

Early Lee rifle.

Black Powder in Lee Metfords?

Readers have recently been asking questions about shooting black powder in early .303 Lee Metford and Lee Enfield rifles. Extracts are as follows.

"I have recently acquired a Lee Metford rifle. My aim is to try and replicate the original black powder .303 British cartridges used before the advent of cordite. Hours on the internet did not really reveal any solid information and load data. The only information available is old historic descriptions. Any advice?"

"What are the ramifications of using black powder in the two types of rifling twist, Metford and Enfield? Was the Metford rifling necessary or better for black powder? Was the change to Enfield rifling due to the use of smokeless powder, or did it simply have a longer barrel life, or what? Have you any load data/advice on this?"

The simple answer is that .303 cases can be loaded with black powder as a propellant, but in our opinion it would be a waste of time because, firstly, it would be very difficult to accurately reproduce the historical load in terms of being 'in the spirit of the original'. And secondly, the results would not justify the hassle. It would be rather like building a replica Betamax video recorder, or a Mustang fighter plane with an Allison engine instead of a Rolls Royce Merlin. All you would prove was that they didn't work well in

**Anglo-Boer War .303
British cartridge.**

By MALCOLM COBB & ROGER INGLE

the original, and they have long since been replaced by better technology.

The question then comes down to whether there is anything magical in the black powder/Metford rifling combination in the .303 that makes it any better than the subsequent cordite/Enfield rifling combination. The answer is no.

First, the technical considerations. The black powder .303 load comprised a 71.5gr compressed pellet of black powder behind a 215gr nickel jacketed bullet. This is one difficulty in reproducing the original BP load. It is impossible to insert a solid pellet that will fill a .450" diameter tapered case, through a .311" diameter neck opening. The original pellet was put into the unformed case, and the neck sized down afterwards. Modern shooters don't have that facility.

Pouring modern black powder into a formed, sized case and then trying to compress it, will alter the burning characteristics of the powders used. Besides, since we don't know what binding agents or aids to burning were used in the original pellet, we won't be making an exact reproduction anyway. Of course, you can simply pour in loose powder and seat the bullet, but we have tried this and found that it fouled badly in a .303 calibre Martini Metford bore, plus it required a lot of cleaning between shots, which, again, is not a replication of the original, so what's the point?

The notion of matching black powder to suitable rifling is actually a bit of a fallacy, since all types of rifling (including Enfield) were used during the black powder era. Metford rifling was developed to use with a special wet-burning, non-fouling black powder and a hardened lead projec-

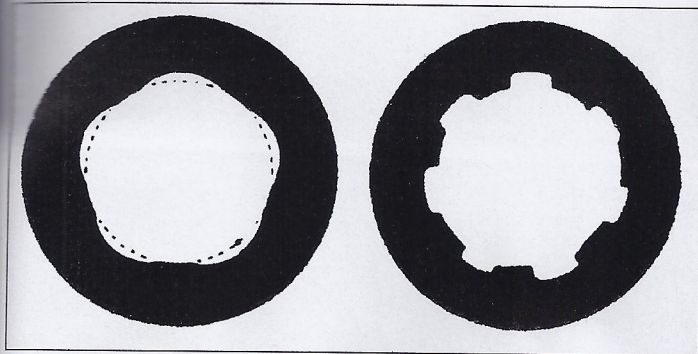
tile, patched with paper. Firstly, this was to enable the paper to 'sweep' fouling out of the bore during firing by having no corners to trap the fouling, and secondly, to have as smooth a projectile as possible to reduce drag for long range firing. Since it worked very well in .45 calibre target rifles, the same design was tried out with the .303 using jacketed bullets, and also worked well, so its use was continued into the smallbore magazine rifle era. In point of fact the Japanese also adopted the .303 as their 7.7 Type 99 Arisaka as late as 1938 – Metford rifling and all – so their successful experience makes an interesting comparison.

The bottom line is that the correct rate of rifling twist for any bullet is determined by its weight, diameter, length and velocity (Greenhill's formula). In the case of a 170 to 200gr, .303 calibre bullet, it remains the same (1 turn in 10" of barrel) no matter what the form of rifling is.

On the face of it, Metford rifling was a good choice for the .303, so what went wrong? Popular histories tell us that the Metford rifling couldn't stand the heat generated by the new cordite propellant, so a deeper, squarer rifling was developed at Enfield which cured the problem. Mr Metford's design was consigned to the dustbin as a failure and there the history of those times rests.

Having said that, there was such a thing as an early .303 black powder round, and how it all came about makes an interesting story.

