, 2002)
[423] Lieutenant H. Gilley, *War Diary from West Yorkshire Regiment*, South Africa 1899-1901 (18/02/1900)
[424] Extract from Digest of Service of the 2nd Battallion Prince of Wales own West Yorkshire regiment in South Africa, p. 4
[425] Extract from Digest of Service of the 2nd Battallion Prince of Wales own West Yorkshire regiment in South Africa, p. 4

Warfare had changed so much that British officers could not adapt to the technology that they possessed in the same way that the Boers did. In some scenarios all the British attempted to achieve was to get close enough to the Boers to finish the fight with bayonets, often charging from hundreds of yards away. 'Our infantrymen gradually forge ahead till within 200 yards of the enemy, when, with loud cheers and fixed bayonets they leap up and rush forward to finish the fight with cold steel.'[426] After all, the bayonet on the Lee-Metford was extremely efficient. Sir Ernest Bennett noted that 'the deadliest tactic of all is the bayonet thrust. Private St. John of the Grenadiers even thrust at a Boer with such force the muzzle of his rifle went clean through the Boer.[427]

It cannot be argued that the bayonet was not effective. The issue lay in the fact that the British troops could not get close enough to the Boers to use it. One can only imagine the consequences of these bold charges across open ground towards machine guns and Boer sharpshooters. Contemporary Boer, Lt. Colonel Pienaar, commented: 'In long thin lines they ran across the plateau hoping to drive the Boers back - and so on for hour after hour the lines of gallant men flung themselves into the open; only to fall from the crest's raging fire.'[428] If the Boers believed their positions would be compromised, they simply retreated and found a new position to defend. The British were at a loss with how to actually fight the Boers. At range they could not match the precision shooting of the Boers, but neither could they close the distance.

In an attempt to find a solution, many ideas were posed by the British officer classes. Some, blamed troop mobility. Burleigh, for example, stated that 'all that is needed is to increase our number of mounted infantry so our average British Tommy can get near enough.'[429] Most officers blamed their inadequacy in battle on the basis that they were 'outgunned' by the Boers and that the Lee-Metford was not good enough. As Major C. Callwell described: 'The Boer's skill is not because of their use of cover, marksmanship or judgement but because they are armed with Mausers: which is in many respects superior to our arms.'[430]

[426] E. Bennett, *With Methuen's Column on an Ambulance Train*, Boer War Diary (London, 1900)
[427] Bennett, *With Methuen's Column on an Ambulance Train*
[428] Pienaar, *With Steyn and De Wet*
[429] B. Burleigh, *The Natal Campaign, Estcourt (21/11/1899)*
[430] Callwell, *Tactics of To-Day*, p. 4

Even if this was the case, only a fraction of the Boer commandos actually used the Mauser rifle. Vast numbers were using a plethora of older weapons, such as the Martini-Henry and quite tellingly, some were even using magazine Lee-Metfords, evidenced below.

Figure 4. Boer commandos armed with Lee-Metford Mk II rifles c. 1900.[431]

If Lee-Metfords really were the reason behind the high rate of British casualties, the question can be raised as to why the Boers were happy to use them themselves. In this light, small arms cannot be blamed for the disaster of the Second Boer War. Instead, it is the inability of the British officers to adapt to the technology that their small arms offered them. Even though the Lee-Metford became tainted by the experiences of the Second Boer War, it was nevertheless an extremely efficient military arm.

Even after the Lee-Metford had been made obsolete by the Lee-Enfield, it still saw a large amount of colonial use. For example, in 1910, Zululand police serving under British officers were issued with Lee-Metford rifles.[432] Like the Snider-Enfield and Martini-Henry, they were

[431] J. Mckerihen, Boer Commandos, Boer War Memorabilia, Anglo-Boer War Museum Collection, 1900-1905 [Accessed 01/05/2016]
[432] H. Rawson, Letter from Zululand to Britain, *Journal of the Royal African Society*, Vol. 9, No. 36 (July 1910), p. 452

also used for training and Home Guard purposes during the First World War. The 1917 '.303 handbook' for example, noted that there were still large amounts of Lee-Metfords in the hands of colonial troops and the Royal Navy.[433]

Strangely, they were also issued to the New Zealand army in 1941, but in an assembly known as the 'Charlton automatic rifle'. This was a conversion of older Lee-Metford and Lee-Enfield rifles into a select-fire, automatic weapon. Although unreliable and unwieldy, it provided New Zealand with a temporary automatic rifle.[434] This odd adaptation can be shown below.

Figure 5. The Charlton Automatic Rifle.[435]

It is interesting to note that after the first 257 Lee-Metford rifles were delivered to New-Zealand for conversion in 1941, twenty rifles were classed as 'still good for service' and returned to Britain.[436] In this light the Lee-Metford also achieved what the Martini-Henry failed to accomplish: be able to adapt successfully to the next generation of small arms development.

Finally, The Lee-Metford still sees ceremonial use today. The Atholl highlanders are recognised as Europes last 'private' army and number around eighty men and are equipped with Lee-Metford rifles.

