The 2012
Complete Book on Lee Enfield Accurizing

Everything you could ever need to accurize a Lee Enfield and shoot it well.

The 2012
Complete Book on Lee Enfield Accurizing

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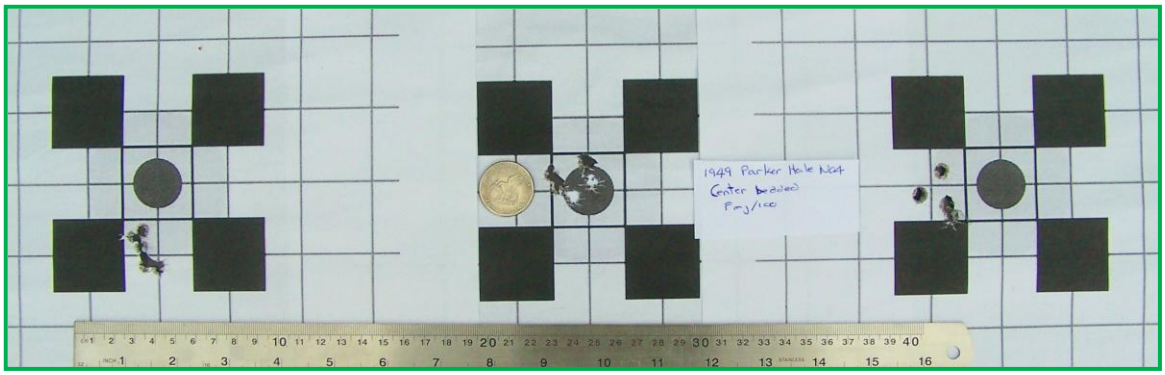

Image; 1949 No4 Mk2 Parker Hale, with center bedding. Three different shooters on the same rifle, and the same day. This rifle is opened up and measured, pg 154.

Foreword

In the footsteps of the Masters

The information presented here is what I was looking for when I was learning how to get better accuracy with Lee Enfields. What I was really after, the actual 'how to' information, didn't seem to be available. After more than a decade of communicating with other Enfield enthusiasts and reading reams of dusty old books the secrets were discovered one by one, and I finally understood how it was done.

I say 'was' because while 'Enfielders' today are an enthusiastic and growing community world wide, the bulk of the knowledge was garnered many years ago during the 'Golden Age' of target shooting, when Lee Enfields were cock of the roost.
After those heydays of 1900 – 1912 the sport continued to grow despite the buffeting of WW1 and WW2 plus the great Depression, nevertheless Enfields went right on through collecting trophies world wide right up to the late 1960's, a feat matched by few rifles, ever, let alone one first designed in 1888.

So this book then is a good look at the old master's methods, compiled into an illustrated, practical guide for those new to Lee Enfields and the home handy enthusiast, complete with all the images, measurements, data and insider's forgotten tips you'll ever need.

This is not just a romp through dusty halls however, with at least one method featured that is so new it's probably never before been seen on an Enfield, and a few as yet untried ones, proving that there is still new life in these 'old girls' yet.

This guide follows in the footsteps of the masters, and so will you.

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Dedicated to

To the men and women defending the freedoms of others with a rifle as their right arm, thank you.

Acknowledgments

Friends
Behind every successful enterprise are those who provide intangible support that's near impossible to define and quantify but without whom no accomplishment would be possible.
My thanks here to Micheal P. who gifted me my first ever 'three nought three', a lovely 1918 Aussie No1 Mk3, which is still in the gun safe, and started the road we are now on, and to Stacy F, a straight shooting Texan, who patiently enjoyed my enthusiasm for years, and who regularly out shot me at the range, Dale P. my ever supportive and fun shooting buddy who I once watched plug a golf ball at 85 yards with his flintlock rifle and thereby set a bar very high for our 'modern' rifles, and my family who have always been the silent support we hope for.

The online Forums, **Jouster.com** and **Milsurps.com**
No acknowledgment is complete without mentioning the invaluable source of friendship, humor, knowledge and experience that has come my way since joining these two excellent forums.
Members have ever been equally happy to encourage an Enfield novice, or 'newby', in ways to restore or to shoot their newly acquired Enfield, to how the military used and maintained their rifles, and to enter into deeper discussions about metallurgy or the finer points of engineering theory that went into the Enfield design.

If you are fresh to Enfields, or even fresh to rifle shooting, I completely encourage you to find forums such as these to kick around a few thoughts, post pics of your own rifle/s, and ask questions of your own.

At the Milsup's Forum an excellent photographic and technical library is on file, and with their kind permission links are provided here at the end of some chapters.

Forum Links;

- Milsurps.com; http://www.milsurps.com/forumdisplay.php?f=72
- Culver's Jouster.com; http://www.jouster.com/forums/forumdisplay.php?8-SMLE-%28Lee-Enfield%29
- Enfield Resource.com; http://www.enfieldresource.com/forums-survivor-polls

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Image; Before and after; Ishapore 1966, and above with carbon fiber sleeved barrel, page 179.

Introduction

Welcome to this guide about accurizing techniques for the Lee Enfield rifle. Roll up the sleeves, get your rifle and cleaning kit out, put' The Dam Busters' on a TV in the background, and sit back for a read ...

This is written for anyone with a growing enthusiasm for Enfields and a few home handy skills. With 110 pages of text and 365 images, every point is well described, and the various levels of accurizing are designed to appeal to whatever skill level you wish to apply.

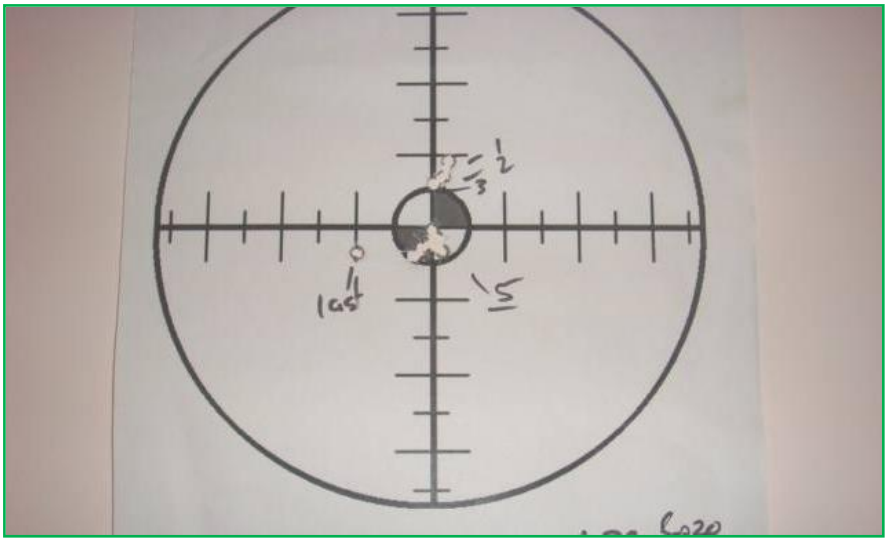
These techniques are designed for all 20th century Lee Enfields with a two piece stock;

- **No1 Lee Enfield** (1902-1910)
- **No1 Mk3** (1907-1985+)
- **No4 Mk1 and Mk2** (1930-55)
- **No5 Mk1 jungle carbine** (1944-46)
- **Ishapore 2a in .308 NATO** (1964-68+)
- **Including all 7.62 ,converted and issued, Enfields.**

Generally speaking, these accurizing techniques apply to any Lee Enfield with the classic two piece stock and steel wrist.

In acknowledging the desire to preserve the integrity of these increasingly collectible rifles the accurizing techniques range from 'no modification/ blue printing' approach, to an all out, no limits modifications in pursuit of maximum accuracy.

The good news for those wishing to create a ground up, target blitzing project rifle is that from the millions of Lee Enfields manufactured, more than enough survive as sporterized rifles, parts, or as rifles needing major restoration, that there is no need to modify a rifle otherwise valued for its originality.



Image; Ishapore 2a1 7.62, 100 yds, carbon fiber project rifle, , pg 179

In addition there are two more unusual methods described that have been proven for other rifles but that have yet to be tried on Lee Enfields. You might be the world's next pioneer in using them.

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The Author

Hello, my name is Roger Wadham, an ex Hollywood writer and set designer with a more than passing affection for these great rifles and all they represent. I met my first Lee Enfield in Los Angeles in 1995 when a friend with a sense of humor handed me a No1 Mk3 on ANZAC day for an outing at the range. Little did Michael, or I, realize what this would start. That lovely Australian made rifle eventually crossed the Pacific back to NZ and is still safe in the safe 15 years later.

After that rifle's arrival I discovered there were other types of Enfield, and I couldn't say no to buying another one, or two, and now they must be multiplying in the gun safe on their own, because without fail every month or two there seems to be another. Decreasing space in the gun safe, it turns out, is a 'problem' other 'Enfielders' discover too.

In Los Angeles I was well spoiled by the local presence of the Angeles Crest Shooting Range, a large complex at the foot of the San Bernadino Mountains that caters to everyone from skeet shooters to LAPD trainees. It's a great place to learn to shoot and best of all, they have a range with steel gongs strung out to almost 800 yards.

Lee Enfields eat 800 yards for lunch.
Do that kind of shooting for a while and it doesn't take long before 300 yards starts to feel like 50, and one's accuracy improves quickly.
It doesn't take long shooting at these distances before any rifle owner starts to think about the nuances of the bullet's flight, how the rifle works and why.

This began the ongoing enjoyment of bettering my shooting.

For myself unexpected health issues have taken me off the firing line, but having got the Enfield bug, new directions have led to me building the website Enfield Resource.com. In addition I've been enjoyably building target rifles for a few years, fun shooting with friends, and with this book have now turned pen to paper.

Forum Links

- Culver's Jouster.com; http://www.jouster.com/forums/forumdisplay.php?8-SMLE-%28Lee-Enfield%29
- Milsurps.com; http://www.milsurps.com/forumdisplay.php?f=72

World wide listing of 165 Enfield related web sites

- Enfield Resource.com; http://www.enfieldresource.com/forums-survivor-polls

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Why 'accurizing'?
I don't know why but the same peculiar 'bug' that develops for collecting Lee Enfields also shows up when thinking about accuracy improvements for them. While there's something seriously satisfying to be at the range with a 'vintage' bolt action rifle clanging steel gongs at 500 yards alongside 'high tech' modern rifles, it's even more fun knowing one has an extra accurate rifle, something with a few invisible tweaks that don't show under its stock military appearance, a wolf in sheep's clothing.

The Lee Enfield SMLE design is one of the most successful rifles of the last hundred years, the No4 is rated in the top three of the best battle rifles of all time. Yet if one were to sit down and design a rifle for accuracy it incorporates many attributes that one would specifically not want, a 'flexy' action, a two piece stock and in the No1's, a 'short and light' barrel.

A one piece stocked rifle could arguably be a naturally more accurate rifle, but there's probably less a home enthusiast could do to lift its performance, so in an odd twist of fate the Lee Enfield's apparent drawbacks are the very thing that allow us to go to work and draw out the rifle's larger potential.

While some methods are dramatic and obvious such as receiver bedding, others can be subtle and unseen. A highly accurate rifle is often the accumulation of a lot of small alterations, the details can make all the difference, so I recommend not to be overly drawn to one method and overlook others.

Some of the descriptions are not overly specific or explored in great depth, and are designed to get you thinking about ways to apply, use, research or improve a method. In other cases the chosen topic will be one with great depth, such as reloading or positive compensation, that many talented authors have written exhaustively on. In those cases you'll find either links to more information, or search phrases to use on the internet that will bring you more results.

A number of images of targets are included. None are designed to demonstrate what a great shot I (in my dreams) and my friends, Tony and Manuka, (who really are great shots) are, but rather to draw attention to the particular rifles grouping tendency with various modifications.
They have all been generated under nearly identical conditions, same bench rest, same ammunition, same range, same weather, and many are the result of simply handing the rifle from one shooter to the next and drilling holes in a fresh target.

The following chapters are alphabetically laid out. Each chapter is titled for that part of the rifle and lists increasing levels of accurizing options.

After a section on bedding, the last section includes the never seen before carbon fiber barrel work on an Ishapore 1966 7.62.

The final chapter is about tips that fine tune you, the shooter.

Beyond the end is a detailed index, a way to navigate back.
So, let's begin.
RJW NZ

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Contents

Chapter One - A Little Background

Regulating, Blueprinting and Accurizing

In the UK and the USA there are several popular use terminologies for the similar things. I'm sure there are folks who can argue these definitions but this will at least provide a beginning.

In US and UK/Commonwealth speak, the term 'blueprinting' is used to mean modifying a car to maximum performance possible within factory tolerances. Typically this would mean boring a cylinder to accept the largest size piston, normally recommended to absorb wear and tear, but now used to create a useful increase in engine capacity.
It does though get used liberally to mean both unchanged from factory, and tuned within tolerances, two quite different things.

Enfield rifles sold for target shooting often have the phrase 'Regulated by '------', stamped on the front top of the receiver.
In the UK 'regulating' is purportedly the process of bringing a rifle within factory specifications, usually to comply with NRA competition rules that require a military rifle to be exactly as manufactured. This is not a common phrase in the USA.

While a 'regulated' rifle would be carefully set to best stock specifications, a rifle with either simply Fulton or Parker Hale stamped on it has probably been tuned for accuracy to the maximum that the rules allow. This can include use of a barrel bedding style not used by Lee Enfield but deemed acceptable for some shooting NRA rules in the UK.

Accurizing is a term used over casually that can mean anything from slight to maximum changes.

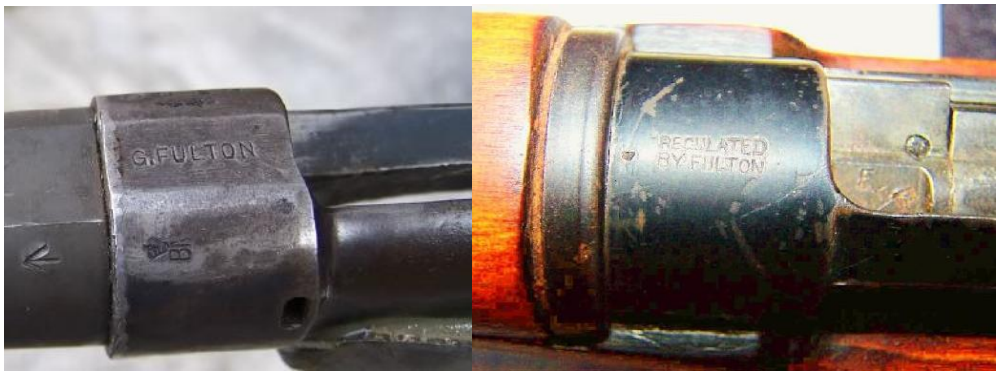
Fultons of Bisley and Parker Hale

From 1890's to 1960 plus, two pre eminent names have stood out in England as the 'go to' people for accurate Enfield shooting, Fulton and Parker Hale. What the name Colt is to Americans, Fulton and Parker Hale is to an Englishman.
They sold and modified to order, accurized Lee Enfields, destined for owners across the world, and their rifles brought home trophies for decades.
Their markings on the rifles they handled are somewhat discreetly stamped into the receiver knox form, the strengthened front portion of the receiver.

They represent many years of experience with some of the world's finest firearms, and to own a Lee Enfield with one of these names engraved into the receiver is increasingly a must have for a Lee Enfield owner.

Fulton's was, and still is, a well known and respected family business which has been connected with the inner circles of English target shooting and Enfield rifles since 1895. They earned a well deserved reputation by not

only accurizing the No1's for competition, but by also evaluating and improving the No1 Enfield for the military when it was first introduced in the 1900's.



Fulton's rifles are recognized by the 'Fulton' or 'G.Fulton', the founder, stamped deeply on top of the receiver.
Many people seem to ask, but we're reliably informed that the stamped G. Fulton is not a mark of Mister Fulton's personnel rifle. It was a widely used trademark, as was the more simple 'Fulton'.

However, a Lee Enfield which is engraved 'G. E. Fulton Bisley', with a flowing script rather than stamped as above, is one that was accurized to a customers personnel order by George Fulton. Knowing this makes for an interesting way to build provenance if you happen to purchase such a rifle and can do more research into previous owners.

Fulton's exist to this day, 2012, still sell new and vintage target rifles, and can be contacted for Enfield parts and rifles.

They often receive requests for information about their long since sold target rifles, but have categorically stated that they have no historical data on rifles that have passed through their hands.

Just to confuse what constitutes 'regulating' a little more a good explanation of Fulton's methods (shown in part) is to be found in the following link;
Quote;
'To start with, the reinforcing tie plate is fixed with a screw and its recess at the rear is made absolutely flush by fixing a hardwood plug so that the fore-end exerts maximum surface pressure on the buttstock. The rear lugs have hardwood inserts and the barrel is bedded under the knoxform and also central bedded. Bedding at the front provides the necessary downward pressure. The best feature I found, was that a steel plate is inserted under the front of the trigger guard to strengthen the downward pressure of the trigger

guard screw.

“Regulated by Fultons” is certainly not a myth. And a lot of extra work went into just this fore-end. A lot more went into work on the barrel, the sighting and the trigger.’ Unquote.

For more information courtesy of Milsurps.com
Fultons regulating discussion as above;
http://www.milsurps.com/showthread.php?t=10314

Fulton’s; http://www.fultonsofbisley.com/

Inside a Fulton target rifle; http://www.milsurps.com/content.php?r=363-Fultons-of-Bisley-Enfield-accuracy-secrets-revealed.-%28By-RJW-NZ%29

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Parker Hale are another well regarded UK family business, who also made a reputation creating aperture target sights for Lee Enfields. They made a wide range of sights from the early 1900’s onwards, in many types, and for most Enfields, right up until the late 1960’s with the 98/68 made in 1968 for the Mauser 98.

Aperture sights well known to Enfielders in 2011 are the PH5c and the TZ 4/47 for the No4, and the PH5A for the No1 Mk3. They are still among the best aperture sights available for Lee Enfields.

In addition to the aperture sights they sold accurized and regulated No4 Enfields until at least the late 1960’s specifically for target shooting.

Their rifles are usually stamped ‘Parker’ or ‘Regulated by Parker Hale’ on the top of the receiver. These rifles often came with after market barrels, or new condition military barrels, some of which were stamped ‘AGP Ball Burnished’ in small letters around the muzzle.

Ball burnishing is a gun smith accurizing technique where a small steel ball is dragged through the barrel to smooth over tiny sharp edges created during the rifling process. The purpose is to smooth the

bullets path, reducing its vibrations, and to slow the build up of copper deposits in the bore.
This was an accurizing technique somewhat debated as the ball also widened the bore slightly, and there are Golden Age shooters who were convinced that only the tightest bore is the most accurate.
Speaking personally, the two ball burnished rifles I own are also the most accurate.

Later model Parker Hale No4 Enfields are also often recognizable by the smoothed over end 'dots' of dowel pegs inserted into the forend around the receiver. These are locating pegs designed to anchor the receiver at crucial points and are described in detail in the receiver section.

It's an accurizing technique used by the Canadian shooting team in 1964, and was also widely accepted by the shooting fraternity. This method is described on page 79.

The name Parker Hale still exists but the family has retired. The trademarked name can still be found on rifle scopes and other accessories but as of 2011 is not to be found on new made rifles.

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Accuracy trialing your rifle

The accurizing techniques we're exploring here are tried and true, gleaned from the writings and anecdotes of generations of shooters active since the 1900's, and from countless hours of personnel experience at the range and modifying my own rifles. Some techniques are less visible than others and seemingly require no changes but will instead require careful alignments, while others are permanent changes that make a rifle into an all out target shooting machine. I suggest thinking each one over carefully and put them into practice in a methodical way before making the more permanent changes. The uniqueness of how a Lee Enfield responds to alterations means that not every alteration will create the same results on two side by side rifles. Experiment, and look for what works best for you and your rifle.

Lee Enfields are well known for being a little unpredictable, quirky or politely, 'have a lot of character'. A bore that appears worn and pitted and at first glance would automatically be destined for the trash can, might turn out to be decently accurate at the range. When choosing a project rifle as the basis for accurizing techniques it will pay to look for one with decent rifling, an unpitted bore, and a bolt that is not too loose in its channel, however buying a roughed up wood, or worn out looking Enfield, can suit a modest budget and still yield a good shooting rifle.

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What methods should you use?

Here is a very approximate guide as to the improvement value of various techniques. This is not a definitive way of looking at these techniques as something as seemingly low down the totem such as trigger guard side clearance for instance can easily turn out to be the hob goblin that was throwing shots astray. Overall though the cumulative value of these techniques are known to add significantly to accuracy.

Significant or 'must haves'

- Reduced barrel reinforce bearing pad
- Bedding barrel
- Bedding and locating of receiver
- Equal and tight fit to draws/recoil lugs in fore arm
- Equal bearing of recoil pressures on bolt lugs
- Equal and tight fit of fore arm to wrist
- Pressure plate around main screw
- Correctly aligned and fitted forend/trigger guards.

Moderate

- Dowels into lugs/receiver
- Front sight centering in nose cap
- Head space
- Lateral receiver bedding
- Nose cap bedding
- Packing barrel bands
- Tight fitting hand guards
- Trigger guard bedding
- Trigger guard clearance
- Weight in stock

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So, how accurate are Lee Enfields?

The No1 Enfield went from being a good battle rifle to something it was never intended to be, a highly tuned target rifle, so a definitive answer is not really fair. The good news is that both the No1 Mk3 and the No4 both became highly acclaimed target rifles.

A battle rifle is designed to hit a center of mass, not the exact centers of bull's eyes, so something of a shotgun effect within an area is acceptable to the military. The shots can fall within a larger circle, the size of the target's vulnerable areas.

Effective range is determined by multiplying distance times the width of the shot fall, measured against the size of the targets vulnerable mass.

If an Enfield shoots for example a 4 inch circle at 100 yards, then at 400 yards the shot fall becomes 4 times larger or a 16 inch circle. If an enemies chest measures 18 inches

across then the range at which shots begin to fall outside the target area is 450 yards. Therefore one would say that on a battlefield a Lee Enfield's most effective range is 450 yards.
If one were shooting at longer distances then a steadily increasing number of shots would fall outside the target zone the further away it gets and become less effective.

At two thousand yards it could be feasible for example that only one in ten would be a useful shot, and in the military this statistic is sometimes worked with by having a platoon of shooters aiming at the soon to be blasted to smithereens target. Most of the shots might still miss but statistically a single successful shot would be a certainty.

A sniper rifle works at greater ranges simply because of this formula; the smaller the 100 yard hit circle of accuracy, or MOA, the further out the effective range becomes. Ultimately the limiting factor is the velocity, energy and stability of the bullet in the upper ends of its flight envelope, and one begins to understand why the powerful and well streamlined design of the .50 caliber sniper rifles bullets are such a potent, 2000 yard, force on the modern battlefield.

In target shooting the most important, somewhat blended, factor is accuracy and repeated accuracy.
Because some shooting contests require multiple shots within a time frame the gun will go from cold to warm and even hot. It can be a challenge for any rifle to be at the peak of its performance when every dimension is changing due to heat expansion. Some rifles handle this acceptably, a target rifle has to be at its best constantly.

Enfields have a reputation of being unique, with one being consistent despite heat and humidity changes, and the next less so. It's a strong case for understanding your rifle, and for paying close attention to its performance, even while just plinking with friends.

Lee Enfields and the .303 bullet are easily accurate and effective to 1,000 yards.

At 2440 fps, the 174 grain standard military .303 bullet has 2,408 ft/lbs energy at the muzzle.

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The No1 Mk3

Famed Australian Lee Enfield shooter and writer James Sweet wrote in 1954 that a well assembled but otherwise stock Lee Enfield No1 Mk3 will place 10 shots into a 2 inch circle at 100 yards, in other words 2 MOA.

Image; target, a good condition 1918 Lithgow in 100% stock configuration after careful attention to set up details, a very good result.

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The No4 Mk2

The No4 Enfield transitioned from being a very good battle rifle to one with a reputation for very good accuracy, especially at 1,000 yards.
A good No4 Mk1 will shoot 2 - 4 MOA.
A good No4 Mk2 can shoot 1.5 inch MOA new, out of the box, and will bed itself in after the first 500 rounds.

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Lee Enfield Sniper Rifles

The Lee Enfield has served as a sniper rifle from 1915 right through to the 1980's, and occasional reports from British troop deployment in Afghanistan suggest that the Lee Enfield L 42 has served there in 2010 as well. Not bad, that's over one hundred years of front line service from the same basic design. That's not only not bad, it's probably unprecedented.

H stands for 'heavy' barrel, T stands for 'telescope', and TR for 'telescope rifle'.

The scope equipped sniper rifle type names are;

- World War One – No1 Mk3 T .303
- World War Two – No4 Mk1 T .303
- World War Two – No1 Mk3 HT .303 (Australia)
- 1970's – No4 based, L 42 7.62
- 1970's – No4 based, L 39, Envoy. 7.62

Image; courtesy;

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The No4 Mk1 (T)

No4 sniper rifles weren't made, they were born.
Somewhat disappointingly my assumption that master gunsmiths toiled for hours by lamp light over the components of No4 sniper rifles is not exactly correct. Instead the powers that be utilized the more organic process of using the rifles that tested as the most accurate as they came off the production lines in Canada (Longbranch), the US (Savage) and the UK (BSA). This played nicely into the observation that randomized factors would coincide on some rifles to create a rifle that stood out from its neighbors.

The first and urgently required batches of No4 T's were made on the prototype 1930 No1 Mk6/No4 trials rifles, many of which were held in reserves or in pieces. The trials rifles had a rear sight axle slightly lower than the TGT micrometer rear sight that all subsequent No4's were equipped with, and it's thought that because these rifles couldn't be handed to troops without a proper rear sight that it was better to equip them with scopes and by pass the problem entirely.
The trials rifles were considered well made and created a quality sniper rifle. They are a most prized sniper rifle today.

Once a No32 scope had been accurately attached, and this is the process that required the greatest time and skill, a rifle destined for sniper work had to pass accuracy tests throughout its creation and service life, and any that failed to do so were returned to the workshops to be put right.

A variety of surviving reports state that a No4 Mk1 T had to repeatedly put;

- 5 rounds into a one inch circle at 30 yards.
- 5 rounds into a 3 inch circle at 100 yards.
- 7 rounds into a 5 inch circle at 200 yards.
- 6 out of 7 rounds into a 10 inch circle at 400 yards.

Additionally, a sniper rifle requirement, and a common need in all sniper rifles, is the ability to makes its best shot with a completely cold rifle. Considering that rifles usually give their best when warm, not hot nor cold, this can be a challenge.
It is also a trait needed by target rifles in competition. They sit cooling or cold while waiting for the shooters turn at the bench, and have to repeat the same good results as the rifle warms.

If you're accurizing your rifle and want to test its parameters try testing the accuracy comparatively, as the rifle is cold, warm and hot. Likewise be aware at the range that these other factors can deteriorate your accuracy as the hours go by; your fatigue, the rifle heating, and debris build up in the rifling.
Target shooters clean their bores often, sometimes between shots. I obtained best accuracy from an Enfield T sniper by cleaning each ten shots with ww2 ammunition.

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The Lee Enfield Target Rifle

It is well documented that well set up Lee Enfield target rifles will shoot 1 MOA, or a one inch circle at 100 yards, and on occasion there are unofficial reports of .75 MOA.

No4's set up for long range competition will shoot 2 MOA at 1,000 yds. This is very good standard. Compared to modern target rifles, which will shoot ½-1 MOA, they're no longer in the front runnings, but they did hold their own in competition even until the early 70's, before fading into history.

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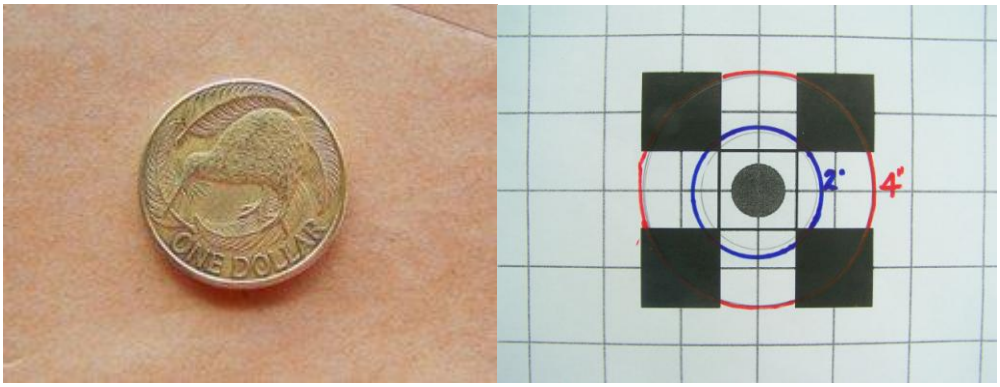

Image left; a one inch dollar coin, a global standard? Right; this target is used at the same scale throughout this site. The black squares form a 4 inch square, and the inner corners 2 inch.

Conclusion

It's safe to say that stock, new condition, well assembled, No1 and No4 Lee Enfields reliably shoot within 2-4 MOA, a two to four inch diameter circle, at 100 yards.
The benchmark 1 MOA, or a 1 inch circle at 100 yards, is attainable with Lee Enfields after either accurizing techniques or reloading has been applied. Using both makes attaining the magic 1 MOA much more reliable.

Note; just a reminder that the targets shown here are to demonstrate comparative size and shapes of grouping and that almost none of the sights are zeroed to the bulls eye.

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Image; No1 type-round head, fine thread. No4 type-flat head, coarse thread.

Main screws, front screws, king screws; whut the …?
These are all common use terms for the large screw in the front of the trigger guard that holds the trigger guard into the fore end, and there's no disputing the meaning, they all describe the one and same item, the large screw in front of the magazine.

This screw is a very important part of a Lee Enfield rifle's accuracy so it will figure in plenty of our descriptions. King screw is not an official name for this screw and comes from common but erroneous usage, 'Main screw' is the correct term.

The small metal tube that the main screw slides through in the forend to stop the trigger guard from crushing the wood excessively is variously described as a collar or main screw bushing.

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Modern competitive shooting
Interest in old military bolt rifles is experiencing a world wide resurgence and competitions for 'as issued' military rifle shoots are increasing every year. These can be fun shoots of an informal nature, or more strictly governed affairs for the dedicated shooter.

The rules of military competition shooting vary from club to club and country to country, so there's little point in summarizing them here, or in designing accurizing techniques that will keep your rifle within a rules formula. You'll have to read up on the local rules that govern each shoot.
Some rules require zero changes to the rifle from an as issued state, while others permit period extras such as aperture sights that don't require alteration of the rifle.
While one would assume that an important element such as barrel bedding has to remain exactly as issued by Lee Enfield, in fact it is within some British NRA rules to create a center barrel bearing on a No4 rifle and legally compete with it.
For a sample of more information;
http://www.imas.co.nz/nzsra.htm
http://www.nranz.com/rules_policy/shooting_rules

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MOA
If you're not familiar with the term, MOA or 'minutes of angle' is a universal standard to describe accuracy of a rifle's bullets on the target.

In casual use it means that a 1 MOA rifle will put its bullets inside a one inch circle at one hundred yards range.
Measuring at 100 yards or meters is the commonly used base standard, and at ranges over this distance a rifle's MOA numbers are simple multiples of the distance, ie a rifle that shoots a 3 MOA (ie 3 inches) at one hundred yards will shoot a 9 inch circle at 300 yards.

The term 'Minute of Angle' comes about if the shooter is the base origin of the bullets path, and the width of the pattern the bullets make on a paper target is the wide portion of a very long and narrow triangle.
To revisit high school maths for a moment, a circle is divided into 360 degrees, each degree sub-divides into 60 minutes of angle, a basic mathematical standard.

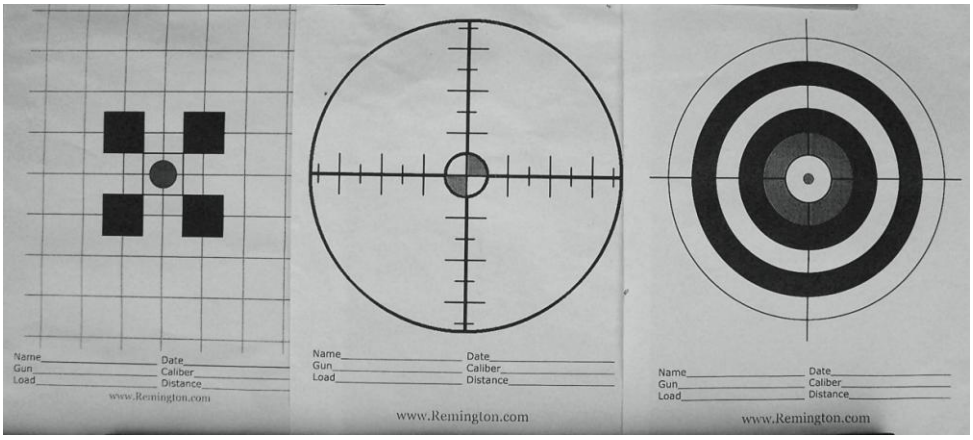

Image courtesy Remington.com ; Typically good targets have graduations in 1 MOA divisions, something that makes adjusting sights, scopes or point of aim a much easier task.
Is your point of impact is one inch off the bulls eye? Easy. Adjust your scope or aperture sight one click per ¼ or ½ moa/inch. 4 inches? 16 clicks if your scope has ¼ moa adjustments.

For over a hundred years, a rifle that shoots 1 MOA is considered impressively accurate, and it remains a good universal standard of comparison.

It has other more subtle insinuations too. If a rifle is able to shoot 1 MOA from a bench rest and then handed to a shooter, human errors can easily double the MOA. A rifle butt held too tightly can move with a shooters heart beat and easily add another one MOA, creating two oddly spaced 1 MOA groups an inch apart. Now factor in a shooter pre-flinching the recoil and pushing the rifle momentarily to the right, or in snatching the trigger, pushing the rifle leftwards, and suddenly the human factors become a challenge to overcome.
Being a shooter who can create a 1 MOA shot pattern is a skillful accomplishment even if the rifle is perfectly engineered to drill them all through a single hole.
A rifle that groups within a one inch circle at one hundred yards is so accurate that it will reveal your own strengths and weaknesses as a shooter.
The one dollar gold colored coin of USA, Australia and New Zealand is about one inch wide. That's a small space to drill a lot of holes at 100 yards.

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BLO and RLO

BLO gets a look in here for the simple reason that the term can be confusing and depending on the modifications you make you may have to refinish part of your rifle or restore the stock finish, which is either raw or boiled linseed oil.
BLO is the common abbreviation for 'boiled linseed oil'. In contrast raw linseed oil, RLO, was most commonly used prior to WW2, has slower curing times, and to an experienced eye appears slightly different, with a softer sheen on the gloss.

During manufacture Enfield wood was put through an automated process where it was dunked into large tanks of hot oil and allowed to drain in a temperature controlled environment to cure the linseed oil off.
Boiled linseed oil these days is designed to cure more quickly, and is commonly available at large hardware stores, good quality shooters supply stores, or for the very best, at art supply stores.

A brief search online for shooter's supply stores will provide sources for a variety of top quality linseed oils, or see
http://www.enfieldresource.com/3b-re-caliber-shooters-supplies
.
A note of caution; rags damp with linseed oil will get hot and possibly ignite, dispose of them carefully.

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Shims (image right) chocolate wrapper cardboard .015, aluminum can .05, copper sheet .040, A4 paper .05, brass sheet .040.

To save endlessly repeating this phrase, anywhere that the use of paper or cardboard as shim material is referred to, we're meaning everyday paper or packaging cardboard that is the densest and most uncompressible you have handy, such as comes around most grocery products.

Some placements, such as on top of the draws, best suit using sheet brass or other metal shims, and where this is best it will be pointed out.
Shim material can be lightly attached to the woodwork with a glue that won't damage the wood work and will allow the shims to be easily pried free if required. White wood glue such as PVA, or minimal use of modern

instant, one drop holds an elephant, is also okay where it won't permanently damage the rifle.

It's worth owning a $10 pair of calipers and becoming familiar with the thicknesses of different types of potential shim material.

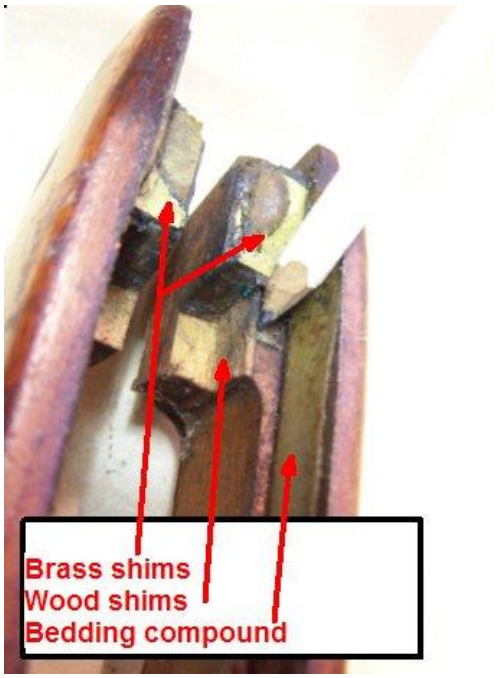

Image right; a good example of three types of shim in situ, brass to increase barrel up pressure, wood shims to entrap the receiver recoil lugs, and bedding material on the forend sides to limit receiver side play.

A recommended source of shim material of all types is hobby shops that cater to model making and trains.

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Terminologies and differences between Enfield types

To abbreviate the endless repetition of No1, No1 Mk3, and No1 Mk3* I'll refer to No1 Enfields as a catch all for all of these models, They are 95% the same rifle, with differences restricted to removal of the volley sights, and alterations over time to the nose cap, rear sight, striker knob, and magazine cut off.

The Ishapore mid 1960's No1 Mk3 2a .308, is externally a No1 Mk3 in all regards except caliber, the bullet extractor, rear sight graduations, magazine and nose cap shape.
Any changes suggested to the No1 Mk3 will apply equally well to the 2a, and any reference made to No1 Enfields includes these rifles too.

Likewise for No4 Mk1 and No4 Mk2, we'll call all of these the No4 Enfield. The difference between them is restricted to the trigger pivot/mount being changed from the trigger guard to the wrist, plus slightly heftier wood sets as the 1950's went on.
A number of No4 Enfields have been converted to .308 over the years, the difference between these and a .303 rifle is; magazine follower, extractor claw and rear sight graduations.

The No5 Mk1, or jungle carbine, has the same receiver as the No4 Enfield, so for accurizing purposes consider that the information for No4's also applies to No5's, although it is much more of an unknown quantity because it has no up pressure and a reputation for inherent accuracy problems.

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.303, .308 and NATO 7.62

The physical differences between a .303 and 7.62 formatted rifle are few, and all accurizing techniques laid out here will apply equally to both the No1 Mk3 and the Ishapore 2A, as well as rifles converted to non stock calibers.

Typically the external physical differences between an Enfield rifle in .303 and 7.62 relate only to the use of the ammunition and are; magazine/magazine follower, extractor claw, rear sight graduations.

The flight characteristics of both are very similar in the lower 2/3rds of the flight envelope, with the main observation being that the 7.62's higher velocity of 2,750 FPS will carry the 147 grain bullet further to a useful max range of 2,000 yards, compared to the Enfield's sights being for 1300 yards for the .303/174 grain at 2440 FPS.

As .308/NATO 7.62 x51mm has become such a universal caliber a great deal of contemporary information is available for reloaders and others researching ballistic flight characteristics. Refer to ammunition makers for ballistic charts.
Wikipedia has good and interesting information about the .303, 308 and 7.62 Nato.
http://en.wikipedia.org/wiki/7.62%C3%9751mm_NATO
http://en.wikipedia.org/wiki/Ishapore_2A1_rifle
http://en.wikipedia.org/wiki/.303_British
More information coming soon; http://www.enfieldresource.com/3087-62-explained

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Determining the rifle's axis

Sometime you'll have to find the axis of a rifle accurately, most often when mounting aperture sights or telescopic sights. Getting this right can be a lot more of a hassle than you'd believe, because almost nothing on a Lee Enfield is straight or level.
Surfaces perhaps meant to be horizontal are often not because of the variable quality of a wartime work force, and the progressive wear on machinery making not a hundred but millions of parts.
The longitudinal axis is through the middle of the barrel, and is usefully worked with by sliding a dowel or cleaning rod that is nearly the same diameter into the bore. It will protrude at both ends and stay on the axis, a useful general purpose reference point. If your cleaning rod is a thinner diameter simply roll some paper masking tape around it fore and aft until the diameter is close to the bore size.

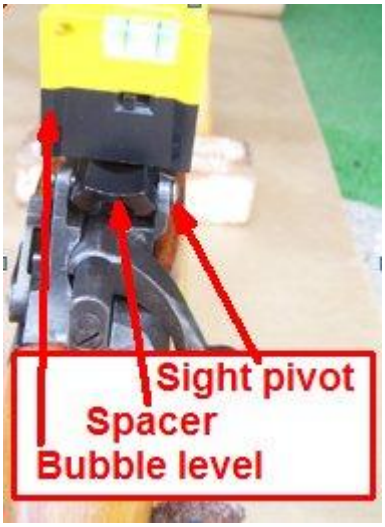
The two other axis, horizontal or left/right, and the vertical axis, can be more a challenge.

Image; Using the No1 Mk3 sight pivot.

Parts of the rifle which at first glance appear to be useful as a flat and square surface that a small bubble level can rest on are; the flat on top of the barrel reinforce/front of the receiver, across the top of the No1 mk3 rear sight protector, across the front sight ears, the tops of the charger bridge. However, when compared side by side every one of my Enfields is different across those surfaces. You also could set a bubble level flat across the receiver flat area, and the result will still be a telescopic sight aligned crookedly.

Old Timer's trick; rear sight axle as a datum point

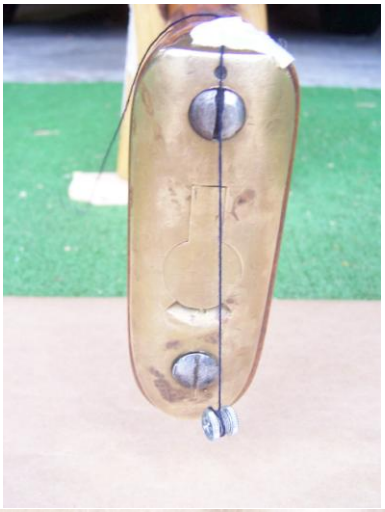
The axle of the rear sight is one most strived to keep accurate during manufacture, the rear sight has to be exactly vertical to the bore, or the point of impact will be offset, and accuracy spoiled.



Method

- Remove the rear sight.
- Put a rod or dowel through the pivot holes.
- Rest your bubble level on the rod and roll the rifle until level.
- Once you have it level check other surfaces for an easier level, such as the flat in front of the receiver, and thereafter you can use that surface without having to remove the sight.

Old Timer's trick - image; Plumb line through the slots of the butt plate screws. This can be a very accurate line also, once verified by using the sight axle method. It can have issues though, as the photo shows. This rifle is a Parker Hale No4 and a previous dedicated target shooter has canted the stock for better stance when shooting.

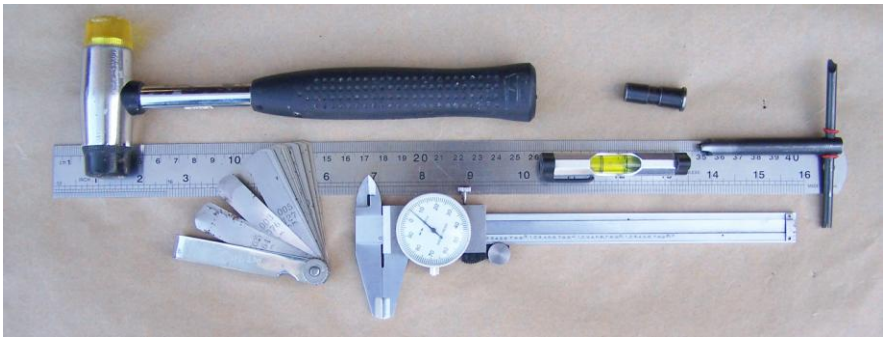


Bubble levels, a cautionary tale.

You'll end up using a bubble level regularly. A note of caution is that they are not all created equal, and this image you can see that every bubble is in a different place despite being on the same horizontal surface. There's no way to get around this, except perhaps with top quality equipment and make sure they all read the same when you buy.

Tools

In addition to the usual hammers and screwdrivers, a few of the right tools will go a long way in your accurizing work and don't have to be expensive.



Image; from left, steel rule in metric and imperial/straight edge, soft face hammer, feeler gauge, dial calipers, bubble level, NoGo gauge, bolt tool.

In addition, a small hard face hammer, narrow punches, a screwdriver tip set, and a Dremel tool will get used constantly.

The global Lee Enfield community - Enfield Resource.com

The single most comprehensive and useful links collection which connects you to the global Lee Enfield community is my own site, Enfield Resource.com. This is an active cornerstone site, with 165 links, 600 images, videos, and the global growth of interest in the Lee Enfield adds as much as 10 or more new links each year.

Main types of links to be found are;

- Rifles, parts, reproduction parts and accessories
- Forums and survivor polls
- Markings, reading and organizations
- EBay sellers and gunsmiths
- Gun shows, classified ads and gun auctions, No Go
- Ammunition, re calibered Enfields and conversions
- New Enfields, shooters supplies
- Sniper rifles, parts and information
- 100 video library
- Alphabetical quick find
- Aperture sights visual library
- Community notice board (free)

http://www.enfieldresource.com/

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Image; top – 1955 No4 Mk2, bottom 1944 Longbranch 5 groove No4 Mk1

Chapter Two - Your Rifle

Introduction

If you're creating an accurate rifle and want to remain within shooting competition specifications it's not possible here to tell you what rules apply to every shooting contest situation you're likely to encounter because there are many variations between clubs and countries. Shooting rules you're likely to bump into at a club or range level are usually 'run what ya brung' and in the nature of a friendly fun shoot.

Shooting events that reach outside your local club or shooting range can involve shooters from other towns, cities, counties and even countries. In order to have all the shooters on the same page, more exacting rules have to be drawn for all to conform to.

For the most part you will be safe to assume that if your rifle is in the configuration that a solider would have received it at the time of the year date on the rifle you will be safely within the rules.

In between stock configured rifles and all out target rifles there are degrees of changes that have been deemed to be acceptable over the years by governing bodies such as the NRA in the UK.

One of the stand out modifications that are acceptable that would automatically seem to be breaking the rules is that changing the stock barrel bedding to mid bedding on the No4 Enfield is acceptable to the NRA UK.

And …sometimes aperture sights are okay and sometimes not.

I can only recommend that you find and study the rules before proceeding to make permanent changes to your rifle.

Conveniently you can make also just make changes to parts that can be taken off and replaced with stock units later, and in that way you can evaluate various methods and revert to 'as issued' when you need to.