Round about the year 1887 the British were tinkering with another set of modifications to the single-shot .450 black powder Martini Henry rifle, which advanced it to the Mk IV model. It seemed to be the pinnacle of perfection in its own way, but, meanwhile, on continental Europe the Germans were busy adopting the 8mm Commission



Above: Metford rifling (left) and Enfield rifling.
Right: Boers posing with .303 rifles.



rifle with a magazine, clip-loading facility, smokeless powder ammunition and all. And the French already had a similar weapon in the 8 mm Lebel rifle.

In the Victorian arms race, Britain was being left behind with obsolescent equipment, so the Brits went onto the market to find their own small bore magazine rifle, and ultimately selected a simple action designed by James Paris Lee, a Scotsman living in America. The first trials rifles were in .45 calibre, and later a .402 design was tried. It was not sufficiently 'cutting edge', so the Swiss 7.7mm ammunition design was copied, and since the Metford rifling was the hottest thing on the rifle ranges at that time, it was adopted as well.

This hybrid of other people's second-hand ideas seemed to work at first, so, in 1888, the Lee Metfords went into limited production of 1 000 or so in .303 calibre, mainly to see how they worked out in practice and to develop new drills, make them soldier-proof and so on.

The question no one had yet figured out, was what propellant to use in the ammunition. Rapid magazine fire with black powder rounds resulted in clouds of smoke which gave away troops' positions and hindered the clear sight of the enemy, so that was no good. There were some commercial smokeless powder designs around in the late 1880s, but they cost money to licence and may not have proved adequate for use in the varied conditions of heat, cold and damp to be met with around the Empire. The French and the Germans weren't letting any secrets out either, so what could be done?

The ever thrifty British authorities however, had a winner in this new explosive called nitro-glycerine. Plenty of bang for their bucks there, but regrettably, it also blew rifles up, so the search was on to turn

it into a propellant. The year 1888 went by, then 1889, until in 1891, three years later, that a Mk 1 smokeless round, containing a modified propellant, 58% nitro-glycerine, 37% guncotton and 5% mineral jelly, hereafter called cordite, came into being. Even then, it wasn't quite right, and a Mk II version was issued in 1893.

So what were the troops to do with their Lee Metfords in the meantime? Good question. The quick fix was to load the cartridges with black powder and hope like hell no major wars broke out.

Of course, questions were asked in the House as to what Enfield was playing at all this time. In fact, private companies like Birmingham Small Arms were proving very successful in producing small arms at less cost than Enfield, so the Liberal government of the day threatened to close Enfield down unless the problem was sorted out.

So what to do? The new, hot-burning cordite propellant was still burning out the finely crafted rifling in Metford barrels. Faced with imminent closure and job losses, the Enfield guys skated over the question that something might be wrong with their propellant, and came up with the explanation that it was the Metford rifling that was at fault. They made a 50% increase in the depth of the rifling grooves, squared them off a bit, and called the result Enfield rifling. This increased the barrel life from 4 000 rounds to 20 000 rounds and was judged an instant success. (If barrel life of 20 000 rounds sounds impossible, bear in mind that the barrel life of 3 000 to 5 000 rounds we regard as normal in today's rifles is based on a group size that is very, very much smaller than that expected from a military rifle in Victorian times when their yardstick was the .577/.450 Martini Henry.)

It is worth mentioning at this point that the sharp corners on the lands of

Enfield rifling are technically more prone to erosion than the rounded corners of the Metford rifling. The heat can't flow away from the corners fast enough, and erosion takes place. That early cordite must have been vicious stuff.

Work on the improved rifle, now called the Lee Enfield, started in 1895 and the order for the closure of the Enfield works, also slated for 1895, was rescinded.

After that, there was no stopping them. Since mass-production of the Lee Metford had hardly got underway even five years after adoption, the British armed forces were still clamouring for their smokeless weapons to replace the Martini Henry. The quick fix for that was to produce .303 barrels for the Martini and call it the Martini ENFIELD. Nothing like having a good brand name on the market.

Even better than that, Enfield's partners at Birmingham Metal and Munitions Limited (a wholly owned subsidiary of Dynamit-Nobel, the nitro-glycerine people) got a nice fat contract for the manufacture of Mk II Cordite rounds in 1897 and bought a new factory with the proceeds.

So, nearly eight years after the adoption of the Lee rifle, Enfield had got it right and everyone was happy. Apart from Mr Metford, that is, who retired from public life and died in 1899, and, most unfairly, is now remembered only for the failure of his system in the hands of his own countrymen – even if the Japanese had no troubles with his rifling at all.

So, ja well no fine. What was the original question about black powder .303s again? A judgement might be that they were an embarrassment best forgotten. Let the final word sit with an impartial end-user. If the Japanese didn't adopt them then they couldn't have been any good. Period. **m**