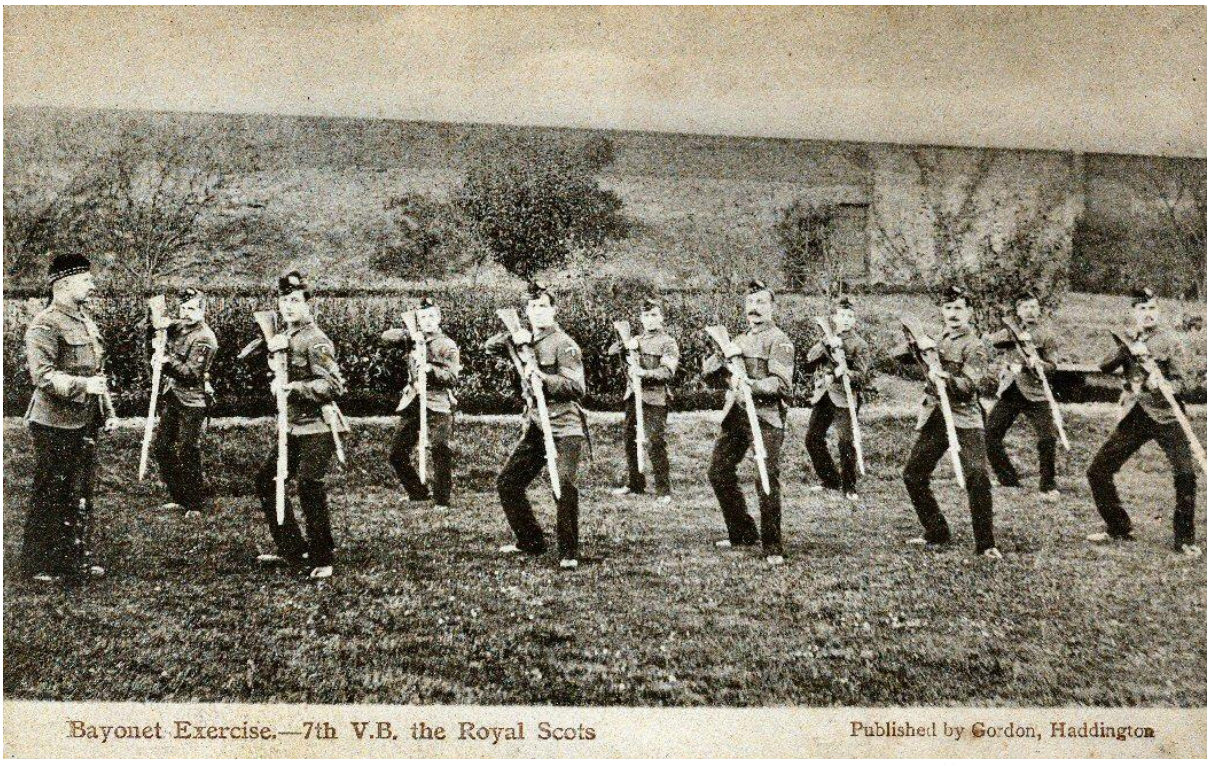
[433] *Magazine Rifles in the Service, .303 Small Arms Handbook*
[434] J. Huon, The Charlton Automatic Rifle, *Small Arms Review* (July 2012)
[435] Britain, .303 Charlton Automatic Rifle, 1941, Royal Armouries National Firearms Centre Gunhall [Photo taken by 'Forgotten Weapons' firearms Research group 09/10/2012]
[436] Huon, The Charlton Automatic Rifle

Figure 6. Atholl Highlanders on parade with magazine Lee-Metfords.[437]

Overall, despite only officially being in service for a small period of time, the experiences of the Lee-Metford in battle show that it was indeed a very capable arm. Despite several external factors reducing its fame, it still proved to be an extremely important rifle of the British army.

[437] Atholl highlanders parade during the annual highland games (09/04/2010) <http://www.explore-highland-perthshire.com/highland_games/blair_atholl_highland_games.htm> [Accessed 10/07/2016}

Conclusions



Bayonet Exercise, 7th V.B. the Royal Scots, Gordon, Haddington[438]

Traditionally, the Lee-Metford is known as nothing more than the forefather of the Lee-Enfield. After all, upon its implementation all other world powers already possessed their own forms of magazine arms. Upon its introduction it was riddled with issues that came to a fore in *The Times* newspaper article. This overview has shown that the Lee-Metford was actually a very successful and significant rifle.

Its process of adoption is a clear indicator of this fact. In various trials that lasted seven years, the Lee action repeatedly finished above its contenders. Once it had been modified

[438] History of the P.1888 Lee-Metford bayonet, Bayonet exercise from the Royal Scots, Image from Mr. Gordon, (Haddington, 12/07/2015) <http://www.bayonetsplus.com/images/Royal%20Scots.jpg> [Accessed: 10/07/2016]

and improved at Woolwich, it was the best choice of arm that the War Office could have made when the first pattern was sealed on 1st November 1888.[439]

The design and operation of the Lee-Metford also stands testament to this fact. In the view of the historian Skennerton, its action was mechanically 'second to none.'[440] This view is evidenced through the demonstration on how to operate the Lee-Metford and how its internal parts functioned. Whilst it did indeed have its issues, these were ultimately resolved with the gradual implementation of later variants.

Finally, although only experiencing a relatively short period of active service in the British army, the experiences of the Lee-Metford in battle clarify its historical importance. It represented such a technological improvement that the officers and men using it did not even originally understand its capabilities. Like the Snider-Enfield and Martini-Henry before it, it was recycled and reused continuously well into the twentieth century, standing testament to its ability as a firearm.

Overall, whilst the Lee-Metford may not have been as cheap as the rifles that came before it, and whilst it may have had teething issues with features such as its sighting and its ammunition, it represented what was to be a small arms revolution in the British army. This ensured that, if combined with its legacy rifle, the Lee-Enfield, it saw a century of service under the British. In the view of Colonel Slade: 'No arm that has to come to the Small-Arms Committee combines so many essentials of a military weapon as the one we are about to introduce.'[441]

[439] Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto (20/04/1888)
[440] Skennerton, *The Lee-Enfield Story*, p. 5
[441] Memorandum on Magazine and Small-Bore Rifles (June 1888)

Concluding observations

> Firearms are social instruments, first and foremost, the creations of man in a set time, place and society. Without understanding these factors, it is all too easy to make assumptions that lead to a complete failure in the assessment of the weapon.
>
> De Witt Bailey, British Military Longarms, 1986.[442]

Overall, it is clear that each of these three rifles played an important role in the development of military small arms, and are important to the wider technological revolution as a whole. The need to for this development came as the result of a global arms race, in an era of expansion and empires. This need first came to a fore in Britain with the prize competition for a military breech-loader that culminated in the adoption of the Snider-Enfield. It was then developed by the volunteer movement, who 'perfected' single-shot breech loaders on the ranges at Wimbledon, leading directly to the adoption of the Martini-Henry. As developments on the continent across the latter half of the nineteenth century sparked a greater need to modernise, the British trialled and adopted the Lee-Metford. This rifle, with its of small bore and detachable magazine, proved to be a truly revolutionary weapons system. Throughout its entirety, this thesis has shown the importance of the three main rifles of the technological revolution:

The Snider-Enfield of 1866 was the first true part of this technological revolution, and is therefore a very important rifle in the assessment of the development of British military small arms. Breech-loading rifles before the Snider-Enfield were too inefficient for general infantry use. The lack of available cartridge technology left the British army lagging behind