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Stock rifle tuning

Now that those cautions are out of the way here are the basic elements that must be correct for a stock Enfield to shoot its best.
Enfields usually conform to these parameters when new, but not always, and after fifty to one hundred years, it's pretty much inevitable that a well used Enfield will not conform to all.

Check list;

For best accuracy a stock rifle must have;

- A firm and equal bearing and fit between the fore end base and the wrist face.
- A firm and equal bearing between the forend draws and the recoil lugs of the receiver.
- An equal bearing between the bolt recoil lugs and the receiver.
- The barrel must be centered in its channel.
- The barrel must have the correct for the type amount of up pressure at the muzzle.
- The headspace must be set correctly.
- The trigger guard must be accurately fitted and not warped.
- The butt stock must be tight and correctly fitted.
- The nose cap (No1 Mk3) must not have front sight/nose cap contact, or be in a warped position.
- The No1 Mk3 front hand guard must not touch the rear sight.
- The No4 front hand guard must not touch the front sight.
- The trigger guard must provide proper up contact to the forend.

As we go down our list in the next chapter, each of these will be examined to best accuracy standards. For instance, the forend to wrist face contact has a factory acceptable clearance of .010 thousands of an inch, however the forend does its best accurizing job of bracing the receiver and barrel if that interface is zero, so we look at ways to confirm that your rifle has the best and most accurate fit possible.

Target rifle tuning

This is a sample check list of the core modifications I would make to a no holds barred rifle project seeking accuracy;

- Barrel fully floated from reinforce forward to (b) …
- (b) … Depending on what type of Enfield, choose a barrel bedding method.
- Bedded and reduced area barrel reinforce bearing.
- Bolt - new spring and firing pin.
- Bolt and bolt channel polished.
- Bolt internals polished and anti rotation washers installed.
- Bolt recoil lugs with even contact on receiver.
- Chamber polished to original specs.
- Extractor spring reduced for light action.
- Forend rear cross wire and wood reinforced.

- Forend squared and tight fit to forend/wrist interface.
- Head space correct, slightly tight.
- Lead shot in butt stock.
- Receiver locating dowels in forend.
- Medium to large pressure plate around main screw.
- Receiver bedded.
- Recoil lugs/draws in forend metal capped and or tight fit.
- Trigger smoothed and lightened.
- Trigger guard bedded.
- Trigger guard shimmed for 1/16ths inch rise.

* * *

Checking for internal contact

This paragraph is put here to be more certain that the information won't be overlooked.

No matter if you're accurizing to stay within as issued rules or intend to modify your rifle, every rifle should be checked to find out what contact points are within your forend and hand guards. Even rifles I thought I knew well have turned out to have unusual contact spots that hurt accuracy.
The explanation and images to do this check are on pages 90, 142, 150.

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The degree of changes you choose to apply is at your own judgment, and as always with guns, your safety is your own responsibility.

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Ammunition

Image; Case – cordite – wad - bullet

Introduction

Good practices

Developing consistency practices with ammunition will pay off in better accuracy at the range. This might sound a little unlikely and pedantic but it's a basic truth about shooting that every sort of ammo will invariably shoot slightly differently. That means that even within an identical caliber a heavier bullet flies differently than a light one, identical rounds made in different factories will shoot differently from each other, and military surplus ammo which is copper jacketed is a different shooter than the same caliber hunting round with a large soft lead tip.

If using military surplus ammunition you have the variances that are unavoidable on a WW2 mass production line, and then add factors like aging and poor storage of 50 years plus aged ammunition, and you'll find that even the best of rifles will produce random results with random ammunition.

Make it a habit of sorting through your ammo. Group and shoot them according to the most similar types.

- Sort them according to maker.
- Year if using ex military ammo.
- Bullet type ie jacketed or lead tipped.
- Bullet weight.

If pursuing best scores and accuracy, each time you go shooting record this information on each target along with which rifle you're using.

The purpose of all this is so that you can come back later and duplicate your shooting days as closely as possible. If time passes between shooting days this also allows you to more quickly get back into the feel of the rifle, rather than going through the whole sighting in process each time you head to the range.

I always end up with a handful of 303 that doesn't really match anything, so these rounds I use for getting the sights roughly on target or for friends to plink with.

Hunting ammunition

Modern made hunting type ammunition is an easy and reliable way to go shooting, although it can be more costly than surplus. The ammunition will shoot reliably and relatively accurately on target.
It's becoming increasingly common to find civilian ammunition available in 174 grain, 150 grain and .303 BT, or tapered, 'boat tailed' and the boxes will be so marked.
Soft tipped hunting ammunition generally shoots as accurately as surplus .303. Surplus ammo that has had its tip shortened (dum dum) to create a crude expanding bullet, as shown in the rounds to the right, will fly less accurately and is not worth creating.
(As an aside, the term 'dum dum' originated with soft lead, and hollow point mushrooming .303 ammunition that was made in the 1880's at the Dum Dum Arsenal in India. (wiki) It was banned in 1899 under 'rules of war' for its terrific wounding capacity, which led directly to the world wide development of long nosed bullets with a rearward center of gravity, whose own capacity for severe wounds probably exceeded the banned type.)

Military ammunition

The stock Lee Enfield ammunition is a flat base, 174 grain, full metal jacket, with a rimmed cartridge. It's considered to be a powerful soldier's bullet which will penetrate over yard of hard oak.

Internally the .303 bullet has spacing material in the nose, and is designed with a rearward center of gravity. Although rumor has it that this was designed to create terrible wounds as the nose of the bullet slowed and the rear flips sideways, it's also likely that the rear center of gravity was required to keep a long tapered bullet stable in the rifling.

Military surplus ammunition is a mixed bag of the very good to the bad and downright dangerous. Good condition milsurp ammunition will have clean shiny cases. It can often be found with the military fully jacketed bullet removed, a soft lead tipped bullet installed, and then repackaged as hunting ammunition.
There's nothing wrong with using this ammunition, just check the cartridge base for a year date, a military standard, and remember that dates before 1960 can have corrosive primers and the rifle therefore requires prompt cleaning, preferably a flush with hot water, soon after shooting.

Old Milsurp

Poorly aged ammunition should be disposed of safely, either left at a firing range with the range officers, or if you're into reloading, the bullet and cordite can be pulled and the primer deactivated with engine oil left in the case.

Image; In this group only the clean one at the lower right is suitable to shoot.

Cheap military surplus ammunition keeps appearing on the market that has been stored in the worst of conditions. It will be externally corroded and the cartridges require wiping down before they're fit to be used. If you have ammunition like this be skeptical about using it.

Discard any cases with corrosion, dents or leaking primers.

In addition to corrosion, old brass becomes brittle, and splits at the neck or on the body are somewhat common. Splits at the neck won't do any damage and splits in the body are usually well contained by the rifle, but do not take chances with old ammunition. Dispose of anything suspect.
Fire single shots, checking the bore each time, until you're certain they are firing reliably.

Any ammunition that goes pop then bang is both useless and dangerous, and you should always look in the bore to make sure that the bullet is not lodged in the barrel after pulling the trigger.
Poor quality military ammunition will have varying velocities and consequently put its shots all over the place, and there's little point in using it for much of anything.

If you have a lodged bullet never, ever try to shoot it through, a catastrophic failure with injury is likely to be the reward. It needs to be driven through by hand with a strong cleaning rod.

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Berdan and boxer primers

A great deal of old military ammunition, but not all, used corrosive Berdan primers. These have two little offset flash holes that fire into the propellant. Because these holes are offset it's not possible for a regular primer remover to access the holes and push the used primer out, and this simple problem is the main reason Berdan primed brass is not used for reloading. If you're into reloading or recycling always check the brass and discard the ones with two primer holes for recycling.

Berdan Boxer
Note the relative cleanliness of the boxer case.

There are ways to remove Berdan primers with water and a plunger, so if you're in a pinch or just want to do it I won't completely discourage you. Berdan primers are no longer as common as they used to be, and the user information is online, just search 'removing Berdan primers', or refer to Wiki Pedia.

Military ammunition accuracy

All other factors being equal, hand reloaded ammunition will generally shoot 1 MOA while milsurp will shoot 2MOA, therefore custom made ammunition offers good gains. NRA competitions where the rifle has to be in as issued condition will also only allow commercial or milsurp ammunition.
It's worth remembering that even well made, good condition military .303 ammunition often makes one in ten rounds a flier, or land an obvious distance such as 8 inches or more from the others. It's not poor shooting, this time you really can blame the ammo. For a laugh shooters often say we ought to have a shooting rule for milsurp ammo that allows you to make a 6 shot group and then remove the single wide shot from the score, and that would be a realistic compensation for 50 – 100 year old equipment.

A last comment that must be repeated is that most older military ammunition used chemicals that leave a corrosive residue in the barrel. Your barrel can show rust the same day after shooting. Luckily flushing your barrel with hot water, and oiling, is a quick and easy solution.

Reloading

Reloading produces good results in Enfields, but because this book is about accurizing your rifle, and other sources exist for good reloading data, we're going to stay away from reloading as a detailed subject, excepting to say that reloading for accuracy is worthwhile and that many serious shooters do reload.

If buying ready made civilian issue ammunition it's becoming more common to find different bullet weights available. A non military bullet weight that reportedly exhibits good accuracy in Enfields is the 150 grain, compared to the 174 grain which is the standard military issue.

Bullets with the same basic 'square end' or flat base of the military bullet seem to be the best choice for Enfields. They provide a good surface area for the rifling to engage but are however a high drag bullet, with that flat base causing a turbulent low pressure area that pulls on the bullet in flight like a car with the emergency brake half on.

More information; Courtesy of Milsurps forum,
Reloading data for .303
http://www.milsurps.com/showthread.php?t=20515

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Ballistic Charts
Ballistic and trajectory charts can be very interesting and at the same time this information is as not as commonly found as it once was, due no doubt to the (temporary, haha) decline of the .303 in popularity.
Online forum members can often help with this information, and a good internet source of such information are the ammunition makers and reloading companies, who publish this sort of data for all of their bullets.

They all belong to SAAMI, the Sporting Arms and Ammunition Manufacturers Institute, and a comprehensive list of members is at Wikipedia;
http://en.wikipedia.org/wiki/Sporting_Arms_and_Ammunition_Manufacturers%27_Institute
Search for; 'ballistic chart' plus 'Remington, Hornady, Winchester, or Browning'.
Ballistic info link at Hornady for .303 British.
http://www.hornady.com/images/ballistics/ballistics_charts.pdf

Ballistic info link at Hornady;
http://www.hornady.com/images/ballistics/ballistics_charts.pdf

Ammo Description			Velocity (fps) / Energy (ft/lb)						Trajectory Tables					
CARTRIDGE	BULLET	ITEM #	MUZZLE	100 yds	200 yds	300 yds	400 yds	500 yds	MUZZLE	100 yds	200 yds	300 yds	400 yds	500 yds
C 303 Bristish	150 gr. SP InterLock	8225	2685/2401	2441/1984	2210/1627	1992/1321	1787/1064	1598/851	-1.5	2.2	0	-9.3	-27.4	-56.5

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Boat tail or tapered bullets
Reports from shooters who have tried surplus boat tail bullets, which were more often used in machine guns because their tapered base produces less of a low pressure zone, hence less drag and significantly longer range, sometimes don't digest well in a 303 rifle, with either poor accuracy or bullets that tumble.

The culprit seems to be that the tapered bullet has less of its length available to bite into the rifling. The owners of rifles that make boat tails tumble invariably report they have worn rifling, particularly at the breech, so it's likely a combination of factors. If you have tumbling bullets try different ammunition types.

Conversely if you have a barrel in good condition boat tail bullets can be an interesting experiment, although actual accuracy gains over stock shapes might not show up. If it's cheap to buy, and shoots well, it could be good plinking ammo.

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Bullets and the bore – tight or loose?

Reloaders have the option of choosing bullet sizes that increase or decrease over stock by small increments. This can be done to compensate for a worn bore, or to shoot with a tighter or looser bullet in a pursuit of accuracy.
Generally speaking, and there are plenty of exceptions to this, but roughly speaking, Enfields best digest bullets that are in the mid range of sizes available. Usually it is the slightly tight bullet batch, or the slightly loose batch that creates more flyers than mid range bullets, so in the pursuit of more reliable accuracy mid ranges are the right place to start.
Enfields have been released from the factories with a great deal of variation in the sizes of the bores, and yet still shoot well.

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Rim thickness

In the Lee Enfield heyday serious shooters also carefully sorted their ammunition according to rim thickness. Ammunition is usually reliably manufactured, but there are always slight variances.

The Australian aperture sight company Central used to make this nifty device that measured the cartridge rim and allowed deviations to be quickly measured. Each round would be grouped into similar sizes of rim and only shot through in those groups.

This is all about creating uniformity where ever possible.

If you set your sights for the first three rounds, get them spot on, and the next round has a thicker rim, making tight headspace, that shot can easily land high or low outside the previous group, and yet, if that same thick rim cartridge was in a similar group all those shots would land together, and ideally where sighted. It's all about ensuring predictability.

Is it necessary to own a rim gauge these days? For most of us shooting at a sporting club level probably not, but they are neat to have and it's always nice to have a bit of an edge. I keep one in the kit.
Central Rim Gauges show up on eBay for around $50 (2011), or sites such as GunBroker.com, but are no longer made by Central.

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'Chamber Inserts' or alternate temporary caliber/s

Alternate calibers can often be used in a stock Lee Enfield by using what is called 'chamber inserts'. This is a turned down metal tube that is the shape of the .303 cartridge on the outside, and the alternate caliber cartridge shape on the inside. It is a drop in fit into the stock .303 chamber.
They often come for sale on eBay and through Enfield parts dealers. The purpose is primarily cheaper shooting, usually with pistol calibers. Accuracy is slightly sacrificed, and at the moment, 2011, the chamber inserts that are available are for calibers that are not always common or cheaper than milsurp .303.
Examples of discussions you can find on forums are about 'inserts for 32 ACP', (automatic, colt, pistol), '7.62 x 25'.
The duel advantage is cheap shooting, and with the lighter recoil from lesser caliber they can be ideal for shooting training. They also suit smaller indoor ranges where big bore is not suitable.
As something interesting with potential, these are something to consider, perhaps as a way of relieving a long snowy winter with a little basement target practice.

For chamber inserts; http://www.enfieldresource.com/3b-re-caliber-shooters-supplies

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Other caliber rifles – new Enfields and kit set conversions

Another option is shooting with Enfields fully converted to different calibers such as .223 or 7.62 x 39. These are the cheapest ammunition in 2011, with 1,000 rounds costing under $100 US.
There are several businesses who can convert your rifle, or supply a kit for you to do it, notably in 2012 , 'Special Interest Arms' in the US.
Link at; http://www.enfieldresource.com/3b-re-caliber-shooters-supplies

In addition there are several manufactures who make new Enfields in .223 and other calibers, such as AIA and Armalon.
Link; http://www.enfieldresource.com/3b-re-caliber-shooters-supplies

For technical articles on converting eg a No4 to .223 yourself try; Surplus Rifle.com at; http://207.36.233.89/index.asp

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Miscellaneous facts about the .303.

The .303 Mk7 174 gn FMJ cartridge, despite its curved flight path compared to modern flat shooting small caliber rifles, was always considered a powerful bullet on the battlefield with a strong 'knock down' ability.

The 1914 'Field Service Pocket Book', issued to every British soldier for WW1, states the following penetration results for .303 Mk7;

- Mild steel plate – ¾ inch
- Sandbags – 18 inches
- Water – 24 inches
- Sand, loose – 30 inches
- Hardwood, oak – 38 inches (!)
- Earth - 40 inches

Image; shown full size – 3.027 inch.

Hunting ammunition is often available in soft point 180, 200 and 240 grain. Good accuracy is often reported from 150 grain, and this weight is also generally available as commercially made .303 at sports stores (2011).

- Turning one time in 10 inches of rifling, with a muzzle velocity of 2440 fps, a .303 bullet spins at 176,400 rpm.
- A .303 bullet has a diameter of .311, and the depth of the groove in the rifling is .316. The .303 number is measured across the high spots of the rifling.
- The muzzle velocity of military full metal jacket (FMJ) .303 ammunition is 2440 fps, the weight is 174 grain and the ballistic coefficient is variously reported as .400, .411 and .499.
- Chamber pressure generated by the milsurp .303 Mk7 cartridge is 45,000 - 50,000 psi.
- A .303 rifle sighted for 25 yards will also be aligned for 300 yards, and have a rise at 100 yards of 6.5 inches.
- The metric description of .303 is; 7.7 x 56R, ie 7.7mm x 56mm, R = rimmed.

In the event of a case failure, or good things to know.

If a cartridge case fails, either through age, fatigue, excessive reloading or metal flaws, there is a cloud of gases under 45,000 - 50,000 psi that is going to escape.
A total failure is not common, however cracks appearing in the side of the case of old ammunition is not uncommon.

Image; personal experience with ammunition purchased at a gun show. Probably old, brittle brass.

The good news for owners is that normally Lee Enfields cope with this fairly well.

A large amount of gas escapes through the holes drilled to the left of the receiver. If you have fingers over this hole when this happens, expect to require first aid, a lot or a little, depending on if you entirely covered the hole or not. Gases under those pressures cut like a knife, and will remove leather and flesh easily.

The moral of the story is Do Not Ever cover those holes while shooting.

Another escape path for the gases is down the slot where the nose of the bullets come up out of the magazine. This results in the magazine blowing off harmlessly onto the ground.

The good news for Lee Enfield owners is that they are designed well, and unless there is some other associated metal failure, escaping gases are directed away from the shooter's face.

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What a Drag

Muzzle velocity declines with distance as a result of air resistance and drag from the low pressure zone at the bullet's blunt end.
At;

- At 100 yards speed is 2200 fps
- At 300 yards speed is 1800 fps
- At 600 yards speed is 1350 fps

Bullet drop for a rifle bore sighted to 100 yards, ie completely level.

- 100 yards = 3 inches
- 200 yards = 14 inches

- 300 yards = 33 inches
- 400 yards = 62 inches
- 500 yards = 108 inches

The Wikipedia page about the 303 bullet makes for interesting reading;
http://en.wikipedia.org/wiki/.303_British

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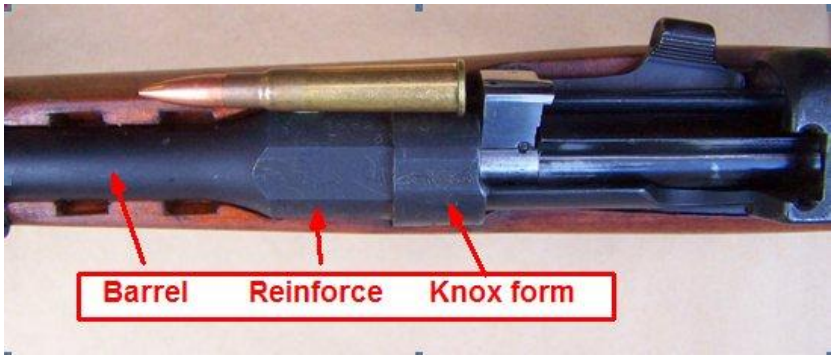
The Barrel

Image; top – No1 Mk3, bottom – No4 Mk1

Introduction
The No1 Enfield has long been considered to have a light and excessively flexible barrel. The designers became aware of this shortcoming early on and the No4 Enfield design specifications in 1926 called for a heaver and stiffer barrel, even if it meant a slightly heavier rifle.

When it comes to barrel accurizing it is the No1 that has created the most coverage because there are so many ways experimented with over the years to improve it. The No4 barrel has experienced less modification as it's a decent barrel as is. It's not because writers and shooters forgot to address the No4 in this way.

Standard No1 and No4 Enfields are designed with partially floating barrels, and incorporate slight up pressure at the front of the fore end. The more rare No1 Mk5 1922 and No1 Mk6 1930 Enfields also have barrel up pressure, but the No5 Mk1 Enfield, the jungle carbine, has a fully floated barrel. The Ishapore 2a .308 has the same barrel design and up pressure as a No1 Mk3 in .303.



Target rifles over the years, generally speaking, developed comprehensive bedding methods for the No1 rifles, and in contrast, different floating styles for the No4.

A floated barrel means that there's no contact between the barrel and the surrounding wood of any kind, either light as a feather or a firm contact. Even light contact between the barrel and wood, such as grains of sand, can disturb the barrel's internal harmonic

vibrations as the bullet is traveling down its length. Slight contact from the fore end can send bullets left or right if the wood is making the opposite contact internally.

Is the barrel floating properly?

In most Enfields the close fit of the forend means that it's difficult to know for sure if the barrel is touching the wood where it shouldn't, or perhaps that debris has worked its way under the barrel. The clearances between barrel and wood can be just a few thousandths of an inch, and you need a way to check in the places you can't see.

Solution

Set your rifle in a stand, remove the hand guards but leave the forend and trigger guard in place. Cut a strip of paper about 3/4 inch wide and 4-6 inches long, insert it under and around the barrel in the channel and pull it to and fro as you slide it along the length of the barrel. Any place where there's contact will be instantly noticeable.

To correct this condition first check that the barrel is correctly centered in the barrel channel. This can be a simple visual check or if you prefer greater accuracy you can insert shims on each side and measure their thicknesses.

If the barrel is not resting in the center of the barrel channel you must check;

- Firstly that the internal recoil lugs of the forend wood are resting with equal bearing on the recoil lugs of the receiver.

If they are making proper contact;

- Next, with a feeler gauge, check that the forend contacts the wrist face in an equal manner on its left and right side.

If these points are all making proper contact your barrel should be right down the center of the barrel channel. If it is not you may have a warped forend. As an organic material the forend can change shape, especially if the rifle has been laying on one side in the sun.

- If your fore end is making proper contact on the wrist face and recoil lugs but the barrel is still making contact, then examine the barrel channel for high spots and remove excess wood with sandpaper or other tools as necessary.

If you have a warped forend you have limited choices.

- If you're sure that the warp is permanent, not from a temporary heating source, and is not excessive, you can open up the barrel channel with common wood working tools.
- Sometimes the wood can be brought back to its proper shape by replacing the oils that have dried out by soaking it in BLO, or boiled linseed oil.
- You may have to replace it. Forends are not expensive and easily located. For Enfield parts sources worldwide the website www.EnfieldResource.com also has extensive links for Enfield parts.

Other aspects of the No1 Mk3 floating barrel

In addition to the importance of the No1 nose cap to not foul the front sight an often overlooked element is that the front hand guard must not contact the rear sight or the rear guard arms.

Because the front guard is clamped to the forend by the mid band and the nose cap, it must not directly contact the barrel or the barrel harmonics will be disrupted. Enfield knew this and the front guard is made wider than the rear sight base, and the arms are slightly shorter than need be, so that it makes no contact with the rear guard.

Image; properly set up, note the equal gap both sides of the sight base, and no contact with the rear sight arms.

If your front guard wants to twist and make contact with the rear sight base you can make small cardboard shims for under the mid band and install them on the opposite side of the contact. As the band swivel screw is tightened it will push the guard away from the sight.

Image; a common sight, contact on one side.

Solution, shims under the guard.

If the front and rear guard arms are making contact they can be slightly shortened, or check that the rear guard may have simply moved forward under recoil and can be moved back.

This same issue of barrel contact also means that the curled tips of the rear guard springs must not contact the forend, and can be straightened with pliers, or cut shorter.

Enfield 4 and 5 and 6 groove barrels

Lee Enfield rifling is not deep compared to some rifles, but even if the barrel is not new and shiny, the ridges should be clearly visible the whole length of the barrel, with no pits from corrosion. The rifling should be visible from the chamber where the bullet enters, all the way to the muzzle where it leaves. A lot of wear accumulates at each end, and the bad news is this is the wear that most affects accuracy.

Enfield 2 groove barrels

Commonly found on random batches of Enfield No4 Mk1's made in the US by Savage and by Longbranch in Canada, a barrel with these wide grooves looks unlikely to be a candidate for accurate shooting and yet it is common to find that they shoot as well as most enfields, and some are surprisingly accurate. If you bump into one you like don't be put off by the odd looking rifling. So long as it's not worn out, and is clean and shiny or will clean up, go for it.

How do they compare for accuracy?

Over the years different shooting teams have concentrated on different numbers of grooves in their competition rifles, but overall neither 2, 4, 5 or 6 groove barrels have stood out head and shoulders above the others, with the great majority of competition shooters staying in the mid range of 4 or 5 grooves.
It is most likely that when one finds a rifle that shoots better than average that it's a combination of multiple supportive factors that makes the difference rather than the number of grooves in the rifling.
The one thing that does make a difference is the degree of wear and tear. Some Enfield No4 Mk2's still show up for sale in new unfired condition, and its well reported that these are an accurate rifle right out of the box, 1.5 MOA, which begins to give its best accuracy after 500 rounds.

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Ascertaining wear on the barrel

Before progressing to accurizing techniques, the first thing to do is to get an idea of the state of wear of the bore on your rifle. Your gains will be limited if the barrel is at or near the end of its life.
To get an approximate idea of the wear on the muzzle end take a stock round of .303 and position it nose first into the

Image; Top – worn Lower – good, little wear

barrel. A stock military bullet is .311 in diameter at the case mouth. The brass of the cartridge will stay back about 5/16th inch from the barrel if the rifling is in new condition, and if it is well worn out then the bullet will slide all the way in so that the brass cartridge case rests against the barrel.

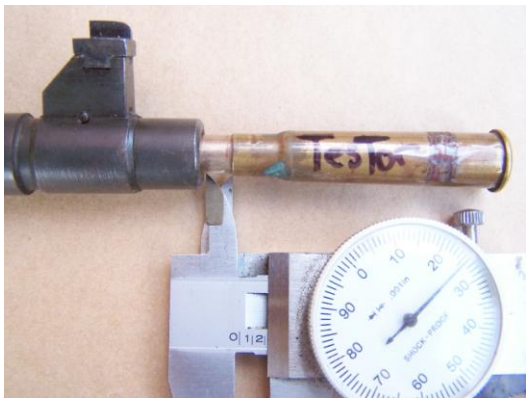
This would mean that as the bullet reaches this part of the barrel that the rifling is not cutting into the bullet's sides, and that it's essentially running in a smooth bore at this stage. It's not hard to see why this affects accuracy so much.

Obviously this doesn't measure the wear in the rest of the barrel but if the muzzle is worn you can fairly safely assume that wear has accumulated in other places too.
Enfield rifles for sale that test as little worn or near new with this method are to be found everywhere, probably as a result of the many FTR, or 'factory thorough repair', programs that took place at varying times over the years. It's not surprising to find a 1918 Lithgow fitted with a 1942 barrel or even a 1953, as Australia embarked on comprehensive FTR programs at these times.
If you find a rifle where the case reaches the barrel, there's not much left to be done except replace the barrel. Enfield's can still shoot decently with this kind of wear but it will be the exception rather than the rule.

If the bore is well worn at the muzzle its safe to assume that it's well worn in the chamber area too, and therefore either not much of a shooter, or of a limited life.

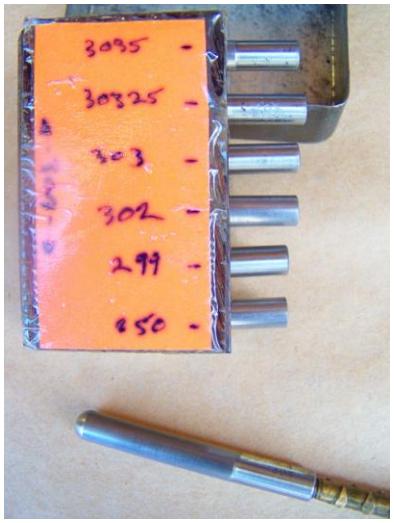
Test bullet

The bullet in the bore test is such an easy and portable one that it's a good idea to have one set aside for this purpose. Choose one that you prefer and stick to using this one. The reason is that even military bullets have variations in their profile and will go into the bore differently. If you use different bullets you'll get different results each time, stick to one.



The muzzle will only reveal half of the wear. Look into the breach end and see if the rifling fades up from nothing and becomes normal looking about 2-3 inches further in. This throat erosion is from the hot gases and there's nothing a shooter can do to prevent this, and nothing can be done to rescue the barrel. Once the rifling has gone you have no choices left.
A shooter being resolute in their search for accuracy would pass on a rifle with throat erosion because a bullet that is not instantly stabilized by the rifling will not be an accurate one. A hobby shooter might see it differently as there can be some significant and satisfying shooting life still to go.

However, Enfields are famous for having the last word, and if your bullet enters the barrel completely and the rifle shoots a reliable group size with few strays, then you have a good shooting rifle, but the caveat is that its lifespan is not long for this earth. It becomes a question for you to address what to do next. A rifle like this will suit simple accurizing techniques but it's probably not worth getting into the serious modifications, if you go ahead you'll still have a rifle with a limited lifetime.



Image; Bore gauges as shown here are the best way to get an understanding of the wear along all parts of the bore. They attach to the end of a cleaning rod and the method is to find the one that just passes and the next size up that does not. The same process is tried for the muzzle, breech and mid areas..

Other signs of wear to be alert for are**;**

- At the muzzle, a groove from the butt stock pull through cord.
- Rifling that fades to nothing at the muzzle
- Rifling erosion caused by hot gases, usually apparent at the breech end as rifling that tapers up from nothing and only really becomes normal looking 2-3 inches up the barrel.
- At the muzzle, dings and dents right on the corner of the bore will disturb the bullet. Most can be removed with files, or by shortening the barrel, not always an option.
- Corrosion in the bore can be as simple as a light speckling caused by rust stains initiated by the corrosive chemicals in the primer cap. This is easily stopped by cleaning with warm water, and usually doesn't cause deep damage but if the rifle is left uncleaned after shooting and you live in a humid as opposed to dry climate, the corrosion i.e. rust, can be visible the same day.

Corrosion like this left unattended on a rifle left in storage can cause such severe and deep pitting that it can completely remove the rifling and make it dangerous to shoot.

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Replacement barrels

With increasing time and finite spare parts available, worn bores will be an increasing problem for enthusiasts. Places to source replacement barrels are; members of online Enfield forums, online auction sites such as Auction Arms, Gun Broker, Guns America, and Enfield spare parts dealers will have them as their supply comes and goes. Numrich.com and Sarco.com (USA) often have barrels, new and used.

They are all listed at http://www.enfieldresource.com/1-enfield-parts-inventories

Some barrel makers such as Tru Flite-NZ, MAB, make target and stock profile barrels for Enfields, and we can hope that future demand will see a reliable source of replacements come from this corner of the sport.

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Barrel set up – correct up pressure

Excepting the No5 Mk1, Lee Enfields are designed with upwards pressure at the barrel tip. In the USA this method is known as 'pressure bedding', and a good technique to employ. It was written widely about in the 1930's by USA military accurizing experts.
Barrel up pressure is;

- Regulated by the wood height on the top of the rear of the fore end.
- Held in place by the main trigger guard screw.
- The wood contact at the front of the fore end puts the pressure on the barrel.

Altering this pressure to keep it within parameters is done by;

- Raising or lowing the wood height under the reinforce bearing.
- Adding thin brass shim stock to the top of the top receiver area. This moves the forend rear down and, pivoting at the main screw position, moves the fore end tip upwards, raising the pressure.
- Putting a strong shim on this area also gives the receiver a better platform to bed down on when the screws are tightened.
- By putting shim stock made of cork sheet, or cardboard, under the tip of the barrel, to increase the amount of deflection.

In old shooters books there seems no consensus that Enfields shoot better with the lesser pressure or higher at either end of the Enfield recommended range, eg, 4 lbs or 7 lbs, and I recommend that you experimentally find out what your rifle prefers.
It's common to open up Enfield target rifles to find brass shims in place on top of the drawers from previous owners who have been fine tuning their rifle.
I usually make a group with the rifle as it is, then set it for the low pressure and make another group, and then set it for the higher pressure and make another group. If it improves with higher pressures I'll move on and start fine tuning other things.
The amount of pressure is not high, and it's not uncommon to find the pressure has slackened off over time.

There are two things to consider;

- Checking the up pressure
- Changing the up pressure.

Before making changes to your forend to adjust the up pressure I recommend asking the experts at the Milsurps.com forum, and other forums, for advice.

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Barrel deflection

The deflection numbers given here show deflection with 5 lbs up pressure, and are useful if creating a temporary wedge when bedding a barrel with cut back wood.

No1 Mk3 – 3.3mm, No1 Mk3 H barrel – 3.2mm, No4 Mk1 - 2.7mm

You can see the extra stiffness built into the No4 barrel by the lesser amount of deflection.

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Check the up pressure

No1 and No1 Mk3

A No1 rifle should have 4-7 lbs up pressure at the tip of the barrel. This is established by the spring on the small stud under the front end of the barrel. When the nose cap is put on the rifle it contacts the spring, forcing the stud upwards. The nose cap is then pushed fully home and the barrel is squeezed down against the spring as it goes though the hole in the cap.

The spring also helps the barrel return to center when firing and to damp harmonic vibrations. It can soften over time, and is a cheap and readily available item. If in doubt, replace it.

Image; This shows the resting position of the barrel, it will be lifted slightly as the nose cap is pushed home and puts up tension on the barrel.

No1 Lee Enfield barrels have a partially floating design;

- There should be zero contact from the reinforce to the mid band.
- The barrel should rest lightly in the center of the barrel channel from the mid band to the nose cap area.
- At the halfway mark there is an inner floating band with a short spring to dampen harmonic vibrations.
- The deflection of a No1 MK3 barrel tip at 7 lbs up pressure is approximately .047 inch.

Because the up pressure comes from a combination of spring and nose cap there is no way to easily measure what your rifle currently has, except to replace that spring with a new item. If you're making a rifle without the nose cap, ie perhaps cut back to a sporting style, you should set the rifle up to create the required deflection and then put an exact thickness wedge between the barrel and forend wood to create this up pressure.

No4 Mk1 and Mk2

A No4 Mk1 and Mk 2 should have 3-5 lbs up pressure at the barrel tip. The stock barrel is free floating, or has zero contact, along its length except for the tip 0 -3 inches which is contacted with up pressure by a wood 'platform' at the front of the barrel channel.

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Checking the Barrel Up Pressure

Method

Checking how much pressure is required to pull the barrel away slightly from the forend is a bit of a pain for the average home shooter. Most spring style weight scales in this range are crude and inaccurate, and not so easily located. Here's a cheap and accurate cure.

Step One - First perform this to test the contact that is being made;

1) Cut a narrow strip of paper1 inch wide and 4-6 inches long. Slide it in under the barrel tip, either lengthways or crossways.
2) If you have up pressure it should be pinched between the barrel and wood and will not freely come out.

Step Two - If the paper comes out freely, indicating zero up pressure, we'll get to that next. Now we'll check the actual pressure being exerted.

1) Install the rifle upside down in a rest, and set it horizontally and securely at the edge of a bench or table so it won't fall.
2) Get a lightweight plastic shopping bag and hang it over the tip of the barrel.
3) For a weight we're going to use something so utterly common that everyone in the world can find it, and also universally reliable in weight. Use the common size 8 oz/225 ml full soda cans such as Coke. Each full can weighs .5552 lbs including the weight of the can.

Image; this is a one person set up, not as easy as with two people, ideally the barrel should be horizontal. The mid rest is contacting the knox form, don't let the barrel itself rest on the stand anywhere. The weight adds quite a bit of leverage so make sure that the butt stock is secure and the rifle doesn't fall. You are checking to see when the paper strip at the muzzle can be moved freely without being held by the barrel against the forend.

This is much easier and more accurate than trying to find and operate a spring operated fishing weigh scale, plus you get to drink the coke afterwards.

6 cans = 3.3 lbs
7 cans = 3.8 lbs

8 cans = 4.44 lbs
9 cans = 4.9 lbs
10 cans = 5.5 lbs
11 cans = 6.1 lbs
12 cans = 6.6 lbs
13 cans = 7.2 lbs

Okay, it's not totally fool proof, different countries must be thirstier than others because Coke and sodas are sold in different sized cans. If you're in a thirsty country and get 355 ml cans, it's easy enough to ask the conversion question on the internet to get the total weight of a full soda can and then multiply it through.

Anything in a food container will also do, because all food products have their weights printed on them. What you're after with this method is convenience plus accuracy of weight. Domestic spring measures are notoriously inaccurate at low weights.

Want a cheaper way? Got your own containers to use, perhaps milk? Fill them with water instead. One liter of water weighs a fraction over one kilogram or 2.2 lbs, 2.25 liters equals just over 5 lbs, which is the correct pressure for a No4, and 3.25 liters is the correct 7 lbs for a No1.

4) Add weight until the barrel comes away just enough so that the paper slips free. Easy, huh? Make a note of this number in your black book.

If you have no up pressure at all first you must investigate the fore end to make sure nothing is obviously awry and needs fixing, see paragraph on this topic below.

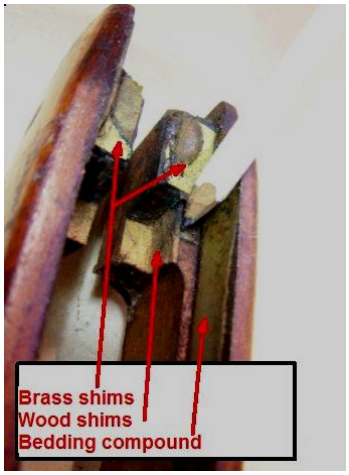
What next?

No matter what pressure you have, the name of the game is to find out how much up pressure your rifle shoots best with.
Start with the natural pressure that it already has, and then make a trial grouping with the pressure set at the lower and again at the higher pressure. This will quickly give you a guide to which region of weight your rifle will shoot best with.

To increase pressure

Up pressure can be increased by adding brass shim stock on top of the drawers area at the rear of the fore end. This causes the fore end to pivot at the trigger guard main screw and raise the fore end tip against the barrel.
The shim stock should be trimmed to size with clean edges, and not doubled over, so that there's no accidentally added thickness. The shims will stay in place while the rifle is

being used however to stop them falling astray when dismantling you can use a tacky glue that will lightly hold them in place.
Up pressure can also be raised by wedging, or packing, the muzzle upwards the same amount as the deflection for any given weight.
Up pressure can also be raised by slightly lowering the height of the wood under the reinforce. Usually this is avoided if at all possible because this fit overlaps with good receiver fit in the forend.



Image; the brass shims have been added to raise barrel up pressure and to make a more secure surface for the receiver, a variation on a bedding style. They also create a better surface for the receiver to sit on.

To lower pressure

To lower the pressure under the barrel tip the height of the wood under the reinforce has to be raised slightly, and as you do so the height of the main screw collar has to be changed too. The main screw collar/bushing height should be no more than 1/16th of an inch below the wood surface as you put the trigger guard into position.
You can put cardboard shims under the reinforce until the pressure is correct. This will guide how much height has to be built up with wood or epoxy, see next paragraph.

What if you have no up pressure, or not enough?

This is not unusual and can be mysterious to solve but it happens. Causes in addition to general aging could be;

- Warped fore end wood
- Improperly or poorly fitted fore end
- Fore end wood at wrist may not be held securely by the trigger guard.
- Bedding material such as epoxy at the front of the receiver area may not have spread out and be holding the receiver away from its proper or intended bedding position.
- Some piece of debris such as a screw or wood chip, a misplaced recoil lug shim, is similarly holding the receiver off position.
- The fore end wood may have been replaced over the years with something handy, but not ever confirmed as being well fitted.

Solution
Investigate to see if you can re fit the fore end properly. If not, replace with a good condition item. New old stock (NOS) British made No4 fore ends sell in the US in 2011 for $50 at Springfield Sporters, Numrich and Sarco, so replacement cost is not prohibitive.

Warped forend

The wood may be warped away from the barrel tip.

Solution
Dealing with warped wood is one of those difficult 'dark arts' and a thorough internet search, including Lee Enfield Forums, may give you some solutions.
You could keep the fore end and try to cure it, if it was a good color or originality match to the rifle, or if you don't have these concerns you might be better off replacing it.
Sometimes warping is caused by the wood oils drying out and can be reversed by soaking the part in BLO or RLO for several days. This image shows a well warped forend from a No4 Mk2 that was tossing its shots all over the place. It's considered repairable by steaming except that a replacement costs less than $50, so it's not worth the time.

I defer to the wood masters on Lee Enfield forums for their advice on warped wood. A comprehensive list of forums world wide for advice can be found at; http://www.enfieldresource.com/forums-survivor-polls

Trigger guard not holding forend
If the main trigger guard screw is not clamping upwards on the fore end wood firmly it will reduce up pressure. If the main screw is bottoming out in its hole it will feel tight but still not be doing its job, the fore end will be loose, and the up pressure will not exist.
Solution
Putting a spring or lock washer or two under the head will usually correct a main screw bottoming out issue, but if not the actual cause is most likely that the wood around the collar and screw has decreased in height due to either progressive crushing over time, or the oils in the wood have dried out and the bulkiness of the wood reduced. The main screw collar/bushing height can be reduced, or the fore end can be soaked in BLO to reconstitute the wood oils.

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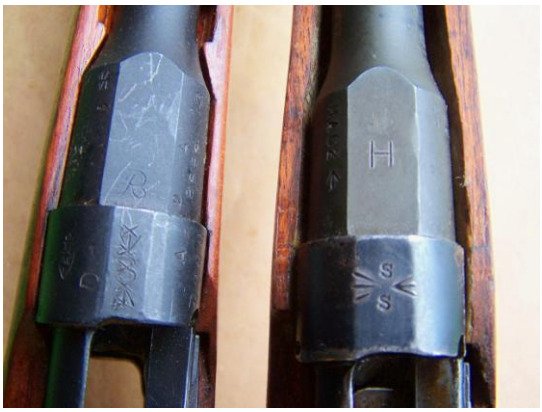
H barrels

The H, or heavy profile barrel originated early on when the No1 smle, or 'short' No1 Enfield came into wider use as a target rifle, and a ruling that governed military shooting competitions reduced the allowable barrel length of a rifle to 25 and 1/4 inch.

Many shooters with older Lee Enfields such as the Long Tom or CLLE, rather than upgrade to a new rifle, simply had their barrels shortened by 5 inches. As the original taper had not changed, it now became stiffer, weighed a little more and where the front sight would be mounted the barrel was thicker and had to be turned down to accept the front sight base.
This length, taper and step down became the pattern for H barrels.
In addition to the large H stamped on Lithgow made H barrels, this step down remains an instantly identifiable trademark of all H barrels.
An H barrel weighs 5 1/4 ounces more than the stock No1 Mk3 barrel.

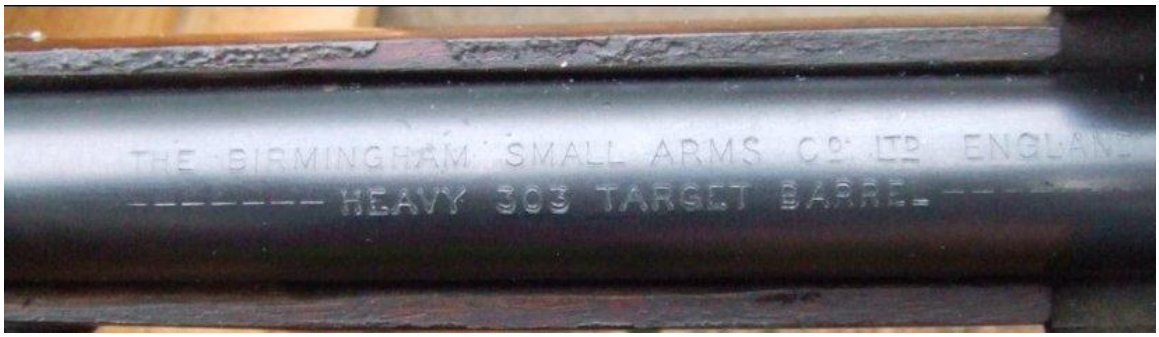


The mystery of the No1 H barrel

The H barrel was an innovation whose potential was realized by the target shooting fraternity, but strangely was almost completely passed over by the military. This may have been simply a matter of timing. H barrels became more popular after the advent of the No4 Mk1 in 1930, a rifle without barrel flexing issues, so perhaps the military thought they had addressed the problem, however millions of No1 Mk3's continued to be made after this date. Many other modifications were to be made to the No1 Mk3, so it does remain baffling that the H barrel failed to reach general acceptance.
This would have affected Lithgow Australia who made No1 Mk3's until 1955, and Ishapore, India who made the 2a .308 No1 Mk3 until 1966, and the .303 No1 Mk3 until 1988.
The advantages were well known and recognized. Lithgow made H barreled No1 Mk3's fitted with aperture sights during the 1930's for army marksmen and snipers, and during WW2 Lithgow in Australia used H barrels in scoped sniper rifles, designated the No1 Mk3 HT, H being for 'Heavy barrel', and T for 'Telescope rifle', a rare and desirable rifle these days.
The HT was known for reliable long distance sniping, and saw good service with Aussie troops during the Korean conflict.

UK sporting barrels

H marked barrels are well known as being made by Lithgow in Australia as late as the mid 50's, but earlier than those sporting companies in the UK also made other heavy profile target barrels for the No1 MK3.



Image; milsurps.com, BSA barrel

British made heavier barrels by Parker hale and BSA (shown) are usually marked 'Target', halfway along the barrel.

In some cases they have slightly different and heavier profiles than the Lithgow H barrel.

In 2011 these barrels do come for sale occasionally, but a lot of shooting has happened since the 1960's when they were last made and it's rare to find them in good condition. If you're keen to obtain one for yourself I advise frequenting an Enfield forum online and ask among shooters in the UK, Australia, Canada and New Zealand if they know of any for sale. Unfortunately United Nation's laws to restrict gun sales to terrorists do override your countries internal laws, and will impact the average shooter who might want to import or export an item like this. Be aware that you may have to do a little research and obtain import or export permits, usually not an expensive or prohibitive process but a little time consuming.

Can't Get an H barrel?

Makers of target barrels do make barrels for the Lee Enfield, it's just a matter of contacting the different barrel makers and asking. They can come in stainless steel and occasionally they won't facilitate the installation of the stock front sights as they're more intended for rifles carrying a scope. It's worth asking the barrel maker about their barrel and your own needs.

We can hope that if there is sufficient interest in H barrels it might prompt a gun barrel maker to create a run of them. Be proactive and send them emails.

Need a seriously stiff No1 Mk3 barrel but can't get your hands on an H barrel?
I'm 100% guilty of providing an alternative of my own devising; 'carbon fiber sleeving', for those who don't mind a much modified appearance to their rifle in pursuit of accuracy, or are willing to do the extra work to embed such a barrel within the guards and forend. This is my personnel 'secret weapon', mentioned previously as something never seen before on Enfields, and one that has produced good results in accuracy.

How do the H and No1 Mk3 compare?

An H barrel Enfield is a simple and reliable set up, and will reduce your target spread, under ideal conditions, and with good bedding, to as little as one inch.
And …

With good bedding and tuning, a stock barrel will also shoot as small as a one inch circle. Just to remind ourselves how small that actually is, one inch is the size of one dollar in most countries.