[442] D. W. Bailey, *British Military Longarms 1715-1865* (London, 1986), p. 8

its European counterparts. The development of the Snider-Enfield therefore came as a result of attempting to modernise the British Army to match these counterparts. The Snider-Enfield was originally introduced as a simple conversion of the older Pattern 1853 Enfield, until a purpose built rifle could be manufactured. It proved to be far more capable than expected, serving the British army in various manners from 1866 to 1899, and serving in the colonies and on the home front well into the twentieth century. [443] This thesis has shown from both just how the Snider-Enfield achieved this legacy, from the trials that brought about its adoption, through to how it operated and developed into later marks and models. This, combined with its battlefield experience, shows that the Colonel Dixon's comment that the Snider-Enfield was a 'better military arm than any possessed by any nation in the world' in 1870 was very well founded.[444]

If Snider-Enfield was a rifle of firsts (the first general issue British military breech-loader and the first self contained cartridge), then the Martini-Henry was a rifle of refinements. Whereas the Snider-Enfield introduced the possibilities of a breech-loading arm, the Martini-Henry perfected it. It took the most accurate rifling of the era, designed by Alexander Henry, and attached it to the fastest, most efficient falling-block action of the Martini rifle. Within this thesis it has been shown that the Martini-Henry did indeed fulfil this role. The intense selection process that resulted in its adoption proves that it was indeed the best breech-loader available to the War Office at the time. Mechanically, its ease of operation and simplicity also prove it to have been an efficient military arm. Where there were problems, these were eventually addressed through the various marks and modifications of the rifle. This efficiency has ultimately been proved by the military experience of the Martini-Henry, and its famous successes. In the view of the historian Suciu, 'if the colt peacemaker tamed the west, the Martini-Henry maintained order around the globe.'[445]

The technological revolution in small arms came full circle with the magazine Lee-Metford rifle. The rifle was an embodiment of modernity: it was a small-bore, magazine-fed, high velocity repeating rifle. Its implementation completed the development of Britain's early

[443] Cobb, Cinderella Snider - Unpublished Book
[444] Skennerton, A Treatise on the Snider, The British Soldier's Firearm 1866-c.1880, p. 170
[445] Suciu, The Versatile Martini-Henry Rifle was a Mainstay of the British Army During Queen Victoria's Numerous 'Little' Wars

breech-loading rifles. This has been shown throughout this thesis, in the first instance with the slow process of the adoption of the Lee-Metford, ensuring that it held all the qualities of a military arm. From the mechanical overview it can be shown just how powerful, efficient and effective the rifle eventually became. This has then been exemplified historically, from the rifle's experiences in battle. A final example of the lasting legacy of the original Lee-Metford is the fact that even today, Australia International Arms in Brisbane still manufacture the latest version of the Lee magazine rifle as the 'M10' rifle, marketed as 'the new Lee for the new millennium.', designed for Australian military and sporting markets.[446]

On this basis, all three of the key rifles from the period 1866 to 1895 offer a key development towards the small arm capabilities of the British army, and all three rifles form an intrinsic part of the wider technological revolution in Britain. Across the service lifetime of just one soldier, military small arms evolved from slow muzzle-loading designs to truly modern military rifles. The firepower of the individual soldier had increased so dramatically that military tacticians could not begin to comprehend their effectiveness, the repercussions of which would only truly be felt as Britain entered into the First World War.

Issues of longevity have ensured that this research project has been confined to the three key infantry standard rifles of the era. A cavalry carbine counterpart of each of the three rifles was also trialled, developed and deployed by the War Office across this period, each with their own marks and modifications and even their own ammunition. Further research could expand to accommodate these cavalry carbines.

A major research project that is as equally important to the development of the rifle is the advancement of ammunition. At the beginning of the period 1866-1895, ammunition was developed to fit a rifle design. For the Snider-Enfield for example, nine different marks of ammunition were created. Yet by the end of the period, rifles were being developed to accommodate new ammunition, such as the Lee-Enfield being issued due to the implementation of cordite. As the rifle cannot work without the ammunition, the development of service ammunition from 1866-1895 as a research project could be made to expand my existing research.

[446] I. Skennerton, The Fifth Generation of Lee-Enfield, *International Arms and Militaria Collector*, No. 25 (Labrador, AU, 2006), p. 64

Bibliography

Primary Sources

Advertisements

The War Office, 1865 Invitation for new breech-loading arms (22/09/1865)

Diaries

Bennett, E., *With Methuen's Column on an Ambulance Train*, Boer War Diary (London, 1900)

Burleigh, B., *The Natal Campaign, Estcourt, 21st November 1899* (London, 1900)

Lieutenant Colonel. Pienaar, *With Steyn and De Wet, Battle of Platrand*, Boer War Diary (1902)

Lieutenant H. Gilley, *War Diary from West Yorkshire Regiment*, South Africa 1899-1901 (18/02/1900)

Images

Britain, Rifle .402 Enfield-Martini W/Long Range Sights 1882, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Rifle .577/450 Martini-Henry Mk I Sample Arm, G&B LTD Leeds c.1875, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Rifle .577/450 Martini-Henry Mk II, NAA co. 1880, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Rifle .577/450 Martini-Henry Mk III Sealed Pattern 1879, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Experimental Rifle, .303" Lee Metford Troop Trials rifle, chambered for the Rubin Cartridge, 1887, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Experimental Rifle, .402 Enfield Lee trials pattern, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Experimental Rifle, .402 Lee Burton trials pattern, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Experimental Rifle, .45 Bethel Burton with side hopper magazine, 1883, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Experimental Rifle, .45GG" Improved Lee Trials Pattern with detachable box magazine, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Experimental Rifle, Martini-Henry, Harston conversion, 1888, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Experimental Rifle, Owen Jones .402 with side hopper magazine, 1886, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Britain, Rifle Martini-Henry Mk IV, 1887, Royal Armouries National Firearms Centre Gunhall [Photo taken 25/05/16]

Cartridge Solid Drawn .402" Experimental <http://www.martinihenry.org/index.php?route=product/product&path=61_65&product_id=110> [Accessed 15/05/2016]

Cocking the Martini, Breech-Loading Rifles, 1868-1871 Trials Rifles Armourer's Drawings, War Office (1871)

Firing the Martini, Breech-Loading Rifles, 1868-1871 Trials Rifles Armourer's Drawings, War Office (1871)

Mk I* Magazine, Lee-Metford Armourer's instructions, The War Office (1892)

Mk II Magazine, Lee-Metford Armourer's instructions, The War Office (1897)

MkI & MkII Solid Drawn Rifle Cartridge <http://www.martinihenry.org/index.php?route=product/product&path=61_65&product_id=94> [Accessed 15/05/2016]

Mont-Storm rifle with open breech, Britain, Rifle, Sealed Pattern .577 Montgomery Storm Breech Loading Rifle (1860), Royal Armouries National Firearms Centre Gunhall [Photo taken 09/08/16]

Mont-Storm Rifle with Seal visible, Britain, Rifle, Sealed Pattern .577 Montgomery Storm Breech Loading Rifle (1860), Royal Armouries National Firearms Centre Gunhall [Photo taken 09/08/16]

Mont-Storm rifle internals diagram, Mont Storm's Breech Loading Rifle, Illustrated Times (23/08/1862)

Mont-Storm diagram with open breech, Mont Storm's Breech Loading Rifle, *Illustrated Times* (23/08/1862)

Martini Block action, Notes on The Martini-Henry Rifle, Royal Armouries Archives, Courtesy of Chris Streek [03/05/2016]

Process of cocking, Notes on The Martini-Henry Rifle, Royal Armouries Archives, Courtesy of Chris Streek [03/05/2016]

Rifle, Magazine, Lee-Metford Mk II, Small Arms Instructions for Armourers, The War Office (London, 1897)

The Snider-Enfield Mk III, armourer's drawing, The War Office (January, 1869)

Letters

Captain Harston to the War Office, Letter No. 34 (04/10/1888), Correspondence between War Office and Captain C. Harston 1886-1889

Northcote, H., Instructions to Committee of Small Arms (18/02/1887)

Henry Dodd, State ordinance Depot, Remarks to 'The Times' Article of 12th November 1890 Letter to Sir Evelyn Wood, Lieutenant-General, Commander of the Aldershot Division (14/11/1890)

Lieutenant General Sir Evelyn Wood, Remarks to 'The Times' Article to Henry S. Dodd, Staff Armourer-Serjeant of the Ordnance State Depot (1890)

War Office to Captain Harston, Letter No. 45 (22/11/1888), Correspondence between War Office and Captain C. Harston 1886-1889

List of Changes

List of Changes in British War Material, The War Office

Minutes

Ayde, J., Director of Artillery and Stores, Minutes of Conference held at the War Office (24/10/1873)

Bullet for Cartridge S.A. Ball, Small Arms Committee Minutes, The War Office (March 1910)

D of A Minutes: Small Arms Extracts 1891-1895, The War Office (1895)

D of A Minutes, Small Arms Extracts 1895-1898, Destructive Effects of Cordite, The War Office (1895)

Lieutenant Newman, in Ayde, Director of Artillery and Stores, Minutes of Conference held at the War Office (24/10/1873)

Minutes from the Director of Artillery and Stores to the Surveyor-General of the Ordnance Department (27/03/1885)

Ordnance Select Committee Minutes - Mr Daw's Ammunition No. 4937 (16/03/1868)

Report of a Special Committee on Breech-Loading Rifles: Together with Minutes of Evidence (11/02/1869)

The State of Naval Defences: Printed for the Council of the London Chamber of Commerce (Incorporated) (1893)

Sergeant Major Davies in, Ayde, Director of Artillery and Stores, Minutes of Conference held at the War Office (24/10/1873)

Newspapers

Colonel Boxer and the Snider Cartridge, *Saturday Review of Politics, Literature, Science and Art* (17/11/1866), Volume. 22, Number. 57

Converted Enfield Rifles, *The Mechanic's Magazine* (08/09/1865)

Delmard, M., The Martini-Henry Rifle, *The Manchester Guardian* (22/02/1875)

Précis of Reports from regiments on the special firing of ten rounds from the Martini Henry, *Special Army Circular* (26/11/1874)

Scoffern, J., Jacob Snider's death, *Belgravia: A London Magazine*, Volume. 1, p. 184

'The Magazine Rifle', *The Times* (12/11/1890)

The Martini-Henry Rifle, *The Engineer* (12/03/1869)

The Martini-Henry Rifle, *The Saturday Review of Politics, Literature, Science and Art* (December 1870) Volume. 790, Number. 30

The Martini-Henry rifle, Wilson's letter and readers comments, *The Engineer* (26/03/1869)

The Martini and its Critics, *The Pall Mall Budget* (28/08/1874)

The New Martini-Enfield Rifle*, Saturday Review of Politics, Literature, Science and Art*, Volume. 57 (16/02/1884), p. 208

The Perak War Dispatches, *The Illustrated London News* (26/02/1876)

The Telescopic Rifles, *Western Daily Press* (29/05/1865)

Waddy, C., Breech-Loaders and Their Inventors, *Belgravia: A London Magazine* (1872), Volume. 7, Number. 4

What are they good for? Speculation as to the value of small-calibre pieces, *The New York Times* (20/12/1891)

Wood, C., Account of Rorke's Drift, *Nottingham Daily Express* (23/07/1914)

Patents

Lee, J., Patent No. 221,328, James Paris Lee's Detachable Box Magazine Rifle Patent, United States Patent Office (New York, 04/11/1879)

Friederich Von Martini to Clinton Edgcumbe Brooman, Commissioner of Patents (22/07/1868)

Poems

Kipling, R., The Young British Soldier c.1889-1891 <http://www.kiplingsociety.co.uk/poems_youngbrit.htm> [Accessed 20/05/2016]

Reports

Brigadier General Alderson, Question as to Jamming of Cartridges, and of Solid v. Rolled Cases (27/03/1885)

Brigadier General Lefroy, Royal Artillery, 1st Trial Results, Royal Artillery, Report of Ordnance Select Committee on Trials, The War Office (06/02/1865)

Brigadier General Lefroy, 2nd Trial Results, Royal Artillery, Report of Ordnance Select Committee on Trials, The War Office (06/02/1865)

Brigadier General Lefroy, Royal Artillery, Second Ordinance Select Committee Report, Ordnance Committee (14/03/1865)

Brigadier General Lefroy, Royal Artillery, Snider's Converted Enfield Rifles, 1st Progress Report, Ordnance Committee (20/04/1866)

Brigadier General Lefroy, Royal Artillery, Snider's Converted Enfield Rifles, 2nd Progress Report, Ordnance Committee (09/05/1866)