The 'weakness' of each are; the No1 Mk3's with fine tuning can be subject to warping as humidity changes affect the wood, and the H barreled rifles are prone to stringing their shots when shooting in the rain.
They can be quite equal performers, with the practical differences being that the H barrel can be a little more simple to get working well, and against it is the extra expense of the barrel, if available.

More Information courtesy Milsurps.com;
H barrel info
1 - http://www.milsurps.com/showthread.php?t=24581&page=1
2 - http://www.milsurps.com/showthread.php?t=29829

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The No4 barrel and 'Positive Compensation'
A little known but happy accident of engineering made the No4 Enfields an unexpected champion at long range 1,000 yard shooting, and this blessing kept the No4 at the long distance range until the late 1960's, a quite startling achievement if you compare it to the sophisticated rifles it was alongside.

All ammunition contains minute variations created during manufacturing. At the range this manifests as small variations in muzzle velocity and is one of the reasons why shots spread out from their aiming point.

Forces that act on a bullet in flight are surprisingly many. They are gravity, air resistance, drag caused by the low pressure area behind the flat base, wind, gyroscopic forces caused by 175,000 rpm spin working on a minutely offset centers of gravity, and maybe even corriolis forces working on whether the bullet rotates left or right, it's enough to make one reach for a lucky rabbit's foot.

Even if the rifle were anchored in a vice, and all human and weather factors removed entirely, these little manufacturing variations would still show up on the target as spread. If the muzzle velocity of one shot is 25 fps under the norm, and the next shot is 25 fps over the norm, and one is exactly on the standard 2440 fps, you will have three shots landing in three different places. Logically enough they land low if the muzzle velocity is a little low, and high if the velocity is a little high.

On the No4 an additional, almost magical, factor is also at play. Each time the trigger is pulled the explosion creates shock waves inside the metal of the barrel, known as harmonic vibration. In an Enfield a number of these barrel vibrations create effects on the bullet in the vertical axis, and the positioning of these vibrations at the moment the bullet leaves the barrel has a significant affect on the bullet's flight path.

Happily for the No4 rifle, when a round is fired whose velocity falls on the low side, the vibrations make the bullet exit with a slight upward tendency. When a bullet is fired with a slightly higher velocity the vibration makes the bullet leave with a slightly lower tendency. The magic result is that the variations in bullet velocity cancel out and no matter what the variations the bullets arrive at the same point 1,000 yards away.

For the shooter this means that long distance shots, even with mass produced ammunition as used in a military shoot, can be very reliably sighted in.

The effect is called 'Positive Compensation', and can be read up via numerous postings on the internet.
Some postings suggest that the effect is not limited to the No4, but may also affect the No1 rifles.
This has been a much discussed topic over the years and can be found in 'The Lee-Enfield Rifle' by Major EGB Reynolds, or by searching online under 'Lee Enfield, positive compensation'.

More information courtesy Milurps.com
Fitting the barrel to the receiver
http://photos.imageevent.com/badgerdog/generalstorage/peterlaidlerpostsleeenfieldforums/Breeching%20Up.pdf
Making of the No1 and No4 barrel
http://photos.imageevent.com/badgerdog/generalstorage/peterlaidlerpostsleeenfieldforums/Barrel%20Manufacture%20and%20Alignment.pdf
Positive Compensation and long range work
http://www.milsurps.com/showthread.php?t=29167&page=1

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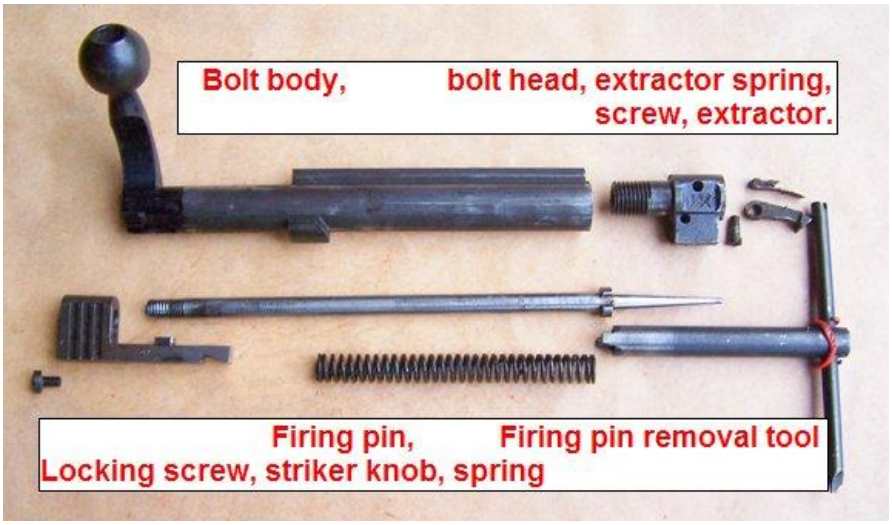
The Bolt

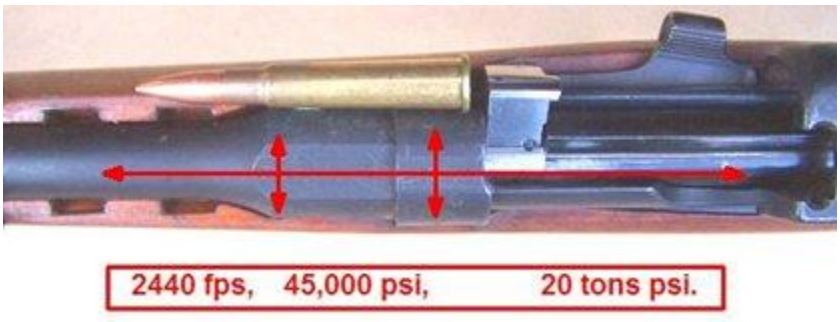
Introduction
The bolt is one of the crucial parts that create accuracy in the Enfield rifle, and all of its components must work well to make their contribution.

The bolt should fit in its channel with little slop or free play, move freely in its travel, move freely in its travel with side pressure from the bolt handle, have proper head space, smoothly pick up a cartridge from the magazine, not bind when extracting a cartridge from the breech, and most importantly, bear evenly on its recoil lugs. The firing pin should strike the cartridge quickly and firmly, with as quick a time in movement after pulling the trigger as possible, called ‘lock time’.



The equal bearing of the recoil surfaces is a little more important on Enfields than other rifles because the shock of recoil is carried by lugs that are located towards the rear of the bolt, ie a rearward locking bolt. (A Mauser type bolt has forward locking lugs inside the knox form.) This leaves the long body of the Enfield bolt liable to slight flexing movements as it carries the shock and pressure.

The cartridge generates 45,000 – 50,000 pounds per square inch pressure in the chamber, and the rearward thrust generated on the bolt head is approximately 20 tons per square inch.



If the exterior of the cartridge has been coated with an uncompressible liquid such as oil, water or grease, the cartridge loses a lot of its friction and grip with the chamber wall and the rearward thrust on the bolt rises dramatically.
Rapidly increasing head space is a sign that the bolt is carrying too much recoil.

The single most important item to accuracy is whether or not the recoil lugs are bearing evenly against their stops. When rifles are newly made and the bolt has its serial number stamped you know that it has been matched to the receiver for even bearing pressure. This is the single most important reason why Enfield bolts are serial numbered to the rifle, and a good reason to look for matching serial numbers on rifles.

Over the years it has become more common to find target rifles with bolts whose serial number does not match the rifle. This usually came about because the owner has taken the time to locate a bolt that is a tight fit in the channel, and because it shoots more accurately.

For peace of mind, or if you have a rifle with a non matching bolt and are concerned about accuracy, then a check for even bearing pressure has to be made.

Note; If a bolt is not bearing evenly, one lug will carry the whole load and the bolt shaft can crack diagonally in half across the area of the lugs, or shear off one recoil lug. Several recorded failures of this type were not catastrophic or caused injury, but uneven recoil lug contact is one topic you don't want to take for granted.

Image; courtesy of Milsurps.com, an example of just one recoil lug carrying all of the thrust.

The bolt has several key components;

- The detachable bolt head which determines the headspace.

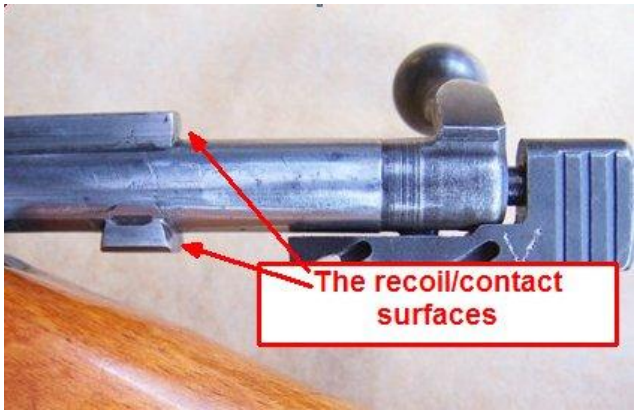
- The main body and the corresponding groove, or ‘bolt channel’, in the receiver
- The recoil lugs and their load bearing zones on the receiver.
- The internal components of spring and firing pin.

Check for even bolt recoil lug contact

We have to check for even bearing contact on the rear of the two ribs on the bolt itself, and on the two rear bearing areas on the receiver.

One bearing spot is the external shoulder on the receiver where the bolt handle rests, and can be easily cleaned and worked with.

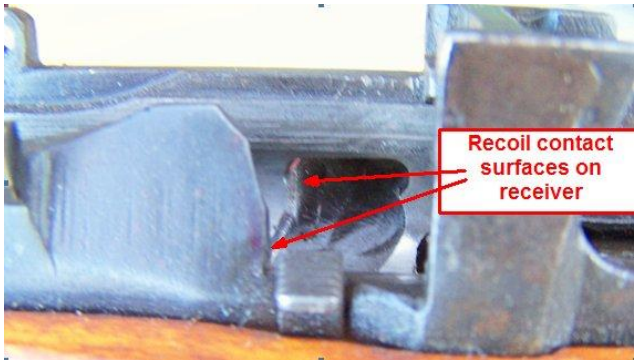
The other bearing spot is a machined recess at the left side of the bolt channel. It is usually full of dried grease, oil, grass seeds and last weeks sandwiches. You get the idea.



Both locations have to be thoroughly cleaned and degreased. Don’t ever use anything that will wear on the recess surfaces, or on the bolt lugs themselves, such as sand paper, abrasives, or coarse steel wool. The surface hardening is thin and once penetrated further impacts will compress the softer steel quickly, resulting in mysteriously opening headspace.

Method

The general method to test is to coat the surfaces with a colored material that will rub off when the two surfaces make contact. There are three materials easily available to do this with;



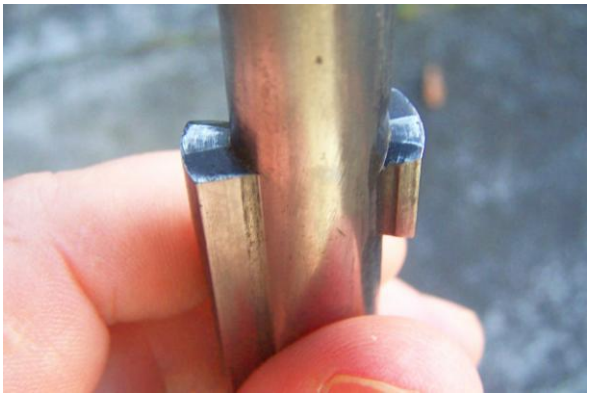
- Bearing blue
- Felt pen ink
- Talcum powder on an oily surface.

A product called ‘bearing blue’ is usually purchased from ball bearing suppliers or a good hardware store. Ball bearing suppliers are commonly found in small business listings.

A felt pen that can lay down a good coat of ink will do, and another method is to wipe a thin coat of oil on the bolt lug surfaces and dust them with talcum powder or similar, so that when the bolt is turned it will rub off the blue/ink/dust where it’s making contact.

What we want is even sized area of contact, or even ink removal, on both lugs.

Image; Red marker pen before, ink covered



Red marker pen after; good, even contact.

1) Clean the bolt thoroughly, removing all traces of oil and grease, especially from the two recoil lugs.
2) With toothbrush, turps and whatever other clever tools you'll need, clean out the oil and grease from the recess deep inside the bolt channel. It must be spotless and dry. It can be easier to do this if you have the receiver stripped for cleaning in a turps bath or in a gallon ice cream container of turps, but not necessary.
3) Now that the oil is off the bolt ribs, ink from a marker pen will stay on it. Ink up both lugs on the bolt, gently put it into the receiver. Likewise with other methods, coat the surfaces with oil and talc or bearing blue.
4) Hold the rifle vertical, so that the bolt will rest back against its stops under gravity, and gently close the bolt handle once or twice.
5) Remove the bolt, making sure the ink isn't wiped off as you do so, and see what you have. Ideally the size of the area of ink rubbed off should be similar. If there's a mismatch, there's contact but obviously uneven then no action may be required.
6) If you have contact on one bolt lug only remedial action is absolutely required.

A poor result, one side contact only, a must fix.

Poor contact but even, should be improved.

More Information; courtesy of Milsurps.com;

Fitting rifle bolts

http://photos.imageevent.com/badgerdog/generalstorage/peterlaidlerpostsleeenfieldforums/Fitting%20rifle%20bolts%20-%20CHS%20and%20boltheads.pdf

Damaged rifle bolts from poor seating

http://www.milsurps.com/showthread.php?t=27425&page=6

http://www.milsurps.com/showthread.php?t=27425&page=7

Bolt lock time

The sooner the firing pin strikes the primer after you've released the trigger, the less time there is for the rifle to move off target, hence a fast 'lock time' is always preferred over a slower one.
The duration of time from the trigger release to the moment the .303 bullet leaves the muzzle is 1/100th of a second. In that length of time a car traveling at 60 mph travels 10.5 inches. 1/100th of a second is longer than you think when dealing with fast moving objects, and is enough time for flinches and muscle fatigue to alter the bullets path off the bull's eye.

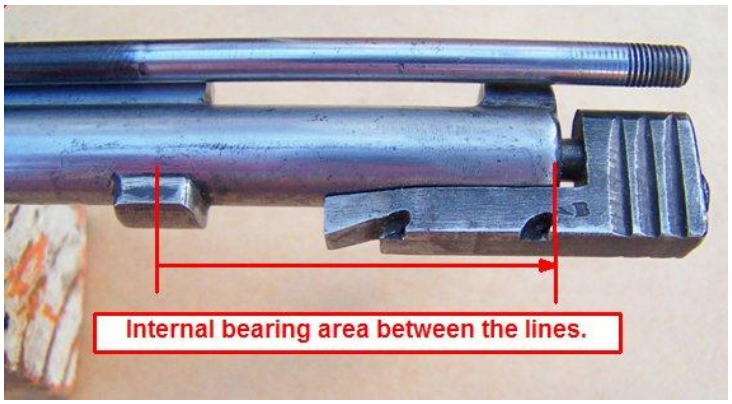
Anything that slows the lock time has to be addressed.

You should strip your bolt and clean it internally, thoroughly removing all traces of old grease on the spring, firing pin shaft and inside the bolt tube itself.
Old grease is a very sticky and slow substance, and it was used because a soldier's rifle could be expected to get dunked in rivers and left out in the rain, accumulating water in its nooks and crannies and hence a source of out of sight corrosion problems.
In addition stripping the bolt was not part of a soldier's regular rifle cleaning routine, so it was likely to be left unchecked for long periods. The deliberate grease build up was a way of keeping as much water as possible out.

As we are target shooting and treasure our rifles such measures are unnecessary, so strip and clean your bolt thoroughly and lightly lubricate with a light weight of gun oil, don't use grease or thicker oils anywhere on it.

Firing pin

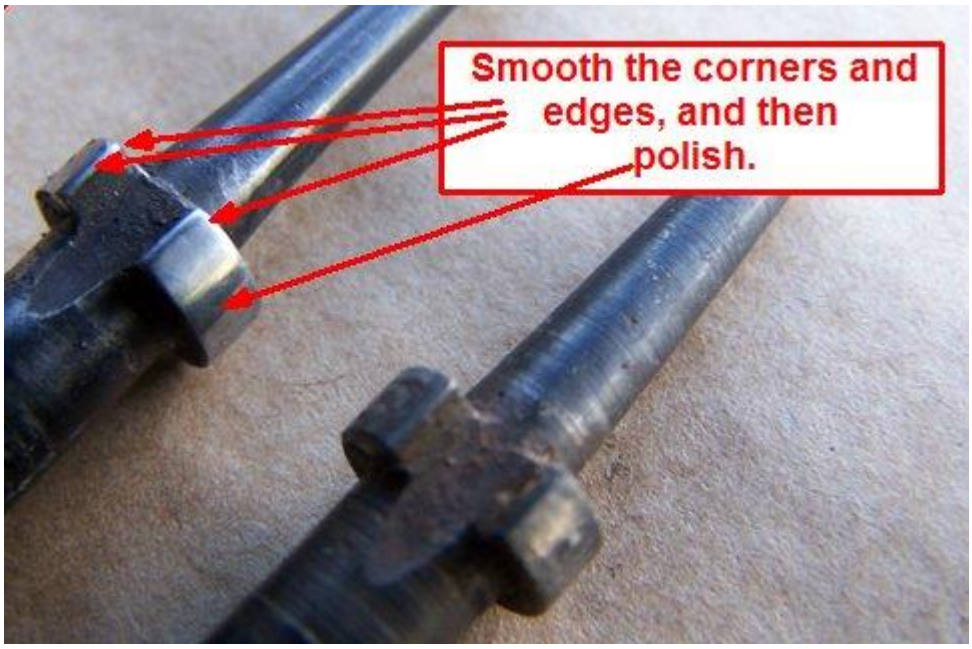
Thoroughly clean the firing pin, and if there are any defects such as nicks and scratches on the shaft that might cause extra friction and slow the action, rub them off with small files or jewelers files, or 600 or 800 wet and dry, using strokes that follow the length of the pin, not cross ways.



Image; note that the pin appears bent, a result of camera lens distortion.

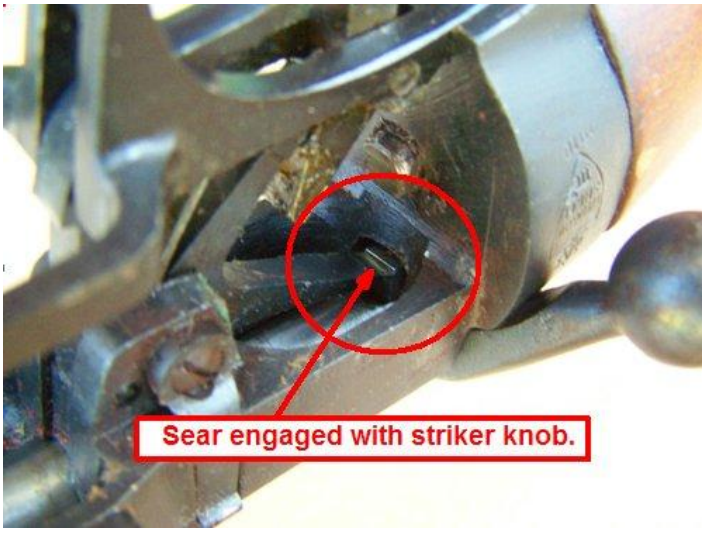
If you have the tools it won't hurt to polish the rear 2 - 3 inches of shaft in the areas where it slides in the guide hole. Some firing pins have a hard glossy surface treatment and won't need polishing.

The shoulders of the locking ring about ¼ of the way back from the tip should similarly be smoothed with lengthways movements, and its corners rounded, paying attention to not leave sharp corners where the bolt dismantling tool engages.



Image; Smooth the corners and edges and surface with 800 wet and dry and if you have the tools, polish the outside of the locking ring.

It's important to remember that the firing pin is a close fit inside the rear section of tunnel, so don't overdo any filing or polishing there. The locking ring fit is more relaxed.



Image/s; the sear contact is very close to the edge of the engaging face and excessive free play in the bolt firing pin tunnel or receiver bolt channel can allow the striker knob to ride over the sear. The result is either an unplanned firing or a vague trigger, or both.

If you find that the firing pin sticks or jams in different positions as you test it by sliding and rotating it without the spring, you have a very slightly bent firing pin shaft.

New ones are affordable and available at most parts sources.
List of parts sources; http://www.enfieldresource.com/1-enfield-parts-inventories

If you have a bent firing pin it can be rescued by using the straight edge of a steel ruler, and gently tapping the pin with a small soft face hammer over a flat surface, or with the careful use of blocks. You have to take it slowly though, the hole in the rear of the bolt body is a very close fit and it only takes a tiny bend in the shaft to obstruct its free movement.
From experience I can tell you that trying to straighten one perfectly can be a futile exercise in back and forth taping, and that replacing it is a better option.

Old timers trick; bent firing pin fix. If you're not able to buy a new firing pin, and the bend has become a game of chasing yourself in circles, an option is to reduce the tight tolerances by slightly reducing the diameter of the locking ring. This allows the firing pin a bit more free lateral movement and invariably will free up a sticking firing pin.

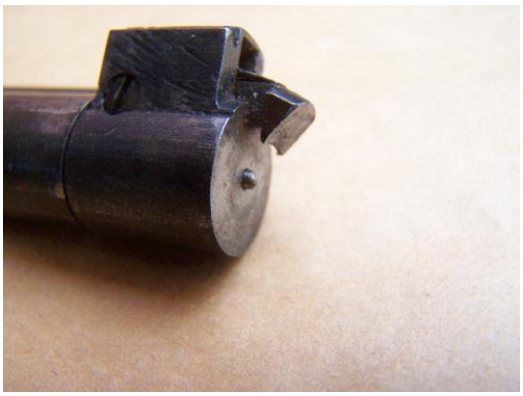
Image; slightly reduce locking ring diameter

Firing pin protrusion
Firing pin protrusion is important and should be between .040 - .050 thousandths/inch, with a smooth, rounded profile. Enfield made a sheet metal gauge for measuring this and they come up for sale on eBay or are often found at parts suppliers.

If the primer is not struck hard or deep enough it may cause slower ignition of the propellant, a slower muzzle velocity and a low shot on the target.

To check the firing pin protrusion;

- Dismantle the bolt and remove the spring and reassemble it without the spring.
- Turn the striker knob to the deepest groove in the bolt body.
- The firing pin will protrude through the face of the bolt head.

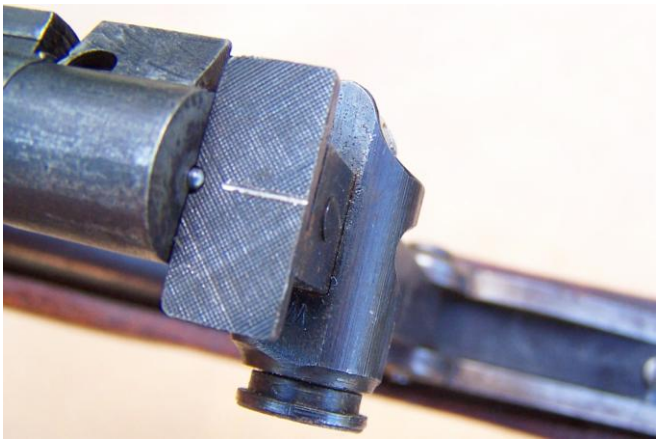


- Set the knob in the upper long groove.

Old Timer's trick; field check for protrusion, No1 MK3. If you don't have the Enfield gauge, or a caliper, a nifty trick to know is that the U shaped notch in the rear sight leaf of a No1 Mk3 is .040 thousandths inch deep, exactly the shortest length that's required on the firing pin.

Method – quick checking the protrusion

- Strip the bolt and remove the spring.
- Partially reassemble the bolt body, firing pin, striker knob and bolt head.
- With the striker knob in the deepest groove check the firing pin protrusion.
- Place it in the No1 Mk3 rear sight notch and compare, it should be at least as deep as the notch.
- If it is not, check that the striker knob is threaded on its threads deep enough. If this is correct you may need to replace the pin as being worn too short.



Image; No4 bolt and protrusion inside a No1 Mk3 rear sight notch

Old Timer's trick – field check for protrusion, No4 or No5. You can make the same field check with No1, No4 or No5 Enfields, which don't have a rear sight notch like the No1 Mk3.

- The width of the stock, flat topped front sight blade is .055 thousandths, on all Enfields.
- First step is to remove the front sight ears/guard.
- Dismantle and reassemble the bolt without the spring, as per above instructions.
- With the firing pin protrusion showing, place it across the top of the sight blade.
- It should cover most of the blade.
- If it is visibly too short or long, you'll need to replace it.

Firing Pin

It's not uncommon for chips to flake off the point over time. The damaged area needs to be filed off and the point returned to a blunt round shape. A pointed end will penetrate the cap, and when the cartridge fires it will allow a jet of hot gases to come backwards towards your face, something worth avoiding.
Dressing the damage off the pin will reduce its length and usually means there is not enough left to fire the cartridge.
If you are caught in the field and need a temporary fix you can install the striker knob one turn less deep on the firing pin threads. Normally the pin would be flush with the surface of the striker knob but this quick fix will do no harm temporarily.
If you have the pin and striker knob set up correctly and filing the pin back below the damage makes the protrusion too low, you have no choice but to replace it.

Bolt handle lift

If you notice that the bolt handle on your No1 Mk3 lifts a little when dry firing don't worry that the bolt is not locking down and might fly back when firing a live round, it's a Lee Enfield quirk. It doesn't happen when firing live rounds.

Image; bolt handle before dry firing.

Bolt handle lift after dry firing.

It's caused by the direction of the coils of the spring inside the bolt unwinding when the trigger is pulled, combined with a rough finish on the end of the spring binding on the bolt internal surfaces and lifting the handle.

To stop this, the sharp ends on the ends of the spring can be smoothed with a Dremel, file or wet and dry sandpaper, and also a thin little washer can be installed between the ends of the spring the bolt and firing pin locking ring during assembly. I do it on my rifles, it's all in the details.

Bolt channel wear

Bolt channel wear is not often discussed but never the less is an increasing issue as the Lee Enfield heads for its second hundred years of service. A bolt can also be a loose fit in the channel through being mis matched to the rifle, so be wary of non matching bolts until you've have confirmed all is well.

Bolt channel wear can also be a significant safety issue. It can sometimes be spotted by the striker knob lower area making contact with the butt stock at the rear of the bolt track.

Image; A worn bolt track allowing the bolt to make contact with the wood.

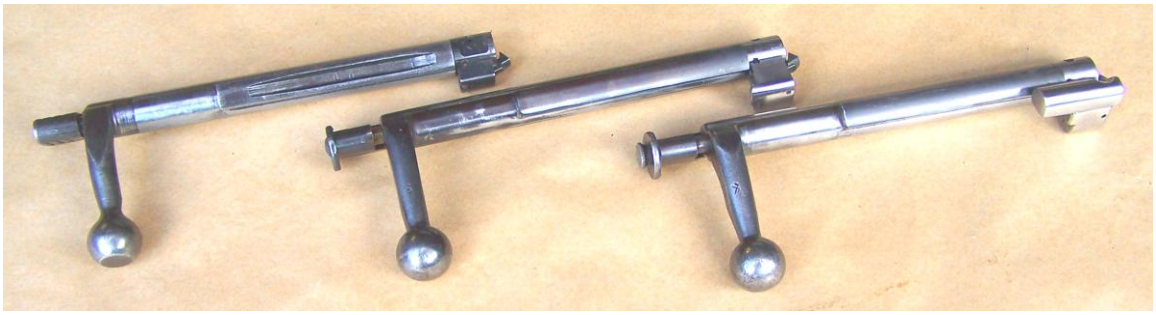
If you ever find an Enfield that releases the bolt and tries to fire when you simply push the safety to the firing position, the rifle probably has a worn bolt channel. This allows

the bolt to slide up over the safety catch protrusion, and causes the trigger sear to miss the notches on the striker knob, parts they should normally stop on. The bolt then releases completely and fires the rifle.

Unexpected firings are extremely dangerous to the people around you, and as bolt channel wear is pretty much unrepairable this may mean the rifle receiver should be destroyed. You may get lucky and find a bolt for sale that creates closer tolerances. It's not uncommon to find new old stock, NOS, bolt bodies available online or through businesses with a stock of Enfield parts.

Old Timers Trick; A subtle shooters trick was to seek out and change to a bolt that was as less sloppy a fit in the receiver channel as possible. The purpose is to restrict the bolt shaft flexing under recoil.
A bolt that is a loose fit has .15 or more of sideways movement in its retracted position.
A bolt that is a good fit has .05 or less of sideways movement.
Most fall in between these numbers.

If your rifle's bolt is not serial numbered to the rifle, you are perhaps more free to seek out a replacement bolt which is a tighter fit in the channel. You could also semi retire your rifles original bolt to the tool chest, but shoot with another one.



Image; Lee Enfield bolts: No4, No1 Mk3, No1.

The Lee Enfield smooth bolt and why it's so good for accuracy

Lee Enfields are famed for their quick and smooth action of opening and closing the bolt. Compared to other same era bolt rifles such you'll discover that the problem with most of the others is that when their bolt is fully drawn back it becomes too poorly aligned with the bolt channel for fast closing.
This is not easy to do if you're trying to reload and keep the rifle at your cheek.
The Enfield bolt has more support when drawn back and thus remains well aligned with the bolt channel at all times, requiring a single movement to get it moving forward.

I like my Enfield bolts to have a 'dry' feel, with a very free and fast movement to them, for no other reason than they're nicer to operate that way, but when target shooting it's important to keep the rifle, your cheek and shoulder in as consistent a position on target as possible as one reloads.

A smooth free moving action is important because less struggle with a sticky or stubborn bolt means less disturbance to the rifle while you're reloading. A lot of the problems that cause a sticky action come from the gunk build up on the bolt surface and where it runs in the receiver channel.

Image; typical before and after cleaning

Stiff bolt action fix

The bolt action is stiff and draggy, and tight when pushing a cartridge into the breech.

- The draggy feel usually comes from a transparent build up of a sticky oil debris on the bolt surfaces, in the bolt channel, on the sides of the bolt rib, and to a lesser extent, on the under sides of the striker knob.
- The other, lesser cause, which can be simultaneously treated, is scratches and gouges in the bolt channel on the left side.

Method

1. The bolt and bolt channel surfaces pick up a considerable degree of discoloration and black staining over time. This combination is like half dry treacle and should first be cleaned off as much as possible with a good degreaser and old toothbrushes.
2. Scratches and gouges usually are too deep to remove, and the steel extremely hard, but their effect can be minimized with the same treatment. One thing to check is that the bolt head doesn't have a sharp front left corner that could be catching in these gouges in the bolt channel on the left side. I round my bolt heads slightly with fine wet and dry paper to minimize the effect.
3. Avoiding the bolt recoil lugs surface, lightly use wet and dry paper well lubricated with WD 40, thin oil or water. Start with 600, then use 800. If you spent 2 minutes on a spot with 600, then 1 minute to buff it a little with 800 will suffice as the next step.
4. Then thoroughly rub the bolt and bolt channel with fine/soft steel wool. Steel soap pads used in the kitchen will work fine too, so long as they are the fine wool, and

not the stuff that will remove the stainless steel off a frying pan in a couple of swipes.

5. If you have a cloth buffing wheel with jewelers rouge, go ahead and gently polish all of the bolt surfaces that contact the receiver. Most large hardware stores sell a 3 inch cloth wheel with rouge in a small kit for less than $20, and universally fits all electric drills. Bolt the drill down firmly to a bench or vice and away you go, it's quick and easy to get good results with them.
6. Working internally on the bolt channel is less easy but has to be done too, using the same steps.
7. An easy way to polish the surfaces of the bolt channel is to use a cleaning rod accessory called a 'mop', made wet with brasso. If you attach a short cleaning rod such as are common in pistol cleaning kits, the other end can go into a cordless drill on a slow speed. Don't run the mop dry or too fast, and stop the polishing when the brasso turns a grey black. The job is done, just wipe and polish by hand. Repeat as necessary.
8. A clean like this can last years and I can only conclude that a really sticky bolt is the result of decades of oil drying out.

Lubricating the bolt and bolt channel

- I like to lubricate the bolt lightly with powdered graphite on the contact surfaces, although it can stain hands and clothes if it wipes off outside the rifle, and modern 'dry' Teflon lubricants get good results too. If you're going the traditional route nothing beats lubricating lightly with a light or thin oil and wiping it off so the surface feels clean but leaves no oil marks on a tissue or cloth, ie very little oil.

- Repeat as much of the cleaning and polishing treatment as possible in the receiver areas that make contact with the sliding parts of the bolt. Pay attention to areas that can build up gunk in hidden corners such as the rim where the cartridge will sit when in the breech, stuff loves to build up there.

More information; courtesy of Milsurps.com - Headspace
http://photos.imageevent.com/badgerdog/generalstorage/peterlaidlerpostsleeenfieldforums/Cartridge%20Headspace%20_CHS_.pdf

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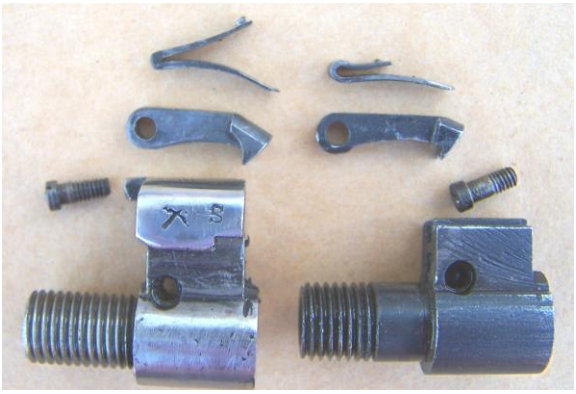
Creating a very slick action

Tight case extraction

Now that friction in the bolt channel on the forward action has been dealt with, the next problem could be called ‘stick-shun’ on the pull back action, and the seemingly harmless and unrelated little extractor spring inside the bolt head is almost the sole perpetrator of a tight ejecting action that requires brute force to get the bolt back, instead of a smooth as silk, almost effortless ejection.

Image; No1 Mk3 (left) and No4 (right) bolt head components with the culprit extractor springs at top.

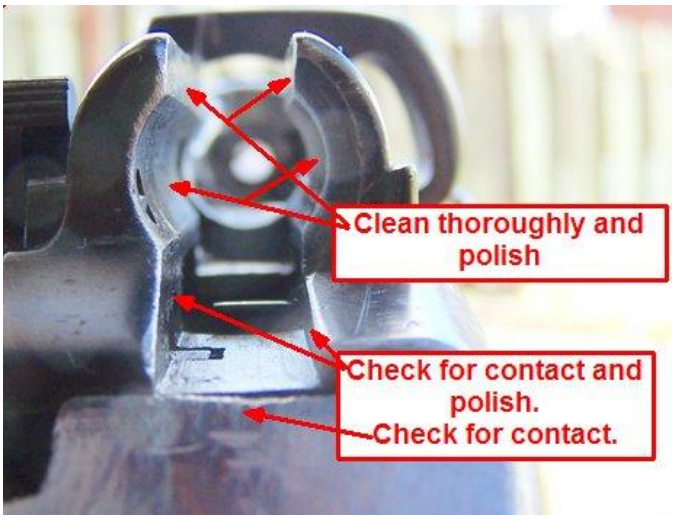


Old timer’s trick (A); reduce bolt channel friction. This tight action is caused by the bullet case dragging hard left into the bolt channel, and it’s this friction that you are overcoming. The channel needs polishing and smoothing.

What’s needed for a slick action is; a) a smooth polished channel.

Method

Investigate the surface of the bolt channel for gunk build up and scratches in the metal that might be slowing everything up, and clean and polish it with the same methods as cleaning the bolt body.



All of the receiver surfaces that contact the bolt, as above, must also be cleaned and polished, as well as examined for high spots, gouges, scratches and oddities, such as poor machining that may be causing a rough ride for the bolt.

Having clean, polished and slippery sides of the bolt's top and bottom ribs are as important as it is on the surface of the bolt body.

While you're looking for side contact in the bottom channel from the striker knob, also examine the striker knob's lower sides for places that it's making high point contact with the bolt channel, and consider smoothing and polishing these also.

Image; clearly defined rub marks from inside the bolt channels

As you pull the bolt handle to extract, the bolt body twists to the upper left corner, putting a lot of pressure and friction on that corner of the receiver, and pulling towards you on the underside of the bolt. As you push the bolt forward it leans forward, down and left at

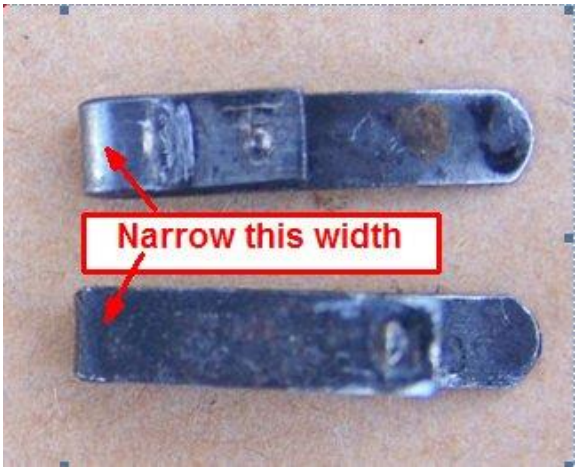
the front, as well pulling closer as the upper right rear, putting friction and pressure on a completely different area.
Because of these constant shifts in pressure points, the whole side of the bolt and receiver tracks have to be clean and polished.

* * *

Old Timer's trick (B); reduce extractor spring strength. Buy a couple of spare extractor springs, in case you break one or two, they can be brittle at the fold.

Lighten the spring's strength and pressure by;

- Experiment with thinning the width of them and, or, thinning the thickness of the metal around the folded mid point of the spring. If you remove too much they can be susceptible to breaking at the fold, that's why you start with a couple of them.
- Straightening the curves on the springs with strong pliers will also reduce the pressure.



Reducing spring pressure is a trade off however. If reduced too much it will not stay engaged with the case.

The strong spring action is also what ejects/springs the used case well clear of the rifle. As you pull the bolt back, the case stops against the eject screw in the channel, twists to the right, forcing open the extractor spring, ready to flip it away.

As you reduce the pressure dragging in the bolt channel you will also be reducing the ejecting power. If you're target shooting this is probably not a concern as you'll be moving gently anyway so as not to disturb the rifle between shots.

This light eject set up is also true of army marksmen in training, you'll often see them picking the case out with their fingers. It's because they chose to have a light, smooth action that doesn't move the rifle off target and to have no eject spring at all.
If you choose a light spring, you can still make a powerful eject by drawing the bolt back sharply and it will flip the case well clear of the rifle just as it always has.

Cleaning the bolt and channel, and reducing the extractor spring strength will make the action so light you'll scarcely believe what you used to struggle with.

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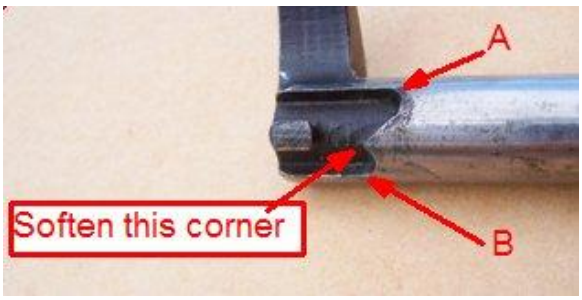
Image; this follower is well worn, and makes contact on the flat too – replace!

Old Timer's trick; smoothing the bolt detents. The striker knob engages a set of detents at the back of the bolt, designed to keep the striker on half cock or full cock. The surfaces that the striker knob moves on can be cleaned and smoothed, and the transition 'bump' can be softened. In addition the striker knob follower must be cleaned, smoothed and in good condition. Also, check the platform around the follower for rubbing contact against the bolt. If either are obvious then replace the striker knob.



Image, left; Clean and smooth between A and B.

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Tight or sticky chamber

The first action that takes place when extracting a spent case is pulling it out of the chamber. The case often seems stuck fast in the chamber and you'll have noticed this can be one of the toughest spots in the extraction process. It has two causes. One is gunk build up, the other is the softness of the brass of the cartridge sticking fast to the chamber walls under the 45,000 psi of firing.
You can reduce this effect and clean the chamber by;

- Use a bore cleaning brass brush of approx .45 caliber, on a pistol cleaning rod mounted in a cordless drill as you did for the bolt channel, and give this a light cleaning.
- The only lubrication allowed in this area is whatever takes place as you normally clean and oil the bore. Oiling the chamber and or cartridges is a no no, and will reduce the friction that helps transmit most recoil forces to the receiver and not down the bolt to the recoil lugs.

After a chamber cleaning process you'll still find some cases that don't easily come free. I've restored the chamber walls to a bright shine with a .410 mop and brasso but while it reduces the effect it doesn't cure it entirely. A light polish is worth doing.

Other than avoiding ammunition types that are very sticky if you're shooting in competition, I don't know of a surefire solution to overcome case stick-ion caused by the brass composition.

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Head space info see pg 87

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Damaged case? You have to use a 'case extractor'

Losing the rim, or head, off the cartridge can happen through excessive reloading, or less commonly, through faulty ammunition.

It suddenly means that your bolt has nothing to grab onto to pull out the shell of the chamber. As the brass is a bit sticky after firing usually it doesn't fall freely out of the chamber either, it's stuck in there.

If you're at the range and aren't prepared for this, your shooting day is over.

The good news is that an original WW2 .303 case extractor is a relatively common and inexpensive item, $10, and can usually be located on eBay or the stores with Enfield parts. It's an excellent item to have in the tool box for that rainy day.

It works by being driven in with the bolt, it jams inside the case and as you open the bolt it pulls the damaged case free.

Image; case extractor.

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Butt Stock

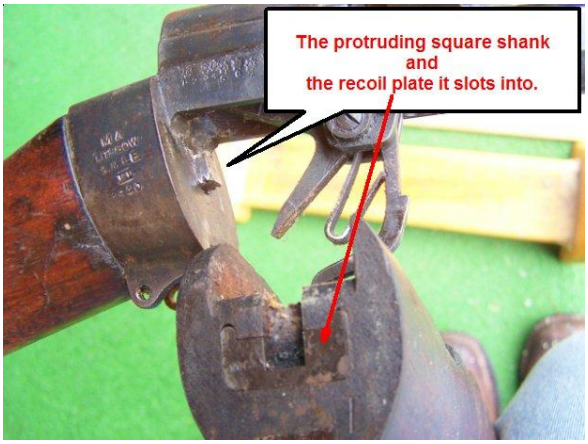
Introduction
If the butt stock is loose, even so little that you can't feel it, a recognizable signature is that your shots will spread out left and right. The best tool for tightening the butt bolt is a long blade screwdriver with a square shaft. Good leverage can then be applied with a wrench on the square sides.
Don't ever be tempted to use loctite on the threads, it almost certainly will work too well and won't come undone when you need it to.

The end of the butt stock that inserts inside the wrist has been tapered to a particular shape. This is not an accident. The end of the butt should just make contact with the inside of the wrist, and the shoulders of the wrist externally should be just fractionally clear of the wrist metal. All of this helps the wood absorb the shock of recoil without causing fractures.
The correct fit of the butt into the wrist socket is one that requires a tap with a mallet to seat home, and when the shoulder of the wood is slightly clear of the metal.

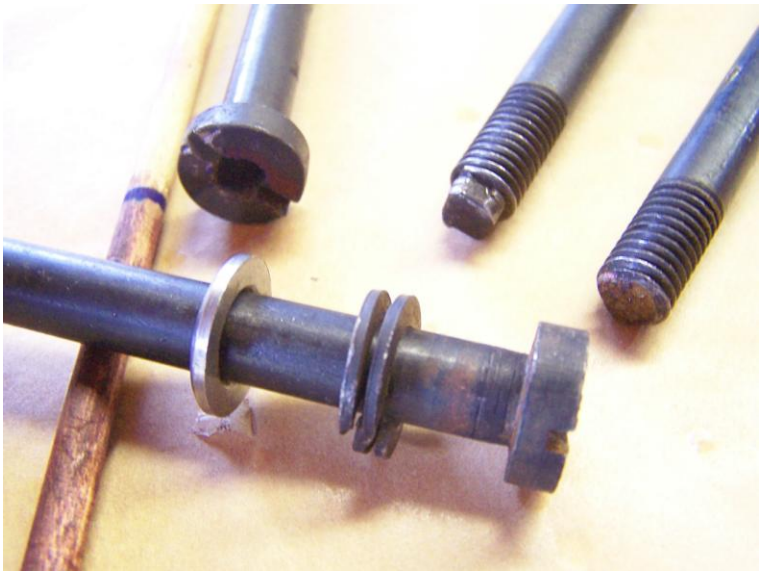
Image; a good butt to wrist fit.

An important warning; - loose butt bolt
Note; Before removing the butt bolt, Lee Enfield No1 Mk3's absolutely require the fore end to be removed first.

If you don't do this a square shank at the very tip of the butt bolt can put a lot of pressure on the rear of the fore end and will split it wide open. This is time consuming damage that must be repaired, and is something best avoided.



Over the years many No1 Mk3's have ended up with butt bolts without the square shank. As we're not in combat with these rifles and a loose butt won't bring our downfall it will do no harm to install bolts without the square shank. The proper fittings on a butt bolt to stop it coming loose are a flat spring washer and a thick tapered washer. The thick washer often jams deep down inside the butt stock and is often not seen when taking the bolt out. Use a flashlight to look in there.



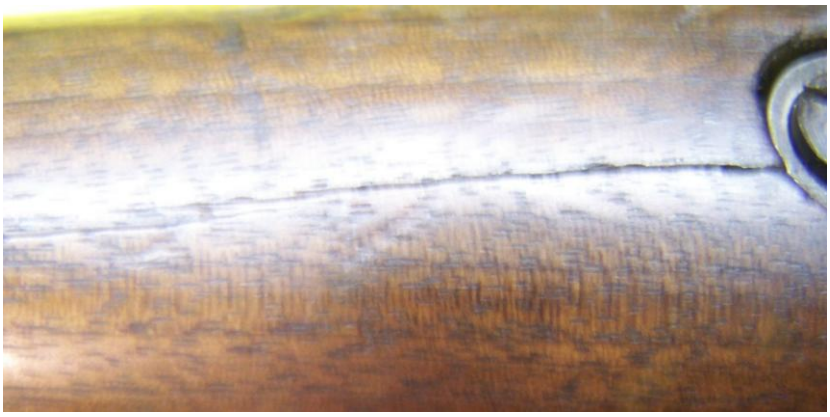
Clockwise; lightened jungle carbine bolt, bolt with square shank,
square shank removed, the proper washers your bolt should and must have.

If you don't know what type of butt bolt your rifle has, with shank or without, don't take a chance. Remove the fore end first so that you are absolutely certain of what you have in there.

Note; This next paragraph seems out of sequence but as we're discussing the cause of the problem a solution seems appropriate.