Brigadier General Lefroy, Royal Artillery, Snider's Converted Enfield Rifles, Final Report, Ordnance Committee (20/06/1866)

Brigadier General Lefroy, Royal Artillery, Snider-Enfield: Report of Ordnance Select Committee on Trials, The War Office (06/02/1865)

Captain Lieutenant-Colonel Fletcher, Committee Report (21/03/1867)

Captain Lieutenant-Colonel Fletcher, Trials of 9 Descriptions of Breech-Loading Rifles Accepted for

Colonel Boxer, Ordnance Enquiry Commission, 5th Day of Proceedings, 2 Victoria Street Westminster (08/03/1887)

Colonel Slade, Lectures on Magazine Rifles, First Lecture (Woolwich, 1887)

Colonel Slade, Lectures on Magazine Rifles, Second Lecture (Woolwich, 1887)

Colonel Slade, Trials of Magazine Rifles in England from 1879, A Memorandum, The War Office (07/02/1887)

Committee on Small-Arms Progress Report, the Rifle, Magazine Mk I, The War Office (1889)

Competition in Accordance with the terms of the War Office Advertisement of 22/10/1866 (12/02/1868)

De Grey, 1st Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864 (09/11/1859)

De Grey, 2nd Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864

De Grey, 3rd Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1862

De Grey, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864 Official Statement (01/08/1864)

Director General of Ordnance Factories, Report on Specimen magazine rifles 1888 (20/04/1888)

Field Marshall Sir Evelyn Wood, Committee on Special Small Arms (07/02/1887)

Final Report on Martini-Henry Breech-Loading Rifles, The War Office (08/02/1871)

First Reports on Martini-Henry Breech-Loading Rifles, The War Office (08/02/1871)

Lee Burton and Improved Lee: Memorandum relating to Magazine rifles issued for trial in 1887, The War Office (1887)

Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, 1st Progress Report (31/10/1883)

Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, 2nd Progress Report (17/06/1884)

Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890 3rd Progress Report (19/10/1887)

Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890 4th Report (11/01/1889)

Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, Final Report, Appendix A (08/06/1887)

Lieutenant Colonel Smith, Magazine Rifles Committee on Small Arms 1883-1890, Final Report, Appendix B (19/10/1887)

Long Range Sights For Rifles - Memorandum prepared for the information of the committee on the Magazine Rifle

Major General Hay, Second Ordinance Select Committee Report, Ordnance Committee (14/03/1865)

Major General Smith, Confidential Report on Times Article, Revised by Secretary of State (14/11/1890)

Major General Smith, Report on 'The Times' article of 12th November (25/11/1890)

Major General Walker, Parliament Report: Solid Metal Cases for Breech-Loading Rifles, Précis on the Subject Of (08/02/1871)

Major Young, 2nd Meeting, Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864

Memorandum on Magazine and Small-Bore Rifles, The War Office (1888)

Ordnance Select Committee Report, Breech-Loading Small Arms 1859-1864 (12/10/1864)

Ordnance Select Committee Report, Mont Storm's Rifle Trials, Breech-Loading Small Arms 1859-1864 (16/04/1861)

Ordnance Select Committee Report, Snider's Rifle Trials, Breech-Loading Small Arms 1859-1864 (02/08/1860)

Ordnance Select Committee Report, Systems Set Aside but Summarily Rejected, Breech-Loading Small Arms 1859-1864 (12/10/1864)

Ordnance Select Committee Report, Wilson's Rifle Trials, Breech-Loading Small Arms 1859-1864 (26/03/1861)

Parliament Report: Solid Metal Cartridge Cases for Breech-Loading Rifles, Prècis on the Subject of (08/02/1871)

Peel, J., Army Sneider Breech Loading System - Copy of Reports by Inspector General of Musketry C. Hay (19/02/1867)

Précis on the steps which led to the introduction of a magazine rifle into Imperial service and subsequent action relating thereto, The War Office (20/04/1888)

Report of a Special Committee on Breech-Loading Rifles: Accuracy trials (11/02/1869)

Reports on Breech-Loading Arms by a Special Sub-Committee of the Ordnance Select Committee (1868)

Report on Martini-Henry troop trials, Cambridge Barracks, Woolwich S.E. (27/08/1873)

Report on rifle selection for service, Special Committee on Breech-Loading rifles (11/02/1869)

Report on Small Arm Experiments, Woolwich, Royal Laboratory (17/09/1867)

Sergeant Mcanlis, R.A, and Private Crofts, Rapidity Tests, Special Sub-Committee (12/02/1868)

South Lancashire Regiment Specimen rifle report , Magazine Rifles Committee on Small Arms 1883-1890 (11/01/1889)

St George, J., Director of Ordnance, Trials of Breech-Loading Small-Arms 1864-67, Ordnance Select Committee (23/08/1864)

Tables Showing Penetration of bullets fired from the .303 Lee-Metford magazine rifle, The War Office (1891)

Trials of Barrels in Respect to Accuracy, Trajectory, Penetration, War Office Report (11/02/1869)

Secondary Sources

Articles

Appleby, A., Thomas Wilson, his Patents, Arms and Ammunition, Research Press, *Historical Breechloading Small Arms Association* (2008)

Atkinson, E., The Brutality of War, *The Advocate of Peace*, Volume. 63, Number. 9 (September 1901)

Beachey, R., The Arms Trade in East Africa in the Late Nineteenth Century, *Journal of African History*, Volume. 3, Number. 3 (1962)

Buck, J., The Satsuma Rebellion of 1877, from Kagoshima through the siege of Kumanoto castle, *Monumenta Nipponica*, Volume. 28, Number. 4 (1973)

Campbell, R., The Lee-Enfield MK 4, *Small Arms Review* (May 2012)

Dallas, D., In the Gunroom, Alexander Henry, Triumph and Tragedy, *Holts Auctioneers on Fine and Modern Antique Guns* (10/12/2015)

De Witt Bailey, The Sharps In England, 1853-1881, *HSBA Journal*, Volume 2.