Split Forend

You have a forend that is split lengthways forward from the main screw. This split is usually initiated by turning the butt bolt without removing the forend first. The forend spreads open and the stress carries forward to the wood around the main screw. The crack then takes off from this point when the rifle is fired.



What really exacerbates the issue is firing the rifle with a loose main screw. Under recoil the forend is driven backwards and the main screw behaves like a wedge driving into the wood, which now splits along the grain for as much as 6 – 10 inches. This can be dangerous as the wood will come towards your face. The moral of the story is to make sure that the main screw is both tightened and is clamping on the wood firmly, and to always remove the forend before the butt stock.

Solution

A split forend can be repaired fairly readily with modern epoxies. The only exception to this would be if the wood is oil soaked. I recommend slow curing two pack epoxy resins such a 24 hour and 30 minute, but not 5 minute epoxy. West System epoxies for boat building are very good.

Don’t use soft glues such as white wood glue- PVA, if you can avoid it, and do not use instant glues except for pinning splinters. PVA is not a bad glue but epoxy is much better.

1. Remove the forend and clean away any oils etc that might affect the glue's adhesion.
2. De-oiling wood can be achieved with clean/new turps and a brush, and afterwards detergent will remove any last traces left by the turps. Let it dry thoroughly.
3. Slightly prize open the crack and hold it there with little wood wedges.
4. Wipe into the crack epoxy glue, using narrow probes such as wood splinters or stiff piece of wire.
5. Remove the wedges and clamp lightly closed.
6. Where possible I prefer to clamp while on the rifle, it's an unexpected way to get the forend to conform to the receiver better, and defeats the risk of clamping the forend tightly and then finding later that it's too tight to go back onto the rifle.

Image; lightly clamp and glue while on the rifle, main screw loosened.

Butt loose in wrist

The wood portion that fits inside the wrist should be a firm fit as recoil is always strong enough to make things move around if they aren't tight.

Old timer's trick; paper shim the butt socket. A traditional and effective method of making the fit tighter is to varnish/glue increasing layers of hard paper around the protruding end. If the butt requires a knock or two from a rubber mallet to fit, you have it just right.

Old timer's trick; add weight to reduce felt recoil. This is an invisible but more useful than one would expect; A heavier rifle has more mass to counteract the action of recoil, resists flinching better than a light rifle and is therefore more steady on the target.

Put lead shot or similar in the butt stock tunnel, and seal it in with a ball of sticky tape under the trap door. Just to rule out any potential errors here I mean that you should use loose lead shot, don't as one earnest hopeful tried, pour hot molten lead into a wooden stock.
Steel shot adds 8.75 ounces to a No1Mk3 or No4, and is quite noticeable when you pick the rifle up. It may not be legal for some military shoots. Your rifle will be more steady and have less felt recoil. You can also adjust this for a more comfortable balancing of the rifle while standing.

Unweighted Weighted

Butt stock proper sizing

Lee Enfield butt stocks come in four sizes, and they have a large letter stamped on the top rear, in the wood close to the butt plate, to show the size, L for large, no stamp for medium, S for small, and B for bantam.
The correct way to know if you have the correct size is to lay the rifle along your shooting hand and fore arm. With the butt end in the crook of your arm, your finger should easily and naturally fall on the trigger. Or visa versa, with your finger on the trigger the butt should reach into your forarm.
Different size butt stocks can often be found on eBay and Enfield parts dealers with wood stocks in supply.

More Information

Mislurps.com – Correct butt fitting
http://photos.imageevent.com/badgerdog/generalstorage/peterlaidlerpostsleeenfieldforums/Butt%20and%20Wood%20Fitting.pdf

Forend

Image; lower - No4 MK1 (1930), No1 Mk3 (1918)

Introduction
Arguably the most significant part of an Enfield's accuracy is the fore end. Believe it or not, and unlike some other rifles, it's not just a handy place to hang onto the rifle, it's a crucial and precisely fitted bit of engineering, and understanding why this is so will reveal all sorts of neat things we can accurize with.

An important function of the forend is to brace the receiver against small movements and vibration caused by recoil.
Because the rifle has a wrist, with an acute angle, which is also below the thrust line of the barrel, at the moment of firing there's a momentary compression of this angle, and a decompression a moment later, creating vibrations in the barrel that disturbs the bullets flight path.
A tightly fitting forend at the wrist face stiffens the wrist/receiver angle, and this, along with the forend being firmly clamped between the trigger guard and the receiver with just the right pressure from the main screw, is essential to accuracy.

This can sound like flim flam, an old timer's technical term for bull fertilizer, but a rifle that is loose in this area will not shoot as well as one which set up tightly in this area, just ask master gunsmiths Fulton and Parker Hale, who always make their rifles tight and right.

Two areas of the forend are vital to your rifle's accuracy
A – Equal bearing on the recoil lugs
B – Equal bearing of the forend against the wrist face.

A new Lee Enfield, which is well set up, has a fore end that is a firm fit to the receiver, sometimes requiring a few strategic knocks on a block of wood with a hammer to break it free. Target shooters often shim the rear face of the fore end to make the wrist forend interface as tight as possible.

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Dowel Anchors

This method has been widely used to anchor the receiver against very small movements inside the forend, and the tell tale ¼" dots on both sides of the forends are still to be seen on Enfield target rifles.

In this method dowel anchors are glued through both sides of the fore end. This reduces any internal side free play between the receiver and forend wood to zero. Shooters have tried doing this with bedding compound, and Fulton with machine screws, but dowels are by far the easiest and best way to achieve the same result.

They usually are installed in two locations, and bear on the receiver sidewalls at the rear, and the sides of the recoil lugs, and sometimes also at the front of the receiver wall.

The purpose of the upper dowels is to reduce any side play in the receiver rear which would throw shots left and right, and the lower dowel is to locate the recoil lugs in order to reduce lateral rocking of the receiver, which generally creates wider groups.

We're talking about incremental movement or vibration at the moment of firing. It would be easy to dismiss the worth of these dowels but Parker Hale used this method on their regulated No4 rifles for well over a decade, and Fulton used either dowels or machine screws on their No1mk3's. Good enough for them, good enough for us.

This method does not necessarily require dowels, but they are the easiest to work with. On the receiver rear end for example, wood blocks/shims with a larger surface area, or using bedding compound would also suffice.
Getting bedding compound to spread evenly into the narrow slot between the receiver sidewalls and fore end is not easy, and therefore is generally not recommended. Fulton rifles often show bedding material between the receiver and forend sides, so the idea is good but dowels make for a much easier execution.

Method

Choose as hard a ¼ inch dowel as you can find. Common softwood dowels will do the job but will compress with age much quicker and loose tolerances will return. If you're purchasing from dowel racks at any popular hardware store, choose one with the darkest color section of the dowels and test the wood discreetly by pressing your thumb nail into it, or alternately marine wood supply stores will have teak dowels and similar hard woods.

You can use either white glue for wood or epoxy glue to fasten them in place.

Notes;

To ensure that the dowels do their best work, glue them in place only after the receiver and barrel is well centered in the barrel channel.

- Use sharp drill bits, and only drill when you're ready.
- Use a smaller drill size first such as 1/8th inch if you want to prevent the main drill from wandering.
- Keep the drill holes square to the fore ends center lines.
- Drill from the outside in, and clamp a piece of wood to the internal surface to prevent the drill splintering its way right through.

- The hole you make for the dowels should be the same size as the dowel, don't try to make it loose to make room for the glue, or too tight to keep it firmly in place, just the same size is ideal. When dry a hole like this is a bit of a friction fit, but when smeared with glue it becomes an easy fit.
- Cover the sides of your fore end in paper masking tape before working to protect it somewhat from any slips with tools and markers.
- Before installing, be sure to round the top edge of the internal dowel end to help the receiver slide past when assembling. It's important. If it is not rounded the receiver will eventually knock the ends off the dowel and open up the tight clearance.

To keep the receiver centered assemble and glue the left and right sides at the same time, and after any receiver bedding.

Location one– rear upper dowel/receiver

The wood on No1's can vary in thickness in the area we want to put the dowels into, and you have room to move it around a little here, so choose a strong spot so that the dowel has some thickness to adhere to, and especially if the measurements used here place you on a crack or weak spot.

1.

1. The location on a No1 Mk3 usually is; measure in 3/8th inch and up 3/8th inch and drill a ¼ inch hole. Double check on your rifle before drilling that this is the best place.
2. The rear dowel location on a No4 Mk1 and Mk2 is; measure in 1 inch and up 3/8th inch and drill a ¼ inch hole.
3. Clean any debris away from each end of the hole
4. Cut off two short lengths of ¼ hard wood dowel, and slightly round the corners at one end. If your dowel sides have a very smooth surface, rough it up so that the glue can key to it better.
5. Although this should end up as a very clean job to do, place a little paper masking tape around the receiver, and exterior wood, if you're worried about glue spillage.

Don't put masking tape or other on the receiver metal surface where the dowel will come in contact the steel. Paper masking tape has a thickness of 3 thousandths of an inch, which is a gap we're trying to eliminate.

6. Assemble the rifle so that everything is in its final correct place and the screws are done up.
7. Using cotton buds (ear cleaning) wipe glue inside the holes, and also on the dowels.
8. Push the dowels into place so that they are firmly touching the receiver, and leave overnight to dry off.
9. Clean any excess wet glue off the exterior wood surface, it will mark the wood if you clean it up later.
10. If possible either lightly clamp the dowels towards each other, or pull wide rubber bands such as inner tube rubber or bungy cords around the fore end and over the ends of the dowels so that they are squeezed into the receiver as the glue sets.
11. Don't disturb or disassemble the rifle until you are 100% certain the glue has set hard.
2. Trim off the exterior extra length, smooth, stain and BLO for the surface finish, and stage one is done.

Location two –lower dowel/recoil lugs

Fulton's No1 Mk3's sometimes had a threaded machine screw through the forend wood that would contact the trigger lug, and later on with No4's Parker Hale achieved a similar result by installing dowels at this point. This one resists lateral oscillations.

This is generally the same method as used above, excepting the location.

1. For the No1 Mk3 measure in from the safety screw center in 2 inches, and 1 inch from the top edge and drill ¼ inch hole.
2. For the No4 Mk1 measure in from the wrist face 1 ¾ inch, and from the top edge 13/16ths inch and drill ¼ inch hole.

3. Don't take these measurements for granted and double check and double check again before you mark the fore end in any way that this is the correct spot to bring the dowels through to the tip of the recoil lug so that there is maximum leverage to restrict movement. The recoil lugs are a small spot to hit, and their location need to be more precise than the rear receiver dowels.
4. Use hardwood, or choose the hardest wood, dowels that are ¼ inch diameter, and cut off two pieces 1.5-2 inches long.
5. Slightly round the corners of the end that you intend to be against the recoil lug, to facilitate rifle assembly.
6. Anchor the fore end firmly, and keeping the drill square to the fore end's center lines, make your holes for the dowels. Use a 1/8th pilot holes if you like, as a way of confirming that the hole will appear at the right spot, and then use the larger drill.
7. Assemble the rifle, properly, and as you do make sure that the barrel is centered in the barrel channel, that the trigger guard is properly clamping the fore end in place and that the main screw is not loose.
8. When assembled confirm that the dowels will arrive at the intended place. You can see the recoil lugs and the dowels by looking inside the magazine well.
9. Lubricate the holes and dowels with epoxy, or white wood glue, PVA, I use ear type cotton buds.
10. Make certain both dowels are firmly touching the recoil lugs and that the opposite side dowel hasn't lifted as you've bottomed the near one.
11. Clean away any build up of surface glue as cleaning this off later will mark the wood.

12. If you have the tools and situation, such as large rubber bands, lightly clamping the dowels inwards is ideal..
13. Leave untouched until you're certain the glue has set hard.
14. Trim off the excess, stain the dowel ends to color match the fore end wood, touch up with a drop of the correct wood stain, BLO (boiled linseed oil) or varnish and you're done.

Front of receiver centering

Fulton's No1 Mk3's and Parker Hale No4's sometimes also centered the front section of the receiver, Fulton's with machine screws and to a lesser extent, Parker Hale with

dowels. The method of installing dowels is the same as previously described for the receiver rear and the receiver recoil lugs. As previously mentioned it is crucial to ensure that the rifle is assembled with everything centered up for maximum accuracy before the dowels are installed.

- No1 Mk3; measure inwards 4 1/2 inches from the wrist face, and down from the top edge 3/8th inch, drill a ¼ inch hole, same on both sides of the rifle.
- For No4 Mk1; measure inwards 4 1/2 inches from the wrist face, and down from the top edge 3/8th inch, drill a ¼ inch hole, same on both sides of the rifle.

Conclusion
Assemble and disassemble the rifle several times to see if the dowels catch on the receiver, making assembly difficult. If they do you can shave a small amount off the upper corner with a razor blade and create a slight taper that allows the receiver to slide over the initial corner as you assemble them.

=========

Wood block insert
A method used to improve the internal stability of the fore end wood in the general area of where the main screw bears down, is the insertion deep into the forend of a wooden hard wood block approximately 1 inch by 1 inch by 2 inches.

With the rifle trigger side up, this block would be at the front of the magazine well and under the trigger guard main screw. The main screw would bear right through this block. Naturally this is a significant piece of wood working that first requires excavating a large hole.

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Bolt through the forend
Old Timer Trick; Some older target rifles from the UK have a through bolt installed about 1.5 inches forward of the magazine. This is not the same as the large screw often seen on Lee Enfields made by Ishapore in India.

In older literature it is described as having a damping effect on the shock waves that travel through the wood, which in the area where the bolt is located, is the largest mass forward of the wrist.

A side benefit is it will also act like the 'Ishapore screw' often seen in Lee Enfields made in India, in resisting or preventing splitting of the forend by the main screw.

Sometimes an additional through pinning is to be found slightly forward of the mid band, using a cut off 1/8th brass bolt, or a section of the same type of rod as used through the rear of the No1's fore end.

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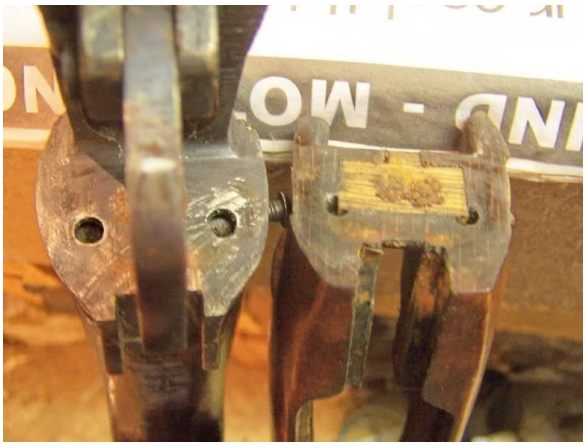
Magazine well through bolts

An accuracy method attributed to various shooting teams is a pair of ¼ inch by 3.5 inch long bolts that firmly bolt the fore end to the wrist. As with many accurizing methods this generated some debate as to its effectiveness, however as the Canadian teams won their events in 1964 there is some proof to the pudding.
J Sweet called this 'India bedding', pg 71, used in 1935.

A point against this method is that it requires ¼ inch holes to be drilled through the steel of the wrist face, and the fore end wood, not ideal if you're intending to shoot in military rifle matches where change is not permitted, or you don't want to alter your rifle to preserve its collectibility. Additionally you must remember that these bolts need removing every time before the forend will come off.

Method

- The bolts are ¼ inch x 3.5 inches long, with either a slotted dome head, or a socket or allen key head, and can be brass or steel, with the brass preferred for its non corrosion quality.
- The usual method of use is to insert the bolts from the butt side



of the wrist with the butt stock removed, then hold the nuts in the magazine well with a finger tip and to tighten from the butt end. The butt stock is then attached.

- It's important to remember that with this method in place you can't remove the fore end without first removing the butt stock to gain access to the bolt heads.
- It is important to have a tight fitting fore end at the wrist face before using this method. If there is a gap when you tighten the bolts, even though there isn't a lot of pressure being used on the bolt, the gap will squeeze closed and transfer a lot of stress to the wood, potentially breaking it along the grain when you fire.

Method

1. Set the rifle horizontally in a stand with the butt stock, magazine and trigger guard removed.
2. Draw light pencil lines for the drills path from the magazine well to the inner wrist to familiarize your self where the holes will go.

3. You need to identify a clear space for the bolt heads inside the butt socket so that when the bolts are in place they sit as flat to the wrist face as possible. If the holes are too close to the center pillar in the socket the heads will jam on the pillar and not sit down flat or be able to be tightened.
4. In the magazine well locate a clear area where the nuts and washers will go. Allow for wider than usual washer to spread the compression forces and not crush the wood. The bolts will have light pressure from tightening them in place, plus during firing the recoil forces can pull strongly on the wood.
5. After double checking the hole locations anchor the rifle firmly, with the butt stock and fore end removed.

6. Drill 1/8th inch pilot holes through the wrist and mark the spot with a dot punch first so there's less risk of the drill skidding around the place and damaging the finish.
7. Assemble the fore end in place and fasten the trigger guard to keep it tightly in place.
8. Carefully and exactly (!) drill through from the wrist socket to the magazine well, drill first with the 1/8th pilot drill, and then use the ¼ inch drill to create the main hole.
9. Use a sharp, narrow chisel, scalpel, or similar to cut recesses in the magazine well so that the nuts and washer are recessed away from the path of the magazine.
10. Don't over tighten the bolts when in use.

Notes

- If you use a 1/8th pilot hole first, any errors in position can be corrected more easily when re drilling.
- If you accidentally drill the wrist holes too close to the wrist socket pillar you can take a Dremel to the bolt head and narrow the bolt head.
- Loctite seems unnecessary as these nuts appear not to vibrate loose. If you're tempted though, either use a mild loctite, or just a single drop or less on the threads, or use a drop of white wood glue.

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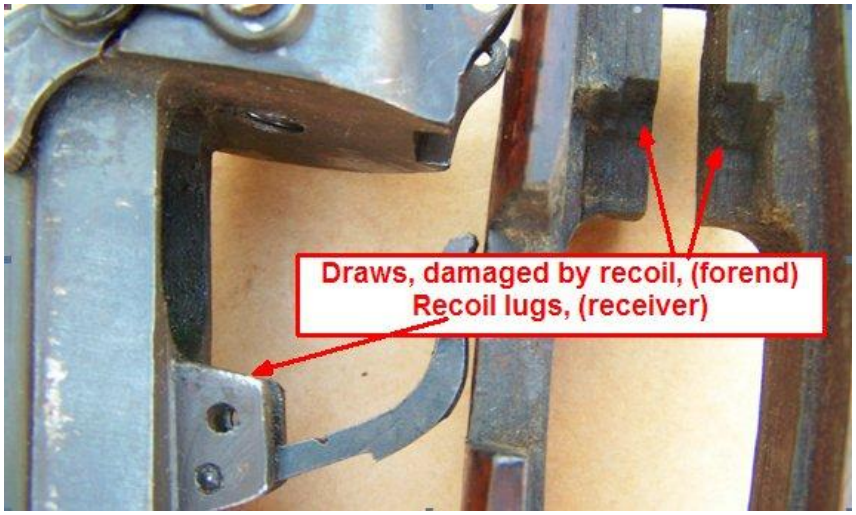
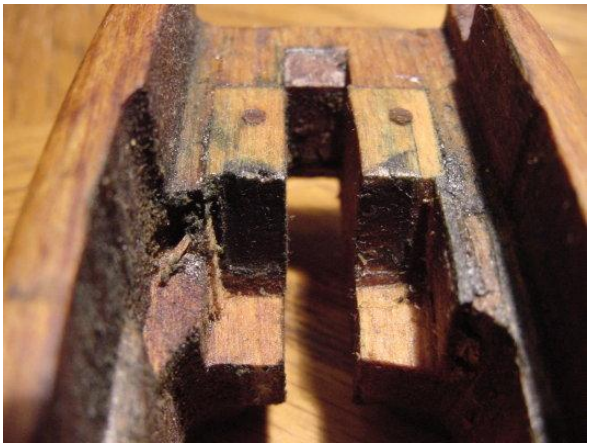
The Draws or Inner Recoil Blocks

It is crucial to both safety and accuracy that the inner recoil blocks of the forend contact the receiver lugs evenly, fully, and that in addition they are in good condition. Tremendous forces are exerted on these tiny areas and as seen here, opening up an older Enfield to find crushed or broken wood here is not uncommon. It's potentially dangerous to shoot with, and is a must repair.



Image; this is a well executed armorer's repair to a damaged recoil block area. Note that the grain of the new wood is parallel to the thrust from the receiver, its strongest direction.



A check for even bearing contact would be advisable if;

- the lugs are excessively oil soaked and appear damaged.
- the fore arm has been replaced.

- if proceeding with other accurizing techniques.
- if there are signs of previous repairs.

Image; below; another example of well executed repairs.

A surprising amount of damage can affect the recoil lugs, and can come from;

- The butt bolt being turned hard in the locking plate, which splits the fore arm to the left and right and allowing the recoil lugs to spread around the receiver.
- Sometimes the whole wood section of recoil lug and upper platform, the left and right sides, can shear along the wood grain and break out rearwards.
- Firing the rifle with the fore end not clamped securely at the trigger guard main screw will invariably force the recoil lugs off their bearing surfaces and split the fore end dramatically left and right.

In any case, what's important is for you is to confirm that your rifle is making good and even contact on these lugs before progressing to the fore arm alterations of wrist face clearance and locating dowels.

Recoil lug metal caps - No1 Mk3

The Australian use of metal cap plates on the recoil lugs appeared during WW2 when the manufacturers changed to a different type of fore end wood and discovered later that the wood was prone to crushing under recoil. The plates were added to spread the load.

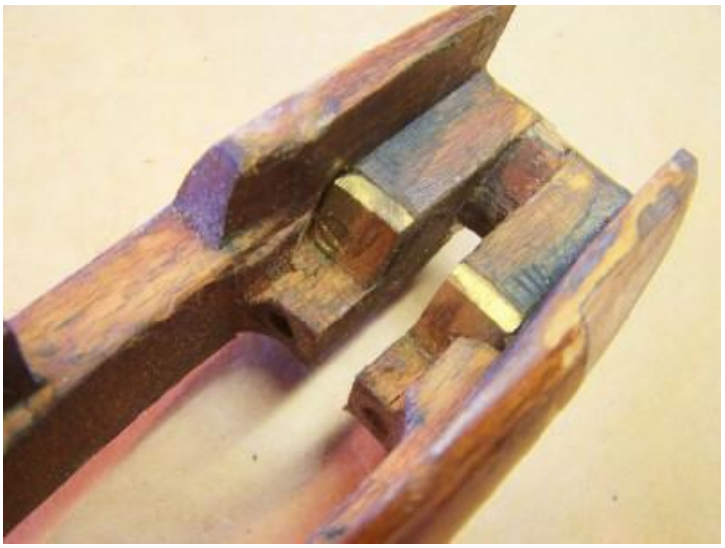
These plates were made of brass or copper, and were 17/32 inch by 7/16th inch in size. (.428 by .528 inch on calipers) They are held in place with everyday ½ inch brass countersunk wood screws, and the holes are located dead center of the plate.

Many target shooters retrofitted these to their rifles. As well as being a good repair method for rifles that had slight damage in this area, they can easily be shimmed underneath to get a firm fit on the recoil lugs.

It's worth mentioning that a fire arms importer to the USA named Jovino New York, (they stamped their rifles with JJ CO NY NY), sold many Lithgow Enfield No1 Mk3's

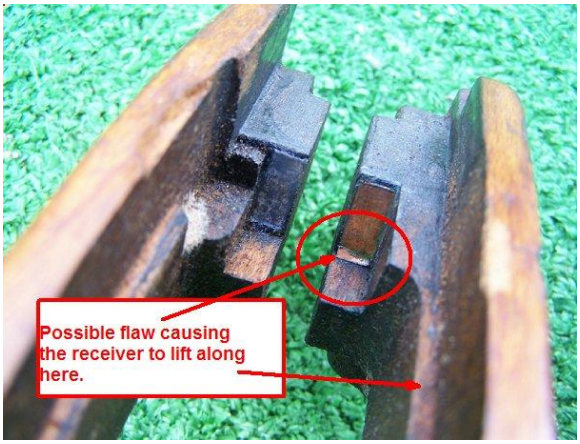
assembled from surplus parts, and as a result there are rifles around that should have these plates but do not.

If you own a JJ CO NY NY rifle, you must check to find out what you have. If your plates are missing or there is wood damage, what to do next has been well covered on many Enfield forums, particularly the Milsurp's and Jouster forum, by very experienced people who can give good advise.



Image; nicely retrofitted recoil plates installed on a Fulton's BSA No1 Mk3.

Broadly speaking, fitting the recoil plates usually involves carefully removing the same depth of wood with a sharp chisel, drilling a pilot hole for the screw so that they don't break the wood away when tightened. It's not a complicated process.
If the wood is damaged beyond this depth it will need to be built up with wood blocks epoxied in place, with their wood grain in line with the recoil forces, not across it, and then the plates are mounted as for above.
I definitely recommend doing some research before beginning this process, and a forum is a great place to start.

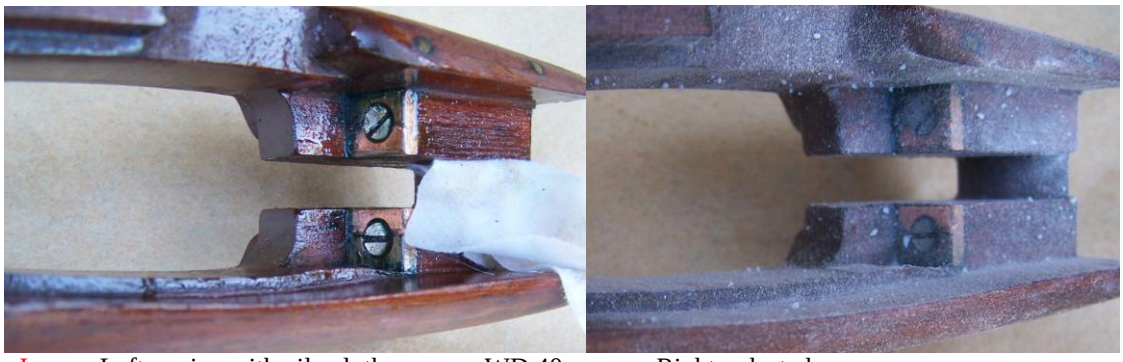


Image; an easily overlooked problem. One shim has shifted during assembly and is partially over the top of the recoil lug, potentially lifting the left receiver rail off its position in the forend.

Checking for equal contact on the inner recoil lug

We're going to re fit the forend a couple of times to look for witness marks on the recoil lugs to find out the areas of contact. We want something that will leave witness marks when we fit them back together and there are several ways to do this;

- Felt pen on metal surfaces
- Bearing blue
- Best - White powder on a film of oil



Image; Left – wipe with oily cloth or spray WD 40. Right – dusted.

Image; Left – carefully assemble, tap lightly, disassemble. Right – a good result, indicating good recoil lug/draws contact and also some contact below the plate that may be keeping the forend off the receiver, this would affect accuracy negatively, a 'must fix'.

Method

1. Clean off any grease, oil and dirt on the fore end wood recoil blocks and the receiver recoil lugs.
2. Wipe a thin coat of bearing blue on the receiver lugs, or wipe a slight film of oil onto the receiver internal shapes and dust with talcum or similar powder.
3. … and gently re assemble the fore arm to the receiver. Make sure that it is moved as far forward towards the muzzle as it will naturally go, and that if there is any gap at the wrist face that it is at its maximum and the forend is not sitting rearward.
4. Double check that the barrel is laying down the center of the barrel channel and is not tending to the left or right side. If one lug is high it could/will push the barrel tip towards the low side.
5. Attach the trigger guard with all the screws and tighten them.
6. Make sure that if you had a wrist gap that the fore arm has not moved rearwards and closed the gap as you tightened the trigger guard screws. The reason we're watching this gap is that we want contact between the recoil lugs and blocks and if a wrist gap has closed it usually means there is now a gap internally, where we can't see the recoil lugs.

7. Gently disassemble and examine the faces of the recoil lugs and blocks. The size of the area which has been moved or transferred or rubbed off should be very similar.
8. Uneven bearing can be adjusted by gently removing the high surfaces on either side. A slow and gently does it procedure board is preferable.
9. If one block is excessively damaged or uneven, there is a known armorer's repair that is recommended. It involves replacing both recoil blocks with hardwood blocks, installed with the end grain facing the forces, and epoxied in place.(see below for link)
10. If your rifle has the Australian style copper caps then you have the choice of either removing excessive height under one, or adding shim material under the other.
11. In all cases proceed slowly, checking often. You can't actually ruin your forend if you make mistakes, but too much enthusiasm might lead you into a larger repair.

More information courtesy of Milsurps.com;
Discussion and tips about repairing the 'draws' or recoil blocks in the forend.
http://www.milsurps.com/showthread.php?t=32099
http://www.milsurps.com/content.php?r=370-Worn-draws-in-your-No1-4-or-5-fore-end-....-%28by-Peter-Laidler%29

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Forend butt/wrist interface

Introduction

Lee Enfield will tolerate a 10 thousandths inch gap at the wrist face, but for best accuracy the fore arm and the wrist face should have no visible gap, and a feeler gauge should not enter anywhere on either side.

Perhaps acceptable to Lee Enfield, but not at all by target shooters, a gap between the forend and the wrist face, contrasting with a snugly fitted butt stock.

Just a reminder, target rifles from Fulton and Parker Hale are invariably a zero to tight fit on the wrist face. Sometimes the fore arm will wriggle off when dismantling, and other rifles require some serious persuasion with taps on a block of wood with a hammer to free it off. Some are fit like a perfect slipper, to coin an old timers phrase about this, but none are loose.

Now that we are looking into this area we know that we've already a) checked the recoil lugs for even bearing of recoil pressures, and that b) the barrel up pressure has been checked and established. Having made these steps first we know that now we can address the wrist face fit without the risk of later altering something that could make it loose again.

Image; A partial fit, not acceptable.

Determining Proper Wrist Face Fit

Assemble the fore end and trigger guard to the rifle, keeping the fore arm positioned forward to open any wrist gap to the maximum.

It's somewhat common to find some forends that only make contact towards the trigger guard. Technically if this is making firm contact then this is acceptable, however, the name of the game in chasing accuracy is attention to detail so I recommend having proper contact all across the face, at a minimum from the strap to the edge of the wood.

Double Checks;

- Make sure that the barrel is centered in the barrel channel, and double check that when the fore arm is held forward, that the barrel wants to remain naturally in the center of the barrel channel.
- If it doesn't, go back and double check that the equal bearing of the recoil lugs occurs when the barrel is in the middle of the channel, you may have to re work the recoil bearing lugs.
- When holding the fore arm forward, check inside the trigger guard main screw bearing so that it is centered over the main screw hole. If this is off center you may have to rework the hole.

Tighten the trigger guard screws to their proper positions.
If you have previously installed a card board shim on the wrist face to aid the up pressure checks now it is time to leave it out so you can see all of any possible gap.
You need a minimum of 80% contact from the forend onto the wrist face.

Use a feeler gauge to measure the wrist face/fore arm gap, and record the numbers.

- as close to the trigger guard as possible
- level with where the butt bolt would protrude
- pay particular attention to any differences between the left and right side.

Note; If there are gap differences between the left and right side, under recoil the barrel will throw shots towards the larger gap, and it is crucial to remedy this problem. Don't underestimate this little observation, it is vital to have the fore end bearing evenly on the wrist face.

To correct an uneven interface or too large a gap

Several methods are used traditionally to close a gap, even or uneven. If you need to build up one side, or across the whole surface, the method is the same. If dealing with both, such as a 10 thousandths gap on one side and 15 thousandths gap on the other, you should build up the 10 gap first and then deal with the extra height as a separate action. If you're confident in your skills you can of course do it in one step too.

Old Timer's trick; reduce the wrist gap with paper shims. Building up the required thickness with layers of paper varnished into place is best suited when the gap is quite small, such as under .008, and with layers of thin hard wood if it is larger than this.

Old Timer's trick; paper shim the wrist in the field. This is also an excellent method for experimenting at the range with more and less pressure on the interface, simply put another loose piece of paper across the forend as you assemble it until it becomes a firm fit.

Notes

- Standard A4 paper in NZ is .005 thousandths thick. It is the right kind of paper but if you're in another country it will pay to measure the paper you intend to use.

- Cardboard will compress under recoil and are not to be used on the forend build up or shimming a gap here.
- It is viable to repair this by creating a layer of good quality epoxy glue sanded to size. This can be very accurate and durable, and detracts little from the original appearance.
- If you need to preserve originality then copy the armorer's method of gluing wood in place and sanding it back to correct thickness.

Image; making repairs and before build up.

It's up to you, your skills, and which materials are available to use.

Build up – Method

1. Thoroughly de grease and de oil the fore end butt surfaces.
2. Lightly rough up the surface/s you are using.
3. Shape your shim material, keeping clear of the butt bolt anchor plate on the No1's and the metal cross strap on No4's
4. Epoxy hard wood / glue layers of paper/ make a paper dam for epoxy glue/ to the fore end butt until the proper clearance has been achieved.
5. After it has set hard, slowly thin the material back to the proper clearance with sand paper.
6. Check the fore end fit to the rifle constantly. Refitting it a dozen times would not be unusual.

As the fore end is slid into place the internal shapes of the recoil lugs, and others, 'draws' the fore end upwards and it becomes a tighter fit the closer it comes to its final position, so thin back the shim material carefully.

Note; You want a firm or slightly tight fit.
I set up my rifles so that the forend requires a one handed squeeze to get it into place, ie , light to moderate pressure.

Image; After build up, especially on the low side.

As mentioned earlier it's well known, 'back in the day' as well as now, for a well fitted fore ends to require a tap with a hammer on a block of wood to free it from the gun. We

can infer from this that the fore end fit can be quite a tight fit without detriment. If you're of an experimental mind you could try adding pieces of paper to the interface, making a tighter fit, to find out just how much pressure your rifle shoots best with.

Conclusion
Some rifles have been observed to use metal plates as shim between the fore end wood and the wrist face, and I've used it myself. They are doing double duty in taking up the gap, taking up a wider gap than epoxy would take care of, and also spreading the recoil forces across the fore end surface. It can be useful way to understand what your rifle prefers prior to making more permanent repairs on the fore end butt surface.

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Forend - butt end
disintegrating wood chips and brass rod repairs

Introduction
You might have a fore end that's split lengthways from shooting with a loose main screw, or perhaps the rear most section where the wood support area between left and right is quite small has disintegrated over time, or perhaps you have a new reproduction fore end that does not have this pin installed as yet.

No1 Mk3's seem to come apart here more often than No4's, probably because the plate that locks the butt bolt takes out even more of the wood that would normally hold in place quite well.
If you need to replace the brass wire but can't repair the original you can use easily found alternatives.
On both the No1 Mk3 and No4 the rod is a brace to prevent the wood expanding, it's not behaving like a bolt and nut squeezing the sides together. The No4 Mk2 forend has a long screw across this area and it is only done up lightly.
To replace the rod you could use a 1/8th inch brass bolt with the head cut off or 1/8th brass threaded rod or smooth rod from a hobby supplies store. These stores have a wide choice of rods and lengths available. Threaded rod is not required but does provide a lot of adhesion power when glued in place.

This can be a very oily part of the rifle, however it can be surprising how little of this does soak in. In order for epoxy glues to hold the wood must be as oil free as possible, so repeated washing with turps and dry off, then wash with dish washing liquid detergent (which breaks down (cooking) oils) in most cases can do a very satisfactory job.

Worst case scenario might be that some of the wood chips are missing. It's thoroughly acceptable to re create the missing wood yourself and to use that instead of the handful of wood chips. Remember that the stress that's taking place here is to restrain the forend butt area from spreading and that it's a passive strength we're after, so a perfectly executed, high strength joint made of original parts is overkill.

If you do reassemble this with wood that you suspect is oily and not making as strong a joint as it could, remember that this is not a strength required assembly, it is probably best described as holding things in alignment, ergo it can be oily, not up to strength and will still do an adequate job.

Forend butt end repairs

Method

If you're doing repairs to a fore end butt area that has cracked or split open or the wood has disintegrated;

1. Completely remove the cross wire and wood chips. The cross wire is not anchored to the wood with glue or a thread when newly assembled, so to remove it all you have to do is remove the domed over end of the wire.
2. No1's love to make lots of small chips as this area disintegrates, most can be re-installed.
3. Thoroughly degrease everything that is going to get epoxy adhering to it. If it's especially oily wash it with turps and a brush to get as far inside cracks and crannies as possible. Let it dry thoroughly. Repeat as needed.
4. Cover any side areas of the forend you don't want epoxy spilling over onto it with paper masking tape.
5. Epoxy works best when clamped under pressure, even quite light pressure, so set up your bench vice or clamp in such a way that the base of fore end can be propped level while it sets.
6. Epoxy all the wood surfaces, including the cross pin and assemble everything.
7. With the jaws of the vice padded with layers of cloth very gently close them only until the glued joins are in their proper places, and leave overnight to harden.
8. Do NOT over tighten clamps or it will not fit on the receiver again, it will be too narrow.

- To reassemble this and gain maximum advantage for accurizing I prefer to protect the receiver against any epoxy run over, and then carefully put the forend into place on the receiver and lightly clamp the sides of the forend together, so that the forend is clamped against the receiver.

- When this sets there is a perfect fit between the two items and zero room for moving around to spoil accuracy.

When everything has set properly you may need to slightly hand fit the fore end until the receiver will fit snugly. The aim is to achieve a very snug fit. If your repairs have not achieved this secondary result, see the section about the dowel method which addresses the same issue of tightening the forend fit to the receiver with a simple approach.

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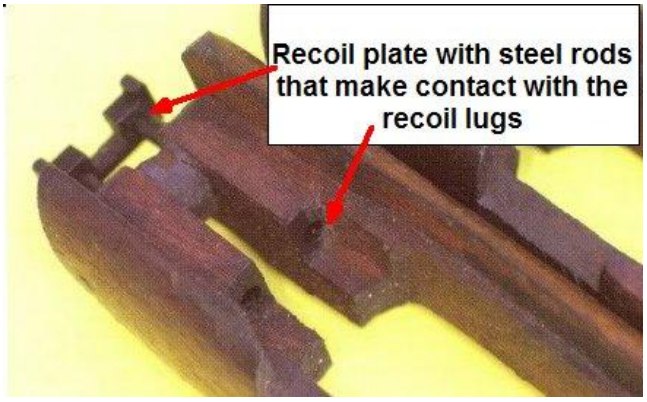
Recoil plate through bolts

A little known accurizing method for No1's and No1 Mk3's, uses the small 'flat U' shaped 'recoil plate' that locks the butt bolt in the back of the forend. It gets threaded for two short bolts that engage the wrist face and recoil lugs, reducing any chance of compression under recoil to zero.

The intention is to make an incompressible steel connection between the receiver recoil lugs and the wrist face, essentially a steel corner brace inside the acute angle of the wrist and receiver. Once installed it depends on a perfectly tight fit between the fore end with recoil plate and the wrist face.
The logic of this method is good, however it is not often seen.
Image courtesy; Milsurps.com



A mock up

A mock up reveals the strengths of the concept plus the nuances of the engineering required. As a ps, the steel of the recoil bracket is very hard and melted several of my drill tips.

Improved method

A way to raise the standards of this method would be to use allen head screws/bolts, drill a pair of access holes through the wrist face, and once the fore end is installed then tighten the bolts via the butt side of the wrist. With the bolts in direct contact with the receiver lugs, as they are tightened the recoil plate is forced back against the wrist face, making a tightly braced connection. A lightly countersunk hole for the rod end would ensure solid contact on the recoil lugs.

More information courtesy Milsurps.com

1 - Repairs to a split forend; http://www.milsurps.com/content.php?r=324-Repairing-a-Split-Stock-on-a-Lithgow-SMLE

2 – Repairs to worn draws; http://www.milsurps.com/content.php?r=370-Worn-draws-in-your-No1-4-or-5-fore-end-....-%28by-Peter-Laidler%29

3 – Fitting a forend; http://photos.imageevent.com/badgerdog/generalstorage/peterlaidlerpostsleeenfieldforums/Fitting%20a%20fore%20end%20correctly.pdf

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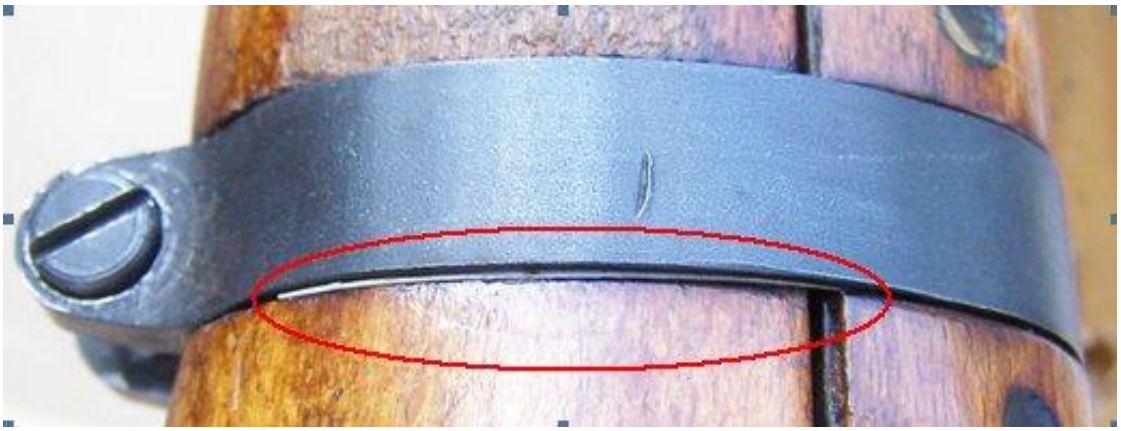
Hand Guards

Image; a No4 guard bowed in the middle that needs correcting.

Old timer's trick; close fitting handguards. No matter if your rifle has stock or non stock bedding on the barrel it is an important element of the overall tautness of the rifle that the hand guards are a snug fit to the forend. This means that they should rest along the forend with no gaps or warping of the wood.
We're not talking about what is factory acceptable here, this is a classic, old timer, invisible, accurizing technique.

- No1 Mk3; Where the front guard slips under the nose cap; with the mid band loose the hand guard should be snug to tight fit under the nose cap and not slide freely along the forarm. If it is you can glue strips of paper or cardboard on either the hand guard lip or nose cap edge to take away the loose tolerances.



Image; under band .010 card shim.

Image; Fulton's No1 mk3 band packing with paper and thread, 1922 (left) and 1930 (right)

No1 Mk3 mid band; this should be a tight fit on the hand guard when tightened. It is common on old target rifles to find all sorts of packing material under the mid band; cotton thread, paper, cardboard. First tighten with a sling swivel in place as it will prevent over tightening and crushing of the wood. Remove it and tighten as you wish once you get a feel for what is correct.

No1Mk3 rear guard; on the No1 Mk3 and earlier rifles this unit is simply clamped to the barrel, and without anchors at each end so you'd think it's contributing little to the tautness and accuracy of the rifle, but nevertheless …
Old Timer's trick; expand the rear guard clips. They should not clamp too tightly, so they do not disturb the barrel harmonics, and to trim the tips off so they can't contact the forend when installed.

Old Timer's trick; hand guards tight under the bands. No4 Mk1 and Mk2; the front guard should be a tight fit under the front and mid band, and the band can be packed with paper or cardboard to take up tolerances.

- No4 Mk1 and Mk2 mid band should be a tight fit around the forend and guards, with packing underneath as required. Test first with a sling swivel in place to prevent accidental crushing of the wood.
- No4 Mk1 and Mk2 rear guard; the rear of the rear hand guard under the retaining ring should be a snug to tight fit.
- As with the No1 Mk3, cardboard or paper shims can be lightly glued to either the wood lip or under the ring to take up any loose tolerances.

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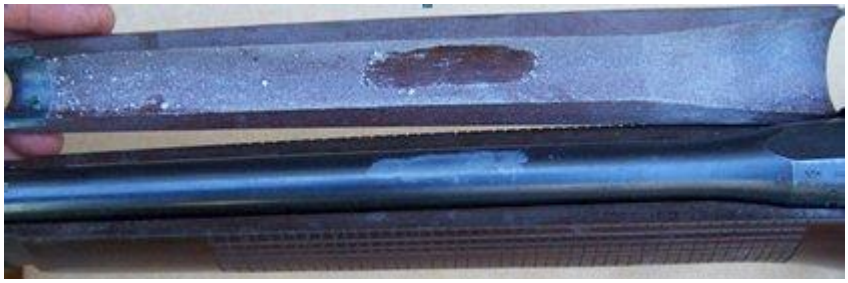
Hand guard internal clearance

The hand guards in a stock Enfield are a close fit. If you re choosing to float any section of the barrel don't forget to make sure the hand guard/s in that area is well clear of the barrel too.

A good method to check for barrel contact is to wipe the barrel surface lightly with an oily cloth and then dust it with a powder; talc, glue filler, or even flour would do the trick.

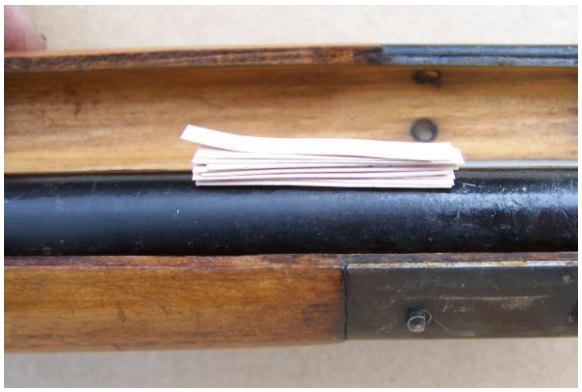


Image; a mock up of talc and barrel contact.

Carefully put the hand guard in place, move it a small amount, carefully remove the guard and then see where the powder has been disturbed or has transferred to the wood, then remove the wood in that area. To allow for swelling from humidity and heat you want a minimum internal clearance of 25 thousandths of an inch. It can of course be more.

Old Timer's Trick; checking out of sight internal clearances.

1. Cut long narrow strips of cardboard packing until you have a number pieces.



2. Fit them inside the guard, and reduce the number until the guard just begins to touch the forend.

3. Measure the thickness of the combined strips.

4. This is the internal gap under the guard. In this case, 6 strips of .015 card equals a total of .090 inch.

3. If you require accuracy eg for floating a barrel area, add an extra .010 cardboard to allow for compression of the guard when the bands are tightened, see below.

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Hand guards, more …
Old Timer's trick; hard wood hand guards; Some shooters made new wood hand guards from very hard woods in the pursuit of adding increased stiffness to the forend.

Old Timer's trick; barrel fitted hand guards. Others made hand guards that were internally a perfect and precise match fit to the shape of the barrel, in effect enclosing the barrel.

An extension of this idea would be to do away with the air gap around the barrel entirely, in both the guards and forend, creating a gain with both pressure and increased stiffness. This could more easily be duplicated by filling the existing stock rifle's air gap completely with epoxy, or by bedding in epoxy and packing with cork so that there is active pressure holding the barrel down into the bedding.

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Head Space

Correct head space

No Go gauges are used on many different types of fire arms to check the degree to which the bolt closes on the cartridge.

Checking headspace is just about the first thing you should do with an Enfield. The NoGo is the simplest tool of the four that are commonly used. These gauges all resemble the rear inch of a 303 cartridge case, complete with carefully machined rim.
The NoGo rim is a very precise measurement, .074.

Note; Gauges of this type for Lee Enfield's come in other measurements, and an experienced shooter can learn quite a bit about the rifle in using them, however the one that should always be checked is with the .074 NoGo, as this measures whether tolerances are getting too loose.
Headspace that is too loose can result in cartridges that get stretched too thin. When you extract them the thin brass gives way and the head pulls off, requiring a whole new game to extract the remains of the case. (see extractor pg 58)
If your rifle's bolt closes on a NoGo gauge you'll need to replace the bolt head with a slightly larger one that is designed to close that gap a little, usually .05 to.010.

Method – using a NoGo

The correct way to use a .074 NoGo gauge is to remove the extractor claw from the bolt head, put the bolt head back on the bolt, insert the gauge into the chamber and then gently try to close the bolt handle. Ideally you will feel resistance somewhere along the mid to late part of the bolt handle's travel.
If the travel feels squashy and stiffens, as though you could go further if you put a bit more effort into it, don't. This resistance point is the one you're looking for.

If you don't want to strip the bolt head and are somewhat careful you can do this without removing the extractor claw. Remove the magazine, gently squeeze the gauge under the extractor claw, reaching up through the magazine well, and gently push the bolt into place. It will drag quite hard along the inner groove of the receiver wall, so be careful so it doesn't gouge into what needs to be a smooth polished surface for the bolt travel.

What you want to discover is how far towards closing the bolt will go. If the bolt handle freely closes then the headspace is too loose and you'll be needing to install another bolt head, usually .05 -.010 thicker. That's sufficient to return the bolt handle to a proper, higher position when repeating this test.
The optimum test result is that the bolt handle halts at least 1/3rd of the way, ie is not too tight, and doesn't go the last ½ inch of travel, ie too loose.

Image; correct bolt closure on a NoGo gauge.

No Go gauges and sets, from several sources, can be located at;
http://www.enfieldresource.com/reloading-ammunition

Bolt heads

No1 and No1 Mk3 Lee Enfield bolt heads came in a variety of unmarked sizes such as .350, .450. 550 etc, and it was also common for armorer's to remove the unwanted excess with an oilstone or wet and dry until the desired thickness was reached. Overtime this has

meant that although bolt heads often come in generally grouped sizes you will now find every possible size in between. It now also generally means that the larger sizes are harder to find and that the smaller ones are much more common as people discard them from aging rifles.

Image; No1 Mk3, No1, No4 and No5

No4 Enfield bolt heads are much easier to use, with slight comments necessary. They are clearly number stamped 0 - 4.
1) A 0 bolt head does not automatically mean the rifle is brand new, they were released from the factories with 0,1's and 2's and perhaps even 3's. If you have a 2 rifle , it may still be in good shape internally and last a lifetime.
2) In addition, the actual bolt heads have often been worked on by some war pressured armourer and you should not take those numbers for granted. A 2 bolt head may have been ground down to a custom fit and be smaller not larger, than a 1. So if you're doing head space and are being careful about it, check those sizes with calipers so that you know for sure what you have.

Most 'Enfielder's' deliberately accumulate a random handful of bolt heads over time for their tool kit.

Conclusion
Tight headspace sounds like a good thing to have for better accuracy but the real world tosses in a manufacturing curve ball. Even though ammunition is carefully made, in practice there are variations. Some of it is in the thickness of the cartridge wall, some in the cartridge rim.
If you head space tightly, when you strike an extra thick rim you'll end up forcing the bolt arm over, and this will almost invariably generate the random shot that lands away from your regular group.
So, medium head space is better than too tight or too loose. If you're a reloader, or are strict about the thickness of brass you use, you can head space more tightly.
Ultimately it comes to what your rifle prefers that gives best accuracy, so a little testing can yield results.
A point worth remembering is that if you're competing in strict 'as issued' rules, that rifle inspectors can reject a rifle is the headspace is too tight and considered not representative of 'as issued', another reason to headspace in a mid range.

More information courtesy Milsurps.com
http://www.milsurps.com/content.php?r=296-Headspace-101-for-.303-s

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Main Screw and Collar

Image; a collar with the copper tube liner in place.

Precision fitting

The main screw at the front of the trigger guard, and the collar it goes through inside the wood of the fore end, are a pair with different roles, and within their roles there is a modification that adds a little additional accurizing help, and that is making the collar a precision fit on the main screw.

As they come the main screw and collar have quite a bit of free play, and if we're going to make this a precise fit, then when the collar installed in the wood of the forend has to align the main screw exactly onto the receiver's threads, instead of the stock set up which has quite a bit of free play to allow a freedom of movement while fitting.
You'll see what I mean if you look down inside the collar when the forend is on the rifle, sometimes the hole for the main screw is dead center, sometimes it is offset.

This is a two step method that first requires reducing the internal diameter of the collar with a liner, and then the collar can be fitted to the fore end.

An alternative to lining a stock collar is to locate a strong piece of metal tube as a collar substitute, that is a tight fit on the main screw and cut it to exactly the same length, and to use this instead of the standard item.
Copper and aluminum may crush under pressure so choose carefully, perhaps with thick sidewalls.

Lining or shimming

Method

- If you're going to fill the stock collar, I can tell you from experience that filling the gap with epoxy isn't the best choice, it disintegrates and adheres when you don't want it to. So, instead, first locate a piece of aluminum or copper tube that is an exact fit onto the shaft of the main screw. If it is thin wall you can use it as a liner, if it is thick wall you could use it to replace the collar.
- The collar is a fraction over ½ inch long, so all you need is a short piece to work with, 3 – 6 inches long.

- Probably it will have too much diameter to fit inside the collar, so reduce the diameter so until it just fits inside the collar. Use a dremel fitted with the ½ inch diameter sanding tube. It's easy to keep it moving around the tube so that the material removes evenly.
- Cut it off the tube about an inch longer than the collar so it will have overhang.
- If so inclined you can experiment with heating the collar in a cup of boiling water and freezing the tube in the icebox and fit them together for a never move fit.
- Sandpaper clean the inner and tube outer surfaces, smear them both with epoxy glue and fasten the lining into the collar.
- Clean up the overhangs and clean up the ends. To help with installing on the rifle cut a slight taper into the entrance of the lining with a couple of turns by hand of the front of a ½ inch drill.

Accurate location of main screw

Image; an exaggerated view of a mis aligned main screw hole.

If you're using a main screw collar that is an exact fit on the screw shaft you can sometimes discover that the screw now does not line up with the receiver hole. The only way to do this right is to enlarge the hole in the wood, insert the main screw and collar, and bed the collar into the forend with epoxy. This will create an exact alignment of the main screw and receiver. Just remember to coat the collar with release agent or paper tape to ensure it will come free.

Method

Do this step after any work on the forend/wrist interface, and the barrel is centered in its channel.

- Clean up the internal surface of the wood in the fore end where the collar will sit in position.
- Coat the collar in release agent, I use a hard wax and a single layer of paper masking tape.
- With the fore arm properly installed on the rifle, and confirming that the forend/wrist face fit is tight, fill the gap around the collar with epoxy and run the main screw down into position.

- Any place you don’t want epoxy to adhere to can be coated with carefully placed strips of masking tape, don’t forget to protect the surfaces of the receiver around the main screw post where the glue might squeeze out.
- After it has set, set the fore up on the bench and tap the collar out so that it is free and not adhered to the fore end. The collar is designed to be a floating unit. The layer of masking tape around the collar before using the epoxy will come free and allow the collar to tap out.

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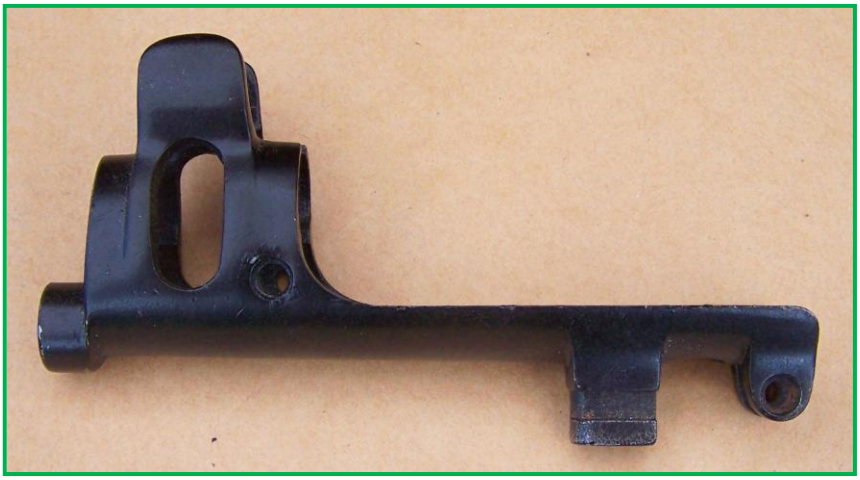
Nose cap



Introduction
The No1 Mk3 has a strongly made nose cap that is easily recognizable as such. The front of No4 rifles is not a nose cap but a front band. These are the correct terms for these respectively however you can easily find them mis described, just be aware that when someone says a No4 has a nose cap that they don't mean that it has something you've never heard of along the lines of a No1 Mk3, it's just a mis label.
Each of then has a quite different purpose, each can spoil accuracy if not set up correctly and in addition we can get accuracy gains with both of them

No1 Mk3

The No1 Lee Enfield nose cap is often overlooked as a source of inaccuracy and as a place where we can gain points. Well known target rifle makers in the UK had several tricks for this item, and it can be 1) accurately positioned, 2) modified and 3) bedded.

In addition the nose cap is a significant strengthening component of the No1 Mk3 forend. As mentioned in the hand guard section, the front end of an Enfield ie the fore end, hand guards and nose cap, can be looked at as a long narrow box enclosing the barrel. Anything that adds to the rigidity of this 'box' helps the barrel's stiffness and hence accuracy.
A careful aligned and bedded nose cap is the front stiffening element of this box.
In this section we'll deal with the less intrusive options, and bedding a No1 Mk3 nose cap can be found on pg 178.

Loose nose cap and barrel

As delivered the normal Lee Enfield nose cap has slight, somewhat randomized contact with the slightly protruding barrel**.** We want to minimize unnecessary contacts that could create 'buzzy' vibrations in the barrel at the moment of firing.

Solution

This would come from either making the nose cap a tight fit to the barrel, or by opening the hole in the nose cap so that there's an even .020 gap right around the barrel. As we're trying not to make alterations to the rifle in this chapter we'll opt for making it a tight fit to the barrel.

Image; Choices; tight fit or .025 gap (Fulton). Note the wide gap both sides of the sight base,

Old timer's trick; The stock barrel rests in the hole through the nose cap but is a slightly loose fit. The answer is to cut a narrow strip of .005 A4 type paper so that it will go around the barrel exactly once, with no overlap of the ends. As you assemble the nose cap keep this paper in place around the barrel. It will be a light fit as the cap is squeezed on. Trim off the excess paper with a sharp blade. This will leave the barrel centrally located, with an almost invisible, very narrow circle of paper around the barrel that fills the gap precisely, and will stop any unwanted movement. If your gap is larger keep using thicker materials but make sure the ends don't overlap to ensure the barrel stays centered in the hole.

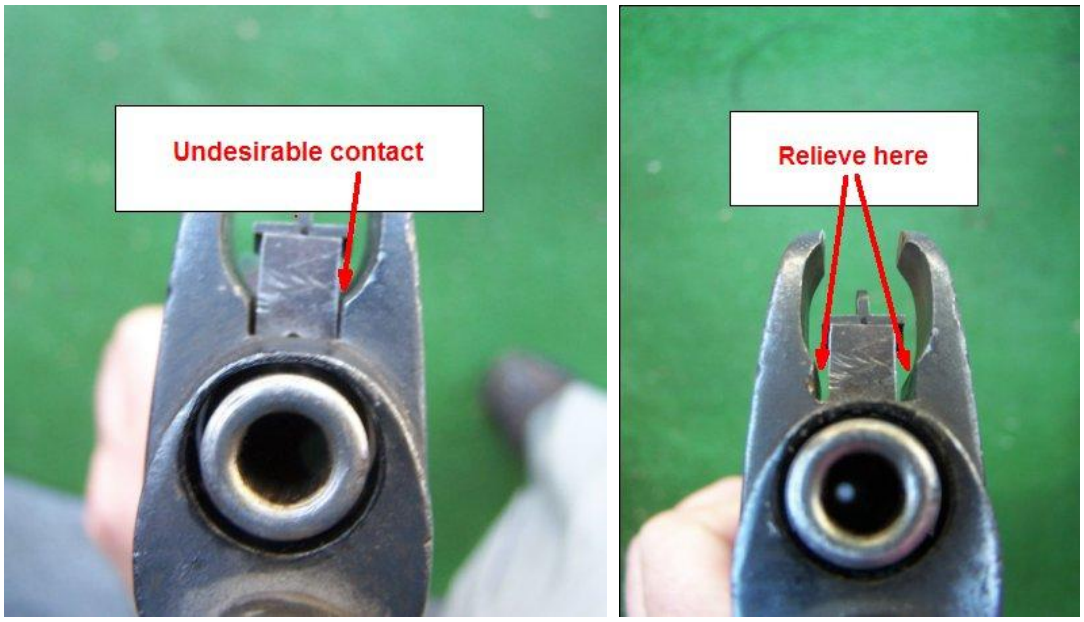
Alignment

After your fore end is properly set up, bedded, and any upward pressure on the barrel tip is correctly set up, you can work on the nose cap.
In addition to the loose barrel contact there are two more things we don't want from the nose cap;

- Adding side pressures on the front sight or the forend wood.
- Being a source of vibration.

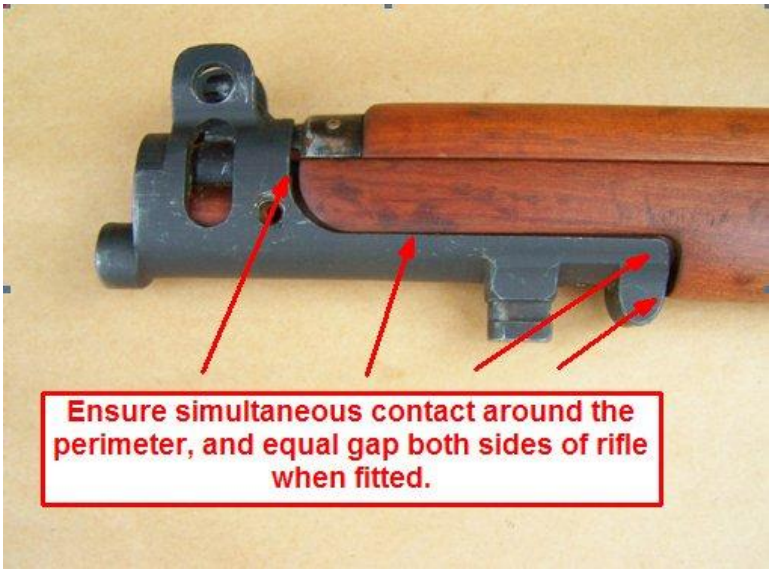
Nose cap contacts front sight

Often over looked, the front sight base of No1 Lee Enfields should not be in contact with the inner sides of the nose cap. This light contact can cause 'buzzy' vibrations and side pressures that affect the harmonics at the moment of firing.
Note; don't alter if competing in 'as issued' matches, instead change for a No1 Mk3 nosecap with the larger clearance, if within the rules.



Images; 1907 Enfield No1 target rifle, H barrel, relieved barrel hole and sight clearance.

On Enfield No1's circa 1905 the clearance is fairly close at .010 each side of the sight base. Enfield seem to have become aware of the problem and increased the nose cap's clearance to just over 1/16th inch on both sides of the sight base on the No1 Mk3.



Poorly aligned nose cap screws and warped wood can make the nose cap twist and exert pressure on the front sight, causing inaccuracies though disturbing the barrel's proper bedding and the barrels harmonics. Half the time it's the small screw at the rear of the nose cap that causes this twist, and is strong enough

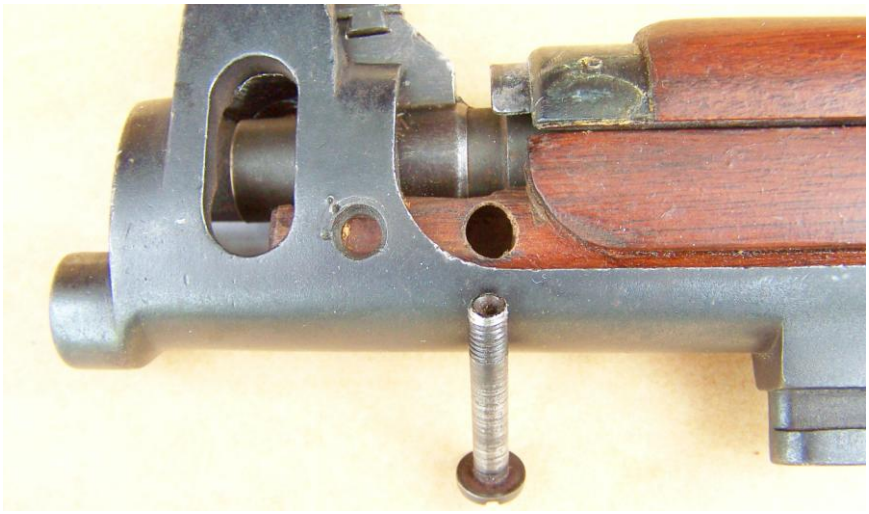
to overpower the larger cross screw which has little stiffening action.
Problem areas are;

- The front screw hole through the wood is often worn loose.
- The rear screw nut is crooked in its anchor hole.
- Warped or aged wood that makes the nose cap lean away.

Worn cross screw hole

The only decent way to repair a flogged out screw hole like this through wood is;

- Drill the hole out to a standard size.
- Fill the hole with an (eg) ¼" hardwood dowel, or fill with epoxy.
- After the glue has set and the ends are trimmed off, assemble the nose cap to the forend, with the front hand guard in place as well.
- Tweak the nose cap's alignment with cardboard shims (temporary) so that the nose cap is squarely aligned and sitting free of any uneven contact with the edges of the forend.
- Mark the holes position with marker pen or similar.



Image; a well worn cross screw hole

- Remove the nose cap and being careful to maintain accuracy, drill the hole through with a 3/16th, or exact sized, diameter drill so that the hole remaining will be a close fit on the cross screw.

Misalignment

Fasten the nose cap using just the horizontal screw, look around the perimeter of the nose cap and see if its edges are being twisted hard against the wood in spots. If there is unusual contact you can …

- Remove just small amounts of wood as necessary to keep a slight and even clearance right around the nose cap.
- If the nose cap wants to twist and contact the front sight you can use cardboard shims under the offside of the tang.

- If you tighten just the horizontal screw and the nose cap does not twist, it is probably the smaller rear screw causing the twist.
- If the cap is now twisted, it usually it comes from the odd shaped nut inside the fore end wood not sitting square in its hole. Remove small amounts of wood under this nut as necessary to allow it to sit square.
- If you're at the range and need a quick fix to stop the front sight contacting the nose cap, it can be twisted or rotated slightly to bring it away from the sight. Keep it in that position with pieces of cardboard shim under the lip of the opposite side of the nose cap.

Dust protection

Old timer's trick; dust protection for floated barrels. If you have chosen a floating or partially floated barrel for your No1 Enfield the nose cap must have zero contact with the barrel.

The traditional target shooters method is to drill out the nose cap barrel hole from the standard 9/16ths, to leave a gap around the barrel of 1/16th to 3/16th inch .
As this can be a trap for debris drawn back in during firing, the gap has traditionally often been filled with a short section of rubber tube. The problem with this is that anything denser than the softest foam rubber interferes with the floating barrel's requirements of being free from contact.
I recommend that if you're concerned about debris, to obstruct the hole with light density foam rubber or similar, cut to shape as needed. The softer the material and the less dense, the less it will be able to transmit vibrations to the barrel.

No4 Mk1 and Mk2 Nose cap/band

The nose band on the No4 has a quite different role to the No1 nose cap. It is seemingly just a simple clamp to hold the front hand guard in place, however, while that is true there are accurizing gains to be had, and there is a real problem to avoid.

Frustrating random shots and unusual groups can sometimes be tracked to a top hand guard that has crept forward just 1/16th inch and made contact with the back of the front sight. This is more common than you'd think, and it can happen in the middle of a shooting session. Naturally, do your best to make sure the front band screw is done up tight and that the band is located properly between the rivet heads on the metal of the forend.

Creeping front hand guard

If the band screw is tight and the guard can move forward under recoil you need other solutions.

- Try tightening the band with and without the stacking swivel if you have one. The swivel thickness prevents over tightening of the band screw and potentially terminal crushing of the wood.
- Old Timer's trick; sticky shims under the front band; You can pack under the bands with layers of hard paper or thin cardboard. This is preferable to metal shim material as the soft crushing effect of the cardboard is ideal for a good friction fit. Aluminum soda can is also good as the alloy is quite sticky when clamped.
- Old Timer's trick; make a tab on the band; With the front band in place, exactly between the sheet metal of the hand guard metal cap, you can create a dent or use a small hack saw to make a tab that hangs lower, below the sheet metal's edge.

- This tab will absolutely prevent the guard sliding under the band but if it is too deep it can obstruct the band removal when disassembling, so only make it as deep as the sheet metal, no deeper.

Even if you don't think you have this problem on your No4 double check anyway and make sure that the forearm and the hand guard cannot interfere with the front sight.

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Receiver

Introduction
The Lee Enfield receiver has been the object of much discussion over the years. The No1 receiver has been described as being a little too flexy, and the No4 receiver was made substantially thicker as a consequence, and after that those comments stopped appearing.

In Australia the WW2 sniper version of the No1 Mk3 was initially deliberately made on a batch of rifles dated prior to 1920 as the quality of WW1 steel was felt to be better than during WW2. The early dated HT rifles are also now more desirable.
From a target shooter's point of view there is not much to be done about flexing issues, it's too inherent to the manufacturing and design processes, however it does open the idea that using early made receivers to create an accurate rifle would pay dividends in accuracy if building a project rifle from scratch.

Over the years target shooters have developed ingenious ways to gain accuracy from the Enfield receiver. These methods can appear small and seemingly unimportant, but despite that do yield positive results on target.
Possible issues about the No1 and No4 receiver which have been speculated to affect accuracy are;

- Potential fore and aft sliding along the fore end wood as the wrist angle compresses.
- Left and right yawing at the receiver front and rear, which in turn pushes the muzzle left and right.
- Lateral oscillations at the moments of firing.

Over the years these were continually addressed in a number of ways by Fulton and Parker Hale.

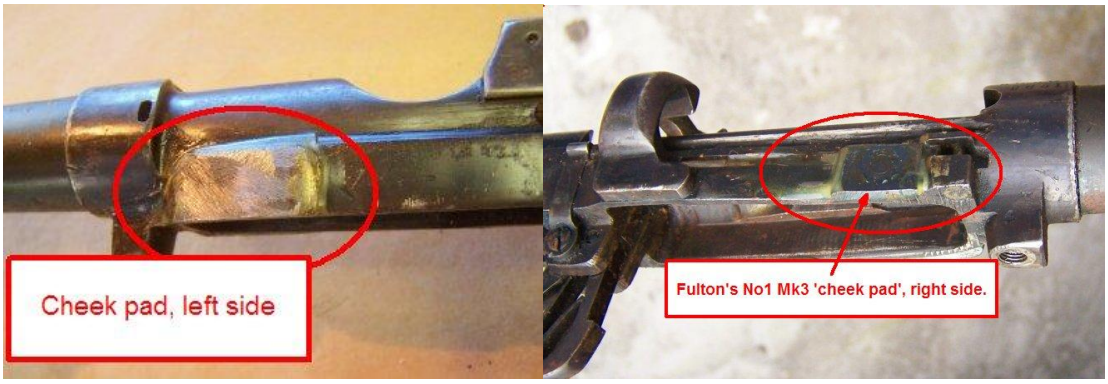
- Fore and aft movements are controlled by firm pressure on the main screw and trigger guard, an L42 trigger guard plate, a tight wrist/fore end fit, and by Fulton's with striations on the receiver underside that bite into the wood.
- Yawing can be reduced by bedding compound on the fore end inner sidewalls, or with dowel locating pins.

- Lateral oscillations can be reduced with dowel pins onto the receiver recoil lugs, bedding compound, or by drilling and tapping the lugs to accept short machine screws.
- Lateral oscillations were also addressed by Fulton in No1Mk3's by adding 'cheeks' to the front area of the receiver to widen the area that rests on the fore end wood.

'Cheek pad' width additions

Invented by Fultons for use on their No1 Mk3 target rifles, and continued by private shooters, was the idea of widening the left front section of the receiver to more equally balance the amount of surface area bearing on the forend wood and therefore increase its stability. This was done with pads of approximately 1/8-1/4" inch mild steel plate.

Fulton's silver soldered these permanently to the receiver and the first example shown here has its pads epoxied on by a home enthusiast. They've been on this rifle for decades without detaching, so we can fairly safely assume that done properly with a well keyed up surface, epoxy glue will work for this method.

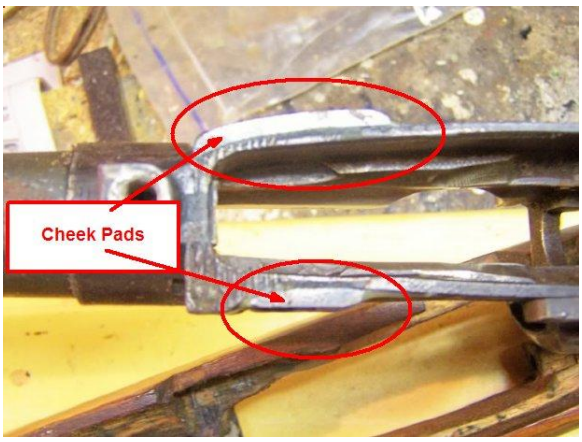


Image; from a 1922 Fulton target rifle with many modifications by subsequent owners, including these cheek pads.

Method

Part A

1. Thoroughly degrease the receiver. Do the whole thing so there is no chance of oils spreading from other places and contaminating the working surfaces.
2. Locate steel plate material 1/8th or 3/16ths thick. If you are using epoxy almost any metal will do. If soldering use the appropriate material such as copper or tinned steel which will accept the solder.
3. Cut to size with hacksaw and grinder, the left side is 1 inch long by ½ inch high, the right side is .75 inch by ½ inch .



4. If using epoxy, use only a high quality one. Never use chinese epoxy from the one dollar store, a post it note would stick better.
5. If epoxy is used, thoroughly scratch up the back side of the pad and the sides of the receiver where they will attach. Do this close to the time that you'll attach the pads, so that atmospheric moisture doesn't begin to oxidize the surface. Also make certain that no oil or oily products get on either of the surfaces, this includes the oils and moisture in your fingertips. Either wear rubber gloves or handle the parts carefully.
6. Put a smear of epoxy on both surfaces and work it into the surface so that it's well into the micro grooves.
7. Set the receiver across a flat surface so that the cheek pads will rest on the right level.
8. Add the cheek pads and lightly clamp then in place with a small clamp. Epoxy makes an incredibly strong joint when set under light pressure.
9. Leave overnight, clean up and a touch up with two coats of black paint and you're done with the receiver. I use a spray can of black epoxy based semi gloss paint, not matt, for good, durable results.

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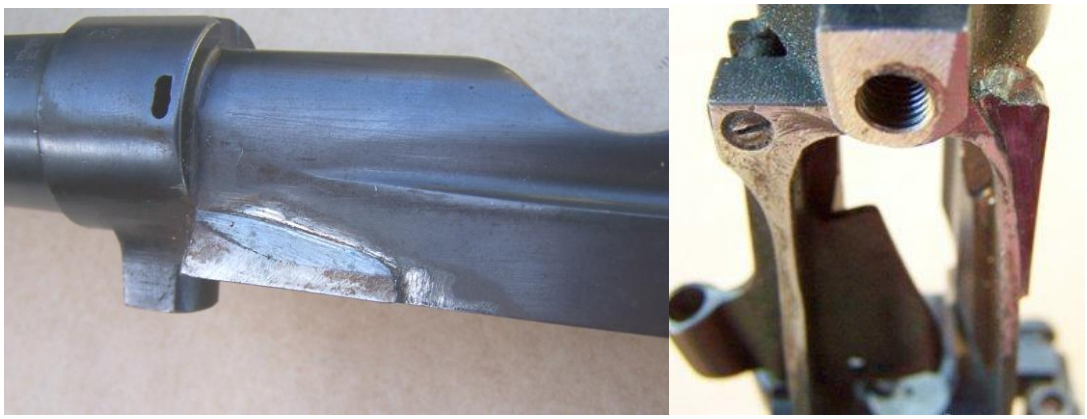
Cheek pads by the professionals.

Image; from a Fulton's rifle circa 1930 with a more professionally added cheek piece to the front left of the receiver wall. You can see how the front receiver surface area and shape to the left and right of the main screw post is now more equally shaped and balanced.



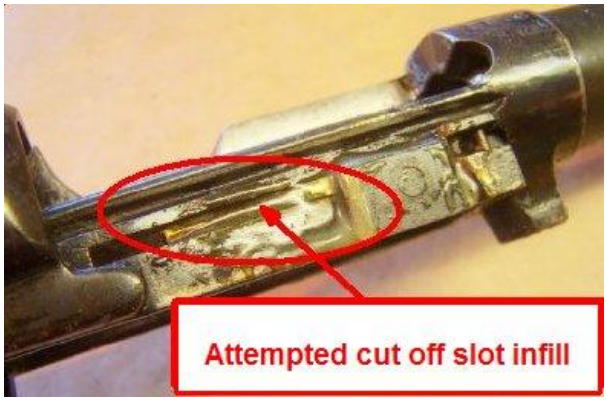
Image; 1930 Fulton, the cheek piece is mild steel and is silver soldered to the receiver.

Part B

1. On the fore end you need to remove a little wood to allow for the extra width, so mark off the area where the pads will intrude.
2. I prefer a sanding tube on a Dremel for this kind of work but a sharp narrow chisel will also do nicely.
3. Remove the wood carefully and slowly. This is a chance to create a tight side fit as well as a smooth flat surface for the cheek to bear on. If you accidentally remove too much, don't worry, the receiver front area is also getting bedded, and the cheek area can be filled at the same time if you've accidentally removed too much.
4. Smooth it up with sandpaper and you're done.

Magazine cut off infill

A very rough attempt at in-filling the magazine cut off slot in the receiver is shown. It does introduce the concept that putting back in the metal that was removed might help address No1 Mk3 flexing issues.



It also raises the possibility of making the in-fill larger than what was removed as a strengthener.
Another point is that if one is building a project rifle from scratch, and deliberately using a WW1 dated receiver, then it would also pay to use one without the magazine cut off slot. The slot began to phase out after 1915.
Australian sniper rifles built during WW2 used early WW1 receivers as much as possible for the better quality of steel and hence less flex.

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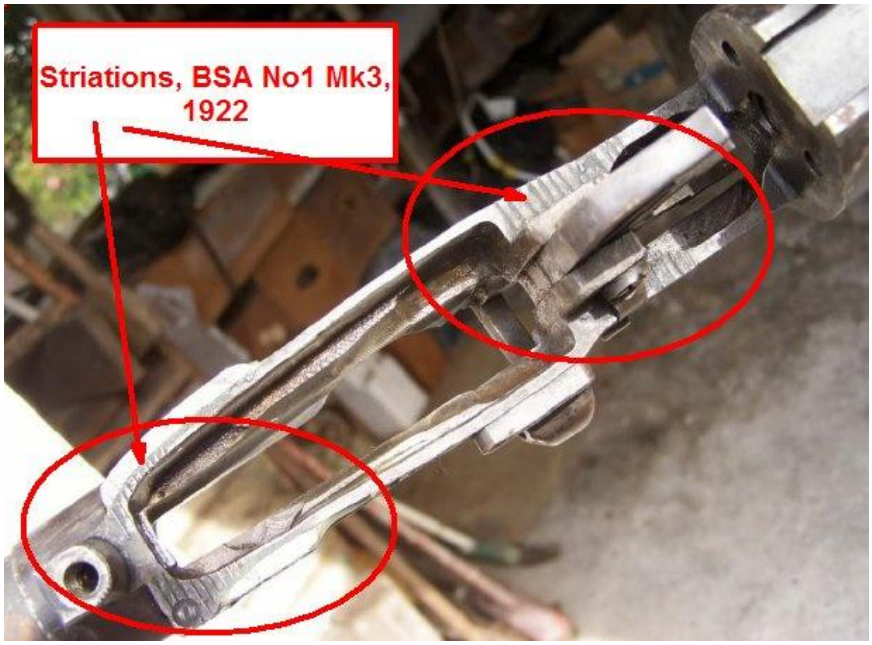
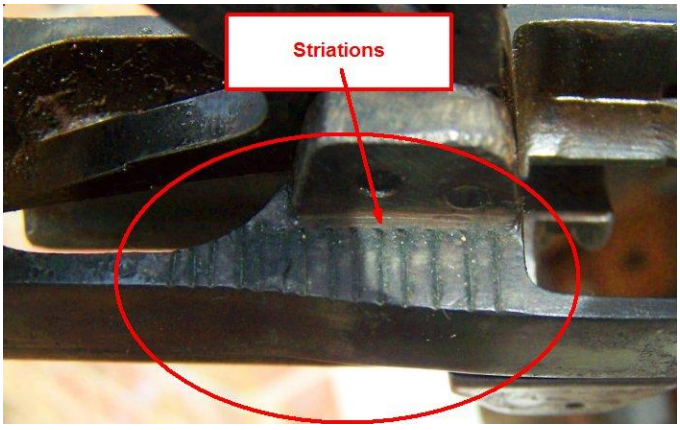
Lateral striations

This was a most interesting and unexpected discovery on a Fulton's No1 MK3, BSA 1922 with a long competitive history.



Any fore and aft 'sliding movement', between the receiver lower and the fore end upper surface mostly comes about due to compression of the acute angle of the wrist. It was enough for Fulton to expend considerable effort in creating striations across this No1 Mk3 receiver in the metal to resist the subsequent sliding action of the forend. Quite how these were created is a bit of a mystery. As they are metallic it could only come from a weld build up, or by machining the surface of the receiver down a little.
They make a good impression in the wood and bedding compound used along these areas.

Given the long history of this rifle it's quite possible that this was created after Fulton's made the rifle, but for now, I'm crediting Fulton's for no other reason than the quality of work involved and intricacy would be in line with their machinist's abilities.



As an accurizing method attention to this area seems to have fallen by the wayside over time, however it does point out that this is an area that might pay dividends.

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Main screw post bedding

An alternate method that also very securely anchors the receiver against fore and aft movement is to use bedding compound around the main screw post, and I've chosen to use this on the 'L 39' carbon fiber project rifle with good results. This method of securing the receiver would apply equally to No1 and No4 rifles.

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Trigger Guard

Image; a No1 MK3 trigger guard needing a little TLC.

Introduction

As harmless and irrelevant as a trigger guard appears to be it has a number of vitally important roles in a Lee Enfield's accuracy, both the No1's and the No4's. Not only that, but if not set up correctly it can cause all sorts of problems, some of which can destroy a fore end in just one or two shots.
On the other hand, getting the adjustments right gives useful gains in accuracy and a very nice trigger to boot.

Proper alignment

The optimum state of the trigger guard is that it must not be putting its own stresses onto the fore arm. A twisted trigger guard can easily exert pressure left and right on the fore end, forcing shots in the opposite direction. The trigger guard of the No1 Mk3 and No4 Enfields must sit in the fore end flat and without tension so that the main screw and rear screw are able to slide easily and freely into position.

Image; sitting flat and free, with no sideways pressures

From the factory the trigger guard recess in the wood forend is accurately made and has close tolerances when assembled, however the trigger guard itself is made of soft steel and is easily bent by accident, thus over a life time can easily begin contacting and pushing the sides.
Tightening the main screw when the guard is obstructed underneath will bow and buckle it away from the points at which it must be absolutely flat.

The trigger guard's vital roles are;

- To clamp the rear portion of the fore end firmly upwards under the receiver. This action comes from the flat inner portion of the trigger guard close to the rear screw and trigger.
- This firm upward pressure at the rear is what gives the fore end its proper upwards pressure at the barrel's tip.
- An equally important job is for the main screw to clamp the mid portion of the fore end upwards into the receiver.
- The last purpose for all Enfields except the No4 Mk2 is to hold the trigger precisely in the right position so that the trigger pull is smooth, not draggy or sticky, and has a distinct two stage pull.

Correct No4, straight and not twisted.

To do this the trigger guard must be;

- Flat when placed on a flat surface.
- Aligned exactly over the main screw hole when attached by the rear screw.
- Not be contacting the forend around the circumference.

Bent or buckled trigger guard

- The trigger guard material is malleable, that it to say, it bends easy.

Image; a typical and easily overlooked bend at the rear of the trigger guard. Compare it to the above, correct, picture.

If you anchor it in a vice, which has the jaws protected against leaving marks on the metal, it is quite easy using hand pressure alone, to progressively straighten out the various bends. Keep laying a straight edge along the flat sides as you work to achieve a level underside.

- Place it into position with the rear screw attached. The main screw hole needs to fall naturally directly over the main screw hole in the receiver, so bend the guard left or right until to achieve this. Now go back and make sure it is still flat underneath. You may have to go back and forward a couple of times to get it aligned right.

Side clearance

The circumference of the trigger guard must also be slightly clear of the fore end when fastened in position, 5 - 20 thousands of an inch gap, or the thickness of a hacksaw blade (or less) at .020 is just right.

Image; a closely fitted trigger guard on a Fulton's rifle, but with no side pressures on the wood.

If your trigger guard is straight and free of stresses but is contacting the fore arm wood, this is the time to gently remove appropriate wood where it touches with sandpaper.
In addition;

- The edges of the recess for the trigger guard must be square in the corners, not rounded. Even though there might appear to be proper side clearances, any rounded corners can easily lift the guard away from bedding down properly.
- The guard must also be making full and even contact at minimum for the front 2 inches of the little ridge that is along the sides of the magazine well. If it is not, we will bed this on page 146.

Insufficient main screw pressure

At the front of the trigger guard the main screw holds the forearm through a collar which is of precise length to allow the wood to compress slightly but not become crushed over time.
If the wood has compressed over time you may find that even with the main screw done up tightly that the trigger guard is not exerting enough pressure to hold the fore arm tightly
A rough guide is that when you examine the wood in this area the collar should be about 1/16th inch below the surface of the wood, so that the trigger guard can compress the wood under the screw's pressure, but not crush it.

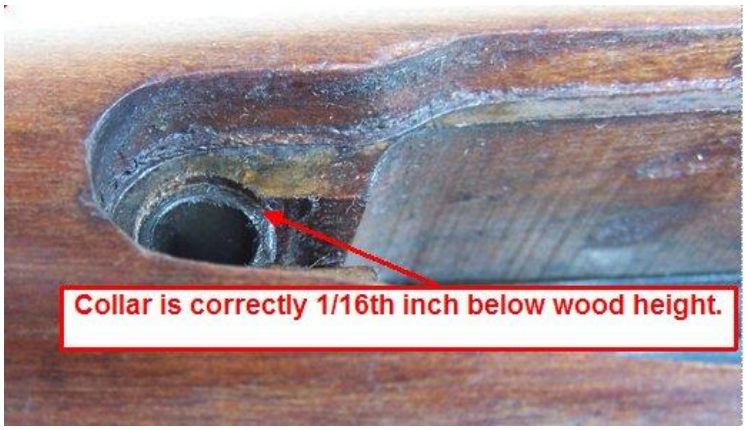
Main screw and lock washers

If you can see that the collar has the correct 1/16th inch below level then the reason that the main screw is not firm on the wood is that it's probably bottoming in its hole. Often this is because the spring/lock washer is missing from the main screw. Not all Enfield main screws have a lock washer from new, but it will cause no harm to install one.

The size of this lock washer is not common and you may have to find one that fits the shaft and narrow the outside diameter with a Dremel tool.
If your rifle never had a lock washer and the main screw is bottoming, you're better off to add a lock washer than try to shorten the screw. Just a cautionary note; the main screw is very strong but also brittle. A light accidental sideways tap can break them off.

Wood height

If the main screw is set up correctly but there is not 1/16th of an inch of wood above the collar then the wood has compressed over time and requires attention. The armorer's way is to glue in a wood layer that restores the wood height. An alternative used by target shooters is to install shims here, either brass or cardboard will do. Experiment with thickness, and use several layers if necessary.



- Trim the shim material to the shape of the front inch of the trigger guard and make sure the hole through it is large enough for the collar to pass through.
- Use enough shims so that the top surface of the shims is about 1/6th inch higher than the top of the collar.

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Main screw - shims and pressure plate

An effective accurizing technique used on the L42 sniper rifle is the addition of a small metal plate to the front inside surface of the trigger guard. Lee Enfield copied this idea from the civilian target shooting community. Shooters experimented and tweaked this through no less than four variations, the least of which causes no alterations to the rifle, to the last which necessitates removing a 2 inch square piece of fore end. (don't worry, it does get put back.) These different approaches were all used widely by the shooting fraternity.

There are four options to apply this technique.

1. As described previously with unattached thin metal shim stock in the shape of the trigger guard tip. You could add this to your ideas for non permanent changes to your rifle, as the shim stock can be slipped in and out at will with no permanent alterations.

2. With a smallish 1/16th plate soldered or epoxied to the front surface of the trigger guard.

3. Or with a medium area plate 1 inch by 1 inch that requires some recessing into the wood. This will create an externally invisible modification.

4 A 1.25 inch by 1.25 inch larger area plate, up to 1.5 inch, this will require an externally visible shaped wooden 'plug' to cover over where wood has been removed from the fore end to allow installation of the plate. A patient craftsman could recess this plate on grooves as an invisible installation.

Must Do; Of all the accurizing techniques that involve making changes to an Enfield this technique of a pressure plate around the main screw is one that should be considered a must have.

The idea is that the trigger guard bears down normally on the main screw collar, which is free to move through the added pressure plate. The new plate surrounds the collar and is mostly recessed into the wood. When pressured by the main screw it creates an increased surface area holding pressure onto the fore end.

Some plates seen over the years are 1 inch square with rounded corners, others are simply 1.25 inch washers, others are flat on one side and rounded on the other. These plates should be 1/16th – 1/8th inch thick and unyielding.

Old timer's trick;
Variation one - shims
To duplicate the target shooters method that requires no changes to your rifle experiment with different thicknesses of shim material. Locate the shim material you want to use, use something non ferrous that won't rust.

Generally speaking, for thin shims soda/coke/beer can aluminum at .004 - .005 thick is ideal, and so is brass sheet, eg .015. Brass and other metal sheets can be purchased at hobby supply stores that provide for model airplanes and trains. It comes in 6 or 10 inch squares, and in a variety of thicknesses from paper thin to as much as .1 inch.

Use the front 1 inch of your trigger guard as a template, cut to size, and make the hole through it large enough so that the collar in the fore end will go through it.

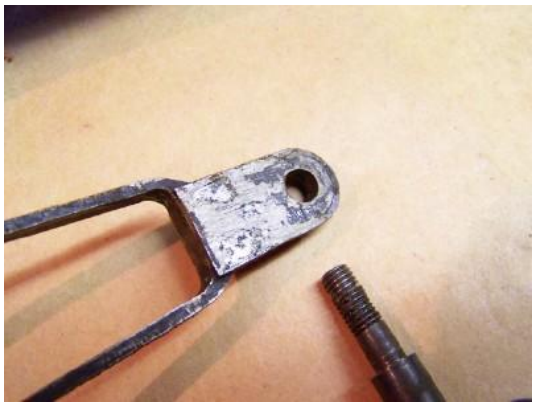
Note; If the collar is not set up to go through the shims their thickness will be added to the collar and reduce, not increase, the pressure bearing on the wood.

There's not a lot of width at the side of the collar but once the shims are in place they're going nowhere, so there's little risk that the narrow section will tear up or break.
The purpose is to add extra binding power to the main trigger guard screw when it's tightened. Stacking shims to build up the thickness is okay, just don't have burred edges or folds that will bulk them up but compress oddly under pressure.

Variation two - small fixed plate

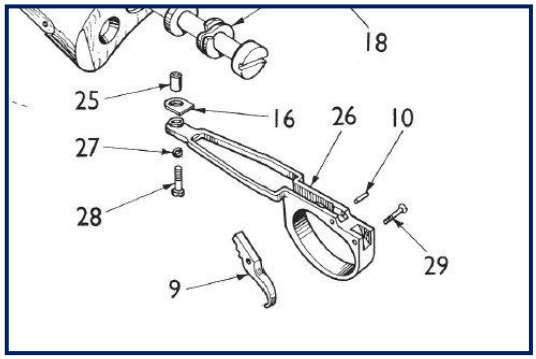
Method

1. Use a strong piece of 1/16th metal, of any type, and cut it to the exact size and shape of the front one inch of the trigger guard.
2. Drill a 9/32 - 7/16ths hole through it, large enough to allow the collar to come through.
3. Attached it permanently to the trigger guard with either solder or epoxy. It will bind much better if you can clamp them lightly while setting.



4. If using epoxy, clean the trigger guard front area until you have clean, shiny and non oily metal. If the surface/s are scratched up it'll provide a better surface for the glue to key into.

5. Scratch up the metal plate glue surface likewise. Don't use cheap epoxy from the one dollar store, its not worth even one cent, don't use it.



Image; L 39 diagram, see number 16/CR1473 Plate, seating.

6. When hardened clean up the edges to match the guard shape exactly, a bit of paint and that's it, you're done.
7. Variations 3 and 4 require the plate to have a matching recess in the wood, this method does not.

Variation three – medium size, one inch floating plate

This is a floating component that is not fixed to the gun. Find the piece of metal plate you're going to use. Metal type doesn't matter, excepting that it needs to be quite stiff so that it won't bend under pressure. It can be a 1 inch washer, cut straight on two sides,

with a 9/32 - 7/16ths hole through the middle, so that the main screw collar is a free but close fit.

Image left and lower right; From a Fulton's rifle.

You don't want it binding so make sure the hole has smooth sides and no sharp corners on the edge of the hole.
If you find a thick 1 inch washer with the right size hole, you can square off the sides and this will also do the job nicely.