Dunn, C., Electric Cartridge Primers: Gone but not lamented, *The Truth About Guns* (19/12/2013)

Edwards, T., .303 British Service Ammunition: A Précis, *International Arms & Militaria Collector*, Number. 25 (Labrador, 2006)

Edwards, T., .303 inch Ball Cordite Marks I to IV, *British Military Small Arms Ammo* (01/07/2013)

Edwards, T., .303 inch Ball Mark VI to VIIIz & L1A1, *British Military Small Arms Ammo* (01/07/2013)

Erenfeict, L., The Magazines, *Small Arms Review* (October 2005)

Green, R., The Ferguson Military Breechloader: The Gun that could have changed history, *Guns, Weapons & Militaria*

Headrick, D., The Tools of Imperialism: Technology and Expansion of European Colonial Empires in the Nineteenth Century, *Journal of Military History*, Volume. 51, Number. 2 (June 1979), p. 256

Hulla, J., Report of the Shooting of the Snider Breech-Loading long rifle with the No.3 pattern cartridges, bullet weighing 480 grains, *Journal of the Society of Arts*, Volume .15, Number. 755 (10/05/1867)

Huon, J., The Charlton Automatic Rifle, *Small Arms Review* (July 2012)

James, G., Britain's Black-Powder .303, The Lee-Metford, *Guns Digest* (09/02/2015)

Knott, R., South Africa's National Museum of Military History, *Small Arms Review* (January, 2002)

Laband, J., Lord Chelmsford's Zululand Campaign 1878-1879, *Army Records Society* (1994)

Mallock, A., Vibrations in Rifle Barrels, *Proceedings of the Royal Society of London*, Volume. 68 (1901)

Massy, Colonel P., Exploration in Asiatic Turkey, 1896 to 1903, *The Geographical Journal*, Volume. 26, Number. 3 (September 1905)

McMahon, R., The .402 Enfield-Martini, from Cinderella to Pumpkin, Rifles at Random, *International Arms and Militaria Collector No. 25* (Labrador, 2006)

Minshall, D., Metford's 2000 Yard Rifle, Long Range Rifle Fire, *Research Press* <http://www.researchpress.co.uk/index.php/longrange/148-metford-2000> [Accessed 30/01/2016]

Rawson, H., Letter from Zululand to Britain, *Journal of the Royal African Society*, Volume. 9, Number. 36 (July 1910)

Reynolds, E., Enfield Arms - The Early Breech Loaders, *Small Arms Profile*, Issue. 18, Volume. 1 (Windsor, 1973)

Scarlata, P., The Model 1893/95 "Boer Model" Mauser, *The Shooting Times* (September 2010)

Shonfield, D., Battle of Omdurman, *History Today*, Volume. 48, Issue. 9 (September, 1998)

Skennerton, I., The Fifth Generation of Lee-Enfield, *International Arms and Militaria Collector*, No. 25 (Labrador, 2006), p. 64

Skennerton, I., The Mk I* Snider Short Rifle Cover up, *Historical Arms Series*

Small, S., A Decision Deferred: The Bolt-Action Rifle and The U.S. Army (1870-1892), *Small Arms Review* (September 2013)

Suciu, P., The Versatile Martini-Henry Rifle Was a Mainstay of the British Army During Queen Victoria's Numerous 'Little' Wars, *Military Heritage Magazine* (August 2005)

The British and French Armies, Comparative Statements*, 1860-61, Journal of the Statistical Society of London,* Volume 24, Number 2 (June 1861), p. 241

Trzoniec, S., The .43 Mauser, *Handloader Ammunition Reloading Journal* (June 2002), Volume. 37, Number. 3

Purdon, C., Jacob Snider's Action & E.M. Boxer's Cartridge: The Snider-Enfield Rifle, *Historical Arms Series*, Number. 24 (Bloomfield, Canada, 1990)

Books

De Witt Bailey, *British Military Longarms 1715-1865* (London, 1986)

Bolco, H., *The Fighting Boers, Foreign and Commonwealth Office Collection* (1900)

Butler, D., *United States Firearms The First Century 1776-1875* (New York, 1971)

Callwell, Major C., *Tactics of To-Day* (London, 1900)

Canadian Forces Technical Order, *Rifle, Caliber .22, No.7 Mk* I, National Defence HQ (Ottawa, CA, 14/09/1984)

Cobb, M., *Cinderella Snider* - Unpublished (21/02/2016)

Cobb, M., Martini-Henry, Chapter 6: Metford Erosion issues - Unpublished (21/02/2016)

Cobb, M., *The Martini-Henry Notebook, The Life and Times of a Grand Old Rifle* (Gillette, New Jersey 2007)

Colenso, F., *History of the Zulu War and its Origin* (London, 1880)

Cunningham, H., The Volunteer Force: A Social and Political History 1859-1908 (London, 1975)

Duxbury, G., *David and Goliath: The First War of Independence, 1880–1881* (Johannesburg, South Africa, 1981)

Edgerton, R., *Warriors of the Rising Sun: A History of the Japanese Military* (London, 1997)

Extract from Digest of Service of the 2nd Battallion Prince of Wales own West Yorkshire regiment in South Africa, from 20th October 1899 to 4th August 1902 (York, 1903)

French, D., *Military identities: the regimental system, the British Army, and the British people, c.1870-2000* (Oxford, 2005)

George, J., *English Guns and Rifles* (Plantersville, USA, 1947)

Greaves, A., *Rorke's Drift* (London, 2002)

Henty, G., *The March to Magdala* (London, 1868)

James, Captain W., Handbook of Tactics, *Gale & Polden's Military Series* (Aldershot, 1895)

Jones, K., Welch, D., *A Cultural History of Firearms in the Age of Empire* (Farnham, 2013)

Laband, J., *The Transvaal Rebellion: The First Boer War, 1880-1881* (New York, NY, 2005)

Lewis, D., *Martini-Henry .450 Rifles & Carbines* (Latham, NY, 1996)

Lynch, G., *The Dance of Death: Impressions of a War Correspondent 1899-1902* (London, 1902)

Manning, S., *The Martini-Henry Rifle* (Oxford, 2013)

Marshall, W., *The Comparative Merits of the Martini Rifle and the Westley-Richards Rifle and Ammunition* (London, 1870)

Mitchell, B., British Historical Statistics (London, 2011)

Mowbray, S., *Bolt Action Military Rifles of the World* (Woonsocket, RI, 2009)

New South Wales Military Forces, *Handbook for the Martini-Henry Rifle* (1897)

O'Donnell, Captain H., *Historical records of the 14th Regiment, now the Prince of Wales' own (West Yorkshire Regiment) from its formation in 1685 to 1892* (Devonport, 1920)

Pauly, R., *Firearms: The Life Story of a Technology* (London, 2004)