1. If starting with a square plate, round off the corners and if you like chamfer the top sides over to the edges.
2. Drill the hole in the center. The main screw collar is .480 inch, so a ½ inch hole or slightly larger would be ideal.
3. The plate requires a recess in the forend and when complete and installed the top surface of the plate should be level with the surrounding wood.
4. The magazine well is wide enough so that a 1 inch plate can get started in the well and slide forward in grooves rather than remove too much wood just to make easy access from the top.
5. Mark where the plate begins to contact the sides, and start removing the wood, creating the grooves.
6. Take your time as you remove wood, it's better to accurate here rather than fast.
7. Once you can get the plate forward to its position you can now hollow the wood and allow it to sit deeper to its correct height.

If by accident you've removed too much wood and the plate is too low, don't stress. This height can easily be rebuilt with either thin metal shims under the plate, or building the wood back up with epoxy fillers.

Variation four – larger 1.25 - l.5 inch plate
This works on the idea that if a small plate works, then bigger must be better. A round washer is better than a square plate.

Image; A 1917 Enfield H barrel I've owned with the large pressure plate shown below was very accurate, and had a history of success in competition. One of its targets is shown below, and other than a 4x scope there were absolutely no other modifications to an otherwise worn and rough looking rifle.

The ‘problem’ is that a 1.25 inch washer is wide and the overhead wood of the fore end must be removed entirely, and then we must create an add on plug to fill the gap.

This is of course a considerable change to the fore end. If you have a spare fore end that you’re experimenting with I consider this modification worthwhile, and afterwards you can decide for yourself whether or not your main stock goes down this road.

Notes

We need to create a wood plug to cover the washer when in place, so it’s better to keep the wood removed if possible.
This could be done with a circular hole saw, the kind used to drill for door locks, or carved from a block. The hole saw sounds easier but that pilot drill needs wood to run and so requires all sorts of steps to get this to work,
Instead I recommend carving a plug from a block of wood afterwards, and staining it to match the surrounding wood color.
The hole saw method can be done, and is a choice I leave to you and your skill level. If you’re inexperienced with hole saws, stay well away from learning on your forend. They have a habit of skittering, and in a flash do tremendous damage to fine surfaces.

Method

Part A – the cut out

1. Mark out the size of the plate on the forend and remove the wood to a depth so that the plate will be level with the surrounding wood when installed
2. Make this surface as clean as possible but you do have the option of using bedding compound later, so don't stress if the wood surface is less than perfect.
3. Remember that the hole through the plate at ½" inch must be slightly larger than the collar, and its edges smooth and free of snags.

Part B – create the cover/plug

You'll need to create a wood plug or filler to cover over the metal plate.

1. You can either use the wood that was removed, or hand shape one from scratch.
2. Shape the wood to fit the forend excavation.
3. Shape the wood to allow room for the front of the trigger guard.
4. Attach it to the metal plate with silicone. Later if needed, it is easily pried out.

Part C – bed the plate

1. If the wood beneath the plate is not perfectly smooth I recommend bedding it.
2. Clean the plate and cover with a single layer of paper masking tape. To protect it from spillage do the same for the outside of the collar, and roll one circuit of paper masking tape around it.
3. Mix up a small amount of bedding compound, spread it on the wood so that the plate will rest on top, and assemble the rifle, Tighten the screw as though for shooting.
4. Wait overnight and disassemble it. Remove the plate and clean off the tape, and clean up any excess compound, double check to see that the trigger guard has the proper side clearances between it and the wood, and also that the plate is a free fit around the collar, and you're done.

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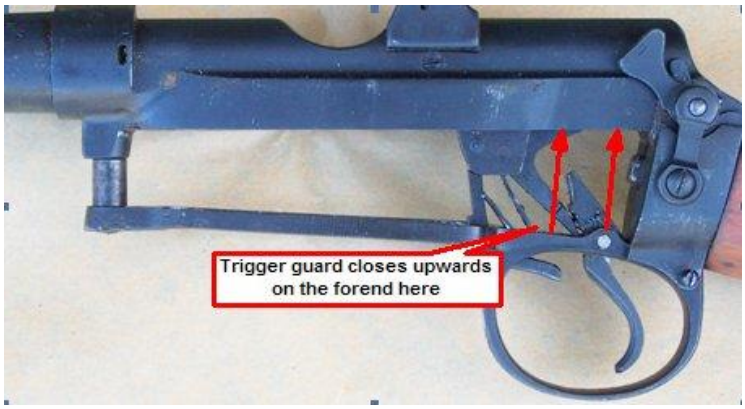
Trigger guard – rear

In addition to the up pressure required at the main screw to keep the fore arm properly anchored, correct upward contact is also required at the rear of the trigger guard where the trigger protrudes.



Correct rear up contact

The rear of the trigger guard holds the forend into the receiver for a firm fit. If it is insufficient the fore end can have slight fore and aft movement, or slight up and down movement, or both, none of it good for your accuracy.

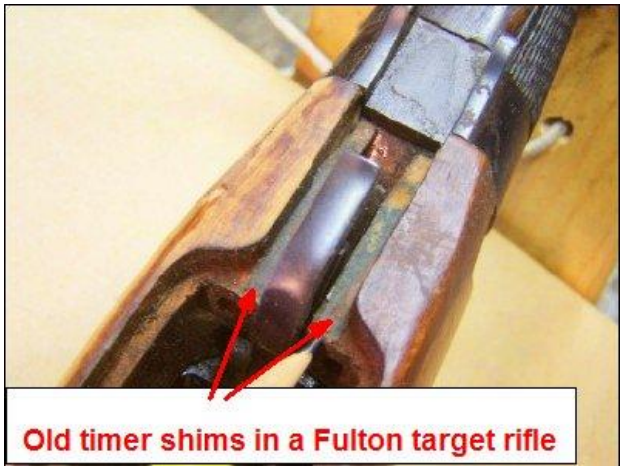
The forend and trigger guard have slants and tapers on them that we often overlook at first. The trigger guard is higher at the front than the rear, and this makes a wedge shape that traps the forend when shoved by recoil, without the need for the heavy clamping pressures that would be needed if they were parallel to each other. The Enfield design fellas were clever in ways that we don't realize.

If you're are just being cautious and want to know that it is tight for best accuracy there is a simple method.

Old Timer's trick; setting the proper forend/trigger guard contact; many old target rifles have slim paper strips on the rail each side of the trigger. As the main screw is tightened they exert the right amount of upward holding power on the forend.

Method – rear trigger guard packing strips

Take out the magazine, place the rifle upside down on a stand, set it up roughly horizontal, and confirm that the trigger guard is properly set up when in place, ie that it sits free of wood side contact all the way around when the screws are tightened, that it sits flat when the screws are removed, and that the wood recess it sits in has square corners.



- Cut two narrow strips of thin cardboard 3/16th inch wide, and 1 – 1.5 inches long.

- Take out the trigger guard and carefully place these strips on the narrow ledge on each side of the trigger. They can be installed both along the ledge, and they can also be bent into the notch for the pivot pin, old time shooters would do both.

- Put the trigger guard back in place, taking care not to disturb the packing. Put the rear screw in place, but not the main, front, screw.

Ideally the trigger guard is allowed to have up to 1/16th inch rise at the front end before tightening the main screw, and if there is insufficient pressure up against the forend at the rear you will not see this slight rise at the front.

Try various thicknesses of cardboard, and multiple layers if you have to, and lay them carefully on the ledge until the trigger guard displays this 1/16th rise at the main screw area.

Image; correct 1/16th inch rise before tightening the main screw.

When you tighten down the main screw it will supply exactly the right amount of contact. These cardboard shims are easily knocked askew during assembly so you can use a drop of white wood glue to anchor them in place.

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Trigger

Introduction

The stock Lee Enfield trigger is a two stage pull, with a distinct initial pull requiring 3-4 lbs pull, and a second firing stage of 5-7 lbs which ideally is more like a switch, crisply releasing the bolt.

The fore end wood on No1 and No4 Mk1's needs to be well set up for this trigger to work as intended, and it doesn't take much misalignment for it to deteriorate and become a single stage pull, or become a heavy, jerky, stubborn, dull pull that you'd think could never be improved.

The No4 Mk2 has a wrist face mounted trigger and is immune to problems created by wood changes, but other than that, it responds to modifications just like the No1 and No4 Mk1. The trigger on the No4 Mk2 was changed to address organic issues with the wood forend but is well recognized as an accuracy improvement.

New Normal wear Modified for single stage

Most shooters have firm opinions about the Lee Enfield trigger, whether it's to their liking or absolutely not. I prefer the two stage pull as I can rest the trigger right on the moment of firing until I'm ready. This has suited my shooting for accuracy in that as my

eyes have aged I rely more and more on ‘snatch shooting’, or letting off at the moment the rifle presents the ideal sight picture.

Shooters tend to habituate as either ‘snatch shooters’ or ‘hold and shoot’. Neither is wrong, many top scoring shooters use one or the other and sometimes both, as snatch shooting can suit a situation where the rifle can’t be held as steady as desired, for instance standing and with a gusting wind. Needless to say, practicing both will only help your shooting.

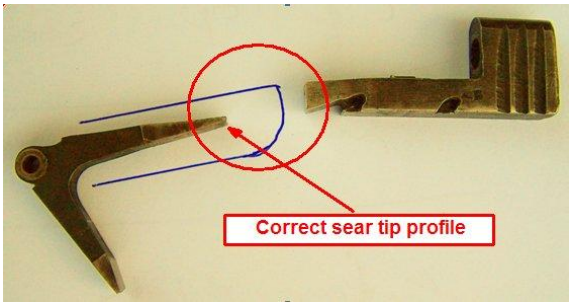
There are a number of ways to approach triggers and what modifications, if any, that you can choose to do.
There a couple of bottom lines about triggers; one is that a rifle with a light trigger pull such as 1.5 lbs, has less time to be pulled off target by a less than perfect squeeze by the shooter. My own experience is that a light, switch like, trigger reduces my group sizes dramatically.
Weighing against this is that most of us also want to shoot in competitions that only allow the stock military configuration and a minimum pull of 4.5 lbs.
If you’re not able to reduce the weight of pull, then the best you can do now is to make it as smooth as glass, and crisp as a breaking biscuit.

The other bottom line is that the good news for military shooters is that the stock trigger can be improved dramatically, and not only that but if you’re wanting more improvement, the trigger can be lightened and smoothed almost as much as any custom trigger unit.
Achieving this on an Enfield entails minute and accurate changes to the angle that the sear makes contact with the cocking piece. If too much angle is created the sear won’t stay engaged, will let itself off, or is too light to be safe, not enough and it will be a stiff and unsteady release.
However, working with the Enfield trigger is a good skill to learn, will impress your friends when they try your rifle, and is not complicated, mostly requiring a little care and patience.

Lightening and Smoothing

The stock trigger as it comes on a new rifle is neither great nor bad. The good news is that it can be improved dramatically with a little smoothing of engaging faces. Opposing that is that with age and neglect the trigger can be the worst, dull, dead, single stage when you want two, and other issues.
If you find an otherwise likeable Enfield, don’t let a poor trigger deter you. In the worst case scenario replacing these three to five minor parts will get it on the road to being excellent**.**

Cocking Piece - Probably the biggest culprit to a sticky trigger is an unusual looking groove worn in the engaging face of the striker knob. Any surface that is not as issued, or has a groove like this, will make a trigger feel heavy or sticky at the moment of release. Solution; you can file and stone this smooth again, keeping the angle precise, or if you have can, replace it with a new one.

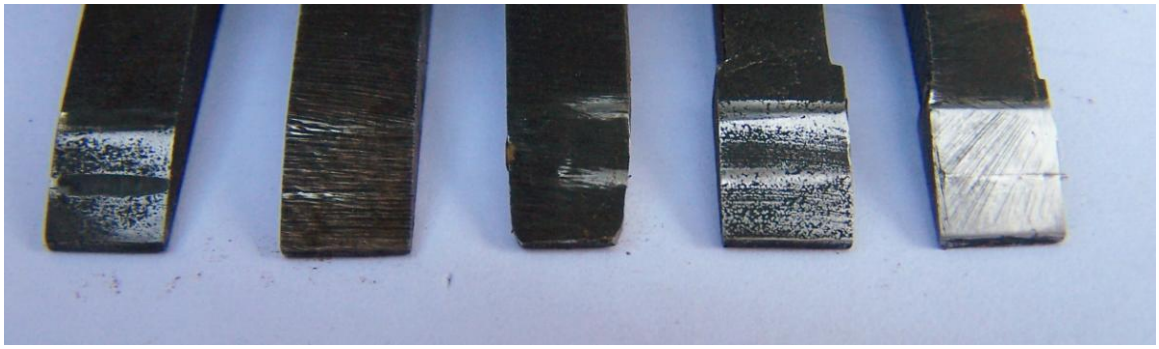


Image; The sear and striker knob interface is where most of the smoothness or problems of the trigger takes place

Sear – Similarly, the long end of the sear that engages the cocking piece can wear into odd angles and lose its intended special profile. The odd angles will create a tightening trigger, and a changed profile will either release too early or make a sticky/draggy/jerky feel.
Solution; stone square and smooth, or replace with new.

Pivot Pins – The sear and trigger pivot pins easily wear over time, with deep grooves showing, allowing all the trigger parts to slop about.
Solution, replace with new. They come in different lengths, and the slightly longer sear pivot pin will foul the fore end wood if accidentally used in the trigger guard.

Trigger – A trigger will wear out in the pivot hole, pivot pin and the height of the trigger bumps. As with pivot pins, sears and cocking pieces, it is an easy and affordable matter to replace all of these items. It is recommended to replace all of these if you're accurizing a rifle.



Image; the lower face on the sear where the trigger presses needs to be smooth and shiny, see the right side one, albeit without that line across it. Horizontal lines will catch on the trigger bumps and a rough or corroded surface will affect the trigger pull. All of these came out of working Lee Enfields, the second from left appears to have entirely missed the machining stage to smooth and polish it.

Two stage and single stage

It is easy to make the trigger a single stage one if that's more to your liking, by filing down the height of one of the bumps. These modified triggers are often discovered when rummaging through boxes of old parts.
The upper bump controls the first stage of the trigger pull, and the lower bump the second, the release portion.

Stock, modified for single stage, trigger stop

There's a lot to be liked about the stock two stage trigger with it lightened and smoothed. I prefer it over a single stage set up, with more control over the moment of release.

More Information courtesy Milsurps.com

How to correctly set up the Lee Enfield trigger
1 - http://www.milsurps.com/content.php?r=354-The-Trigger-Pull-Off-Part-1-%28by-Peter-Laidler%29
2 - http://www.milsurps.com/content.php?r=355-The-Trigger-Pull-Off-Part-2-%28by-Peter-Laidler%29
Correcting problems with the stock trigger
http://www.milsurps.com/showthread.php?t=8583

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Trigger pivot pin

As issued the Lee Enfield trigger can be remarkably loose on its pivot pin. They all come this way brand new, and simply replacing the trigger and/or pin is no guarantee to take out the free play. Unless you decide to replace the pivot pin with a larger diameter one, and to drill out the trigger and trigger guard to match, about the only way to get a less loose trigger/pin combination is to rummage in a box of new/used triggers and pins until you find a combination that has less free play than others.
A loose trigger will have a side play of .10 inch and .15 inch.

If you choose to install a trigger with no free play it will pay even more to follow the armourer steps to ensure you have a trigger exactly functioning the way Lee Enfield designed it. This is because a loose trigger will 'float' slightly, and as pressure is applied the two trigger bumpers will align themselves more squarely to the sear, thus allowing for and correcting for mis-alignments, this does come at a price, with a less precise feel overall.
If you have a tight trigger, if there's any misalignment the bumps will not be sitting square to the sear and will wear until they are.

I prefer the feel of a tight trigger, it may not be an issue for you, it's purely a personal call.
Because of the ease of changing these parts over and the low cost to buy a couple of spares, you could consider modifying a trigger and trying both to find out if you prefer a single or two stage trigger, or more importantly, shoot best with.

Trigger Stop

Something I tried and liked is having a trigger that mimics competition triggers and stops its travel as soon as the bolt releases, rather than having the long pull through of a stock rifle.
The long pull through is also typical of hunting rifles and is made this way to create a large movement of the trigger, which is best suited to situations where the rifle is being quickly and rough handled and can't afford an accidental fire.

If your trigger is the stock two stage pull but smoothed and slightly lightened, having a trigger stop enables you to make a more decisive firing movement, ideal if you're a snatch shooter.

Method one

1. You'll need a 1/8th inch 10BA drill, and tap, available at most nut and bolt supply stores. Also buy a handle unit if you don't already have one. Total cost under $20.
2. Choose several lengths of 1/8th 10BA screws with a socket or allen key head, ¼, 3/8th, 1/2 and 5/8ths inch. You'll want a couple to offset losses. Grab some medium strength Loctite if you don't already have some, and a correct sized allen key,
3. Start the hole with a dot punch and drill it accurately so that the hole starts and remains exactly where you want it.
4. Clamp the trigger in a vice, between wood, leather or cloth pieces so as to not to imprint the vice surface into the trigger.
5. Run the tap through. If you've not done this before it requires a gentle back and forth motion, slightly cutting a little further ahead with each turn, and backing the tool up a bit to clear the cut metal away, then forward again. It's pretty easy but must be done gently and kept straight or the tap will break. If the tap does break

most times you can work the pieces out of the hole but sometimes not. Go gently, and be prepared to do it more than once on another trigger.

6. Don't overdo using the tap, it can flog the hole out and make it too loose on the screw, there's not much metal here and it needs to be well supported.
7. Clean up any rough edges and install it on the rifle. You'll discover that the adjustment can be quite precise, stopping the trigger a very short moment after bolt release, however you'll be better served with the screw turned ½ to one full turn away from the bolt release point.
8. After some trial and error, including at the firing range, you can install the shortest screw possible so that your trigger finger doesn't get accidentally ripped on a protruding screw end, and use a small amount of Loctite to anchor the screw.

Method two

An alternative trigger stop can be made with a short bolt mounted through the back of the trigger guard, and contacting the rear of the trigger when pulled.

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Trigger - Alternatives

There are two after market trigger units available in 2011. One is the Huber Concepts trigger, USA, and the other is a whole replacement trigger unit from CanWest, Canada.

Huber Concepts

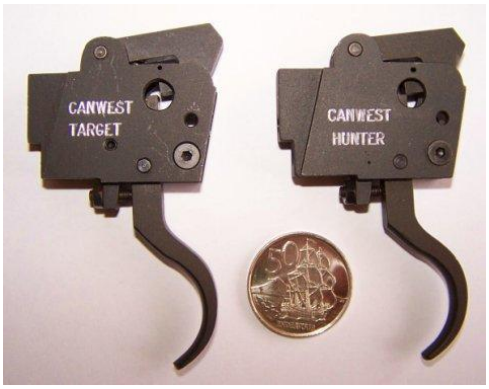
Huber Concepts is an American company that sells low friction triggers for a variety of military bolt action rifles, to counter the usually rough and ready triggers usually found in military rifles. In case you were wondering, army rifles are built this way so that firing requires a very deliberate action and is less prone to accidental discharges when the gun is being used in other ways, such as a club.

The Huber Concepts trigger is the same profile as a stock Lee Enfield unit except that instead of the two trigger release bumps it has a hard ball bearing embedded in the body. The bearing has a height adjustment on the reverse side via turning a grub screw.

The ball provides a very concentrated surface point that reduces friction, and the polished surface makes for a smooth draw. They come with either a teflon coating or in stainless steel.

As the stock trigger spring is used, the weight of pull remains the same.
If you're a trigger purist you'll appreciate the improvement, but if you're a 'died in the wool' Enfielder, or perhaps on a budget, a similar quality trigger pull can easily be achieved with the stock trigger parts.
One of the great aspects of the Huber trigger is that it is a drop in unit, requiring no changes, externally looks the same, and can be easily taken out and reverted to military stock.
Contact; http://www.huberconcepts.com/

Can West
The Canadian made CanWest trigger unit is a small box of high quality parts, designed to install with few hassles and to replace entirely the stock trigger and sear. It provides for fine adjustment of the sear and trigger weight. They make a hunting unit with a long pull through, and a competition unit with a short pull through.



They have a website with illustrated installation instructions.
I installed one on my 1966 Ishapore shown here, and installation, while requiring some handy skills with a drill, was straightforward. It performs well and reliably at the range. If you're going down this road I do recommend this trigger as being a very good addition to an Enfield.
Counting against it is that it requires permanent changes to the rifle; a hole has to be drilled through the receiver recoil lugs for the anchor pin, and the fore end wood has to be cut through in the fashion of the No4 Mk2 so that there is room for the trigger body. In addition to cutting this wood out, because the restraining strap on a No4 or the brass rod on a No1 has been removed, a through bolt must now be installed to stop the fore end spreading open under recoil.

And just to round off, remember that the stock Enfield trigger can be tuned up to be as fine a trigger as you'd want, so if you're on a budget and are eyeing the Canwest, you still have good options with stock equipment.

CanWest
Contact; http://www.lee-enfieldrifles.com/guns.html

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Chapter Two – Bedding

Introduction
This chapter is a broad introduction to bedding.
Bedding refers to the fit of the receiver, action and barrel to the wood of the forend, and can be divided into two main areas of separate work; the receiver and the barrel. It has three principle purposes; to maintain alignment, stop movement and to stop vibration.
In addition to support under and around the receiver, the term 'bedding' refers to a built up area in the forend under the barrel. 'Packing' refers to a matching area in the hand guards above the barrel.

Bedding processes can sound daunting to learn however it's not complicated, is a satisfying skill to learn, and yields positive results. On an Enfield it's the key ingredient that brings the rifle from 2-4 MOA to 1-2 MOA.
If you're handy with epoxy glue products as used in general wood work environments such as boat building and home hobbies, you have ample skills.

In Lee Enfields No1 and No4, No5, N01 Mk5 etc, the receiver design has been relatively unchanged for over 60 years and receiver bedding methods described here will apply equally to all models from 1902 to 1967 and beyond. The purpose of receiver bedding (in an Enfield) is to;

- Correctly position the receiver and barrel relative to the barrel channel.
- To keep it there.
- To keep its position absolutely unchanged during the momentary shock of firing.
- To inhibit inherent vibrations caused the by firing's shock wave.
- To stop additional harmonic vibrations arising between the wood and steel during firing and their flow on effect on the bullet.
- To dampen any flexing, and stiffen the receiver during firing.
- To maintain position of the trigger guard relative to the receiver so that the trigger action is absolutely consistent. (Excepting No4 Mk2's which have an integral trigger system.)

Barrel

Barrel bedding is technically less difficult to carry out than receiver bedding and there are a number of bedding styles known to produce good results. Nearly all of these involve

just the use of cork sheet for packing, as used for automotive gaskets, and epoxy bedding paste.

Before the advent of epoxy resins barrel bedding invariably involved carefully shaping blocks of wood to the barrel shape and glueing them into a chosen place along the barrel channel. The process required decent wood working skills, and some elements had to quite accurately executed for it to work right. Epoxy glues changed all that, and while the accuracy requirements are unchanged, the ease with which good bedding can be achieved has improved dramatically.

You should complete your bedding work on the receiver, whatever that is, before moving to the barrel. It's an invitation to error making if you bed the barrel first and then the receiver.

Receiver

Receiver bedding design has changed little over the years. With the advent of epoxy based compounds the usual method is to fill under the receiver and along its sides.
In pre epoxy times receiver bedding was a highly skilled art that involved removing tiny amounts of wood by hand, all the while balancing the different bearing pressures along the length of the barrel and receiver. Removing wood under the front of the receiver can raise the bearing pressure at the barrel tip for instance, not so desirable if the pressure was already at its optimum level.
These considerations are all still part of any bedding process but the master wood skills have been supplanted by the use of epoxy bedding compounds.

Image; traditionally these high spots indicated would be gradually lowered until the in between areas finally make contact. With modern bedding compounds, the low areas are filled until contact is evenly spread across the whole forend.

The Dark Arts Explained

If you do a little research on rifle bedding you'll invariably bump into mutterings about 'the dark arts', and 'many a fore end has been ruined …' and such like.

For peace of mind both are worthy of a little explanation.

'The Dark Arts of Wizards'

The progress in understanding weapons dynamics from the 1850's to the 1950's was dramatic. In those years engineering was also a growth science. As a result a great deal of

the new knowledge came from trial and error experiments carried out by private individuals/gunsmiths, who accumulated years of experience and little black books of notes in the process.
Results at the range made a gunsmith's reputation and livelihood, and naturally became closely guarded secrets. This secretive nature is what produced the phrase of mystery 'the dark arts'.

By WW2 modern engineering had become an established science, and now allows us ample rules and tools to create a weapon's accuracy, even while still in the design stage. How and why bedding works is no longer such a mysterious process, we know now fairly well what will make a bullet fly crooked or straight, and the closely guarded wizard's secrets are part of history now. Now it's the closely guarded secrets of corporations.

'And many a fore end has been ruined by …'
This phrase also comes from the emerging period, and originates from the bedding practice of trying to create a perfectly matching wood surface for the receiver and barrel to rest on.

This process involves gradually removing high spots of wood in and around the receiver and fore end. Removing a fraction too much wood then implies that the nearby wood now has to be also removed to bring it level again. It easily becomes a process of chasing compounding errors as more and more wood is removed until other factors such as barrel up pressure are affected, and soon the out of balance corrections become uncorrectable.

The single reason we can ignore this dire warning is that we now have epoxy resin bedding compounds that fill any accidental low spots. In fact the bedding process has almost become one of simply removing a lot of wood to create a cavity and re filling it with the bedding compound, which is squeezed perfectly into place during a partial reassembly.
Compared to the 'good' old days it could hardly be easier.

Bedding Notes

Bedding compound can be bought online in an affordable kit form, from supply houses such as Brownels (usa), which includes release agent and coloring agents for the compound. Release agent creates a film on metal surfaces and peels freely away during disassembly, preventing the compound adhering to the metal. One small Brownells kit has served me for 2-3 rifles. It is also usually available at local gunstores who cater to reloading.
Acraglass Gel, 4oz $28usa:
http://www.brownells.com/.aspx/pid=1038/ttver=1/Product/ACRAGLAS_GEL_reg_

Bedding and packing materials often used are; cork sheet from an auto parts store used for gasket making, cork sheet with silver paper glued to one side for heat protection, and also epoxy resin based bedding compounds.
As cork bedding settles over time, thin hard cardboard needs to be layered into the channel on top of the bedding about once or twice per year to build it up again.

All Stuck Up? If you are nervous that the bedding material might permanently glue something fast that shouldn't, and in never say never fashion, these things can happen, a handy tip is; after waxing the surfaces, don't use the release agent yet but very precisely line everything with paper masking tape. Make sure there are no overlap lines, so that the tape edges are exactly alongside each other.
When the bedding material cures off it will stick to the tape, but as you dismantle everything the glue will separate from the metal surfaces. It all separates as a bit of a mess and can take a bit of gentle persuasion at first, but it will come away and clean up well afterwards. Waxing first is extra insurance, and you can wax over the tape if need be as well as using the release agent.
The exception to using tape is not to use it where a really precise fit is required. Tape is about 3.5 to 5 thousandths of an inch thick, acceptable for some places, not in others.

Bedding/barrel lubricants
When shooting the barrel channel is the only place that gets some lubrication, to help it return to center after each firing. Receiver bedding works best with friction.
It's somewhat common to open an old target rifle and discover a dark, silvery, slippery material has been applied to the bottom of the barrel channel or to the bedding surfaces. This is powdered graphite and is there to aid the barrel in returning to the same position after each shot. It's an optional extra that does no harm, the only caveats being that the stuff is dirty and can make a mess if it gets outside of the rifle, and that if it soaks up oil it will clump and damage any soft surface bedding such as cork.

It is commonly available in small engineering shops or auto parts stores such as Chief Auto and Pep Boys, where it's sold as a 'dry' way to reduce squeaks, without the need to spread wet oils around that attract dust and grit.

Keep your barrel as dry as possible to avoid build up of dust and grime that can dig into the surface of bedding material. Cork is especially vulnerable to surface damage.

All Finished? Once the job is complete, don't overly wax or oil the surfaces of any bedding material, you want friction and grip between the bedding and the metal.
Bedding is best done after all work on the forend is complete, and in this order. It is also illustrated in this order in the next paragraphs.

1. The magazine well and trigger guard, No1, No4 and No5
2. The receiver, No1, No4 and No5
3. The barrel, No1 and No4
4. The nose cap, No1

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Bedding Methodology

Introduction

As already mentioned, bedding processes can sound daunting but it's not complicated, is a satisfying skill to learn, and yields positive results.

If you're handy with epoxy glue products you have ample skills. If not, then experiment first with mixing a small batch of compound to get your confidence going and you'll be fine.

Method

A brief overview of any bedding technique is;

- Clean and prepare the wood areas.
- Clean the metal areas of the parts and coat with masking tape/ wax and release agent.
- Spread a thin layer of bedding compound in the low areas, assemble the parts to the wood, and allow to set overnight.
- Gently separate the parts from the wood.
- Clean up excess material on the edges of the compound, and it's done.

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Bedding the Trigger Guard

Introduction

Perhaps the simplest introduction to the bedding process is bedding down the magazine well area beneath the trigger guard. This includes the front area plus the narrow rails along the magazine well. These wood rails are prone to quite a bit of wear and accumulated damage, and they're a good straightforward area to learn the processes. The Lee Enfield god's of accurizing insist on good bedding for the front 1/3rd minimum. In the image above the suggested bedding would reach back to the dialogue box.

Header image; this Lithgow forend has excellent wide side rails, unlike many which are either narrow, damaged or non existent. If the rails are less than the size of the TG side rail then build up the same thickness with bedding compound, tapering it away to allow smooth passage of the magazine.

This is best done after you've completed any other work at each end of the guard, ie the packing for each side of the trigger, and any work for the front trigger guard pressure plate.

This is also a good time to use the bedding material to repair/replace any wood broken away behind the main screw collar.

Image; to increase the area bearing on the forend I filled the front of the magazine well with bedding compound level with the trigger guard. Conveniently it also allowed me to fill in the missing wood chips beside the main screw.

Method

1. Complete a test assembly of the fore end, receiver and trigger guard, including the front trigger guard pressure plate and any packing beside the trigger.
2. Examine inside the magazine well and look for areas at the sides and front where you can feel and see that the metal is proud of the wood work. This is where the compound will go.
3. Masking tape the forend around the magazine well and mark these locations lightly with pencil so you can find them when the guard is off.
4. Mount the gun, trigger side up, so everything doesn't fall apart, and remove the trigger guard.
5. Clean any oil off the wood at the marked off areas, and sand it smooth/clean with a medium paper.

Image; as the side rails were in good contact, all that was left to do was bed the very rear where the trigger guard contact the forend.

6. Clean the trigger guard in those same areas, and coat with a single smooth layer of masking tape, or use release agent, or both.
7. Gently reassemble the trigger guard to the gun, taking care not to bump the release agent. It's important that this assembly is using all the steps you would use for a final, go shooting assembly.
8. Use a small wood or plastic spreader about ½" wide, and layer in smears of the compound along the inner edge of the trigger guard without disturbing the release agent. Make it as tidy as you can but don't worry too much, this area has good access later and can be easily reshaped when the bedding has hardened.
9. When it's properly hardened take off the trigger guard screws and give the guard a light tap and it will break free. Now you'll be able to see the extra overhangs and rough bits, and its time to go to work with sandpaper to smooth it all down.
10. Do a test fitting of the magazine and smooth down any spots that interfere. Any release agent adhering to the trigger guard will remove with a damp cloth.
11. Pat yourself on the back, you're done.
12. Once the guard is removed the first time, don't do a full muscle reassembly for several days. Epoxy has a 3 day slow cure period for maximum strength.

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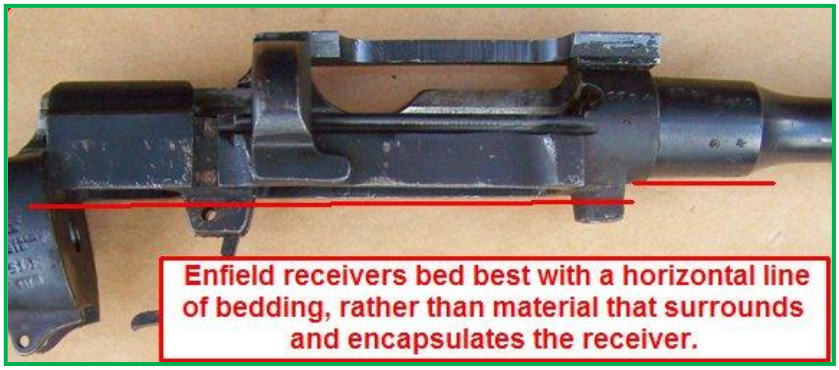
Bedding the Receiver



Introduction

Image; a new reproduction No1 forend, sprayed with WD 40 and dusted with glue filler powder.

The Aim

The purpose of receiver bedding is to make sure that the surface on the underside of the receiver has full and perfectly flat contact with the wood of the forend.
With the lateral dowels taking care of the left and right anchoring of the receiver there is no need to embed the receiver inside a sandwich of bedding material.
Best practices by Fulton and Parker Hale and borne out by private shooters is to minimize the contact around the knox form, to zero in some cases, with the only contact forward of the receiver square frame being the reduced area of the reinforce bearing.

Image; carefully test fitted, looking for the contact points shown with arrows. Assemble carefully, and add the trigger guard, insert the rear screw and then tighten the main screw lightly. Disassemble carefully.

Image Comment; This is a good example of why bedding is important and why new parts should not be assumed to be a perfect fit. The only contact made here under the receiver is at the very front and at the very rear when it should be full length, and not only that, but only one recoil/draws is making contact, and the other just barely, when it should be both and equal.

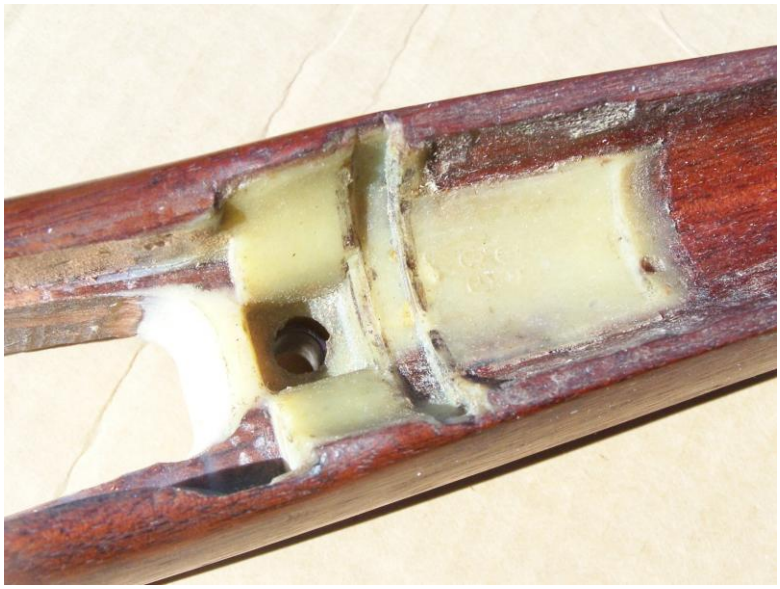
The traditional bedding method would see these high spots that are making contact gradually lowered by scrapping with a chisel, until the receiver was touching evenly from front to rear and all along the side rails of the magazine well.
The modern method with bedding compounds would be to create a clean dry surface, then lay down a thin layer of epoxy from front to back. When fastened to the forend the excess at the high front and rear will squeeze out, leaving a filler level across the low areas.

Image; this shows the contact that should be made under a bedded Enfield receiver. The reduced reinforce bearing is unchanged, there is light contact around the main screw post, the receiver makes full contact across the front, down both sides of the magazine rails, and broadens out to wider contact under the rear side rails.

As we want a precision fit between the receiver and the wood, don't use the masking tape method as a non stick step. You should tape over areas you want protected but that's all.

Image; project carbon fiber, the rear bedding soon after opening it for the first time. Note that the actual amount of material deposited and remaining in the contact areas is quite small. All that's left to do is

remove the excess and make it look tidy. I wanted plenty of support left and right of the recoil lugs, even though I knew this would bind slightly during the first disassembly.

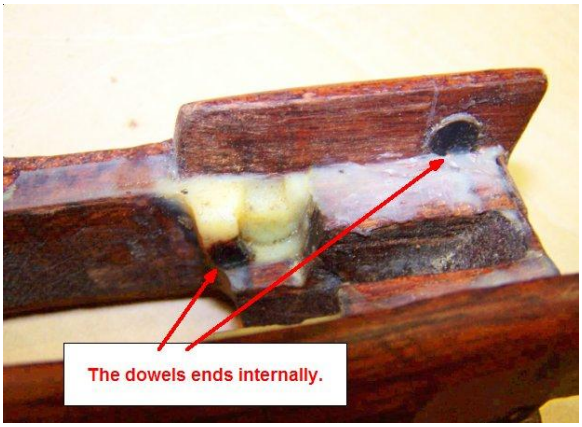


Image; This is the bedding inside the project carbon fiber (No1 MK3/Ishapore) rifle soon after opening. I prefer the shoulder bedding to the left and right of the main screw hole but other methods don't suggest this. The reinforce bearing pad is ¾ by 1 inch long.
Note the build up reinforcing the rear of the main screw where recoil forces pulling on the main screw post often knock the wood away.
The next step is to make the square hole for the main screw/post deeper, so that when the main screw is tightened the post won't bottom out on the material and fail to pull the receiver down.
Notice along the beginning of the side rails how little material is deposited, this is normal and correct.

Method

Receiver – preparation

1. Thoroughly degrease the barrel and receiver, making certain to clean right into the nooks, crannies and corners.
2. Wait until you're almost ready to start the bedding process before applying the release agent in the next step.
3. Gently wipe over the receiverl contact areas with release agent. Do it twice, even three times, allowing it to dry thoroughly between coats. Make sure that you get it into recessed areas, and also have an even coating on protruding corners and edges where it is easy to wipe it on too thinly.



4. Once coated, leave it where it can't be bumped. The film of release agent is soft and easily damaged, and a scratch could create an adhesion point.

5. If you need to repair a scratch you can keep applying more coats of release agent to affected areas, there's no need to begin the whole process.

Image; build up the side rails to match the area of the receiver walls.

Fore end wood - preparation

1. Thoroughly degrease the fore end wood. A liter of turps, an ice cream container and an old toothbrush will do a decent job. Pay special attention to degreasing the areas where you think the compound will spread. It's worth degreasing the whole thing to stop hand contact spreading an oil film where you may not notice but will prevent adhesion where you need it.
2. After it's dry and clean, run a pointed tool along the corners to clean out any debris.
3. Using a medium paper, ie 150 grit, to rough up the surfaces where the compound needs to stick. Don't damage the other nearby areas that are not being bedded.
4. You can often see an imprint of where the receiver sits on the wood and you can restrict your sanding and other preparing to just those areas, we don't need to spread the compound where its not doing any work.
5. If you have damaged wood where you want to bed, or it's excessively oily, it's okay within reason to dig below the surface to remove it down to clean wood because the bedding compound is going to fill in any cavities you create, they'll never be seen.
6. As we're not creating a stress bearing joint and the bedding material only has to cling to the wood enough to stay in place, wood that is discolored from oil and appears unclean, will still provide enough adhesion to do the job, so, don't stress if the wood is not looking like new.

Assembly

1. Go ahead and thoroughly mix the bedding compound.
2. Apply it to the fore end wood in the chosen places, there's no need to apply too much.
3. Taking care not to bump or scratch the release agent coating that coats the receiver, gently assemble the receiver into the fore end.
4. Attach the trigger guard as though for a final, go shooting assembly, utilizing any packing each side of the trigger, front metal plate or shims, and whatever tweaks or modifications you might have used to make the fore end/wrist a tight fit.

5. Do not assemble the No1 Mk3 nose cap, or any packing that will create extra up pressure on the barrel tip.
6. Leave it until the bedding compound has set rock hard. Don't get impatient and try to short cut this step, it's not difficult to squash softish epoxy and end up with bedding that's not a good fit.
7. Normally the parts will disassemble with the same kind of effort as removing a tight forend from the receiver. Even if its tight at first a bit of gentle wriggling of parts, gentle taps with hammer and block of wood, or soft face hammer, applying some leverage pressure etcetera will generally break it free.
8. Clean up any rough edges and overhangs.
9. Don't sand the bedding compound surface.
10. If you find large air bubbles or areas that have obviously not made contact with the metal, you can fill these with a small batch of compound and a second assembly process.

Don't panic

A receiver has many nooks and crannies, a set up that commonly creates places that cling extra tightly. If you find that the finished and set job is difficult to disassemble don't panic, unless an entire step such as release agent has been omitted the worst that will happen is that a small section of bedding compound will break free

In the unlikely event that you have a very stubborn area that won't come apart there are several things you can do.

1. Closely examine the job to see if any excess compound has squeezed into a cavity such as a threaded hole and is trapping the receiver. If you can't pry the epoxy out of the hole then use small tools to cut off its connection to the bedding, and clear the hole later.
2. Closely examine where the compound has squeezed out to see if it has created an overhang that is trapping the receiver or has squeezed out around the semi circle of the barrel/receiver and created that type of overhang. Cut it back with small tools.
3. Normally these two steps will account for 90% of hang ups. If you are still stuck there are more things that will work.
4. Epoxy, wood and steel all have different expansion rates, leaving it exposed to heat and then cold will usually break the seal. You could try immersing it in boiling water, leaving it in a freezer or leaving it in a hot car, etc for a while.
5. Before doing this you will get good results if the joint is under light pressure to break free. Insert a wedge between the barrel and fore end to create some leverage, but not so much as to damage the parts.
6. Sudden shocks are a good way to break a seal too, such as tapping with a light hammer and block of wood.
7. The ultimate problem; let's say you've forgotten to apply the release agent and everything appears stuck fast. A combination of the above methods will break it free eventually. Most damage will be cracks in the wood or cavities, both of which are repairable. In the worst case scenario, at least replacement Enfield fore ends are readily available and are not expensive

8. ***But, it's worth remembering;*** As a last comment though, in decades of working with epoxies I have never seen a 100% stuck rifle, or even one seriously damaged by adhesions, it is most unlikely. If you have a stubborn fore end most likely it is just caught in one or two spots.

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Bedding the Barrel

Introduction
Over the years a number of barrel bedding styles were developed and became well known, and a historical cross section is illustrated here. Some standouts have had long lived success in competition, and we'll delve into three of each for both the No1 and No4 Enfields, as well as three for the H barrel.

The No5 Mk1 'jungle carbine' is a special case and has a fully floated barrel. There seems little data existing from folks who may have been experimenting with improvements. There's every reason to think that the accurizing techniques will work on the jungle carbine as well as the other Enfields, with the caveat that when it was made there were concerns that it had built in accuracy problems.

The methods to create these and the varying historical types are all the same, so that if you're inclined you can easily experiment with any of these styles of bedding.

Barrel bedding incorporates two purposes; one is to contain flexing and the other to inhibit resonant vibration. Barrel bedding methods differ mainly in the size of the platform areas and locations along the barrel that are determined to give the best results.

Barrel resonance is dealt with by putting pressure on the barrel at either the high portion of the barrel's vibratory wavelength, 'the node', or the low portion of the wave length, 'the anti node'. Often barrel bedding is positioned to inhibit flexing and vibration at the same time.
The Enfield practice of slight up pressure at the barrel tip is to inhibit barrel harmonics, and the floating internal band on a No1 Mk3 is at a harmonic vibration low point or anti node.

Fully floating, or removing that pesky military forend

This deserves a solid mention because sooner or later someone will suggest that the wood on an Enfield was only to keep a soldier's hands off a hot barrel and that it is otherwise a hindrance to good shooting, pointing to the accuracy of modern target rifles with their naked, fully floating barrels.
A simple before and after test at the range would quickly prove the fallacy of this. A stocked up Enfield will make about a 2 - 4 inch circle at 100 yards and an unstocked rifle will throw shots into a circle of 10-15 inches at 100 yards.
The wood on No1 and No 4 Enfields is an active part of their accuracy because of the ways it supports the barrel and supplies up pressure.

Removing all the wood simply allows the barrel to flex with less restraint and scatters the shots unpredictably, somewhat like a shotgun. It's not even a good idea for a hunting rifle, except to strip weight off the rifle. The inaccuracy might be acceptable if the hunting is principally under 100 yards or a similar short range. That 15 inch circle at 100 yards is about the size of a deer chest and therefore the rifle might still be useful at shorter ranges.

Image; stock bedding barrel contact in white, No1 mk3 top, No4 Mk1 lower.

Lee Enfield 'as issued' barrel bedding

The No1 Mk3 barrel

For a battle rifle the No1 Mk3's stock barrel configuration is a remarkably sophisticated set up. The notably narrow barrel is carefully supported by the forend wood at multiple points, an internal 'floating' mid band is installed at a resonance node, a plunger and spring supplies up pressure and makes sure the barrel comes back to center after firing, up pressure at the barrel tip dampens resonance and movement.
It reads more like a highly tuned single purpose bench rifle rather than a weapon of war that could be left in the rain or used as a club.

No1 Mk3 H barrel bedding

Two principle choices for bedding rifles with an H barrel installed are;

- The H barrel is floated from the reinforce to the mid band, and then rests in the barrel channel to the nose cap with light pressure. The forend makes contact under the barrel at 6 o'clock. The hand guard is either cork packed between 11 and 1 o'clock, or and the hand guard makes no contact.
  The stud and spring that supplies the normal up pressure is omitted, and the barrel hole is opened up 25 thousandths around the barrel.

- Used on fully wooded rifles, or sporterized half stocked', the barrel is fully floated. The reinforce contact on the forend is reduced in area to 1 inch by ¾ inch. Additionally the pressure plate L 39 style is installed around the trigger guard main screw. A plate with a larger area produces good results.

The No4 barrel bedding

The No4 Enfield barrel designers took into account the No1 Mk3's deficiencies, and created a barrel with wider diameter and more weight, and as a result the stock Enfield No 4 rifle has a fully floating barrel from the receiver end to just short of the muzzle, where it also includes up pressure at the tip created by a slightly raised section of the barrel channel.
With less flexing problems to cope with alternative bedding styles have been more restrained.

No 4 shooters experimented with the known No1Mk3 styles but with varying results.

Historic bedding styles used on the No1 and the No4 barrel

There have been quite a number of different bedding methods seen at rifle ranges from the Enfield golden age in 1900 to the 1960's.
On a comparative basis the different bedding styles all have repeated characteristics;

- *Common to most*; the very beginnings of the barrel, the wide tapered section referred to as 'the reinforce' rests on a smaller bearing area than as issued.
- *Common to all No1's*; the barrel makes no contact at all from the reinforce to the mid band area, ie about the first 12 inches.
- *Common to all No 4's*; The barrel makes no contact at all from the mid area bedding to the muzzle.
- *Common No1 style*; The barrel is bedded from the mid band to the nosecap, with variations in length and size of the bedding contact area.
- *Common No4 style*; The barrel is bedded in the area of the mid band, with variations in position and length.
- *Common to both*; Alternately the barrel has a smaller bedding area just to the rear of the mid band.
- *Common to all bedding*; The hand guards have various sizes and types of packing to work opposite the bedding areas, less often with no packing.
- *Fully Floating*; the barrel makes no contact for its whole length, most often seen on sporterized Enfields.

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Different barrel bedding styles No1 MK3

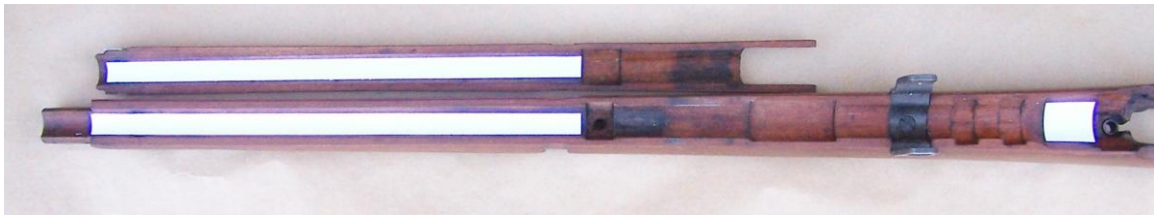
Reknown Australian Enfield shooter and author James Sweet described several good performing bedding styles for the No1 MK3 in his 1954 book 'Competitive Rifle Shooting'. They are written in more detail and if you can find his book it's well worth a read, albeit somewhat hard to find these days. The illustrations of the barrel contact points below are a visual interpretation, and for copyright reasons are not sufficient to reproduce these methods without referring to James Sweet's book. Note; refer end of this section, pg 162.

The purpose here is to show that quite different barrel bedding styles were producing good results for shooters, and while conclusions could be drawn between them if we could see the different shapes of target groups, at this time we are a little in the dark. Perhaps an interesting mystery to be solved one day.

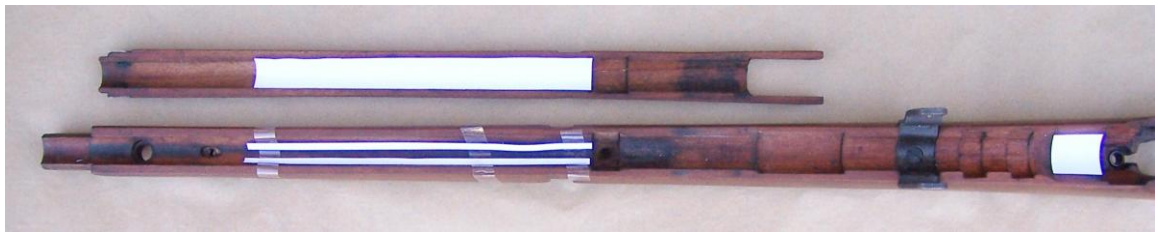
The featured bedding style with spring damping works on the barrel in multiple ways and for that reason gets my vote as the logical winner. Were you to be considering buying a target rifle with any of these methods inside, I would say that you should buy it if you like the rest of the rifle. Regardless of the barrel bedding set up it would seem that you have a good chance of owning an interesting piece of history as well as a good shooting rifle.

‘Standard, as issued, Lee Enfield’, below, reinforce bearing, fully floated to inner band, light contact from inner band to muzzle.

‘**Orthodox’**



‘Orthodox variation’



‘**G. Beaton’**

‘Altman’

‘Pitman’

‘Heat Groove’

An idea that achieved some following is to create a groove through bottom of the bedding material to help barrel heat to dissipate and thus resist changes in accuracy as the rifle warms up. Rifles that have this modification have a smaller surface area bearing on the barrel however this has been no detriment and worked satisfactorily for years for many shooters, including myself.

Heat build up is an area of concern for serious shooters as they are always trying to keep their rifles shooting consistently despite temperature and humidity changes, however this type of heat build up is much less likely to affect the weekend shooter

Keeping barrel up pressure with non stock bedding?

Although literature seems skimpy, all of the target rifles I’ve examined do have up pressure built incorporated, no matter where the bedding is located and how much of the barrel is free floated from the bedding forward.

Interestingly the Parker Hale rifles have had 12 – 15 lbs up pressure required at the muzzle to free the barrels off the bedding, and Fulton’s rifles, with No1 Mk3 barrels or H barrels, require 2-3 lbs up pressure.

Generally speaking this can be achieved by creating the bedding in two steps, the first with the mechanism in place that normally creates the up pressure, ie, nose cap and spring, or front platform in the barrel channel.

After the first bedding step is complete and the barrel is resting its weight on it, the bedding mechanism is removed and any further bedding material is laid down if required. This will retain the correct up pressure to the bedding platform and leave forward of that area as free floating.

If the rifle has cut back wood the up pressure component can be is created with the temporary use of a wedge at the front of the barrel channel.

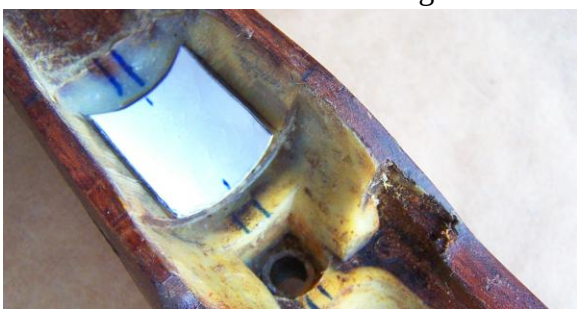
Barrel channel clearance

To make room for bedding materials the barrel channel in the fore end has to be opened up, about 1/8th inch. In the No1 Mk3 there are several recesses in the wood for the inner barrel band and rear sight and sight protector, and to create the bedding platforms for the stock rifle. These make a handy place to start reaming out the wood, and a semi circular chisel is a very good tool to do this with.

After the larger amounts of wood have been removed, smoothing out the channel can be made easier with a large dowel or similar tube shape wrapped in 80-150 coarse grit sandpaper.

Reduced reinforce bearing

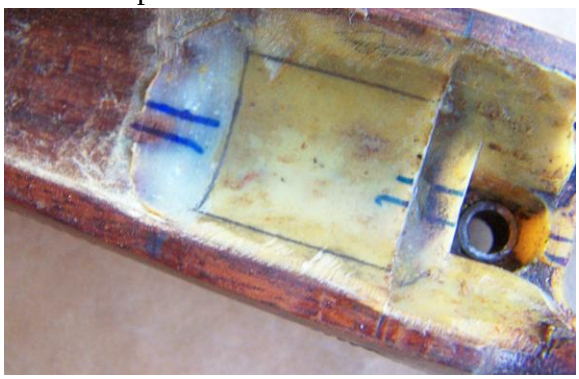
This recommendation is common to all models of Enfield that have barrel bedding. The stock rifle's bearing area can vary its contact from a full U or cup shape around the thick end of the barrel, the reinforce, to a naturally occurring smaller area of about half that size. Target shooters have all found that reducing the bearing area to 1 inch long and either 1 inch, ¾ and even ½ inch wide is essential for best accuracy.



Must Do; Of all the accurizing techniques that involve making changes to an Enfield this technique should be considered a must do.

Method

- Make a card template to the size you want the pad to be.
- Locate the center line of the forend.
- With the template centered in the forend, draw around it.
- Using a Dremel tool or chisels, lower the height of the forend wood or bedding material around the outline, so that when the barrel is installed the only point of contact with the forend is the where you placed the template.



Image;

No4 Mk2, two examples of reinforce bearings reduced by simply sanding away the wood either side, creating a smaller area pad.

The right forend also has wood relieved left and right of the main screw hole so that there's no side contact.

Note; to be on a contact list for a copy of J Sweet's 1954 book 'Competitive Rifle Shooting', go to; http://www.enfieldresource.com/sweet.

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Barrel Bedding Case Studies

Featured here are case studies, two of each for No1 Mk3 plus, two for No1 Mk3 H barrel plus, and two for No4 Mk1 and Mk2 plus others.

No1 Mk3 Enfield

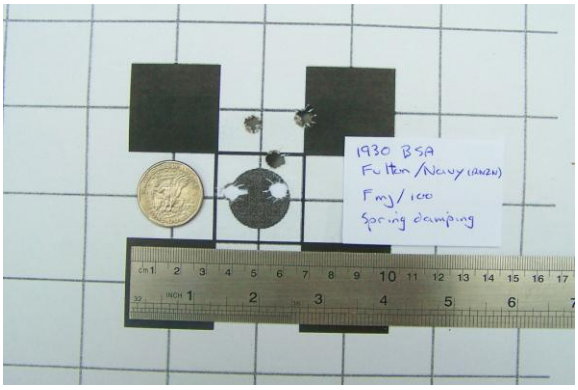
Two well regarded bedding styles used on stock profile No1 Mk3 barrels are; forward bedding with spring damping, and forward bedding with cork packing in the hand guards. The explanations might seem limited but are in fact the same methods you would use to implement any of the other bedding styles.

Study No1; - A - Bedding under the whole front 10 inches of barrel, with spring damping in the hand guard and 2 inches of cork packing at the muzzle.

Study No1; - B - Bedding under the whole front 10 inches of barrel, with 10 inches pf cork packing in the hand guard.

Notes;
These two methods differ only in how the front hand guard makes contact with the top of the barrel. If you are contemplating using any of the other 'historic' styles the methods of creating the bedding and packing are the same for all, differing only by dimension and location.
Because the method described here may have copyright or trademark issues I can only describe the rifle, but not advise you how to step by step re create it.

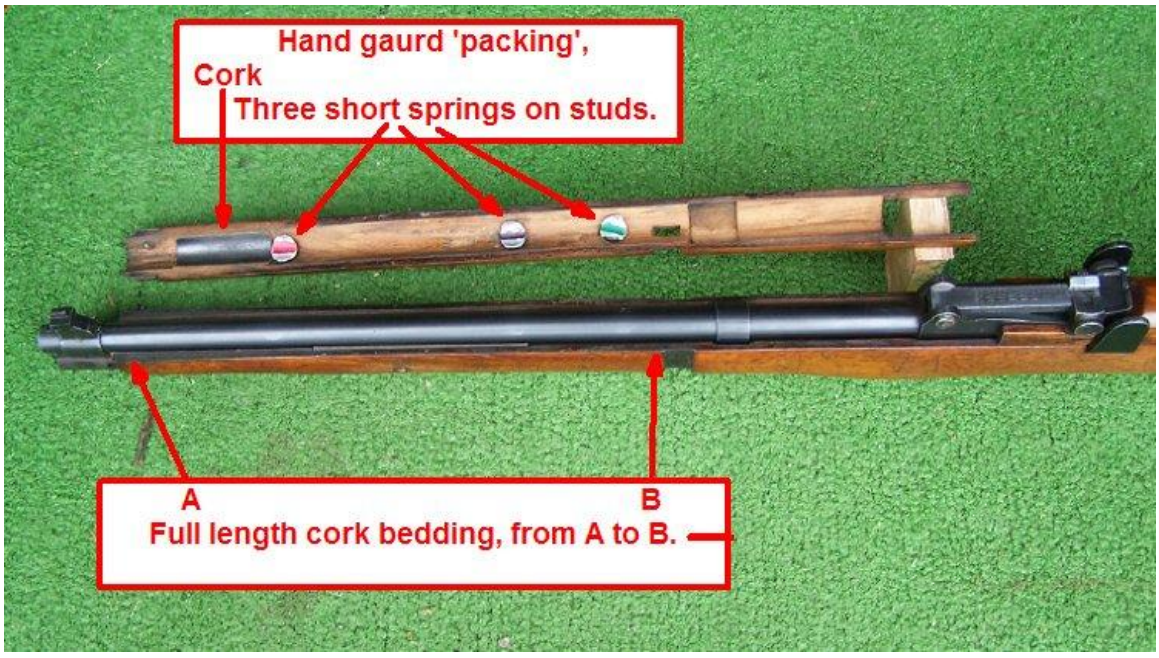
The spring packing method shown here is probably the most sophisticated set up you're ever likely to see on an Enfield, and the prized rifle shown was once the property of the Royal New Zealand Navy shooting team.



The advantages of spring packing over cork packing are two fold; one is that the springs exert steady pressure that don't fade over time as quickly, unlike cork which will settle, thus reducing its hold on the barrel and require extra thickness once or twice per year.
The second advantage is that the springs can be placed exactly on harmonic points to dampen the vibrations in the barrel.

The exterior top strap is to prevent the hand guard bowing away from the forend under the internal spring's pressure. Beneath the strap is another shortened spring, located in a shallow pit.

Note; I've color coded the springs because each one is a different length and belongs in one place. Their contact surface is paper taped to protect the barrel finish.



Description;

- The barrel reinforce rests on a reduced area bearing pad, .
- The barrel is floated to the mid band.

- Bedding material is laid down in the fore end from the mid band to the tip of the front end so that the barrel will rest in full contact with it.
- The barrel has slight up pressure, 3 lbs.
- A system of three short springs exert downward pressure at three points on the front 11.5 inches of the barrel.
- The springs are sourced from the No1 Mk3 floating mid band screw, and each is shortened to different lengths.

- Three studs from the rear of the No1 MK3 nose cap were used to contact the barrel and mount the springs, and their shafts were also shortened to different lengths accordingly. The studs are the type of which one is used to mount the spring at the rear of the nose cap.
- The upper hand guard has three shallow pits to locate the stud and spring at the correct location over the nodes.

- In pressing down on the barrel the springs exert upward pressure on the front hand guard, which can bow away from the barrel and reduce the correct pressure, and to restrain this a top strap over the outside of the hand guard which is held in place by a 1.75 inch/1/8th inch bolt through the forend.

Image right; note the very narrow reinforce bearing 1'x ½" inch, and the total lack of contact around the knox form.

Dimensions

- The bearing pad under the reinforce measures 1 1/8th by ¾ inch.
- The fore arm bedding extends from the mid band to the tip of the fore end.
- The positions of the springs (to centers) in the front hand guard from its front edge are; A – 3 3/8th B – 7 7/8th C – 9 13/16th
- The bedding in the forend fills the barrel groove from edge to edge.
- The bedding, and packing, shown are layers of cork sheets approx 3/32 thick and are held in place with contact glue.
- The forend bedding has been laid down in two stages to allow the up pressure to be built in. (by first wedging the required deflection and building up the rear bedding material until it carries the loading, then remove the wedge and complete the front portion.)
- The hand guard is unaltered from stock, with the packing added to the stock inner surface.
- The forend barrel channel has had wood removed from the rear sight mount recess forward to the tip.
- The spring heights are; red-.245 inch, black-.30 inch, green-.310 inch.
- The stud height is arbitrary, just enough to engage the spring.
- The brass cross screw is located 5 inches from the mid band and is ¾ inch below the forend top edge. The screw is 1/8th inch by 1 and 3/4 inch.

No1 Enfield method; (B), description

The second variation does away with the complications of the spring set up, and instead relies on cork packing in the hand guard for the containment pressure.

- The barrel reinforce rests on a small area bearing pad.
- The barrel is floated to the mid band.
- Bedding material is laid down in the fore end from the mid band to the tip of the front end so that the barrel will rest in full contact with it.
- The cork packing in the guard extends right around the inner curve from side to side.
- The cork extends full length from mid band to the very front.
- The nose cap barrel hole is relieved .025 thousandths inch.

==========

Barrel Bedding Studies – No1 MK3 H barrel

Three well regarded bedding styles used on H barrels are; fully floated, center bearing and forward bedding.

==========

Study One ; H barrel – fully floated. In the fully floated style there is little to report. The barrel rests on a 1 x 1 inch reinforce bearing, the main screw is set up with a large metal pressure pad, and that's it. Any barrel contact with the forend channel will deteriorate the accuracy.

Image1 ; 1907 No1H barrel, fully floated from reinforce bearing to muzzle.

Image 2; 1907 No1 H barrel, 1/8th inch plus clearance around barrel.

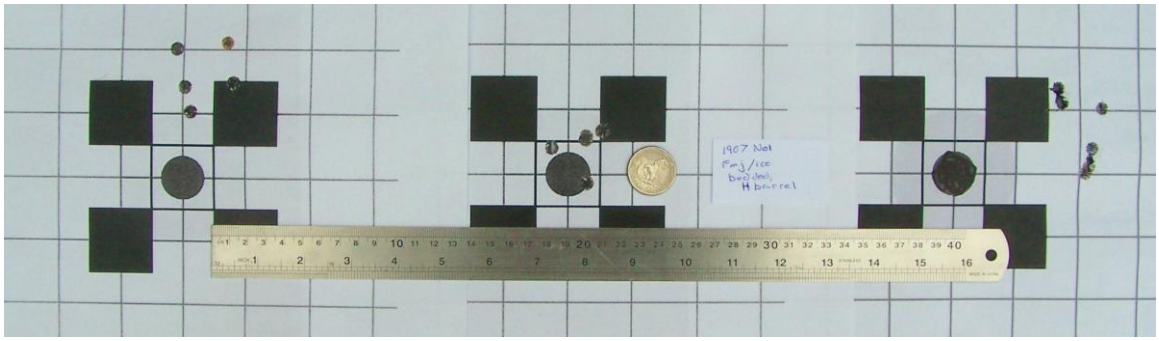


Image 3; a work in progress, the 1907 No1 with floated H barrel, tight butt/forend fit, tight draws/recoil lugs, reduced reinforce. Yet to be done; receiver bedding, main screw pressure plate. At present this rifle is showing potential to make nice clover leafs and small groups, a good result for a half completed set up.

Image above, an interesting rifle, 1917 Enfield, a nice cloverleaf from a fully floated H barreled rifle with a main screw pressure plate being the sole other accurizing technique on this rifle. (see page 115 for this rifles main screw pressure plate info.)

Image B, below, the 1917 Enfield, nothing fancy, a wolf in sheep's clothing.

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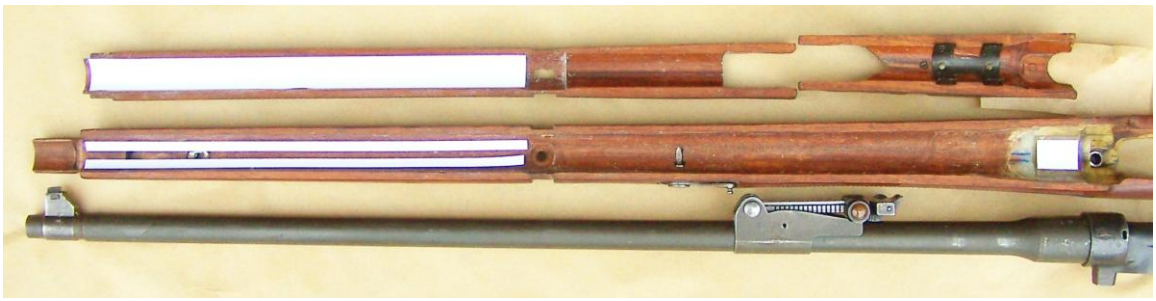
Study Two, below, H style two – center bedded, floated from reduced reinforce bearing, 1" x ¾", to a center bearing 2 inches wide beginning ½ inch aft of the mid band, and fully floated to the muzzle. 12 lbs up pressure at muzzle to free off the center bearing. No hand guard packing.

Image; Fulton BSA, a center bedded forend with the rest floated - H barrel

StudyThree; H style three – front bedded, floated from the reinforce to the mid band, in light contact with the barrel channel at 6 pm with a up pressure of 3 lbs, with equal packing in the overhead hand guard. A variation is to have no packing in the hand guard.

Image; 1907 No1 H barrel, floated to mid band, 6 pm contact, full packing.



Image; 1907 No1 H, front bedding at 5 and 7 pm, with heat groove.

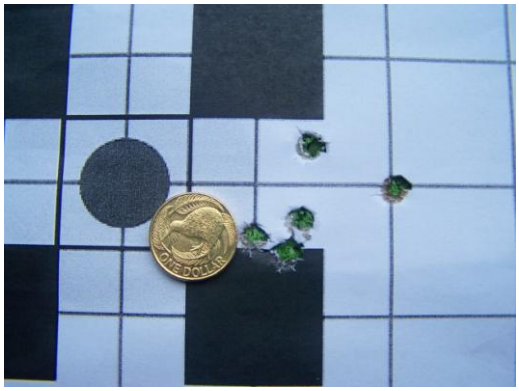
Sorry, no H target results available for these last methods.
==========

Barrel Bedding Case Studies – No4 Enfield

Three well regarded bedding styles suitable for No4 Enfields are; mid bedding and center bedding, and one that has bedding in between.
The third is also described here because although I don't have targets generated, it was very favorably regarded after championship wins in 1964.

Case Study; No4 style one - mid bearing. Bedding platform 2 - 3 inches long across the mid band area, with cork packing in the hand guard.

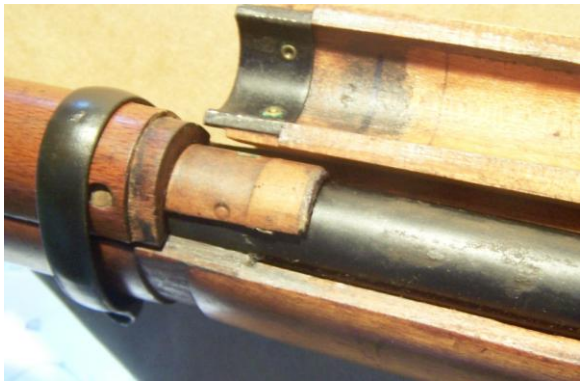
Target rifle by K&B, No4 Mk2 1949, mid barrel bedded, 100 yds.



Image; K&B mid bearing

Method

- The reinforce part of the barrel is resting on a small, one inch by one inch pad, or less, ¾ inch x 1 inch.
- Centered across the mid band, in the forarm, the bedding platform is 1.5 inches long,
- In the upper hand guard, opposite the bedding, the non attached packing is 2.5 inches long.
- The barrel from the bedding forward is fully floating.
- The front hand guard and the forend are internally relieved at the muzzle to ensure that the barrel is floating.



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Case Study; No4 style two - center bearing. Bedding platform 3-4 inches long midway between the reinforce and mid band, with cork packing in the hand guard.

Images above and lower right; 1949 No4 Mk2 by Parker Hale, with center bedding shown. Targets generated by three shooters one after the other.

Method

- The reinforce part of the barrel resting on a small, one inch by one inch pad, or even less.
- Midway between the reinforce and mid band a bedding platform 4 inches long, consisting of two cork strips located at 4-5 and 7-8 pm.
- In the upper hand guard there is a similar opposing packing.

- There is a thin metal shim plate, .05, that wraps around the barrel above the cork strips, possibly heat protection.
- The barrel from the bedding forward is fully floating.
- The front hand guard and the forend are internally relieved at the muzzle to ensure that the barrel is floating.

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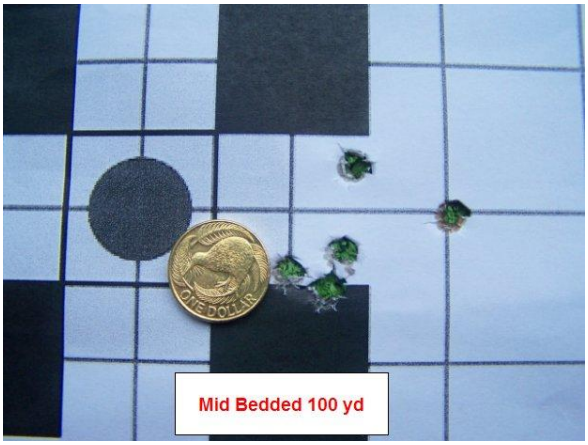
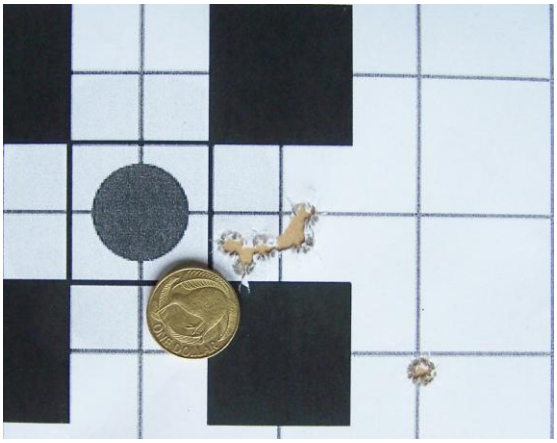


K&B - mid bearing


Parker Hale - center bearing.

In conclusion, for easy comparison mid bedded/left and center bedded/right. All shooting conditions are identical, same range, fmj ammo, sights, target, weather, shooter.

Case study plus; No4 style three - mid/center bearing. This additional method was also popular in Parker Hale No4 rifles in 1964, I don't have targets, but the excellent target scores exist. The barrel has a reduced reinforce bearing, is floated forward to a (2.5 inch) center bearing located between 1.5 and 4 inches behind the mid band, with cork packing in the overhead hand guard, barrel floated to muzzle where the step has been removed. Barrel up pressure at the muzzle to free off the mid bearing is 12 lbs.

Image; Parker Hale No4, a mid/center bearing and fully floated to the muzzle.

==========

Barrel bedding – the general method

Implementation

Decide on the bedding style you'll use, become familiar with the steps you're going to make, and get in the materials. You'll need clean up materials, epoxy bedding compound, contact glue, and cork sheet for the barrel channel in the fore end and the hand guards.

Barrel bedding procedures for the No1 MK3 and the No4 are so similar that a single description here with separate images and dimensions where needed will suffice.

==========

Cork or Epoxy?

The choice of bedding material under the barrel is yours, either traditional cork sheet or epoxy bedding compound.

Cork is a nice material to work with, it's easy, clean and attaches with a simple contact glue or similar. It a drawback is that it requires maintenance because it is soft and settles or compresses over time, and consequently the bedding and packing will have need thin layers of paper or card added regularly to keep the bedding tight against the barrel.

Epoxy bedding can be messy to set up but has the advantage of forming perfectly to the barrels contours, not changing with age and not compressing under pressure.
If you used cork under the barrel and it settles, any lack of support under the barrel combined with pressure from the hand guard packing, will squeeze the barrel into a slight bend creating high shots. This alone is my preference for epoxy bedding under the barrel, it maintains the barrel rigidly in position and doesn't change with time or conditions.

If you prefer to use cork bedding beneath the barrel refer to the separate Resource Section at the end of this book.

==========

Method

Forend preparation

1. Determine where the bedding area is going to be and how long.
2. Thoroughly degrease the barrel channel.
3. If the grease and oil has soaked into the wood you have no choice but to remove the wood upper layers until a good quality of wood is reached so that the epoxy will adhere well.
4. Remove oily wood with chisels, files or sandpaper, whatever will do the job. Only remove where you wish the bedding to be, there's no need to open the channel along its length unless you've decided on a floating barrel concept.

Barrel preparation

1. Barrel preparation: You need the barrel to be clean, non oily and very smooth where the bedding is to be. Refinish and repaint if necessary. When the paint is hard you can begin waxing it as a bedding release step, several times is better.
2. Mask off the areas of barrel you want protected with 1 inch white paper making tape.
3. You can use either of these next steps. If you use my preferred method, the finished job will have a layer of paper between the bedding and the barrel as a slightly softer bearing surface than hard epoxy.
4. *Preferred method*; With tape; After cleaning and waxing the barrel use a new roll of 1 inch or ¾ inch white paper masking tape and lay out a strip 6-8 inches long smoothly along the barrel. Do this around the barrel underside, butting the edges of the tape against each other without overlaps. Where they meet at the top center line of the barrel just bunch it up or stick the excess together out of the way.
5. The purpose is this; paper masking tape will not attach permanently to either bedding epoxy or the barrel. No matter how well adhered they seem, the glue will always stretch free of the barrel and the tape can be peeled up easily from the bedding.
6. The paper masking tape sold in my area is .05 thousands thick, or the same thickness as A4 writing paper. Later, once the barrel has been freed off and the bedding cleaned up, you want to create a shim of paper or card of that same thickness and lay it into the epoxy bedding. This will bring the bedding up to the correct thickness and provide a softer surface for the barrel to rest against than the hard surface of epoxy. Multiple layers can be installed if you re-do the up pressure checks and need to add more thickness.
5. *Traditional next step*; Without tape; One of the last steps before creating the bedding is to coat the barrel area with release agent. This comes with the Brownell's kit or you can create your own with slightly thinned PVA white wood glue. Wipe on 2-3 layers and let dry. Hang the barrel some place where this coating will not get touched, scratched or damaged in any way.

6. To review; you've waxed the barrel several times, then coated with either paper tape or 2 + coats of release agent. You've prepared the forend and should have an oil free surface ready for the application of the epoxy bedding material.

Creating the up pressure

No1 Mk3; The way to retain the up pressure component is to create the bedding in two stages, first create a portion the bedding area but leave room for the nose cap and spring to be assembled while it hardens. After the first bedding area has hardened you can safely remove the nose cap and create the second half as the first portion will be holding the barrel in the right position.

No4 Mk1 and Mk2; First confirm that you have the desired pressure at the barrel tip. Create the bedding required but keep the stock wood platform at the front of the barrel channel in place. After the bedding has hardened, the platform can be removed and the bedding will now carry the tension.

For exposed barrels; Step one; if you're creating the type that has a short forend and exposed barrel such as the Envoy, L 39, or L 42, first invert the assembled rifle and create the required up pressure as on page 47. When the right amount of deflection has been created, measure it and create an exact sized wedge from wood or similar hard material. This will carry the barrel at the right angle when the weight is off.
Step two is to dismantle the rifle, create the new bedding material, and insert the wedge at the front end of the forend as you tighten the main screw. After the bedding has hardened you can remove the wedge.

Method

1. Mask off the areas that you don't want epoxy getting onto with paper and masking tape. Delineate a start and finish line across the barrel channel and don't forget to mask off the upper edges of the fore end, and also along the exterior sides of the forend too. There will be spill over. Any spill over can be wiped off with acetone or epoxy thinners.
2. Mix and install the epoxy bedding material; wipe into the area an amount of bedding material sufficient to do the job and squeeze out slightly but not too much that it will cushion the barrel away from the muzzle/pressure up area.
3. Assemble the rifle.
4. Double check that the barrel tip is not floating higher than what you require, the bedding material can hold the barrel up if it's too thick. Gently squeeze it down so that the excess epoxy squeezes out.
5. If you find air bubbles or cavities in the bedding, after you disassemble everything you can fill them with a smaller amount of bedding and reassemble it again. Ditto if the height is too low, you can add a fresh layer of epoxy to build it up and reassemble again.
6. Leave this to set overnight. It can be tempting to open it up but epoxies have a habit of taking time to set rock hard.

7. When you disassemble everything the barrel should come away freely with about the same pressure you normally exert to release the fore end from the receiver, ie slight pressure but not excessive.
8. If there's some stronger than usual adhesion first inspect the bedding area to make sure there is no areas of squeeze out that have wrapped around the halfway mark of the barrel and thus trapped it around the circumference. If so, carefully sand/cut them away.
9. You can tap the barrel to free it up, there will be no problems.
10. Clean up the edges of the bedding material.
11. If you have used the paper masking tape method, clean any glue remnants off the bedding and barrel, and line the bedding with paper or card of the correct thickness to replace the thickness of the masking tape.
12. Round any edges at the front and back of the bedding slightly so there are no sharp corners against the barrel. This is a protection against mis-positioned guard packing squeezing the barrel down against a sharp corner. Similarly, any guard packing material must be at least ½ inch or 1 cm shorter than the bedding material, for the same reasons; down pressure over an edge is not a good thing.

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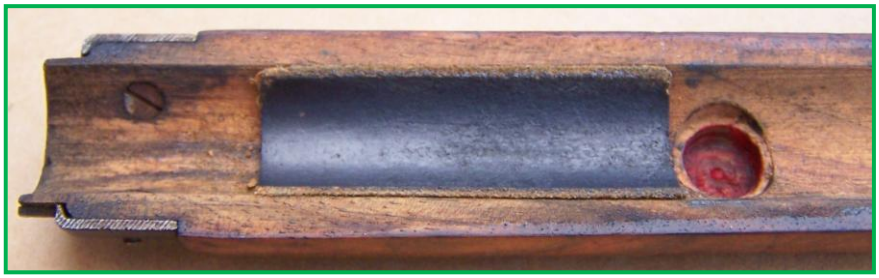
Hand Guard - Packing



Image; cork packing held with contact glue, and colored by powdered graphite

Introduction

Packing materials found in old target rifles hand guards above the barrel can be a range of materials, it seems to have depended on the intentions of the shooter at the time. Some material types are clearly to hold the barrel firmly, such as cork or epoxy, while others, such as firm sponge rubber with adhesive backing, seem designed to keep the barrel in position, with very light pressure only. For good packing we want material that will compress just slightly under the pressure from the mid band and nose cap, and cork is ideal for this.

A rule of thumb for this is that if your barrel is in hard epoxy bedding, it should also be held somewhat firmly by the overhead packing. If you use a softer barrel bedding material such as cork or foam rubber, then the packing should also be softer and not exert so much pressure.

As always the over riding rule here is to find out what your rifle performs best with, either no packing, light contact or firm contact.

Generally the barrel channels in the hand guards do not need opening up, except on No4's where the barrel has been fully floated forward of the bedding and the front barrel

channel step for the up pressure has been removed, however don't take the inner clearances for granted, and you should do the contact check with oiled wood and powder to make sure.

Guard Packing

Method – Step One

- Before going to the auto store to buy cork or gasket sheeting you'll first need to determine the thickness that will do the job.
- Cut several cardboard shims of a known thickness that you can insert under the guards above the location of the bedding.
- Place them in position and press the guard down on the barrel until the guard is clear of the forend by 1/32 – 1/16th inch.
- Measure the total thickness of the shims, and purchase this thickness if you can.
- It's common to find packing which is several layers thick and of several different thicknesses, and includes cork and cardboard.
- Don't try sanding the cork thinner, you'll get a better result by layering.

Method – Step two

1. Thoroughly degrease and de oil the barrel channel.
2. Cut your cork so that it is about ½ inch shorter at each end than the epoxy bedding in the forend.
3. Install the cork in place with contact cement, making sure that it is centered fore and aft directly above the forend bedding.
4. Wrap it right around the barrel channel to the edges, or as required.
5. Build up the cork depth with repeated layers as necessary, using cork, cardboard or paper layers until you can see a gap between the forend and the hand guard of 1/32-1/16th inch, or 1-2mm, when the guard is rested on the assembled rifle.
6. Coat the surfaces with graphite powder and make sure the finished surface has no glue or other detritus on it as you assemble the rifle
7. The 1/16nd gap is designed to compress closed as you tighten the mid band and nose cap on the No1, and the mid band and front band of the No4, thus trapping the barrel firmly into its bedding.
8. Over time you need to periodically check that this 1/16 gap exists before assembling the rifle. If it does not, you'll need to add another layer of thin packing in the guard to open the gap back up again.

Image; a .015 thick cardboard illustrating how much gap to allow for compression by the bands.

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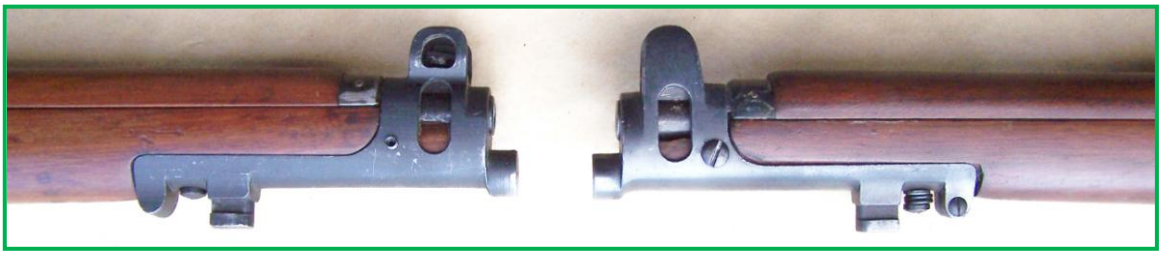
Nose Cap



Introduction

Old Timer's trick; nose cap alignment. We've already looked at how the nose cap of No1 and No1 Mk3's can be misaligned and how to get it straight. To review, target shooters had several accurizing tricks for this item. It can be;

- accurately positioned
- modified for either tight or loose contact on the barrel
- internally bedded.

We've looked at getting it accurately positioned in earlier chapters where modifying the rifle is not allowed. This section is about internally bedding the cap so that there are no gaps between it and the forend when secured in place. This enhances the box brace concept that the forend and guards can give the No1 Mk3.

Bedding the nose cap must be done only after the cap has been accurately located and its screws positioned properly, and provided there will be no changes such as replacing the forend or front hand guard with new items.


The example shown is an early BSA No1 Mk3 Fulton's rifle.

We're going to add bedding material in two places. One is deep inside the nose cap to fill the void between the tip of the fore end and the cap, usually about 3/16th's on an inch thick, and the other place is along and under the tang in the general area between the short vertical screw and the transverse screw.

- Make sure the nose cap slips precisely into its proper place, and that the two mounting screws don't twist it in any unexpected directions.
- If you have previously used card board shims to keep it in position, keep them handy for the bedding setup. If the shims are required, then the bedding will soon take their place permanently.


The bedding compound shown has been applied to both the forend and inside the nose cap.

Method

1. Make sure that the surface finish on the forend wood is stable, not peeling off, and not going to be refinished at a later stage. Get that done first so the bedding paste has a clean surface to perfectly match to.
2. Make certain that the threads and holes where the two screws engage are oiled, waxed or greased or release agent covered, to stop any bedding material from accidentally gluing the screws in place.
3. Using paper masking tape mask off the external surfaces of the nose cap, the sides of the fore end, and any other nearby surface where you don't want any material squeezing out and potentially finishes. Likewise enclose the barrel tip with masking tape and cover the muzzle so none can enter the barrel.
4. Thoroughly clean the inner surfaces of the nose cap, including de greasing, loose dirt and paint, corrosion and last week's sandwiches.
5. Scratch up the nose cap inner surfaces to provide a good keying surface for the epoxy to adhere to.
6. On the forend wood areas where the nose cap makes contact clean the surfaces and wax them. I also recommend covering these surfaces with flush fitting masking tape. This will provide a foolproof surface that is guaranteed to break free. You can also wax over the tape and coat it with release agent. The tape thickness is .05, and in this location is an acceptable thickness.
7. Mix the bedding paste and go ahead and spread the bedding material inside the nose cap and along its tang.
8. Keep an eye on the barrel being centered in the hole through the nose cap and gently put the nose cap in place. Progressively tighten the screws, allowing the excess bedding material to squeeze out. It's okay clean off this excess as you go provided you don't pull material out from under where it should be.
9. Let the bedding material cure over the recommended time, usually first stage of the cure is approx 30 minutes depending on the room temperature. If you're around during this time, after the material has first cured and there's no chance of disturbing it, gently undo the two screws just a turn or so. This will help break the seal if any glue has got in that area and will help free the screws off later.
10. To remove the cap undo the screws and tap lightly with a hammer on a block of wood against the piling swivel boss or sight ears.
11. After it's cured and you've got the cap off and cleaned up, slightly round off the edges of the bedding material and you're done.

More bedding information courtesy of Milsurps.com;
http://www.milsurps.com/showthread.php?t=21249&page=1

Bedding – the end.

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Lee Enfield Project Rifle

Project – ‘L 39’ lookalike Rifle

Pushing the limits – Carbon Fiber

"Okay, you're kidding right?" you've got to be thinking about now, "a 100 year old Lee Enfield and carbon fiber? Those two words couldn't possibly belong together."

We're tuning a hundred years old rifle, that millions of shooters have played and tinkered with already until the cows come home, what possible worthwhile new thing could be conceived of that millions haven't thought of already?
Well, it's just as well you didn't put a twenty dollar bill down or it'd be in my pocket about now.

The king gremlin of a No1 Mk3 is the narrow, flexy barrel. So … Lee Enfield "flexy barrel, meet carbon fiber tube", one of the stiffest, lightest, strongest products we can create in the 21st century.
To be precise, a carbon fiber tube that slips on over the stock barrel.

This will create a multi layered No1 Mk3 barrel that could be used a pogo stick and not bend or flex. See the logic, stiffening the barrel, the same logic that prompted shooters to install the 'heavy' H barrels?
Same concept + modern method = (very) good result.

Before proceeding I have a small apology to make; due to the it seems inevitable computer glitches, the bulk of the photos I've kept for the last 5 years have not survived, consequently the carbon fiber sleeve method is not as well illustrated as I hoped. It is not a complicated procedure so what we do have should be sufficient.

Project Rifle 1966 2a Ishapore 7.62 - carbon fiber barrel

By any standard this is sounds like a pretty extreme concept, but the great news is that it worked really well, and also lays the groundwork for others to fine tune the method further. Plus, given the attractive appearance of the carbon fiber it was a win win. And talk about the shock factor, I mean who ever shows up at the range with a Lee Enfield sporting a carbon fiber barrel?
It wasn't even costly to create.

As the normal barrel mounted rear sights had to be removed to enable the sleeve to slide on, the final concept is most suited to being a scoped rifle but an aperture rear sight and a hand fitted Parker Hale front could also be fitted.
With a little care the original sights could also be reinstalled.
From the outset I wanted the carbon fiber barrel to be visible, and I chose the general look of the Enfield L 39, complete with an aperture sight base.

The overall principles at work in a sleeved barrel are at minimum the following;

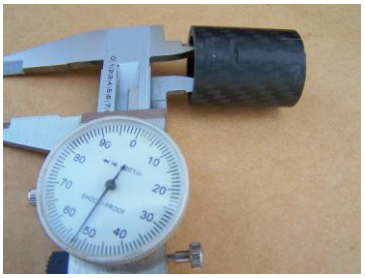
- Tube shape that resists deformation.
- Layers of differing materials working as a sandwich against each other to resist lateral movements.
- Layers of differing materials working as a vibration dampener.
- The extra diameter of the tube, and being attached securely to the barrel, works like a long thin box brace, it resists flexing more effectively as the width of the 'box' increases.
- The muzzle brake on it's thread can increase pressure on the barrel, possibly allowing fine tuning of the harmonics.

The Modifications

As a through and through, no holds barred rifle project seeking accuracy, other accurizing methods also used on this rifle are;

- Barrel fully floated from reinforce forward
- Bedded and reduced barrel reinforce/wood forend pad
- Barrel carbon fiber sleeved
- Bolt, new spring and firing pin
- Bolt and bolt channel polished
- Bolt internals polished and anti rotation washers installed
- Bolt recoil lugs with even contact on receiver
- Can West Trigger
- Chamber polished
- Extractor spring reduced for light action
- Forend rear cross wire reinforced

- Forend squared and tight fit to forend/wrist interface
- Head space correct, slightly tight
- Lead shot in butt stock
- Receiver locating dowels in forend
- Main screw collar clearance reduced to zero and relocated in forend
- Main screw post area fully bedded.
- Muzzle brake, shimmed to exert pressure on the barrel
- Pressure plate around main screw
- Receiver fully bedded
- Recoil lugs/forend metal capped, tight fit
- Trigger guard bedded
- Trigger guard shimmed for slight rear up pressure



I concede that all of this makes it difficult to evaluate the barrel sleeve concept as a stand alone accuracy concept and to quantify the improvement for this book, but it did work, better than expected.

The Rifle – my 'L-39' look alike.

The installation in 2005 was on a 1966 Ishapore 2a 7.62 NATO, of average condition and bore wear. Ishapore 7.62 NATO rifles are available in surprisingly good internal condition, and I recommend making a little search before settling on a rifle. Ignore the exterior condition, always check the bore.
7.62 is an excellent caliber for accurizing and shooting with. Considering the increasing scarcity and cost of military surplus .303, then 7.62 is making more and more sense. Due to its wide acceptance there is also plenty of support structure around this caliber, ranging from ballistics understanding to reloading information.

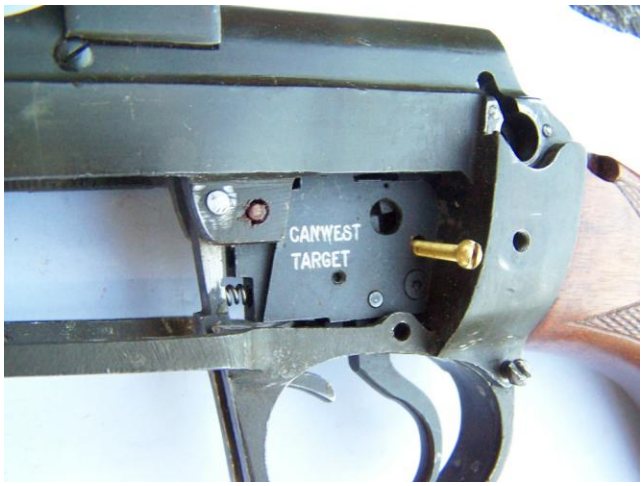
The Tube

Carbon fiber tube sellers and makers are listed in most cities in the commercial yellow pages, or online under 'tube makers', 'carbon fiber manufacturing', or carbon fiber tubes'. They usually have a fair stock on the shelf, and most are also open to custom orders.
As the store just happened to be out of the size I was after, a carbon fiber sleeve was custom made which was 1 inch outside diameter, with a 1/8th inch or .125 wall thickness, and 30 inches long. The cost was $80US.
Tubes are a very stiff shape and I could probably have used a thinner side wall and still gained advantage, however, I didn't want to under shoot and get it wrong, leaving a flexy barrel. Combined with my work background in these materials, the 1/8th inch I chose was a well educated estimate.

'L-39' project cost in 2007 US dollars

Rifle - $90, minus bolt and magazine.

Carbon fiber tube - $80 in Los Angeles
Canwest trigger - $100
Sile wood stock set - $85
Muzzle brake - $20
Thread cutter – recouped) - $100
Bipod - $35
Sling, 1911 style, - $20
Scope, hi power 44mm - $65
Bolt, jeweled, - $25
Magazine - $10
Brownells bedding kit - $35
Front sight - $20
Laser - $20
PH5a sight base - $10
Miscellaneous - $50



What about a fully enclosed carbon fiber Lee Enfield?

A thinner wall combined with reduced dimensions would make it just possible to create a sleeved rifle that remains out of sight inside the No1 Mk3 wood work. The minimum dimensions for this are; internal diameter, barrel taper 9/16 – ¾ inch, the hand guards would hide a tube with an OD of 7/8ths. So it would be a tight and carefully set up arrangement, but should be possible.
So many projects, so little time …

Method overview

- The barrel is stripped of sight parts
- The surface finish is removed to bare clean metal
- The carbon fiber tube is internally prepared
- The tube is slipped over the barrel and carefully centered
- The air space between the tube and barrel is filled with slow curing epoxy

Carbon fiber is generally a material that works fairly easily with hand tools and Dremel tools. A signature of carbon fiber though, is that unless you're using sharp edged tools it often frays when trying to cut it.
As with fiberglass products the resins used produce dust, so consider using the precautions you would normally use for a semi toxic or itchy dust, especially if asthmatic etc, such as a mask and good ventilation.
You will be using liquid epoxy glues for installation, but will not be making anything with carbon fiber sheet yourself.