Pegler, M., *The Lee-Enfield Rifle* (Oxford, 2012)

Petrillo, A., *British Service Rifles and Carbines 1888-1900* (Latham, NY, 1994)

Roads, C., *The British Soldier's Firearm, 1850-1864, from Smooth-Bore to Small-Bore* (London, 1964)

Robson, B., *The Road to Kabul: The Second Afghan War 1878-1881* (Stroud, 2007)

Royal Small Arms Factory, *Enfield Enforcer 7.62mm Sniper Rifle Handbook* (Middlesex 1968)

Skennerton, I., *A Treatise on the Snider, The British Soldier's Firearm 1866-c.1880* (Margate, AU, 1977)

Skennerton, I., *.577 Pattern 1853 Rifle Musket & Snider Enfield, Small Arms Identification Series* (Labrador, QLD, AU, 2005)

Skennerton, I., *.577 Snider-Enfield Rifles & Carbines, British Service Longarms 1866-c.1880* (Labrador, AU, 2003)

Skennerton, I., List of Changes in British War Material in Relation to Edged Weapons, Firearms and Associated Ammunition and Accoutrements, Volume I, 1860-1886 (1979)

Skennerton, I., *The British Service Lee: The Lee-Metford and Lee-Enfield Rifles & Carbines* (Australia, 1982)

Skennerton, I., *The Broad Arrow, British Empire Factory Production, Proof, Inspection, Armourers, Unit & Issue Markings* (Labrador, QU, AU, 2001)

Skennerton, I., *The Lee-Enfield Story: The Lee-Metford, Lee-Enfield, S.M.L.E. and No. 4 Series Rifles and Carbines, 1880 to Present* (London, UK, 1993)

Skentlebery, N., *Arrows to atom bombs: a history of the Ordnance Board* (London, 1975)

Smithurst, P., *The Pattern 1853 Enfield Rifle* (Oxford, 2011)

Temple, B., Skennerton, I., *A Treatise on the British Military Martini, The .40 & .303 Martinis 1880-c1920* (London, 1989)

Temple, B., Skennerton, I., *A Treatise on the British Military Martini, The Martini-Henry 1869-C1900* (London, UK, 1983)

The War Office, *Magazine Rifles in the Service, .303 Small Arms Armourer's Handbook* (1917)

The War Office, *Rifle and Carbine Exercises, Manual Exercise, Firing Exercise, Bayonet Exercise, Firing Exercise for Webley Pistol and Instructions for Cleaning Arms*, Her Majesty's Stationary Office (London, 1898)

The War Office, *Rifle Exercises & Musketry Instruction 1879,* Her Majesty's Stationary Office (London, 1879)

Webster, D., *Military Bolt Action Rifles 1841-1918* (Alexandria Bay, NY, USA, 1993)

Westwood, D., *Rifles: An Illustrated History of Their Impact* (Santa Barbara, CA, 2005)

Films

Gajda, R., The Use of Blackpowder Cartridge Rifles, Carbines and Handguns in WWI, Film footage

Home Guard inspection by Lord Kitchener c.1914, BBC Film footage, <http://www.bbc.co.uk/iplayer/episode/p01nprmc/Britains_Great_War_War_Comes_to_Britain/>, 28 Minutes 0 Seconds

Martini Henry Trigger Diagnostics (20/10/2012) <https://www.youtube.com/watch?v=7UFnWkHtTqA> [Accessed 17/05/2016]

Roads, C., *The Gun: Riflemen All*, BBC 2 1980'S Film Footage

Mk I Lee-Metford: Sustained Rate of Fire Experiments, *Britishmuzzleloaders* (08/05/2014) <https://www.youtube.com/watch?v=g8fbszT8MKs> [Accessed 04/03/2016]

The Mk I Lee Metford: The Firing Exercise, Britishmuzzleloaders (09/04/2016) <https://www.youtube.com/watch?v=SlBdVXrhFSk> [Accessed 10/04/2016]

The MK I Martini Henry: Introduction, Britishmuzzleloaders (20/08/2014) <https://www.youtube.com/watch?v=DiT6Bzz2SP> [Accessed 15/05/2016]

The Mk I Martini Henry: Rifle Exercises C.1879/1881, Britishmuzzleloaders (25/08/2015) <https://www.youtube.com/watch?v=RPNc5IAwp6g> [Accessed: 14/05/2016]

The Mk III Snider-Enfield: An Introduction (21/02/2016) <https://www.youtube.com/watch?v=DJ-f11hM4Sk> [Accessed: 22/02/2016]

Images

1876 BSA Martini-Henry Rifle <http://www.oldbike.eu/museum/guns/1876-bsa-martini-henry-rifle/> [Accessed 27/05/2016]

Askew, J., The Defence of Rorke's Drift, Help for Heroes Charity Commission (2011) <http://www.yessy.com/jasonaskew/zulu.html?i=29786> [Accessed 03/02/2016]

Atholl highlanders parade during the annual highland games (09/04/2010) <http://www.explore-highland-perthshire.com/highland_games/blair_atholl_highland_games.htm> [Accessed 10/07/2016}

Battle of Echoes Hill <http://britishmilitariaforums.yuku.com/topic/11886/Canadian-Soldiers-w-Snider-Enfields-Photo#.Vwe6raQrJnR> [Accessed: 25/09/2015]

Battle of Tabaruzaka <https://rekishinihon.com/2014/06/07/battle-of-tabaruzaka/> [Accessed: 26/09/2015]

British Marines c.1900 <http://www.forgottenweapons.com/wp-content/uploads/2015/10/Lee-Metfor-Alacrity-China.jpg> [Accessed: 10/07/2016]

British Maxim Gun Detachment. Chiteral Campaign. 1898. National Army Museum Copy (Printed 11/08/2012)

Bye, O., The Rise and Fall of the British Empire (19/01/2015) <https://www.youtube.com/watch?v=ox-Jd8amw80> [Accessed 27/05/2016]

Canadian use of the Snider-Enfield <http://britishmilitariaforums.yuku.com/topic/11886/Canadian-Soldiers-w-Snider-Enfields-Photo#.VwU49KQrJnR> [Accessed: 24/09/2015]

'Defending the Biscuit Box Wall' Battle of Rorke's Drift <http://www.britishbattles.com/zulu-war/rorkes-drift.htm> [Accessed 30/05/2016]

Fides, A., The Battle of Omdurman, against the Kalifa and the Ansar, 2nd September 1898 (Print made 28/02/2014) [Accessed: 10/07/2016]

History of the P.1888 Lee-Metford bayonet, Bayonet exercise from the Royal Scots, Image from Mr. Gordon, (Haddington, 12/07/2015) <http://www.bayonetsplus.com/images/Royal%20Scots.jpg> [Accessed: 10/07/2016]

Hogg, I., Afghan fighters at prayer shortly after Soviet invasion of Afghanistan, 1979, *Janes Guns* (1996)

Mckerihen, J., Boer Commandos, Boer War Memorabilia, Anglo-Boer War Museum Collection, 1900-1905 [Accessed 01/05/2016]

Sammon, J., The Martini-Henry Rifle and the Greatest Discovery of Antique Firearms Ever (31/01/2012), <http://www.guns.com/2012/01/31/the-martini-henry-rifle-and-the-greatest-discovery-of-antique-firearms-ever/> [Accessed 22/05/2016]

Interviews

Cobb, M., Online interview with Malcolm Cobb regarding Snider and Martini Rifles and their use (23/02/2016)

Lectures

Cobb, M., *The Martini and its Place in History: A Historical Perspective* - Unpublished (02/02/2016)

Photographs

.303 Magazine Lee-Metford Mark I with wire breaker (Enfield, 1889), Serial No. 5329, Tag no. 18, The Robert W. Farris Long arm Collection (December 2015)

.303 Magazine Lee-Metford Mark I*(Enfield, 1892), Serial No. 3286 S, Tag no. 21, The Robert W. Farris Long arm Collection (December 2015)

.303 Magazine Lee-Metford Mark II (Sparkbrook, 1893), Serial No. 18597, Tag no. 23, The Robert W. Farris Long arm Collection, Image Courtesy of Ian Skennerton (December 2015)

Britain, .303 Charlton Automatic Rifle, 1941, Royal Armouries National Firearms Centre Gunhall [Photo taken by 'Forgotten Weapons' firearms Research group 09/10/2012]

Collectors photo of evolution of British .303 (2011) <http://i.imgur.com/8xHi1.jpg> [Accessed: 20/06/2016]

Skennerton, I., Charger loading, The Robert W. Farris Collection, IMG_0355bcd (16/12/2015)

Skennerton, I., Magazine cut off applied, The Robert W. Farris Collection IMG_0136rbd (16/12/2015)

Skennerton, I., Open Magazine cut off, The Robert W. Farris Collection IMG_0145bcd (16/12/2015)

Skennerton, I., Skeletonised Lee-Enfield, The Robert W. Farris Collection IMG_1277bc (16/12/2015)

Skennerton, I., Snider-Enfield 'b-Lock full cocked', Snider-Enfield Picture collection (16/12/2015)

Skennerton, I., Snider-Enfield 'b-Lock half-cocked', Snider-Enfield Picture collection (16/12/2015)

Skennerton, I., Snider-Enfield 'b-Lock uncocked', Snider-Enfield Picture collection (16/12/2015)

Skennerton, I., Snider-Enfield 'IMG_0642', Snider-Enfield Picture collection (16/12/2015)

Skennerton, I., Snider-Enfield 'Scan575', Snider-Enfield Picture collection (16/12/2015)

Skennerton, I., *Snider Enfield and Snider Enfield Cavalry Carbine with Armourers tools*, the Bob Farris private firearms collection

Skennerton, I., Snider Sergeant's rifle and Snider Carbine "Dscn6645bc", Snider-Enfield Picture collection (16/12/2015)

Websites

The Martini Henry Rifle <http://www.martinihenry.org/> [Accessed 15/05/2016]

Excellent and Extremely Rare Wilson's Patent Rifle <https://www.collegehillarsenal.com/shop/product.php?productid=1186> [Accessed 11/09/2015]

Guiness World Records, Longest Confirmed Sniper Kill <http://www.guinnessworldrecords.com/world-records/longest-confirmed-sniper-kill> [Accessed 25/06/2016]

Joslyn 1864 Carbine <http://www.horsesoldier.com/products/firearms/carbines/4323> [Accessed: 11/10/2015]

Matkin, J., *The Short Chamber Boxer-Henry .45 Caliber Cartridge* (01/05/2008) <http://www.martinihenry.com/450577.htm> [Accessed 20/05/2016]

Muzzle Loaders Association of Great Britain (MLAGB), Transitional Rifles <http://www.enfield-snider.com/Transitional%20Rifles.htm> [Accessed: 12/11/2015]

N., F., Magazine Fed Martinis (25/02/2015) <www.thefirearmblog.com> [Accessed 15/10/2015]

N., F., Shooting a Lee-Metford at 400 yards (12/06/2015) <www.thefirearmblog.com> [Accessed 30/11/2015]

Pfeiffer, G., The Snider Bullet (2009) <oldbritishguns.com/the-snider-bullet> [Accessed 23/09/2015]

Pfeiffer, G., The Snider Rifle (2009) <oldbritishguns.com/the-snider-rifle> [Accessed: 15/09/2015]

Snider Enfield Information <http://www.enfield-snider.com/.htm> [Accessed: 22/09/2015]

Sniders Ammunition and Dum Dum Rounds <http://britishmilitariaforums.yuku.com/reply/36549/historcal-question-what-was-the-first-dum-dum-bullet#.Vv6Jy6QrJnQ> [Accessed: 28/09/2015]

The Service history of the Surprise Class Fleet, The Alacrity <http://www.battleships-cruisers.co.uk/surprise_class.htm#HMS Alacrity> [Accessed: 10/07/2016]

The Snider Enfield <http://www.britishempire.co.uk/forces/armyarmaments/rifles/sniderhistory.htm> [Accessed 13/09/2015]
Visual description of how sears and tumblers function <http://britishmilitariaforums.yuku.com/topic/16487/My-577-Snider-will-fire-at-HalfCock?page=1#.Vv_QVKQrJnQ> [Accessed: 22/09/2015]

Zuljan, R., Lee-Metford (2016) <https://www.onwar.com/weapons/infantry/firearms/Lee-Metford.html> [Accessed 24/07/2016]

Zuljan, R., The Perak War 1875-76 (2016) <https://www.onwar.com/aced/chrono/c1800s/yr75/fperak1875.htm> [Accessed 20/05/2016]