Muzzle Brake

I chose to use a thread on muzzle brake and ordered the muzzle brake, the thread cutter, and hand tool with barrel guide, from Brownels, USA, total cost was about $100. They have thread cutting tools that correctly match the No1 and 2a barrel outside diameter. It will be very difficult to thread the barrel after the carbon fiber tube is installed, so plan on cutting the muzzle brake threads before any other work.

I like muzzle brakes, and choosing a thread on style gave some interesting options. Browell's have a wide range, including cheap 'AK 47' muzzle brakes for 7.62, so it was possible to experiment with styles and degree of recoil reduction quite affordably. I don't think these are actually from the AK 47 rifle, I suspect that it is just a brand name.

Muzzle Brake link:
http://www.brownells.com/.aspx/cid=0/k=muzzle+brake/t=P/ksubmit=y/Products/All/search=muzzle_brake

You will end up cutting the thread for the muzzle brake before proceeding to any other steps. This turned out to be an arduous task as the steel is incredibly hard and slow to cut.

AK 47 muzzle brakes have a diameter that matched the tube, and looked integral, a nice touch but not actually necessary.

The carbon fiber sleeve concept does not require a muzzle brake, but if you decide to not use one you will have to decide how to dress the muzzle end of the carbon fiber tube satisfactorily.

A reminder of the project rifle's origins.

Method introduction

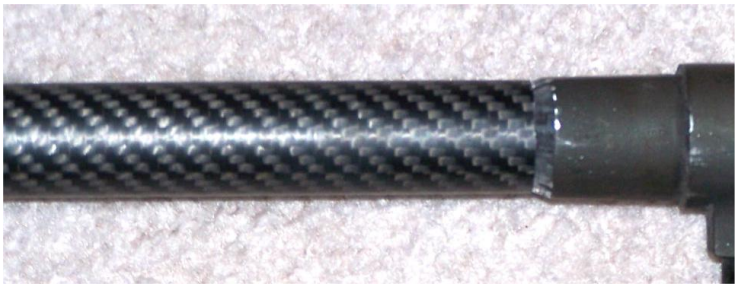
Read all of this and think the processes through before beginning. Work in a place with medium temperatures, and no extremes, ie cold nights or blistering days. You want the tube to adhere well and not have a weak joint caused by the different materials slightly moving as the glue is setting. You can have a warm environment but not a hot one. Epoxy glues generate heat as they set, which accelerates hardening. Epoxy that has hardened excessively quickly does not have as much strength as a moderate curing time.

Materials

- You need a top quality, two pack type epoxy glue, ideally with heat resistant properties, and one that is not too thick when mixed. I have a preference for West System epoxies, often used in boat building. It's extremely good, with a very low shrinkage ratio as it hardens. Two pack epoxy glue as sold by Home Depot in the USA is also acceptable, and West System is also sold there or at Marine stores.
- Buy the usual stuff for using glues; drop sheets, old newspaper, ½" or ¾" paper masking tape, thin rubber gloves, paper breathing mask, epoxy thinners, mixing containers and sticks, sand paper, steel wool etc.

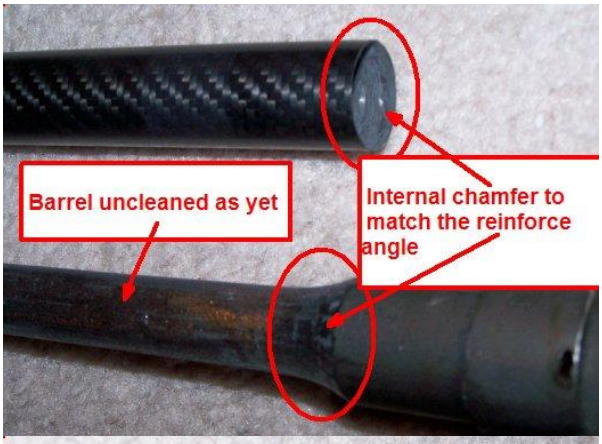
Method

1. Leave the barrel attached to the receiver but remove everything else. Remove the front and rear sights and components so that the carbon tube will slip over freely.
2. Measure how far the muzzle brake comes down the barrel when/if it was attached. This will give you the forward point at which the tube will end. Determine the eventual length of the carbon fiber tube, (but don't cut it to length just yet), and mark the barrel so that the thread for the muzzle brake will extend slightly inside the tube, 3/8th inch or so. You need these extra threads so the brake can keep winding tension onto the tube.
3. Cut the thread for the muzzle brake. This is very hard steel and it takes a while. It took me 2-3 days, working an hour each day, and I do mean working, under maximum effort the tool sometimes would only cut 1/16th - 1/8th inch before needing to be backed out. You could always outsource this job to a local gunsmith.



4. Sand all of the surface finish off the barrel up to the reinforce. I used a 4 inch angle grinder with coarse grit paper so that it scratches up the surface and provides a good keying surface for the epoxy. Take precautions while sanding the barrel clean, the coatings might be more toxic than normal paint, and it makes good sense to wear a dust mask, not to mention eye protection if using a power grinder. I also delayed sanding the barrel until just before assembly in order to prevent slight and usually invisible surface rust from humidity beginning on such a pristine surface.

5. Decide which end of the tube is going to be at the receiver end, and cut it square. Inside the square end, bevel an angle of about 45 degrees with a Dremel or similar, so that when assembled it will match the shoulder of the barrel. This will help it to self center when assembling, as well as a bit more binding area.



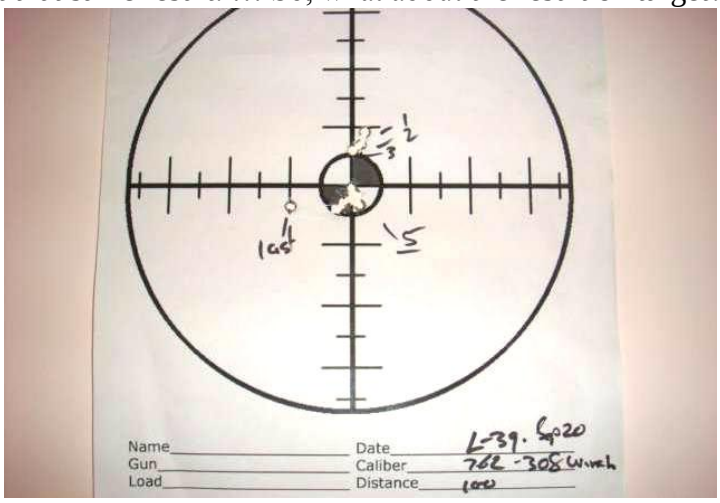
6. The tube's inside surface will be shiny and smooth, make sure that you sand it thoroughly to provide a good key surface. I used coarse steel wool on a stick, and sand paper which was contact glued to a dowel of nearly the same size to do the job.

7. Double check everything and cut the tube to the exact length you want, (reminder; cut only after the chamfer has been made and the muzzle brake threads cut). Make sure that your cut is square and clean because later any corrections will keep shortening the tube and throw off the muzzle brake position, requiring shims to correct.
8. Plug the muzzle of the barrel to keep any epoxy spillage from entering the rifling and wrap the muzzle brake threads in masking tape.

9. Wrap the receiver, as well as the carbon fiber tube exterior, for protection against accidental spillage.
10. Prop the barrel/receiver vertically where it can sit undisturbed for 24 hours. I used a bucket filled with medium sized blocks to hold it securely.
11. Slip the tube over the barrel and carefully ensure that it is centered on the barrel's shoulder/reinforce. At the base, wrap paper tape around it several times to stop any epoxy running out. Paper tape softens when it gets gluey so you want it tight and several layers deep, enough to hold it while the glue goes off.
12. At the muzzle end, center the tube on the barrel with small wedges. We'll initially fill below the wedges, they'll be removed and won't interfere later.
13. Make up a cardboard funnel and tape it around the tube, mix the epoxy, and start slowly pouring it in. You can use a thin wire rod to help air bubbles break out, and the glue to go deep. West System has about 15-20 minutes of useful time, ample to encourage it all the way down the tube. Work in a cool environment to delay the initial cure. Keep working that wire until you're sure the bubbles are all out. Fill until you're close to the centering wedges
14. (After the epoxy has hardened you can remove the wedges and with a new small batch of glue, fill that last one inch.)
15. After the epoxy has set overnight, clean up the muzzle brake threads, and you're done, you have one of the world's very few carbon fiber barreled Lee Enfields.

Don't be tempted to tighten the muzzle brake straight away. Don't stress it before complete curing.
If the muzzle brake is a type that needs to be vertically aligned use thin shim washers between the brake and the sleeve so that it tightens in exactly the right spot.

Conclusion
By the way, after completion and rifle assembly, sideways barrel deflection using the method on page at 25 pounds! is … zero. Now think about how much heavy steel it would take to get that same result. … So, what about the result on target?



Image;.7.62 FMJ, 100 yds, a great result.

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The Future

Pushing the Limits
Okay, carbon fiber was a pretty radical step, what on earth could possibly be an actual innovative cutting edge for a hundred year old rifle?
Believe it or not there are things that have yet to be tried.

Concept One – Accu-strut

There is a product recently available called Accu-strut, designed for sporting rifles such as the Ruger Mini 14. It consists of small, heavy duty clamps and a bar of strong steel. The bar is clamped to a barrel in three places and its purpose is to strengthen a barrel against flexing and also possibly improve its harmonics.
For the rifles that Accu-strut is currently designed for, it apparently produces good results.

The cosmetic advantage that the Accu-strut designers have is that the appearance of a rifle with this attached makes an everyday plinking rifle resemble a semi/automatic military rifle with a gas tube beside the barrel.
Lee Enfields don't leap to mind as falling into the AK 47 category, however as a barrel stiffening technique the science is solid and it won't be long before some earnest Enfielder tries this out and perhaps creates a way that it can have a viable design look.
In addition, their web site has some interesting ideas that could translate to Enfields.
For more information; http://www.accu-strut.com/pages/tests_Ia.htm

Concept Two - Barrel Harmonic Damper Weights

Designed for free floating barrels not surrounded by wood work, the idea of a movable weight to adjust the barrel's harmonics is not new, since the 1920's it has come onto the market place several times, mostly due to a passing popularity. It does however definitely produce accuracy improvements.
The Ruger Mini 14 Target rifle (2011) features an 'adjustable harmonic dampener', to dampen harmonic vibrations in the barrel, which has been very successful.
An Enfield with exposed barrel in the

L 39 or L 42 style would easily lend itself to experiments with such a device.

For more information; http://www.youtube.com/watch?v=z89nJ5zA4bI

Notes From the Man Cave

There are several accurizing ideas with potential and I pass the musings along to you.

Receiver Locating Studs

The object of the lateral striations shown on page 120 is to resist fore and aft movement between the receiver and the forend wood. Other built in methods address the same issue; the tight fit on the wrist interface, the pressure under the trigger guard and main screw. There is though another approach that could yield results.

At the corners of the receiver underside install 4 small, tapered studs that are threaded into the receiver. On the matching areas on the wood forend a slightly larger hole could be drilled, just over the depth of the stud. Bedding paste would be put in the hole and the forend assembled to the receiver.
This would create 4 tapered studs that assemble easily into precisely matching cups. This exact fit would cancel entirely any chance of any fore and aft movement.

The All Metal Forend

Given that wood as a material is organic and can be crushed and compressed by the stresses of firing, not to mention having aging problems as moisture dries out, excepting for the hassle of creating it, an all metal forend would seemingly cancel any weaknesses inherent in using wood.

Image; The images shown are of a home created aluminum forend for a No1 Mk3, reproduced here courtesy of Milsurps.com.
A metal forend can also bring its own issues, such as changed harmonics in the barrel, but as an interesting and worthwhile experiment, this is well up the scale.

One piece stock

If the two piece stock is at the root of so many accuracy variables, what would happen if an Enfield had a one piece stock and no wrist?
It's a good question and at least one gun smith in Auckland, New Zealand used to engineer No4 Enfields this way.
At a local gun show this No4 rifle sold quickly for a good price so they are well received by local shooters who know of them.

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Tuning you, the Shooter

Index

Introduction

Okay, you've tweaked the rifle and you've come a long way by this point. You've discovered Lee Enfields, for no logical reason you're addicted to them, they keep multiplying when you least expect it, you've learned a lot about the background of accurate shooting, you've examined almost 50 items that affect and increase accuracy, but there's one thing left to address; what about the budding champion behind the sights? What can you do to improve your shooting? What about tuning the shooter?

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Aging and deficient eyesight

When our eyes are working well they simultaneously try to keep the distant target, the front sight and the rear sight in good focus. As we age we progressively lose this ability to keep such widely separated objects in focus. For most of us it's the rear sight that becomes less and less clearly seen, and for some it's the target, hence the phrase long and short sighted.
It can be a frustrating part of enjoying shooting, however the good news is there are several answers, some so good it they will improve your shooting even if you have good vision.

Lasik;

A topical and relevant subject, reports from shooters who have used Lasik and other eye corrective procedures are good, and that besides the usual daily benefits, shooting and sighting is improved as well.
Courtesy Milsurps.com link; http://www.milsurps.com/showthread.php?t=33331

The current solutions to the problems of having soft eye focus issues are;

- Telescopic sight or scope.
- Target shooter's aperture sights.
- Stock issue rear aperture sights as on the No4 Mk1.
- After market aperture sights.
- Shooters glasses with pinhole panels, called 'orthoptic sights'

When sighting remember that as you pull the trigger you want the front sight in best focus, the target in as much focus as you can make, and the rear sight focus as best you can.

Sights

Front sights

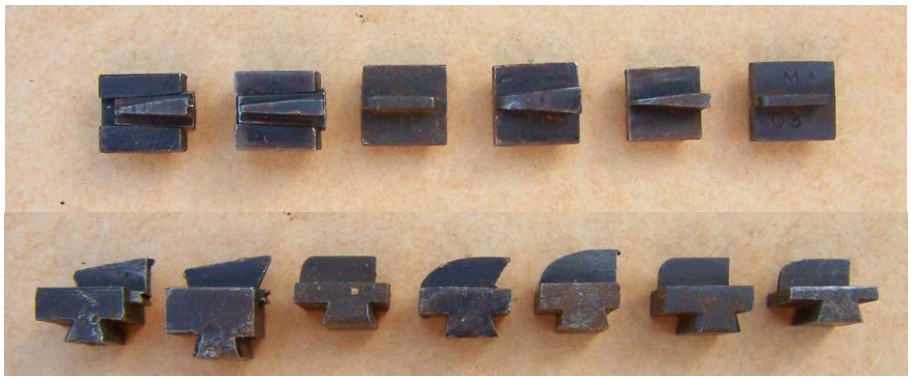
Parker Hale and one or two other companies have made after market front sights that take a variety of reticles. Sarco.com still sell one that comes with a sheet of different reticles. While front sights that consist of a short tube with a post, blade or reticle can give you a more precise picture to shoot with it's worth remembering that they also cut a lot of available light down.

Image; front sight variations, from left – tunnel sight built into nose cap, Parker Hale, Parker Hale.

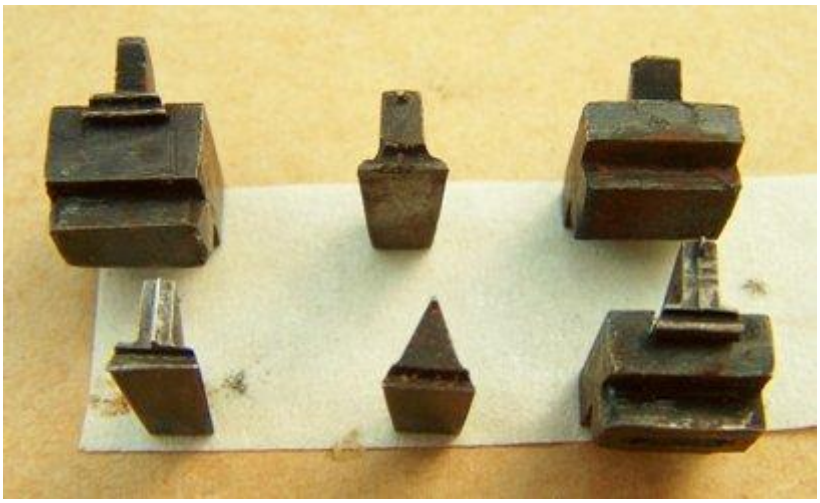
For Sarco, Parker Hale front sight;
http://e-sarcoinc.com/phglobefrontsightwsetof10inserts.aspx

Old Timer's trick ; quick change front sight blades. Back in the day it was common for serious target shooters to have quick change front sights, and to change the front sight blades often according to light and eyesight conditions.

Sight blades came in all sorts of sizes and shaped profiles in an effort to create the sharpest front sight image possible in varying light conditions.



Some of these sight blades were made with various dots and lines on them, which were called 'Miller lines or Bisley 'dots'. They were highlighted with white, or left in the black, and the shooter could see these and align them with any lines on the target. They are probably not available new in 2011 but show up on places like eBay and via forum members, and are very collectible.



Old Timer's trick (image below); windmill front sight for in the field sight changes. Fitted to No4 Enfields, the windmill front sight gives on the spot quick change ability by rotating the sight and tightening a screw. Good to have, not so easy to find these days, and collectible.

The best place to research these items further will be Fultons of Bilsey.com and Lee Enfield forums via members.

Rear sights

A couple of short informational comments are worth while. If you're using the No1 Mk3 over open sights but prefer something with better adjustments you can't do better than the rear sight from an Enfield No1 (circa 1903-1910). They adjust in all directions, will mount into a No1 Mk3 base, and are found in a V notch or the U shape, which is the same as the No1 Mk3 sight.
No1 sights show up on eBay and other auction sights, as well as gun shows, and range from $35 - $85 US, in 2011.

Image; No1,

No1,

No1 Mk3 with windage.

Telescopic sights

Scopes are heaven sent for those of us with eyesight issues because they bring everything you can see into focus, both the reticle and what's in the field of view.
If you're using a scope with zoom capability the depth of field of view kept in focus will change, and can result in the target being in focus but the reticle not. It's a matter of adjusting back and forward to your personnel needs, or choosing a different scope.
Scopes can be readily fitted to No4 and No5 Enfields with no gunsmith scope mounts, but Enfields earlier than No4's are not so easily set up and are often best with aperture sights or less desirably, with scope track that is drilled and taped into the receiver.

For more information courtesy of Milsurps; Zeroing of rifles.;
http://photos.imageevent.com/badgerdog/generalstorage/edhortonmanuals/Zeroing_of_Rifles-a.pdf
How to use a scope; http://www.enfieldresource.com/using-scopes-explained

Scope track

Scope track for Enfields is a custom fit because the charger bridge and knox form are at different heights. One piece tracks or two pieces all incorporate this step effect to keep the scope parallel with the bore.
While there are any number of gunsmiths who will install scope mounting track to your rifle, it is semi permanent and requires holes to be drilled in the rifle. It is an option you might choose depending on the quality and originality of your rifle, but generally it's not ideal in this era of increasing value for original rifles.

Image; No4Parker Hale scope mount

If you want scope track for an Enfield probably the quickest source is EBay.com for several types.

No gunsmith scope mounts

No4 and No5

There are a number of 'no gunsmith' after market scope mounts available for No4 and No5 Enfields, at least 6 different types that require no changes and cause no damage to your rifle.

They fall into two styles and mount either with the rear sight axle pivot and the ejector screw, or the rear sight axle pivot and a wedge shaped block that pulls into the underside of the charger bridge. They cause no damage to the rifle and require no permanent changes.

Image; B Square, No4 Mk1 Parker Hale

No gunsmith mounts are made in steel, aluminum or nylon, usually sell for $50-$100, and install easily and quickly.

Brand names that will help a search online are; 'scope mount' +

- Accumount
- Advanced Technology International
- ATI
- B Square
- UAG
- S&K
- SIA

A collection of no gun smith mount images are at;
http://www.enfieldresource.com/no-gunsmith-scope-mounts

No1 Mk3

There are generally three types of no gunsmith mount for the No1 Mk3's, a receiver rail wedged into the open top of the receiver against the charger bridge, a receiver rail with a front ring that clamps around the receiver ring, and a mount that fits into the rear sight base on the barrel.
These are all well made, however each of these can fail to be a good answer.

Type one, the sort that works pressed into the charger bridge and the front of the receiver, trap the mount with a lot of force pressing back and forward across the top of the receiver. Keeping them in place under recoil can sometimes be a problem, and receiver flexing caused by the bolt rear locking lugs transferring the recoil to the rear of the receiver first, causing the receiver to stretch, is the culprit. The gap opens for a moment, the scope mount works its way up and out of the receiver after 3-5 shots, and you'll join the half moon club, with a semi circular cut above the right eyebrow where the scope takes a bite out of you.

Type twos attach at the charger bridge and the front end has a ring that slips over the barrel and around the receiver front. They are promoted as 'no change' mounts but it's not possible to use these without cutting wood away to make room for the ring, entirely defeating the 'no changes' concept, but acceptable for sporter converted rifles.

Type threes mount in place of the rear sight leaf and are often called a 'scout mount'. This requires a scope with a long eye relief, such as are used on handguns. German Mauser 98 sniper rifles of WW2 sometimes used a scope mounted in this position and were quite successful, so whether this style works for you or not is very much a personal preference.

If you're keen to mount a no gun smith scope on a No1 Mk3 I recommend asking on forums about the success of others. Some report finding a mount that has never given a problem and others are less happy, and also receivers from different makers apparently behave differently. Forums are an invaluable source of good advice.

BDL Ltd in the USA have a good quality steel model for the No1 Mk3, designed by Fultons, and in the UK you can buy direct from Fulton's, who also ship internationally.

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Aperture sights

A law of refraction helps keep objects seen through a pinhole stay in clearest focus in the middle of the picture, thus one automatically tends to center objects one is aiming at.

They are such a good idea that the No4 Mk1 and Mk2 rear sight has two aperture/ peep sights in the rear sight. As a way of helping a wider variety of civilian soldiers shoot better with the urgent demands of WW2 it was a good choice for a battle rifle.

Image; No1 MK3 with Parker Hale PH5a aperture sight

Telescopic sights were somewhat crude in WW1 and not widely distributed, especially early in the war, and as a result UK and also Aussie troops, often brought their personnel aperture sights to the battlefield.
During the interwar years the Australian military used aperture target sights. These old sights with 'broad arrow' army acceptance marks are now prized collector's items.

The eyepiece of aperture sights is usually an extra item and can often be a disc with 6 different sized holes, or an iris sight that closes like the inside of a camera. The iris is by far the nicest to use.
Aperture competition sights for Enfields were made from WW1 right through to the 1950's, with some surviving to this day, particularly an Australian model named 'Central', which is now available as the A E Clarke, in the UK and Australia.

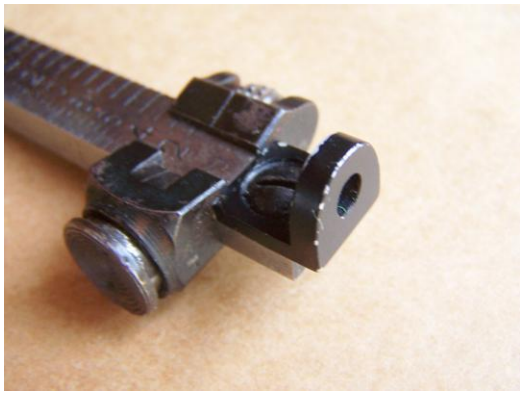
An excellent range of images of many of these old sights are on Enfield Resource.com in the Aperture Sights Visual Library .
http://www.enfieldresource.com/aperture-sights

How to Use Aperture Sights

1. To adjust the sight left or right, send the eyepiece in the same direction as you need to correct your shot.
2. Hold your fire until your sight picture is exactly the same for each shot.
3. The flat top of the front post should be level with the horizontal center line of the picture, and the sight guard 'ears' should be touching, or an equal distance from, the sides of the aperture.
4. Move your head a little until you find a brighter area in the middle of the picture through which the front sight is seen most clearly.
5. Find the best size of aperture to suit your vision – start small and move up various sizes until the target has a normal level of brightness, then go back down one size.
6. Alternately you can decrease the aperture size until the brightness abruptly diminishes, and then open up one size.

7. A yellow filter helps on dull or misty days, and a green filter will lower excessive glare.

No1 Mk3 after market aperture sight



A small, after market peep sight device, is usually available on ebay, which attaches to the No1 Mk3's rear sight leaf. Although some shooters with congenital sight issues can feel strained shooting with them, for the rest of us they are a good and interesting addition to the No1Mk3.

An alternate method for the No1 Mk3 is an after market scope mount that attaches in place of the rear sight leaf, half way up the barrel. As with pistol scopes it requires a sight with long eye relief as the scope will be far forward of the shooter. It's not very original appearing but at least it gets you shooting. Interestingly one of the WW2 German sniper rifles successfully used a small scope mounted in the same position.

In New Zealand a company called JNT made a robust aperture sight so that hunters using the No1 Mk3 had the visual aperture sight benefits of No4 owners, as well as the longer sight base between front and rear location. They still sell in 2012 at a very affordable price. There are no fine adjustments as it is not a target sight.

More information

1 - Parker Hale aperture sights; http://www.milsurps.com/content.php?r=330-1940-Parker-Hale-Service-Section-Catalog

2 – How to use Parker Hale sights; http://www.milsurps.com/content.php?r=172-Parker-Hale-Sights-Adjustment-and-Use

Pinhole glasses

Failing eyesight can be sorely tested by trying to shoot over the open iron sights of the No1 Mk3, but there is another interesting answer. The same principle of refraction can be put into practice by wearing a pair of 'pin hole' glasses. These are sometimes found for sale in novelty joke stores or 'One Dollar' stores as a semi serious eyesight training aid, and they bring the rear and front sight into sharp focus. They are most effective in bright sunlight and over iron

sights like the No1 Mk3.

They're not a real answer to the problem, but don't discount the 'flies eyes' affect and ignore them, they're very cheap, they work for some, and could be an interesting solution. They are sold as a novelty/tool to re-train or repair your eyesight, and perhaps there's some truth to it.

Orthoptic sights

Orthoptic sights are often seen being worn by upper echelon target shooters. These are a normal looking pair of glasses with a clip above ones leading eye that supports a small panel with a pin hole through it. The advantage gained is the same as for aperture sights, everything comes into universal focus, with the benefit that they are not attached to the rifle.
Some competition rules allow these to be worn by the shooter but won't allow the use of aperture sights installed on a rifle, so the same advantage is gained but within the rules.
In 2012 these are still commonly used by serious shooters, and readily available.

Orthoptic sights: http://rifleman.org.uk/Orthoptics.html
More information, make your own; http://www.jarviser.co.uk/jarviser/orthoptic.html

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Bipods

Although Lee Enfields were never issued bipods standard they are a good device to shoot with, both for fun plinking, and as an aid for accuracy training.
To attach one in such a way that doesn't alter or damage your Enfield you'll need to modify generic bipods intended for other rifles. The ideal place to mount a bipod is at the mid band screw region. If you mount too far rearward small movements of the stock are exaggerated at the muzzle and overpower the accuracy gains of having the bipod.

A cheap gun show bipod ($15) made for the AK 47 has an aluminum ridge in its middle. Narrow the ridge to the thickness of the Enfield sling swivel base and drill a through hole the exact size of the band screw. You'll need to round the corners to remove any excess height in the metal so that it doesn't accidentally damage the forend wood.

The front band is not the ideal location but avoids damage to the wood.

Another good bipod is a universal ‘Harris’ type with a knurled screw that closes two little plates that engage the rifle they are designed for. Happily these two little plates can be removed, a hole for the band screw drilled through their other end, and they are returned to the bipod inverted and reversed. Now when the mid band screw is screwed through the hole the bipods mounting mechanism works normally and clamps under the forend smoothly, tightly and with no damage to the rifle. The bipod legs fold forwards and are height adjustable.

Although not a stock item, a bipod has been a good addition to my rifles and a good help with accuracy by increasing the steadiness of the rifle.

Occasionally WW2 detachable bipods designed for the Bren gun can be found. They have a bracket that wraps around the forend without damage to the rifle.

Bore Sighting

Traditionally bore sighting is the process of removing the bolt, setting the rifle in a stand, and looking through the bore at a distant target. Once on target the scope can then be adjusted to that point. The purpose is to get a scope roughly dialed in to limit the amount of time and money spent using ammunition to get closer and closer to the target.

These days we also have an excellent and inexpensive tool widely available, a laser built into a cartridge case called 'laser bore sighter .303'. This loads into the breech and the laser travels exactly down the center of the bore and puts an aim point on any distance in front. They are $20-$40 and are available on places like eBay.

If an Enfield is bore sighted to 100 yards the amount of bullet drop is exactly 3 inches. The way then to use a laser bore sighter is to put the dot 3 inches over the bulls eye, tune the scope to the bull, and the bullet will then drop the 3 inches onto the bulls eye.

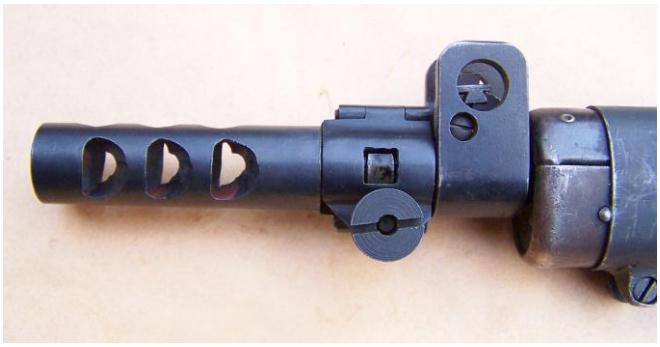
Muzzle brakes

Albeit not standard issue on Enfields, muzzle brakes are a good shooting aid. They reduce muzzle rise when firing, and felt recoil by a half to two thirds, a great help with fatigue during extended shooting sessions.
They work by capturing a proportion of the explosion gases and directing them backwards, or onto a flat surface area in the brake. This jerks the rifle off the shoulder at the moment of firing, reducing the recoil. They have become recognized as being very useful and are now standard issue on almost all military rifles, including artillery and tanks.

Sadly there are few options available for Enfields in 2011. Almost any universal muzzle brake designed for .308 or 7.62 will have the right characteristics to use on a .303. The gases moving inside a muzzle brake can disturb the bullets flight path, so it can take a little experimenting to find the right one.

No4 Mk1/2

The problem is that the way to mount a muzzle brake on a stock rifle requires something that will clamp to the No4 barrel and around the bayonet lug.
If you use a universal brake the problem is that they require threading onto the barrel, which naturally undoes the value of an original rifle.



The muzzle brake shown here is no longer in production and had design flaws that led them to shatter after as little as 100 rounds, but apart from the flying shrapnel it was a good idea that worked well. At the expense of more noise directed sideways from the rearward directed ports, muzzle rise was almost eliminated and felt recoil reduced by half to 2/3rds.

No1 Mk3;
The No1 Mk3 is a special case, there are few other rifles with such a blunt nose and almost nothing to attach a muzzle brake to. The attachment style of the No1 Mk3 cup style grenade launcher would be one of the few mounting options.

Image; Muzzlebrake link at Brownells;
http://www.brownells.com/.aspx/cid=0/k=muzzle+brake/t=P/ksubmit=y/Products/All/search=muzzle_brake

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Psy-Ops - Outshoot your friends

Swear an oath you'll never tell.
Psy-Ops 1
Drinking coffee or caffeinated drinks like Coke before shooting can raise the blood pressure, making the pulsating effect of heart beats in muscle tissue more apparent.
This is handy to know if you intend to outshoot your friends at the range. You all stop at the coffee shop on the way and while they get coffee with double shots, cokes or Red Bull, you discreetly order decaf or hot chocolate.
It works well.

Psy-Ops 2
If you're shooting on a bright or sunny day, wear a wide brimmed hat but no sunglasses. Your iris's will be more open, allowing more light to pass, and the sight picture will appear more crisp. It's the same reason we put a 50mm lens on the front of a scope instead of a 32mm, more light equals a sharper picture.
You forget to pass this tidbit to your friends.

PsyOps 3
Don't leave a rifle in the sun collecting heat on one side. The wood will warp slightly because of the temperature difference between the top and bottom sides. Similarly leaving a rifle on its side in grass will cool one side and also warp the wood.
You all shoot at the range benches but you cover your rifle, to 'keep the dust off'.
You accidentally forget to tell your friends the other why, again!

PsyOps 4
Ditto for ammo, it's not recommended to leave your ammo in the sun on the shooting bench. Having ammo scattered about on the bench, with some covered and some in the full sun, will play havoc with some shots going wide.
The same applies with a cartridge left in a hot chamber, bullets will absorb the gun's heat, to accuracy's detriment.
Your friends think you're a bit nuts, putting the ammo away all the time, but if they don't know to cover their ammo, they could be wondering why their groups are so wide when they shot much better last time.

PsyOps 5
There's nothing so confidence building as shooting a rifle you know is accurate. Magically you get better results on target but as you do it seems that your bad habits of flinching, being distracted, making hasty careless shots, also seem to go away for a while. Building ones own target rifle, with all the accurizing methods build right in, is a great confidence builder too.
It's called the placebo effect; believe you are going to shoot better and chances are that you will. It also works in reverse, expect a bad result and you can be working a bit uphill after that.
You would never imply to your friends that; it's a difficult day with cross winds, the ammunition is old, useless and makes flyers, or that the rifle is old and worn out, they should buy a new one, you would never tell your friends that, would you?

Conclusion
But seriously, you get the idea, these are little things that make a difference. Drinking coffee in the morning is a sure fire way for my day to become a plinking exercise rather than target shooting.

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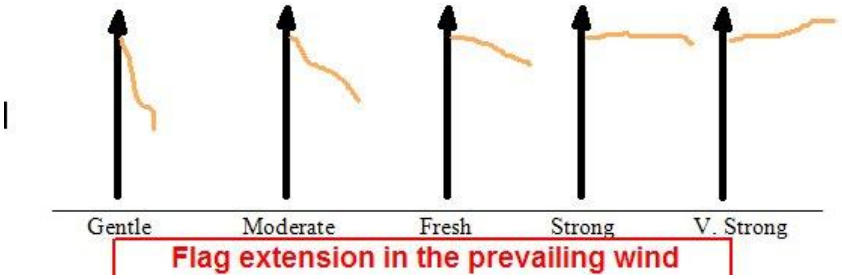
Winds

One of the great skills of a shooter is dealing with the effect of cross winds on a bullet. Small caliber bullets such as a .22 are more influenced by the wind, large bullets with more mass less so.
Cross winds are recognized and named in 5 categories, and each degree of cross wind equates to a particular amount of distance at 100 yards that can be adjusted for. If you're at a shooting contest a weather report about wind will often be posted. They are;

Wind Name	Speed	Correction
1 - Gentle	5 mph	0.5 inch
2 - Moderate	9 mph	1.0 inch
3 - Fresh	12 mph	1.5 inch
4 - Strong	15 mph	2.0 inches
5 – V. Strong	20 mph	2.5 inches.



These numbers are for winds at right angles to your shooting path. If the wind is more oblique or acute then these numbers diminish slightly.
It's common to see small flags posted at a firing range. The amount of deflection of a flag can show you the speed of a cross wind, and these deflections are worth either remembering, or taking a small chart to the range.
On a long range shot bullets can even make an S curve as the wind varies along its flight path. Observing flags, leaves on trees, the waving of grass or bushes, are all tell tales that good shooters look for to determine the speed of cross winds at different points along the path.

These guideline numbers are available in shooters books but studying the terrain and learning how much deviation is required when visiting unfamiliar ranges is what makes you an exceptional shooter.

Wind tips

- A tail wind or head wind won't cause any deviation left or right.
- A strong tailwind will carry the bullet to a high shot.
- A strong headwind will force the bullet to a low shot.
- A singularly effective way to learn cross wind shooting is to take a .22 rifle every time you take a .303 to the range, and spend 30 minutes on the 100 yard targets. This trains your muscles and mind to think about the flight path and its variations, and the skill transfers remarkably well when you pick up a heavier rifle.

Dealing with Slope

In short there is one simple effect of slope.
Whether shooting up hill or down, your shots will land high.
You must aim lower than usual, and the effect increases with range or with a steeper slope.
On a (steep) slope of 45 degrees, the correction required varies from ½ inch at 100 yards to 10 inches at 400 yards.

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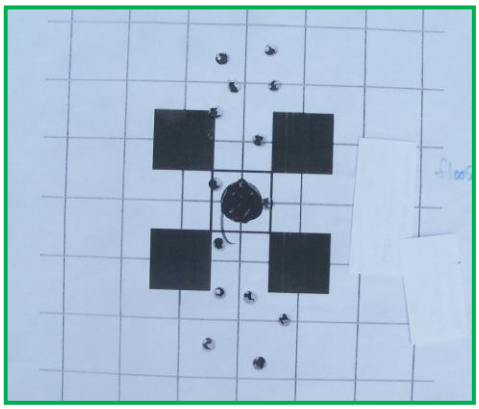
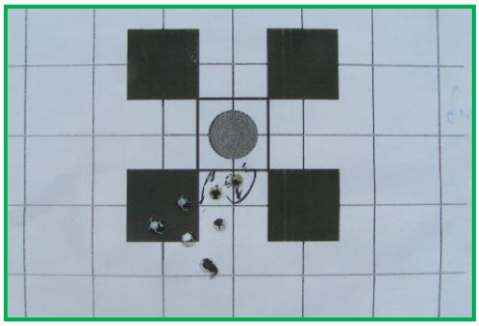
Targets

The placement of shots on the target can reveal a lot about how you hold the gun at the moment of pulling the trigger. Learning not to move the gun off target as you pull the trigger is a significant part of learning to be a good shooter.
If you have the option of shooting with hand guns or air pistols, you can and should use the training targets to inferentially also teach you about rifle holds, the issue of gun control is the same one, the rifle just has more mass to deal with.
The following targets are not real, just mock ups for this lesson.

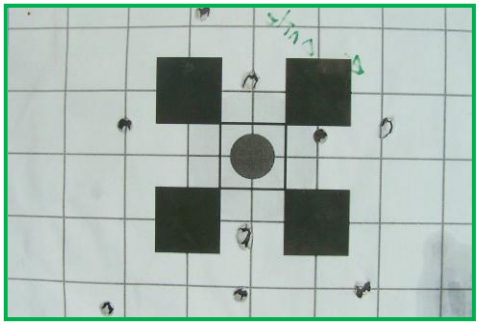
Target one; a loose forend will string shots in the vertical plane. Check the main screw for being tight, that the front of the trigger guard is pressuring the wood, the rear of the trigger guard and that it is firmly holding the forend butt end upwards.



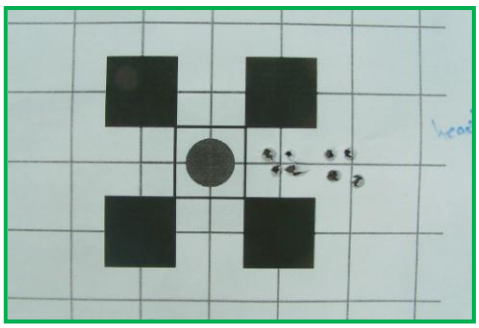
Target two; a trigger finger pushing on the side of the trigger instead of pulling it straight back will slightly roll and gun and pull it down, resulting in low, left leaning shots. Practice and observe the spot on your trigger finger that pulls straight back only and always use that contact point.



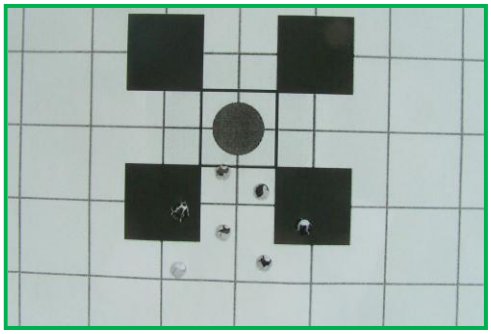
Target three; a No4 front hand guard jamming on the back of the front sight will create a scattering of erratic shots.



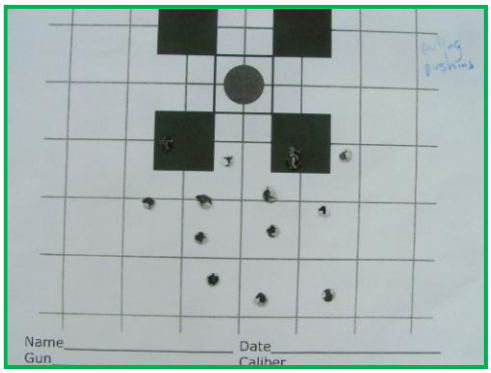
Target four; small groups off side to the the bulls eye and separated by one to three inches are caused by the heartbeat distending the muscle tissue holding the rifle in an over tight grip. The solution is to relax a little and to not hold the rifle so long before firing. The side off set is caused by tightly pulling or pushing on the butt stock, in the expectation of recoil.



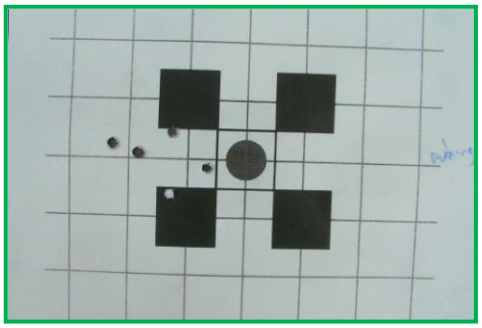
Target five; a too tightly held forend will pull downwards at the moment of firing and group below the bulls eye. Learn that the majority of control for aiming is actually in the trigger hand, not the fore hand.



Target six; grouping that is generally below the bull is caused by overly anticipating recoil, flinching and pushing the barrel down, or leaning forward into the rifle's recoil at the moment of firing.



Target seven; left grouping caused by anticipating recoil and leaning right, into the butt stock as you fire. A right grouping comes from the same issue, but is caused by clenching the butt towards you as you fire.



Conclusion

Becoming objective about your shooting and reading your target is an important skill. Overcoming many of these issues that are revealed is surprisingly easy if you regularly spend time on a smaller caliber rifle with less blast and recoil.

Training with .22 rifles is crucial, and was a part of soldier training in both WW1 and WW2, and the purpose is to train your muscle memory to stay relaxed and in control instead of the natural tendency to brace oneself against the anticipated blast.

Additionally, pistol use is of great benefit too. Hand guns are much more susceptible to errors caused by poor hand hold and posture, and the hand gun fraternity commonly have training targets that correlate shot fall with hand grip, 360 degrees all the way around a circular target. If you're in a country that restricts hand gun ownership, then try to obtain an air pistol, either spring or CO2 operated. The skills don't perfectly cross over to rifles, but the self awareness of one's actions does.

Pistol training target and info; http://www.bullseyepistol.com/training.htm

I can't emphasize this enough, if you really want to be a good shooter, regularly spending time at the 100 yard range with a .22 semi auto rifle and a bucket of cheap ammo is a must do, and will pay good dividends when you later pick up the mighty three nought three.

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Random Bits

- The duration of time from the trigger release to the moment the bullet leaves the muzzle is 1/100th of a second. In that length of time a car traveling at 60 mph travels 10.5 inches. 1/100th of a second is longer than you think, and is enough time for flinches etc to alter the bullets path.
- When assembling your rifle make certain there is no excessive oil between any metal to wood surface contact, especially around the receiver and barrel area. You want friction in these areas and oil will disturb the bedding action.
- It is okay to lube the bullets, ie the bit that flies.
- It is absolutely not okay to lube the brass cartridges, or the walls of the chamber, or to have other non compressible substances such as water, oil or grease on the cartridge. This means keeping your bullets dry if shooting in the rain. The reduction in friction between the brass case and the chamber walls during firing can raise the pressure on the bolt by 4 tons per square inch. Problems will manifest as increasing head space.
- If using aperture sights a good average peep hole size to shoot with is 1/20th inch, or .05. On a 6 hole eye piece that is usually hole number 4.
- On aperture sights it's a myth that the smallest hole is the right way to use them, in fact you need the hole size just before the sight picture suddenly goes a shade darker.
- If experimenting with front sight blades remember that wider sight blades suit older eyes better. The blade width should not exceed .09 inch, and .055 to .060 is recommended.
- A normal use barrel's total life is generally 10,000 to 30,000 rounds. When Lee Enfields were the pre eminent competition rifle and spares easily located, a

serious shooter would consider his barrel's life to be over when the explosive and corrosive gases eroded the rifling at the chamber, even though the rest of the rifling appeared in decent shape and showed little wear at the muzzle. This unavoidable chamber end wear can cause a barrel change over at approximately 7,500 rounds, or much less. A dedicated competitor might start thinking about this after 1,000 rounds.

- Wear on the rifling at the chamber end is checked with a 'barrel gauge' on a cleaning rod.
- When sighting remember that you want the front sight in best focus, the target in as much focus as you can make, and the rear sight focus as best you can.
- Shoot with a .22 regularly and often. This helps overcome flinching caused by anticipation of the blast and recoil of the larger .303. It also ingrains an excellent understanding of how a bullet flies, affected by gravity, cross winds and air resistance. On a scale of one to ten of things to do when learning how to shoot I rate regular .22 training a solid 9 out of 10 of things one must do.
- If shooting a set of eg 5, try to keep the rifle at your shoulder and unmoved from the contact points with your shoulder, hands and cheek as little as possible. 'Back in the day' shooters would embed a small coin into the butt where their cheek touched it. The idea is to remember that exact spot of contact and come back to the same precise location over and over.
- When learning shooting, first try to create small groups rather than being goal oriented about bulls eyes. Tuning the sights to the bull's eye is a mechanical issue easily adjusted, the ability to make repeated, tight groups is about you.

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Conclusion

We have covered a lot of ground here, looking over more than half a century's worth of insights, experimentation and sometimes just dogged hard work from many talented men and women, exerted in the quest for making a great rifle even better.

It apparent that there are many interesting and successful ways to tweak more magic out of the Enfield rifle, and that with this compilation you now have the tools to regulate your own rifle or modify one into a dragon slayer, and while holding a nicely perforated target at the rifle range you are now one of those who can mutter mysteriously about your knowledge of the secret dark arts.

My hope is to see more shooters world wide enjoying matches with bolt action military rifles, perhaps even more matches where one can have a 4x scope of similar magnification to the originals, where those many folks who have aging eyesight can compete again on an equal playing field, where, they say, cunning and wisdom will, or should, overcome youth and sharper eyes.

And what next you might ask?

Well, of course I've been looking ahead, and as these words reach this last page I'm getting in the hardware to …. well, you'll just have to wait and see. I promise there is more to discover about accurizing Enfields, and like the knowledge in this book, it will be worth it.

Keep on the mailing list and I'll keep you posted as the results come about.
Congratulations on getting this far, I hope you've found plenty to think about and get excited over, and that you're just itching to tighten a screw or two and take the 'ol girl' out to back out to the range.
Mailing list; xtc1-enfieldaccurizing@usa.net
Happy shooting,
RJW NZ
Nov 2011

The End

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The 2012
Complete Book on Lee Enfield
Accurizing

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